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

(11) **EP 2 253 905 A1**

(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
24.11.2010 Bulletin 2010/47

(51) Int Cl.:
F25B 43/00 *(2006.01)*

(21) Application number: **10163223.0**

(22) Date of filing: **19.05.2010**

(84) Designated Contracting States:
AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO SE SI SK SM TR
Designated Extension States:
BA ME RS

(30) Priority: **19.05.2009 IT MI20090878**

(71) Applicant: **ARO TUBI TRAFILERIE S.P.A.**
20122 Milano (IT)

(72) Inventors:
- **Bonati, Sergio**
  22039 Valbrona (IT)
- **Cremonese, Roberto**
  31015, Conegliano (IT)

(74) Representative: **Borsano, Corrado et al**
Notarbartolo & Gervasi S.p.A.
Corso di Porta Vittoria, 9
20122 Milano (IT)

(54) **A process for obtaining devices for treating the cooling fluid in refrigerating machines and devices thus obtained**

(57) La presente invenzione concerne un processo di ottenimento di dispositivi per il trattamento del fluido refrigerante in macchine frigorifere ed i dispositivi ottenuti con tale processo.

Il processo di ottenimento oggetto della presente invenzione consente di realizzare detti dispositivi di trattamento del fluido refrigerante quali i filtri disidratatori e gli accumulatori adatti ad essere impiegati in circuiti frigoriferi e/o in impianti di condizionamento in allumino commercialmente puro o in lega di alluminio. Oggetto della presente invenzione è pertanto il processo tecnologico di ottenimento di detti dispositivi ed i dispositivi così ottenuti.

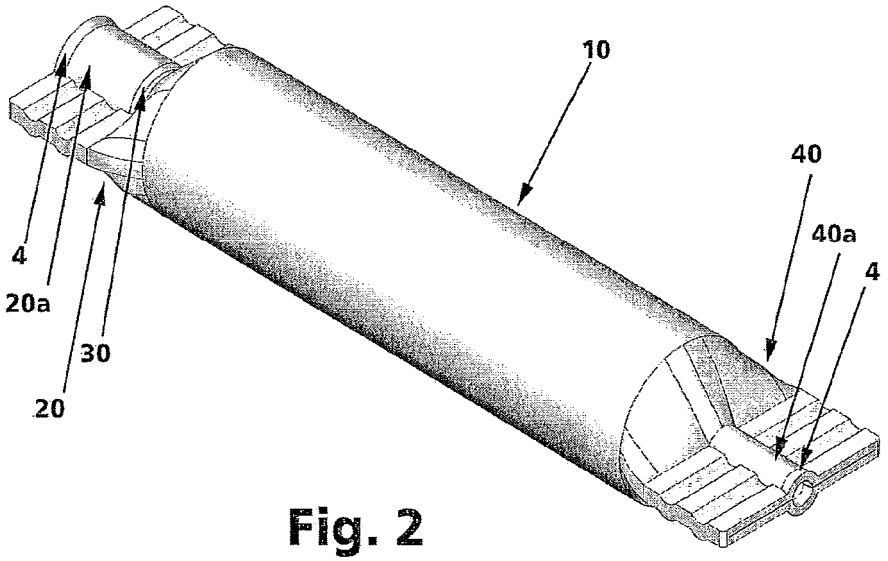


Fig. 2

EP 2 253 905 A1

Description

[0001] The present invention relates to a process for manufacturing devices such as dehydrating filters, accumulators and the like adapted to be used in refrigerating circuits and/or in conditioning systems, as well as to said devices thus obtained. As known, both dehydrating filters serving the primary function of eliminating every trace of humidity from the cooling fluid running through the circuit, and accumulators having the task of separating possible residues of liquid refrigerant still present at the outlet of the evaporator, are provided inside the circuit of refrigerating and/or conditioning systems.

[0002] Therefore, said devices may be generally indicated as devices for treating cooling fluid.

[0003] Even the minimum presence of humidity is indeed highly damaging for the system, in particular due to the danger of corrosive phenomena which may compromise the hermetic seal of the circuit or the functionality of the compressor. High pressure refrigerant in liquid state runs through the dehydrating filters placed between circuit condenser and expansion valve.

[0004] As said, the main function of the dehydrating filter is to dehumidify the refrigerant, however it also serves the important function of blocking and retaining possible solid particles of impurities, which may remain in the circuit upon assembly operations thereof. The existence of abrasive materials in the refrigerating circuit, such as steel or copper shavings, would cause the blockage of the expansion valve or would damage the compressor or other components of the refrigerating circuit.

[0005] In order to serve their function, the filters are equipped with molecular sieves therein for absorbing the humidity, and with screens, generally mesh filters adapted to retain the solid particles of impurities.

[0006] The accumulators are placed between evaporator and compressor i.e. in the low pressure branch of the circuit where the refrigerating fluid substantially transits in the gaseous state.

[0007] As already mentioned above, the function of the accumulator is nothing more than a receptacle with the function of separating the residues of liquid cooling fluid possibly still present at the outlet of the evaporator to avoid their introduction into the suction duct of the compressor. Given its incompressible nature, the liquid could indeed cause significant damages to the pistons of the compressor.

[0008] The filters and accumulators known from the state of the art are made of copper or copper alloys, as well as the other parts of the refrigerating circuit, the condenser tube, the evaporator and the capillary tubes used for lamination are also usually made of copper.

[0009] As known from the state of the art, the filters and the accumulators are made by plastic deformation from a small hollow cylindrical section of copper of suitable size obtained by slicing a continuous roll or bar of hollow tube. In the case of dehydrating filters, the small section is filled with the particles forming the molecular sieves capable of adsorbing the humidity. Other elements are also inserted, capable of filtering possible impurities. In particular, a filtering element is provided at the inlet end of the fluid into the filter, generally consisting of a cup having a plurality of holes, while a filtering unit having a metal net is provided at the outlet end of the fluid from the filter where the filter will be connected to the capillary.

[0010] Once the small section is filled with these filtering and adsorbing elements, the intermediate product is placed on a deformation station in which the ends are shaped through rolling.

[0011] In the case of accumulators which, as said, are not filled with the filtering and adsorbing elements, the obtaining process includes that the small section is directly placed on a deformation station to shape the ends through rolling.

[0012] The friction of the rollers against the small section causes the material to overheat so that indeed the deformation occurs in any event concurrently with an overheating of the material.

[0013] Two-way dehydrating filters made of copper are known from the state of the art, i.e. having an fluid inlet hole and an outlet hole to which the capillary tube is connected, or three or more way filters, where there is always a capillary tube outlet hole and two or more inlet holes. The product is always obtained by means of mechanical machining with machine tools, even in the case of filters having three or more ways. This type of machining is preferred due to the need of keeping the level of cleanliness required: it is indeed fundamental that no particulate, shavings, residues of lubricant or other substances deriving from preparing and shaping the ends of the filter housing remain inside the filter to avoid the components of the circuit in which the filter is inserted from being polluted and therefore damaged.

[0014] Moreover, horizontal accumulators, every bit as similar to the afore-described dehydrating filters except for the absence of the filtering and adsorbing elements, and vertical accumulators equipped with an hermetically closed end and one end equipped with two holes, one fluid inlet and one outlet, respectively are known. Now, it is known that copper and its alloys are commercially expensive, and for this reason it appears highly advantageous to think of using cost-effective, less noble materials, especially when such a raw material is used to make devices or peculiarities for which the physical properties of the material are not determining, as are indeed the filters and the accumulators at hand.

[0015] Moreover, both the dehydrating filters and the accumulators at hand are highly simple devices which should have a very low unit price and therefore should be obtained with highly simple, and therefore inexpensive, rapid production processes, as a high productivity is desired, intended in terms of pieces produced per unit of time.

[0016] It is therefore apparent how the dehydrating filters and accumulators of known type are not capable of

meeting the need of having an inexpensive product which is easy to be manufactured.

[0017] Therefore, the main task of the present invention is to provide a process for manufacturing devices such as dehydrating filters and accumulators which allows to manufacture said devices employing a more affordable material as compared to copper filters and accumulators known from the state of the art.

[0018] Within the scope of this task, a further object of the present invention is to provide a simple, inexpensive production process for manufacturing said devices.

[0019] Not last object of the present invention is to provide a dehydrating filter and/or accumulator which may be connected to aluminium tubes and capillaries. It has been said indeed how the high cost of copper and its alloys suggests replacing all the elements in the refrigerating and/or conditioning circuits made of copper heretofore, with similar elements made of alternative, more affordable materials. In this view, patent application EP1840487 describes manufacturing and using a capillary tube made of aluminium alloy, for example.

[0020] Therefore, the object of the present invention is, among others, to provide a dehydrating filter and an accumulator which may be coupled to tubes or capillary tubes made of commercially pure aluminium or aluminium alloy, without compatibility problems of the materials, i.e. formation of undesired galvanic currents, or problems during the step of soldering the tube or capillary to the filter or accumulator.

[0021] Hence, the object of the present invention is also to provide a process for obtaining a dehydrating filter and/or an accumulator made of commercially pure aluminium or aluminium alloy capable of achieving the above-described objects. This task and these and other objects which will become more apparent below are achieved by a process characterized in that it comprises the steps of: arranging a hollow, cylindrical tubular semifinished product made of pure aluminium or aluminium alloy of suitable length; shaping at least one of the ends of said cylindrical, tubular product by molding while previously providing for the positioning of suitable cores for making ducts for introducing the fluid into the filter or accumulator and for releasing the fluid from the filter or accumulator.

[0022] In the case of dehydrating filters, the process according to the present invention also comprises the step of positioning a molecular sieve consisting of synthetic compounds in the form of microspheres capable of adsorbing the humidity, and filtering elements capable of retaining solid particles, inside said semifinished product.

[0023] Moreover, the objects of the present invention are achieved by a process comprising a further step of calking the end zones.

[0024] Further features and advantages of the present invention will become more apparent from the following detailed description, provided by way of non-limiting example and illustrated in the accompanying drawings, in which:

figure 1 shows a perspective view of a dehydrating filter of type known from the state of the art;

figure 2 shows a perspective view of the dehydrating filter obtained by means of the process according to the present invention according to a first embodiment; figure 3 shows a partial section view of a detail of the inlet duct of the filter in figure 2;

figure 4 shows a partial section view of a detail of the outlet duct of the filter in figure 2;

figure 5 shows a perspective view of the dehydrating filter according to the present invention according to an alternative embodiment;

figure 6 shows a partial section view of a detail of the outlet duct of the filter in figure 5;

figure 7 shows a perspective view of an accumulator of type known from the state of the art;

figure 8 shows a perspective view of an accumulator filter obtained by the process according to the present invention according to a first embodiment;

figure 9 shows a perspective view of an accumulator obtained by the process according to the present invention according to an alternative embodiment;

[0025] Figure 1 shows an example of dehydrating filter 1 of the type known from the state of the art. The filters of known type, made of copper or copper alloys, have a first end 2 on which an inlet duct 2a is made to connect an inlet tube, not depicted in the figure, and a second end 3 on which an outlet duct 3a is made which will be connected to the outlet capillary, also not depicted in the figure. Both ducts are equipped with terminal flares 4.

[0026] The cooling fluid which runs through the circuit of the refrigerating or conditioning system runs through the filter substantially in an axial direction, following the direction indicated by the arrows in figure 1.

[0027] The filter in figure 1 is obtained by plastic deformation with machine tools, in particular through rolling. Once the small, hollow cylindrical section is filled with molecular sieves, filtering elements are inserted, being placed at the inlet end 2 of the fluid into the filter and at the outlet end 3 of the fluid from the filter, respectively. As known, a filtering element is generally provided consisting of a cup having a plurality of holes at the inlet end 2, while a filtering unit having a metal net is provided at the outlet end 3 of the fluid from the filter.

[0028] The ends 2 and 3 of the small, hollow cylindrical section are shaped by means of plastic deformation through rolling. The deformation and shaping of the ends according to the desired geometry based on the client's specific dimensional requirements are obtained by employing rotating rollers capable of keeping the required level of cleanliness. Indeed, piece machining should consider the need of avoiding dust, machining residues or lubricant from being deposited inside the filter.

[0029] The dehydrating filter according to the present invention is made of aluminium. More particularly, alu-

minium alloys are preferred, in particular commercially pure Al 1050/1070, i.e. having 99.5%-99.7% by weight of Al and impurities contained to a maximum value of 0.5%-0.3%, or alternatively 3103. However, other aluminium alloys may be equally employed to manufacture the filter according to the present invention.

[0030] The production procedure known from the state of the art for manufacturing copper dehydrating filters of known type is not applicable if there is a will to make the device of a different material, precisely aluminium or aluminium alloys.

[0031] As said, indeed, one of the main needs when manufacturing the device, in particular when shaping the ends of the small cylindrical section once this has been filled with filtering elements and molecular sieves, is to prevent both traces of lubricant and the formation of machining residues, in particular solid particles, which as said may be deposited inside the device thus compromising the system on which said filter is installed. Despite all the technical contrivances possibly conceivable to limit the production of particulate, such as for example designing specific tools, reducing the heat generated from the friction of piece-tool contact by means of a suitable cooling, varying the contact and deformation geometry, it is however not possible to comply with the necessary and obtainable cleanliness levels when processing copper.

[0032] The present invention thus relates both to the method of obtaining a dehydrating filter or an accumulator made of aluminium or aluminium alloy, and to the filter or the accumulator obtained through said method.

[0033] In particular, the filter 10 according to the present invention, seen in figures 2-5, is obtained in the same way as the copper filters of known type, starting from a hollow cylindrical semifinished product cut to the desired dimension, which is filled with the adsorbing and filtering elements comprising synthetic compounds 50 adapted to serve the function of molecular sieves, and filtering elements 60, 70 capable of treating the particulate, respectively.

[0034] In particular, a substantially cylindrical cup 60 having a plurality of suitably sized holes, i.e. capable of treating solid particles of more significant dimensions, is placed at the inlet end 20 of the fluid into the filter 20. The duct 20a may be further equipped with a restricted section 30, also obtained through molding, serving the function of limiting the insertion of the inlet duct during the assembly step. Instead, an element 70 to finely filter the particulate is placed at the opposite outlet end 40 of the fluid from the filter, e.g. a filtering element having a metal net supported by a collar ring, capable to treating particulate of finer dimensions. The molecular sieves consisting of synthetic compounds in the form of microspheres 50 are placed between these two filtering elements inside filter 10.

[0035] The cup 60 and the metal mesh element 70 are placed inside the filter transversally to the axial flow direction of the cooling fluid.

[0036] The filtering elements are made of suitable materials to prevent undesired galvanic corrosions. In particular, in the case of cup 60, it is normally made of copper steel or steel coated with a brass alloy, while in the filter according to the present invention, it is also preferably made of pure aluminium or aluminium alloy. The metal net filtering element 70 for fine filtering may be advantageously made with a galvanized steel or stainless steel or pure aluminium or aluminium alloy collar, while concerning the metal net, it may be advantageously made of stainless steel, steels having similar features or phosphorous bronze, brass or other materials, when explicitly required.

[0037] Once the small, hollow cylindrical section forming the structure of the filter with the above-described filtering elements and molecular sieves is filled, the process according to the present invention includes shaping the two ends 20 and 40 by means of molding. In particular, a core for each duct to be obtained is placed before proceeding with molding and therefore shaping the ends of the filter. As shown in the accompanying drawings, in particular in figures 2 and 5, the filter according to the present invention may be a filter having two or three or more ways. Obviously, as easily comprehensible to a person skilled in the art, obtaining several access ways to the filter requires accurately positioning several cores next to one another before proceeding with molding.

[0038] The shaping of the device ends through cold molding with specific internal core in order to keep the dimensional tolerances of the ducts as required, is completed by calking the edges of the zones which are deformed by molding, so as to further increase the contact between the closing flaps pressed against one another in addition to ensuring a greater structural resistance during the assembly steps. With particular reference to figures 3 and 6, for example, the flaps 21 and 22 pressed against each other by molding the end 20 are closed, thus obtaining the further contact of the material in a sealing zone 20c immediately adjacent the last section of the end 20. In particular, in the case of the two-way filter shown in figure 3, the sealing is performed at the section 20c immediately adjacent the end of the device, where the two flaps 21 and 22 are still visible. Similarly, in the case of the three-way filter shown in figures 5 and 6, the two ducts 20a and 20b are also obtained in this case by inserting a core for each duct during the step of shaping by molding the end 20 of the device, and the sealing zone 20c is also obtained by molding the intermediate section placed between said two ducts.

[0039] This similarly occurs with the flaps of the opposite outlet end 40 of the fluid from the filter. In this case, calking also ensures the sealing of the end in the zone about the duct 40a.

[0040] With particular reference to the three-way filter shown by way of example in figures 5 and 6, it is noted that obtaining the shaping of the ends by molding and calking the filter according to the present invention allows to obtain a significant advantage when then soldering the

ducts for introducing the fluid into the filter and the capillary for releasing the fluid from the filter.

[0041] In particular, it is underlined how the soldering operation in the case of copper filters of known type has both the object of firmly connecting the inlet duct or the outlet capillary to the filter, and the object of hermetically closing the end, in particular in the case of closing the inlet end 2 of the fluid into the filter in three or more way filters. As known, the soldering operation normally occurs by brazing employing particularly fluid alloys. As soldering the ducts to the filter may occur when the filter is positioned in place and therefore also in a vertical position, soldering the lower end of the filter occurs against gravity, i.e. the brazing alloy tends to slide due to gravity outside the zone to be soldered, while the inverse occurs at the upper end. The flares 4 in the terminal portion of the ducts serve the function of containing the brazing alloy in the fluid state to better fill the free spaces between filter and coupling tubes in order to obtain integral and hermetic connections. It can also be appreciated, in consideration of these difficulties, how limiting the sealing zone to be soldered, which is limited in the case of the filter object of the present invention to solely connecting the ducts to the filter, is a large advantage in this case in terms of installation simplicity and speed, due to the calkings.

[0042] As shown heretofore with specific reference to manufacturing a dehydrating filter is also to be intended as valid for manufacturing an accumulator, with the exception of the step of positioning the filtering and adsorbing elements.

[0043] More particularly, figure 7 shows an example of accumulator 11 of the type known from the state of the art, in particular it shows a horizontal accumulator, i.e. equipped with an inlet hole and an outlet hole positioned at the opposite ends of a substantially cylindrical body. The accumulators of known type, made of copper or copper alloys, have a first end 8 on which an inlet duct 8a is made to connect an inlet tube, not depicted in the figure, and a second end 9 on which an outlet duct 9a is made which will be connected to the outlet tube, also not depicted in the figure. Both ducts are equipped with terminal flares 4.

[0044] The accumulator in figure 7 is obtained by plastic deformation with machine tools, in particular through rolling. The ends 8 and 9 of the small, hollow cylindrical section are shaped by means of plastic deformation through rolling. The deformation and shaping of the ends according to the desired geometry based on the client's specific dimensional requirements are obtained by employing rotating rollers capable of keeping the required level of cleanliness. Indeed, piece machining should consider the need to avoid dust, machining residues or lubricant from being deposited inside the accumulator.

[0045] As said for the dehydrating filter described, the accumulator obtained by the process object of the present invention being also part of the scope of protection of the present patent as identified by the accompanying claims, is made of aluminium. Aluminium alloys are preferred, in particular commercially pure Al 1050/1070, i.e. having 99.5%-99.7% by weight of Al and limited impurities to a maximum value of 0.5%-0.3%, or alternatively 3103. However, other aluminium alloys may be equally employed to manufacture the filter according to the present invention.

[0046] The production procedure known from the state of the art for manufacturing copper accumulators of known type is not exactly applicable if there is a will to make the device with a different material, such as aluminium or aluminium alloys. In particular, the accumulator 110 according to the present invention, seen in figure 8, is manufactured in the same manner as the copper accumulators of known type, starting from a hollow, cylindrical semifinished product cut to the desired dimension.

[0047] The process according to the present invention thus includes shaping the two ends 80 and 90 by molding. In particular, a core for each duct to be obtained is positioned before proceeding with molding and then shaping the ends of the accumulator.

[0048] Shaping the ends of the device through cold molding with specific internal core in order to keep the dimensional tolerances of the ducts 80a, 90a as required, is completed by calking the edges of the zones which are deformed by molding, so as to further increase the contact between the closing flaps pressed against each other in addition to ensuring a greater structural resistance during the assembly steps.

[0049] The flaps 21 and 22 pressed against each other by molding the end 90 are closed, thus obtaining the further contact of the material in the sealing zones 90b immediately adjacent the duct 90a.

[0050] This similarly occurs with the flaps of the opposite end 80. In this case, calking also ensures the sealing of the end in the zone about the duct 80a.

[0051] In particular, it is underlined how the soldering operation in the case of the copper accumulators of known type has both the object of firmly connecting the inlet and outlet ducts to the accumulator, and the object of hermetically closing the ends. As known, the soldering operation normally occurs through brazing by employing particularly fluid alloys. Since soldering the ducts to the accumulator may occur when the accumulator is also vertically positioned, the soldering of the lower end of the accumulator occurs against gravity, i.e. the brazing alloy tends to slide due to gravity outside the zone to be soldered, while the inverse occurs at the upper end. The flares 4 in the terminal portion of the ducts serve the function of containing the brazing alloy in the fluid state to better fill the free spaces between accumulator and coupling tubes in order to obtain integral, hermetic connections. In consideration of these difficulties, it can also be appreciated how limiting the sealing zone to be soldered, which is limited in the case of the accumulator object of the present invention to solely connecting the ducts to the accumulator, is a large advantage in this case, in

terms of installation simplicity and speed, due to the calkings.

[0052] According to an alternative embodiment, the accumulator may be of vertical type, as shown in figure 9. This type of accumulators provides for both the inlet and outlet ducts 80a, 90a of the fluid being provided at the same end of the substantially cylindrical body of the accumulator.

[0053] Figure 9 shows a horizontal vertical accumulator obtained by the process object of the present invention which is also part of the present invention.

[0054] With regards to the process for obtaining this device, it provides starting from a small cylindrical section, as in the previous cases.

[0055] The hermetic sealing of the end 80c may be made through plastic deformation by a method known from the state of the art. As said, since the rolling method is not adapted to make an effective sealing of the end of a device made of aluminium or aluminium alloy, the hermetic sealing of the closed end 80c of the accumulator may be preferably made according to the method described in patent application EP1488870, which is integrally referred to herein.

[0056] The process for obtaining the vertical accumulator of the type in figure 9 thus includes closing at least one of the two ends by molding, in particular the end 90 in which inlet and outlet ducts of the fluid are obtained, while the closed end 80c is sealed by means of a mechanical machining.

[0057] It has thus been shown how the process for manufacturing devices such as dehydrating filters or accumulators according to the present invention achieves the object and purposes proposed.

[0058] In particular, it has been illustrated how the production process for a dehydrating filter or an accumulator made of pure aluminium or aluminium alloy according to the present invention provides a device capable of completely meeting all the functional and quality requirements for a device suitable for being installed inside refrigerating or conditioning circuits, while allowing the material (copper and its alloys) traditionally employed to manufacture said devices to be replaced with an highly less expensive material (aluminium and its alloys), in particular preferably commercially pure aluminium.

[0059] The production process according to the present invention allows to obtain the device made of a material (pure aluminium or aluminium alloys), which could not be employed with the production processes normally employed for the dehydrating filters made of copper known from the state of the art.

[0060] The device, i.e. the dehydrating filter or accumulator, made of pure aluminium or aluminium alloy obtained by the production process object of the present invention, is also object of the present invention.

[0061] It has been illustrated indeed how dehydrating filters and accumulators obtained due to the process improved by the present invention have several advantages as compared to similar devices known from the state of the art.

[0062] A first advantage obtained is to replace the raw material copper, which as known is very costly, with the less expensive, commercially pure aluminium or its alloys, thus drastically reducing the final cost of the device.

[0063] A second advantage obtained is the sealing of at least one of the ends of the filter being obtained by means of simple operations of molding and calking - obviously barring the presence of the fluid inlet and outlet ducts. Machining and calking the ends directly obtained in the step of sealing the end equipped with the fluid passage ducts due to the deformability of the aluminium, significantly simplifies the next operations of soldering by brazing which is manually performed by the operator during the step of installing the filter on the circuit, this resulting in an apparent advantage both in terms of a greater installation simplicity and thus rapidity, and in terms of seal reliability and effectiveness.

[0064] Several modifications may be made by the person skilled in the art without departing from the scope of protection of the present invention.

[0065] Hence, the scope of protection of the claims should not be limited by the disclosures or by the preferred embodiments shown in the description by way of example, but rather the claims should comprise all features of patentable novelty inferable from the present invention, including all features which would be treated as equivalents by the person skilled in the art.

Claims

1. Process for obtaining a device (10, 110) for treating the cooling fluid in refrigerating machines, **characterized in that** it uses aluminium or aluminium alloy for producing said device.

2. Process according to the preceding Claim, **characterized in that** it comprises the following steps:

   prearrange a hollow cylindrical tubular semifinished product made of pure aluminium or aluminium alloy having a suitable length;
   closing at least one end (20, 40, 80, 90) of said cylindrical tubular product by means of molding previously foreseeing the positioning of suitable cores for making ducts (20a, 20b, 40a, 80a, 90a) for the inlet of the fluid to the filter or accumulator and for the outlet of the fluid from the filter or accumulator.

3. Process according to the preceding Claim, **characterized in that** it comprises a further step consisting of positioning inside said semifinished product a molecular sieve (50) formed by synthetic compounds in the form of microspheres able to adsorb the humidity and filtering elements (60, 70) able to retain solid particles before closing the ends of said hollow cy-

lindrical tubular product.

4. Process according to one or more of the preceding Claims, **characterized in that** it foresees a further step of calking of the end areas (20, 40, 80, 90) deformed by means of molding.

5. Process according to any one of the preceding Claims, **characterized in that** said closing operation of at least one of said ends (20, 40, 80 90) of said cylindrical tubular product is carried out in several successive molding steps, in order to improve the level of surface finishing and the geometry of the connected surfaces.

6. Process according to one or more of the preceding Claims, **characterized in that** one end (80c) is closed by means of plastic deformation by mechanical processing with machine tools.

7. Dehydrating filter (10) **characterized in that** it is made of aluminium or aluminium alloy.

8. Dehydrating filter (10) **characterized in that** it is obtained according to the process described in any one of Claims 1-5.

9. Dehydrating filter (10) according to the preceding Claim, **characterized in that** said filtering elements comprise at least a drilled cup (60) for the rough filtering and at least a metal net element (70) for the fine filtering of the fluid running through the filter.

10. Dehydrating filter (10) according to the preceding Claim, **characterized in that** said drilled cup (60) is made of commercially pure aluminium or aluminium alloy.

11. Dehydrating filter (10) according to one of Claims 7-10, **characterized in that** said metal net element (70) for finely filtering the fluid comprises a supporting ring made of commercially pure aluminium or aluminium alloy.

12. Dehydrating filter (10) according to the preceding Claim, **characterized in that** said metal net element (70) for finely filtering the fluid comprises a portion of metal net made of stainless steel, phosphorous bronze or other material.

13. Accumulator (110) **characterized in that** it is made of aluminium or aluminium alloy.

14. Accumulator (110) **characterized in that** it is obtained according to the process described in any one of Claims 1-6.

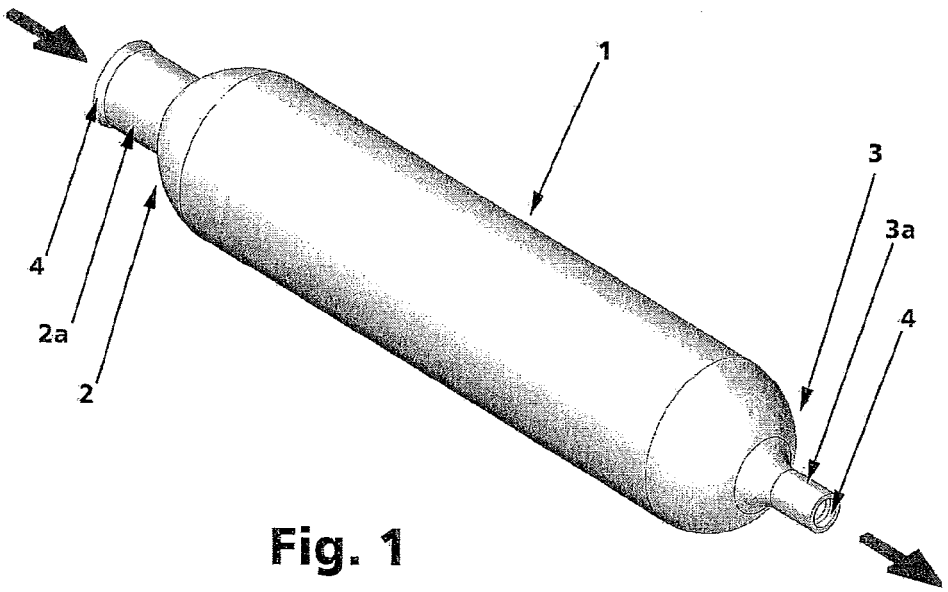


Fig. 1

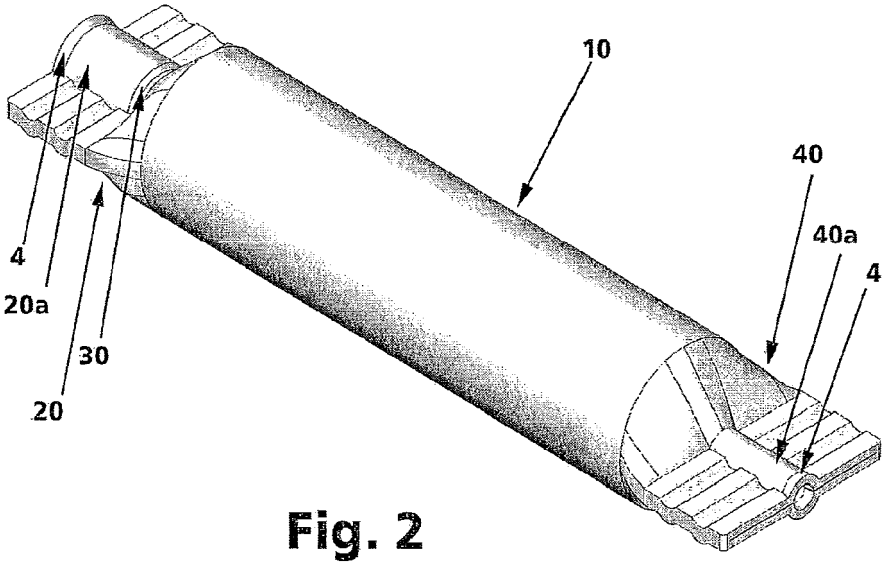


Fig. 2

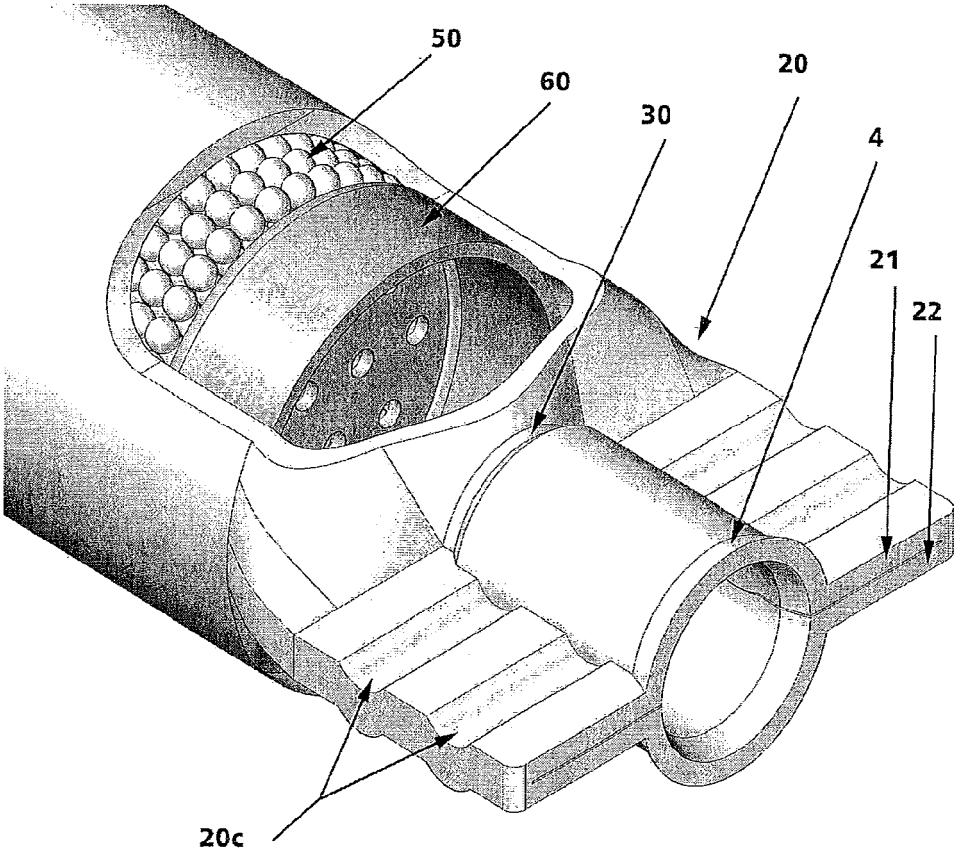


Fig. 3

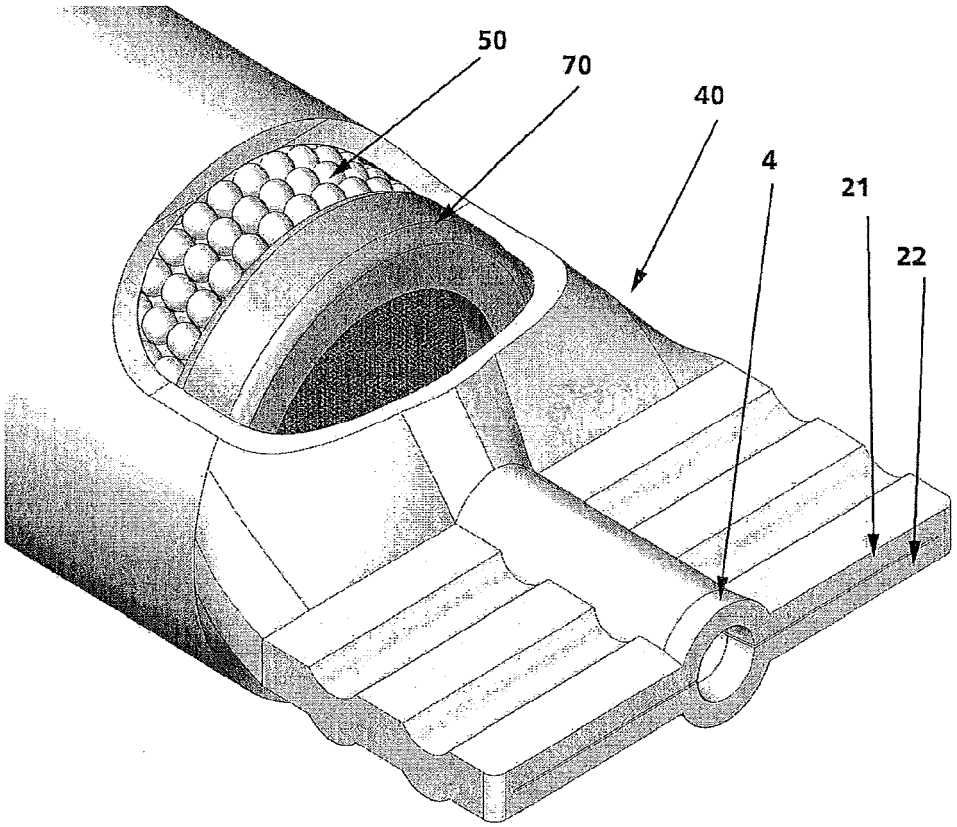


Fig. 4

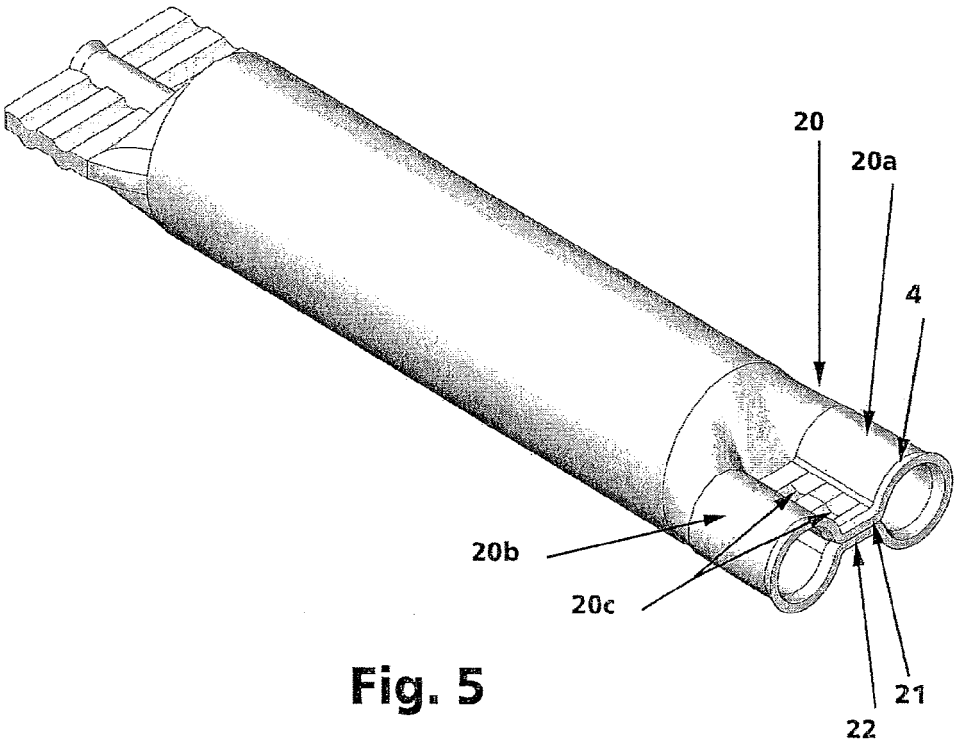


Fig. 5

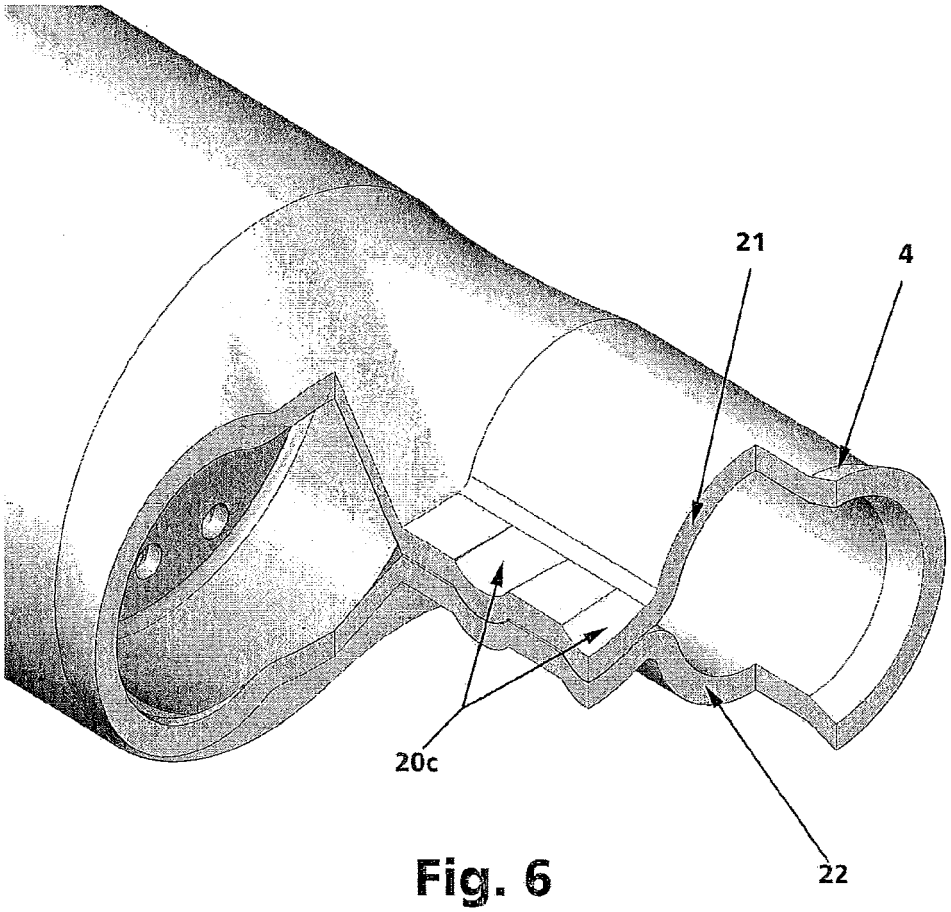


Fig. 6

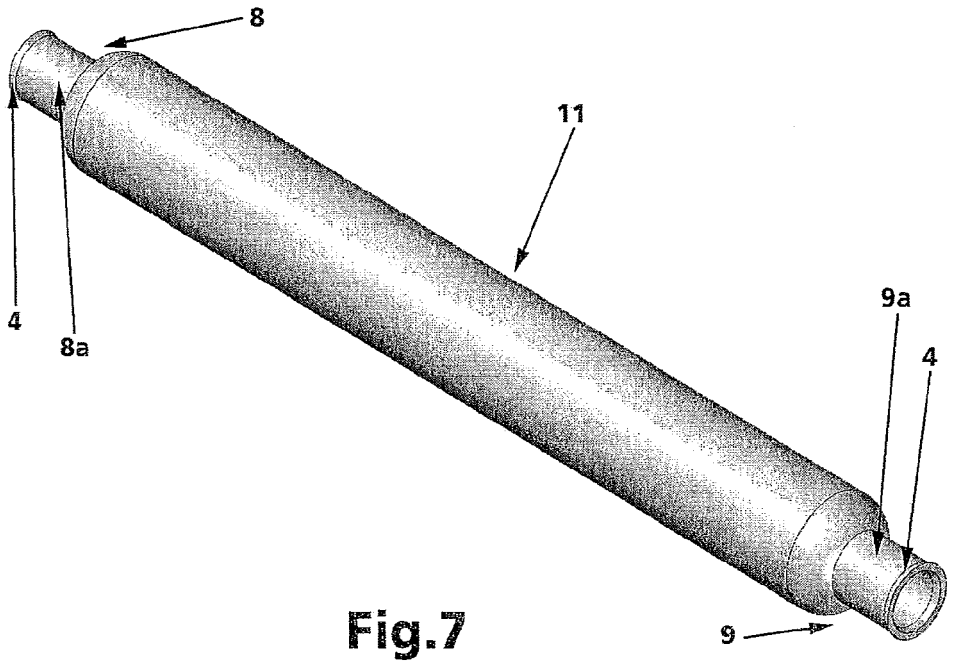


Fig.7

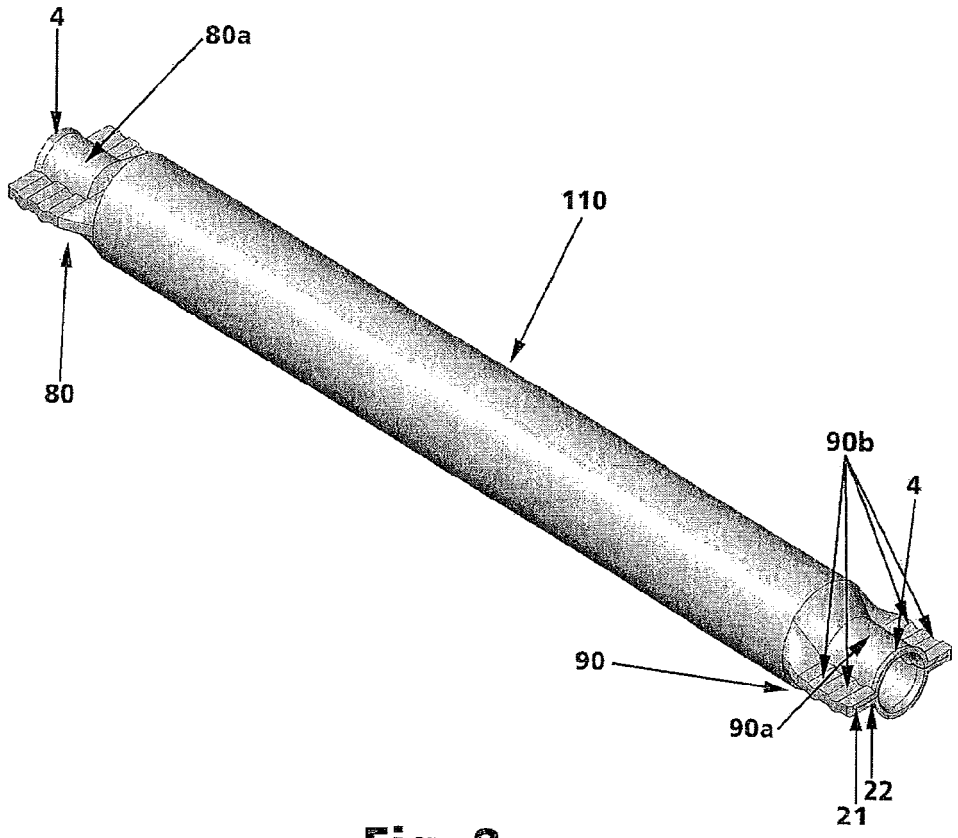


Fig. 8

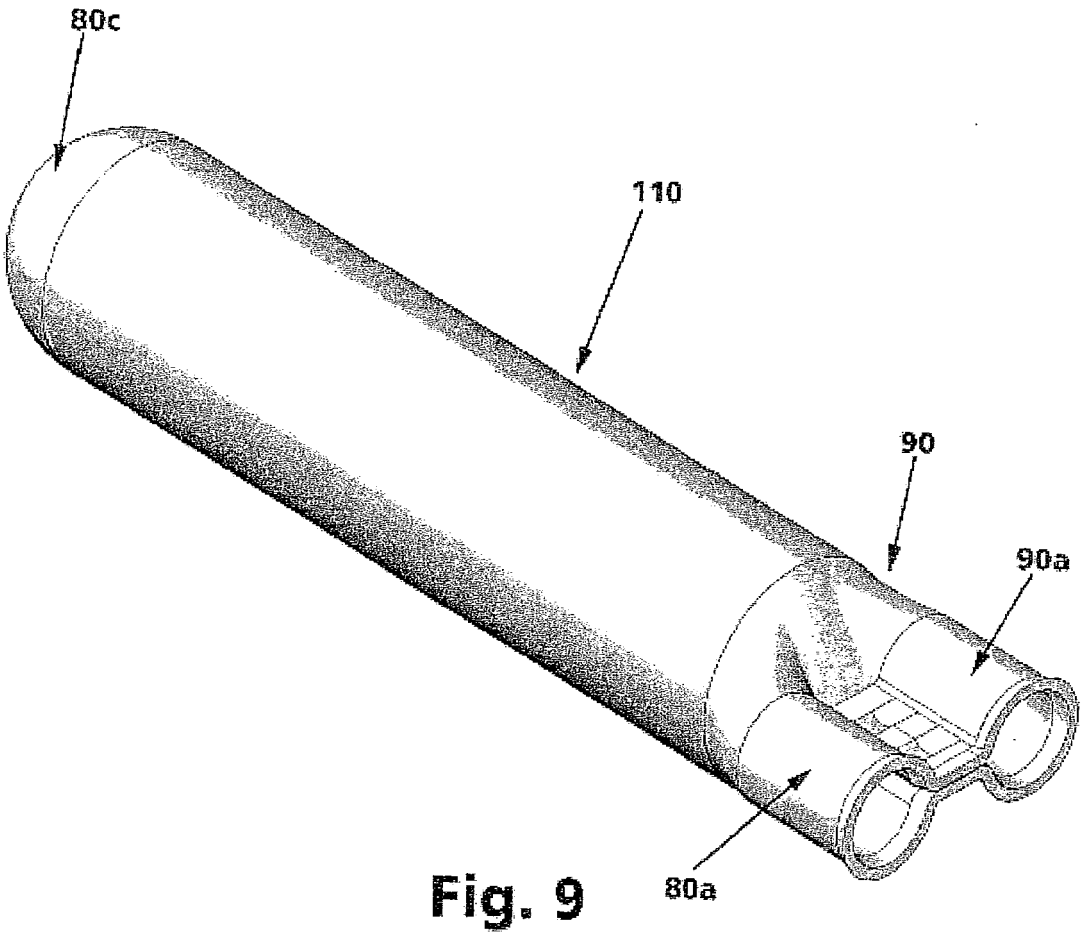


Fig. 9

Europäisches Patentamt
European Patent Office
Office européen des brevets

EUROPEAN SEARCH REPORT

Application Number
EP 10 16 3223

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X Y	US 5 245 842 A (SEARFOSS JERRY R [US] ET AL) 21 September 1993 (1993-09-21) * column 2, line 50 - column 4, line 58; figures 2-8 * * column 1, lines 28-45 *	1,3,6-14 2,4,5	INV. F25B43/00
X	WO 97/33129 A1 (NEUMAN USA LTD [US]) 12 September 1997 (1997-09-12) * page 2, lines 21-26 * * page 3, lines 13-25; figures 2-4 * * page 5, line 6 - page 6, line 14 *	1,6-8, 13,14	
Y A	JP 61 162782 U (UNKNOWN) 8 October 1986 (1986-10-08) * the whole document *	2,4,5 6	
A	JP 2004 085015 A (SANKIN CORP) 18 March 2004 (2004-03-18) * figures 1-14 *	1-14	
A	EP 0 999 421 A1 (MANULI AUTO FRANCE [FR]) 10 May 2000 (2000-05-10) * paragraph [0031] - paragraph [0034]; figures 1,2, 8 *	9-12	TECHNICAL FIELDS SEARCHED (IPC) F25B

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	9 August 2010	Léandre, Arnaud

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

1

EPO FORM 1503 03.82 (P04C01)

ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 10 16 3223

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

09-08-2010

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 5245842 A	21-09-1993	CA 2094943 A1	02-11-1993
		CZ 9300792 A3	14-06-1995
		DE 4314371 A1	04-11-1993
		ES 2092932 A2	01-12-1996
		FR 2690735 A1	05-11-1993
		GB 2266581 A	03-11-1993
		IT 1272368 B	23-06-1997
		JP 2560195 B2	04-12-1996
		JP 7043048 A	10-02-1995
		PT 101259 A	30-06-1994
WO 9733129 A1	12-09-1997	AU 2318897 A	22-09-1997
		US 5787573 A	04-08-1998
JP 61162782 U	08-10-1986	NONE	
JP 2004085015 A	18-03-2004	NONE	
EP 0999421 A1	10-05-2000	DE 69900883 D1	21-03-2002
		DE 69900883 T2	07-11-2002
		FR 2785552 A1	12-05-2000

EPO FORM P0459

For more details about this annex : see Official Journal of the European Patent Office, No. 12/82

REFERENCES CITED IN THE DESCRIPTION

This list of references cited by the applicant is for the reader's convenience only. It does not form part of the European patent document. Even though great care has been taken in compiling the references, errors or omissions cannot be excluded and the EPO disclaims all liability in this regard.

Patent documents cited in the description

- EP 1840487 A **[0019]**
- EP 1488870 A **[0055]**