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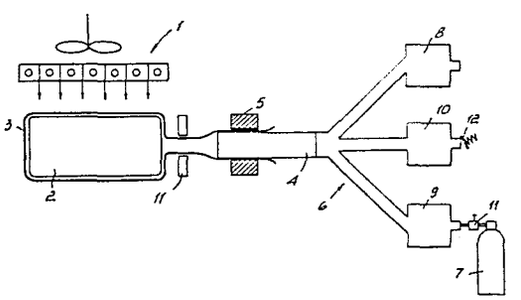
(54) A method and apparatus for packaging in flexible heat-shrinkable packages.

(57) A product (2) to be packaged is placed into a container (3) made of a flexible, heat-shrinkable material, and an insulating gas is injected into the container until it is at least partially inflated whereby the container walls are detached from the contained product. The container material is heated with an external source of heat (1) to induce heat-shrinking thereof, and insulating gas is removed from the container interior and the container is sealed tight.



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"A METHOD AND APPARATUS FOR PACKAGING IN FLEXIBLE HEAT-SHRINKABLE PACKAGES"

This invention relates to a method and an apparatus for packaging articles and products of various description in flexible heat-shrinkable packaging material. This method is specially useful for packaging food products, especially perishable ones.

Known and currently employed are methods and machines for vacuum packaging various products in flexible, heat-shrinkable, bags or containers, the respective machines being provided with suction nozzles for the evacuation of the bags. With some known methods of this type, which require no vacuum chamber for their operation, an operator manually inserts the vacuum suction nozzle into the mouth of a bag or heat-shrinkable container containing a product to be packaged. After complete evacuation of the air in the container, the mouth is sealed tight with a clamp or clip. Then, the sealed bags are temporarily placed in hot water to cause the container material to heat-shrink all around the product.

With alternative prior methods, heat-shrinking is effected in a vacuum chamber rather than by immersion in hot water. In UK Patent No. 1,561,837 filed March 29, 1976 and in Canadian Patent No. 934,718 filed July 22, 1971, both assigned to W R Grace & Co., the container whereinto the product to be packaged has been previously placed, is positioned inside a chamber, the chamber, and hence the container, are evacuated, the mouth of the container is sealed while the chamber is under vacuum, the chamber vacuum level is increased (chamber is evacuated to a greater extent) to cause the container to bulge out, the walls of the bulging container are heated from a heat source within the vacuum chamber, and atmospheric pressure is restored, at a controlled rate, inside the chamber to accomplish heat-shrinking of the wrapper around the product.

The above-mentioned prior methods have several limitations and disadvantages. For example, the former of

the prior methods outlined above involves a complex,laborious, and uneconomical step of immersion in boiling water.

The vacuum chamber method is often complicated to implement because all of the main operations are carried out within the chamber, access to which can cause pneumatic seal problems.

Other prior packaging methods provide for the products to be packaged under a protective gas atmosphere (CO_2,N_2 etc.) as disclosed by US Patents Nos. 3,968,692 filed December 30, 1974 and assigned to Elektrowatt AG and 3,939,624 filed March 4, 1975 and assigned to CVP Systems, Inc. Such methods involve no heat-shrinking operations, and hence make no use of heat-shrinkable packaging films.

It is a primary object of this invention to obviate such prior method drawbacks by providing a method of vacuum packaging with heat-shrinking, which can be readily and effectively implemented.

Another object of the invention is to provide a method whereby the preservation of the packaged product can be improved, with special reference to the instance of perishable products.

A further object of the invention is to provide a method which is highly reliable and simple and enables heat-shrunk vacuum packages to be produced which are free of wrinkles and of the utmost value as regards their aesthetic presentation.

Also an object of this invention is to provide an apparatus of simple design and construction, adapted to implement the inventive method.

One aspect of the present invention provides a method of vacuum packaging in flexible packaging materials wherein a product to be packaged is inserted in a container formed from a heat-shrinkable thermoplastic material leaving an opening for communication to the outside comprising the steps of:

heating the container by heat application from an external heat source to induce heat shrinking of the container;

removing gas from within the container while still applying heat; and thereafter sealing the container; characterised by the fact that an insulating inert gas is injected into the container until the container is caused to bulge out such that the container walls are detached from the contained product; and in that the removal of gas from within the container includes removing at least some of the injected insulating gas.

A further aspect of the present invention provides an apparatus for vacuum packaging products in containers formed from flexible, heat-shrinkable packaging materials, comprising:- at least one nozzle, a means of clamping a said filled container with an opening in said container in communication with the said nozzle; a means of dry heating said container; and a means of sealing said container tight; characterised by:- vacuum means and gas injection means in communication with said at least one nozzle; at least one cut-off valve in communication with said nozzle means; and at least one vent valve in communication with said cut-off valve.

In order that the present invention may more readily be understood the following description is given, merely by way of example, with reference to the accompanying drawings, in which:-

Figure 1 is a diagrammatic view of an apparatus according to the invention;

Figure 2 is a diagrammatic illustration of the step sequence which characterizes the inventive method; and

Figure 3 is a diagrammatic illustration of a modified embodiment of the inventive apparatus.

Making reference to Figures 1 and 2, the packaging apparatus according to the invention comprises a heat source 1, which can supply heat, for example either by convection or radiation. Preferably, for a heat source, an electric resistance heater combined with a blower will be used.

A product 2 to be packaged is introduced into a container 3 formed of a flexible thermoplastic material of a heat-shrinkable nature either manually or through

conventional loading means for such applications, not shown. The container, with the product to be packaged inside it, is positioned at a nozzle 4, it being, for example, fed by a specially provided conveyor, e.g. a belt conveyor. A suitable clamp 5 provides a tight fit of the mouth of the container 3 onto the nozzle 4. The nozzle 4 is in communication through a valve 8, with a suction means such as a vacuum pump (not shown), and is also in communication with a means 7 of injecting a pressurised gas, for example, through a three-way connector, generally indicated at 6. Specially provided valves 8 and 9 control the opening and/or closing of said suction means and injection means. The nozzle 4 also communicates with the outside atmosphere through a third cut-off valve 10 and additional vent valve 12 connected thereto.

A sealing means 11 is arranged either to heat seal the neck or mouth of the container 3 on completion of the packaging operation, or to apply a strap or clip thereon. The sealing means may comprise heated pressure sealing bars, or as an alternative, where the material of the container 3 is of the self-sealing type, a means of sealing by mere heat application. Alternatively, conventional clipping means may be used.

The packaging method of this invention will be next described with reference to Figure 2. With the sequence indicated at A, the container enclosing the product to be packaged is inserted with its mouth over the nozzle 4, and the clamp 5 is tightened around the container mouth to provide a perfect seal between the container and nozzle. Where the insulating gas of the following step is other than air, e.g. nitrogen or CO_2, a pre-evacuation step is carried out at this time. For this purpose, the valve 8 is opened to put the interior of the container 3 into communication with the vacuum pump, the valves 9 and 10 being held closed. As air is removed from the space between the product 2 and container 3, the latter will collapse to contact the surface of the product 2.

On completion of the air removal step, the insulating gas injection sequence, indicated at B, takes

place. Where the insulating gas is air, the pre-evacuation step would be omitted, and the cycle would be resumed by directly going to the gas injection step. During this step, with the valves 8 and 10 closed, the valve 9 is opened to admit pressurised gas from the pressure bottle 7 (Fig. 1) through a pressure reducer into the space between the container 3 and product 2. The gas injection step is continued until the walls of the container 3 bulge out and separate completely from the surface of the product 2, to be insulated therefrom by the gas layer.

The gas pressure at this stage will be the least required to fully detach the container walls from the product, and such as to avoid rupture of the walls. Depending on the material used for the container, the pressure level may range, for example, from 200 to 10,000 Pa.

Thereafter, the operative sequence indicated at C in the drawing takes place, wherein heat begins to be applied by means of the heat source 1 and the valves 8 and 9 are closed and the cut-off valve 10 opened. Under the action of the applied heat, the container 3 undergoes a heat-shrinking effect which causes the previously introduced insulating gas to be discharged through the cut-off valve 10 and vent valve 12 whereby the walls of the container 3 collapse down to contact the surface of the product 2. In such conditions, quick heating of the bag walls can be achieved without the heating rate being hindered by the thermal inertia of the product 2 placed inside the container, owing to the provision of the insulating gas between the product and container. Thus, if the product 2 is a chilled or frozen product, separation of the bag walls from the product by the gas provides insulation so the wall can be heated throughout its thickness. Otherwise the chilled product in contact with the bag wall acts as a heat sink.

The exit of gas from the container is appropriately controlled through the vent valve 12, which is calibrated for a preset pressure level dependent on the container size, the material of which it is constructed, and its heat-shrinking temperature. Said vent valve 12 can prevent, during the heat shrinking process, both rupture of the container as caused by excess pressure, and a too high rate of gas removal. In fact, if the container is emptied quickly before its walls have reached their heat-shrinking temperature, the result will be an inadequate heat-shrinking.

The heat-shrinking step may be completed, as illustrated by the sequence indicated at D, by continued application of heat and by opening the valve 8 connected to the vacuum suction system, while closing at the same time the cut-off valve 10. Thus, complete removal of the insulating gas is assured along with the desired level of vacuum in the container 3. The sequence D is specially useful where the product being packaged is of a perishable nature.

Finally, the package sealing step, as illustrated by the sequence E, takes place, for example, by heat sealing using the sealing bars 11. During this step, the excess portion of the container walls is cut off and removed from the nozzle after releasing the clamp 5. Heating is continued to completion of the heat-shrinking process also at the mouth area after sealing.

The material useful for the container in the inventive method is any thermoplastic material exhibiting heat-shrinking properties, and possibly heat welding properties. Single layer films may be used such as biaxially oriented, radiation cross-linked, polyethylene films like the films sold by W R Grace & Co. as "D-FILM" or as "CRYOVAC D-FILM" (Trademarks of W R Grace & Co.) or bi-oriented plastified polyvinylidene chloride, like the one sold by W R Grace & Co. "S-FILM" (Trademark of W R Grace & Co.). Alternatively, multilayered films are

used which have at least one heat-shrinkable layer and additional layers performing the function of a heat welding layer, of a gas barrier, etc., depending on the final use contemplated. For the heat-shrinkable layer, bi-oriented polyvinylidene chloride and copolymers thereof with ethylenically unsaturated monomers, fluorocarbon polymers, and fluorohydrocarbon polymers, may be used.

For the sealing layer, a polyvinyl acetate or EVA (ethylene-vinyl acetate) copolymer may, for example, be used. The packaging material may moreover comprise additional intermediate layers, e.g. of polyvinylidene chloride, nylon, etc.

An example of a multilayer film useful with this invention is an oriented film having layers of irradiated ethylene-vinyl acetate copolymer/vinylidene chloride copolymer/ethylene-vinyl acetate, or a biaxially oriented film having layers of nylon/nylon/ irradiated polyethylene.

The container used with this invention may be in the form of a wrapping sheet to be folded up in the process, or may be seamless tubing closed at one end, or may be a preformed bag.

Figure 3 of the drawings shows an alternative embodiment of an apparatus according to this invention, which allows the inventive process to be carried out in a semi-continuous or continuous fashion.

The apparatus comprises a plurality of nozzles, e.g. four, which are mounted pivotally about a vertical centre axis, each of them being communicated to a vacuum pump, an insulating gas blowing means, a cut-off valve, and a vent valve, as described hereinabove. Timers control appropriately the opening and closing sequence of the various control valves to enable each nozzle to complete its processing cycle, as described with reference to Figure 2, in an independent and non-synchronous manner with respect to the other nozzles.

Each nozzle performs a complete processing cycle during its full revolution about the vertical axis, so that upon returning to its starting point, or station A, a nozzle is ready to receive a fresh container with a product to be packaged therein and to complete a further revolution to go through all of the processing sequences B-C-D-E, the finished package being discharged at the point illustrated as station E. The heating and heat-shrinking step is expediently effected by passing the rotating nozzles through a heat tunnel, preferably a convective hot air tunnel but radiation may also be employed, as indicated at 13. To ensure a uniform heat application and rapid transfer of heat, electric resistors and blowers may, for example, be provided inside the tunnel, and arranged evenly across the side and top walls of the tunnel.

As an example, to implement this embodiment of the method and apparatus according to the invention, an existing multistation apparatus may be used, such as the "Girovac" (Trademark of W.R. Grace & Co.) machine from W.R. Grace & Co. or "Roto-Matic" machine from Tipper-Tie Division of Rheem Manufacturing Company, but equipped additionally with all the necessary facilities mentioned above, i.e., a hot air tunnel, heat welding bars and, for each nozzle, a cut-off valve and vent valve.

The invention will be now illustrated by the following example, given herein by way of illustration and not limitation thereof.

EXAMPLE 1

For a container, a bag is used of a biaxially oriented heat-shrinkable material, of the type available commercially under the trademark "Barrier Bag" and being distributed by W.R. Grace & Co. Said material comprises an outer surface layer of irradiated ethylene-vinyl acetate copolymer, an intermediate, gas impervious layer of plastified vinylidene chloride copolymer, and an inner

surface layer of heat sealable ethylene-vinyl acetate copolymer. A product is introduced into the container. In this specific case, a cut of cooked ham is packaged. Next, by means of a sealing clamp, the bag mouth is inserted over a nozzle of a multistation machine, as shown in Figure 3. During the step A, the container with the product therein is secured and sealed to the nozzle. The product being packaged is conveyed over a surface provided with rotating rollers, while through the nozzle, during the step B, air at a pressure of 1.96 KPa is introduced. This pressure can be controlled accurately, for example, with a manostat which automatically closes the gas intake valve upon reaching a preset level. During the step, the cut-off vent valve is closed. The ham cut being packaged is then started along a hot air heating tunnel 13 which has sufficient length to provide perfect heat shrinkage. Heating is accomplished by means of an electric resistance device incorporating a fan, such as "Leister Forte S" unit or similar unit of 10,000 watts. The tunnel interior temperature is about 170°C. A residence time in the tunnel of 4-5 seconds is adequate to provide full heat shrinkage.

During this step, the cut-off valve 10 is opened. The outflow of the gas contained in the container is appropriately controlled by the vent valve 12, which includes a calibration spring arrangement effective to prevent rupture of the container as well as too fast a removal of the air. At the tunnel end, the vent valve opens fully to allow out all of the contained air. For application in many practical cases, and with special reference to delicate materials, the cycle may be terminated at this point by closing the container with a clip or by heat sealing. Where, on the contrary, heat-shrinking is less than perfect, at the tunnel end, a gas removal step may be provided through the vacuum forced

suction system. This additional step is particularly suitable for stronger products where the shrink forces in the wrapping material will not distort the product.

It may be appreciated from the foregoing that the method disclosed herein affords the achievement of a quick and effective heat shrinkage owing to the absence of contact during the heating and shrinking step between the container material and the product, and, therefore, the absence of heat dissipation to the product. Further, this method is more promising from the standpoint of preservation of the packaged product, owing to the insulating gas introduction step ensuring complete removal of the air from the container. Moreover, the presence of the insulating gas layer during the first heating step allows just slight heating of the product and contributes, in turn, to an improved preservation of the product. With the method according to the invention, a highly improved heat-shrinkage of the bag material is achieved without wrinkles, and with aesthetic appeal, similar to that obtained by employing a complex vacuum chamber as with conventional methods. The method and apparatus described herein are susceptible of many modifications and variations, as the skilled person in the art will readily recognize, without departing from the scope of the invention as herein described and claimed.

The "insulating gas" used in the method of the present invention is a gas, preferably an inert gas, which thermally insulates by expanding the bag and placing the bag out-of-contact with the product, i.e., the gas separates the bag and product so that the product will not chill the bag and keep it from being heated to its shrinkable temperature.

CLAIMS

1. A method of vacuum packaging in flexible packaging materials wherein a product to be packaged is inserted in a container formed from a heat-shrinkable thermoplastic material leaving an opening for communication to the outside comprising the steps of: heating the container by heat application from an external heat source to induce heat shrinking of the container; removing gas from within the container while still applying heat; and thereafter sealing the container; characterised by the fact that an insulating inert gas is injected into the container until the container is caused to bulge out such that the container walls are detached from the contained product; and in that the removal of gas from within the container includes removing at least some of the injected insulating gas.

2. A method according to Claim 1, characterised in that said insulating gas is air.

3. A method according to Claim 1, characterised in that the insulating gas is either nitrogen or CO_2.

4. A method according to Claim 3, characterised by an additional step wherein the air in the container prior to gas injecting step is evacuated from said container by injecting said insulating gas.

5. A method according to any one of the preceding claims, characterised in that said heating step is effected by either convection or radiation.

6. A method according to any one of the preceding claims, characterised in that the gas removal step is effected by the heat-shrinking action of said container.

7. A method according to any one of Claims 1 to 5, characterised in that said gas removal step is effected by the heat shrinking of said container and subsequent application of a vacuum suction means.

8. A method according to any of Claims 1 to 7, characterised in that said container comprises a multilayer laiminated film having at least one heat-shrinkable outer surface layer and a heat-sealable inner surface layer.

9. A method according to any one of the preceding claims, characterised in that the insulating gas admitted during step a) is at a maximum pressure in the range of 200 to 10,000 Pa.

10. An apparatus for vacuum packaging products in containers formed from flexible, heat-shrinkable packaging materials, comprising:- at least one nozzle, a means of clamping a said filled container with an opening in said container in communication with the said nozzle; a means of dry heating said container; and a means of sealing said container tight; characterised by:- vacuum means and gas injection means in communication with said at least one nozzle; at least one cut-off valve in communication with said nozzle means; and at least one vent valve in communication with said cut-off valve.

11. An apparatus according to Claim 10, characterised in that said vent valve is caused to open upon reaching a pre-determined pressure threshold inside said container which is adjustable.

12. An apparatus according to Claim 11, characterised in that adjustment of the opening pressure for the vent valve is performed through either a spring means or pneumatic means.

13. An apparatus according to Claim 10, characterised by comprising a plurality of said nozzles adapted for rotation about a vertical centre axis, each said nozzle being arranged to perform said vacuum packaging in accordance with independent and non-synchronous cycles with respect to the other of said nozzles, each cycle being performed during a complete revolution of each said nozzle.

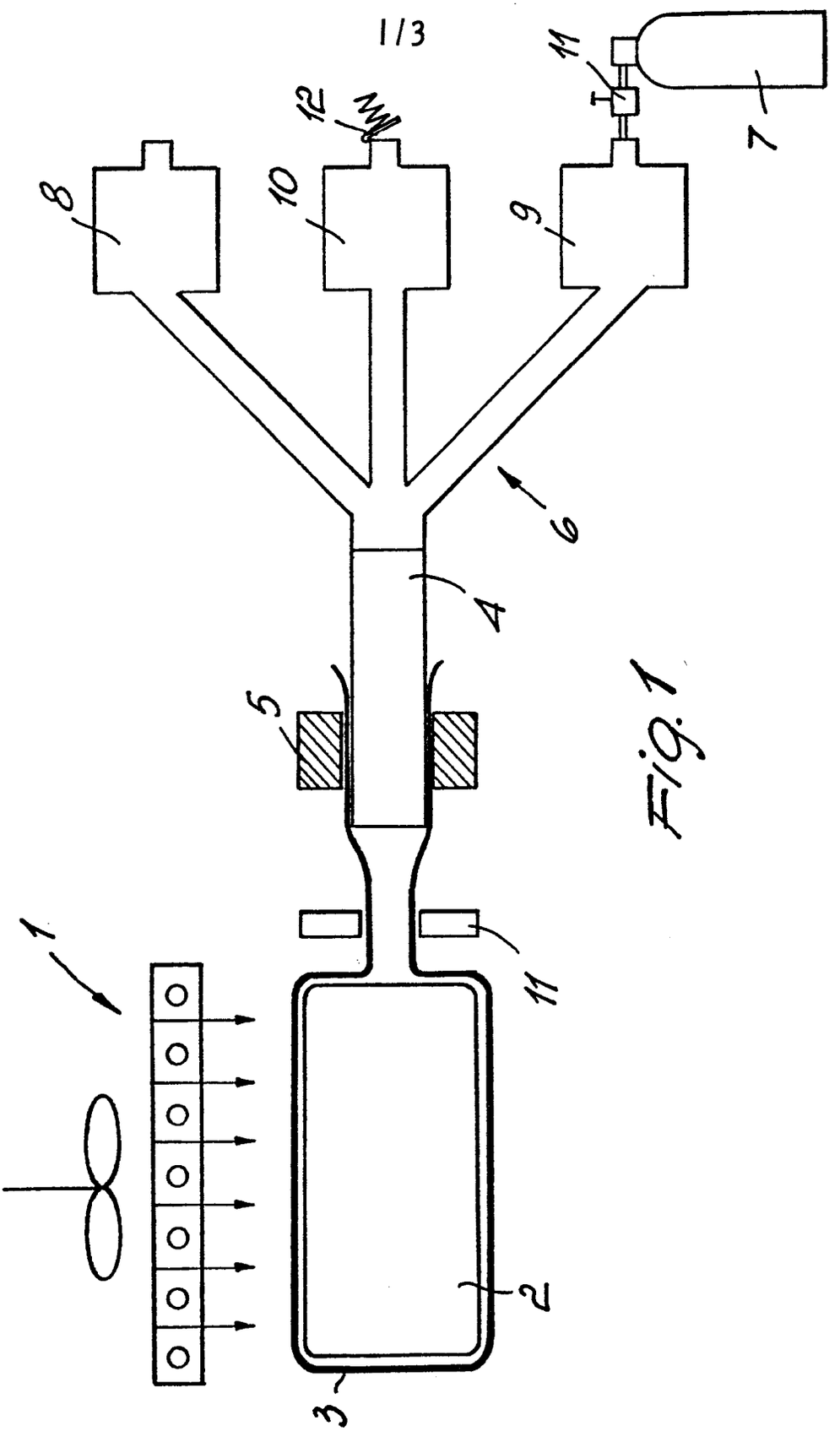

Fig. 1

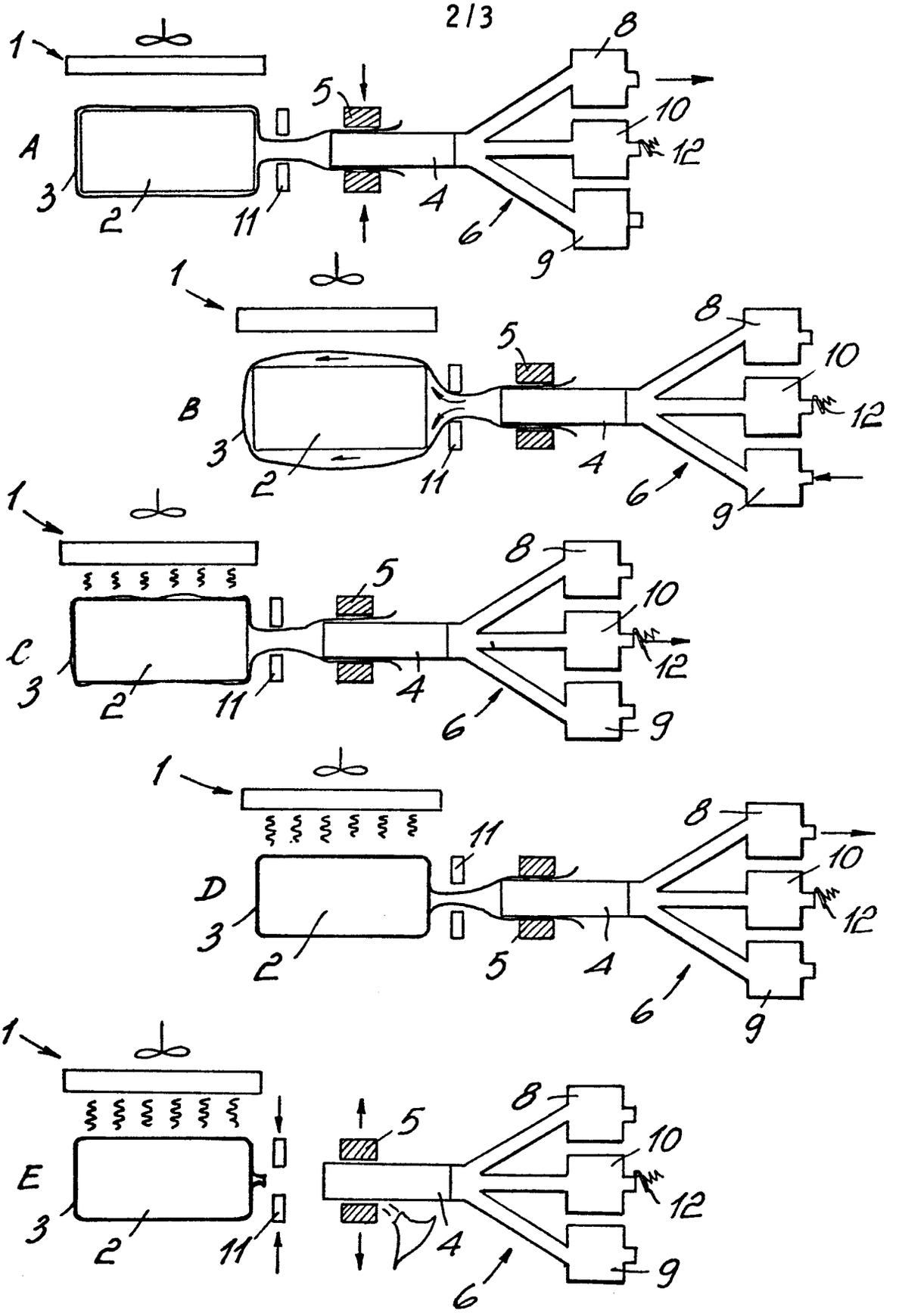

Fig.2

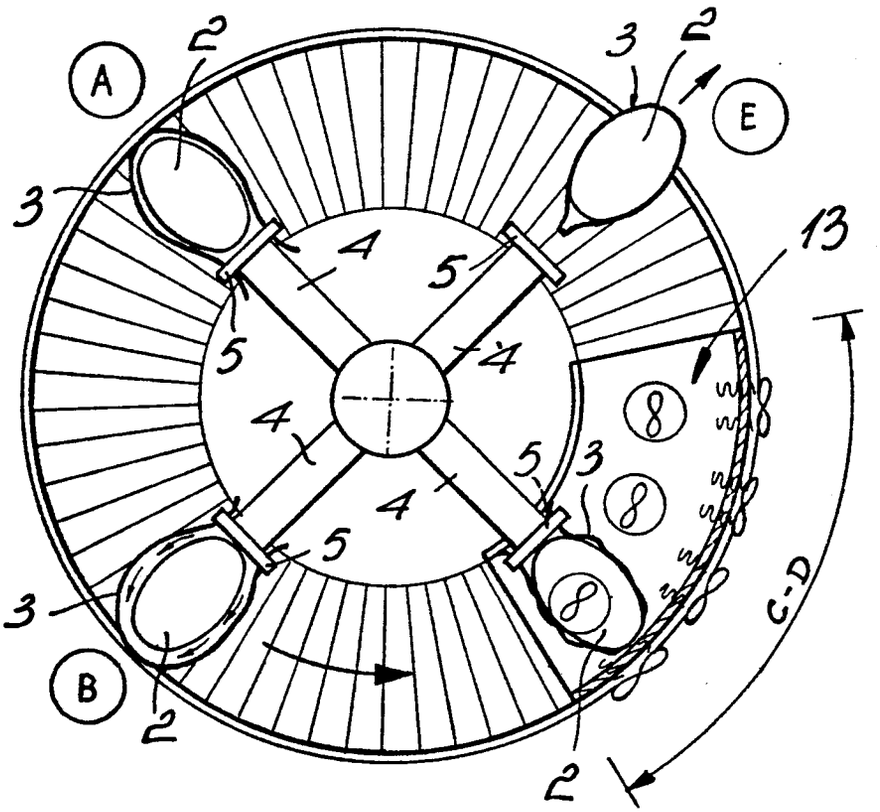

Fig. 3

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Application number

European Patent Office

EUROPEAN SEARCH REPORT

EP 84304145.0

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.4)
A	DE - A - 2 247 452 (TECHNOPACK) * Totality * --	1-7,10, 11	B 65 B 31/04 B 65 B 53/06
A	DE - A1 - 3 123 768 (GRACE & CO.) * Totality * --	1,5,8, 10	
A	DE - A - 1 326 649 (GRACE & CO.) * Fig. 1,2 * ----	10,13	

TECHNICAL FIELDS SEARCHED (Int. Cl.4)

B 65 B 31/00
B 65 B 53/00

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
VIENNA	26-03-1985	MELZER

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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