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(54) Title: APPARATUS FOR FORMING FOODSTUFF MASSES BY EXTRUSION

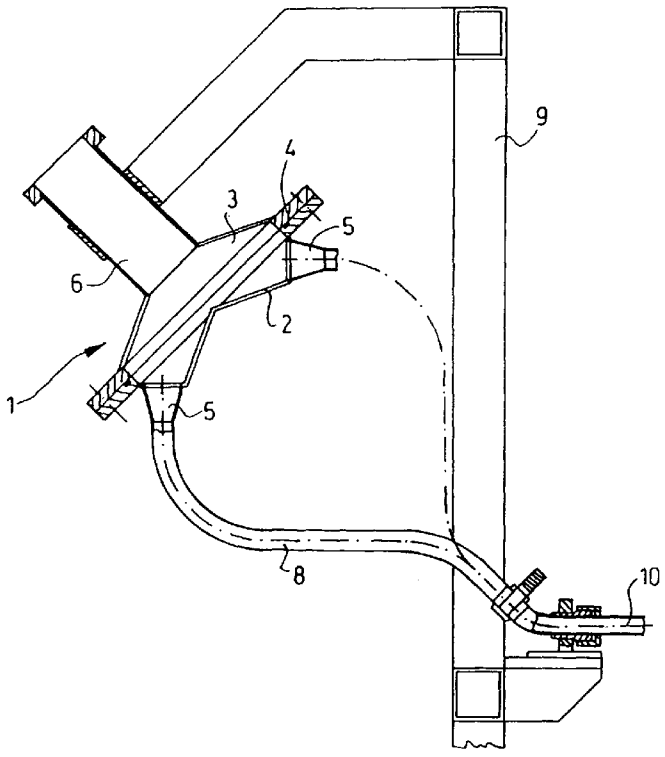

Fig. 3

(57) Abstract: The present invention relates to an apparatus for forming foodstuff masses by extrusion, in particular for forming candy, dairy and bakery snack products, said apparatus comprising an extruder housing equipped with a material forwarding assembly, and further comprising product forming extruder pipes fixed to the outlets of the extruder housing. The apparatus is characterized in that said material forwarding assembly is in the form of a positive displacement pump (7) to which a drum-shaped, rotationally cylindrical extruder housing (1) with a central inlet pipe stub (6) is attached, said outlets of the extruder housing being spaced evenly along a circle on the envelope of said drum-shaped extruder housing (1), and wherein the product forming extruder pipes (8) connected to the outlets are all of equal length and are lead to a product chopping device with their end sections being arranged in multiple lines in one plane.

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APPARATUS FOR FORMING FOODSTUFF MASSES BY EXTRUSION

The present invention relates to an apparatus for forming foodstuff masses by extrusion, in particular for forming filling masses for candy, dairy and bakery piece-like products (so-called snack products), as well as of pastes constituting the corpus of such products, by extrusion.

Forming various foodstuff masses by extrusion in the food industry is conventionally carried out by using forming cylinders with hoppers or screw extruders, where the foodstuff mass is forwarded within the drum-shaped extruder housing by a screw conveyor, functioning as a material forwarding assembly, toward the forming pipes attached to the end of the extruder housing. However, these conventional forming machines are extraordinarily sensitive to the rheological properties of the materials to be formed, especially to their viscosity, solidity and penetration. (The latter term refers to the penetrability of the foodstuff mass and, in this context, to its rigidity and consistency). For instance, ordinary screw extruders can be used safely only for forming foodstuff masses that are very solid and of low penetration, which, however, affects the product's deliciousness adversely. Using co-extrusion to manufacture certain dairy snack products that consist of two different fillings (chocolate milk-cream and cottage-cheese cream), such as "Duett Rudi", entails the simultaneous co-extrusion of, for example, 20 lines of products. Consequently, to ensure reliable quality in manufacturing such products, co-extrusion cannot be performed precisely by using a conventional screw extruder since due to the variable pressure conditions arising in such devices, it is practically impossible to maintain stable forming and flow rates for each of the two components (i.e. for the chocolate milk-cream and the cottage-cheese cream).

Furthermore, consumer protection regulations require that a fluctuation-free gram-weight of the snack products (e.g. "Túró Rudi", "Duett Rudi", etc.) be safely respected. By using conventional extruders, this requirement can be hardly met even in the case of single-layer products, whereas for multi-layer products, (in particular for foodstuff masses consisting of ingredients of different viscosity, penetration and consistency), it is almost impossible to set a constant forming

rate in an industrial manufacturing process while maintaining a uniform snack-weight. In this regard, for manufacturers producing items with a weight of less than 50 grams, a variance of +/–9% in weight is allowed in case of individual samples.

Obviously, there are other types of snack production processes around the world that, instead of continuous extrusion, cutting on band and subsequent dipping, rather use the so called "moulage" technology, which refers to a process of injecting chocolate, filling with cream after cooling, and subsequent application of coating.

This solution is precise but excessively costly.

The object of the present invention is to provide a forming apparatus that extrudes economically and that, while operating continuously and hygienically, is capable of forming foodstuff masses with most diverse rheological properties (solidity, viscosity and penetration), also including the production of formed products consisting of two or more layers by co-extrusion, with constantly maintaining the prescribed gram-weight for the product, whilst retaining a constant flow rate (for materials ranging from lumpy cottage cheese to soft end-products and fruit jellies).

The present invention is based on the recognition that the mass or masses should be fed into the respective forming pipes projecting above the cutting-table under constant pressure providing constant flow rate and that this pressure should be maintained, which may be achieved by attaching the forming pipes, in an evenly distributed arrangement, to the circumference of a closed, drum-shaped, rotationally symmetrical mass distribution chamber.

The above object is achieved by providing an apparatus for forming foodstuff masses by extrusion, in particular for forming candy, dairy and bakery snack products, said apparatus comprising an extruder housing equipped with a material forwarding assembly, and further comprising product forming extruder pipes fixed to the outlets of the extruder housing. According to the invention, the material forwarding assembly is formed as a positive displacement pump to which a drum-shaped, rotationally cylindrical extruder housing with a central inlet

pipe stub is attached, said outlets of the extruder housing being spaced evenly along a circle on the envelope of said drum-shaped extruder housing, and wherein the product forming extruder pipes connected to the outlets are all of equal length and are lead to a product chopping device, such as a cutting tape, with their end sections being arranged in multiple lines in one plane.

The mass distribution chamber, i.e. the drum-shaped extruder housing, to the circumference of which extruding pipes of equal length are attached evenly distributed along a circle, provides a compensation of the pressure variations resulting from the pulsation arising when the materials are being forwarded. In this way, products of uniform size, weight and shape may be produced from the foodstuff masses entering into the extruding pipes without pressure fluctuation and under the same pressure, while providing the same speed (i.e. flow rate) for each mass. Thus, in a particular case of combined products, the product components of different viscosity may be co-extruded in the same cycle with the same speed. To ensure the proper quality of the product, and more specifically to retain the colloidal structure of the foodstuff mass, it is essential to use the positive displacement pump since the use of another kind of pump, such as a centrifugal pump, would result in the collapse of the material's desired structure.

In a preferred embodiment of the invention, the drum-shaped extruder housing consists of two housing portions, wherein the discharge nozzle of the positive displacement pump is attached to the central pipe stub of the upper housing portion, whereas the pipe stubs forming the outlets of the drum-shaped extruder housing and connecting to the extruder pipes are arranged on the envelope of the lower housing portion in an evenly distributed manner. According to the invention it is preferred that the two housing portions are in the form of rotationally cylindrical bodies with opposite conicities.

It is also preferred, according to the invention, that a plurality of outlets for the extruder pipes are formed on the envelope of the drum-shaped extruder housing.

For an easy and precise adjustment of the apparatus according to the invention, it is preferred that the positive displacement pump is equipped with a power control means using frequency conversion.

Preferably, the extruder pipes are made of stainless steel, which is beneficial in respect of both industrial engineering and food hygienic aspects. It is particularly preferred that all parts of the apparatus are made of materials allowing the use of the apparatus in an automatic washing cycle (CIP), mainly of stainless materials. In case of certain masses, such as fruit jellies and the like, it may be advantageous that the extruder pipes are made of plastic.

The extruded mass may be formed by the cross sectional shape of the extruder pipe itself, but in a particular case, it is preferred that the ends of the extruder pipes are equipped with forming heads.

Finally, for extruding various foodstuff masses simultaneously (co-extrusion), it is preferred that the horizontal end sections of the extruder pipes are partitioned lengthwise by one (or more) partition wall(s), and extruder pipes of an (or a plurality of) other extruder apparatus of similar construction, each for feeding another kind of mass, are connected into said end sections of the extruder pipes.

The present invention will now be described in more detail by illustrating a preferred embodiment with reference to the accompanying drawings, in which:

- Figure 1 shows a vertical longitudinal sectional view of the drum-shaped extruder housing of the extruder according to the invention,

- Figure 2 illustrates a top plan view of the bottom part of the extruder housing shown in Figure 1, and

- Figure 3 shows a schematic side view of the extruder apparatus according to the invention, wherein the extruder is mounted on a support frame and comprising a positive displacement pump connected to the extruder housing, and wherein only one extruding pipe is illustrated.

Since the most important physical condition for industrial forming is the maintenance of the internal pressure of the extruded mass at a constant level within the closed extruder housing in respect of each line when measured at the respective locations (wherein the pressure value ranges from 0,5 to 7 bars, depending on the properties of the foodstuff mass, like its viscosity, temperature, solidity, fat content, water content, colloidal state and dry matter content.), the extruder apparatus according to the invention, as shown in Figure 1, comprises a

drum-shaped, rotationally symmetrical extruder housing 1 that preferably consists of two coupled housing portions 2 and 3, which, in a particular case, are formed as a conical bottom plate and a conical cover plate, respectively, said housing portions 2, 3 being attached to each other by a releasable joint along a properly sealed rim 4.

Around the entire circumference of the extruder housing portion 2 formed as a conical bottom plate, stainless steel pipe stubs 5 are welded equidistantly, said pipe stubs 5 directly penetrating through the envelope of the extruder housing portion 2 and being connected to the inside of the drum-shaped extruder housing 1. The central axis of said pipe stubs 5 extend substantially in parallel to the generatrix of the conical envelope of the bottom plate.

The diameter of the pipe stubs may vary in a wide range (from 8 mm to 50 mm), typically depending on the viscosity, the consistency, the type, the form and the weight of the corpus to be extruded.

There is a stainless steel inlet pipe stub 6 of size ND 65, ND 50 or ND 45 secured to the peak of the conical cover plate forming the upper housing portion 3, to which the discharge nozzle of a positive displacement pump 7 – or alternatively, of a rotary piston pump – controlled by a frequency converter is connected, wherein the frequency converter is used to control the rotational speed, and consequently the flow rate, of the pump.

As clearly shown in Figure 2, stainless steel extruder pipes 8 of equal length are releasably or rigidly fixed to the envelope of the bottom housing portion 2 in a uniformly distributed manner. Alternatively, releasably fixed, plastic extruder pipes of equal length may also be used instead of said extruder pipes 8.

The extruder pipes 8 have a planar arrangement with running along an arcuate path from the envelope of the bottom housing portion 2, and are secured by means of a suitable support frame 9, as shown in Figure 3.

The extruder pipes 8 (depending on the width of the associated cutting tape extending below them) are arranged in a plane and form 16, 18, 20, 22, 24, 26 or 28 lines above the cutting desk. These extruder pipes 8 are mostly used alone to form the products, but they may be equipped with various forming heads coupled

to the pipe ends.

Obviously, the diameter (together with the circumference) of the drum-shaped extruder housing 1 distributing the foodstuff mass may be increased by increasing – or even independently of – the number of extruder pipes 8. For example, the diameter of the extruder house with 18 pipes used in the co-extrusion of fruit jellies is 200 mm. Conversely, the diameter of the extruder-house with 16 pipes used for maxi-sized "Túró Rudi" is 330 mm. It can be said that the "logical limit" for the diameter of an extruder housing 1 is the cutting tape width, and additionally, an acceptable level of loss of material, since the volume of the extruder housing cannot be emptied at the end of the extrusion process for the purpose of manufacturing end products.

The process of extrusion is as follows:

The foodstuff mass prepared for extrusion is forwarded from a backup tank or other storage to the positive displacement pump 7. The positive displacement pump 7 (with a transport capacity of 200 kg to 1000 kg mass per hour) conveys the foodstuff mass to be formed into the drum-shaped extruder housing 1 through a stainless steel pipe and the central inlet pipe stub 6. In the extruder housing 1 functioning as a closed system, the pressure fluctuation caused by the peristaltic conveyance of the pump 7 is compensated, and the pressure arising on to the circumferential envelope of the housing portions 2 and 3 will be identical everywhere. Thus, the pressure and velocity of the foodstuff mass being formed and exiting the extruder pipes 8 will be constant, therefore only the speed of the cutting tape is to be set in order to convey the formed corpus exiting the apparatus at a constant speed, pressure and weight ratio to an ultrasonic cutting tool or an other type of cutting tool. The product lines arranged in one plane and a plurality of lines can thus be easily cut to length without any loss.

The great advantage of the extruder apparatus comprising a positive displacement pump 7 and a drum-shaped, rotationally symmetrical extruder housing 1 is that the material loss is less in comparison to the use of a screw extruder, and additionally,

- industrial engineering and product shift is simpler and requires less time,

- producing snack items of different weight and density as a result of pressure fluctuation is avoided,
- configuration (setting the optimal frequency of the pump) should be done only once, at the beginning of production, and thereafter, the system runs automatically.

The apparatus according to the invention fully meets the food hygiene requirements because it is CIP-capable, i.e. it can be connected into an automatic washing cycle, unlike other extruders that cannot fulfil this condition. Thus, the microbiological characteristics of the products manufactured by this apparatus are better than those of products manufactured by conventional extruders.

In addition, the apparatus according to the invention facilitates the co-extrusion of multi-layer products by coupling two or more such extruding apparatuses. Accordingly, the apparatus described above is used for the production of multi-layer products (e.g. for the production of "Duett Rudi", in which an upper layer of milk cream is combined with a lower layer of flavoured cottage-cheese) in such a way that two extruder apparatus with rotationally symmetrical housing, according to the invention, are connected in series, and the masses of different colours, consistencies, tastes and rheological properties are fed by means of two associated positive displacement pumps 7 into the rotationally symmetrical extruder housings 1 and the extruder pipes 8.

The end sections 10 of the extruder pipes 8 of the first extruder apparatus (extruder of white foodstuff mass) are partitioned inside lengthwise by stainless steel plates, said end sections being arranged in one plane and a plurality of lines.

The aligned pipe sections of the second extruder apparatus (extruder of chocolate milky cream) arranged above the first extruder apparatus are connected to the partitioned upper part of the pipe sections 10 of the extruder pipes 8 of the first extruder apparatus in a completely sealed manner. The extruder pipes 8 of the two extruder apparatuses are fixed together by shielded welding for hygienic safety reasons (CIP-capability).

By implementing the solution described above, and supplementing it with the rotational speed control of the positive displacement pumps 7 by means of frequency conversion, the complicated multi-layer products may be manufactured with high reliability and with maintaining the least possible differences in the weight ratios between the various lines. At the same time, the proportion of the two kinds of masses may vary in a wide range from 10% to 90%, although a ratio of 50-50% is most frequently adjusted in practice.

The extruder apparatus according to the invention that can be economically implemented is adapted to provide a constant flow rate (for products ranging from lumpy cottage cheese to very soft end-products and fruit jellies) to form foodstuff masses of the most variable rheological properties (solidity, viscosity, and penetration), also including the production of formed products consisting of two or more layers by co-extrusion, whilst ensuring the stable gram-weight prescribed for the product.

CLAIMS

1. An apparatus for forming foodstuff masses by extrusion, in particular for forming candy, dairy and bakery snack products, said apparatus comprising an extruder housing equipped with a material forwarding assembly, and further comprising product forming extruder pipes fixed to the outlets of the extruder housing, **characterized in that** said material forwarding assembly is in the form of a positive displacement pump (7) to which a drum-shaped, rotationally cylindrical extruder housing (1) with a central inlet pipe stub (6) is attached, said outlets of the extruder housing being spaced evenly along a circle on the envelope of said drum-shaped extruder housing (1), and wherein the product forming extruder pipes (8) connected to the outlets are all of equal length and are lead to a product chopping device with their end sections being arranged in multiple lines in one plane.

2. Apparatus according to claim 1, **characterized in that** the drum-shaped extruder housing (1) consists of two housing portions (2, 3), wherein the discharge nozzle of the positive displacement pump (7) is attached to the central pipe stub (6) of the upper housing portion (3), whereas the pipe stubs (5) forming the outlets of the drum-shaped extruder housing (1) and connecting to the extruder pipes (8) are arranged on the envelope of the lower housing portion (2) in an evenly distributed manner.

3. Apparatus according to claim 2, **characterized in that** the two housing portions (2, 3) are in the form of rotationally cylindrical bodies with opposite conicities.

4. Apparatus according to any one of claims 1 to 3, **characterized in that** a plurality of outlets for the extruder pipes (8) are formed on the envelope of the drum-shaped extruder housing (1).

5. Apparatus according to any one of claims 1 to 4, **characterized in that** the

positive displacement pump (7) is equipped with a power control means using frequency conversion.

6. Apparatus according to any one of claims 1 to 5, **characterized in that** the extruder pipes (8) are made of stainless steel.

7. Apparatus according to any one of claims 1 to 6, **characterized in that** all parts of the apparatus are made of materials allowing the use of the apparatus in an automatic washing cycle (CIP), mainly of stainless materials.

8. Apparatus according to any one of claims 1 to 5, **characterized in that** the extruder pipes (8) are made of plastic.

9. Apparatus according to any one of claims 1 to 8, **characterized in that** the ends of the extruder pipes (8) are equipped with forming heads.

10. Apparatus according to any one of claims 1 to 9, **characterized in that**, for extruding various foodstuff masses simultaneously (co-extrusion), the horizontal end sections (10) of the extruder pipes (8) are partitioned lengthwise by one (or more) partition wall(s), and extruder pipes of an (or a plurality of) other extruder apparatus of similar construction, each for feeding another kind of mass, are connected into said end sections (10) of the extruder pipes (8).

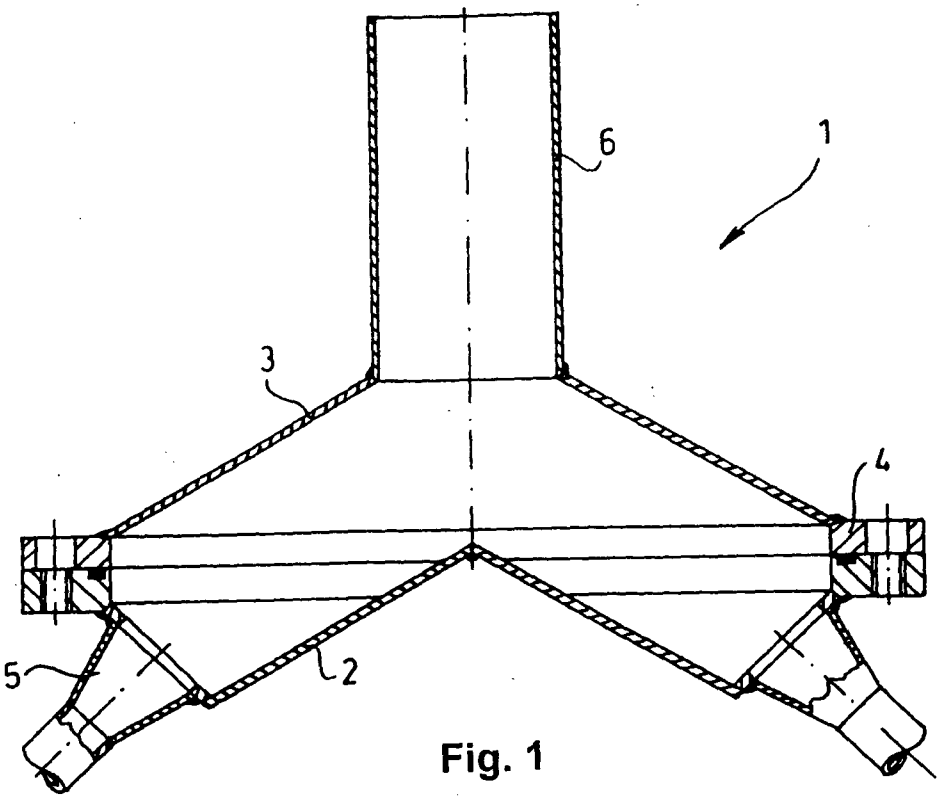

Fig. 1

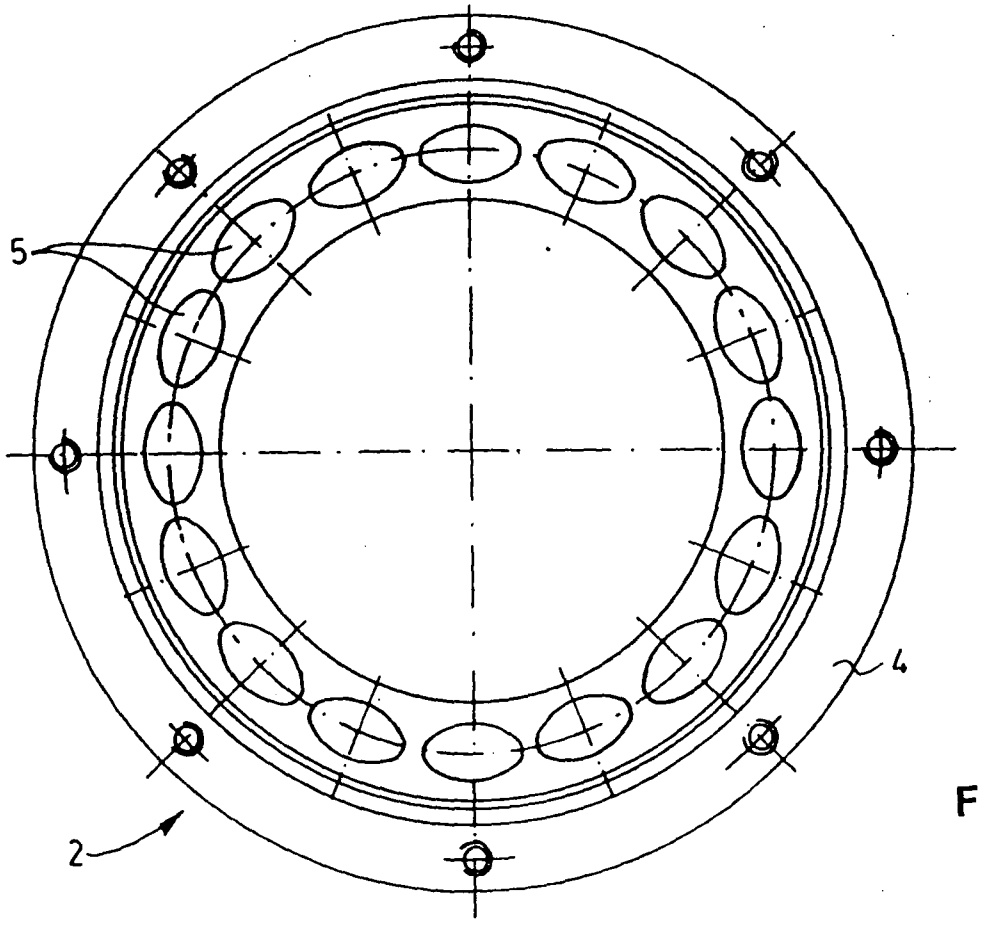

Fig. 2

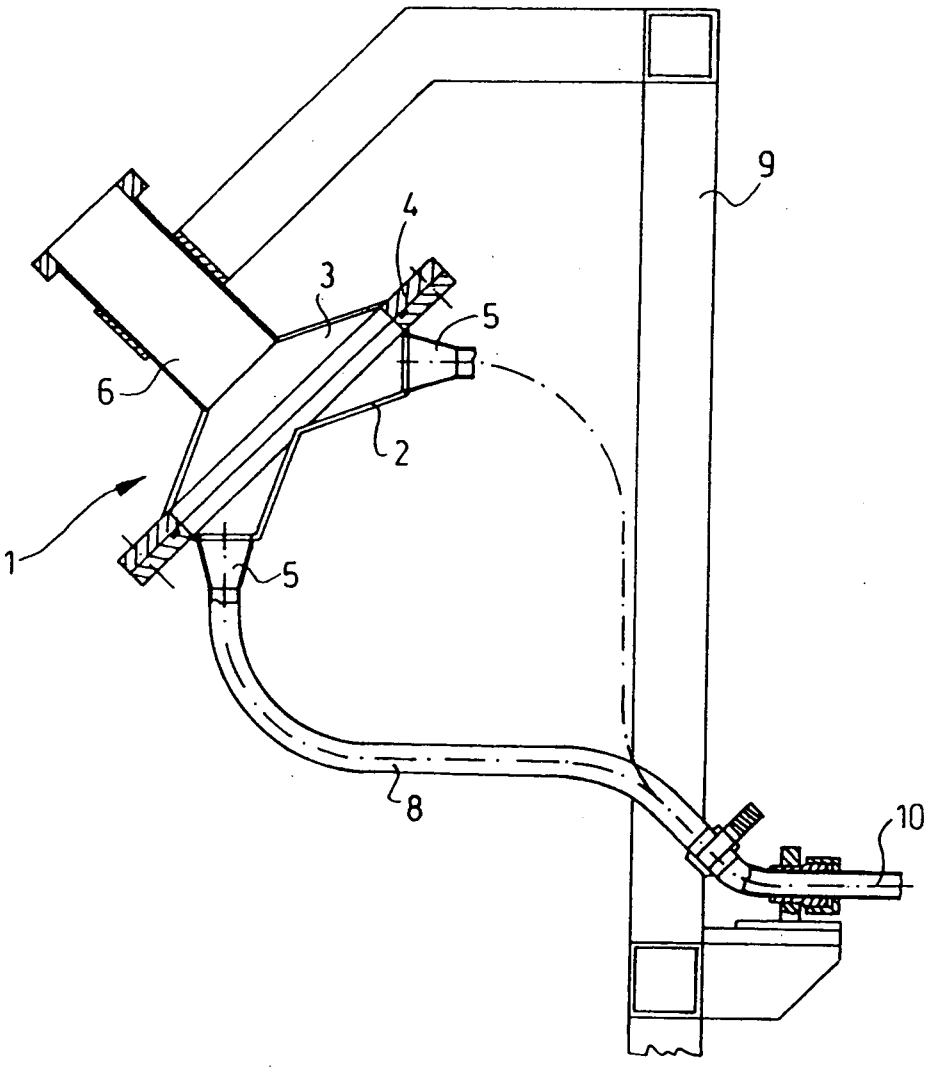

Fig. 3

INTERNATIONAL SEARCH REPORT

International application No
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A. CLASSIFICATION OF SUBJECT MATTER
INV. A23G1/20 A23G3/02 A23G3/20 A23P1/12 A21C11/16
A21C11/18

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)
A23G A23P A21C A22C

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 practical, search terms used)
EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
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Y	US 3 320 905 A (URSCHEL GERALD W) 23 May 1967 (1967-05-23) column 4, line 61 - line 71; figures 1,4 column 8, line 38 - line 49; claim 1	1-10
A	US 4 119 252 A (BERNARD VINCENT E) 10 October 1978 (1978-10-10) column 1, line 63 - column 2, line 33; figures 2-4,8	1-4,10
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[X] Further documents are listed in the continuation of Box C. [X] See patent family annex.

* Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance
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Date of the actual completion of the international search	Date of mailing of the international search report
14 January 2009	27/01/2009

Name and mailing address of the ISA/	Authorized officer
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INTERNATIONAL SEARCH REPORT

International application No
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C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
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