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(54) Apparatus for grinding and/or mixing sticky or fatty substances

(57) An apparatus for grinding and/or mixing sticky or fatty substances and the like comprises a treatment chamber (5) having an inlet and outlet opening (6, 11), and a driven grinding and/or mixing means (7) arranged within the chamber, at least a substantial part of a circumferential wall of the chamber being made of an elastic material. The elastic wall (14) includes means for deforming the wall, said means include a sealed pressure chamber (18) on the outer side of the wall (14), as well as deforming members (26) distributed over the area of the wall in order to locally retain the wall (14) during displacement of the wall (14).

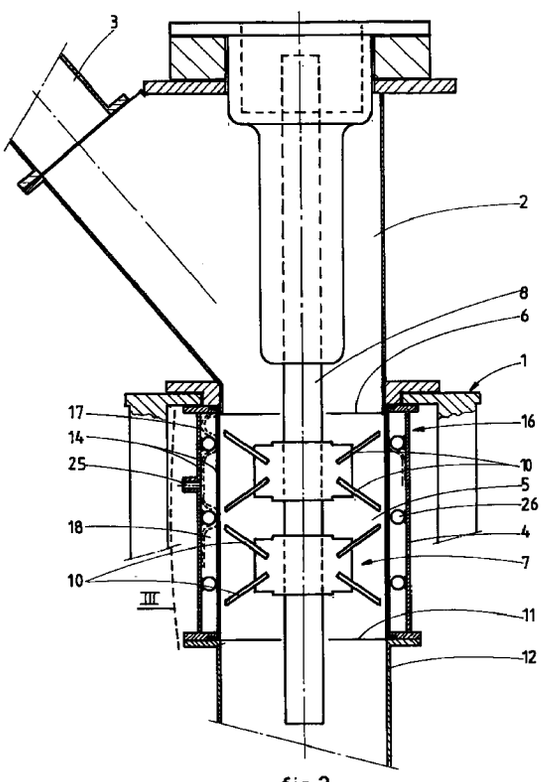

fig.2

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Description

The present invention relates to an apparatus for grinding and/or mixing sticky or fatty substances and the like, comprising a treatment chamber having an inlet and outlet opening, and a driven grinding and/or mixing means arranged within the chamber.

Such an apparatus can for instance be used in an installation for forming an agglomerate. In such an installation, powders are being mixed within an agglomerate chamber and are sprinkled with liquid and then formed into agglomerate. The particles are dried with air. It can happen then that oversized particles are formed which exceed a predetermined particle size and are consequently separated from the process. Because the particles are big, it often happens that, while the outer side of the oversized particles is dry, the inner side is still wet. In order to be able to still use the agglomerate particles as end product, they should be grinded into smaller particles. Due to the wetness of the core of the particles, relatively fatty or sticky substances will cause adherence to the wall of a grinding apparatus which prevents it from a proper operation.

The object of the present invention is to provide an apparatus in which this problem is removed in an effective way.

For this purpose, the invention provides an apparatus for grinding and/or mixing sticky or fatty substances and the like, comprising a treatment chamber having an inlet and outlet opening, and a driven grinding and/or mixing means arranged within the chamber, at least a substantial part of a circumferential wall of the chamber being made of an elastic material and the elastic wall including means for deforming the wall, said means include a sealed pressure chamber on the outer side of the wall, as well as deforming members distributed over the area of the wall in order to locally retain the wall during displacement of the wall.

Due to these features, the wall portion of the apparatus where risk of adherence and accumulation of the substance exists, may continuously be deformed by changing the pressure within the pressure chamber, said deformation of the wall causing the substance to peel off from the wall which solves the problem as described above.

For the sake of completeness it is noted that there is known a prior art apparatus for making agglomerate in which a wall part is also deformable, i.e. by means of rollers pushing from outside against the wall and being movable in reciprocating manner by means of cylinder-piston assemblies or other drive means. Such apparatus, however, includes many movable parts which are eliminated or reduced in the present invention.

According to the invention it is favourable if the pressure chamber is a vacuum chamber to which a suction means connects, the deforming members being formed by projections of a fixed wall of the pressure chamber, which preferably extend upto or nearby the elastic wall.

In this embodiment, as seen from the treatment chamber, the wall is deformed outwardly around the projecting deforming members, causing a controlled deformation of the wall. If the suction system is a vacuum source for sucking and letting in again gas, preferably air, out of and into the pressure chamber, great accelerations of the wall are possible which further promotes the peel-off of adhering substance. If the projections acting as deforming members are shaped as round spheres there is created a maximum deformation of the wall per unit of volume of the projections when the wall is deformed around the spheres to a greater extent. Because the projections are positioned between the elastic wall and the fixed wall, and hence outside the treatment chamber, it is impossible that material to be treated accumulates around the deforming members.

The invention will hereafter be further explained with reference to the drawings showing an embodiment of the invention by way of example.

Fig. 1 is a very schematic front view of an apparatus for grinding sticky or fatty substances and the like in accordance with the invention.

Fig. 2 is a slightly enlarged sectional view of the apparatus of Fig. 1.

Fig. 3 illustrates detail III in Fig. 2 on a larger scale.

The drawings, and first of all Fig. 1 and 2 thereof, show an apparatus for grinding sticky or fatty substances and the like, such as agglomerate particles of chemicals, such as detergents, water-soluble polymers and agricultural chemicals, of animal feed and milk substitutes, of food products such as soups and gelatines and other types of agglomerates. Also other types of particles may be grinded or mixed in the apparatus. For this purpose, the apparatus according to the embodiment as shown comprises a frame 1 for supporting the apparatus. On the frame 1 there is positioned a top piece 2 to which a supply tube 3 for the particles is connectable. The top piece 2 connects on its lower side to a housing 4 arranged within the frame 1, and a treatment chamber 5 (see Fig. 2) being formed in the housing 4. On the upper side, the treatment chamber 5 comprises an inlet opening 6 for supply from the top piece 2 and the supply tube 3.

A grinding means 7 extends through the treatment chamber 5 and is constructed as a journalled vertical shaft 8 which is rotatable about its axis by means of an electric motor 9 or another drive and which is provided with a plurality of longitudinally and circumferentially spaced Wing knives 10 for chopping the particles supplied through the inlet opening 6 into the treatment chamber 5. On the lower side of the treatment chamber 5 there is formed an outlet opening 11 connecting to a discharge tube 12 and said discharge tube 12 itself may be connected to an inlet 13 of a fluidized bed device for the ground particles in order to dry it.

As is particularly illustrated in Fig. 3, the circumferential wall 14 of the treatment chamber 5 is formed by a cylinder 15 having a circular cross-section. This cylinder 15 and consequently the circumferential wall 14 thereof

is formed of an elastic material, such as for example polyurethane or another rubber-like material, such that the circumferential wall 14 is deformable under the influence of an external force. The cylinder 15 is surrounded by a cylindrical casing 16 having a rigid circumferential wall 17, the diameter of which is slightly larger than the deformable circumferential wall 14 and is arranged concentrically therewith so that an annular pressure chamber 18 remains between the walls 14 and 17. The cylinder 15 is provided on its upper and lower sides with outwardly extending flanges 19 cooperating with inwardly extending flanges 20 of the casing 16 and being adapted to be urged onto these flanges 20 by a headplate 21 or pressure ring 22 to effect a seal therebetween, thereby creating a fully sealed pressure chamber 18. To improve the seal between the flanges 19 and 20, the flanges 19 comprise annular thickenings 23 fitting into annular grooves 24 in the flanges 20 of the casing 16.

In the rigid circumferential wall 17 there is formed a connection 25 to connect a pressure or vacuum source to the pressure chamber 18 in order to create in a periodic fashion an under or overpressure within the chamber 18. Preferably, there is created an underpressure or vacuum within the pressure chamber 18 by suction of air or another gas out of the chamber 18, which is let in again subsequently to allow a return of the pressure in the chamber 18 to normal level.

A plurality of deforming members 26 is fixed to the rigid circumferential wall 17 of the chamber 18 and are shaped in this case as round spheres which are welded to the wall 17. The spheres 26 are spaced in circumferential direction of the wall 17 and also in axial direction of the wall there may be provided several rows of spheres 26. The shape, the number and the distribution of the deforming members depend on the respective use.

If air contained in the pressure chamber 18 is now exhausted through the connection 25 by a vacuum source (not shown), then the created pressure difference on both sides of the circumferential wall 14 will cause this wall to move in a direction to the rigid circumferential wall 17 in places where it is not hindered by the deforming members 26 which, in this case, are of such radial dimension that they reach upto the circumferential wall 14 when in undeformed position. The final position of the circumferential wall 14 is shown in dashed lines in Fig. 2 and it is illustrated that the circumferential wall 14 fully abuts the circumferential wall 17 and the deforming members 26. Consequently the circumferential wall 14 is substantially deformed and stretched in axial and circumferential directions causing with great certainty that substance which adheres to the inner side of the circumferential wall 14 peels off. In case this has not yet happened, then this will certainly happen if subsequently air is allowed into the pressure chamber 18 with great speed causing the circumferential wall 14 to return to its undeformed position with a great acceleration and due to this abrupt acceleration and subsequent deceleration the substance which still adheres will be shut away inwardly. This exhausting of air and letting it in again into the chamber 18 can take place with an adjustable frequency depending on the respective circumstances and the substance to be treated.

From the foregoing it will be clear that the invention provides an apparatus for grinding and/or mixing of sticky or fatty substances and the like which effects a reliable and controlled deformation and stretching of at least a portion of the wall of a treatment chamber such that a persistant adherance of substances to the wall cannot take place.

The invention is not restricted to the embodiment shown in the drawings and described hereinbefore, which may be varied in different manners within the scope of the invention. It is, for example, also possible to use the present invention for making agglomerates therein by mixing powders and liquid under certain circumstances. Furthermore, axial or circumferential ribs or projections having other shapes may also be used as deforming members. These deforming members may also be formed on the outer side of the elastic wall. The treatment chamber may also have another shape or only a portion of the wall may be deformable. In an embodiment having overpressure in the pressure chamber, the wall should be retained locally, for example by attachment in order to effect deformation and stretching.

Claims

1. Apparatus for grinding and/or mixing sticky or fatty substances and the like, comprising a treatment chamber (5) having an inlet and outlet opening (6, 11), and a driven grinding and/or mixing means (7) arranged within the chamber, at least a substantial part of a circumferential wall of the chamber being made of an elastic material and the elastic wall (14) including means for deforming the wall, said means include a sealed pressure chamber (18) on the outer side of the wall (14), as well as deforming members (26) distributed over the area of the wall in order to locally retain the wall (14) during displacement of the wall (14).

2. Apparatus according to claim 1, wherein the pressure chamber is a vacuum chamber to which a suction means is connected, said deforming members (26) are formed by projections on a fixed wall (17) of the pressure chamber (18), which preferably extend up to or near the elastic wall (14).

3. Apparatus according to claim 1 or 2, wherein the suction means is a vacuum source for sucking and letting in again gas, preferably air, out of and into the pressure chamber (18).

4. Apparatus according to claim 2 or 3, wherein the projections (26) acting as deforming members are shaped as round spheres.

5. Apparatus according to one of the preceding claims, wherein the treatment chamber (5) is circular cylindrical, preferably in a vertical direction, and the elastic wall (14) is a cylinder having on its ends outwardly extending flanges (19) connected to inwardly extending flanges (20) of a rigid cylinder (15) which is positioned concentrically around the elastic wall (14) and forming therewith the pressure chamber (18).

6. Apparatus according to claim 4 and 5, wherein the spheres (26) are fixed to the rigid wall (17) of the pressure chamber (18) in uniform patterns.

7. Apparatus according to claim 5, wherein the flanges (19) of the elastic wall (14) comprise at least an annular thickening (23) fitting into an annular groove (24) on the flanges (20) of the rigid wall (17).

8. Apparatus according to one of the preceding claims, wherein the grinding means (7) includes a preferably vertical shaft (8) having a plurality of wing knives (10) on its circumference.

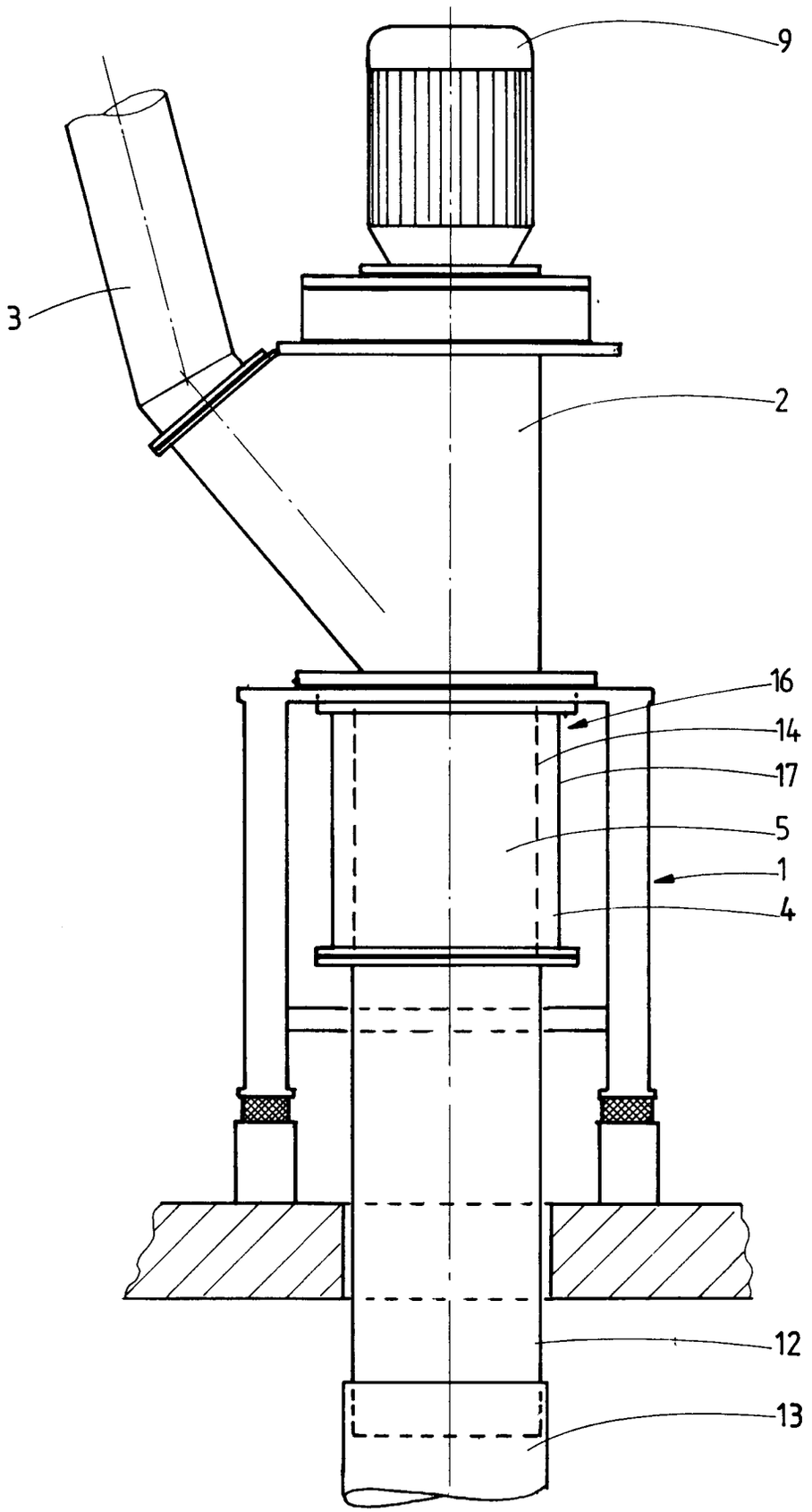

fig.1

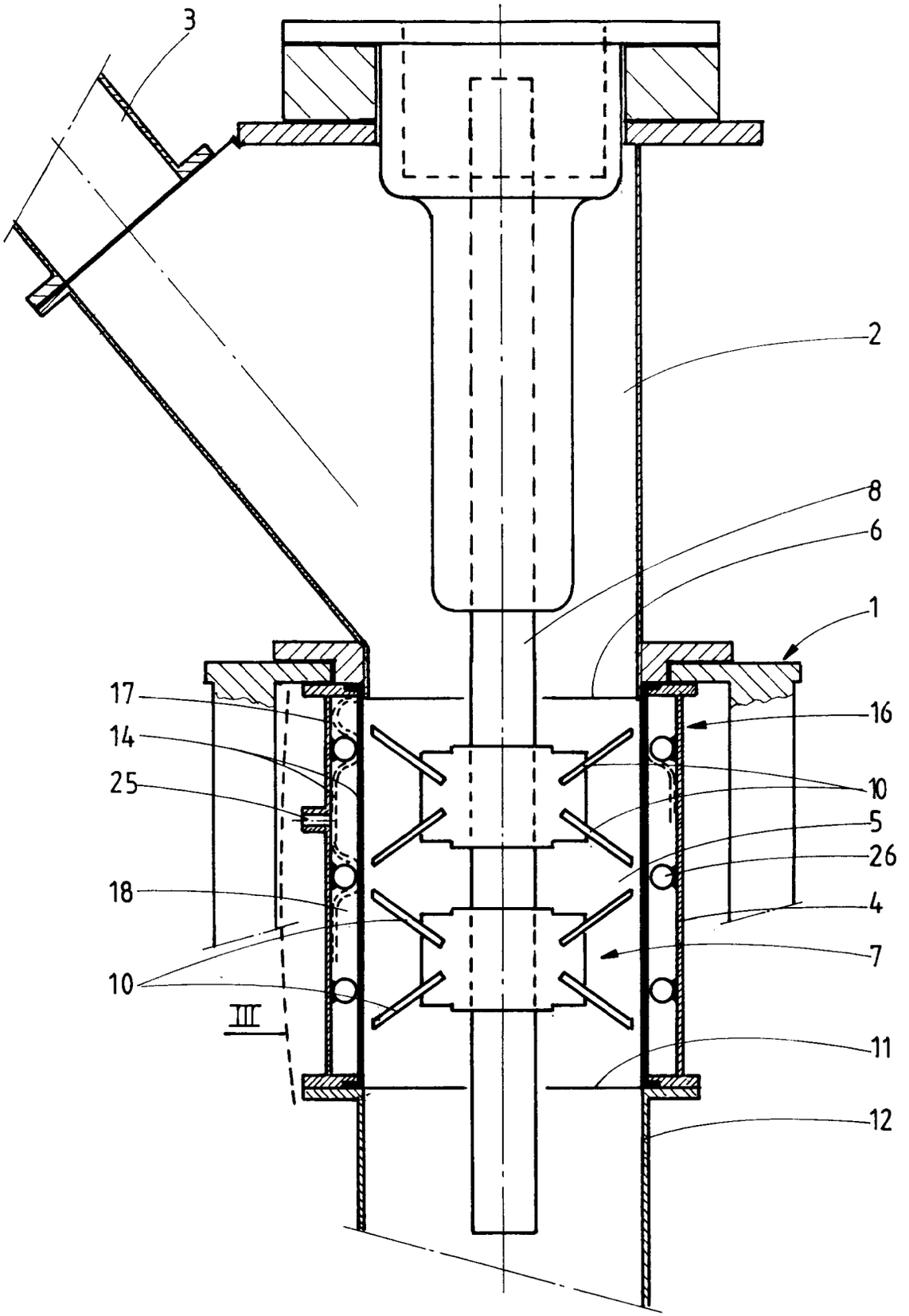

fig. 2

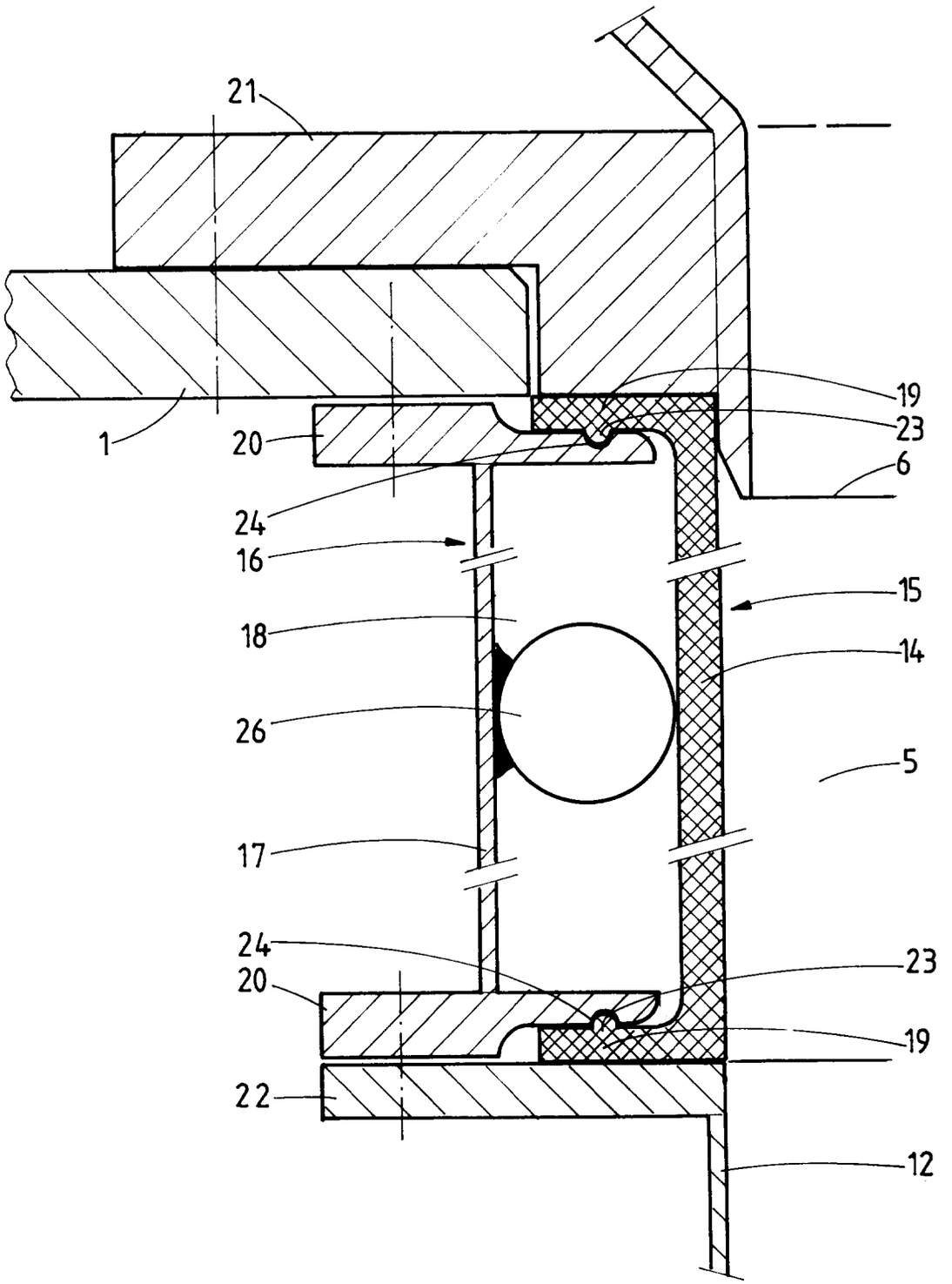

fig. 3

European Patent Office

EUROPEAN SEARCH REPORT

Application Number
EP 96 20 1232

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.6)
X	US-A-3 298 620 (G.M.B. FAGARE) 17 January 1967 * the whole document *	1	B02C18/16 B02C18/10
A		2-8	
A	EP-A-0 110 714 (UNILEVER PLC) 13 June 1984 * claims 1-6; figures 1,2 *	1	
A	NL-A-6 707 768 (STAMICARBON N.V.) 3 December 1968 * the whole document *	1,8	

TECHNICAL FIELDS SEARCHED (Int.Cl.6)

B02C

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	26 August 1996	Verdonck, J

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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