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(54) Disintegrating mill for glass packaging containers

(57) A disintegrating mill for glass packaging containers and the like, such as glass bottles and jars, comprises two rotors (11, 13) rotatably mounted about parallel axes within a disintegration chamber (5). The rotors (11, 13) have blades (15) having a clearance with respect to the side walls (17) of the chamber (5) such as to produce the required size of glass fragments as a result of the disintegration process. Disintegration results mainly from impact of the fed-in glass containers with the rotor blades (15) or with the side walls (17) which are reinforced with replaceable wear plates.

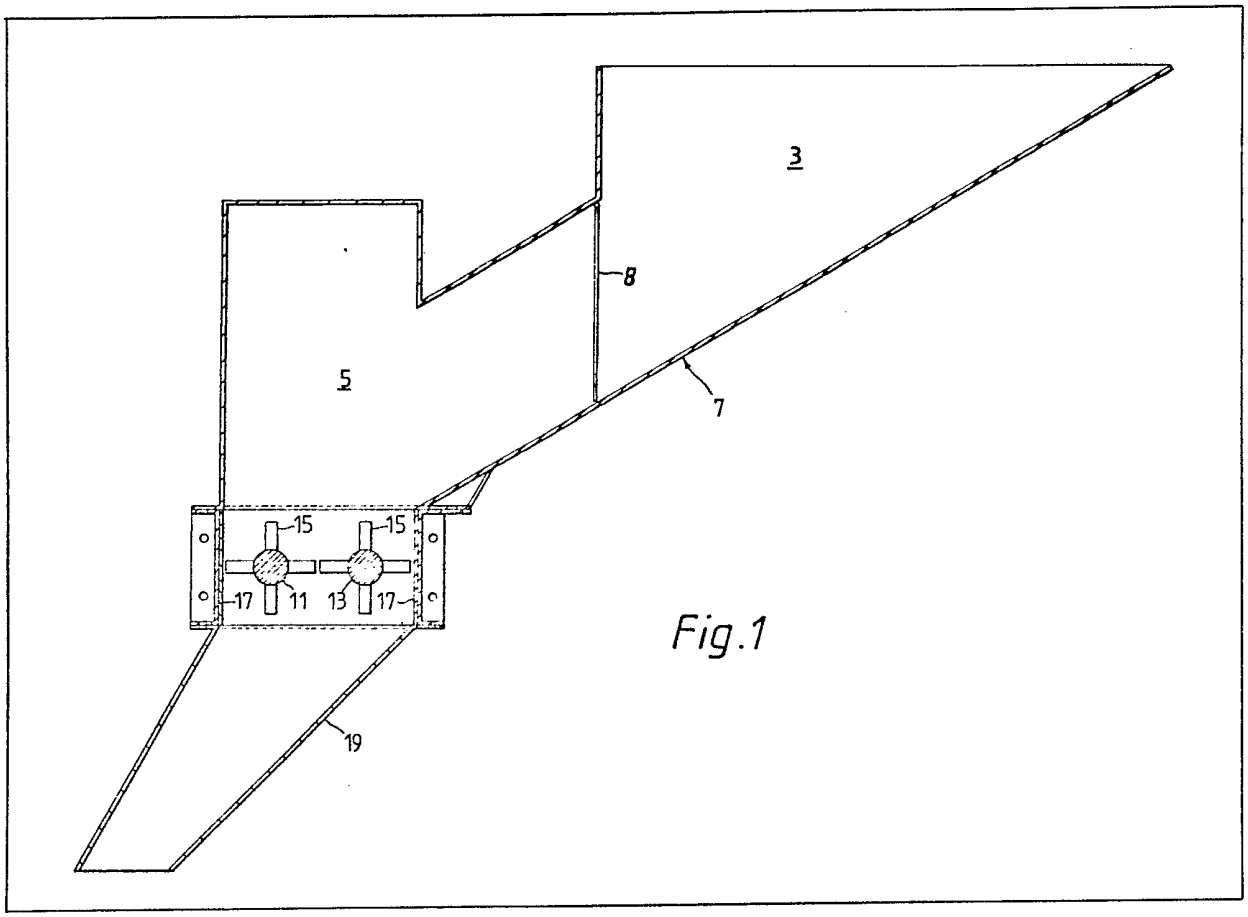

Fig.1

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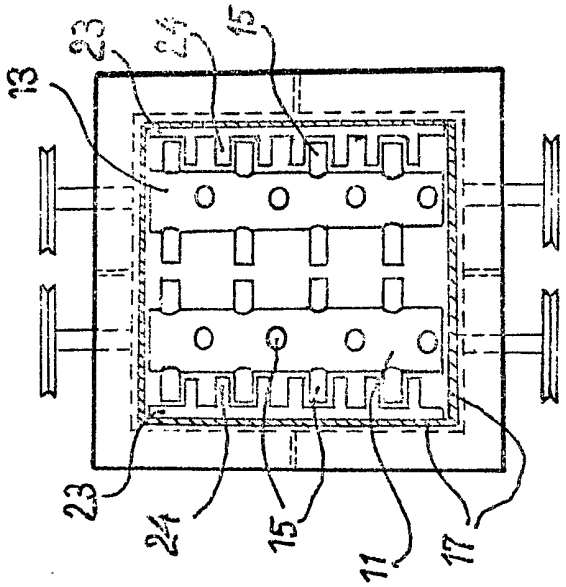

Fig.3

Fig.1

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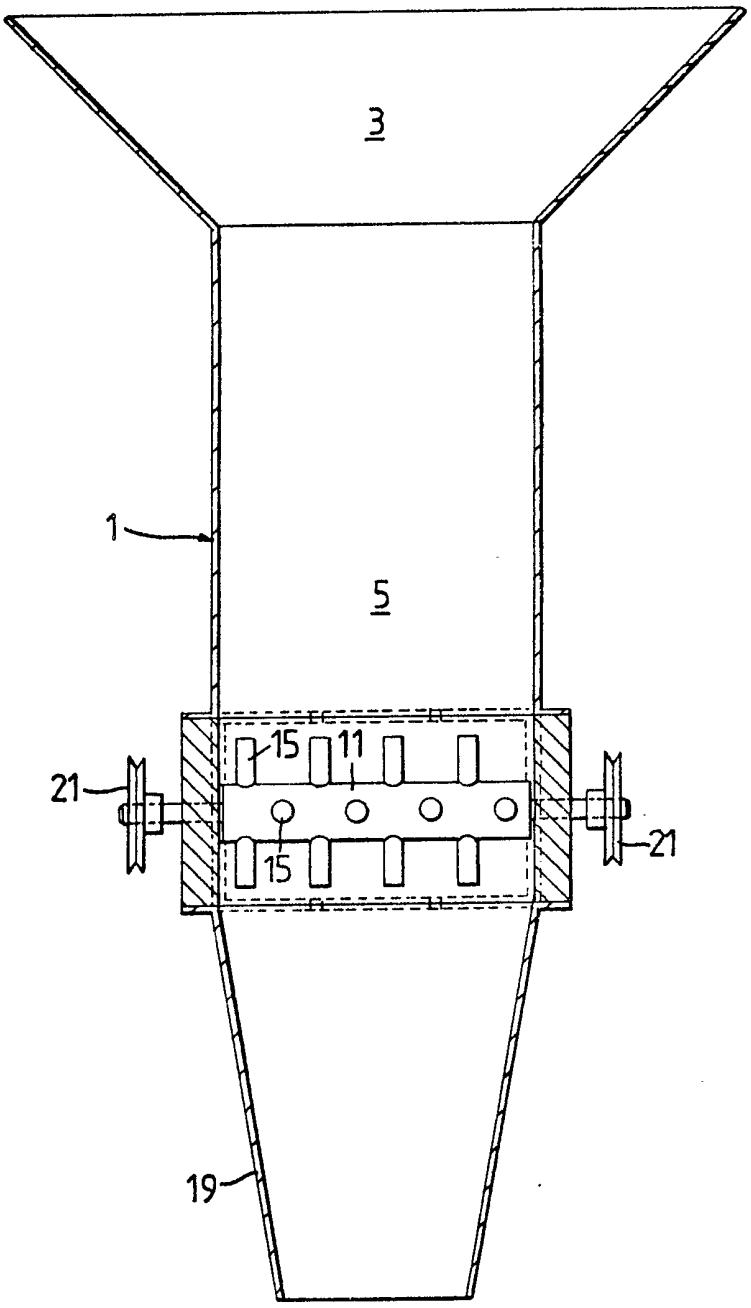

Fig.2

SPECIFICATION

Improvements relating to disintegrating mills for glass packaging and the like

The present invention relates to improvements in disintegrating mills for glass packaging containers and the like, and more particularly to improvements applied to the disintegrating mill which is described in my Belgian Patent No. 840,858.

In said Belgian patent, I have disclosed a disintegrating mill suitable for glass packaging, such as bottles, jars etc., and which comprises a closed shell separated into two compartments. One of these compartments contains a rotor fitted with blades and serves as a disintegration chamber.

The foregoing construction is, in fact, designed to avoid actual crushing of the glass packaging, and utilises to advantage the characteristics of low shock resistance possessed by glass (ductility) in order to break it up, either at the time of impact of a glass container when it falls from above on to the rotor blades or, and this principally, by projection of the container against the disintegration chamber walls by the action of the rotor blades.

This device, which is satisfactory for household applications, or for use in cafes, restaurants, institutions etc., presents, however, certain disadvantages when being used for sizeable loads of glass packaging. Notably, these result in a low output for a device of this type. In certain cases, notably when bottles, etc. are introduced into the apparatus in large quantities, one can observe a blocking of the disintegrating mill as a result of jamming of objects or debris between the rotor blades and the chamber walls.

The present invention aims to achieve the necessary improvements to disintegrating mills of the aforesaid type having a rotor fitted with blades, arranged in a chamber and operating according to the same general principle as the former type, with the object of avoiding the disadvantages thereof already referred to.

Other characteristics and complementary advantages will appear during the following exposition of the principles, and description of a specific embodiment, of the invention.

According to the invention, a device of the type referred to is characterised in that it has two rotors fitted with blades and rotatable about separate parallel axes in the disintegration chamber with a clearance, relative to the internal wall of the chamber, such that the glass fragments present an appropriate particle size which is, typically, in the range of 0.5 to 50.0 mm.

According to the essential mechanical requirements and the characteristics of the products to be treated, the two rotors may be driven either in the same or in opposite directions of rotation. In the case of contra-rotation of the rotors, the rotational directions can be selected either to project the glass or the like articles inwardly of the two rotor axes, or to project them outwardly thereof. Driving of the rotors in opposite directions and in such a way as to project the glass or similar materials outwardly offers the advantage of practically excluding any blockage of the rotors by jamming with glass debris or by containers of small dimensions.

In this case, especially in order to ensure accurate control of the fragmented glass particle size, it can be advantageous to arrange, on a side wall of the disintegration chamber and substantially perpendicular to it, a "comb" between the teeth of which the rotor blades mesh. It is preferred that this comb should be coplanar with the rotor axes, or in a plane close to the common plane of the rotor axes.

With such an arrangement, the glass debris cannot pass through the combs until a certain particle size, determined by the spacing of the rotor blades and the comb teeth, has been attained.

In the case of opposite rotation inwardly of the two rotors, the relative arrangement of the blades thereof can likewise be chosen so as to obtain particle-size control of the disintegrated product.

A device in accordance with the invention renders it possible, with low energy consumption, to reduce large quantities of glass packaging to suitably sized fragments in an efficient manner.

The arrangement of the rotors additionally makes it possible to occupy a very much reduced space, and the reduced bulk permits adaptation of the device to refuse collection lorries.

The device can function at rotor speeds of the order of 1500 to 3000 rpm, preferably of the order of 2000 to 2200 rpm.

By using different constructional parameters (clearing distances of blades, clearance and where the occasion arises the thickness of the "comb" teeth, direction and speed of rotation, etc.) it is possible to adjust, in a practically free manner, the particle size of the glass debris obtained.

The control of the particle size which can thus be achieved is especially important for the recycling of glass. Notably, it makes it possible easily to eliminate the flange which encircles the neck of a bottle (generally of aluminium, or tin) which could be troublesome in certain applications, especially in recycling.

By an adequate choice of the directions of rotor rotation it is possible to reduce the mechanical stresses, particularly in flexion, to which the rotor shafts are subjected.

The arrangement of the rotors for rotation about two parallel axes, and the choice of their directions of rotation, also offers the advantage of being able to make an optimum choice of the geometrical features of the disintegration chamber — on one hand to ensure the safety of operating personnel and efficient fragmentation by projection of the glass against the chamber walls, and on the other hand to ensure a quick and efficient discharge of the fragmented products.

The discharge of the fragmented products can be carried out vertically downwards by arranging an outlet at the base of the disintegration chambe

or, alternatively, effected laterally on a moving conveyor band or belt for example.

Complementary equipment, notably for sorting employing a verticyclone, can be associated with a device in accordance with the invention.

The feeding of the crushing device with glass containers and other packaging can, likewise, be automated. Due to the fact that practically all risk of jamming is eliminated, the packaging items do not have to be fed into the device one at a time, and it is possible to arrange for an "unsorted" feed which may be continuous or discontinuous.

As a result of the geometrical arrangement of the rotors central feeding of the device is possible, this being from above on a median plane between the two rotor axes.

Especially in the case of rotor rotation such as to throw the glass packaging outwardly, it is advantageous to provide a central spout for feeding the packaging, in the median plane between the rotor axes and through an opening in the top of the disintegration chamber, with the feed in of the materials to be treated effected laterally. In this manner one eliminates in a very marked manner the risks of accidental projection of glass fragments, or of glass being disintegrated, outwardly from the equipment.

It is advantageous to strengthen the disintegration chamber wall plates in the main zones of impact by crushed glass.

The invention will now be more fully described, and its advantages further explained, with reference to the accompanying drawings which illustrate two preferred embodiments of the invention which are described solely by way of illustrative example. In the drawings:

Figure 1 illustrates in longitudinal sectional view the disintegrating mill providing one preferred embodiment;

Figure 2 is a transverse sectional view; and

Figure 3 is a top view into the disintegration chamber of a further embodiment of the invention wherein combs are provided.

Referring to Figures 1 and 2 of the drawings, a shell having the general reference 1 is divided into a first compartment 3 and a separate compartment 5 which, strictly speaking, forms a disintegration chamber.

In the lower part of the disintegration chamber 5 there are arranged two rotors 11 and 13, which are fitted with blades 15 and arranged with their longitudinal axes parallel. The lower part of the disintegration chamber 5 is advantageously strengthened, and it preferably includes wear plates 17 on the lateral edges, these side plates being readily replaceable.

The discharge of the fragments of disintegrated material is effected through a lower discharge spout 19.

The drive for the rotors 11 and 13 can be effected, for example, by external drive pulleys 21 and the rotors can equally well be driven in the same direction of rotation or in opposite directions. In the latter case the contra-rotating rotors may be driven in such manner as to project the glass and glass debris either inwardly, towards the median axis between the two rotors, or outwardly against the side walls 17.

The conception of the disintegration chamber 5 in the constructional form illustrated is sufficient to prevent the debris projected by the rotors from entering into the feed chamber 3, a valve 8 further reinforcing this safety aspect of the design.

In the embodiment of Figure 3 parts which are identical to those of the embodiment of Figures 1 and 2 have been identified by the same reference numerals and will not be further described. The additional characteristic of this further embodiment is the presence of two combs 23 having teeth 24 and located on the inner lateral walls 7 of the lower part of the chamber 5. The combs are mounted to project substantially perpendicular to the wall 7 in such manner that the teeth 24 are located substantially in the plane containing the axes of the two rotors 11 and 13. The spacing of the teeth 24 is of course such as to allow the passage of the blades 15.

CLAIMS

1. A disintegrating mill for glass packaging and the like and of the type comprising a rotor fitted with blades, arranged in a chamber and acting according to the principle of disintegration, wherein the disintegrating mill comprises two rotors each fitted with blades and which are rotatable in the chamber about two parallel axes, the rotor blades having a clearance with respect to the wall of the chamber such that the disintegrated glass fragments present an adequate granulometry, typically having a mean particle size of 0.5 to 50.0 mm.

2. A disintegrating mill according to claim 1, wherein said rotors are driven in the same direction of rotation.

3. A disintegrating mill according to claim 1, wherein said rotors are respectively driven in opposite directions.

4. A disintegrating mill according to claim 3, wherein the rotors are driven in such a way as to project glass and the like being disintegrated inwardly of the two rotor axes.

5. A disintegrating mill according to claim 3, wherein the rotors are driven in such a way as to project glass and the like being disintegrated outwardly of the two rotor axes.

6. A disintegrating mill according to any one of the preceding claims, wherein on a lateral wall of the disintegration chamber, substantially perpendicular thereto and preferably in an identical or close plane to that of the rotor axes, there is arranged a comb between the teeth of which the disintegrating rotor blades mesh.

7. A disintegrating mill according to any one of the preceding claims, wherein the disintegrating mill is fitted on a refuse collection lorry.

8. A disintegrating mill according to any one of the preceding claims, wherein the rotors are driven at speeds of the order of 1500 to 3000 r.p.m., preferably of the order of 2000 to 2200 r.p.m.

9. A disintegrating mill according to any one of the preceding claims, wherein the evacuation of the disintegrated products is carried out vertically downwards by arranging at the base of the disintegration chamber an outlet, or is effected laterally by a moving conveyor belt or band.

10. A disintegrating mill according to any one of the preceding claims, wherein the mill comprises complementary equipment such as a sorting verticyclone.

11. A disintegrating mill according to any one of the preceding claims, wherein the feed of the products to be disintegrated is carried out by feeding centrally from above and in the median plane between the two rotor axes.

12. A disintegrating mill according to any one of the preceding claims, wherein a central feed-in spout for packaging to be disintegrated is provided in the median plane between the two rotor axes, in the form of an opening in the top of the disintegration chamber, the feed-in of the materials to be treated being carried out laterally.

13. A disintegrating mill according to any one of the preceding claims, wherein a side plate of the disintegration chamber against which disintegration is effected is strengthened in the main zones of impact by fragmented glass.

14. A disintegrating mill according to any one of the preceding claims, wherein the mean particle size of the disintegrated glass fragments lies within the range of 0.5 to 2.0 mm.

15. A disintegrating mill according to any one of the preceding claims, wherein the mean particle size of the disintegrated glass fragments lies within the range of 15 to 20 mm.

16. A disintegrating mill for glass packaging containers and the like, constructed and arranged substantially as herein particularly described with reference to Figures 1 and 2, or Figure 3, of the accompanying drawings.

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