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Aegidius

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[54] **GRINDER**

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[58] **Field of Search** ..... 241/168, 169.1, 199.9, 241/199, 199.11, 262, 283, 170, 175, 153, 169; 19/66 R; 259/79, 87

[56] **References Cited**

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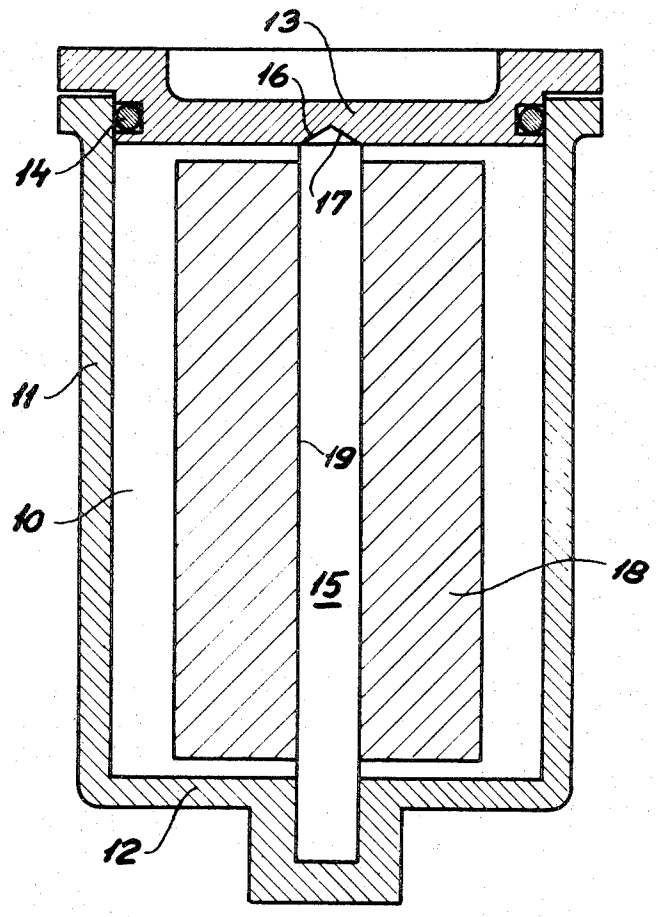
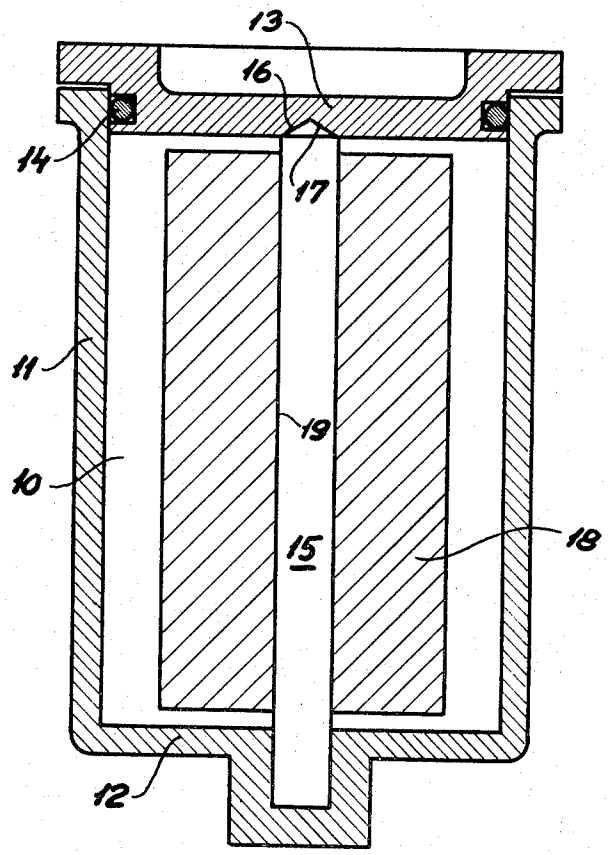
[57] **ABSTRACT**

This invention provides for a grinder of the type having a closed chamber in which an impact means is slidably mounted for substantially reciprocating movement of a predetermined stroke length, characterized in that the impact means is a smooth cylindrical body with plane parallel end faces and with a throughgoing axial bore fitting loosely on a shaft mounted fixedly in one end wall and disposed on the longitudinal axis of the chamber, and that the chamber is formed as a cylindrical hollow space of a diameter that is substantially larger than the impact body and is closed at the other end by a detachable cover provided with a guide for the corresponding end of the shaft.

2 Claims, 1 Drawing Figure

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GRINDER

This invention relates to a grinder of the type having a closed chamber in which an impact means is slidably mounted for substantially reciprocating movement of a predetermined stroke length.

The invention aims particularly at providing an apparatus for use in the determination of the fat or oil content in products of vegetable or animal origin, such as beans, grain, seed, nuts, meat products, foodstuffs and feeding stuffs.

In such analyses it is normal to use an extraction liquid for extracting the fat, often in a so-called wet-grinding process, in which a weighed amount of non-ground material, for instance soybeans, ground nut, rapeseed or the like, is treated together with a measured volume of extraction liquid in a so-called Waring Blender. This blender has a chamber in which a plurality of steel knives rotate at high speed, whereby the material is finely divided and mixed with the extraction liquid. After this treatment, which can be performed in a few minutes, the mixture is filtered, and on the clear filtrate a physical property dependent on the fat concentration is measured, for instance the dielectricity constant, refraction index or density.

But this grinding procedure is attended with certain drawbacks and sources of error. In the blender the liquid is subject to a very heavy handling while the material is being comminuted by cutting and beating. This results in a considerable increase of temperature which might cause uncontrolable evaporation of the extraction liquid. Moreover, the blender knives will get blunt, and this, too, will affect the measuring result because the extraction within the given period of time will not be complete.

The specification of US Pat. No. 3.010.666 describes a grinding and blending apparatus for determination of the protein content in grain. This apparatus has a chamber mounted for oscillating movement and closed at both ends while a spout for filling and discharging liquid is provided in a side wall. The chamber contains a slidable impact member in the form of a dumbbell and at both ends it is provided with a ring of radially projecting fingers of for instance nylon. This apparatus is adapted to treat a mixture of grain and a coloured liquid, and the change of the colour of the liquid is a measure of the protein content. When the chamber is caused to move, the impact body will alternately hit one and the other end bottom and thus crush and blend the contents. The nylon fingers serve partly to guide the impact body, partly to agitate the contents.

An apparatus of this description, however, will not be suitable for accurate measurement of the fat content, which requires very careful cleansing before each filling, because the quantitative determination must be very accurate and the fat content may vary greatly from sample to sample.

It is the object of the invention to provide an apparatus of the said type which is capable of rapid and effective grinding and extraction and which can be easily and rapidly emptied and adequately cleansed.

This object has been accomplished by providing impact means in the form of a smooth cylindrical body with plane parallel end faces and with a throughgoing axial bore fitting loosely on a shaft mounted fixedly in one end wall and disposed on the longitudinal axis of the chamber, which is formed as a cylindrical hollow space of a diameter that is substantially larger than the

impact body and is closed at the other end by a detachable cover provided with a guide for the corresponding end of the shaft.

In this apparatus both the chamber and the detachable impact body have smooth, easily accessible surfaces which are easily cleansed after each grinding operation. There are no pockets or corners where leftovers can accumulate and be transmitted from one sample to the next. Any wear to the active faces will be uniform and not affect the operational efficiency. When temperature increases occur in the blend or in the impact body it will be possible to use two impact bodies which are cooled alternately. Thus rapid and uninterrupted operation is secured.

By forming the guide in the cover as a conical bore and the shaft end complementary thereto and by inserting an O-ring as a seal between a cylindrical circumferential surface of the cover and the end of the inner surface of the chamber, a particularly simple construction of the guide of the cover has been obtained which facilitates cleansing and receives the full pressure caused when the chamber is fitted in the moving mechanism.

The invention will be explained in greater detail by the following description of an embodiment of the apparatus according to the invention with reference to the drawing, the only FIGURE of which presents a section through the apparatus.

The FIGURE shows a chamber **10** with a cylindrical side wall **11** and a fixed end wall **12.** At the other end the chamber has a detachable cover **13** provided with an O-ring **14** as seal. A steel shaft **15** is secured in the centre of the end wall **12** and terminates at the other end in a low conical surface **16** which fits into a corresponding conical recess **17** at the centre of the cover **13.** A massive cylindrical impact member **18** can move axially relatively to the chamber because it is provided with an axial bore **19** enclosing the shaft **15** at a loose fit, for instance with a clearance of about 0.2 mm. When the impact member is in the middle position in the chamber there is at each end an axial clearance of 4.5 mm. This leaves room for big seeds or beans, for instance soybeans, ground nuts etc. If the clearance were smaller the reaction could not start because the seeds would cause the impact member to stick. By means of a clamping arrangement, which is not shown in the drawing, the detachable cover is retained in position on the chamber. The chamber with the impact body is caused to perform a reciprocating movement by means of an eccentric driven by an electromotor working 1450–1500 rpm. When the chamber oscillates, the impact body will alternately hit one and the other end bottom of the chamber. The eccentricity is 5 mm, i.e., slightly more than the clearance at the end bottoms. 1500 rpm give 3000 strokes per minute, which ensures a very effective treatment of the material in the chamber.

In the Waring Blender the particles were cut up and the liquid subjected to heavy handling, whereas in the apparatus of the invention the particles are squeezed and the effect on the fat extraction is much more wholesome. In actual fact, a sort of explosion occurs every time the impact body strikes. The particles are beaten flat and at the same time they are further disintegrated by being thrown out radially at an extremely high speed when the end of the impact body approaches the bottom of the chamber; the material is thus subjected to a simultaneous impact and friction

effect. The movement of the impact body also causes an effective agitation of the liquid so that new liquid and material particles are constantly treated at the two end faces.

Contrary to the Waring Blender the instant apparatus treats chiefly the material particles, while the treatment of the liquid particles is much less, with the result that the increase of temperature is much smaller, and in consequence the loss caused by evaporation during decantation from grinder to filter will be reduced. By means of the O-ring in the cover the chamber is kept completely sealed during the grinding operation so that evaporation loss and squirting of liquid are eliminated.

It is significant to provide the correct proportion between the eccentric and the axial clearance. If the clearance is too great or too small the effectivity will be affected.

Also the frequency is of great importance. A higher frequency produces greater impact force and a greater number of strokes per unit of time, whereby the fat extraction is completed more rapidly. Regards for the durability of the moving mechanism, however, set an upper limit to the frequency. The chamber including impact body, liquid and material and clamping arrangement weigh in actual practice about 1 kg, which is to be oscillated at an amplitude of 5 mm. Thus the demands on eccentric and bearings are very heavy, and a number of revolutions of about 1500 per minute will be a suitable compromise.

The size of the chamber and the impact body depends on the chosen size of the sample. When this apparatus is used together with the "Apparatus for Filtering and Density Determination of a Liquid" which is the subject of a co-pending application 232,719 filed on Mar. 8, 1972 and still pending and in accordance with the method taught thereby for fat determination, a sample of 45 g is chosen and 120 ml tetrachloroethylene is used for extraction. When these amounts of material and liquid have been introduced in the chamber and the impact body has been inserted, the chamber should be filled by two thirds.

Under the conditions described above complete extraction can be effected, even of substances which are difficult to extract, in 2 minutes of ordinary substances in 1.5 minute.

If the initial temperature of liquid and impact body is about 20° C, the end temperature after grinding will be about 37°–40° C. At this temperature no measureable evaporation will occur during decantation.

If a new reaction follows upon the first, the impact body will still be warm and the end temperature therefore higher than in the first reaction. To avoid a too high end temperature the impact body may be cooled by being placed in a cylindrical container which encloses it accurately and the outer surface of which is kept cooled by running water from the tap. Where several impact bodies are used it is not necessary to wait for a body to be cooled; the next reaction may be started right away with a second impact body.

What we claim is :

1. A grinder of the type having a closed chamber in which an impact means is slidably mounted for substantially reciprocating movement of a predetermined stroke length, characterized in that the impact means is a smooth cylindrical body with plane parallel end faces and with a throughgoing axial bore fitting loosely on a shaft mounted fixedly in one end wall and disposed on the longitudinal axis of the chamber, and that the chamber is formed as a cylindrical hollow space of a diameter that is substantially larger than the impact body and is closed at the other end by a detachable cover provided with a guide for the corresponding end of the shaft.

2. A grinder according to claim **1**, characterized in that the guide in the cover is formed as a conical bore while the shaft end is formed complementary thereto and that seal between chamber and cover is provided by an O-ring inserted between a cylindrical circumferential surface of the cover and the end of the inner surface of the chamber.

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