Nov. 25, 1924. 1,516,913

H. CRAMM

ROTARY GRINDING MACHINE

Original Filed Aug. 15, 1917 3 Sheets-Sheet 1

Fig. 1.

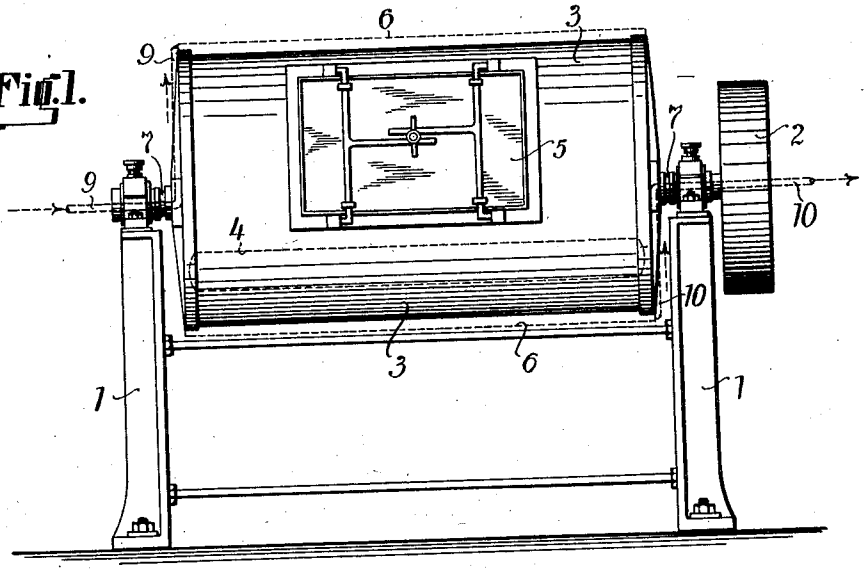


Fig. 2.

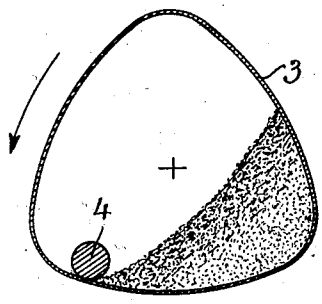


Fig. 3.

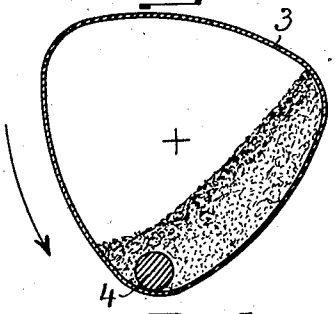


Fig. 4.

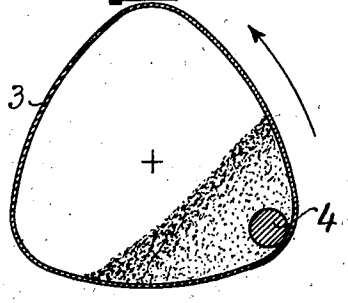
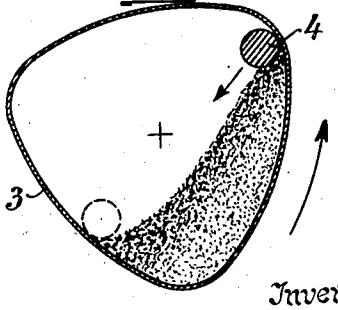


Fig. 5.



Witness
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Nov. 25, 1924. 1,516,913

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ROTARY GRINDING MACHINE

Original Filed Aug. 15, 1917 3 Sheets-Sheet 2

Fig. 6.

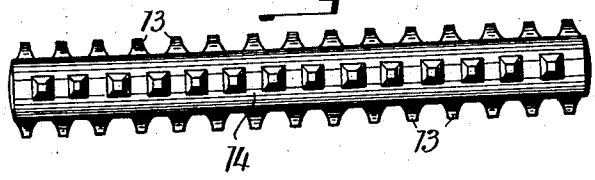


Fig. 7.

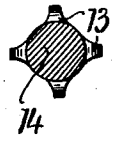


Fig. 8.

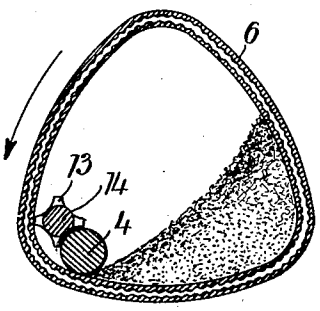
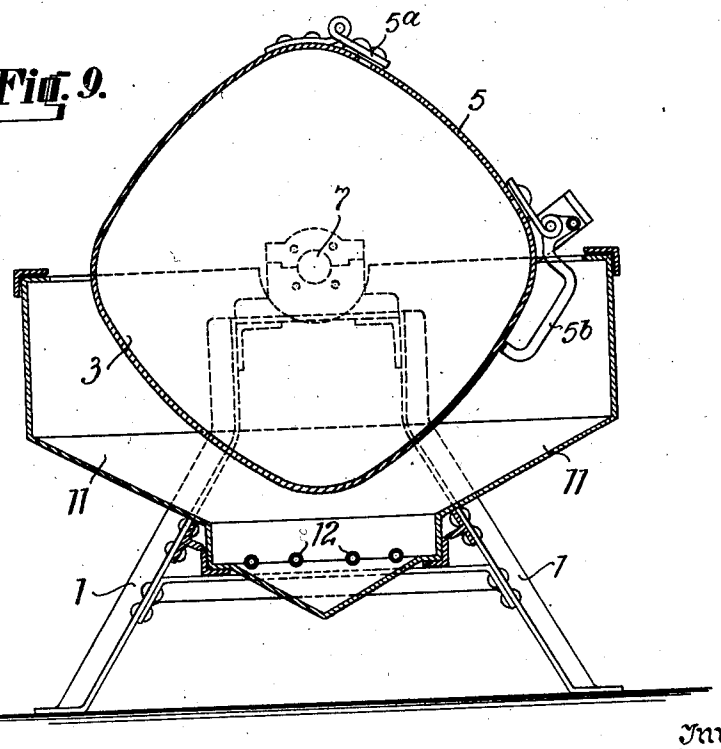


Fig. 9.



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Nov. 25, 1924. 1,516,913

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ROTARY GRINDING MACHINE

Original Filed Aug. 15, 1917 3 Sheets-Sheet 3

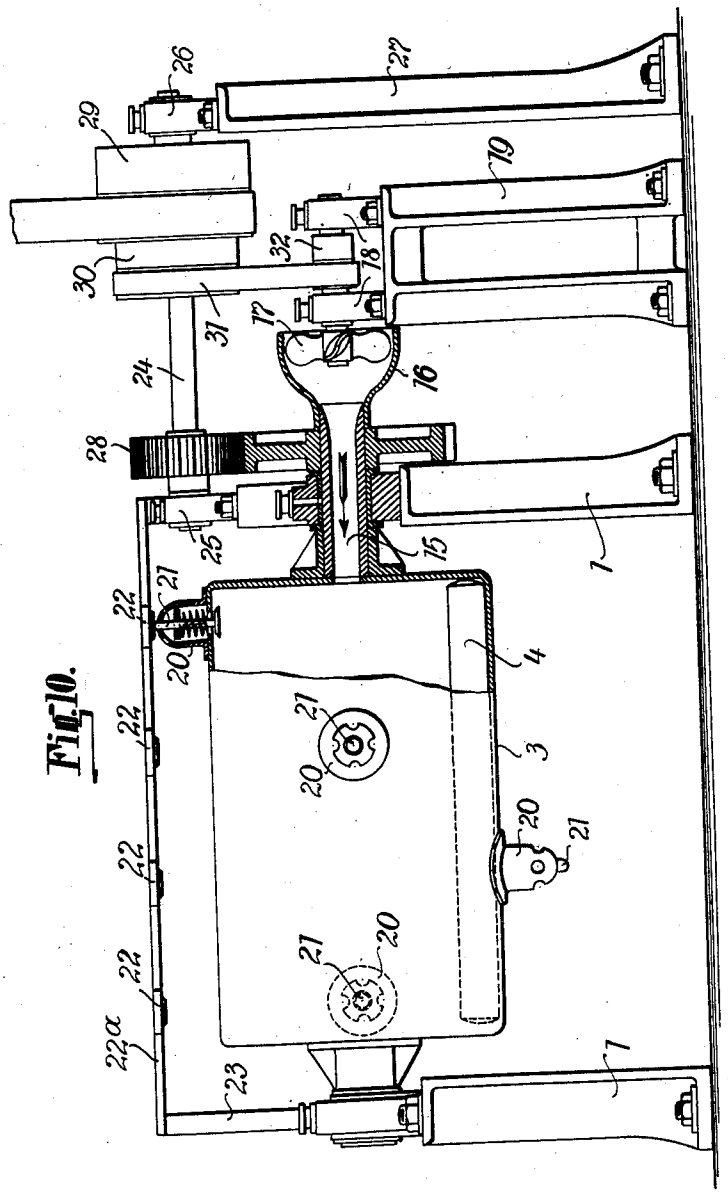

Fig. 10.

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Patented Nov. 25, 1924. 1,516,913

UNITED STATES PATENT OFFICE.

HARRO CRAMM, OF NEUKOLLN, GERMANY.

ROTARY GRINDING MACHINE.

Application filed August 15, 1917, Serial No. 186,423. Renewed October 21, 1924.

To all whom it may concern:

Be it known that I, HARRO CRAMM, a citizen of the German Empire, and resident of Neukolln, Germany, have invented certain new and useful Improvements in Rotary Grinding Machines, for which patents have been applied for and obtained as follows: Germany, filed May 15, 1914, Patent No. 290,409, issued February 26, 1916; Germany, filed September 22, 1916, Design-Patent (Gebrauchsmuster) No. 659,478, issued March 3rd, 1917; Germany, filed October 20, 1916, Design-Patent (Gebrauchsmuster) No. 695,567, issued January 15, 1919; Switzerland, filed August 14, 1916, Patent No. 73,937, issued December 16, 1916; Czechoslovakia, filed February 4, 1920, Patent No. 2,162, issued December 15, 1918; Great Britain, filed June 29, 1920, Patent No. 145,599, issued March 17, 1921; France, filed July 1, 1920, Patent No. 518,552, issued May 27, 1921; Austria, filed August 11, 1916, Patent No. 78,078, issued September 10, 1919, and of which the following is a specification.

My invention relates to a rotary machine for comminuting, mixing, kneading and otherwise treating materials, particularly such that are granulated or in the form of pieces, as aniline colours, grain, fruit-shells, minerals, resins, salts, etc.

My improved machine comprises a rotary barrel like that of a tube mill. The inside of the barrel is smooth, that is, without openings and without ribs or other projecting parts. Where the machine is to be used for comminuting purposes, I provide a barrel of polygonal, e. g., triangular, quadrangular, cross-section. Loosely running in said barrel is a stamper (or a plurality of stampers) which extends approximately over the entire length of the barrel. The comminuting or grinding action of this machine is accomplished by carrying up said stamper to a suitable height and then allowing it to fall over under the action of gravity.

It is desirable that the inner surface of the barrel should be smooth, not only in order to simplify the construction of the barrel but also to facilitate its cleaning, which latter item is important where various materials are successively treated that must be prevented from getting into contact.

The amount of power required to operate my improved machine is comparatively small and the material is thoroughly comminuted.

I have found that my machine is particularly suited for the treatment of chemical substances as its smooth inside can readily be cleaned and may without difficulty be provided with a lining that is proof against the action of acids, alkalies, etc. It may be desirable to heat or cool the contents of the barrel, for instance, where the machine is used for treating material which becomes heated during the comminuting and mixing operations or gives off vapours or gases, so that the barrel is liable to become deformed. In order to avoid this, I provide an additional shell around the shell of said barrel, and introduce a cooling medium into the chamber formed by the inner and outer shells. Obviously, I may also, where the contents of the barrel should be heated, employ a heating medium in said chamber. This is, for instance, effected if the machine serves for the comminution of mussels which, during the grinding operation, must be dried or roasted so as to obtain a dry powder which may be used as fodder or manure.

Instead of circulating a heating or cooling medium in a chamber surrounding the barrel, I may also make arrangements for introducing the heating or cooling medium into the barrel so that it acts directly on its contents.

Where it is desirable to remove the vapours or gases which may form during the process, I provide a valve or a plurality of valves communicating with the interior of the barrel, and means for automatically actuating said valve or valves.

As material which clogs at a relatively high temperature might adhere to the inside of the barrel, I preferably provide the stamper or stampers with projections, ribs or the like so that it is able to disengage such adhering matter in the manner of a scraper.

Reference is to be had to the accompanying drawings in which I have illustrated several embodiments of my invention.

Fig. 1 is an elevation of one form of my improved machine, Figs. 2 to 5 are cross-sections through its barrel illustrating several relative positions of the barrel and the stamper running in it, Figs. 6 and 7 are, respectively an elevation and cross-section of a preferred form of stamper, Fig. 8 is a cross-section of a barrel having a double shell for heating or cooling, Fig. 9 is a cross-section of a machine the barrel of which is heated or cooled by means of a fixed apparatus, and

Fig. 10 is an elevation, partly in section, of a machine in which the heating or cooling agent is introduced into the interior of the barrel.

Referring now to Fig. 1, it will be seen that the barrel 3 is rotatably carried on standards 1, by means of trunnions 7, and motion may be imparted to it by any suitable means, such as a pulley 2. The barrel in the machine illustrated is triangular or heart-shaped in cross-section, see Figs. 2 to 5. Running loosely in the barrel is a stamper 4 which extends approximately over the entire length of the barrel and is here shown in the form of a cylinder.

Figs. 6 and 7 illustrate a stamper 14 provided with projections or bosses 13 which enable it to act like a scraper and to remove adhering matter from the inside of the barrel. If desired, such a stamper may co-operate with a plain cylindrical one 4, as indicated in Fig. 8. The barrel has a feed opening adapted to be closed by a door or cover 5. Through this opening, about two thirds of the barrel are filled with the material to be treated. After the cover 5 has been closed, the barrel is rotated through the medium of pulley 2. The velocity with which the barrel rotates should be such that the material which continually falls over as the barrel is rotating, will be carried up as high as possible.

The operation of the machine will be clearly understood upon reference to Figs. 2 to 5. When the barrel is in the position indicated in Fig. 2, the stamper 4 will be almost in its lowest position. Upon the barrel being rotated in the direction of the arrow, the material in the barrel will continually fall over and cover the stamper 4, see Figs. 3 and 4 in which the barrel is at an angle of 45 or 125°, respectively, to its position in Fig. 2. When the stamper has been raised to such a height that it is wholly or partially free from the material, which will be the case after the barrel has turned through an angle of 180°, see Fig. 5, it will fall back into the position shown in dotted lines in Fig. 5, thereby comminuting the material between it and the barrel. This alternate raising and dropping of the stamper 4 is continuously repeated as the barrel rotates, causing a very expeditious and effective reduction of the material with a comparatively small amount of power, as, owing to the triangular or heart-shaped cross-section of the barrel, the stamper is carried up to a considerable height and so enabled to exert an effective action on falling down, without necessitating an increase in the velocity of revolution, as would be the case in a cylindrical barrel.

The cross-section of the barrel, instead of being a triangle or "heart-shape" as illustrated, may also be a quadrangle or any other polygon, but in each case I prefer to have the entire inner surface of the barrel concave towards the axis of rotation, which extends within the barrel. If it is desired to heat or cool the material in the barrel, I may provide an additional shell 6 around the shell of barrel 3, see Fig. 8, so as to form a chamber in which a heating or cooling medium may circulate. Preferably, such medium is introduced into the chamber and discharged from it through the trunnions 7 of the barrel 3, which are made hollow for the purpose, and connected with supply and discharge pipes 9 and 10, respectively, see dotted lines and arrows in Fig. 1. In order to facilitate the heat-exchange, I may provide the opposing faces of the double shell 3, 6, (that is to say, the faces in contact with the heating or cooling medium) with corrugations or grooves extending lengthwise of the axis of rotation, as illustrated in Fig. 8. These corrugations not only increase the area of the surface in contact with the said heating or cooling medium, but also intensify the whirling motion of such medium during the rotation of the barrel and thus insure a more powerful heating or cooling action.

The barrel may also be heated or cooled by a fixed apparatus past which it rotates. Such an arrangement is illustrated in Fig. 9.

The barrel 3, mounted to rotate on standards 1 as before described, is here, by way of example, shown quadrangular in cross-section. In one side of this quadrangle is formed a feed-opening adapted to be closed by a cover or door 5 which is hinged to the barrel at 5^a and adapted to be locked by a bolt or lever 5^b.

Below the barrel, and so that the barrel partly projects into it, I arrange a casing 11 which, at or near its bottom, is provided with a plurality of pipes 12 which may either be spray pipes for cooling the barrel as it is rotating or gas burners for heating it.

If material is comminuted, mixed, kneaded, etc., which gives off vapours or gases, spring-loaded valves 20 are provided which are in communication with the interior of the barrel, see Fig. 10. Lugs 22 are secured to a rod 22^a arranged above the barrel 3 and supported on the standards 1 by uprights 23. These lugs periodically open the valves by means of spindles 21, as the barrel rotates, so that the vapours or gases will periodically escape and no excessive pressure can occur in the barrel. I have illustrated four valves which are distributed over the barrel in a helical line, so that vapours, etc., are discharged successively from several parts of the barrel, as the spindles 21 of the valves are successively engaged by the corresponding lugs 22. The area of the valves and their distribution over the barrel are such that the pressure in the barrel can

not exceed a predetermined limit. If the pressure in the barrel were allowed to rise too high, it might occur that the material would be partly ejected through one of the valves 20 on its being opened. The valves should be so distributed over the barrel, that the excess pressure escapes successively at several places along the axis of the barrel, thereby effecting a thorough aerating or heating of its contents and at the same time assisting in the satisfactory mixing of the material in the barrel. Obviously, the number and arrangement of the valves will vary according to the work performed by the machine.

Machines of this type are particularly suited for the manufacture of soap-powder. The soap in the barrel is treated with a solution of soda. The mass will become strongly heated and give off vapours which periodically escape through the valves 20 while the barrel is continuously cooled and a stamper 4, preferably of the scraper type illustrated in Figs. 6 and 7, detaches those particles of soap that may adhere to the inside of barrel 3.

The machine illustrated in Fig. 10 is so constructed that the heating or cooling medium is introduced into the barrel instead of being applied to its outside.

One of the trunnions of barrel 3, say trunnion 15, is made hollow and has a hood-shaped extension 16 in which is arranged a ventilator 17. The shaft of this ventilator is carried in bearings 18 on a standard 19, and motion is imparted to it by the driving shaft 24 which is carried in bearings 25 and 26 on standards 1 and 27, respectively. Mounted on this shaft is a gear wheel 28 which meshes with a corresponding gear wheel on trunnion 15. Motion is imparted to shaft 24 by means of fast-and-loose pulleys 29. A belt 31 passes from further fast-and-loose pulleys 30 on shaft 24 to a pulley 32 on the shaft of ventilator 17. In this manner, a heating or cooling medium is compressed by the ventilator 17 and forced into the barrel 3.

I claim:

1. An apparatus of the class described, comprising a rotary barrel which in cross section perpendicular to the axis of rotation has smooth surface portions alternately approaching and receding from, the said axis, which is located within said barrel, said cross section being uniform throughout the operative length of the barrel, and a crushing roller located in said barrel and extending substantially the entire length of the barrel, with the axis of such roller parallel to that of the barrel.

2. An apparatus of the class described, comprising a rotary barrel having a chamber provided with means for supplying it with a medium under pressure, a series of valves controlling outlet from said chamber and located in a spiral series at different points of the length of the barrel, and a stationary bar extending lengthwise of the barrel exteriorly thereof to engage and open said valves successively during the rotation of the barrel.

3. An apparatus of the class described, comprising a rotary barrel formed at one end with a trunnion held to turn with said barrel, a fan located within said trunnion, and means for rotating said fan relatively to said trunnion.

In testimony whereof I have signed this specification.

HARRO CRAMM.