Aug. 31, 1937. M. R. XIMENEZ 2,091,297

MEANS FOR GRINDING

Original Filed Aug. 21, 1930 2 Sheets-Sheet 1

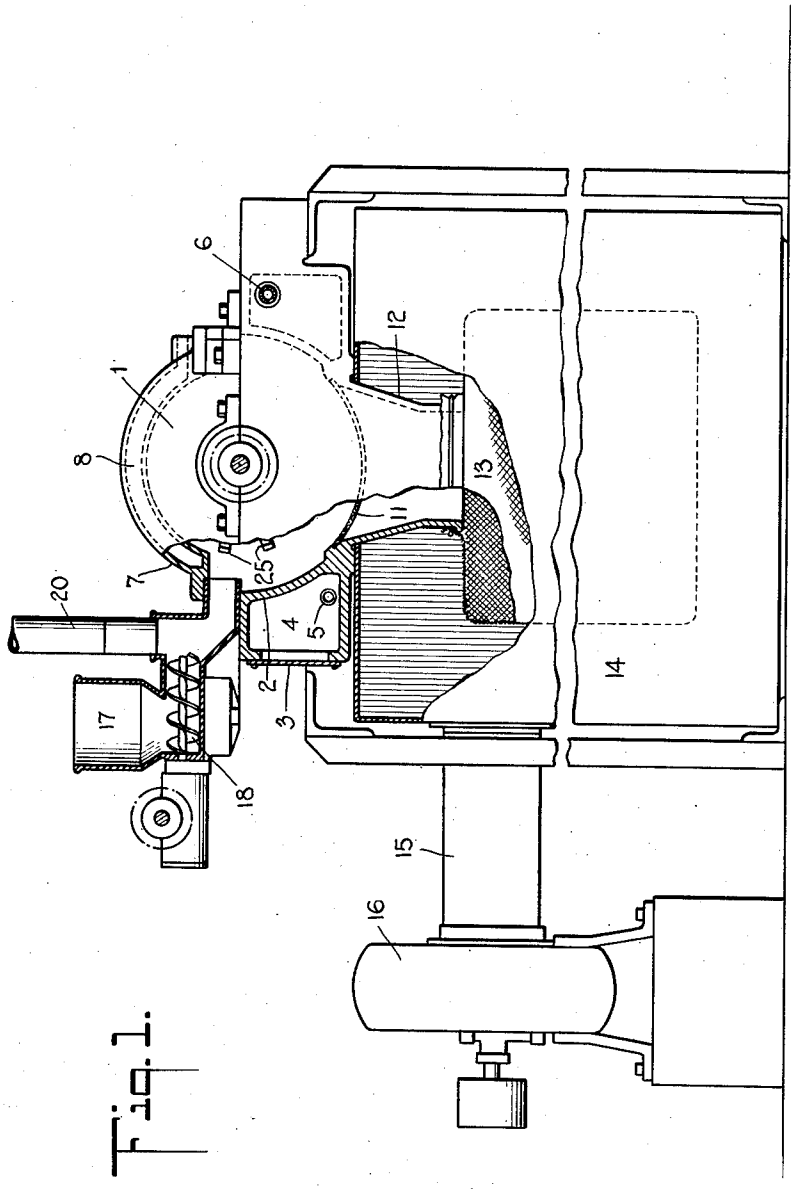

Fig. 1.

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Fig. 2.

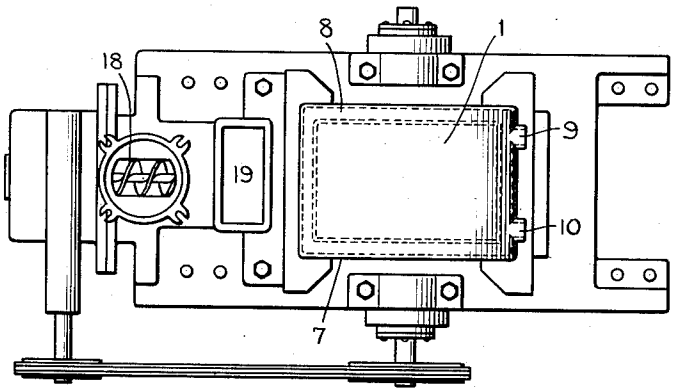
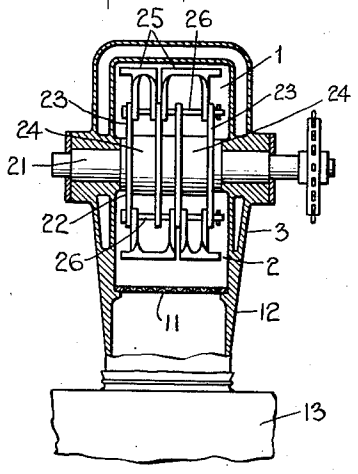


Fig. 3.



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UNITED STATES PATENT OFFICE

2,091,297

MEANS FOR GRINDING

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Original application August 21, 1930, Serial No. 476,818. Divided and this application January 19, 1933, Serial No. 652,474. In Canada July 31, 1931

1 Claim. (Cl. 83—11)

This invention relates to means for reducing the size of thermoplastic materials.

This application is a division of my application S. No. 476,818, filed Aug. 21, 1930.

An object of my invention is to provide means for reducing the size of materials which tend to soften when heated, in an economical and expeditious manner. A further object of my invention is to provide means for grinding thermoplastic material while cooling the same so that the softening of such material by the heat generated during grinding is largely or even wholly avoided. Other objects of my invention will appear from the following detailed description.

The grinding of thermoplastic compositions containing derivatives of cellulose presents serious difficulties. If attempts are made to grind such material in ordinary mills, the heat generated during grinding raises the temperature to a point where the material becomes soft and gummy so that the grinding must be interrupted until the mass cools to the point where it can be ground. This involves a low rate of production and low yields. Moreover the parts of the ordinary mills are inaccessible and therefore difficultly cleaned with the result that if different materials are ground, subsequent materials become contaminated with prior materials.

I have found that the above disadvantages, as well as other disadvantages, may be avoided and further advantages introduced when the size of thermoplastic materials is reduced in a mill which is provided with jackets for cooling media and which is also preferably provided with pneumatic means whereby air or other gas is caused to cool and convey the ground material through and from the mill. By providing at the outlet of the mill a bag made of material pervious to gas or air only, loss of material is avoided and contamination of the air of the room where grinding is taking place by dust is also avoided. Moreover a different bag may be used for each material of different kind or color being ground.

Furthermore by making the interior surfaces of the mill of non-corrosive metal or alloy, contamination by products of corrosion is avoided. Further to avoid contamination, the parts of the mill are made easily removable for inspection and cleaning, and the mill is made of curved surfaces so that the interior is easily accessible and the stock being ground does not collect in sharp corners and thus remain to contaminate fresh charges of materal of different kind or color.

While mills of any suitable kind such as an impact pulverizer, ball mill, edge runner and the like may be employed for breaking, cutting, crushing, grinding, pulverizing or otherwise reducing (hereinafter referred to as grinding) the size of thermoplastic material, I have found that the best results are obtained by the use of an impact pulverizer which will be hereinafter described in detail.

Any thermoplastic material may be ground according to this invention. By thermoplastic material is meant material which softens at elevated temperatures. Such materials may be resins or gums, but the present invention is particularly adapted to the treatment of thermoplastic materials containing derivatives of cellulose such as cellulose nitrate or organic derivatives of cellulose. Examples of organic derivatives of cellulose are cellulose esters such as cellulose acetate, cellulose formate, cellulose propionate and cellulose butyrate, or cellulose ethers, examples of which are ethyl cellulose, methyl cellulose and benzyl cellulose.

The organic derivatives of cellulose are preferably admixed with suitable plasticizers, such as camphor, dimethyl phthalate, diethyl phthalate, triphenyl phosphate, para ethyl toluene sulphonamid, dibutyl tartrate, triacetin, monomethyl xylene sulfonamid, etc. The thermoplastic material may contain besides the derivative of cellulose and the plasticizer other materials such as pigments, dyes, effect materials, etc. Grinding of cellulose acetate or other organic derivative of cellulose alone, that is, not in admixture with plasticizers or other materials may also be effected.

The thermoplastic material which is ground in accordance with my invention is superior to similar material ground in a normal manner. It possesses a higher stability due to the fact that the material has not become heated during the grinding operation. Since no local overheating of the stock results in the present process, there is no volatilization of the plasticizer, no color changes in the stock and no development of foreign odors.

The derivative of cellulose such as cellulose acetate may be mixed with the plasticizer and other material and the mass ground to form an intimately mixed and finely divided powder. Or else slabs or chips produced by gelatinizing the derivative of cellulose and the plasticizer with a volatile solvent by means of kneaders and malaxating rolls at elevated temperatures may be ground in accordance with this invention.

For a detailed description of one mode of carrying out my invention which description is merely

illustrative but not limitative, reference is had to the accompanying drawings; wherein

Figure 1 is a side view, partly in section of an impact pulverizing mill made in accordance with my invention;

Figure 2 is a plan view of the same; and

Figure 3 is a vertical cross section along the line 3—3 of Figure 2.

Referring to the drawings the impact pulverizer 1 is constructed of a lower member 2 surrounded by a casing 3 to form a jacket 4, through which water, cold brine or other cooling liquid is adapted to flow being introduced through the inlet 5 and leaving by the outlet 6. The cover or upper member 7 of the mill 1 has a jacket 8 through which a cooling liquid circulates from the inlet 9 to the outlet 10. The parts are preferably made of noncorrosive metal or alloy.

A foraminous or perforated screen 11 is provided and this has apertures or interstices of such size as to permit the ground material of the desired size or mesh to pass through to the chute 12 to the mouth of which a fabric bag 13 is attached. The bag 13 is contained in an air tight chamber 14, which is connected by means of the pipe 15 to the inlet of suction pump or fan 16.

The thermoplastic material to be ground is fed either manually or mechanically from the hopper 17 by means of the screw conveyor 18 into the charging belt 19 which also acts as an air intake for the air drawn by the suction fan 16 through the air inlet pipe 20. This air not only acts to convey the material into and through the mill, thus removing material that is ground sufficiently fine to make room for fresh stock, but also cools the same while it is being ground.

For grinding the material there is provided a rotating impact device which comprises a rotor shaft 21, the rotor 22 having rotor blades 23 and spacers 24 and rotor hammers 25. A large number of such rotor hammers 25 are provided although but two sets are shown in Figure 3. The hammers 25 are loosely and pivotally mounted on the rotor rods 26.

As a specific example of one mode of carrying out this invention the following description is given in connection with the grinding of material formed by the kneading at elevated temperatures of cellulose acetate, a plasticizer and a volatile solvent and the subsequent kneading and rolling of the same by heated malaxating rolls until gelatinization is completed and most of the volatile solvent is evaporated.

The sheets or slabs formed by the malaxating rolls are preferably precrushed into small chips or slabs and then fed from the hopper 17 by the screw 18 into the mill 1. In the meantime the suction fan or pump 16 draws air through the inlet pipe 20 and this air helps to convey the material into and through the mill. The rotating hammers 25 crush and grind the material by impact and the material that is ground sufficiently fine falls or is drawn through the screen 11 into the bag 13. The material in the mill 1 is cooled not only by the air drawn through the same but by the walls of the mill which are kept cool by water or other cooling liquid circulating in the jackets 4 and 8. The softening or gumming of the material due to heat of grinding is thus avoided and the mill may be used continuously without interruption.

The finely divided material that collects in the bag 13 is a molding powder which may be molded under heat and pressure to form articles of any desired shape. If another material of different color or constitution is to be ground, the bag 13 is removed and is replaced by a different bag.

As will be readily seen, the parts of the mill, such as the lid, rotor, screen, screw conveyor and bag, are readily removable and may be readily cleaned of the old material. Moreover there are no sharp corners in which the material may collect. Because of the arrangement of parts, all of the ground material is caught in the bag 13 so that there is no loss nor is there contamination of the surrounding air by dust.

It is to be understood that the foregoing detailed description is given merely by way of illustration and that many variations may be made therein without departing from the spirit of this invention.

Having described my invention what I claim and desire to secure by Letters Patent is:

Apparatus for reducing the size of thermoplastic material comprising a body, a cooling jacket around said body, rotatable impact hammers in said body, means for introducing material to be ground into said body, means including a perforated member for permitting the discharge of sufficiently ground material, a gas permeable collecting bag attached to said discharge means and means for passing a current of gas through said means for introducing the material and through the said body into said bag, whereby the introduction of the material into said body and the discharge of the material into said bag is facilitated and the local overheating of the material during the grinding thereof is prevented.

MANUEL R. XIMENEZ.