

Crushing Apparatus

This invention relates to a crushing apparatus and relates in particular to apparatus for crushing synthetic resin products or the like into the form of pellets.

5 When products formed of polyvinyl chloride resin, acrylic resin, polyethylene resin or the like are no longer wanted or become useless, wastes therefrom have to be treated, which can pose problems. Under these circumstances, it has been proposed to reuse
10 these wastes as a part of raw material for new resin products. That is, unwanted resin products are crushed into pellets, and the crushed resins are mixed into virgin pellets to produce new resin products.

For such a crushing apparatus, there has been
15 proposed, for example, an apparatus generally indicated at 11 in Figs. 1 and 2. The crushing apparatus 11 comprises a crushing chamber 14 having a hopper 12 for receiving material to be crushed at a top thereof and a pellet discharge opening 13, and a driving
20 chamber 16 for accommodating therein a motor 15. Within the crushing chamber 14, there are provided two vertically spaced drive shafts 17 and 18, the upper drive shaft 17 having a plurality of rotating blades 19 adapted for rough crushing of material
25 mounted thereon, and the lower driving shaft 18 having a plurality of rotating blades 20 adapted for fine crushing mounted thereon. The driving shaft 17 is connected to a shaft 22 of the motor 15 through a coupler 21 and the driving shaft 18 is connected
30 to the driving shaft 17 through gears 23, 24. Pieces 25 of waste resin moulded products roughly crushed by means of a press or the like are discharged through the hopper 12 and roughly crushed by the rotating blades 19 while being guided by a guide plate 26

and affixed comb blades 27 which correspond to the rotating blades 19, after which they drop onto the lower rotating blades 20. The roughly crushed pieces are finely crushed into pellets by means of the rotating blades 20 while being guided by a guide plate 28 and fixed comb blades 29 which correspond to the rotating blades 20, and the pellets 30 are fed outside the crushing apparatus 11 via the discharge opening 13. Since such a crushing apparatus is provided with vertically spaced rough and fine crushing blades, the construction of the whole crushing apparatus is bulky. Furthermore, conventional crushing apparatus requires drive mechanisms for two rotating blades, and the driving mechanism is thus relatively complicated.

It is an object of the present invention to provide a crushing apparatus for synthetic resin material or the like which is simpler in construction and which can be less bulky than such apparatus known heretofore.

In accordance with the present invention, there is provided a crushing apparatus comprising a housing including a hopper at its upper end for receiving material to be crushed, and a downwardly directed discharge opening at its lower end for the release of crushed material, a drive shaft rotatably mounted within the housing which extends in a generally horizontal direction, first rotating blades for roughly crushing said material mounted on said drive shaft, second rotating blades for finely crushing said material mounted on said drive shaft coaxially with and between said first rotating blades, and a cover member or members surrounding the lower parts of said first rotating blades, the arrangement thereby being such that roughly crushed material is repeatedly crushed by the first blades without falling through said discharge opening until being sufficiently fine for further crushing by the second blades and release downwardly through the discharge opening.

In accordance with a preferred embodiment of the present invention, the first rotating blades include at least two crushing blades which cooperate with first fixed comb blades mounted on the housing, the blades being spaced apart through 180°, and the second rotating blades include a number of saw-tooth blades which also cooperate with fixed comb blades mounted on the housing. The thickness of the first rotating blades is preferably greater than that of the second rotating blades such that the first blades scoop up material dropped into the cover member.

In the crushing apparatus in accordance with the present invention, if the products are so rough as not to be caught by the second rotating blades, such products jump on the second rotating blades until they are fed onto the first blades whereby they are roughly crushed, after which they are finely crushed by the second blades. Thus rough products can be finely crushed effectively. Moreover, in the crushing apparatus of the present invention, the rotating blades for rough and fine crushing are provided on a single driving shaft, and, therefore, the present crushing apparatus can be made more compact than the conventional crushing apparatus, and in addition, only one drive shaft need be driven and therefore the driving system may be simplified.

A preferred embodiment of the invention will now be described, by way of example only, with reference to Figures 3 to 5 of the accompanying drawings, wherein:

Fig. 1 is a side sectional view showing one example of a conventional crushing apparatus.

Fig. 2 is a sectional view taken along line 2-2 of Fig. 1.

Fig. 3 is a plan view showing one embodiment of a crushing apparatus in accordance with the present invention.

Fig. 4 is a sectional view taken along line 4-4 of Fig. 3.

Fig. 5 is a sectional view taken on line 5-5 of Fig. 3.

Referring now to Figs. 3 to 5, there is shown one embodiment of a crushing apparatus for synthetic resin moulded products or the like in accordance with the present invention, which is indicated generally at 31. The crushing apparatus has a housing 34 formed at its top with a hopper 32 adapted to receive products to be crushed and at its bottom with a discharge opening 33 for the discharge of finely crushed material. The hopper 32 comprises inclined surfaces 35, 36 which are obliquely and downwardly inclined towards a central region internally of the housing 34. Disposed in the central region of the housing 34 is a drive shaft 37 rotatably supported thereon. The axis of the drive shaft 37 extends horizontally and perpendicularly to the inclined surfaces 35, 36. On the drive shaft 37 are mounted two rotating blades 38 for rough crushing in suitably spaced relation, which extend upwardly into the hopper 32, and downwardly into the discharge opening 33. On the drive shaft 37, between the rotating blades 38 and between the housing side walls and the rotating blades 38, are mounted a plurality of rotating blades 39 for fine crushing in a suitably spaced relation. The fine crushing blades 39 also extend partly into the hopper 32 and partly into the discharge opening 33. The rotating blades 38 for rough crushing each comprise two crushing blades 41 which are spaced apart through approximately 180°, the thickness of the rotating blades 38 being greater than that of the fine crushing blades 39. The fine crushing blades 39 each comprise a number of saw-tooth blades 42. As shown in Figure 4, the lower region of each rough crushing blade 38 extending into the dropping opening 33 is surrounded by a cover member 43 which is shaped so as to not impair rotation of the blade 38.

The inclined surface 35 of the housing has fixed comb blades 44 corresponding to the rotating blades 38, 39 mounted thereon, whereas the inclined surface 36 thereof has a receiving plate 45 mounted thereon to receive products. While as illustrated the upper ends of the fixed comb blades 44 and receiving plate 45 are spaced from the upper end of the hopper 32, it should be noted that the blades 44 and plate 45 could if desired extend to the upper end of the hopper 32. The upper half of the housing 34 is designed to cover the outer peripheries of the rough crushing and fine crushing blades 38, 39. The drive shaft 37 has one end extending outwardly from the side-wall 34 of the housing, which end is provided with a pulley 46. The pulley 46 is connected to an external power source through an endless belt (not shown). It will be of course be noted that alternatively the rotating shaft of the motor could be directly connected to the drive shaft as shown in Fig. 1.

In use, for example resin moulded products or pieces to be crushed are charged into the hopper and the drive shaft 37 is driven to rotate rough crushing and fine crushing blades 38, 39. If the resin moulded products charged through the hopper 32 are relatively large in size, they will tend not to be caught by the rotating fine cutting blades 39 and instead will jump thereon within the hopper. During such jumping, the products will also move laterally due to collisions with other resin molded products. Thus the larger products soon move into contact with the rough crushing blades 38 owing to this lateral movement and such products are then roughly crushed by the crushing blades 41 of the rotating blades 38. Products so crushed are collected by and scooped out of the cover member 43 without dropping into the dropping opening 33, and are repeatedly crushed. When the products are sufficiently finely crushed by the rough cutting blades 38, then they

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are further crushed by the rotating fine crushing blades 39 into fine or pellet-like products which fall out of the machine through the discharge opening.

- As described above, in the crushing apparatus
- 5 for synthetic resin molded products or the like in accordance with the present invention, the fine and rough crushing blades are mounted on the same shaft, and the crushed pieces of the molded products which are too large to be caught by the blades for fine
- 10 crushing are subjected to preliminary crushing by the rough crushing blades, after which they are finely crushed into a predetermined size. Accordingly, material to be crushed having a large or varying particle size can be finely crushed effectively.



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CLAIMS

1. Crushing apparatus comprising a housing including a hopper at its upper end for receiving material
5 to be crushed, and a downwardly directed discharge opening at its lower end for the release of crushed material, a drive shaft rotatably mounted within the housing which extends in a generally horizontal direction, first rotating blades for roughly crushing
10 said material mounted on said drive shaft, second rotating blades for finely crushing said material mounted on said drive shaft coaxially with and between said first rotating blades, and a cover member or members surrounding the lower parts of said first
15 rotating blades, the arrangement thereby being such that roughly crushed material is repeatedly crushed by the first blades without falling through said discharge opening until being sufficiently fine for further crushing by the second blades and release
20 downwardly through the discharge opening.
2. Crushing apparatus as claimed in claim 1, wherein said hopper has surfaces downwardly inclined from the upper ends of the housing towards a central region internally of said housing, said drive shaft extending
25 in a direction perpendicular to said surfaces, one said surface being provided with fixed comb blades matched to said first and second rotating blades.
3. Crushing apparatus as claimed in claim 1 or 2, wherein said first rotating blades have at least
30 two crushing blades circumferentially spaced apart, and the thickness of said first rotating blades is greater than that of said second rotating blades.
4. Crushing apparatus as claimed in claim 1, 2 or 3, wherein said second rotating blades have a
35 number of saw-tooth like crushing teeth provided on their outer periphery.
5. Crushing apparatus substantially as herein described with reference to Figs. 3 to 5 of all the accompanying drawings.