

# United States Patent

[19]

Shah

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[54] **GRANULATOR WITH NOISE ABATEMENT AND SAFETY MEANS**

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[58] Field of Search.... 241/73, 100, 101.7, 189 R, 241/222, 224, 282.1, 285 R, 285 A, 285 B; 83/349, 658, 700

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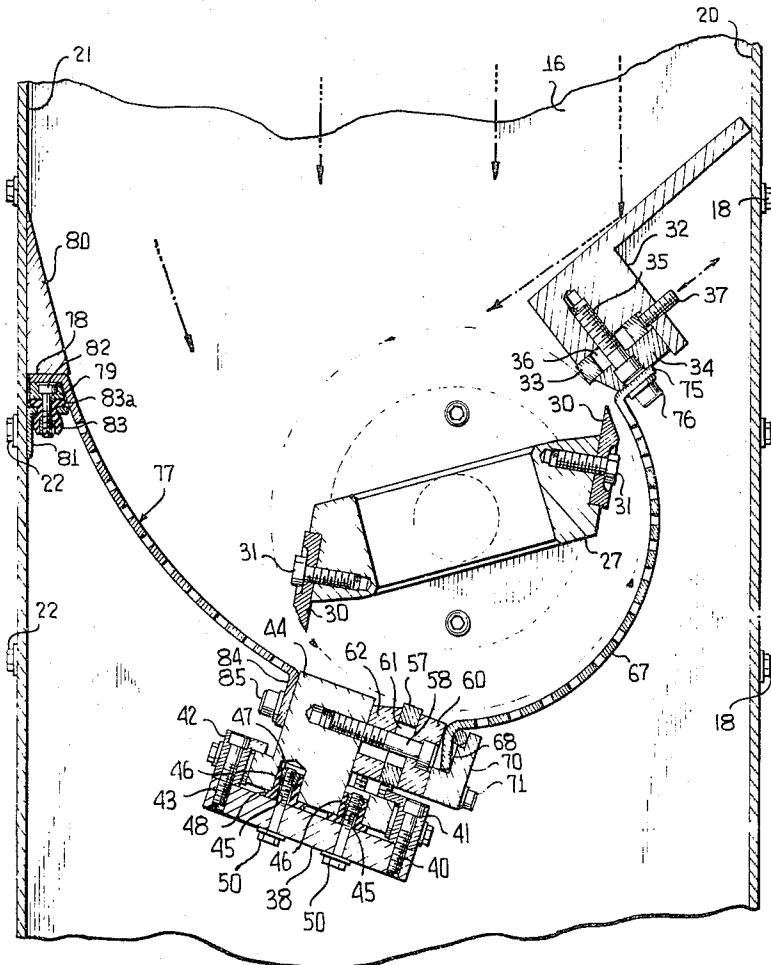
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[57] **ABSTRACT**

A device for comminuting or granulating plastic and like material including a housing having a rotating cutter therein, at least one fixed cutter cooperating with the rotating cutter, and a perforated screen, insulated mounting means mounting the fixed cutter and screen in fixed but insulated relationship with respect to the housing thereby greatly abating noises. The device also has access means for supplying materials to be comminuted including an access opening remote from the rotating cutter by a distance greater than the reach of an operator thereby preventing operator contact with the rotating cutter. The device has removable parts which provide access to the rotating cutter and there are control means for the rotating cutter for rendering the rotating cutter inoperative upon the removal of any one of the removable parts.

7 Claims, 6 Drawing Figures

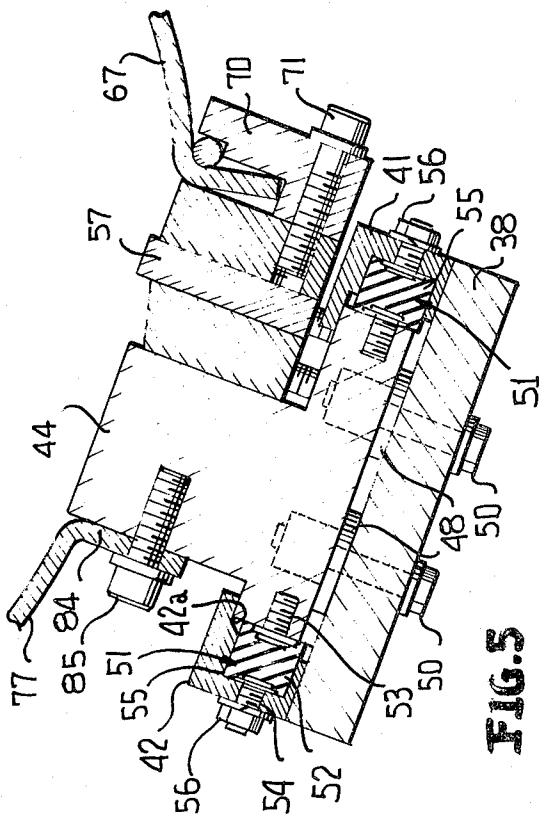


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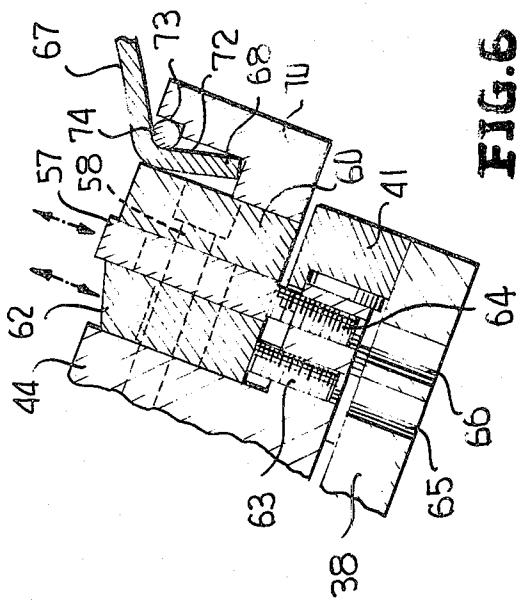
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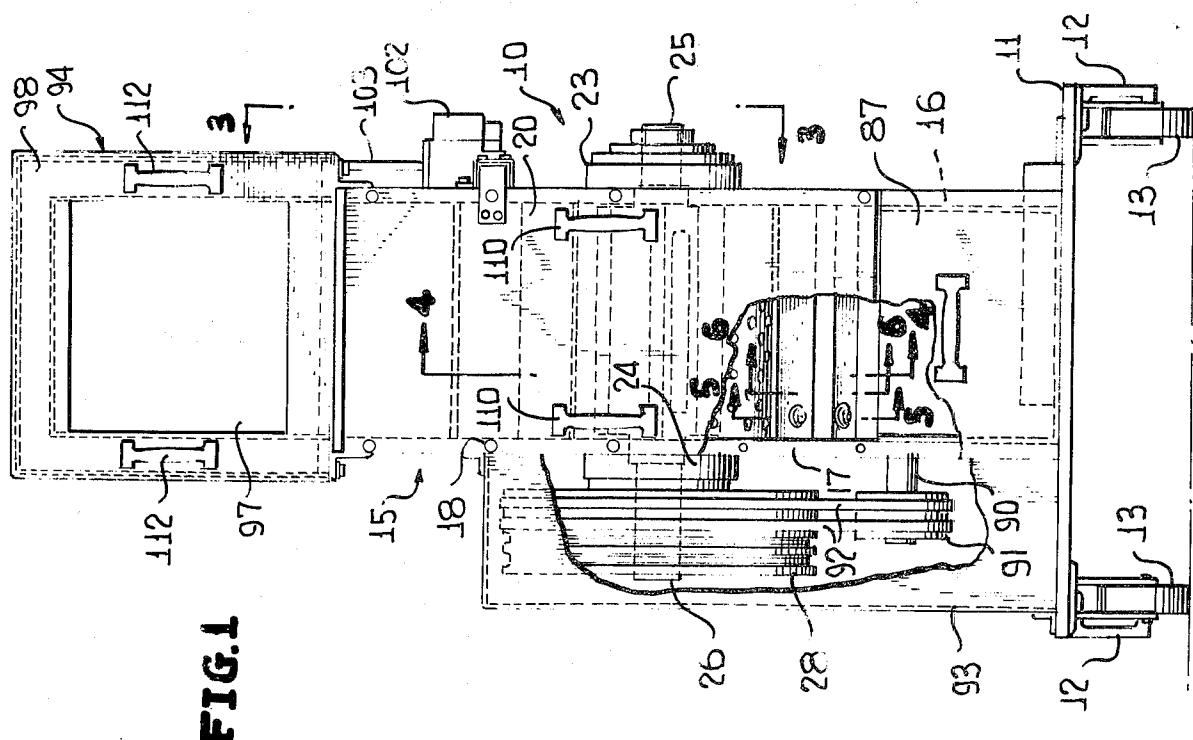
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## FIG. 1

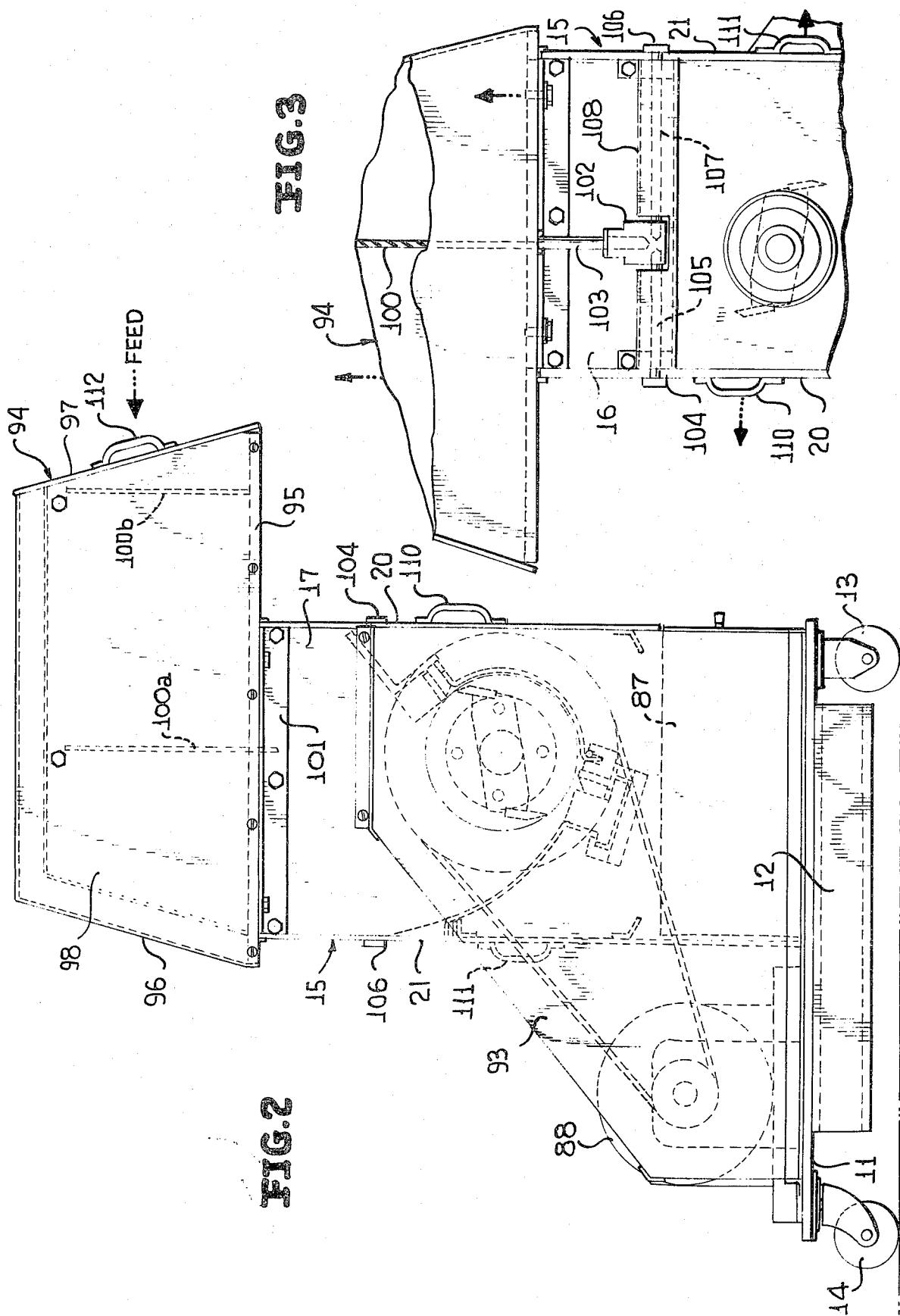
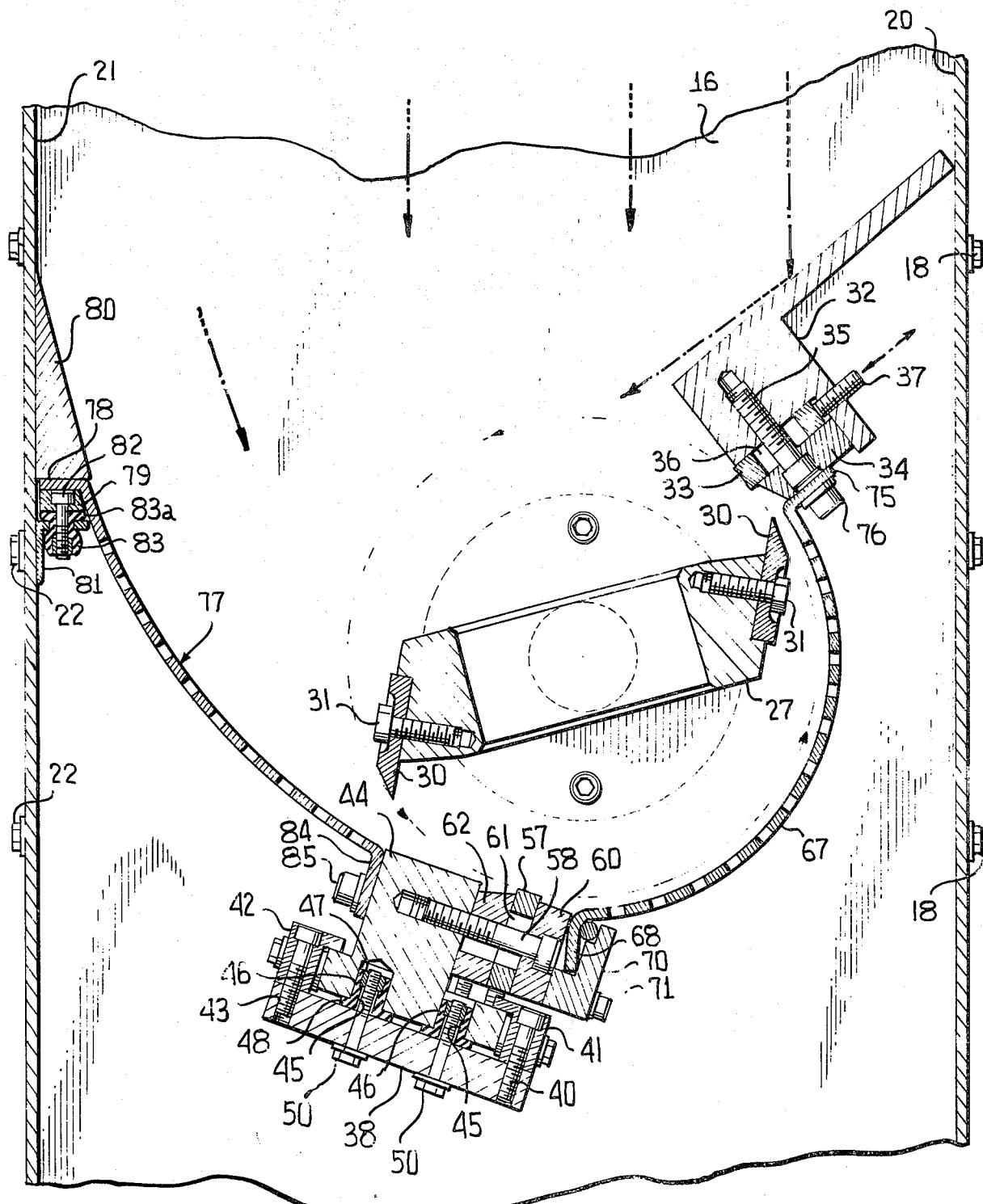


FIG. 4



## GRANULATOR WITH NOISE ABATEMENT AND SAFETY MEANS

This invention relates in general to new and useful improvements in comminuting or granulating devices, and more particularly to a granulating device having cooperative rotating and fixed cutters.

### BACKGROUND OF THE INVENTION

Granulators for comminuting plastics and like material utilizing cooperating rotating and fixed cutters and associated material sizing screens are known noise polluters and may not meet the noise pollution standards imposed by modern industrial laws.

Certain granulators may also fail to meet safety requirements in that it may be possible for an operator, working under abnormal conditions, to inadvertently place his hand into contact with the rotating cutter. Further, certain granulators are constructed wherein certain parts thereof, such as entry chutes, side panels, etc., may be removed without the drive for the rotating cutter being disabled.

### SUMMARY OF THE INVENTION

The most common expedient way in combating noise pollution is to enclose noise-polluting machinery with insulated housings. While such housings do successfully reduce noise the initial cost of the noise-abating housing increases the over-all cost of granulators and access to the machinery is restricted when repairs or inspections of the granulator are required.

In accordance with this invention, it is proposed to construct a granulator wherein critical elements thereof have insulated mountings, the construction of which is such that noises which might be produced during normal interaction of a rotating cutter with a fixed cutter are substantially eliminated. Further, the screens associated with the cutter elements are also mounted in an insulated manner so as to greatly reduce noise transfer. The net result of such insulated mountings and other features of the invention is to produce a granulator which substantially reduces noise pollution without requiring complex and expensive insulated housings.

Another feature of this invention is that the required insulation of the granulator may be accomplished by the simple use of the fasteners having resilient mounting components which effectively absorb noise, shock, and vibration even under high-impact conditions.

Another feature of this invention is the provision of a feed hopper having an access opening which is spaced from the path of the rotating cutter a distance in excess of the reach of an operator whereby it is physically impossible for the operator to reach the path of the rotating cutter even under the most abnormal conditions.

Another feature of the invention is the provision of a feed hopper having a feed muffer with a unique draw-type inner assembly with flexible baffles therein which simultaneously serves to deflect material placed in the granulator into the path of the rotating cutter and to prevent chips of material flung by the rotating cutter from ricocheting out through the access opening while attenuating airborne noise that would otherwise normally escape through the feed opening.

A further feature of the invention is the provision of switch means for rendering inoperative the drive for the rotating cutter when the feed hopper or certain parts of the removable panels of the housing of the granulator are removed, whereby it is impossible to ef-

fect the driven rotation of the rotating cutters when access to the path thereof is obtainable.

Another feature of this invention is the integrated design whereby various sections normally found in conventional granulators such as the base, cutting section and feed chute are integrated into one piece with suitable access doors, thereby minimizing the leakages of noise from where the conventional sections normally abut against each other.

With the above and other objects in view that will hereinafter appear, the nature of the invention will be more clearly understood by reference to the following detailed description, the appended claims, and the several views illustrated in the accompanying drawings.

FIG. 1 is a front elevational view of the granulator with parts broken away and shown in section;

FIG. 2 is a side elevational view of the granulator and shows generally the details of the feed hopper in the relationship thereof with respect to the rotating cutter;

FIG. 3 is a view taken along the lines 3-3 of FIG. 1 showing in detail the means for rendering the drive for the rotating cutter inoperative upon the removal of components of the granulator;

FIG. 4 is an enlarged fragmentary vertical sectional view taken along the line 4-4 of FIG. 1 and shows the details of the rotating cutter, the fixed cutters associated therewith, the sectional screen associated therewith, and mountings of the fixed cutters and sectional screen;

FIG. 5 is an enlarged fragmentary sectional view taken along the line 5-5 of FIG. 1 and shows further the details of an insulated support for the lower fixed cutter, and for adjacent portions of the sectional screen; and

FIG. 6 is an enlarged fragmentary sectional view taken along the line 6-6 of FIG. 1 and shows the adjustable mounting of the lower fixed cutter and the lower edge of the front screen section.

Referring now to the drawings in detail, it will be seen that the granulator is generally identified by the numeral 10 and includes rigid base 11 having two opposite sides thereof reinforced by a pair of channel members 12 secured to the underside thereof. The front end of the base is provided with a pair of fixed support wheels 13 while the rear end of the base 11 is provided with a pair of casters 14.

Seated on base 11 and extending upwardly therefrom is a generally rectangular housing 15. Housing 15 includes a pair of thick and very rigid side plates 16 and 17 which are suitably secured to base 11 in fixed relationship. Extending between side plates 16, 17 at the front edges thereof and removably secured thereto by a plurality of fasteners 18 is a front panel or door 20. A similar rear panel or door 21 is secured to rear edges of the side plates by means of like removable fasteners 22. Doors 20, 21 provide access to the interior of housing 15 for adjustment and mounting of the cutting knives positioned within housing 15. Doors 20 and 21 are laminates consisting of opposite outer steel plates between which is sandwiched a layer of visco-elastic plastic to minimize the generation of noise by these members.

Referring now to FIGS. 1 and 4, it will be seen that side plates 16, 17 carry bearing assemblies 23, 24, respectively, for the shaft ends 25, 26, respectively, of a two knife hollow rotor 27. Shaft end 26 has a flywheel sheave 28 mounted thereon. Rotor 27 has removably

mounted thereon a pair of rotor knives 30 which are secured in place by means of fasteners 31.

A knife holding block 32 extends between the side plates or panels 16, 17 adjacent front panel or door 20 and has the opposite ends thereof fixedly secured to side panels 16, 17 in a conventional manner. A bed knife 33 is adjustably clamped to knife holding block 32 by means of an upstroke knife shield 34 which is secured in place by suitable fasteners 35 which pass through openings 36 in bed knife 33 and which are threaded into knife holding block 32.

Bed knife 33 is adjusted by means of a set screw 37. It is to be understood that the position of bed knife 33 is adjusted so as to cooperate with rotating rotor blades or knives 30.

Also extending between and fixedly secured to side panels 16, 17 is a support block 38. Support block 38 has removably secured along the front edge thereof by means of fasteners 40 a front clamp block 41. A similar rear clamp block 42 is removably secured along the rear edge of support block 38 by means of fasteners 43. It is to be noted that clamp block 42 is chamfered at 42a (see FIG. 5) for guiding the movement of knife holding block 44 next to be described. Support block 38 and clamp blocks 41 and 42 combined to define a generally outwardly opening channel shaped support.

A downstroke knife holding block 44 is supported by the support block 38 in insulated relation. Block 44 is of a generally inverted T-shaped outline and has the cross-bar portion thereof in overlying relation to support block 38 and within the confines of the recess defined by clamp blocks 41 and 42.

Block 44 is provided with a plurality of bores 45 on the underside thereof and fitted in each bore 45 is a shouldered resilient insert having an internal nut 47 bonded thereto. Each shouldered insert 46 also includes at one end thereof a shoulder 48 which abuts against the under surface of block 44.

Suitable fasteners 50 extend through the support block 38 and are threaded into nut insert 47. Fasteners 50 simultaneously effect expansion of the shoulder inserts so as to clamp the same within bores 45 and draw block 44 towards support block 38 so as to compress shoulder 48. In this manner, block 44 is resiliently mounted on support 38 in insulated relation.

It is to be understood that fasteners 50 draw block 44 down toward support block 38 only sufficiently to permit clamp blocks 41, 42 to engage over the projecting edges of block 44, as is shown in FIG. 5.

Referring now to FIG. 5, it will be seen that knife holding block 44 is further secured to support block 38 in insulated relation by a plurality of special resiliently mounted fasteners identified by the numeral 51. Each fastener 51 includes a resilient body 52 having extending from one end thereof a first threaded portion 53 and from the opposite end thereof a second threaded portion 54. The threaded portion 53 is threadedly engaged in a bore in block 44 with body 52 in an abutting engagement therewith. Body 52 is seated in a suitable bore 55 in the respective one of clamp blocks 41, 42 and the opposite threaded stud 54 extends through a bore in the clamp block and is tightened in place by means of a nut 56.

It is to be understood that fasteners 51 are positioned on knife holding block 44 and thereafter clamp block 41, 42 are engaged thereover. Nuts 56 are then applied so as to draw clamp blocks 41, 42 into position wherein

fasteners 40, 43, respectively, securing the clamp blocks to support block 38, are aligned with the respective bores in support block 38 for the fasteners. Fasteners 40, 43 are then applied so as to draw clamp blocks 41, 42 tightly against support block 38. It is to be noted that chamfer 42a guides the movement of knife holding block 44 to preclude interference between rotor knives 30 and bed knife 57. It will now be apparent that at this time the knife holding block 44 is mounted with respect to the support block 38 in insulated relation such as to permit only such movements of knife holding block 44 that will not result in interference between the rotating knives 30 and bed knife 57 and, also, that will not change the relationship between rotating knives 30 and bed knife 57 beyond ordinary permissible limits during operation of the granulator.

As is clearly shown in FIGS. 4, 5 and 6, a lower bed knife 57 is clamped to knife holding block 44 by means of suitable fasteners 58. Said fasteners 58 engage a clamp block 60 and extend therethrough to pass through enlarged openings 61 in bed knife 57. Fasteners 58 also pass through an upstroke knife shield 62 and are also engaged in knife holding block 44. As is best illustrated in FIG. 6, knife shield 62 and bed knife 57 are adjustable relative to knife holding block 44 by means of set screws 63 and 64, respectively, which are threaded in threaded bores of knife holding block 44. Access openings 65 and 66 are formed, in support block 38 to facilitate adjustment of set screws 63, 64, respectively.

Viewing FIGS. 4, 5 and 6, there is mounted within housing 15 a sectional perforated screen which includes a front screen section 67. The front screen section 67 includes a lower mounting flange 68 held in place by a clamp block 70 which is secured to clamp block 60 by means of fasteners 71. As is best illustrated in FIG. 6, clamp block 70 has an upwardly opening enlarged recess 72 formed therein. The width of recess 72 is increased as is 73 adjacent the upper end of the clamp block and seated in area 73 is an elongated rod or pin 74 about which the lower portion of screen section 67 pivots with flange 68 being retained within the recess. Rod 74 is preferably welded to the clamp block 70.

The upper end of screen 67 is provided with a mounting flange 75 which is clamped against knife shield 34 by means of fasteners 76.

A rear screen section 77 extends between rear panel 22 and knife holding block 44. Screen section 77 has an upper mounting flange 78 which is clamped between an impact bar 79 and a rear material deflector 80. Impact bar 79 is held in insulating relationship with a support bracket 81 by a plurality of fasteners 82. Fasteners 82 are threaded into nut elements positioned within resilient grommets or well nuts 83 which are received in the mounting bracket 81 which is further secured to the rear panel 21. Well nuts 83, in cooperation with the impact bar 79, resiliently clamp the upper end of screen segment 77 in position. Insulation of impact bar 79 from support bracket 81 is achieved as well, nuts 83 expand and form a resilient cushion as at 83a.

The lower end of screen segment 77 is provided with a mounting flange 84 which is rigidly secured by means of fasteners 85 to knife holding block 44.

It is noted that the openings in perforated screens segments 67 and 77 are of a predetermined size for passing the granulated or comminuted plastic material.

It will be readily apparent that inasmuch as bed knife 57 and the lower ends of perforated screen segments 67 and 77 are carried by support 44, which, in turn, is resiliently mounted with respect to the housing 15 of granulator 10, there is a great reduction in the transmission of noise and impact or shock to the housing. The reduction of noise is also greatly facilitated by the resilient clamping of the upper end of screen section 77. At this time it is also particularly noted that although knife holding block 44 is resiliently mounted so as to abate the transmittal of noise and impact or shock, block 44, for all practical purposes, is supported so that there is no undue movement of the bed knife 57.

With respect to FIG. 4, rear material deflector 80 has already been referred to. The material deflector 80 directs falling material down onto rear screen segment 77 and into position for movement by rotating knives 30 into cooperation with bed knife 57. The granulated particles, when of sufficiently small size, pass through the openings in screen segment 67. Those segments which are not sufficiently small in size to pass through the openings in screen segments 67 are engaged between the rotating knives 30 and bed knife 33 and further comminution thereof is effected.

It is to be noted that rotor 27, by being hollow, also admits materials to be granulated down into the area of front screen section 67 for granulation by the cooperation of rotating knives 30 and bed knife 33. Further, it is to be noted that the shape of support 32 is such that particles to be granulated fall down into the center area of rotor 27 for transmission therethrough. The granulated particles passing through screen segments 67, 77 fall into the lower portion of housing 50 and are collected in a tray 87 removably mounted therein.

Rotor 27 is driven by an electric motor 88 which is seated on base 11 to the rear of housing 15. Motor 88 includes a shaft 90 having a driving sheave 91 thereon. Suitable drive belts 92 couple the sheaves 91 and 28 to effectively drive rotor 27.

Sheaves 28, 91, as well as the drive belts 92, are disposed within a suitable guard 93 which is secured to the side panel 17 and base 11 so as to meet all safety requirements. Guard 93 is readily removable for inspection and belt replacement purposes.

The upper end of housing 15 is open and has seated thereon a horizontal feed hopper, generally identified by the numeral 94. Hopper 94 is generally rectangular in cross-section and is in communication with the interior of housing 15 through an opening (not shown) in a bottom wall 95 thereof. Hopper 94 is provided with a sloping rear wall 96. As is best shown in FIG. 1, an access opening 97 is provided at the front end through which materials, such as plastic materials, to be granulated are fed. At this time it is particularly noted that the distance from access opening 97 to the path of rotating rotor 27 and knives 30 carried thereby is in excess of the reach of a person; and, therefore, it is physically impossible for an operator of the granulator to reach into the housing 15 and to come into contact with the rotating blades 30.

With more particular attention now to feed hopper 94, said feed hopper is provided with a removable draw-type inner muffler liner assembly 98 from which are suspended baffles 100a and 100b. Baffle 100a extends into the interior of housing 15 (FIG. 2) and acts to prevent granulated particles deflected off rear panel 21 from ricocheting out through opening 97. Muffler

liner assembly 98 serves to attenuate noise that would otherwise escape through the feed opening while lending itself to thorough cleaning by virtue of its being slideable out of hopper 94.

It is noted that, as shown in FIG. 2, the feed hopper 94 is removably mounted on the housing 15 in a suitable manner including brackets 101 extending along opposite sides of the housing 15. When feed hopper 94 is removed from housing 15, it will be readily apparent that access to rotating rotor 27 and blades 30 carried thereby is possible. Therefore, it is desired to render drive motor 88 inoperative when feed hopper 94 is removed. To this end there is mounted on one of the side plates, namely side plate 16, a safety switch 102. Said safety switch 102 is electrically connected in the circuit for motor 88 and includes an upstanding plunger 103 which bears against feed hopper 94. When feed hopper 94 is removed, plunger 103 moves upwardly and opens switch 102, thereby de-energizing motor 88.

As seen in FIGS. 1 and 3 front panel 20 has a small plate 104 secured thereto adjacent one edge thereof with plate 104 projecting beyond the edge of front panel 20. Plate 104 is associated with another plunger 105 of switch 102 so that when front panel 20 is removed, switch 102 will open and electric motor 88 de-energized so that rotor 27 cannot be driven while access to the interior of the housing 15 is possible.

Rear panel 21 is provided with a similar plate 106, with plate 106 engaging a third plunger 107 of switch 102. When the fasteners 22 holding the rear panel in place are removed and rear panel 21 is displaced, plunger 107 will retract and switch 102 will open.

If it is so desired, a suitable guard 108 may be provided for the plungers 105 and 107 so as to prevent tampering.

In order to facilitate the removal of the front panel 20, the same is provided with a pair of handles 110, as is best shown in FIGS. 1 and 2.

In a like manner, rear panel 21 is provided with a pair of handles 111. Similarly, muffler liner assembly 98 within the feed hopper 94 is provided with a pair of handles 112. The handles 110, 111, and 112 constitute safety features which prevent injury to an operator by facilitating the handling of the removable components.

From the foregoing, it will be readily apparent that there has been devised a granulator wherein the usual attendant noise has been greatly reduced without requiring a special casing. At the same time, the constructional details of the granulator are such that it is impossible for an operator thereof to come into contact with rotating rotor 27 and the blades carried thereby under all possible conditions of operation of the granulator. It will also be readily apparent that knife holding block 32 could be similarly supported as has been described for block 44, if desired.

Although only a preferred embodiment of the granulator has been specifically described herein, it is to be understood that minor variations may be made in the granulator construction and the details thereof departing from the stated scope of the invention, as defined by the appended claims.

What is claimed is:

1. Apparatus for comminuting plastics and like materials wherein said mechanism includes a rotating cutter element and a cooperating fixed cutter element, the combination comprising, mounting means for mounting said fixed cutter element, fixed support means for

holding said mounting means, said mounting means being movable in said support means in a first direction corresponding generally to the direction of rotation of said cutter element and in a second direction generally perpendicular to said first direction, and resilient means interposed between said support means and said mounting means and operable to insulate said mounting means from said support means while affording limited movement of said mounting means in said first and second directions.

2. Apparatus as set forth in claim 1 wherein said mounting means includes a cutter mounting support and clamp means for securing said fixed cutter element to said mounting support.

3. Apparatus as set forth in claim 1 wherein said fixed support means is of a channel cross-section including a base and legs, and said mounting means includes a portion engaged by said legs.

4. Apparatus as set forth in claim 3 wherein said fixed support means and said mounting means have opposed surfaces remote from said base limiting movement of said mounting support away from said base.

5. Apparatus as set forth in claim 1 wherein a sectional screen is positioned generally around the path of said rotating cutter element and generally along a path leading into said rotating cutter element path.

10 6. Apparatus as set forth in claim 5 wherein said screen has opposite positioning edges, and at least one of said edges is supported on insulated support means.

7. Apparatus as set forth in claim 6 wherein said insulated support means includes a fixed bracket, a plurality of insulated support elements carried by said fixed bracket, and fasteners securing said one edge to said fixed bracket through said insulated support elements.

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