An auger feed granulator for comminuting material such as plastic or thin metal is disclosed. The granulator is configured to have a low profile so that it can be conveniently situated under an injection press or the like for receiving the scrap material dropped therefrom. The granulator includes a rotor suitably mounted. The outboard end of the rotor has an auger fastened thereto and in axial alignment therewith. Thus, the rotor and auger both are powered by the same motor and rotate in unison. The auger is situated within an enclosure which has an opening therethrough to permit feeding of the plastic material directly from the injection press to the auger. The auger, in turn, operates to positively advance the material laterally to the cutting chamber in which the rotor is housed where the knives in the rotor, cooperating with one or more bed knives in the cutting chamber cut the material into small particles. The particles are discharged from the cutting chamber and may be recycled to the injection press if desired.

9 Claims, 5 Drawing Figures
AUGER FEED GRANULATOR

BACKGROUND OF THE INVENTION

The present invention relates to granulators for comminuting material of plastic, thin metal or the like and relate, more particularly, to a granulator incorporating a feed auger intimately connected with the rotor of the granulator for positively feeding material to the rotor and its cutting chamber for comminuting thereat.

Various types of granulating machines are presently commercially available for cutting up thermoplastic materials, thin metal pieces such as foil containers, and similar materials into small pieces. In a usual form, these granulating machines include a cutting chamber which houses a motor driven rotor. The rotor mounts a plurality of fly knives which come into cutting engagement with one or more stationary bed knives as the rotor is driven. The granulating machine may include a throat which opens directly into the cutting chamber. In operation with the prior art machines the material to be cut up is usually manually fed through the throat directly into the cutting chamber under the force of gravity.

With the advent of automated molding operations it has become desirable to provide a granulator which can be positioned under the molding machine where the scrap plastic material is automatically dropped into the granulator to be cut up and recycled into the molding operation. The prior art granulators have not been entirely adequate for such automated operations, due primarily to their rather high profile and the general need to charge these granulators manually. Efforts have been made to provide granulators which were compatible with automated molding operations. These granulators include the usual cutting chamber in which the rotor knives and bed knives cooperate to cut up the material. An auger serves to deliver the scrap from the molding machine to the granulator. However, these prior art devices have not proven to be reliable. This is largely due to the fact that in these prior art auger feed granulators the auger and the rotor are not intimately joined. Rather, the auger typically driven independently of the rotor and is positioned in a plane above the rotor and bed knives. The auger operates to deliver the plastic scrap into a void or box above the granulator cutting chamber where it releases the scrap to fall under the force of gravity into the cutting chamber. This approach has been deficient in that the plastic scrap, such as sprues and runners, being of highly irregular shape and very light in weight often times does not migrate downwardly into the granulator cutting chamber under the force of gravity but, rather, becomes trapped in the box or void upwardly from the throat of the granulator. Once such clogging commences in this box it may continue until such time as the scrap jams the auger and causes a back up of the material into the molding mechanism. This condition obviously requires operator attention resulting in the consumption of valuable man power, causes loss in production, and possibly, injury or destruction of certain of the molding machine mechanisms.

SUMMARY OF THE INVENTION

The present invention admirably overcomes the deficiencies of prior art mechanisms and, in brief, includes a granulator having a cutting chamber in which is mounted a rotor. An auger is fastened to the outboard end of the rotor so that the rotor and auger, in effect, constitute an integral one piece unit to be driven by a single motor. By virtue of the fact that the auger is able to be connected directly to the rotor, an auger feed granulator of low profile is provided. This low profile of the improved auger feed granulator of the present invention permits situating the auger directly under a molding machine so that the waste material therefrom can be dropped into a trough leading directly to the auger. The material is positively and continuously fed by the auger laterally into the cutting chamber where it is granulated by the co-action of the rotor knives and cooperating bed knives after which the material is discharged from the cutting chamber to be recycled to the molding machine, if desired. The unique arrangement of the present invention precludes the jamming up and malfunctions found in the operation of prior art mechanisms and leads to a highly efficient means for granulating waste material from a molding operation or other environment where material such as plastic waste or thin metal material is to be granulated.

In keeping with the foregoing it is one object of the present invention to provide an improved granulator incorporating auger mechanism for positively feeding material to be granulated to the cutting chamber of the granulator.

Another object of the present invention is to provide an improved auger feed granulator wherein the auger and rotary cutting mechanism of the granulator are driven by a single drive.

Still another object of the present invention is to provide an improved granulator which incorporates an auger operable to positively charge the cutting chamber of the granulator with material to be comminuted and wherein the mechanism has a low profile to adapt it to be situated under production machinery for automatically receiving the scrap material therefrom.

Other objects of the invention will in part be obvious and will in part appear hereinafter.

The invention accordingly comprises the apparatus possessing the construction, combination of elements and arrangement of parts which are exemplified in the following detailed disclosure.

BRIEF DESCRIPTION OF THE DRAWING

For a fuller understanding of the nature and objects of the invention reference should be had to the following detailed description. Taken in connection with the accompanying drawing wherein:

FIG. 1 is a general perspective view of the auger feed granulator of the present invention showing the unit positioned in operative position under the discharge hopper of plastic molding machine;

FIG. 2 is a cross sectional view taken longitudinally through the auger feed granulator of FIG. 1;

FIG. 3 is a cross sectional view taken along lines III — III of FIG. 2;

FIG. 4 is an end view sighting in the direction of lines IV — IV of FIG. 2; and

FIG. 5 is a detail view showing the interlocking arrangement of the auger and the rotor.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Turning initially to a consideration of FIG. 1 of the drawing the improved auger feed granulator 10 of the present invention is depicted in its operative position
situated below the discharge hopper (not shown) of a molding press 12. Waste thermoplastic materials, such as sprues and runners, are discharged through the afore-said hopper and are conveyed by mechanisms yet to be described for cutting up, i.e., granulating, in small pieces for recycling to the extruder of the molding press, if desired. While for purposes of illustration, the unique auger feed granulator of the present invention is shown in association with such a press, it should be understood that the invention has equal applicability with other types of equipment for processing thermoplastic materials, thin sheet metal such as cans or the like and, indeed, the auger feed granulator of the present invention may be employed to process materials which are manually fed thereto although, obviously, the unusually low profile of which the present invention admits contributes important advantages in permitting the auger feed granulator to be situated below processing equipment to automatically recycle scrap delivered therefrom.

With continuing reference to FIG. 1 the invention includes a main frame or chassis 16 of fabricated steel which is supported on casters 18 so that the complete mechanism may be readily moved from place to place. A relatively heavy steel plate is welded to chassis 16 and serves as a base 20 from which certain of the components of the invention are supported. Thus, the housing 22 of a cutting machine, or granulator, is secured to base 20. Except as herein noted the granulator may be the same construction as the Model 1/2 Granulating Machine manufactured and sold by Cumberland Engineering Co., Pawtucket, R.I., U.S.A. In view of the fact that said granulator is a commercially available machine only sufficient details of its construction and operation will be set forth herein as are deemed necessary to provide a full and complete understanding of the present invention.

With reference to FIG. 4 a constant speed electric motor 24 is secured to a pad 25 which, in turn, is welded to base 20. Motor 24 has the usual armature shaft 26 provided with a drive pulley 28 which receives one or more drive belts 30 wrapped thereabout. As best seen in FIG. 2 the rotor 32 is situated for rotation within housing 22. Rotor 32 is provided with a shaft 34 extending from the left-hand end thereof. The outer end 36 of said, shaft i.e., that shaft end remote from rotor 32 is turned to a reduced diameter and has a drive sheave 38 affixed securely thereto. The belt or belts 30 which engage around pulley 28 are also engaged around drive pulley 38 for the purpose of rotating rotor 32 in response to excitation of motor 24. Pulley 28 and sheave 38 together with the drive belt or belts 30 are enclosed by the usual type of guard 42 for purposes of personnel safety.

Turning now to FIGS. 1, 2 and 3 it will be observed that a casting is machined to form a housing 44 which is suitably machined to provide seats for a pair of bearings 46 at spaced apart locations therein. Bearings 46 receive shaft 34 on the inner races thereof and provide a surface of rotation for this rotor shaft. As seen in FIG. 2 a fly wheel 48 is also affixed to shaft 34 interiorly of housing 44 and acts through the inertia provided thereby when shaft 34 is rotated to moderate any tendency of the angular speed of shaft 34 to vary during the cutting operation.

With attention now to FIGS. 2 and 3 it will be seen that the housing 222 which forms the granulator encl-
receive the threaded shank 112 of an auger 120 and thus connect the auger with the rotor. Obviously, the arrangement will be such that auger 120 is screwed into rotor in a sense opposite to the direction in which the auger will rotate. The end wall of the cutting chamber has a clearance therethrough at 122, as best seen in FIG. 2 of a diameter at least as large as the major diameter of auger 120 to preclude any interference with the movement of material from the auger to cutting chamber 80. Said auger 120 includes the usual shank 124 and helical rib 126 extending therearound from one end of the auger to the other. The outer end of auger 120, i.e., that end remote from threaded shank 112, is formed as a bearing surface 128 which is seated in suitable bearings (not shown) contained within a pillow block 130. As seen in FIG. 5 the forward terminus of helical rib 126 of auger 120 is formed as a plane surface which, when shank 112 is threaded into the tapped hole and auger 32, abuts against the frontal surface 132 of one of the knives 84 secured on rotor 32. Suitable shimming may be provided between shank 112 and wall 110 of rotor 32, if necessary, to insure that the forward end surface of rib 126 abuts on surface 132 of one of said knives 84. In this fashion a positive connection is made between the auger and rotor so that as motor 24 is energized the auger and rotor turn as an integral unit and slippage between these two components is precluded. In FIG. 5 the degree to which the forward end of rib 126 engages the front surface 132 of knife 84 is somewhat exaggerated for purposes of illustration. It will be appreciated that such engagement may be relatively small, say the forward end of the rib 126 overlying knife 84 in the order of 0.050 of an inch or less, and successful interlocking of the rotor and auger can be achieved.

As is most evident in FIGS. 1 and 2 auger 120 is surrounded through part of its length with a sleeve 140 which serves to define a cavity 142 in which the auger is free to rotate. Sleeve 140 has an opening through its upper section toward the right-hand end thereof as viewed in FIGS. 1 and 2 and a feeder trough 144 is formed thereat. Thus, feeder trough 144 serves as an inlet opening into cavity 142 and forms a passage through which the material to be comminuted can be introduced to the cavity to be acted on by auger 120. As seen in FIG. 2 an upstanding rib 146 is situated in the bottom of sleeve 140 interiorly of cavity 142. This rib precludes material within the cavity from being rotated excessively around the auger as the material moves generally laterally toward rotor 32 in response to the action of auger 120.

The operation of the novel auger feed granulator of the present invention will be more or less obvious in view of the foregoing description. Thus, by way of summary let it be assumed that the auger feed granulator 10 is positioned under a molding press in the manner as depicted in FIGS. 1 and 4 wherein feeder trough 144 is aligned with a waste discharge of the press. Further, let it be assumed that motor 24 is energized whereupon power is transmitted through the train including pulley 28, belt 30, pulley 38 and drive shaft 34 to rotate rotor 32 and, in turn, auger 120 at 300-400 r.p.m. Waste plastic material, such as sprues and runners, are discharged from the molding press and passed through feeder trough 144 where they are seized by the rib 126 of auger 120. These scrap materials are thus positively drawn toward and into cutting chamber 80. As the cut-

From the foregoing it will be seen that the present invention provides a new and novel auger feed granulator operable to constantly and positively charge the cutting chamber of a cutting device with material to be comminuted. The comminuted material is automatically released from the cutting chamber for recycling to the processing apparatus with which the unique auger feed granulator of the present invention is associated.

Since certain changes may be made in the above invention without departing from the spirit of the invention herein involved it is intended that the foregoing shall be interpreted as illustrative only and not in a limiting sense.

What is claimed is:

1. Apparatus for comminuting material comprising, a substantially enclosed cutting chamber adapted to receive said material, rotor means positioned within said cutting chamber, means for driving said rotor means, cutting means affixed on said rotor means, bed knife means positioned within said cutting chamber and arranged to make cutting engagement with said cutting means as said rotor means is driven to thereby comminute the material in said chamber, auger means affixed to said rotor means in axial alignment therewith, enclosure means surrounding at least a portion of said auger means and defining a cavity in which said auger means rotates, a first inlet opening from said cavity to said cutting chamber, and a second inlet opening into said cavity and forming a passage for introduction of said material to said auger means, said auger means being rotatable in response to said rotor means being driven to thereby move material introduced to said auger means toward said cutting chamber.

2. Apparatus as set forth in claim 1 wherein said enclosure means is an elongated member having an interior wall, and a ridge element extends outwardly from said interior wall intermediate opposite ends of said member.

3. Apparatus as set forth in claim 1 wherein said auger means includes a rotor member having opposite sides, a shaft extending outwardly from one of said sides and in axial alignment with said rotor member, and bearing means supporting said shaft for rotation.

4. Apparatus as set forth in claim 3 wherein said rotary member has a threaded hole in the side opposite to said side provided with said shaft, and said auger means has a threaded shank for engaging in said hole.

5. Apparatus as set forth in claim 4 wherein the end of said auger means remote from said rotary member is in a supporting surface, and including bearing means for engaging said supporting surface.

6. Apparatus as set forth in claim 3 wherein said cutting means comprise a plurality of knives, said knives being spaced equidistantly around the periphery of said rotary member.

7. Apparatus as set forth in claim 6 wherein said auger means includes a helical rib extending along a shank portion of said auger means, said rib terminating
proximate said rotary member in a projection engaged on a frontal surface of one of said knives.

8. Apparatus as set forth in claim 6 wherein said knives extend generally from one side of said rotary member to the other, and a portion of said rotary member adjacent to said auger means and between each adjacent pair of knives is chamfered.

9. Apparatus as set forth in claim 1 wherein said cutting chamber includes a discharge opening for release of the material after comminuting thereof.