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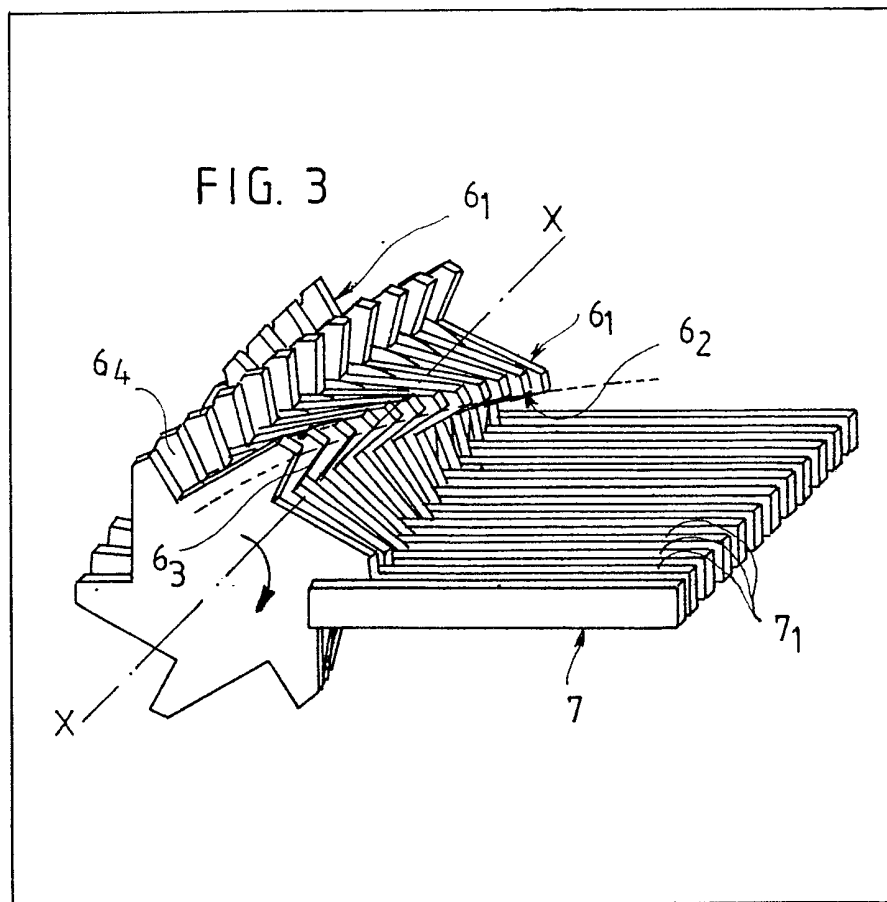
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(54) **Comminuting apparatus**

(57) In a grinder for grinding plastics material a rotatable drum has a plurality of longitudinal teeth (6₁) each delimited by a respective helical line

(6₂) centred on the axis (X—X) of rotation of the drum. Each tooth (6₁) is divided by grooves (6₄) into a plurality of tooth elements (6₃), which pass between a plurality of fixed blades (7₁) arranged parallel to each other.



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FIG. 1

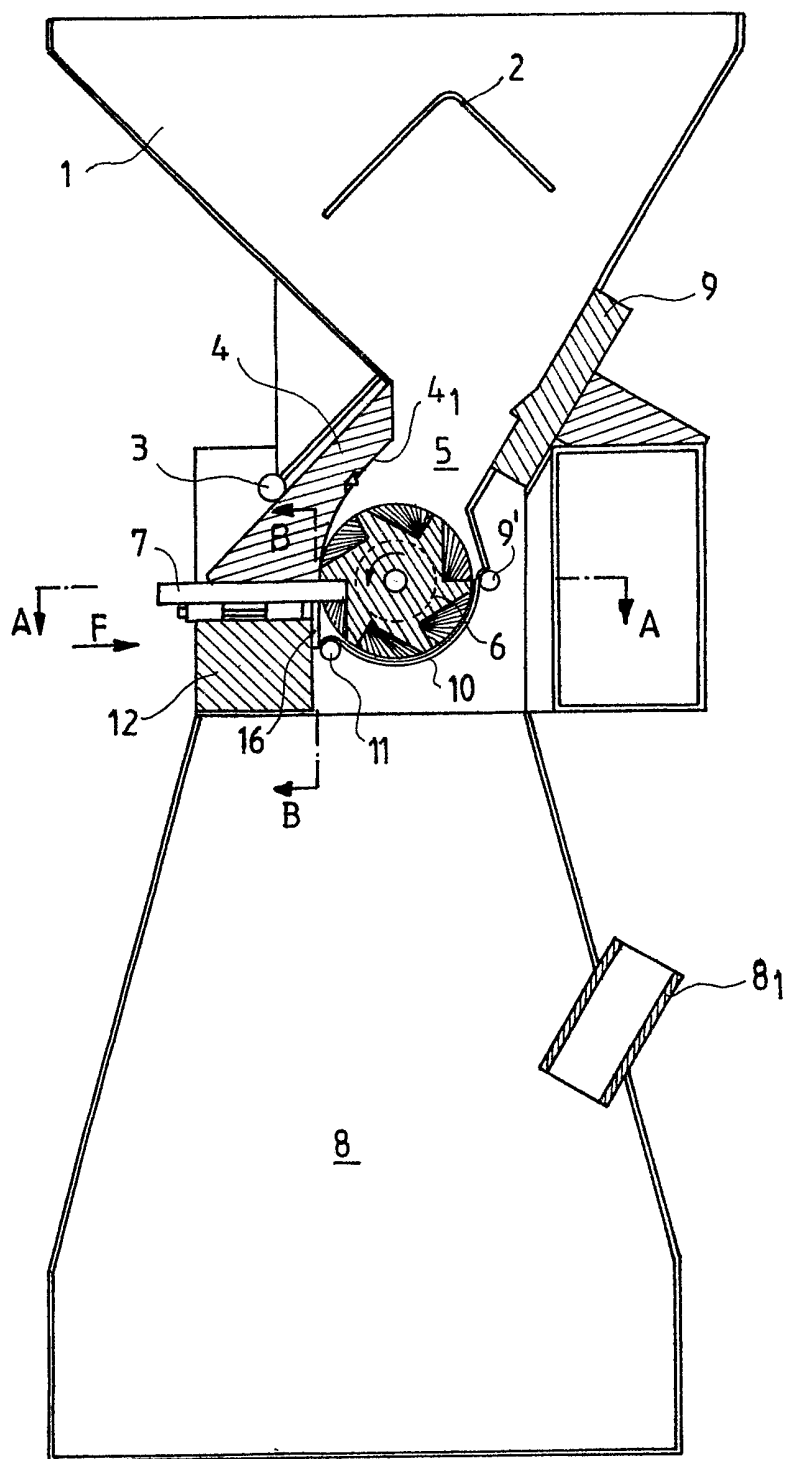


FIG. 2

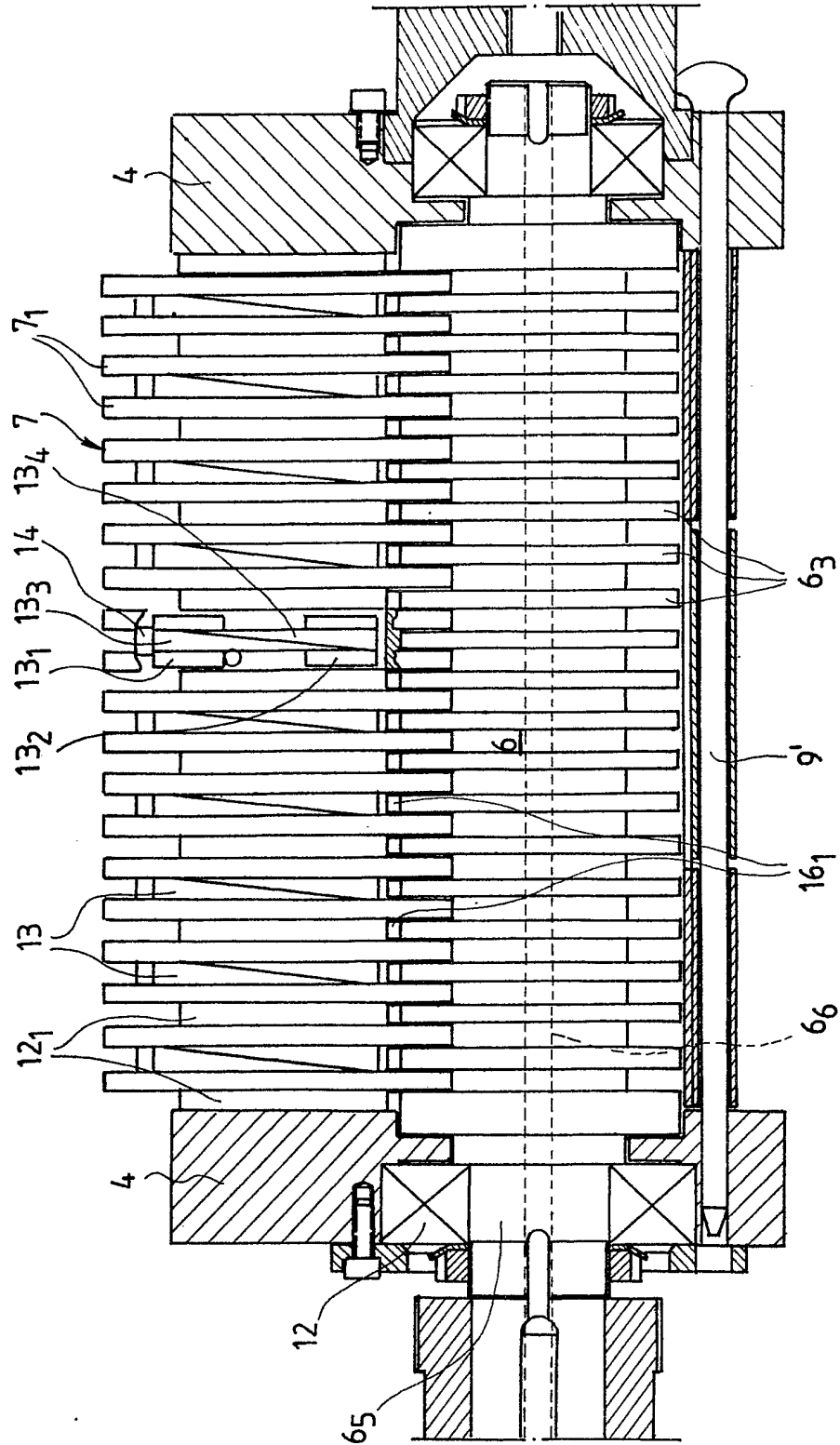


FIG. 3

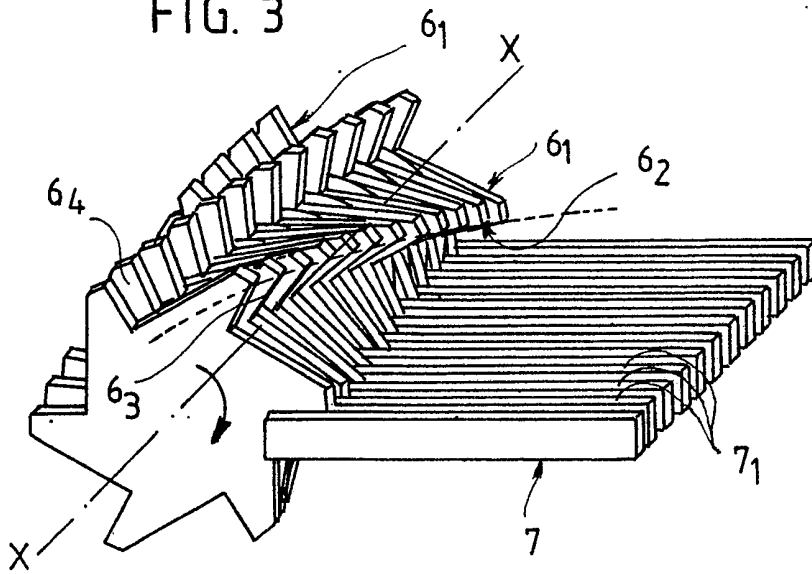


FIG. 4

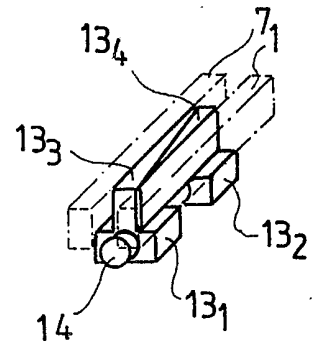


FIG. 5

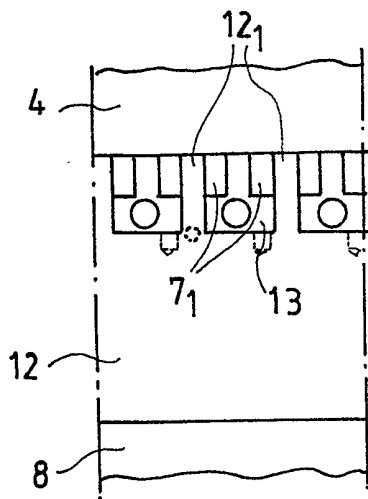
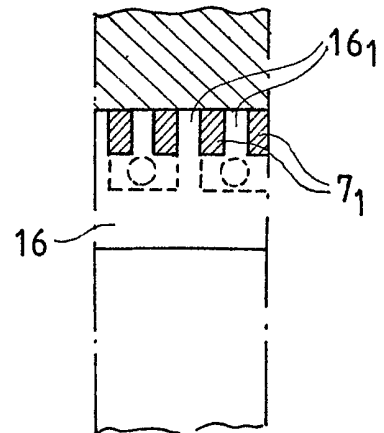


FIG. 6



SPECIFICATION Grinder for plastics material

This invention relates to a grinder for plastics material.

- 5 Grinders for plastics material comprising a drum which is equipped with knives and mounted to rotate inside a casing with the periphery of its teeth passing close up against a fixed counter knife to chop up the plastics material by a shearing action are already known. The ground up plastics material is then mixed with virgin plastics material to be reused in an injection mould.

- The grinders hitherto manufactured are, however, noisy in operation, require a powerful motor and have a low output yield, all the more so since plastics material which has been ground once in such an apparatus must generally be ground again several times in order to be reduced to sufficiently small particles to enable it to be mixed homogeneously with the virgin plastics material.

- The present invention is concerned particularly with overcoming these disadvantages and to this end it relates to a grinder for plastics material comprising a drum equipped with teeth and mounted to rotate inside the chamber of a casing against a fixed knife, the grinder being characterised in that, in the longitudinal direction of the drum, each tooth is bounded by a line which is set at an angle to the axis X—X of this drum while in the transverse direction of this drum each tooth has grooves subdividing it into a plurality of tooth elements, the knife consisting of a plurality of parallel blades fixed to the casing and engaging at their respective ends in the grooves separating the tooth elements.

According to another feature of the invention, the thickness of the blades is substantially equal to the width of the grooves.

- 40 According to yet another feature of the invention, the drum is manufactured from a single piece.

- According to a further feature of the invention, each device for fastening the blades is composed of two wedge-shaped pieces connected by a screw to lock them together and fasten the blades.

- According to another feature of the invention, the fastening devices are arranged in a comb-like structure, each space between two teeth of the comb receiving two blades of the knife separated by a fastening device.

The invention is described below by way of non-limiting example with reference to the attached drawings, in which:

- 55 Figure 1 is a transverse sectional view of a grinder according to the invention;
Figure 2 is a section taken on the line A—A of Figure 1;
Figure 3 is a schematic sectional view of the grinder drum and of the knife;
60 Figure 4 is a perspective view of one of the fastening devices for the knife;
Figure 5 is a view taken in the direction of F in Figure 1;

- 65 Figure 6 is a section taken on the line B—B of Figure 1.

The present invention relates to the manufacture of a grinder which is reliable and comparatively silent, requires only a low power motor, is capable of a high output and grinds to particles which are small enough to enable them to be directly mixed with a virgin material for their reuse.

- In the example illustrated in Figure 1, the grinder comprises a feed hopper 1 with a protective metal plate 2 inside it. The said hopper is mounted to pivot by means of a spindle 3 on a casing 4 enclosing the grinding chamber 5, the lower end of which chamber is occupied by the drum 6 which cooperates with the knife 7 fixed to the casing 4.

- Underneath the casing 4 is a vat 8 for receiving the ground up particles of plastics material. This vat is optionally provided with a sleeve 8₁ extending through its wall to receive a suction pipe for removing the ground particles by suction and directly returning them to the feed hopper of the injection moulding machine.

- The hopper 1 is equipped with a magnetic plate 9 to retain any metal parts introduced into the hopper with the plastics material. A pin 9' serves to lock the hopper in its operative position and to support a screen 10 which is in the form of the arc of a circle to fit round the outside of the drum 6 and which is held at its other end by a pin 11.

- The drum 6 has teeth 6₁ extending along its length, with their cutting edge delimited by a line 6₂ which is at an angle to the axis X—X of the drum 6, this line being preferably helical.

- As already mentioned with reference to Figure 3, the teeth 6₁ which extend along the length of the drum are sub-divided into tooth elements 6₃, each element 6₃ being separated from its neighbours by a groove 6₄.

- The drum is preferably manufactured from a single piece, the tooth elements 6₃ being obtained by first machining the teeth 6₁ by cutting in the longitudinal direction, and the grooves 6₄ being then formed by cutting out annular, transverse pieces.

- The axial end portions 6₅ of the drum 6 are mounted to rotate on the casing 4 by way of roller bearings 12. These axial end portions 6₅ together with the core of the drum are perforated by at least one channel 6₆ for the passage of a cooling liquid so that the apparatus may be used for grinding the scraps of plastics material delivered straight from an injection machine while still hot.

- This arrangement also improves the output of ground material obtainable.

- The knife 7 cooperating with the drum 6 is composed of independent blades 7₁ of rectangular cross-section which are arranged parallel to each other and to the axis X—X of the drum. These blades are fixed across the wall of the casing 4 so that their ends engage in the grooves 6₄ separating the tooth elements 6₃.

The plastics material is thus ground down by a shearing action between the tooth elements 6₃

and the blades 7₁, one of the dimensions of the ground particles corresponding to the distance between two consecutive teeth 6₃, which in most cases is small enough to enable the resulting particle to pass through the mesh 10 to be received in the vat 8 without having to be carried round the drum once more to be cut up again.

This arrangement thus improves the output of the grinding apparatus and production is even further improved by the fact that the distance between the wall 4₁ of the casing 4 and the periphery of the drum 6 progressively diminishes in the direction towards the blades 7₁ so that at the level of these blades 7₁ the wall 4₁ is at a tangent to the drum 6.

By this arrangement, the plastics material gripped by the teeth 6₁ cannot be pushed away from the pathway of the teeth since it is pressed against the knife 7 so that it is inevitably cut up by the shearing action of the tooth elements.

In spite of this increase in the output of the grinding apparatus, the apparatus may be driven with a less powerful electric motor since the line 6₂ defining the cutting edge of the teeth 6₁ is inclined to the axis X—X of the drum so that the grinding action on the plastics material along any one tooth is performed at successive instants in time along the tooth.

The driving power required for rotating the drum 6 in the course of grinding is therefore substantially less since the grinding work is distributed substantially uniformly over the surface of the drum.

The parallel blades 7₁ constituting the knife 7 are arranged so that their ends fit into the grooves 6₄ situated beyond the base of the teeth 6₁. This arrangement also increases the output of the grinding apparatus since grinding takes place along both sides of each blade 7₁ and to a depth equal to the height of the teeth 6₁.

The structural combination of drum 6 and knife 7 provides an important advantage due to the increase in the yield of ground plastics material and a reduction in the required driving power.

These two advantages combine to enable the drum 6 to be driven at a much lower speed of rotation than in existing grinding apparatus, thereby considerably reducing the noise of the grinder.

It will also be noted that the use of independent blades 7₁ to make up the knife 7 enables the life of the knives to be increased to the fourfold span by placing the two opposite edges of the two ends of each blade into the operative position in turn, and the longitudinal position of the blades can each time be adjusted independently of the other blades in order to be placed close up to the core of the drum 6 formed by the base of the grooves 6₄.

This possibility of putting the blades 7₁ into operation independently also enables any one of the blades to be replaced if necessary without requiring all the other blades to be replaced at the same time.

These blades 7₁, whose width is substantially equal to that of the grooves 6₄, are held in position

across the wall of the casing 4 by a member 12 having on its upper surface a comb-like structure comprising teeth 12₁ which are spaced apart to receive between every two successive teeth two blades 7₁ which are separated by a fastening device 13 (see Figures 4 and 5).

This fastening device 13 consists of two parts 13₁, 13₂ which are generally T-shaped in cross-section and joined together by a tightening screw 14.

The vertical arm of the T of these two pieces 13₁, 13₂ is wedge-shaped as indicated at 13₃, 13₄ so that by adjustment of the screw 14, the two blades bearing against the horizontal arms of the T tend to be pushed apart by the surfaces of the wedges 13₃ and 13₄ so that the two blades 7₁ are pressed against the teeth 12₁ of the comb-like structure of the support 12.

This arrangement ensures rapid and firm locking of a pair of blades 7₁ while accurately positioning the blades 7₁ in relation to the tooth elements 6₁ since the distance between the teeth 12₁ is equal to the distance between three consecutive tooth elements of the drum 6.

Situated under the blades 7₁ of the knife 7 and at the level of the grinding zone is a supporting plate 16 (see Figure 6) attached to the member 12. This plate 16 also has a comb-like structure comprising teeth 16₁ spaced apart at a distance corresponding to the width of a blade 7₁.

The plate 16 serves to maintain the blades 7₁ at the level of the grinding zone and prevents particles of plastics material from entering the space between the teeth 12₁ of the member 12.

100 CLAIMS

1. A grinder for plastics material, comprising a drum provided with teeth and mounted to rotate in a chamber against a fixed knife wherein each tooth is delimited in the longitudinal direction of the drum, by a respective line inclined to the axis of the drum, while in the transverse direction of the drum each tooth has grooves dividing the tooth into a plurality of tooth elements, the knife comprising a plurality of parallel blades arranged in the grooves separating the tooth elements.

2. A grinder according to claim 1, wherein the thickness of the blades is substantially equal to the width of the grooves.

3. A grinder according to claim 1 or claim 2, wherein the drum is manufactured in one piece.

4. A grinder according to any preceding claim, wherein the blades are fixed by fastening devices situated between the blades.

5. A grinder according to claim 4, wherein each fastening device comprises two pieces in the form of wedges connected by a screw to fasten them together and lock the blades.

6. A grinder according to claim 4 or claim 5, wherein the fastening devices are arranged in a comb-like structure, each space between two teeth of the comb receiving two blades of the knife separated by a fastening device.

7. A grinder according to claim 5, wherein the

two parts of the fastening device are T-shaped in section with the vertical arm constituting the wedges of the two parts, this vertical arm being enclosed by two blades supported on each side by the horizontal arm of this T.

- 5 8. A grinder according to any preceding claim, wherein the chamber has an internal wall which, in a direction towards the blades of the knife, is progressively closer to the drum.
- 10 9. A grinder according to any preceding claim, wherein the blades of the knife bear against a supporting bar having a comb-like structure with teeth spaced apart at intervals substantially equal to the width of a blade of the knife.

- 15 10. A grinder for plastics material comprising a drum having generally radially directed teeth and mounted to rotate in a chamber against a fixed knife, comprising an array of spaced parallel blades, wherein each tooth on the drum is divided into a plurality of tooth elements arranged to pass between the blades, and wherein each tooth is delimited by a line inclined to the axis of the drum.

- 20 11. A grinder according to claim 10 wherein each line is defined by helix centred on the axis of rotation of the drum.

- 25 12. A grinder for plastics material, constructed and arranged substantially as herein described and shown in the drawings.