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(54) DEVICE FOR DEALING WITH THE SCRAPS OF FOAMED THERMOPLASTIC SYNTHETIC RESINS

(71) We, NIHON REPRO MACHINE KOGYO KABUSHIKI KAISHA, of 49-2-2 Horikiri, Katsushika-ku, Tokyo-to, Japan, a Company organised under the Laws of Japan, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

The present invention relates to a device for dealing with scraps of foamed thermoplastic synthetic resins and odds and ends, chips and cut ends produced during the processing of plastics and synthetic resins with good efficiency and for producing good quality recycled pellets.

Nowadays, there arises a problem of pollution from scraps of the foamed thermoplastic synthetic resins.

Such foamed thermoplastic synthetic resins as styrol, polyethylene and polypropylene have been used widely in recent times as heat insulating materials, packaging materials and sound insulating materials. However, in the processing of foamed thermoplastic synthetic resins, a large quantity of the scraps are produced and a large space is necessary to stock the scraps until they can be disposed of. Large quantities of broken plastics from foamed synthetic resin products are produced when the product has been used and is thrown away.

There is at present no device for processing of foamed thermoplastic synthetic resins, that does not tend to produce pollution.

Foamed thermoplastic synthetic resins have many bubbles therein, have a low apparent specific gravity and have a large volume. Therefore, up to this time, scraps of the foamed thermoplastic synthetic resins or the odds and ends produced during the processing of synthetic resins could not be fed directly to an ordinary extruding machine. Accordingly, they were crushed by an ordinary crushing machine and conveyed to the hopper of an ordinary extruding machine. Accordingly, the noises generated from said ordinary crushing machine cause a nuisance to people nearby and it becomes necessary to install another conveying system and apparatus. Further, with light weight foamed synthetic resins which have a low apparent specific gravity, it is necessary in order to obtain uniform reproduced materials to extrude under pressure by means of hydromechanics or by a screw for compression in the hopper of said ordinal extruding machine. Therefore, the cost of the equipment is increased and the efficiency of dealing with the odds and ends of synthetic resins was low.

Further, when scraps of foamed thermoplastic synthetic resins are extruded, it is necessary to melt the scraps of the foamed thermoplastic synthetic resins and remove bubbles therefrom. The melted and foam-free scraps of the foamed thermoplastic synthetic resins have to be fed uniformly to the screw for extruding. However, there are no extruding machines which are capable of carrying out all these melting, foam removing and uniform feeding functions.

The present invention provides a device capable of efficiently recovering a wide variety of excess or used materials or scraps including those of polyethylene, containers and bottles, films, and others with relatively light nominal specific gravity without the need for crushing them. It is ideally suited for reducing a large volume of raw materials to pellets.

In view of the above described defects in the description of the prior art, one object of the present invention is to provide a compact device for dealing directly with scraps of the foamed thermoplastic synthetic resins and chips and off cuts produced during the processing of plastics and

synthetic resins with a compact mechanism and with high efficiency. Another object of the present invention is to provide a device for dealing directly with various volumes of said scraps, said chips and said off-cuts without producing powders or excessive noise which would be caused by a separate crushing operation. A further object of the present invention is to provide a device for producing on a continuous basis recycled pellets of the thermoplastics synthetic resins, of improved quality.

According to the present invention a device for processing fragments of thermoplastic synthetic resins or plastics incorporates a feeding chamber defined by an arcuate front wall and a rear wall, the lower end of which is arcuate, a feeding inlet positioned at the upper portion of said feeding chamber, a shaft mounted for rotation about a horizontal axis on the centreline of a cylinder defined by the said arcuate portions of said front and rear walls, a cutting blade fixed above the shaft to the edge of the front wall facing the inlet, a plurality of spaced apart bladed wheels mounted on the rotatable shaft for rotation therewith and a plurality of stationary blades located one between each pair of adjacent bladed wheels the stationary blades extending rearwardly from the shaft to the bottom edges of the rear wall.

A melting chamber is preferably fixed below the feeding chamber and has an outlet at its lower end and an extruding cylinder having an inlet communicating with the outlet from the furnace is positioned below the melting chamber. The melting chamber is preferably V-shaped. A plurality of vertical fins are located on the inner walls of the melting chamber the depth of each fin increasing as it extends down the melting chamber, the outlet being located below the fins.

The upper inner wall surface of the extruding cylinder is preferably located on the same surface as the outlet from the melting chamber, which is formed by the lower edges of the fins.

In a preferred form of the invention a device for processing fragments of thermoplastic synthetic resins or plastics comprises a feeding chamber defined by an arcuate front wall and a rear wall, the lower end of which is arcuate, a feeding inlet positioned at the upper portion of said feeding chamber, a shaft mounted for rotation about a horizontal axis on the centre line of a cylinder defined by the said arcuate portions of said front and rear walls, a cutting blade fixed above the shaft to the edge of the front wall facing the inlet, a plurality of spaced apart bladed wheels mounted on the rotary shaft for rotation therewith, a plurality of stationary blades located one between each pair of adjacent blade wheels, the stationary blades extending rearwardly from the shaft to the bottom edge of the rear wall, a V-shaped melting chamber or furnace fixed below the feeding chamber, a plurality of vertical fins being located on the inner walls of the V-shaped furnace the depth of each fin increasing as it extends down the furnace and having an outlet below the fins and an extruding cylinder including an extruding screw mounted below the outlet from the melting furnace the upper inner wall surface thereof being located on the same surface as the outlet from the furnace which is formed by the lower edges of the fins.

The blades of the bladed wheels preferably are curved in the opposite direction to the stationary stopping blades and the blades of the bladed wheels are preferably curved in the opposite direction to the direction of rotation of the blade wheels.

A recirculation prevention plate preferably is located along the centre of the melting furnace between the fins.

In a modification of the invention a movable plate is mounted above the edge of the cutting blade so that the lower edge of the movable plate can swing past the cutting blade but is biased into a position in which it is adjacent the cutting blade and is prevented from swinging into the inlet.

The invention may be put into practice in various ways and a number of specific embodiments will be described to illustrate the invention and some conventional embodiments of devices for dealing with scraps of foamed thermoplastic synthetic resins and the chips and off-cuts of plastics and synthetic resins will be described for comparison purposes with reference to the accompanying drawings in which Figure 1 is a longitudinal sectional view from one side of a conventional device,

Figure 2 is a cross sectional view thereof from one end,

Figure 3 is a longitudinal sectional view from one side of another form of conventional device,

Figure 4 is a cross sectional plan view thereof taken along the line IV-IV of Figure 3,

Figure 5 is a cross sectional view from one end of the embodiment of Figure 3 taken along the line V-V of Figure 3 and denotes the melting state of the scraps of the foamed thermoplastic synthetic resins,

Figure 6 is a cross sectional view from one and of a first embodiment of a device according to the present invention, for dealing with scraps of foamed thermoplastic synthetic resins.

Figure 7 is a longitudinal part sectional front view from one side of the embodiment shown in Figure 6,

Figure 8 is a longitudinal sectional view from one side showing portions of the cylinder and the screw of the device shown in Figure 7 but on an enlarged scale,

Figure 9 is a cross sectional view on the line IX-IX of Figure 10 from one end of a second embodiment of the present invention, and

Figure 10 is a longitudinal part sectional view of the device shown in Figure 9 taken along the line X-X of Figure 9.

The present invention will be explained in detail according to the accompanying Figures which show two preferred embodiments of the present invention in Figures 6, 7 and 8 and Figures 9 and 10, in comparison with Figures 1 to 3 and 4 and 5 which show ordinary machines for dealing with scraps of plastics and the synthetic resins. Figures 1 and 2, show an extruding machine having a cylinder 2 with an extruding screw 1 located therein and a melting furnace 4 mounted on the upper portion of the cylinder 2. The melting furnace 4 has a V shaped cross section and a heater 3 on the outside surfaces thereof. When varying volumes of foamed thermoplastic synthetic resins are fed into the melting furnace 4, the melting operation cannot be carried out uniformly. The melted raw materials thus cannot be fed uniformly to the screw 1 and the reduced materials are not uniform and equal in quality.

The efficiency of the extrusion increases when the scraps of the foamed thermoplastics fed to the melting furnace 4 are pressed into the cylinder. However, when this is done the pressure concentrates in the lower portion of the melting furnace 4, and the scraps in contact with the sides of the melting furnace 4 are melted, and the friction between the melted scraps and the inner surface of the melting furnace 4 becomes very low. As a result, the molten polymer from these scraps goes upwards in the opposite direction to the processing along the inside surfaces of the melting furnace 4 as indicated by the arrows in Figure 2 and do not flow down to the cylinder smoothly. Therefore, in the ordinary extruding machine, smooth extrusion cannot be expected. In an attempt to remove these defects, the melting furnace was provided with a plurality of fins 5. These project vertically parallel to each other from the inner surfaces of the melting furnace and were spaced apart along the furnace. In this melting furnace, as shown in Figure 4, the scraps of plastics before being melted are held away from the inner side surfaces of the melting furnace 4 by a distance by the plurality of fins 5. Therefore, the scraps do not reach the inner side surfaces of the melting furnace 4. As shown in Figure 1 and Figure 2, in a melting furnace without fins, the scraps are directly in contact with the inner surface of the melting furnace. However, in a melting furnace which has fins, the scraps do not come into direct contact with the inner surface of the melting furnace and passage of the molten polymer upwards along the inner surface of the melting furnace is avoided. However, as shown in Figure 3, the lower edges of the plurality of fins do not extend down to the level of the upper inner surface of the wall of the extrusion cylinder and there is a space C between the lower edge of the fins 5 and the upper inside surface of the extrusion cylinder. The half melted fed raw materials of the scraps A have a tendency to migrate through the space C between the lower edges of the fins and the blades of the extruding screw in the cylinder in the direction of extrusion as shown by the arrows rather than enter the extrusion cylinder 2 from the edge portion 2*a* of the cylinder 2 as shown in Figure 3. Thus they go back into the melting furnace counter to the extruding direction, and pile up therein. This is a great defect of this known form of extruding machine. This hinders smooth feeding of the molten polymer derived from the scraps, the extrusion efficiency is reduced rapidly and the gases in the melted raw materials A extruded by the screw 1 cannot be vented. This is another defect of this known form of extruding machine. Moreover the height H of the fin 5, that is to say, the horizontal length of the fin, was the same at any position in the melting furnace. However, the melting furnace is V-shaped and the pressure of the fed scraps concentrates on the lower portions of the fins 5. The scraps in the lower portion of the melting furnace 4 are much more melted than those in the upper portion of the melting furnace 4 and as shown in Figure 5, the melted raw materials of the scraps of plastics at the low portion of the melting furnace 4 are directly in contact with the inside surfaces of the melting furnace 4. This is another defect of this form of known extruding machine.

Figures 6 and 7 show the first embodiment of the present invention. A feeding inlet 7 is mounted at the upper portion of a feeding chamber 6 to feed in scraps of foamed thermoplastic synthetic resins and chips and off-cuts produced during the processing of synthetic resins and plastics. The feeding chamber 6 is defined by an arcuate front wall 9 enclosing a front chamber 8, the lower end of the wall 9 being spaced further from the centre of the chamber 6, which is defined by a horizontal shaft 12, than is the upper end of the wall 9. The feeding chamber 6 is also defined by a rear wall 11 enclosing a rear chamber. The lower end of the wall 11 is provided with

a part arcuate portion 11A which extends into an upper portion 11B which extends rearwardly and upwardly. The rotary shaft 12 is equipped with a plurality of bladed wheels 13. Each bladed wheel has three blades and a ring shaped spacer 14 is located between one bladed wheel and the next bladed wheel. The blades of the bladed wheels 13, are curved in the opposite direction to the direction of rotation of the bladed wheels 13. The rotary shaft 12 carrying the plurality of bladed wheels 13, is mounted so as to be able to rotate within the circular zone defined by the curved front wall 9 and the curved portion 11A of the rear wall 11. A curved stationary blade or stopper 15 having the shape of a comma-shaped bead encloses each of the spacers 14. The other end of the curved stopper 15 is made in the form of a flange 15A and this flange is fixed to the rear wall 11*c* of the device below the curved portion 11A of the rear wall 11.

The front wall 9 extends downwardly and outwardly in a lower front wall 9B ending in an outwardly extending flange 9C. The rear wall 11C of the device extends downwardly and outwardly from the curved position 11A and also ends in an outwardly extending flange 11D.

A final reduction gear 16 is connected to one end of the rotary shaft 12, the said reduction gear 16 being connected to a torque motor 17 to rotary shaft 12 can then be made to rotate at a rate corresponding to the load applied to the said wheel blades 13, in the chamber 6.

A horizontal cutting blade 18 is fixed to the upper end of the front wall 9 above the shaft 12 positioned so that the cutting edge of the said cutting blade 18 is above the centre of the feeding chamber 6 and the rotary shaft 12.

A V-shaped melting furnace 4 is fixed beneath the feeding chamber 6 the melting furnace 4 having inclined side walls converging to the centre line thereof. The furnace 4 is connected to chamber 6 by means of a connecting chamber 20. A cylinder 2 for an extruding machine is fixed horizontally in the longitudinal direction of the melting furnace 4. The cylinder 2 of the extruding machine is equipped with a screw shaft and an extending screw 1 located therein. The melting furnace 4 has a plurality of fins 5, mounted on the inner wall thereof. The width H' at a lower portion of the fin 5 becomes greater than the width H of the fin 5 at an upper portion of the fin 5. The lower end of the plurality of the fins 5 is formed in a single body, the under edge surface 5*a* (see Figure 6) of which is formed with the same shape as that of the inner surface of the cylinder 2, so that the space between the under edge surface of the body forming the lower end of the fins and the blade edge of the screw 1 is of the same size as the space between the inner surface of the cylinder 2 and the blade edge of the screw 1 as shown in Figure 6.

A flow prevention plate 21 which traverses the fins 5, extends horizontally along the length of the melting furnace 4. This flow prevention plate 21 prevents the half melted raw materials of the scraps of foamed plastics from flowing down into the cylinder 2. A plurality of heaters 22 for heating and melting the scraps of the foamed thermoplastic synthetic resins are located in the side walls of the melting furnace 4. If the distance between adjacent fins is too great, the fed raw materials A of the scraps of the foamed synthetic resins can come into direct contact with the inner surface of the melting furnace 4. They can then fall downwards along the inner surface thereof and rise upwards, in the opposite direction to the main body of material being processed, through the centre portion of the furnace just as occurs in an ordinary melting furnace. If the distance between adjacent fins is too narrow, it becomes difficult for the raw material scraps to flow down the furnace.

The extruding screw 1, as explained in detail in Figure 8, is formed with a taper such that the core diameter of the extruding screw decreases gradually from a broad diameter at the starting point of the extending screw beneath one end of the melting furnace for one fifth of the length of the melting furnace to a narrow diameter, then has the same diameter from there to the end of the melting furnace, then increases to the broad diameter again to form a compressing portion 23 for compressing the melted raw materials after which an opening portion 24 is formed as a defoaming zone where the screw 1 is stepped down directly to the narrow diameter, and then increases again in a taper to the broad diameter to form a further compressing portion 25. A vent 26 is formed in the upper portion of the cylinder 2 corresponding to the opening portion 24 of the screw 1. The cylinder 2 has a nozzle 27 fixed to its tip.

The inlet end of the screw 1 is connected to a motor 30 by means of a belt pulley 28 and a belt 29 as shown in Figure 7. In Figure 7, the numeral 31 denotes a heater mounted on the outer surface of the cylinder 2 and the numeral 32 denotes a panel box which shows the operating state of the device. The heater 31 is mounted around the outer surface of the cylinder 2.

On preferred mode of use will be described for the first embodiment of the present invention described above. Scraps of the foamed thermoplastic synthetic resins

or chips and off-cuts produced during the processing of plastics or synthetic resins are fed as raw materials for the process into the feeding inlet 7 and the wheel blades 13 move them in the direction of the arrow 7A by the rotation of the rotary shaft 12 driven by the torque motor 17. The stationary stopping blades 15, it will be observed, are curved in the opposite direction to the direction of rotation of the bladed wheels 13, so that the angle between the stationary stopping blades 15 and the bladed wheels 13 is always more than 90 degrees. The raw materials A which are fed into the feeding chamber 6 are thus easily separated from the bladed wheels 13, by the stationary stopping blades 15, and are prevented from returning to the feed inlet 7, and are pressed down into the melting furnace 4 and compressed therein.

When the liquid molten plastics or synthetic resins produced from the fed raw materials A fills the opening of the cylinder 2 of the extruding machine, and the scraps of the foamed thermoplastic synthetic resins and the chips and off-cuts of plastics of the fed raw materials fill the melting furnace 4, the load applied to the screw 1 in the cylinder 2 will exceed the capability of the screw 1, and the pressure by the scraps and the chips and off-cuts of plastics of the fed raw materials A will come to the limit, and the speed or rotation of the rotary shaft 12 will be reduced or stopped by means of the action of the torque motor 17. The feed into the feeding chamber 6 is then regulated, the pressure in the melting furnace 4 will be maintained at a constant level and the device of the present invention will operate in a stable state, the amount of material being extruded being kept constant. The fed raw materials A pressed into the melting furnace 4 are always kept apart from the inner surface of the melting furnace 4 by a constant space by means of said plurality of the fins 5, they are heated by the heaters 22 through said plurality of fins 5, and melt gradually. The melted raw materials A flow between the inner surface of the melting furnace 4 and the fins 5 and flow into the cylinder 2.

Due to the shape of the fins 5 the temperature at the inside edge or tip of each fin 5 in contact with the fed raw materials A becomes lower towards the bottom of the fin 5 and the fed raw materials A do not touch directly the inner surface of the melting furnace 4 and the flow of molten material along the inner surface thereof to the cylinder 2 is not prevented. The flow prevention plate 21 also assists in smooth melting of the fed raw materials A. The flow prevention plate 21 which is mounted across fins 5, in the centre of the melting furnace 4 prevents the fed raw materials A which are not melted or are in only a half melted state from moving down into the cylinder 2. Also the fact that the lower edge of the fins 5 is made to form an arc of the same diameter as that of the inner surface of the upper portion of the cylinder 2 assists in smooth extrusion of the molten material. Thus there is avoided such troubles as occur in ordinary extruding machines which have a small space between the lower edges of the plurality of fins 5 and the cylinder 2. In these arrangements half melted raw materials in the melting furnace 4 can move in the direction of the extrusion through this small space between the lower edges of the plurality of fins 5, and the blades of the screw 1 due to the action caused by the viscosity of the melted fed raw materials A according to the extrusion of the melted fed raw materials A by the screw 1 and flow in the opposite direction and pile up at the extruding side end of the melting furnace 4. This can interfere with the evenness of the extrusion.

The effects of the plurality of fins according to the present invention are as follows:

The heat is transmitted to the scraps of foamed thermoplastic synthetic resins or the chips and off-cuts of plastics in the furnace 4 through the plurality of fins from the heaters 22 mounted on the outer surface of the melting surface 4 and the melting of the scraps of foamed thermoplastic synthetic resins or the chips and off-cuts of plastics is accelerated. The fins assist in the even melting of the materials and in ensuring that the molten material can flow evenly down to the extruding screw of the extruder. If there are no fins, there will be a clearance between the lower edge of the fin and the upper inner surface of the cylinder, and the melt is liable to gather in the direction of extrusion.

When the scraps or the chips and cut ends of plastics are solid they will not tend to adhere to the inner surface of the melting furnace 4, and therefore, it is easy for the scraps or the chips and cut ends of plastics to flow down along the inner surface of the melting furnace 4 where they melt by the heat from the heaters 22. (see Figure 6).

The reason why the width of the fin is made wider at the downward portion thereof is that as the shape of the melting furnace 4 is like that of the letter V, the pressure of the melt of the scraps or the chips and cut ends of plastics in the melting furnace 4 becomes higher at the downward portion thereof. Accordingly, if the width of the fin does not become wider at the lower portion thereof, the scraps or the chips and cut ends of plastics are liable to adhere to the inner surface of the melting furnace 4, and there is insufficient clearance between the inner surface of the melting

furnace 4 and the scraps or the chips and cut ends of plastics, and this may interfere with the ready flow of the melt down to the opening of the extruder.

Also, if there are no fins the molten material is liable to be pressed upwards along the inner surface of the melting furnace 4 by the pressure of the still solid material which is being fed in from the inlet of the device (see Figure 2).

Further, if there are no fins, the scraps or the chips and cut ends of plastics fed into the melting furnace go upwards counter to the feed direction along the inner surface of the V-shaped melting furnace 4. This phenomenon arises because of the fact that the scraps or the chips and the cut ends of plastics are in contact with the inner surface of the V-shaped melting furnace melt and have a tendency to slide.

As the downward tip of the fin is formed so as to be on the same surface 5*a* as that of the inner surface of the cylinder of the extruder, the melt of the scraps or the chips and cut ends of plastics flows down with equal quantity and equal distribution independently to the method of extrusion which is used. (see Figure 6 in comparison with Figure 3).

Complete melting of the molten materials that flow down into the cylinder 2 from the melting furnace 4 is ensured by the mixing produced by the rotation of the screw 1, and the molten materials are moved in the direction of the nozzle 27. When they reach the opening portion 24 the pressure is suddenly reduced under the vent 26 and any gas included therein is vented through the vent 26. The degassed melted fed raw materials A are compressed again, any foams thus been collapsed, and are extruded from the nozzle 27 as wires. Vapours which arise during the processing are vented through the vent 26. The melted fed raw materials A which were extruded from the nozzle 27 are cooled in a water tank (not shown) then are cut into pellets, each of which has the length appropriate to a next processing stage, by a tip cutter (not shown) and become recycled raw materials.

A second embodiment of the present invention is shown in Figure 9 and in Figure 10. This incorporates a movable plate 34 at the inlet 7. The movable plate 34 is mounted at its upper end on a horizontal rotatable shaft 33 and has a forwardly extending arm 35 which is connected by a coil spring to a projection 36 which extends forward from the feeding chamber 6. The lower end 34A of the plate 34 is positioned above the cutting portion of the blade 18 and a stop member 38 is positioned below the arm 35 so as to prevent the plate 34 swinging rearwards into the feeding inlet 7. The remaining parts of the second embodiment of the present invention are the same as those of the first embodiment and the same numerals are used to denote these parts. The operation of the movable plate 34 will now be described. Scraps of the foamed thermoplastic synthetic resins are fed into the feeding chamber 6 and are cut by the cutting blade 18. Material positioned above the cutting blade 18 and forced against the plate 34 by the force of the rotation of the blades 13 may make the movable plate 34 swing outwardly. Material below the blades 18 is thus not repelled back into the inlet 7 but can move in the direction of rotation of the blade wheels 13 and thus be cut completely. The scraps or the chips and cut ends of plastics that made the movable plate 34 move outwards, are made to return to the feeding inlet 7 by the counterclockwise direction force caused by the coil spring 37 and are cut by the next blade 13, and are thus fed into the feeding chamber 6. The material cut by the cutting blade 18 and the plurality of bladed wheels 13 is prevented from returning to the inlet 7 by the stationary stopping blades 15, and thus falls into the melting furnace 4, is compressed therein, melts gradually due to the heat provided by the heaters 22, flows down between fins 5 into the cylinder 2 of the extruding machine, is mixed during the passage to the nozzle in the direction of extrusion thereof, any foams therein being collapsed and is etxruded from the nozzle 27 as filaments. Vapours produced during the processing are vented through the vent 26.

This arrangement reduces any tendency for the fed raw materials A to remain stuck on the cutting blade 18 and helps ensure that all the fed raw materials A are fed into the melting furnace 4.

The recycled synthetic resin that is extruded as filaments is first cooled and then cut into pellets for use as recycled raw materials. When impurities exist in the recycled synthetic resin, it is cut into the standard length of the chips at the outlet of the nozzle 27 whilst hot.

The movable plate 34 is mounted above the cutting blade 18 so as to make it easy to generate cracks between the scraps or the chips and cut ends of plastics in the feeding chamber 6 during the passage thereof in the direction of rotation of the wheel blades 13. Even if the movable plate 34 is not mounted, cutting can be readily accomplished.

Since the scraps, chips and cut ends are cut by the cutting blade 18, and are compressed by the wheel blades 13, and are fed into the feeding chamber 6 it is not necessary to cut the scraps or the chips and cut ends of plastics before they are fed into

the feeding inlet 7 and this avoids the noise and dust hazards that a separate cutting step could produce. Also since the melting furnace 4 is V-shaped the scraps or the chips and cut ends of plastics are compressed and melted and the molten material is fed to the cylinder 2 of the extruding machine evenly and an even amount of recycled synthetic resin is extruded from the nozzle 27.

Thus it is not necessary to have another extruding device, constant feeding pressure of the melt of the fed raw materials is always sustained, the melted raw materials are fed into the cylinder constantly, and uniform and good quality recycled materials can be produced continuously by a simple operation.

WHAT WE CLAIM IS:—

1. A device for processing fragments of thermoplastic synthetic resins or plastics which incorporates a feeding chamber defined by an arcuate front wall and a rear wall, the lower end of which is arcuate, a feeding inlet positioned at the upper portion of said feeding chamber, a shaft mounted for rotation about a horizontal axis on the centre line of a cylinder defined by the said arcuate portions of said front and rear walls, a cutting blade fixed, above the shaft, to the edge of the front wall facing the inlet, a plurality of spaced apart bladed wheels mounted on the rotatable shaft for rotation therewith, and a plurality of stationary blades located one between each pair of adjacent bladed wheels the stationary blades extending rearwardly from the shaft to the bottom edge of the rear wall.

2. A device as claimed in Claim 1 in which a melting chamber is fixed below the feeding chamber and has an outlet at its lower end and an extruding cylinder having an inlet communicating with the outlet from the furnace is positioned below the melting chamber.

3. A device as claimed in Claim 2 in which the melting chamber is V-shaped.

4. A device as claimed in Claim 2 or Claim 3 in which a plurality of vertical fins are located on the inner walls of the melting chamber the depth of each fin increasing as it extends down the melting chamber the outlet being located below the fins.

5. A device as claimed in any one of Claims 2 to 4 in which the upper inner wall surface of the extruding cylinder is located on the same surface as the outlet from the melting chamber, which is formed by the lower edges of the fins.

6. A device for processing fragments of thermoplastic synthetic resins or plastics comprising a feeding chamber defined by an arcuate front wall and a rear wall, the lower end of which is arcuate, a feeding inlet positioned at the upper portion of said feeding chamber, a shaft mounted for rotation about a horizontal axis on the centre line of a cylinder defined by the said arcuate portions of said front and rear walls, a cutting blade fixed above the shaft to the edge of the front wall facing the inlet, a plurality of spaced apart bladed wheels mounted on the rotatable shaft for rotation therewith, a plurality of stationary blades located one between each pair of adjacent bladed wheels, the stationary blades extending rearwardly from the shaft to the bottom edge of the rear wall, a V-shaped melting chamber or furnace fixed below the feeding chamber, a plurality of vertical fins being located on the inner walls of the V-shaped furnace the depth of each fin increasing as it extends down the furnace and having an outlet below the fins and an extruding cylinder including an extruding screw mounted below the outlet from the melting furnace, the upper inner wall surface thereof being located on the same surface as the outlet from the furnace which is formed by the lower edges of the fins.

7. A device as claimed in any one of Claims 1 to 6 in which the blades of the bladed wheels are curved in the opposite direction to the stationary stopping blades.

8. A device as claimed in Claim 7 in which the blades of the bladed wheels are curved in the opposite direction to the direction of rotation of the bladed wheels.

9. A device as claimed in any one of Claims 1 to 8 in which a recirculation prevention plate is located along the centre of the melting furnace between the fins.

10. A device as claimed in any one of Claims 1 to 9 wherein a movable plate is mounted above the edge of the cutting blade so that the lower edge of the movable plate can swing past the cutting blade but is biassed into a position in which it is adjacent the cutting blade and is prevented from swinging into the inlet.

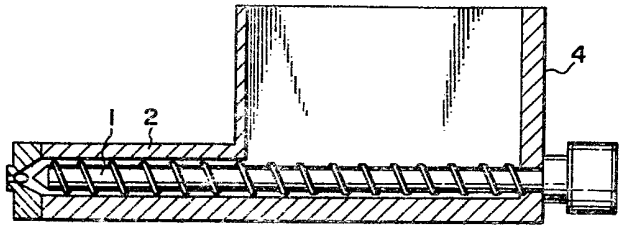
11. A device as claimed in Claim 1 substantially as specifically described herein with reference to Figures 6, 7 and 8 or Figures 9 and 10 of the accompanying drawings.

12. A device as claimed in Claim 6 substantially as specifically described herein with reference to Figures 6, 7 and 8, or Figures 9 and 10 or Figures 6, 7, 8, 9 and 10 of the accompanying drawings.

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Agents for the Applicants.

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FIG. 1



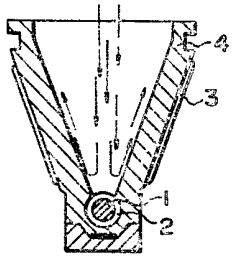


FIG. 2

FIG. 3

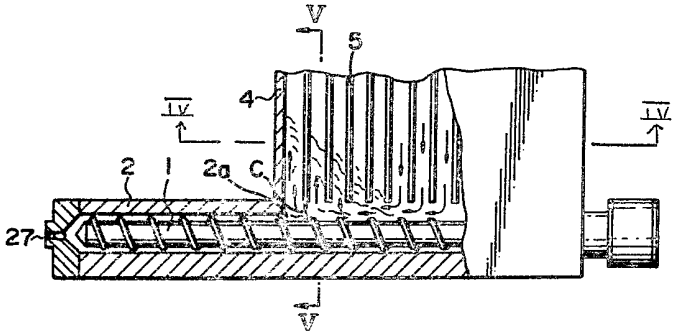


FIG. 6

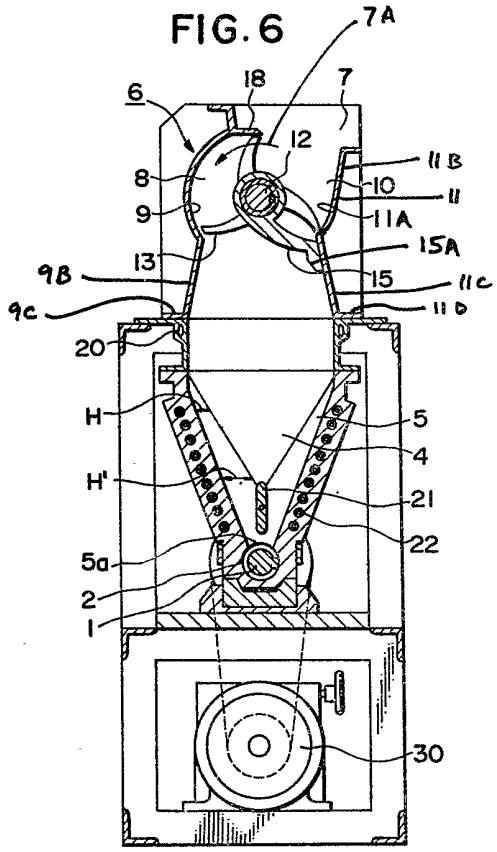

7A
18
7
6
12
11B
8
10
11
9
11A
15A
13
15
9B
11C
9C
11D
20
H
5
4
H'
21
22
5a
2
1
30

FIG. 7

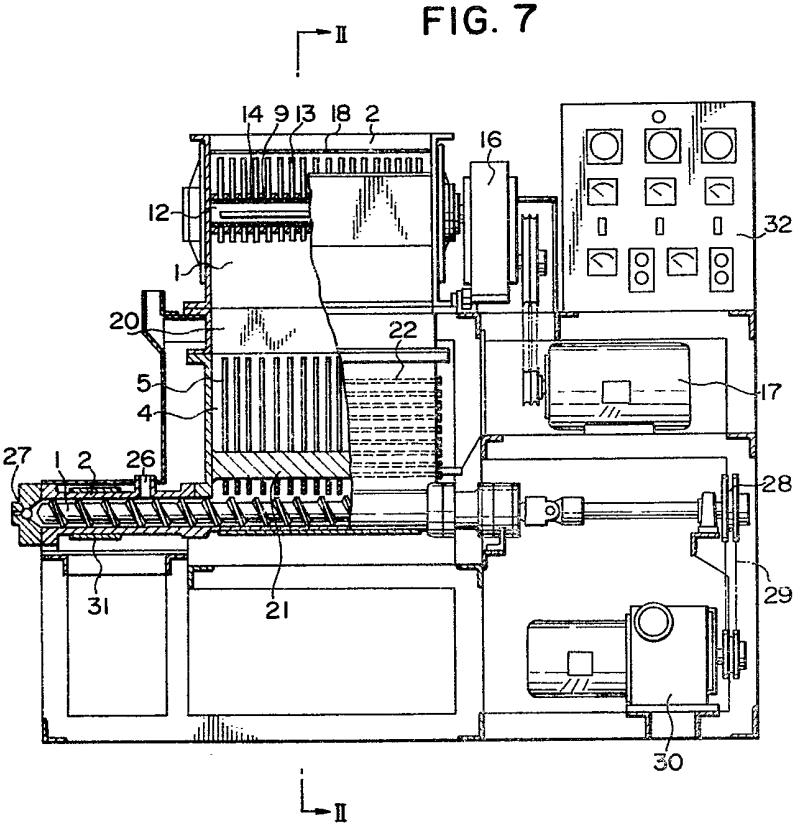


FIG. 8

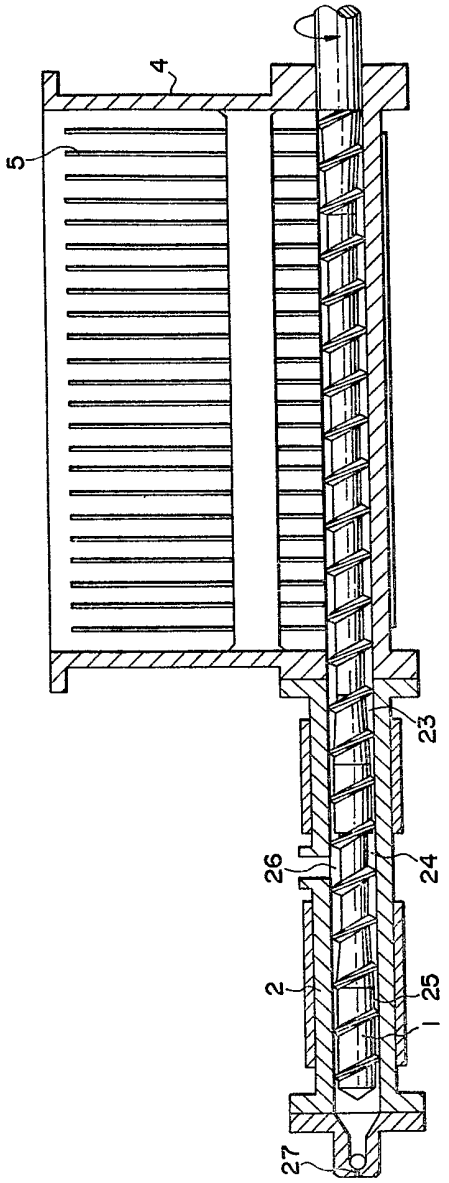


FIG. 4

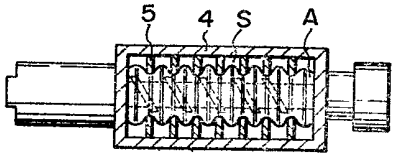


FIG. 5

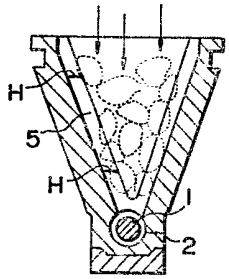


FIG. 9

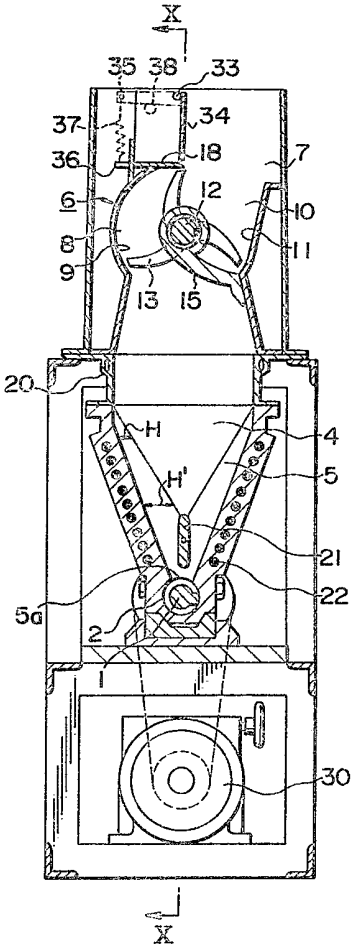


FIG. 10

