(12) UK Patent Application (19) GB (11) 2 124 964 A

(21) Application No **8219046**
(22) Date of filing **1 Jul 1982**
(43) Application published **29 Feb 1984**
(51) **INT CL³ B29B 1/02**
(52) Domestic classification **B5A** 1G12 1G4X 2A1 2A2 2B1 T17C **U1S** 1452 B5A
(56) Documents cited **B5A**
(58) Field of search **GB 1549569 GB 1514160 GB 1445863 GB 1382701 GB 1152781 GB 1100841 GB 1098496 GB 1049232 GB 849935 GB 835097**

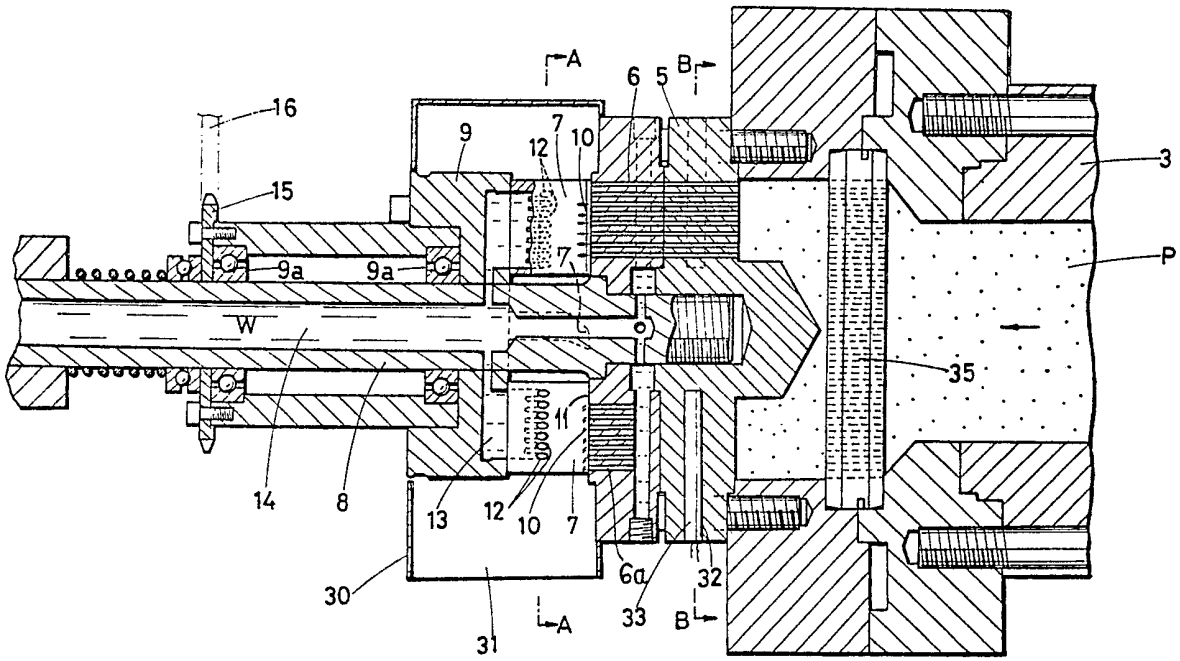
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(54) A resin pellet producing machine

(57) A resin pellet producing machine includes a die (5) having a face (11) through which extrusion apertures (6) open. Cutters (7) carried by a rotary carrier (9) slidably cooperate with the face (11), and cut into pellets, the streams of resin extruded through the apertures (6). The extruded resin is cooled and solidified by water jets emenating from nozzle openings (12) in the cutters (7), and which are directed towards the cutting ends (10) of the blades. The cooling water used for the jets is preheated by using it to cool the extruder barrel (3).

Cooling water may also issue from die passages (6*a*, and die heaters (33) may be provided.

FIG 2



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FIG 1

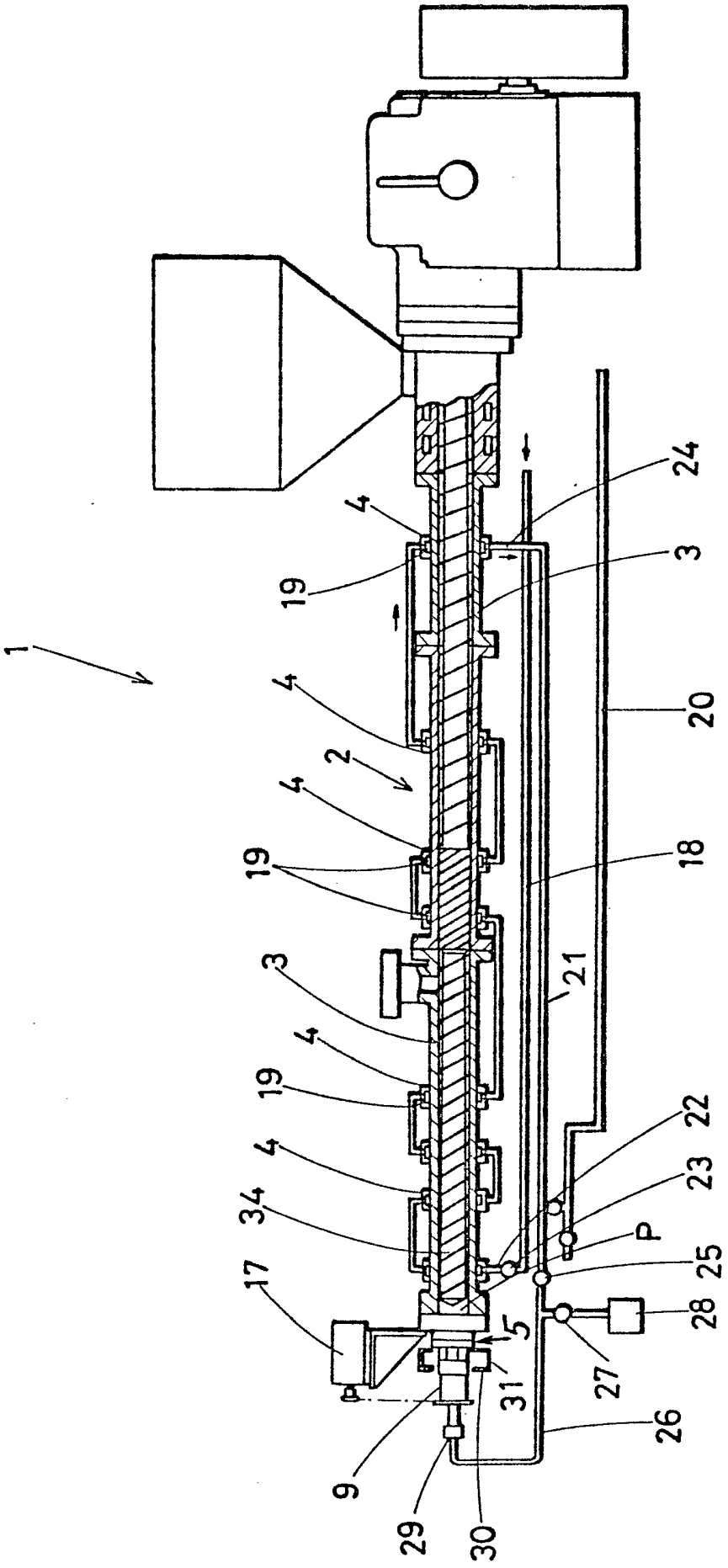


FIG 2

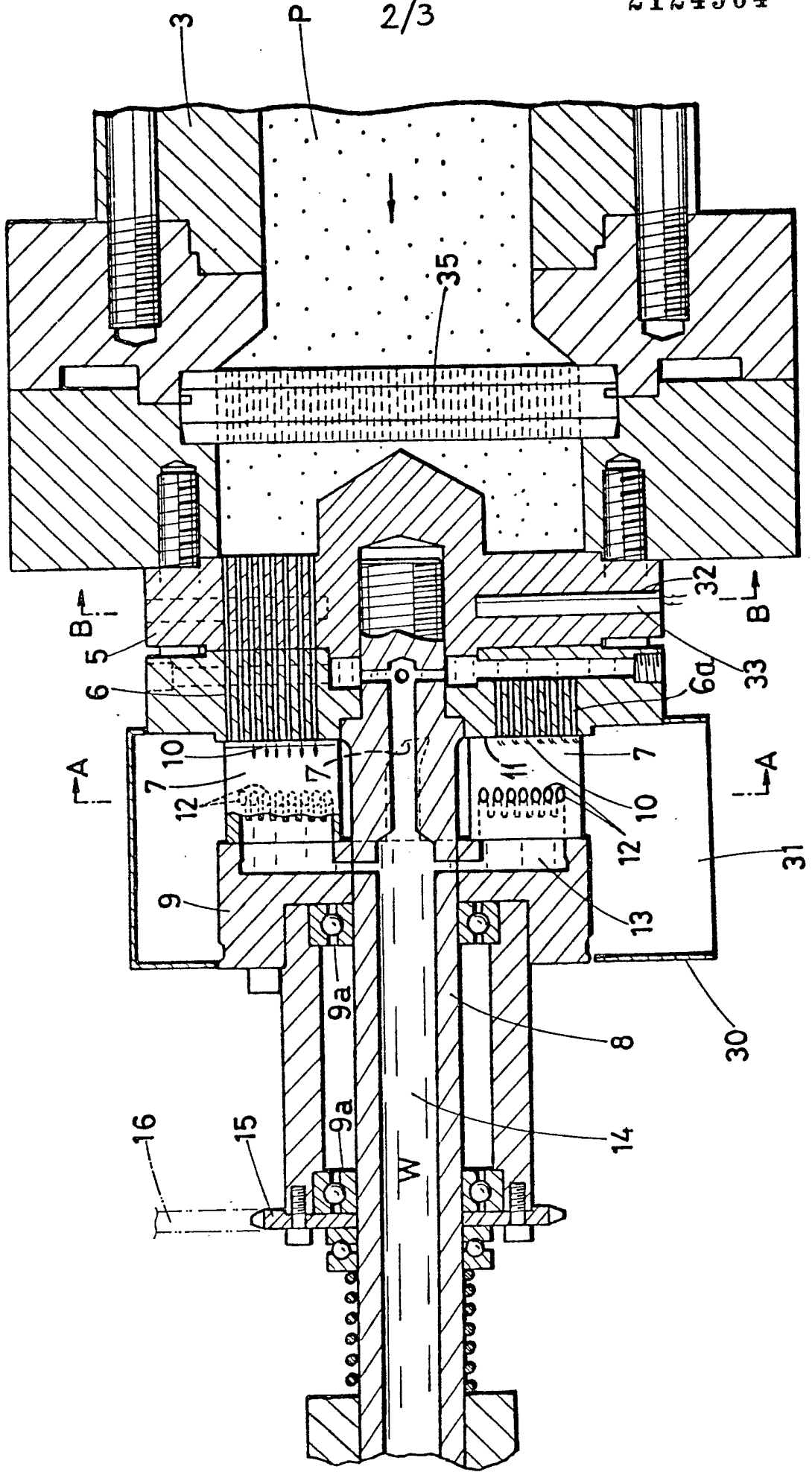


FIG 3

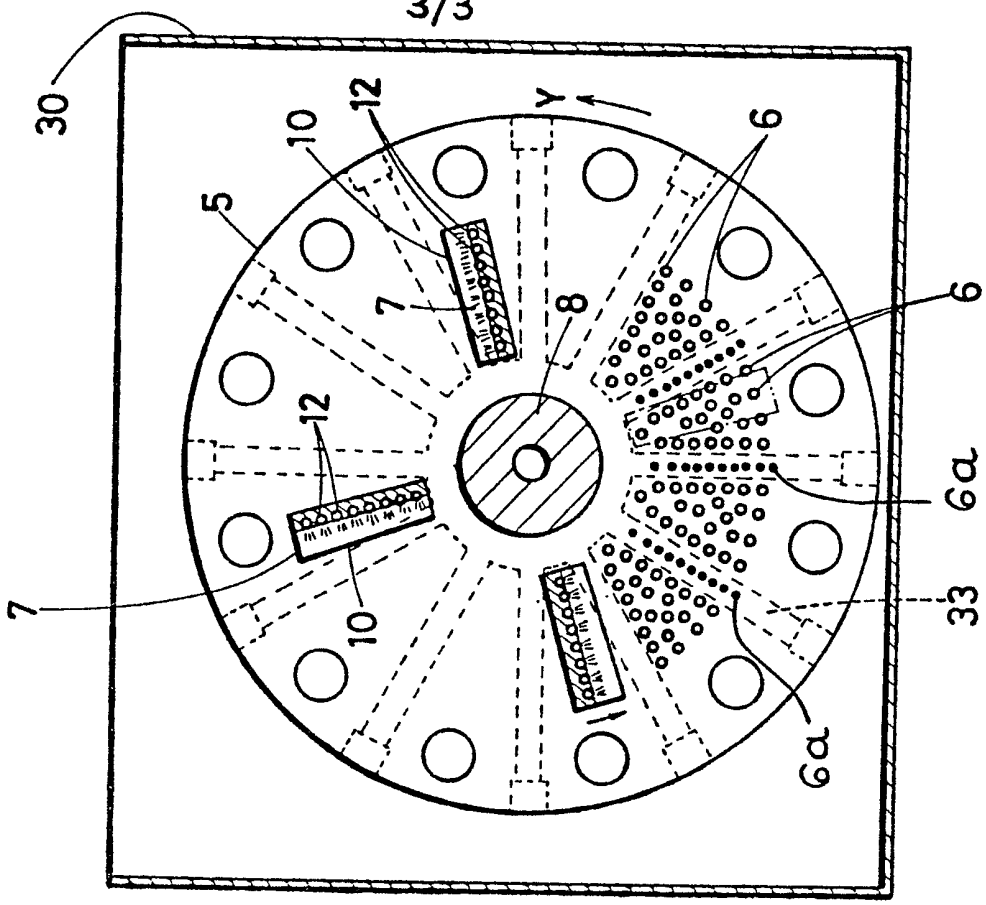
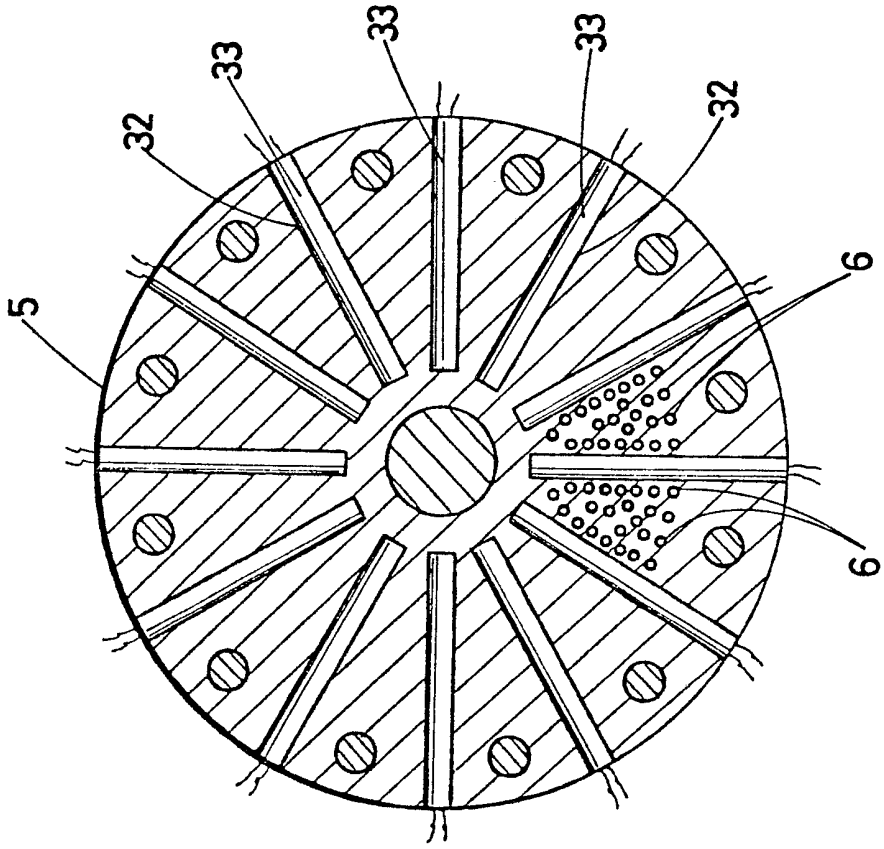


FIG 4



SPECIFICATION

A resin pellet producing machine

The present invention relates to a machine for producing resin pellets.

In most convention resin pellet producing machines for cutting a length of resin material extruded in a linear shape from a die of an extruder, the resin material is continuously extruded into a cooling water tank so as to be cooled and hardened, wherafter the extrusion is cut into pieces.

However, the above-mentioned type of machine has the disadvantage that the cooling water tank must be elongated in form, since a length of resin material extruded in a linear line must be passed through a tank. As a result, it is necessary to provide a significant area for accommodating the machine, and furthermore, the cost of providing or equipping a cooling water tank is prohibitively expensive.

Furthermore, inasmuch as a length of linear resin material is continuously forced out from a die, it is apt to be cut midway along its length, and in this case it is difficult to set the die again in its original position.

In order to mitigate the foregoing disadvantages of the conventional type of machine there has been proposed an underwater cutting technique in which a water chamber is provided externally of a die of an extruding means, whereby a length of resin material extruded from the die is cut in the water by means of a cutting means provided in the water chamber.

However, according to this latter underwater cutting technique, the water chamber always has to have heated cooling water passing therethrough so that a considerable quantity of water is consumed, with the additional disadvantage that a high cost is involved in heating the water and keeping the heated water at an elevated temperature.

Accordingly, it is an object of the present invention to mitigate or substantially eliminate the above-mentioned drawbacks and disadvantages.

The resin pellet producing machine embodying the invention is adapted to cool and harden a length of resin material once it has been extruded from a mold hole, and simultaneously or immediately cut the length of resin material into pieces or pellets, thereby eliminating the requirement for a cooling water tank. As a result the machine is capable of being reduced in size, and may occupy a smaller area, in comparison with a conventional type of machine.

The resin pellet producing machine embodying the invention is so constructed that cooling water is forcibly passed through cutter means and discharged in the form of a jet from cutter nozzle toward and foremost or cutting end or edge of a cutting blade. Thus, this foremost end is not only protected from being burnt, thereby considerably increasing the life of the cutter means, but is also prevented from being adhered to by resin material with the result that resin cutting can be carried out effectively over a period of time.

The resin pellet producing machine embodying the invention, in comparison with underwater resin cutting means employing a cutter chamber, consumes only a small quantity of cooling water, discharged in the form of jets, thus effecting a considerable saving in consumption of water.

The resin pellet producing machine embodying the invention employs cooling water jetted or sprayed through a cutter nozzle arrangement toward the foremost or cutting end or edge of a cutting blade. The cooling water is required to be at a temperature above the ambient temperature of cold water, and pre-heating of the water is achieved by utilizing heat derived from the barrel of the extruder. Thus, it is unnecessary to provide special additional means for heating a quantity of cold water, and the water for cooling the barrel is used as effectively as possible.

The machine embodying the invention includes heater means buried within the die provided with the mold holes through which the resin to be pelletised is continuously extruded. Since the die is always being cooled by cooling water when in operation, the heater means prevents the die from being cooled to an excessively low temperature, and maintains it at a suitable temperature. As a result, a quantity of resin material is smoothly fed through the die, and a fixed or constant size of resin pellets can be effectively produced.

In order that the invention may be more readily understood, one embodiment thereof will now be decribed with reference to the accompanying drawings, in which:-

Figure 1 is a partially sectioned longitudinal elevation of an entire resin pellet producing machine;

Figure 2 is a sectioned longitudinal elevation, on an enlarged scale, of the die portion of the machine shown in Figure 1;

Figure 3 is a transverse sectional elevation on the line A-A in Figure 2; and

Figure 4 is a transverse sectional elevation on the line B-B in Figure 2.

In the accompanying drawings, numeral 1 designates, generally, resin pellet producing machine, basically comprising an extruder 2, and a barrel 3 having heater means comprising heaters 4 disposed circumferentially thereabout and spaced therealong. The barrel 3 is provided, at its foremost edge or downstream end, with a die 5 having centrally thereof a plurality of mold passageways or holes 6 through which a quantity of molten resin material P is extruded in linear or rod-like form. The mold holes 6 are gradually tapered down in diameter towards their outlet or downstream ends.

As shown in Figures 2 and 3, cutter means comprising cutters 7 are rigidly fixed at suitably mutually circumferentially spaced intervals on the outer face of an axial end of a rotary stand or carrier 9. The carrier 9 is rotatably supported by bearings 9*a* from the outer periphery of a fixed or rotary shaft 8 rigidly mounted from, and centrally of, said die 5, the carrier 9 being rotatable, by means of a torque motor 17 via a chain 16 passing around a sprocket 15, in the direction of arrow Y in Figure 3. The foremost or cutting ends or edges 10 of said cutters 7 are disposed in slidably contactable relation with the

outer surface area 11 of said die 5 into which the exit or downstream ends of the mold holes 6 open. In each of said cutters 7 are formed a plurality of nozzle holes 12 which communicate with an axial cooling water passageway 14 in the shaft 8 through passageways 13 in the shaft 8.

A water feed passageway 18, shown in Figure 1, is adapted to feed cooling water W into a cooling channel or groove 19 provided within each heater 4. In particular, the water feed passageway 18 is connected through a valve 23 to an inlet 22 of the cooling groove 19 of the leftmost heater 4 as viewed in Figure 1, the grooves 19 being interconnected in series as shown. The cooling groove 19 of the right-most heater 4 is connected via an outlet 24 to a pipe 21 through which heated cooling water flows from the heaters. Some of this heated water is drained from the system via a valve and drain pipe 20, whilst at least some of this water passes through a valve 25 to a water pressure passageway 26. The water pressure passageway 26 is also connected through a valve 27 to an air compressor 28, and an outlet 29 of said passageway 26 is connected to the cooling water passageway 14 of the shaft 8 of said rotary carriage 9 and thus to the nozzle holes 12.

Numeral 20 denotes a cover or shroud for preventing resin pellets from scattering randomly in any direction. The cover 30 is mounted on the outer periphery of the die 5 around the cutters 7, and is provided with an outlet 31 for draining resin pellets and water from the lower portion of the cover 30.

The die 5 is bored radially with a plurality of holes 32 in which heater means comprising respective sheathed heaters 33 are buried. The heaters 33 prevent the die 5 from being cooled down by the cooling water W to an extent such that the quantity of resin material flowing along the mold holes 6 towards the outlets thereof is prevented from solidifying in, and blocking, these holes. The heaters 33 are controllable by adjusting the electrical supply thereto.

The right-hand end of the water passageway 14 in the shaft 8 as viewed in Figure 2 opens into radial passages in the die 5, aligned with the holes 32 as viewed in Figure 3, and communicating with rows of nozzles or apertures 6*a* disposed between the groups of mold holes 6.

Incidentally, 34 is an extruder screw, and 35 is a strand or grid mounted at the extruding or downstream end of the barrel 3.

In operation of the above-described resin pellet producing means 1, each of said valves 23, 25 and 27 is opened to allow the cooling water W to pass through the cooling grooves 19 of the heaters 4, thereby cooling the barrel 3 and maintaining the latter at a suitable temperature. In consequence the cooling water W is heated up as it cools said barrel 3, and this pre-heated cooling water is discharged through the pipe 21 to the water pressure passageway 26, then forced along the passageways 14 and 13, and then discharged in the form of jets or sprays from the nozzles 12 of each cutter 7, towards and/or against the foremost or cutting ends or edges 10 of the cutters, as the carrier 9, and therefore the cutters, rotate. Thereafter the jets of cooling water W impinge on the lengths of linear or rod-like resin material extruded from the mold holes 6 of the die 5 to cool down a quantity of molten resin material until the latter is sufficiently hard to be cut into pieces. Simultaneously jets or streams of water emenate from the holes 6*a* in the die.

A quantity of resin material that is forcibly pushed through the strand 35 from the outlet of the barrel 3 and through the mold holes 6 is cut into pieces in the form of pellets by means of the cutters 7. These pellets drop, together with water, from the outlet 31 of the cover 30 without the pellets being struck to each other.

Although the cooling water W jetted or blown out of the nozzle holes 12 of the cutters 7 must be at a high temperature, the resin pellet producing machine 1 emboding the invention is adapted to make use of the hot water that is heated during cooling of the barrel 3, so that no special or additional heating means is necessary.

Moreover, the cooling water W is always fed to the foremost end of the cutters 7 and is blown against a quantity of resin material extruded from the mold holes 6 of the die 5, so that a conspicuously small quantity of water is used, compared with most of the conventional underwater cutting machines which are constructed to cut the resin material by always circulating a large quantity of water within the cutter chamber.

Further, with the machine embodying the invention, it is clearly apparent that the resin pellets do not adhere to each other, nor do they adhere to the foremost ends 10 of the cutters.

CLAIMS

1. A resin pellet producing, machine comprising a die, located at an outlet of an extruder barrel, having mold holes for forming a generally linear length of resin material, cutter means mounted on an outer surface area of the die and operable to cut into pieces said resin material extruded from the mold holes in the die, and nozzle means through which, in operation, cooling water is directed or blown towards or against the foremost or cutting end of said cutter means.

2. A machine according to claim 1, including heater means for heating the die in the region of the mold holes, to at least partially compensate for the cooling effect of the cooling water.

3. A machine according to claim 2, wherein the heating means is buried within the die, and includes sheathed heaters located in passages extending generally radially of, and spaced around, the longitudinal axis of the die, and disposed between groups of said mold holes.

4. A machine according to claim 1, 2 or 3, wherein, in operation, the cooling water blown against the foremost end of said cutter means is hot water that has been heated by heat transfer cooperation with said barrel.

5. A machine according to any preceding claim, wherein the cutter means comprises a plurality of cutters, mounted on a rotary carrier, and slidably cooperate with an end face of the die through which

the outlets of the mold holes open.

6. A machine according to claim 5, wherein the nozzle means comprise nozzle apertures in each cutter.

7. A machine according to any preceding claim, wherein, in operation the cooling water is forced out of the nozzle means by compressed air.

8. A resin pellet producing machine substantially as hereinbefore described with reference to the accompanying drawings.

Printed for Her Majesty's Stationery Office, by Croydon Printing Company Limited, Croydon, Surrey, 1984.
Published by The Patent Office, 25 Southampton Buildings, London, WC2A 1AY, from which copies may be obtained.