PATENT DRAWING

FIG. 1

FIG. 2

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ROTATING TOOLS AND GRINDERS MOUNTED ON REVOLVING TOOLHOLDER FOR CUTTING ARTIFICIAL FLAMENTS


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6 Claims. (Cl. 83—174)

This apparatus relates to an improved apparatus for cutting continuous filaments into short lengths.

Apparatus suitable for the production of staple fibre have been described in United States Patent No. 2,664,160. The original technique involved holding a continuous filamentary yarn in contact with a number of projections round the periphery of a wheel and cutting the yarn by means of a series of knife blades rotating about an axis at a rate synchronised with the rotation of the wheel so that the knives made contact with the yarn while it was bridging a space between projections. An improved version of the technique afforded periodic sharpening of the knife blades by means of abrasive stones. This arrangement is satisfactory at comparatively low speeds, but as the speed of the knife is increased, the impact velocity of the knife upon the stone is sufficient to make the stone rebound away from the knife and parts of the knife edge therefore do not make contact with the stone.

The primary object of the present invention is to provide a new apparatus in which continuous sharpening of the knives takes place and efficient operation at much increased speeds is thereby made possible. The apparatus consequently permits the production of staple fibre at correspondingly enhanced rates.

According to the present invention, apparatus for cutting continuous filaments into short lengths comprises a yarn wheel having equi-spaced projections round its circumference, means for holding filamentary yarn in position on the periphery of the yarn wheel, generally in the manner described in the aforesaid Patent No. 2,664,160, at least one rotatable circular knife blade and abrasive stones mounted to be maintained in continuous contact with said knife blade, the arrangement being such that, in operation, the rotating knife blade moves across the yarn wheel between a pair of said projections to sever the yarn. The arrangement is preferably such that in operation, the point of contact of the rotating knife blade with the yarn between the two projections moves, at a similar velocity, in the direction of movement of the yarn during the passage of the knife blade through said filamentary yarn.

A series of such continuously sharpened circular knife blades may be provided, mounted to operate successively, for example on a turntable whose movement is synchronised with that of the yarn wheel.

Each knife blade of a series is preferably arranged to rotate at a speed relative to the turntable such that successive cuts are made by different parts of the knife blade's circumference. It may be preferred to make the rotation of the knife blade an odd fraction i.e. 100% of the rotation of the turntable in order to assist even wear of the knife blade's circumference.

The abrasive stones may be stationary but they can be made rotatable, adapted to be driven either positively or merely by means of the friction between the knife blade and the surface of the stone. It is normal to provide a pair of rotatable stones for each knife blade so that the knife blade is located between the stones and the stones may be mounted either on a single spindle or on separate spindles. The spindles carrying rotatable knife blades or stones obviously should be mounted at relative inclinations required to achieve optimum cutting or sharpening as the case might be. According to one aspect of the present invention, we provide an apparatus for cutting continuous filaments into short lengths consisting of a yarn wheel having equi-spaced projections round its circumference, means for holding filamentary yarn in position round said wheel, a series of rotatable circular knife blades carried on a turntable and maintained in continuous contact with abrasive stones mounted on said turntable, the turntable and knife blades being so positioned that the cutting edges of the knife blades will fit into the spaces between the projections on the wheel, and means for rotating the yarn wheel and turntable at synchronised rates so that the knife blades will not come into contact with said projections. According to a further aspect of the invention, I provide a process for the production of staple fibre from continuous filamentary yarn by means of the aforementioned apparatus wherein a continuous filamentary yarn is held in contact with a number of projections on a moving wheel and are cut by a series of rotating circularly continuously sharpened knife blades, mounted on a rotating turntable, which make contact with the yarn only when it is bridging a space between two projections on the wheel, the point of contact moving, at a similar velocity, in the direction of movement of the yarn during the passage of the blade through the filamentary yarn. Operation of the process in the specified manner is achieved by tilting the knife blades at an appropriate angle to the turntable which is itself tilted relative to the yarn wheel.

One embodiment of the invention will now be described by way of example with reference to the accompanying drawings in which:

FIG. I diagrammatically shows a side elevation of an apparatus for cutting continuous filaments into short lengths, and

FIG. II diagrammatically shows a plan view of the apparatus of FIG. I.

In the drawings, a turntable 1, mounted on a spindle 2 carries a series of four circular knife blades 3 mounted on individual spindles. Two abrasive grindstones 6, 7 are associated with each knife blade 3, the grindstones being in contact with opposing edges of the knife blade 3 and arranged to provide continuous sharpening of the knife blade 3 in operation. The grindstones 6, 7 being rotatably mounted, are driven in operation by the friction between the knife blade 3 and the contacting surfaces of the grindstones.

A yarn wheel 5 with radial slots 4 is located adjacent to the turntable 1, the yarn wheel 5 and the turntable 1 being arranged to operate synchronously so that in operation the cutting edges of the knife blades 3 pass through the radial slots 4.

A filamentary yarn (not shown) is carried on the periphery of the yarn wheel 5 and is located by a series of prongs 9, in a position on the yarn wheel 5 in grooves 8 formed between the radial slots 4.

The spindles of the knife blades 3 are tilted at an angle so that when the yarn wheel 5 and the turntable 1 are rotated together, the point of contact of the cutting edge of a knife blade 3 with the yarn bridging a slot 4 moves, at a similar velocity, in the direction of movement of the yarn during the passage of the knife blade 3 through the filamentary yarn. The knife blades 3 are driven at a speed relative to that of the turntable such that each knife blade makes about a fifth of one turn for each complete revolution of the turntable, and this arrangement ensures that each cut is made by a different part of the blade, and each part of the blade is sharpened by passing between the grindstones 6, 7 before it makes another cut. The drive of the knife blade 3 is actually arranged so
that each makes 101 turns for 500 revolutions of the turntable, i.e. \( \frac{101}{500} \) of a turn for each complete revolution of the turntable, and in this way wear on each knife blade is substantially equalized over the whole cutting edge instead of occurring in five separate places.

This embodiment of the present invention can of course be provided with alternative detail arrangements of the apparatus.

It may be desired to cause the blades to rotate at a speed relative to the turntable other than approximately \( \frac{1}{5} \) of the turntable speed, for instance it might be in some cases an advantage to sharpen the edge more or less than once per cut.

The grindstones 6, 7 may be positively driven either by gearing or other form of drive, or they may be stationary instead of rotatable. If the grindstones are held stationary relative to the turntable, the angle of approach of the knife edge to the stone is zero, i.e. scratches formed on the edge of the blade by the action of the grindstone are parallel to the edge of the blade. This generally is not the best method of producing a sharp edge. The rotary motion of the stones, whether produced by a special drive, or by the friction of the knife blade on the surface of the stone, causes the scratches on the blade edge to be other than parallel to the blade edge, and this in general produces a sharper edge on the blade.

In the embodiment shown in the drawing the sharpening stones are shown mounted on separate spindles but it is possible to mount two stones on one spindle, such that the knife blade runs between the stones and in this case the spindles of the stones should preferably be mounted at an angle relative to the axis of the knife blade.

The embodiment described the turntable is provided with four circular knives mounted thereon. Any number of knives may be mounted on a turntable. For instance if two opposing knives of the four were removed, then the remaining two knives would enter alternate slots 4 in the yarn wheel 5 and the length of the cut pieces of yarn would be doubled. If three of the blades were removed then the length of the cut pieces would be increased four times. Other turntables can be designed with other yarn wheels, e.g. turntables with other numbers of knives of which any selection may be used at any one time.

The relative positions of the circular knives on the turntable can be maintained very accurately, such that each knife enters its appropriate slot in the yarn wheel in precisely the same position relative to the sides of the slot. Narrow slots may thus be used without any part of the blades making contact with the sides of the slots. One advantage thus gained is that the distance between slots, centre to centre, may also be reduced, thereby enabling shorter lengths of fibre to be cut.

The apparatus and process of our invention have been used for cutting synthetic filaments in general, and in particular for the production of staple fibres of polyesters, polyamides, and polyelefines.

What I claim is:

1. Apparatus for cutting continuous filaments into short lengths comprising: a yarn wheel having spaced apart radial projections on its circumference; means for rotating said yarn wheel; means for holding filamentary yarn in position on the periphery of said yarn wheel; a carrier disposed adjacent said yarn wheel and mounted for rotation in a plane different from the plane of rotation of said yarn wheel; means for rotating said carrier; a circular knife; means for mounting said knife on said carrier for rotation about an axis fixed with respect to said carrier, said means for mounting means positioning said knife to pass between adjacent projections on said yarn wheel in a direction normal to the plane of said wheel as said carrier is rotated and simultaneously to move the point of contact of the knife with a yarn on said yarn wheel in the direction of movement of said yarn wheel.

2. Apparatus as in claim 1 including a plurality of circular knife blades and wherein said carrier is a table disposed and rotatable in a plane normal to the plane of said yarn wheel, said mounting means for said knife blades disposing said blades near the periphery of said table in spaced apart relationship and in tilted positions relative to the surface of said table.

3. Apparatus as in claim 1 including at least one abrasive stone mounted on said carrier in continuous contact with said knife blade, said apparatus further including means for rotating said knife at a substantially lower rotational speed than said carrier.

4. Apparatus as in claim 1 including a plurality of circular knife blades and wherein said carrier is a table disposed and rotatable in a plane normal to the plane of said yarn wheel, said mounting means for said knife blades disposing said blades near the periphery of said table in spaced apart relationship and in tilted positions relative to the surface of said table, said apparatus further comprising at least one abrasive stone associated with each knife and mounted on said table in continuous contact with its respective knives, and means for rotating all said knives at a substantially lower rotational speed than said table.

5. Apparatus as in claim 4 in which a pair of abrasive stones is associated with each knife, one stone of each pair contacting one surface of the respective knife and the other stone of each pair contacting the other surface of the respective knife.

6. Apparatus as in claim 4 in which a pair of abrasive stones is associated with each knife, one stone of each pair contacting one surface of the respective knife and the other stone of each pair contacting the other surface of the respective knife, the stones of each pair being mounted on separate spindles.

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