Dec. 24, 1940. E. KINSELLA 2,226,130

MACHINE FOR CUTTING CONTINUOUS FILAMENTS INTO STAPLE FIBERS

Filed April 7, 1939 3 Sheets-Sheet 1

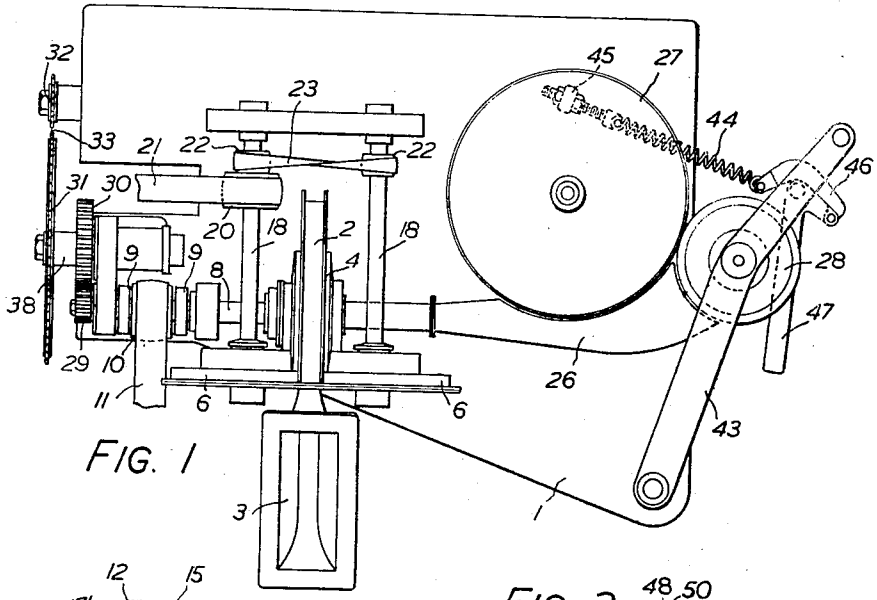


FIG. 1

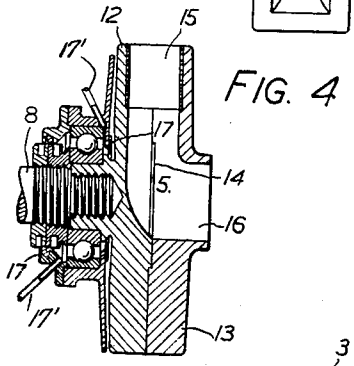


FIG. 4

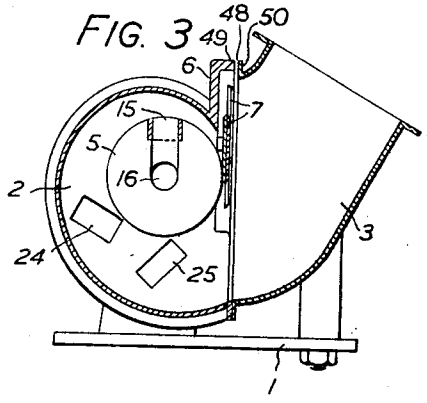


FIG. 3

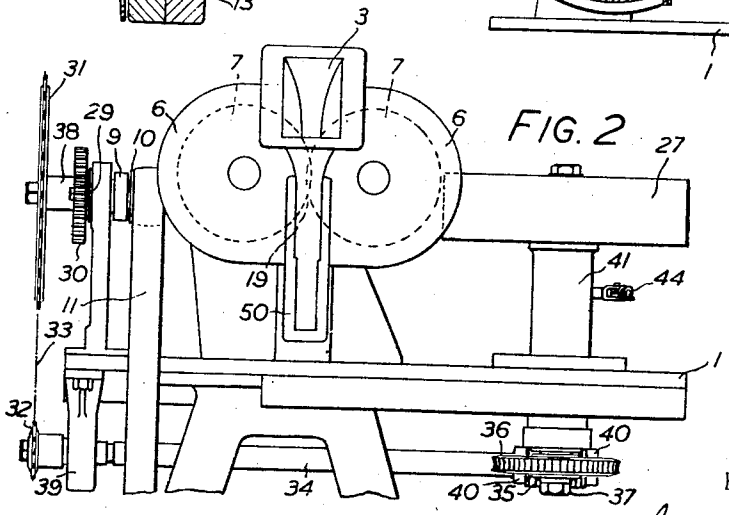


FIG. 2

E. KINSELLA
INVENTOR

J. Selby & A. Stevenson
ATTORNEYS

Dec. 24, 1940. E. KINSELLA 2,226,130

MACHINE FOR CUTTING CONTINUOUS FILAMENTS INTO STAPLE FIBERS

Filed April 7, 1939 3 Sheets-Sheet 2

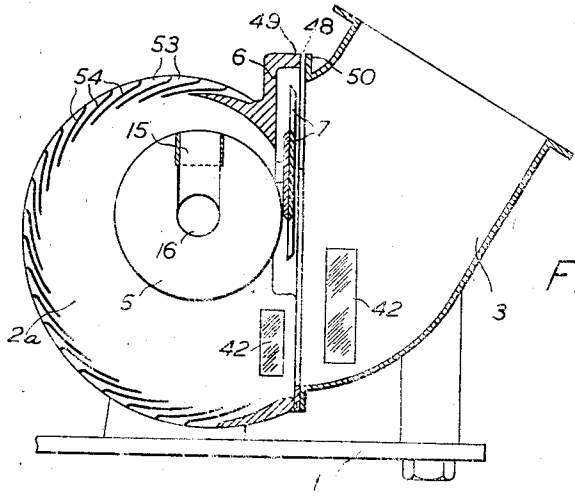


FIG. 5

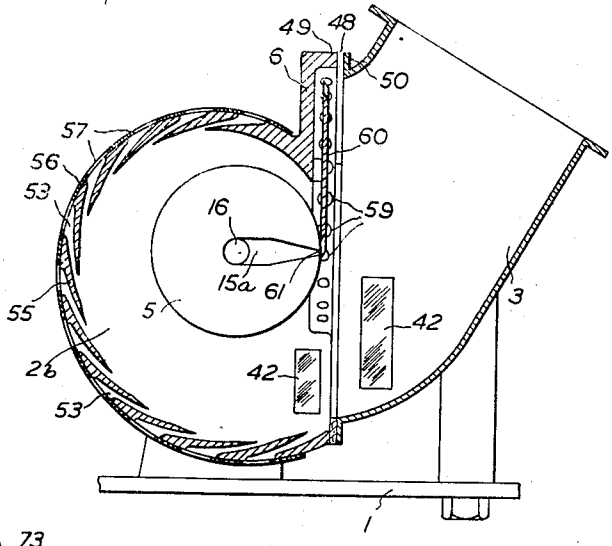


FIG. 6

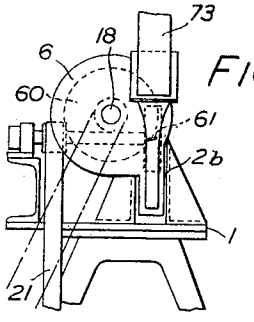


FIG. 7

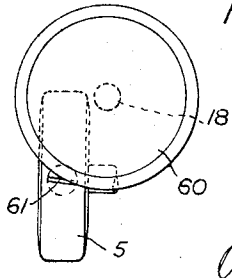


FIG. 8

E. KINSELLA
INVENTOR

J. Seltzer & A. Weinman
ATTORNEYS

Dec. 24, 1940. E. KINSELLA 2,226,130

MACHINE FOR CUTTING CONTINUOUS FILAMENTS INTO STAPLE FIBERS

Filed April 7, 1939 3 Sheets-Sheet 3

FIG. 9

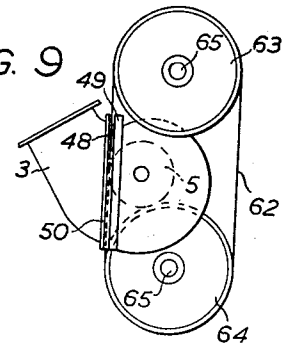


FIG. 10

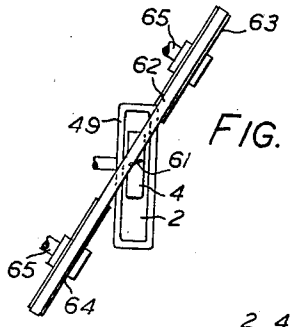


FIG. 11

E. KINSELLA
INVENTOR

ATTORNEYS

Patented Dec. 24, 1940 2,226,130

UNITED STATES PATENT OFFICE

2,226,130

MACHINE FOR CUTTING CONTINUOUS FILAMENTS INTO STAPLE FIBERS

Edward Kinsella, Spondon, near Derby, England, assignor to Celanese Corporation of America, a corporation of Delaware

Application April 7, 1939, Serial No. 266,671
In Great Britain April 20, 1938

18 Claims. (Cl. 164—17)

This invention relates to machines for cutting continuous filaments into staple fibers.

According to the invention, continuous filaments fed to the centre of a rotating member and delivered to the periphery of the member through a passage extending from the axis of the member to the periphery are carried on emergence from the member into an air stream moving in the direction of rotation of the member and at such a speed that the filaments stand erect from the member. By the rotation of the member the erect filaments are carried repeatedly into contact with a knife arranged with its edge near the point of emergence of the filaments, so that the filaments are severed into fibers of a length equal to the length of filaments fed through the member between successive cuts.

To provide the air flow the rotating member is surrounded by a spiral casing increasing progressively in the direction of rotation of the member from one side of the cutting point to the other and continuing from its widest point into a duct to which suction is applied. The suction causes air to pass through the rotary member into the casing, and the amount of suction is such that the rate of flow of air round the casing is of the same order as the peripheral speed of the rotary member. The spiral form of the casing ensures that the rate of air flow is maintained at substantially the same order round the whole of the casing. The flow may, however, be augmented by the provision of one or more openings in the casing through which secondary air is drawn by the suction. This secondary air serves to control the angle of the filament bundle leaving the rotary member and is most advantageously introduced into the casing at a point or points close to the cutting point under a degree of suction such that the air speed immediately before the cutting operation is at least approximately equal to and may be considerably greater than the peripheral speed of the rotary member.

When the filaments have been cut into fibers, it is important that they should all be drawn away from the moving parts of the mechanism, and for this purpose further air (tertiary) may be admitted to the cutter casing in a quantity sufficient to provide the necessary conveying power in the delivery duct.

Some forms of apparatus according to the invention will now be described in greater detail with reference to the accompanying drawings in which

Figs. 1, 2 and 3 are a plan view, a front elevation and a sectional side elevation, and Fig. 4 a detail in section, respectively, of one form of apparatus according to the invention;

Figs. 5 and 6 show two modifications of the apparatus shown in Fig. 1;

Figs. 7 and 8 are a front elevation and a detail, respectively, of a further form of apparatus according to the invention;

Figs. 9 and 10 are a side elevation and a front elevation, respectively, of a further form of apparatus; and

Fig. 11 is a view of an apparatus according to the invention showing the general arrangement and connections of the apparatus.

Referring to Figs. 1–3, the apparatus shown therein is carried on a base plate 1 and comprises a spiral casing 2 terminating in an outlet duct 3. An enlargement 4 is provided in said spiral casing for the accommodation of a rotary member shown at 5 in Figs. 3 and 4 and extensions 6 are provided on each side of the spiral casing for the accommodation of a pair of overlapping disc knives indicated at 7 in Fig. 2. The rotary member 5 is carried on the overhanging end of a shaft 8 mounted in bearings 9 between which is disposed a driving pulley 10 driven by a belt 11.

As shown in Fig. 4 the rotary member is built up of two halves 12 and 13, the half 12 being secured directly to the shaft 8, while the half 13 is secured to the first half 12. The dividing plane between the two halves 12, 13, is at right angles to the axis of the shaft 8 and for assembling purposes a spigot and socket connection 14 may be provided between the two halves. A radial passage 15 divided equally between the halves 12, 13, leads smoothly to an axial passage 16 in the half 13 remote from the shaft 8 so that the bundle of filaments may be led horizontally into the rotary member 5 to pass into the radial passage 15 and so to the periphery of the member 5. The spiral casing 2 surrounds the rotary member 5 as shown in Fig. 3 and, starting at about the same radius as that of the rotary member 5, it gradually increased in depth until after completely encircling the rotary member 5 it leads to the wide delivery passage 3. Sealing means 17 are provided as shown in Fig. 4 to prevent either air or lubricating oil circulated through the pipes 17' from entering the spiral casing 2 at the entry of the shaft 8.

Mounted on two horizontal shafts 18 at a height just above the shaft 8 are two disc knives 7 overlapping each other slightly and providing a nip at 19 at approximately the same level as

the shaft 8. At the point 19 the spiral casing has reached its largest radius. The disc knives 7 are plain on one face and bevelled on the other face to form a sharp edge, the two plain faces being pressed against each other. A driving pulley 20 driven by a belt 21 is provided on one of the shafts 18, and an additional pulley 22 is carried on each shaft, the pulleys 22 being connected by means of a cross belt 23 so as to carry the drive from one shaft to the other and to drive the shafts in opposite directions. In this way, at the nip 19 the cutting edges of both knives 7 are moving upwards, in substantially the same direction as the adjacent periphery of the rotary member 5.

Suction is applied to the delivery duct 3, as described hereafter, so that an air flow is set up round the spiral casing 2, the air being drawn through the passages 15, 16, in the rotary member at such a speed that the air flow round the casing 2 is approximately equal or preferably even greater than the peripheral speed of the rotary member 5. The constantly increasing radius of the casing 2 provides for a substantially uniform air speed round the casing. Immediately before the cutting point 19 the air speed is increased by the provision of two inlet holes 24, 25, shown in Fig. 3, provided on each side of the casing 2, the holes 24, 25, being so shaped and positioned that the incoming air moves substantially tangential to the rotary member so as to lift the emerging filaments clear of the member.

The bundle of filaments is fed to the axial passage 16 in the rotary member 5 by means of a duct 26 shown in Fig. 1 and a pair of feed rollers 27, 28. The roller 27 is a steel surfaced measuring roller and is driven from the shaft 8 by means of gears 29, 30, chain sprockets 31, 32, and a chain 33, a horizontal shaft 34 and a worm 35 and worm wheel 36 driving the shaft 37 on which the drum 27 is mounted. The gear 30 and sprocket 31 are mounted on an intermediate shaft 38 and the sprocket 32 is mounted on the shaft 34 which is carried in suitable bearings 39, 40. The shaft 37 is carried in a sleeve 41 mounted on the base plate 1. When it is desired to change the speed at which the filaments are fed, this may be effected by changing the sprockets 31, 32 at the end of the apparatus. The bundle of filaments is nipped against the measuring roller 27 by means of the rubber covered roller 28 carried in a swinging bracket 43 which is drawn towards the roller 27 by means of a spring 44 anchored at 45. The spring 44 is connected to the bracket 43 by means of a quick-release link 46 and lever 47 whereby the roller 28 may be released and thrown back from the roller 27 when desired. The duct 26, roller 28 and associated parts are omitted from Fig. 2 for greater clarity. Windows 42 are provided in the spiral casing 2 and in the duct 3 so that the progress of the cutting operation may be observed.

As the member 5 rotates there emerges from the radial passage 15 therein a length of filament bundle in accordance with the relative rates of rotation of the member 5 and the roller 27. The protruding length of the bundle is caused by the air current round the casing 2 to project substantially erect from the rotary member 5 and is thus carried cleanly into the nip 19 formed by the disc knives 7. The fibers formed by severing the end of the bundle are carried away from the vicinity of the knives 7 by further air admitted through a slot 48 formed between the flanges 49 of the casing 2 and the flanges 50 of the delivery duct 3. The whole apparatus is maintained under a suction of say 4 to 10 inches water gauge, which ensures the admission of the necessary proportions of primary, secondary, and tertiary air to give correct presentation of the filaments to the cutting point 19 and to carry away the cut fibers.

As is shown in Figs. 5 and 6 the inlet holes 24, 25 may be omitted and the secondary air may be admitted round the periphery of the casing by means of a series of slots 53. In Fig. 5 the slots 53 are formed between vanes 54 mounted all round the periphery of the casing 2*a*, the vanes 54 being pivotally mounted, e. g. on pivots extending parallel to the passage 16 from the inner edges of the vanes 54 into the flat side walls of the casing 2*a*, so that they may be opened or closed to any desired degree.

In Fig. 6 the slots 53 are formed between fixed members 55, and a sliding shutter 56 having slots 57 therein is provided outside the casing 2*b* by means of which the slots 53 may be closed to any desired extent. Fig. 6 shows in addition how the tertiary air admitted through the slot 48 may be augmented by the provision of a series of circular holes 59 round the edge of the extensions 6 of the knife casing. Furthermore, Fig. 6 indicates the employment of a single disc cutter 60, the general arrangement of which is shown more clearly in Figs. 7 and 8. From Fig. 7 it will be seen that there is only one extension 6, on one side of the spiral casing 2, for the accommodation of the single rotating disc 60 which is mounted on a shaft 18 as described with reference to Figs. 1–4. The single disc 60 contacts with the periphery of the rotating member 5 so as to sever the filaments emerging therefrom. As shown in Figs. 6, 7 and 8 the radial passage 15*a* may terminate in a slot 61 which is formed nearly tangential to the disc knife 60 so that the filaments emerge from the radial passage in the form of a band and are cut by the disc cutter 60 progressively across the width of the band.

Figs. 9 and 10 show diagrammatically the employment of a band knife in place of the disc knives shown in the preceding figures. As with the single disc knives, it is preferable to use a passage 15 terminating in an oblique slot 61. The band knife 62 is mounted on pulleys 63, 64 carried and driven by shafts 65. The band knife 62 enters the apparatus between the flange 49 of the spiral casing 2 and the flange 50 of the delivery duct 3 which is omitted from Fig. 10. That is to say, the band knife 62 enters and leaves the apparatus through the slot 48 provided for the admission of tertiary air.

Fig. 11 shows a general arrangement of the apparatus according to the invention. It will be seen that the base plate 1 is mounted on a standard 66 and that electric motors 67, 68 are provided for the driving of the shafts 8 and 18. Suitable tension arrangements 69, 70 are provided for tensioning the belt 21. The delivery duct 3 is connected by means of a pipe 71 to a suction head 72 maintained under suction by means of a suction pump, air ejector or the like. The pipe 71 is flattened at 73 so as to fit the flat section of the delivery duct 3.

Having described my invention, what I desire to secure by Letters Patent is:

1. Method of cutting continuous filaments into staple fibers, which comprises feeding a bundle of filaments along a path turning through an angle, constraining the part of said bundle be-

yond said angle to rotate about an axis coincident with the path of said bundle to said angle so as to forward said part by centrifugal force, carrying the leading end of said bundle into an air stream moving in the direction of rotation of said part of the bundle and at such a speed as to maintain said end substantially radial to said axis, and periodically cutting off said end at a fixed point to form a bundle of fibers, said cutting being effected by virtue of the lateral motion of the rotary part of said bundle, and being facilitated by the radial disposition of said end.

2. Method according to claim 1, which comprises supplying the air to the air stream partly along the same path as the filaments and partly at one or more fixed points disposed close to the path of the filaments shortly before they reach the point where they are cut.

3. Method according to claim 1, which comprises augmenting the air stream immediately after cutting so as to carry the cut fibers away from the point where they are cut.

4. Method according to claim 1, which comprises supplying the air to said air stream partly along the same path as the filament and partly at one or more fixed points disposed close to the path of the filaments shortly before they reach the point where they are cut and augmenting the air stream immediately after cutting so as to carry the cut fibers away from the point where they are cut.

5. Method according to claim 1, which comprises delivering the filaments at the point where they are cut in the form of a ribbon and cutting said ribbon progressively across its width.

6. Method according to claim 1, which comprises delivering the filaments at the point where they are cut in the form of a ribbon, cutting said ribbon progressively across its width, supplying the air to the air stream partly along the same path as the filaments and partly at one or more fixed points disposed close to the path of the filaments shortly before they reach the point where they are cut and augmenting the air stream immediately after cutting so as to carry the cut fibers away from the point where they are cut.

7. Apparatus for cutting continuous filaments into staple fibers, said apparatus comprising a rotatable member having a radial passage and an axial passage communicating with one another therein, a cutting device for severing the protruding ends of filaments as the end of said radial passage passes said cutting device, a spiral casing surrounding said rotary member and increasing in radial depth from a point immediately after said cutting device to a point immediately before said cutting device, and means for inducing a current of air through said axial and radial passages and through said spiral casing.

8. Apparatus according to claim 7, wherein the spiral casing is provided with openings for the entry of air immediately before the cutting device.

9. Apparatus according to claim 7, comprising a series of openings round the periphery of the spiral casing for the admission of air.

10. Apparatus according to claim 7, comprising a series of openings round the periphery of the spiral casing for the admission of air and additional openings for the entry of air immediately before the cutting device.

11. Apparatus according to claim 7, comprising as the periphery of the spiral casing a series of pivoted vanes between which openings are constituted for the admission of air, said vanes being adapted by pivoting to close said openings to any desired degree.

12. Apparatus according to claim 7, comprising a series of openings round the periphery of the spiral casing for the admission of air and a sliding shutter surrounding the periphery of the spiral casing and adapted to close said openings simultaneously to any desired degree.

13. Apparatus according to claim 7, comprising means for admitting additional air immediately after the cutting point to facilitate the removal of the cut fibers from the cutting point.

14. Apparatus according to claim 7, comprising as the periphery of the spiral casing a series of pivoted vanes between which openings are constituted for the admission of air, said vanes being adapted by pivoting to close said openings to any desired degree, additional openings for the entry of air immediately before the cutting device, and means for admitting still further air immediately after the cutting point to facilitate the removal of cut fibers from the cutting point.

15. Apparatus according to claim 7, comprising a series of openings round the periphery of the spiral casing for the admission of air, a sliding shutter surrounding the periphery of the spiral casing and adapted to close said openings simultaneously to any desired degree, additional openings for the entry of air immediately before the cutting device, and means for admitting still further air immediately after the cutting point to facilitate the removal of cut fibers from the cutting point.

16. Apparatus according to claim 7, comprising as the cutting device a pair of disc knives overlapping to form a cutting nip and means for rotating said knives in opposite directions.

17. Apparatus according to claim 7, comprising as the cutting device a single sharp edged disc and means for rotating said disc.

18. Apparatus according to claim 7, comprising a band knife constituting the cutting device.

EDWARD KINSELLA.