Jan. 1, 1957 K. H. ANTHONY 2,776,005

STAPLE CUTTER

Filed Nov. 17, 1953 2 Sheets-Sheet 1

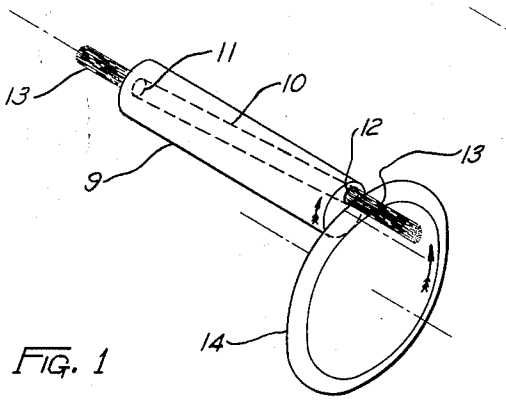


FIG. 1

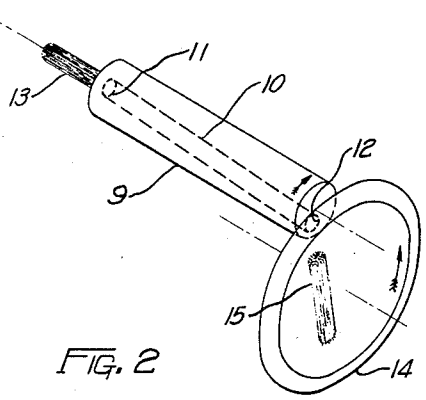


FIG. 2

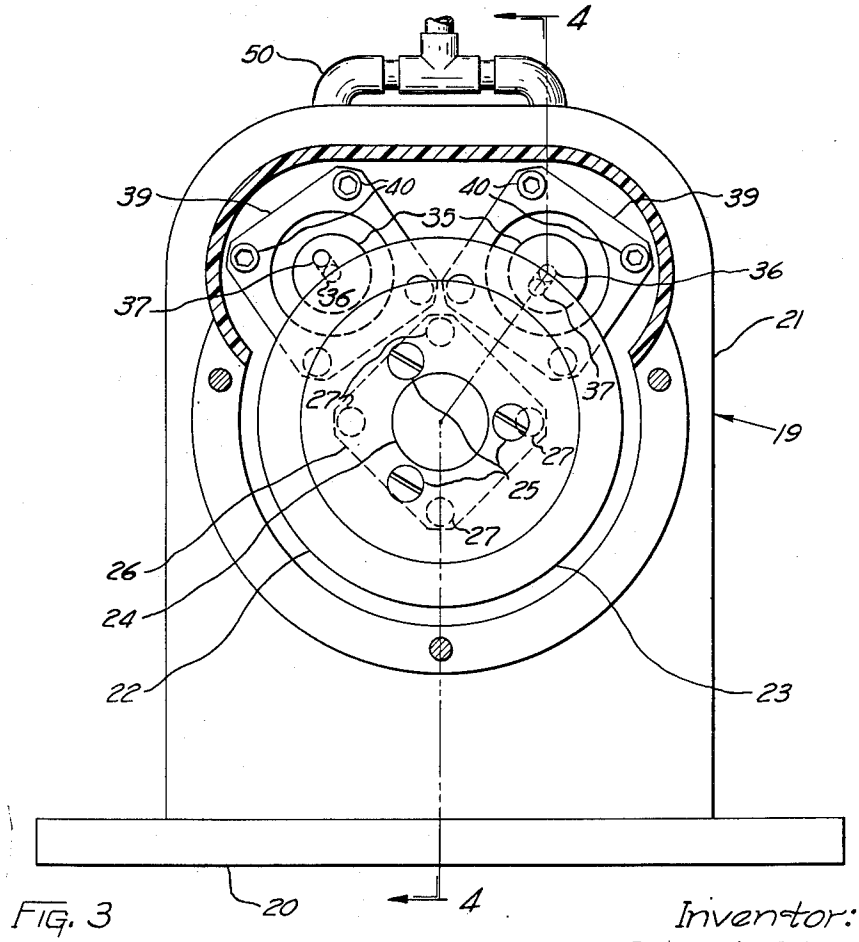


FIG. 3

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STAPLE CUTTER

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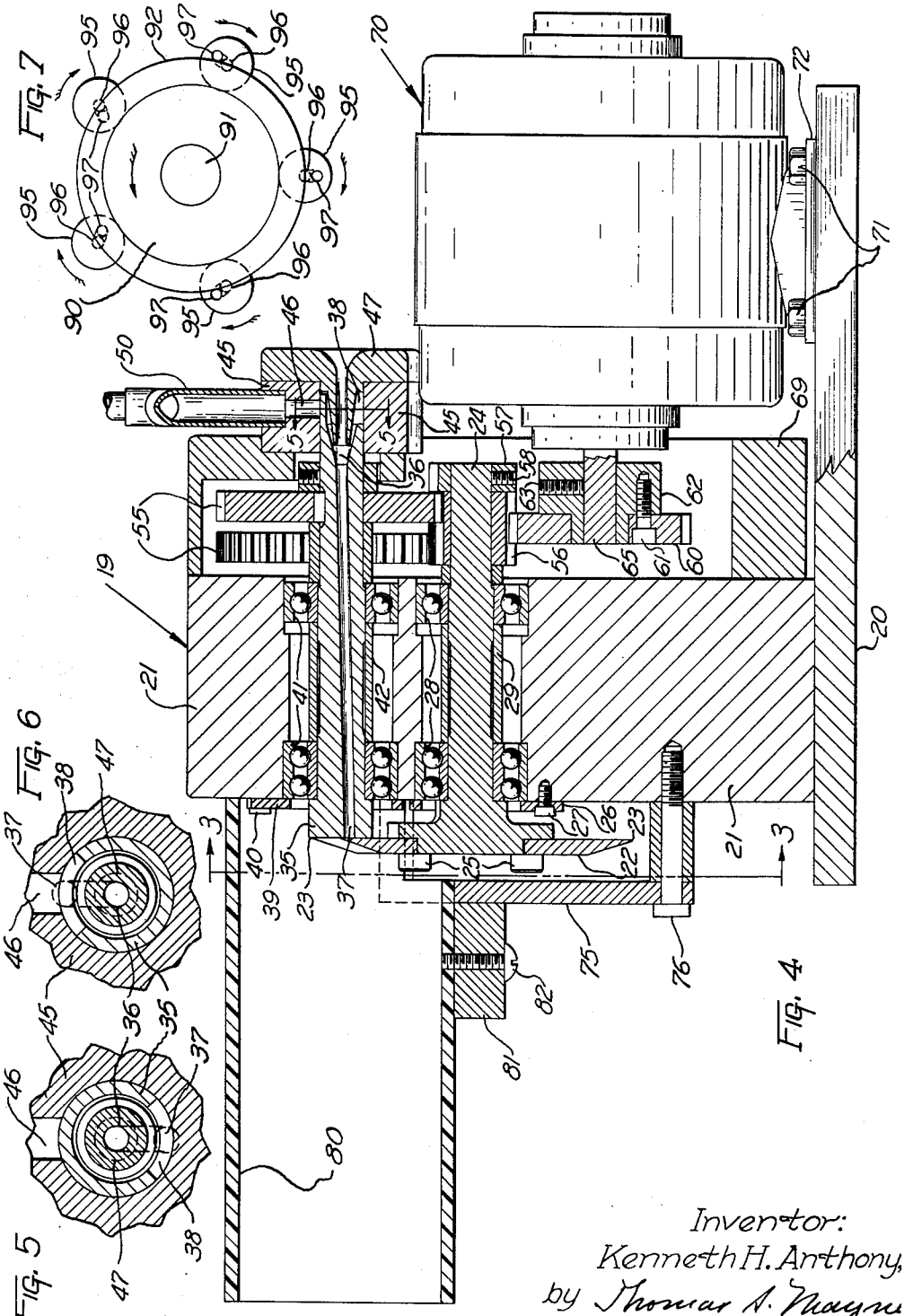


FIG. 4

FIG. 7

FIG. 6

FIG. 5

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STAPLE CUTTER

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17 Claims. (Cl. 164—61)

This invention relates to a cutter for severing continuous filaments into staple fiber lengths. In particular, this invention relates to a rotary cutter for producing staple from a rope or tow of synthetic or artificial filaments, especially continuous filaments of synthetic linear polymers, regenerated celiulose and the like.

Generally, staple fiber cutters comprise a stationary, tubular, continuous filament feeding device, and a rotating series of knives or a reciprocating cutting knife, or a centrifugal filament feeding means rotating relative a stationary knife blade. Knife blades in such cutters have to be sharpened or replaced at frequent intervals, and stand-by units must be provided for continuation of the cutting process. The present invention advantageously provides for a cutter where the cutting knife will last for an extended period before requiring to be resharpened or replaced.

In accordance with the present invention, a rope or tow of continuous filaments is conducted (by a filament conducting means) to a cutting means through a passage in a tube, spindle or the like rotatable about its longitudinal axis and having an eccentrically positioned filament outlet. The outlet being eccentrically positioned relative to the axis of the filament feeding means describes an orbit. When the filament conducting passage is rotated, the outlet is occluded by the cutting means during a part of its orbit. The length of the continuous filaments or tow extending out of the outlet being projected therefrom during the non-occluded part of the outlet's orbit forms the staple length. These lengths are transversely severed into staple when the outlet rotates past the cutting means into the occluded part of its orbit.

Advantageously the cutting means is a rotating cutting wheel having a knife edge about its circumference and the rotatable filament conducting passage with the eccentric outlet may have a central filament inlet into which the filaments are directed. The passage is positioned substantially perpendicularly to the plane of the cutting wheel, and the structure which forms the passage is advantageously positioned with its longitudinal axis of rotation about intersecting the knife edge of the cutting wheel. A plurality of filament conducting passages may be employed to provide for the severance of a plurality of the continuous filaments by a single cutting wheel, especially when a rotary cutting wheel is used. The filaments may be conducted through the rotating passages by pneumatic means, although other means may be employed. Where pneumatic means are used an air cut-off valve may be utilized at the inlet end of a passage to cooperate with the rotating passage for admission of air for forcing the filaments therethrough whenever the eccentric outlet of the passage is not occluded by the cutting means. The inlet end of the passage may be ported to function as an integral part of the valve for admitting air from the valve into the passage.

The aforesaid advantages of the cutter of this invention and others will be more specifically shown and described in the following specification and the drawing.

In the drawing:

Figure 1 is a schematic perspective view of the cutter of the present invention;

Figure 2 is a further view of the cutter of Figure 1 showing the eccentric filament outlet being occluded by the cutting wheel;

Figure 3 is a front sectional view of an embodiment of the cutter taken along 3—3 in Figure 4;

Figure 4 is a side sectional view of the complete cutter of Figure 3, excepting the drive means, taken along the plane of section line 4—4 in Figure 3;

Figure 5 is a sectional view of an air port in the inlet end of the filament passage and part of the valve body taken along 5—5 in Figure 4;

Figure 6 is the same view as shown in Figure 5 with the air port in the passage rotated to close off the entry of air into the passage; and

Figure 7 is a schematic front view of a plurality of filament passages positioned about the same cutting wheel.

With reference to Figures 1 and 2, illustrating the principle of the present invention, a cylindrical bar **9** having a filament conducting passage **10**, rotatable about its central longitudinal axis, in the direction illustrated by the arrows, has a central filament inlet **11** and an eccentric filament outlet **12**. A rope or tow **13** of continuous filaments is conducted through the passage **10** to the cutting means which is a revolving, cutting wheel **14** having a knife edge about its circumference. As the passage **10** rotates, the eccentric filament outlet **12** is occluded by the cutting means during a part of its orbit. During the non-occluded part of the outlet's orbit, the tow **13** is forced out by a filament moving means into the knife path to be transversely severed into the staple fiber lengths **15** when the outlet **12** rotates past the cutting knife. With each complete rotation of the passage **10** another length of staple fibers are severed from the tow **13**.

The length of the staple fibers cut from the tow during each revolution of the passage depends upon the length of tow forced out of the outlet **12** while it is not occluded by the cutting knife **14**. This is a function of the rate at which the filaments are conducted through the passage by the filament conducting means, and the speed of rotation of the outlet **12**.

As mentioned, it is advantageous to employ a cutting wheel **14** as the cutting means since it can be more readily used at higher rotational rates, and the filaments are cut more cleanly for over a longer period of operation, and the wear upon the cutting edge is more evenly distributed.

Referring to Figures 3 and 4, a more specific embodiment of the cutter is illustrated, generally, by the reference numeral **19**. As shown it comprises an assembly in a support housing **21** on a base **20**. A cutting wheel **22** mounted on a shaft **24** and having a knife edge **23** around its circumference, is rotatably supported in the housing **21** by a pair of ball bearings **28** separated by a spacer **29**. The cutting wheel **22** is held on the shaft **24** by screws **25**. A bearing retainer **26**, which fits about the shaft **24** and is secured to the support housing **21** by screws **27**, maintains the assembly against displacement. While ball bearings in the cutter are advantageous, other types of bearings may also be suitable.

A pair of cylindrical spindles **35** are rotatably mounted in the support housing **21**, each supported in a pair of ball bearings **41** separated by spacers **42**. The spindles **35** are positioned above and about the shaft **24** and are disposed substantially perpendicular to and abutting the edge of the cutting wheel **22** and being substantially parallel to the shaft **24**. The bearing retainers **39** for the bearings **41** are held on the support housing **21** by means of the screws **40**.

Each of the spindles **35** rotates about a central lon-

gitudinal axis which about intersects the knife edge **23** of the cutting wheel **22**. Through each spindle there is a filament conducting passage having a centrally positioned filament inlet **36**, and an eccentric filament outlet **37**. During rotation the outlet **37** is occluded by the cutting wheel **22** for a part of its orbit.

The spindle **35** in the support housing **21** is journaled at its inlet end in an annular valve body **45** having an air orifice **46**. The spindle **35** is recessed at its inlet end to provide for an air port **38** to admit air into the spindle passage from the air orifice **46** in the valve body **45** for forcing a filament tow during a portion of each spindle revolution. As illustrated in Figures 5 and 6, the spindle **35** when mounted in the annular valve body **45** functions as an integral part of the cut-off valve by sealing off the entrance of air from the air orifice **46** when the air port **38** in the spindle is rotated away from the orifice (as shown specifically in Figure 5). In Figure 6, the recessed air port **38** in spindle **35** is shown matching the air orifice **46** in the valve body **45** so as to admit air into the passageway through the inlet **36** during a part of each revolution made by the spindle. The air port **38** at the inlet end of the spindle **35** is correlated to the outlet **37** to admit air into the spindle passage from the air orifice when the outlet is not being occluded by the edge of the cutting wheel. The air port **38** is synchronized with the forcing of filaments through the passage with the non-occluded phase of the filament outlet's rotation. A conduit means **50** is attached to each air orifice **46** in the annular valve bodies **45** for providing air under compression from the supply source to the valve.

The spindles are provided with driving gears **55** which mesh with the gear **56** positioned about the shaft **24**. The gear **56** is retained in place by a collar **57** and a set screw **58**. The gear **56** is driven in turn by gear **60** which is driven by a suitable driving means such as an electric motor **70**. The gear **60** is fixed to the gear hub **62** by means of screws **61** and the gear hub **62** is fixed to the motor shaft **65** by means of set screw **63**. The motor **70** is mounted on a base **20** by means of the bolts **71** through mounting strips **72**. The entire gear train may be covered with a cover plate **69** fastened on the support housing **21**.

A tow of continuous filaments is passed into each spindle **35** passage by being directed through the filament inlets **36** by a funnel-like filament nozzle **47** attached to the annular valve body **45**. The filament nozzle **47** protects the filaments from a direct blast of air from the port **38** and it directs the air from the port towards the filament outlet **37** to force the filaments through the passage. The filament nozzle also facilitates the entry of tow into the filament inlet **36**. The tow is forced through the passage by the air admitted into the passage through the port **46** during the time when the filament outlet is not occluded by the cutting wheel **22**, and it is forced out of the filament outlet **37** by the air to be transversely severed into staple fiber lengths when the outlet **37** rotates past the knife edge **23** of the cutting wheel. The staple fiber lengths cut from the tow are propelled through a collecting tube **80** by the exhaust force of the air from the filament outlets **37**. The collecting tube **80**, which may be of plastic or other suitable material, is fastened by means of a screw **82** to a mounting block **81** which is attached to a cutting wheel guard **75**. The cutting wheel guard **75** is secured to the support housing **21** by the threaded bolt **76** tapped into the housing **21**.

Figure 7 illustrates schematically a cutting means comprising a rotatable cutting wheel **90** rotating on a shaft **91** having a knife edge **92** around its circumference and a plurality of five rotatable filament conducting passages **95** feeding tow to be served into staple fiber lengths. Each of the passages **95** has a central filament inlet **96** and an eccentric outlet **97** which rotate so as to have part of their orbits occuled by the cutting means. The passages **95** rotate in a direction opposite to the direction of rotation of the cutting wheel as indicated by the arrows. Advantageously each of the outlets **97** rotate out of phase from one another by an approximately equivalent amount totaling about 360 degrees of a circle. In this manner a more uniform production of staple may be achieved by a cutter. However, the phase variations of the filament outlets need not be varied at all, or they may be related in any other suitable arrangement. While only a single filament conducting passageway may be employed with each cutting means, it is generally advantageous to employ a plurality of passages with each cutting means in a cutter.

Although a particular type of cut-off valve for forcing the filaments through the passageway has been described, it is to be understood that other types of pneumatic cut-off valves synchronized to cooperate with the filament outlet may be employed for admitting air into the passage to force the filaments therethrough. Other filament conducting means such as feed rolls, thread-advancing reels or conveyor belts may also be employed in accordance with the present invention for forcing the continuous filaments through the passage.

It is also advantageous for the cutting wheel to be self-sharpening. This may be readily accomplished by providing independent honing means on the housing to sharpen the rotating cutting wheel during operation, or by sharpening the knife edge on the end or ends of the abutting spindle or spindles having mounted in their faces an abrasive material. If desired, other types of cutting means may be employed with the cutter for severing the tow feed through the eccentric filament outlet into staple. For example, a stationary or reciprocating knife blade may be employed in the cutter. With a reciprocating knife blade, a continuously different part of the knife edge is used for cutting the tow.

If desired, the filament conducting means for forcing the filaments through the passage to the cutting means may be solely by vacuum means applied on the filament outlets through the collecting tube. For example, a suction device (not shown) may be positioned at the end of the collecting tube **80** and the filaments forced through the passage by the effect of the vacuum thereby created. In such a case the staple fiber lengths cut from the tow are propelled through the collecting tube by the effect of the vacuum which withdraws the tow from the filament outlets.

The cut staple fiber lengths can be removed, or may be assisted in their removal, from the collecting tube **80** to a bin or other storage compartment by means of a suction or aspirator device (not shown) even when pneumatic or other means are employed for forcing the tow through the passages.

As a wide variety of different embodiments and modifications of the present invention may be entered into without departing from its spirt or scope, it is to be understood that the foregoing specification be taken as illustrative only and in no sense limiting of the invention excepting as defined in the appended claims.

I claim:

1. A cutter for severing continuous filaments into staple fiber lengths comprising, in combination, a rotatable cutting wheel having a knife edge about its circumference; means to rotate said wheel; at least one passage being rotatable about its longitudinal axis for conducting said filaments to said cutting wheel; means to rotate said passage, said passage being substantially perpendicular to the plane of said cutting wheel and positioned with its longitudinal axis intersecting the knife edge of said cutting wheel; a central filament inlet at one end of said rotatable passage and an eccentric filament outlet at the other end of said passage, said outlet, when said passage is rotated, having a part of its orbit occluded by said cutting wheel; a pneumatic cut-off valve cooperating with said passage and positioned at its inlet end for admitting air to said passage to force said filamentary material therethrough while said outlet of said passage is not occluded by said cutting wheel; means for gathering said staple fiber lengths from

said cutting wheel; and means for providing air under compression to said cut-off valve.

2. A cutter for severing continuous filaments into staple fiber lengths comprising, in combination, a support housing; a rotating cutting wheel on a shaft in said housing having a knife edge about its circumference; at least one passage being mounted to rotate about its axis in said housing for conducting said filaments to said cutting wheel, said passage being positioned with its longitudinal axis about intersecting the knife edge of said cutting wheel and being substantially parallel to said shaft and substantially perpendicular to the plane of said cutting wheel; a filament inlet centrally positioned at one end of said passage and an eccentric filament outlet at the other end of said passage, said outlet, when said passage is rotated, having a part of its orbit occluded by said cutting wheel; a pneumatic cut-off valve adapted to cooperate with said passage and positioned at its inlet end for admitting air to said passage for forcing said filaments therethrough while said outlet of said passage is not occluded by said cutting wheel; means providing air under compression to said cut-off valve; and means to rotatably drive said shaft and said filament passage.

3. A cutter for severing continuous filaments into staple fiber lengths comprising, in combination, a support housing; a rotating cutting wheel on a shaft in said housing having a knife edge about its circumference; at least one spindle rotatably mounted in said housing being positioned with its longitudinal axis about intersecting the knife edge of said cutting wheel and being substantially parallel to said shaft and substantially perpendicular to the plane of said cutting wheel, said spindle having an interior filament conducting passage with a central inlet and an eccentric outlet, said outlet being occluded by said cutting wheel during a portion of each revolution of said spindle; a pneumatic valve, positioned at the inlet end of said rotating spindle, adapted to cooperate with said rotating spindle for admitting air through said inlet into said passage for forcing said filaments therethrough while said outlet of said passage is not occluded by said cutting wheel; means for providing air under compression to said valves; and means for rotatably driving said shaft and said spindle.

4. A cutter for severing continuous filaments into staple fiber lengths comprising, in combination, a support housing, a rotating cutting wheel on a shaft in said housing having a knife edge about its circumference; at least one spindle rotatably mounted in said housing abutting said cutting wheel and being positioned with its longitudinal axis about intersecting the knife edge of said cutting wheel and being substantially parallel to said shaft and substantially perpendicular to said cutting wheel; drive means interconnecting said spindle and said shaft; said spindle having an interior filament conducting passage with a central inlet and an eccentric outlet, said outlet being occluded by said cutting wheel during a portion of each revolution of said spindle; a pneumatic valve, positioned at the inlet end of said rotating spindle, adapted to cooperate with said rotating spindle for admitting air through said inlet into said passage for forcing said filaments therethrough while said outlet of said passage is not occluded by said cutting wheel; means for providing air under compression to said valve; means for gathering said staple fiber lengths from said cutting wheel; and means for rotatably driving said shaft.

5. A cutter in accordance with claim 4 wherein said staple fiber gathering means is a conduit attached to said housing and enclosing said cutting wheel through which said staple fiber is propelled by the force of air vented from said outlet in said spindle.

6. A cutter in accordance with claim 4 wherein a plurality of said spindles are mounted rotatably in said housing and wherein said eccentric outlets in said spindles are rotated in varying phases while being occluded during parts of their orbits by said cutting wheel.

7. A cutter in accordance with claim 6 wherein said ecentric outlets in said plurality of spindles are rotated out of phase from one another in approximately equivalent amounts totalling about 360 degrees of a circle.

8. A cutter in accordance with claim 4 wherein said drive means interconnecting said shaft and said spindle are gear means.

9. A cutter for severing continuous filaments into staple fiber lengths comprising, in combination, a support housing, a rotating cutting wheel on a shaft in said housing having a knife edge about its circumference; means for rotatably driving said shaft; a plurality of cylindrical spindles rotatably mounted in said housing about said shaft, each of said spindles abutting said cutting wheel and being positioned substantially parallel to said shaft and substantially perpendicular to said cutting wheel; gear means in said housing interconnecting each of said spindles to said shaft; each of said spindles having an interior filament conducting passage with a central inlet and an eccentric outlet; an air port in the wall of each spindle at its inlet end; each of said outlets being occluded by said cutting wheel during a part of the revolution of each spindle while said outlets are being rotated out of phase from one another by a synchronized, approximately equivalent amount totalling about 360 degrees of a circle; a plurality of annular valve bodies mounted in said housing in which the ported inlet ends of said spindles are journaled; each of said valve bodies having an air orifice adapted to being opened when said air port in said spindle journaled therein is rotated past said orifice thereby admitting air into said passage in each of said spindles for forcing said filaments therethrough; said air ports being correlated with said eccentric outlets in each of said spindles to rotate past said air orifices in said valve bodies while said outlets are not being occluded by said cutting wheel; means providing air under compression to the air orifices in each of said annular valve bodies; a funnel-like filament nozzle extending through each of said valve bodies into the inlets of each of said filament passages in said spindles for directing said filaments therethrough; and a conduit attached to said housing through which said staple fiber is propelled by the force of air vented from said outlets in said spindles to be subsequently gathered.

10. A cutter in accordance with claim 9 wherein said spindle ends abutting on said cutting wheel are adapted to continuously hone the knife edge of said cutting wheel while said wheel is being rotated.

11. A cutter in accordance with claim 9 wherein said spindles and said shaft are rotatably mounted in ball bearings in said support housing.

12. A cutter in accordance with claim 9 wherein two rotating spindles are rotatably mounted above and about said shaft in said support housing and wherein said spindles are synchronized to rotate with their eccentric outlets out of phase from one another by about approximately 180 degrees of a circle.

13. A cutter in accordance with claim 9 wherein the inserted ends of said filament nozzles in said filament inlets assist in directing the passage of air through said air ports toward said filament outlets of said spindles.

14. A cutter in accordance with claim 9 wherein said means to rotatably drive said shaft is an electric motor connected with said shaft.

15. In combination in a cutter for severing continuous filaments into staple fiber lengths; a cutting means; at least one filament feeding means having a passage rotatable about its longitudinal axis associated with said cutting means, said axis being generally normal to the plane of said cutting means and said passage having an outlet end eccentric to the axis of rotation; means for conducting said filaments through said feeding means; and means for rotating said feeding means, the passage outlet end being occluded by said cutting means during part of its rotation.

16. A cutter for severing continuous filaments into

staple fiber lengths comprising; in combination with a cutting means; at least one filament feeding element rotatable about its longitudinal axis having a passage for conducting said filaments to said cutting means; means for rotating said filament feeding element; said passage in said filament feeding element being at an angle to the said feeding element axis so that its outlet end is offset from the said element axis; said passage during part of the rotation of said feeding element having its outlet end occluded by said cutting means; and means for effecting movement of said filaments through said rotating passage while said outlet end is not occluded by the said cutting means.

17. A cutter in accordance with claim 16 wherein said cutting means is a cutting wheel having a knife edge about its circumference.

References Cited in the file of this patent

UNITED STATES PATENTS

1,059,268	Bond	Apr. 15, 1913
1,653,257	Davis	Dec. 20, 1927
1,895,048	Rose	Jan. 24, 1933
2,207,383	Rodenacker et al.	July 9, 1940
2,563,986	Bauer	Aug. 14, 1951