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Eichler et al.

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[54] **APPARATUS FOR CUTTING OF FIBER STRANDS**

[75] Inventors: **Norbert Eichler**, Bohlerwerk; **Kurt Urban**, Waidhofen/Ybbs, both of Austria

[73] Assignee: **Gebr. Bohler & Co., Aktiengesellschaft**, Kapfenberg/Steirmark, Austria

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Related U.S. Application Data

[62] Division of Ser. No. 18,274, March 10, 1970, Pat. No. 3,735,661.

[30] **Foreign Application Priority Data**

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July 9, 1969 Austria 6564/69

[52] **U.S. Cl.** **83/675**, 83/356.3, 83/592, 83/698, 83/913

[51] **Int. Cl.** **B26d 1/28**

[58] **Field of Search** 83/355, 356, 391–396, 83/675, 698–700, 913; 241/195, 191, 356.3

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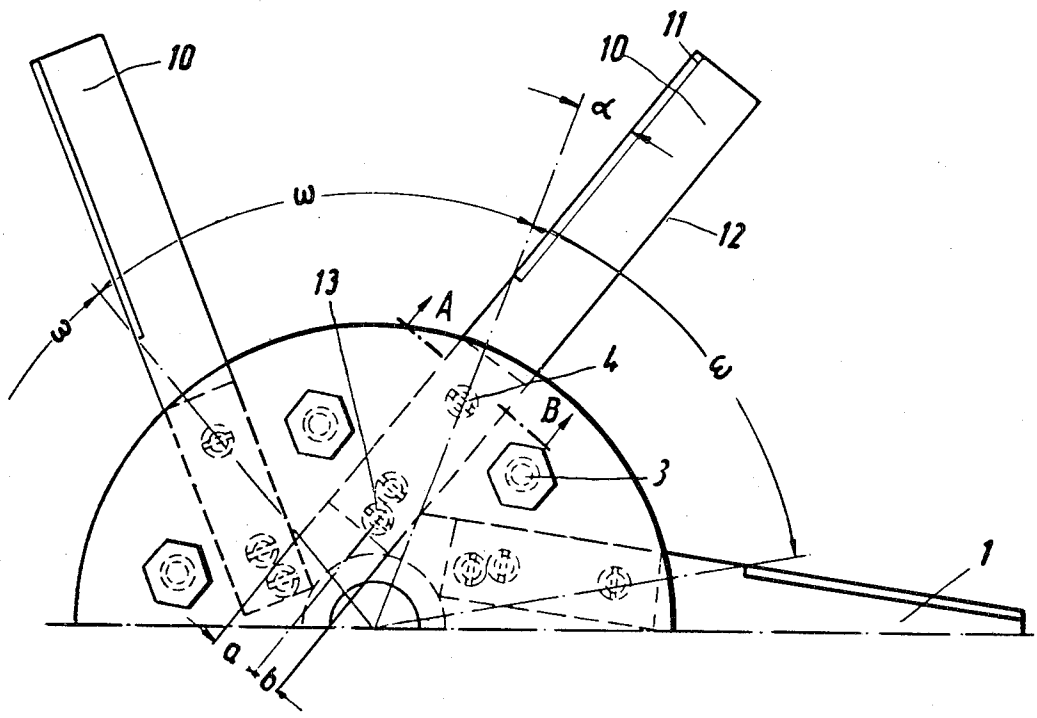
Primary Examiner—J. M. Meister
Attorney, Agent, or Firm—Holman & Stern

[57] **ABSTRACT**

An apparatus for cutting fiber strands in which there is provided a rotatable clamping head defined by two disc-shaped members, means for forcing the members against each other and knives clamped between the disc members and protruding from the periphery thereof, each knife being constituted by a straight metal body of substantially triangular cross-section having a first portion clamped between the disc-shaped members and a second portion protruding beyond the periphery of the disc-shaped members, with the second portion being provided with a knife edge.

2 Claims, 8 Drawing Figures



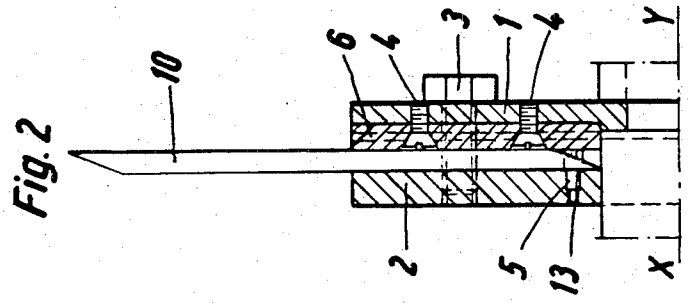


Fig. 2

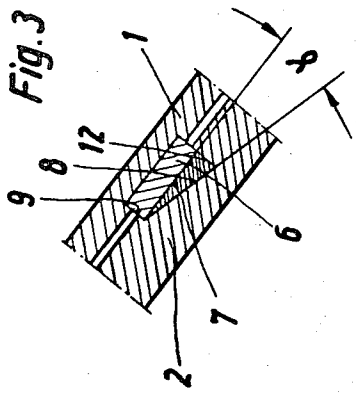


Fig. 3

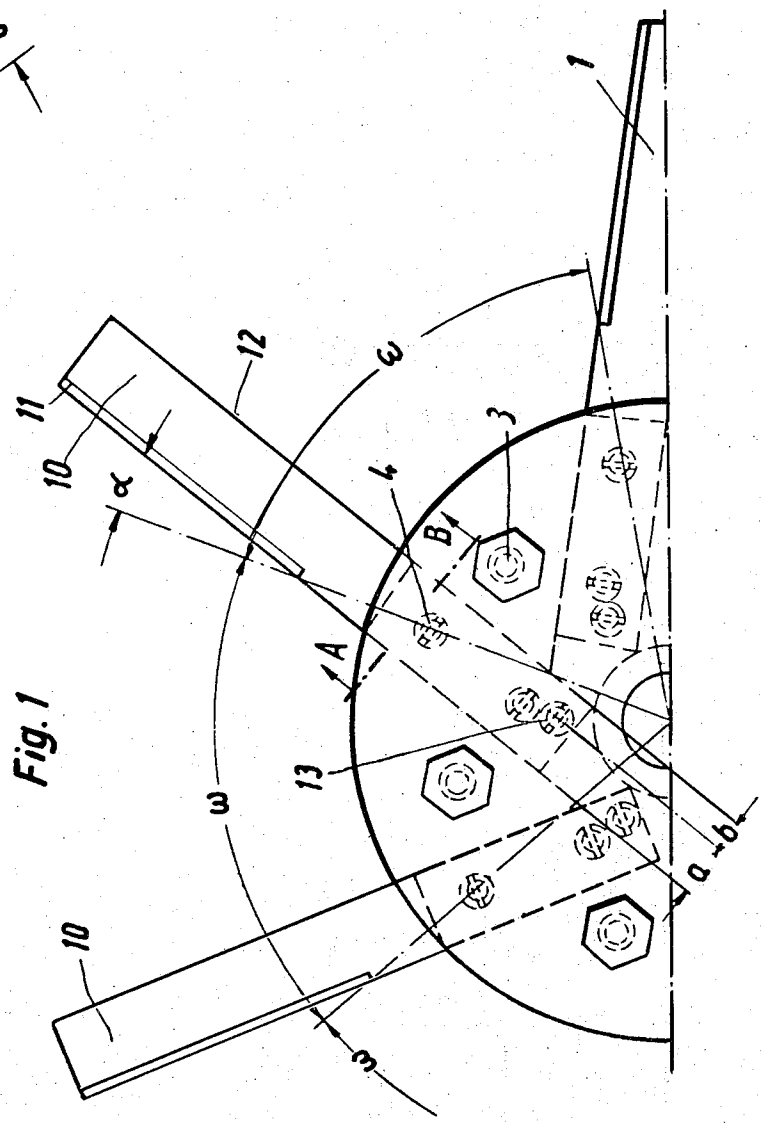


Fig. 1

Fig. 4

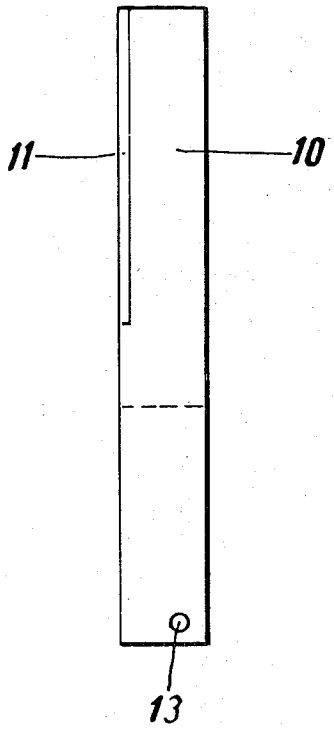


Fig. 5

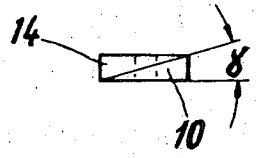


Fig. 7

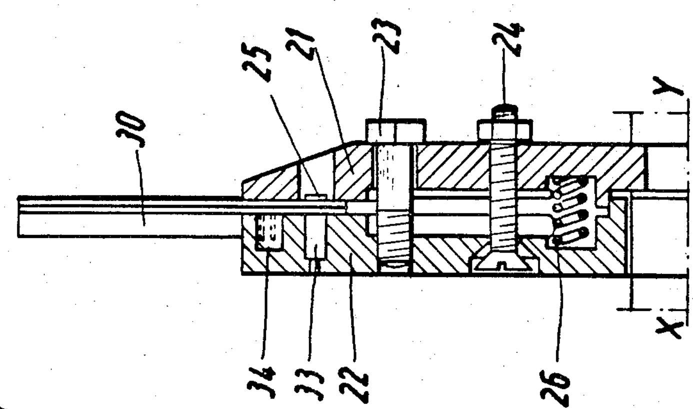


Fig.8

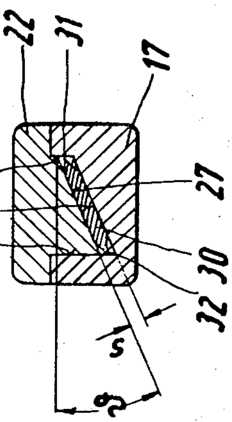
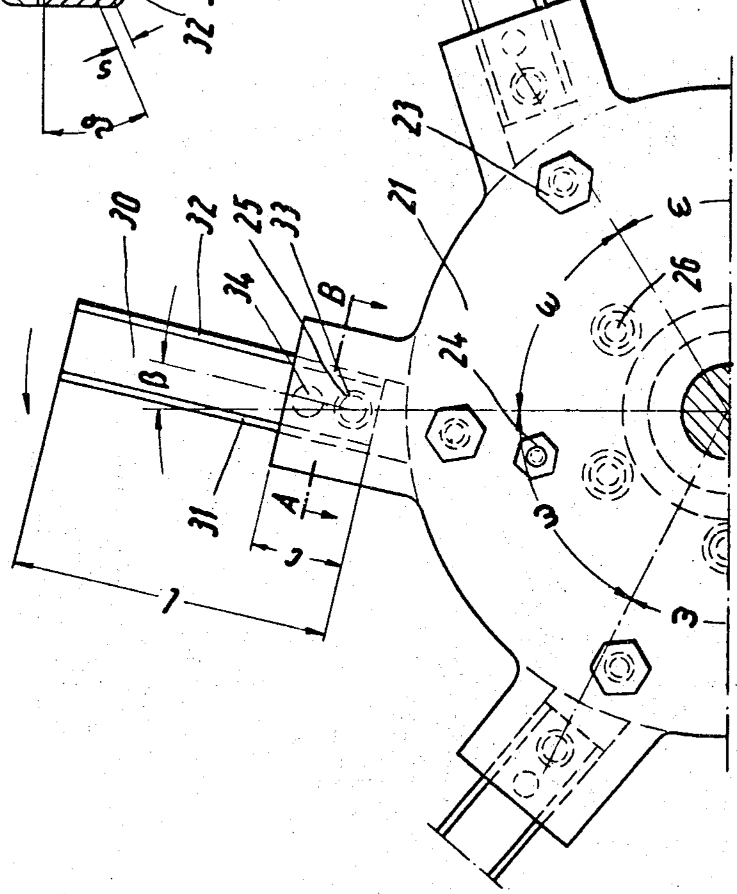


Fig.6



APPARATUS FOR CUTTING OF FIBER STRANDS

This application is a division of out copending application, Ser. No. 18,274, filed Mar. 10, 1970, now U.S. Pat. No. 3,735,661.

BACKGROUND OF THE INVENTION

This invention relates to apparatus for chopping strands of fibers, such as cellulose fibers or man-made fibers, and comprises a rotating cutter head in which the chopping knives are detachably mounted.

PRIOR ART

The known forged chopping knives for making staple fibers consist of a knife blade having, in cross-section, a shape which approximates a very acute-angled triangle, and a shank, which, in most cases, has the cross-sectional shape of a narrow rectangle. The two parts include an obtuse angle so that the shank is clamped in the head to extend in a radial direction whereas the blade lags by the obtuse angle during the rotation of the cutter head. Such knives are made by forging, heat treating and grinding operations, which involve considerable labor and other costs. After a certain time of use, the knives are removed, reground and re-installed for further use.

SUMMARY OF THE INVENTION

It is an object of the invention to provide, for the chopping of a strand into staple fibers, an apparatus including knives which can be made at a lower cost and can be clamped and replaced more easily. This is accomplished in that the blade and shank of the present chopping knives extend along a straight line and have, in cross-section, an approximately constant shape, which is preferably substantially triangular.

A process of making such knives is characterized, according to the invention, in that steel is rolled to form a rod which has, in cross-section, the shape of an acute-angled triangle, and sections having the overall length of a knife are severed from the rod. These sections are hardened, e.g., in a salt bath, and the narrow edge is sharpened by grinding the length thereof which is required for the knife edge protruding from the clamping head. The knives are so clamped in the clamping head that the knife edge includes an obtuse angle with the radius so as to lag behind the rotating head. The openings which are formed in the clamping head and serve for the fixation of the knives may conform to the triangular cross-section. When knives having a shank of rectangular cross-sectional shape are sometimes used in the cutter head and the openings are rectangular in cross-section to conform to the shank, a shim consisting of plastic material or another resilient material and having in cross-section the shape of an acute-angled triangle may be adhered to the shank.

To eliminate the need for the time-consuming fixation and removal and for re-grinding, which can be performed only on special machines, another apparatus has been developed, which comprises discardable blades. The same are clamped throughout their length in holders and their portions provided with knife edges are similar in configuration to the above-mentioned chopping knives. Such apparatus has the disadvantage that fibers tend to be caught by the blade holders and require a shut-down of the apparatus.

For this reason, it is another object of the invention to avoid also the disadvantages of these discardable

blades which are clamped throughout their length. This is accomplished, according to the invention, in that the knife blades are clamped in the holders only in a length which is short compared to the overall length of the blades. The length of these blades, which freely protrude from the clamping head, is smaller approximately by one-half than the length of the knives having a shank which is clamped. This accounts for a considerable saving of the expensive material.

To enable such an arrangement, the clamping head is provided with holders which considerably protrude from the body of the clamping head in the directions of the axes of the knives. In a preferred embodiment of such apparatus, each knife blade is provided with one or two knife edges extending throughout the length of the blade or only along the portion which protrudes from the clamping means. Blades having two cutting edges can be turned around and used twice.

It has proved desirable to use discardable blades in which the ratio of the clamped length to the overall length is smaller than 0.3. It is also desirable if the ratio of the thickness of the discardable blade to its overall length is 0.01–0.03. These discardable blades are made, in accordance with the invention, from prerolled strip in which the knife edges are formed on one or both edges of the blade by cold rolling and are subsequently hardened, e.g., by induction heating. This process of manufacturing discardable blades results in additional significant advantages and savings in cost compared to the known knives which are forged, then ground and heat-treated, as well as to the knives having a constant shape, e.g., a triangular shape, in cross-section. The use of these discardable blades eliminates the need for a removal and replacement of knives and for a re-grinding so that the special machines required for this purpose are not needed and skilled labor for this work need not be employed.

Further details of the invention are apparent from the following description of embodiments shown diagrammatically and by way of example in the accompanying drawings, in which

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is an elevation showing a cutter head and a plurality of knives according to one embodiment of the invention;

FIG. **2** is a longitudinal sectional view of the arrangement of FIG. **1**;

FIG. **3** is a transverse sectional view taken on line **3—3** of FIG. **1** through a knife and the cutter head;

FIG. **4** is an elevation showing another embodiment of a knife according to the invention;

FIG. **5** is a top plan view showing the knife of FIG. **4**;

FIG. **6** is an elevation showing another apparatus according to the invention;

FIG. **7** is a longitudinal sectional view showing the apparatus of FIG. **6**, and

FIG. **8** is a transverse sectional view taken on line **8—8** of FIG. **6** through the cutter head.

The structures shown in the drawings may be described as follows.

DETAILED DESCRIPTION OF THE DRAWINGS

The chopping knives **10** for making staple fibers will be briefly referred to hereinafter as knives and are approximately triangular in cross-section. These knives

are clamped in the openings of a bipartite rotatable cutter head, which is composed of disc bodies **1, 2.** The knives protrude from the cutter head. All knives **10** are evenly angularly spaced by an angle ω. In its portion protruding from the cutter head, or throughout its length, each knife is formed with a cutting edge **11.** The knives **10** are made from steel and are hardened throughout their cross-section or only adjacent to the cutting edges **11.** The cutter head has side faces **7, 8** which define the sides of the openings in which the knives are clamped. These side faces **7, 8** contact the clamped knives **10** and include an angle which is equal to the wedge angle ω of the knives **10.** The side faces **7, 8** and end faces **9** contacted by the edges of the knives **10** and these edges themselves are inclined from the parting plane between the two disc bodies **1, 2** of the clamping head and from the radii extending through the axis of rotation X–Y. Desirable conditions will be obtained if the angles α included by the cutting edges **11** and the radii are in the range from 0°–30°. The two disc bodies **1** and **2** of the cutter head are held together by screws **3.** Adjacent to each opening formed in one disc body **2** and serving to receive a knife shank, the other disc body **1** may accommodate a plate **6,** which is rectangular in cross-section and consists of plastic material, such as polyvinylchloride. The plate **6** is disposed in a groove and protrudes from the disc body **1.** Each of those plates **6** may be secured to the disc body **1** e.g., by means of two flathead screws **4** and ensure a uniform contact pressure at the clamped surfaces of the knives **10.** Each knife **10** is provided with a fixing hole **13,** which, in the knives shown in FIGS. **1** to **5,** is spaced from back **12** of the knife by a distance *b*, which is much smaller than the distance *a* from the hole **13** to that edge of the knife which is provided with the cutting edge **11.** The fixing hole **13** is fitted over a pin screw **5** provided in the disc body **2.**

The knife which is shown in FIGS. **4** and **5** comprises a part **10***a*, which consists of steel and is triangular in cross-section and provided with the cutting edge **11***a*, and a plate **14,** which is also triangular in cross-section and consists of plastic material, such as polyvinylchloride. The plate **14** is secured, preferably adhered, to that end portion of the part **10***a* where the latter is to be clamped so that the knife is reactangular in cross-section in that end portion and can be clamped in existing cutter heads which have rectangular openings of constant width.

FIGS. **6, 7** and **8** show an apparatus which embodies the invention and in which knives **30** consist of short and thin discardable blades, which have two cutting edges so that they can be used twice. The holders protrude from the edge of disc-like halves or bodies **21, 22** of the bipartite clamping head by a distance *c*, which is equal to the length in which the knives are to be clamped, and in the direction in which the clamped knives extend. This direction is determined by the angle S. The portion in which the knife blades are clamped in the holders of the bipartite, rotatable cutter head has a relatively short length *c*. The knives **30** protrude from the cutter head. All holders are equally spaced from the axis of rotation X–Y and are spaced apart by like angles ω. Each knife blade **30** is provided with two parallel cutting edges **31, 32,** which extend throughout length l of the blade and in cross-section have the shape of a rectangle and two triangles adjoining the ends of the rectangle. The bodies of the knife blades **30** consisting of hardenable steel are heat-treated. Their cutting edges **31, 32** are formed, e.g., by cold rolling and grinding and are hardened by high frequency induction heating. The knife blades **30** could be hardened throughout and, in this case, would have a Rockwell hardness above **50.** The cutter head is formed with side faces **27** and **28,** which contact the clamped knife blades. These faces **27** and **28** and the knife blades themselves extend at an angle to the parting plane of the cutter head. This angle is determined in view of the ratio of the feeding speed of the strand to be chopped to the peripheral velocity of the blades. Those edges of the knife blades **30** which are formed with the cutting edges **31, 32** contact end faces of the openings and these end faces as well as the knife blade edges formed with the cutting edges are inclined from the radii which extend through the axis of rotation X–Y. This inclination (β,) may desirably be within the range from 0°–30°. Helical compression springs **26** are provided between the radiis **21** and **22** of the cutter head, which bodies are held together by screws **23.** A known permanent magnet system **34** is fixed in the body **22** adjacent to each holder and a protruding retaining pin **25** is fixed to the body **22** on that side of each magnet system **34** which faces the axis of rotation X–Y. Each knife blade **30** has, formed in an end portion, a hole **33,** which is fitted on one of the retaining pins **25.** Spacing flathead screws **24** are screwed into the body **21.** Each of the screws **24** is held against rotation by a spring lock washer and a hexagon nut and extends through a bore in the body **22.** When the operative leading cutting edges **31** of the knife blades **30** fixed in the cutter head have become blunt after a prolonged use, the screws **23** are somewhat loosened to form a clearance between the body **21** and the knife blades **30,** which adhere to the permanent magnetic systems. The knife blades **30** can now easily be turned around or replaced by new ones by hand. The permanent magnet system **34** facilitate these operations.

The knife blades used in the apparatus according to the invention are not re-ground, as a rule. Nevertheless, the work using such apparatus is much less expensive than the use of the known apparatus provided with chopping knives which must be re-ground.

The invention comprises also apparatus in which the straight knives are clamped by other suitable means or in which the knives have different cross-sectional shapes, which are constant throughout the length of the knives. For instance, cross-sectional shapes may be used which consist of two acute-angled triangles forming, e.g., a diamond, or which have different cutting angles for cutting different materials and are similar to a rhomboid.

We claim:

1. In an apparatus for chopping strands of fibers, such as cellulose fibers and man-made fibers, a rotatable clamping head constituted by two disc-shaped members, means forcing said members against each other and chopping knives clamped between the disc-shaped members and protruding therefrom, each knife including a straight metal body of substantially right-triangular cross-section having a first portion adapted to be clamped between the disc-shaped members and a second protruding portion, and a knife edge on said second portion, one of said disc-shaped members having openings receiving the first portions of the knives, each opening being complementary to the first portion

so that the longer cathetus of the first portion faces the other disc-shaped member, the other disc-shaped member having rectangular grooves opposite said openings, a rectangular plate disposed in each groove and protruding from the groove, means securing the plates in the grooves, and the protruding portion of each plate engaging the longer cathetus of each first portion of each knife.

2. The apparatus as claimed in claim **1** in which each plate is of polyvinylchloride.

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