July 7, 1970 H. NIEMANN ET AL 3,518,911

CUTTING MECHANISM FOR TOBACCO OR THE LIKE

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Fig.1

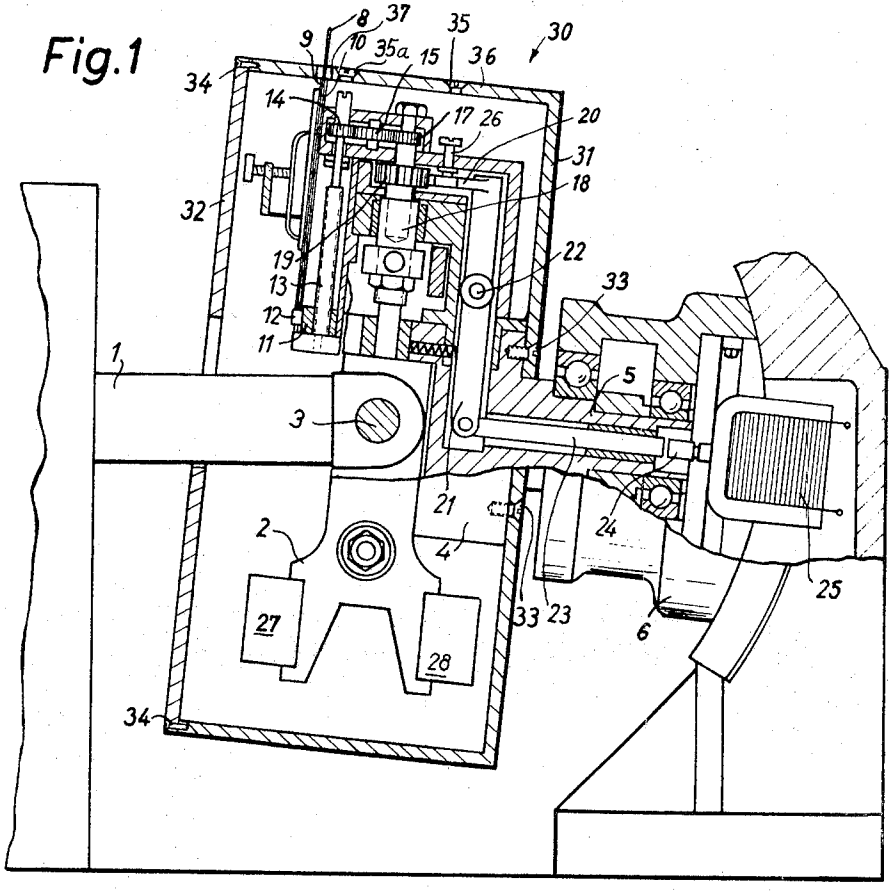


Fig.2

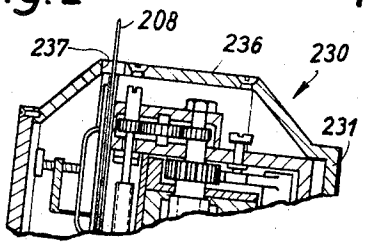
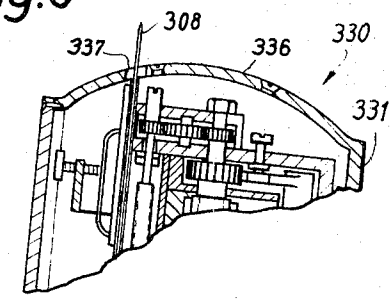


Fig.3



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Fig. 4

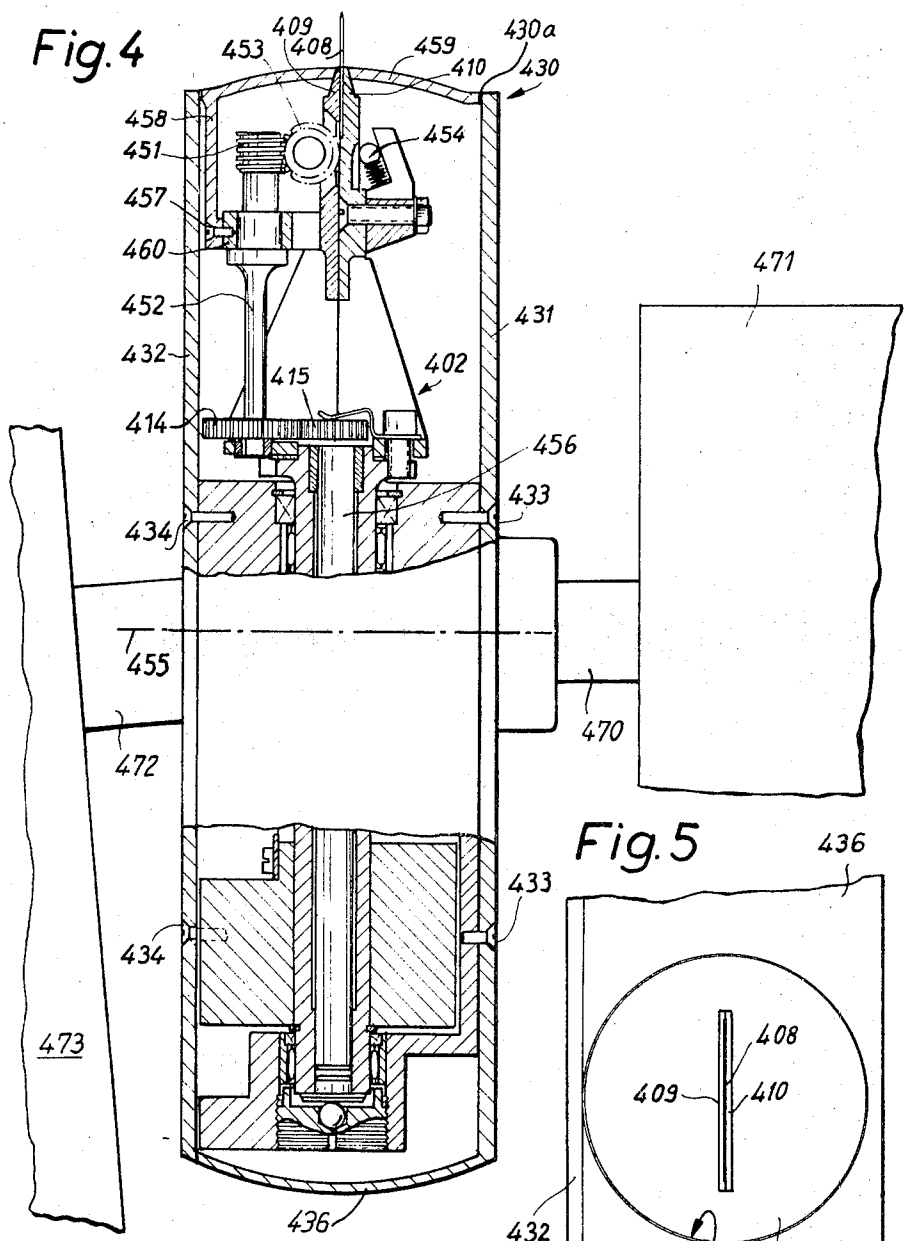


Fig. 5

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CUTTING MECHANISM FOR TOBACCO OR THE LIKE

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Int. Cl. B23d 1/56
U.S. Cl. 83—338 8 Claims

ABSTRACT OF THE DISCLOSURE

A cutting mechanism for travelling tobacco rods comprises a knife which orbits at a high speed about a first axis and moves back and forth with reference to a second axis so as to travel in the same direction and at the same speed as the rod when its cutting edge forms a cut. The parts which support, move and feed the knife are accommodated in a noise-reducing envelope which shares rotary movements of the knife and is configurated with a view to minimize turbulence in the surrounding atmosphere. The envelope resembles a hollow cylinder having a circumferential wall provided with an opening through which the cutting edge of the knife extends.

BACKGROUND OF THE INVENTION

The present invention relates to improvements in cutting mechanisms for travelling tobacco rods or like elongated bodies.

A tobacco rod cutting mechanism normally comprises a rotary carriage which supports a knife and a feed serving to move the knife with reference to the carriage so as to compensate for wear on the cutting edge. As a rule, the parts of the cutting mechanism are not distributed symmetrically with reference to the axes about or along which the knife travels when the mechanism is in use. For example, the carriage normally supports one or more protruding counterweights which balance the mass of the knife and of the knife feed. Furthermore, the feed is quite complicated and comprises a large number of parts portions of which protrude outwardly and produce turbulence in the surrounding atmosphere when the mechanism is driven at a relatively high speed, for example, at a speed required to produce up to and in excess of 2,000 cigarettes or filter rod sections per minute. When the rotational speed of the carriage is relatively low, noise caused by such turbulence is still acceptable; however, the noise becomes unpleasant to workmen at higher operating speeds. Such noise interferes with communication between workmen and affects their morale and efficiency.

SUMMARY OF THE INVENTION

It is an object of our invention to provide a novel and improved cutting mechanism for tobacco rods, filter rods or like elongated bodies which must be severed at frequent intervals and in rapid sequence, and to construct and assemble the cutting mechanism in such a way that it produces much less turbulence in the surrounding atmosphere and is therefore quieter than heretofore known cutting mechanisms.

Another object of the invention is to provide the cutting mechanism with very simple, inexpensive and readily applicable noise reducing means.

A further object of the invention is to provide a noise reducing device which can be provided on or combined with presently known cutting mechanisms for tobacco rods or the like.

An ancillary object of the invention is to provide a cutting mechanism which, in addition to being practically noiseless or less noisy than presently known cutting mechanisms, is also capable of standing longer-lasting use.

A further object of the invention is to provide a combined noise reducing and protective enclosure or envelope for the moving parts of a cutting mechanism for tobacco rods or the like.

The improved cutting mechanism is particularly suited for use in severing of tobacco rods, filter rods or like elongated bodies which travel lengthwise and must be severed at frequent intervals and with a high degree of accuracy. It comprises one or more knives and a plurality of parts for supporting the knife or knives and for moving the latter with reference to at least one axis at speeds which are high enough to result in generation of noise in response to turbulence created in the surrounding atmosphere by protrusions of moving parts. In accordance with our invention, such parts together form an assembly having an external configuration which is substantially free of protuberances to thus minimize turbulence in the surrounding atmosphere.

In accordance with a presently preferred embodiment of our invention, the aforementioned assembly of parts includes an envelope or jacket which is affixed to a rotary carriage for the knife or knives and provides a substantially airtight closure for the remaining parts of the assembly. Such envelope is preferably provided with a smooth external surface to reduce friction with the surrounding air and resembles a flat disk, a short cylinder, a tire or a like body of rotation having two halves which are mirror symmetrical with reference to a plane that is normal to the aforementioned axis.

The novel features which are considered as characteristic of the invention are set forth in particular in the appended claims. The improved cutting mechanism itself, however, both as to its construction and its mode of operation, together with additional features and advantages thereof, will be best understood upon perusal of the following detailed description of certain specific embodiments with reference to the accompanying drawing.

BRIEF DESCRIPTION OF THE DRAWING

FIG. 1 is a partly elevational and partly sectional view of a cutting mechanism which embodies one form of our invention and comprises a cylindrical envelope;

FIG. 2 is a fragmentary sectional view of a second cutting mechanism with a modified envelope;

FIG. 3 is a similar fragmentary sectional view of a third cutting mechanism with an envelope similar to that shown in FIG. 2;

FIG. 4 is a partly elevational and partly sectional view of a fourth cutting mechanism wherein the envelope provides a hermetic seal around the other parts; and

FIG. 5 is a fragmentary top plan view of the structure shown in FIG. 4.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

FIG. 1 illustrates a cutting mechanism for a travelling tobacco rod. A similar mechanism, but without the noise reducing or noise eliminating feature, is disclosed in German Auslegeschrift No. 1,219,374.

A drive shaft **1** carries a transverse shaft **3** for a carriage **2**. The latter is rockable on the shaft **3** and is provided with a forked portion **4**. A shaft **5** in the forked portion **4** is journalled in a bearing **6**. The knife **8** is held between two plates **9** and **10** and is affixed to a holder **11** by means of a pin **12**. The holder **11** is adjustable by means of a feed screw **13** which can be rotated by a transmission including gears **14** and **15**. The latter gear is in mesh with a gear **17** mounted on a shaft **18** which also

carries a ratchet wheel **19**. The teeth of the ratchet wheel **19** can be engaged by a pawl **20** which is mounted on a two-armed lever **21** fulcrumed at **22**. Each pivotal movement of the lever **21** causes the pawl **20** to turn the ratchet wheel **19**, shaft **18** and gear **17** by the width of a tooth on the ratchet wheel. The means for rocking the lever **21** comprises a rod **23** which can be attracted by a portion **24** of an electromagnet **25**. The electromagnet **25** is energized at predetermined intervals. The parts **13–25** together form a feed for intermittently advancing the knife **8** so as to compensate for its wear. The frequency at which the electromagnet **25** is energized is a function of the speed of the cutting mechanism.

To remove the knife **8**, the operator turns a screw **26** which can disengage the pawl **20** from the ratchet wheel **19**. The feed screw **13** is then rotated by means of a screwdriver or the like to move the holder **11** to its lower end position, as viewed in FIG. 1. Counterweights **27**, **28** are provided on the carriage **2** opposite the knife **8** to balance the mass of the knife and of the parts which serve to feed it with reference to the plates **9**, **10**.

When the shaft **1** rotates, the knife **8** performs a composite movement including a movement about the axis of the shaft **1** and a tilting movement about the axis of the shaft **3**. When its cutting edge engages a tobacco rod, the knife **8** is normal to the axis of such tobacco rod and travels in the same direction and at the same speed.

The heretofore described parts of the cutting mechanism comprise several protuberances or protrusions (such as the counterweights **27**, **28**, portions of the carriage **2**, the screw **26**, the outer end portion of the feed screw **13**, and others) which are likely to produce noise when the knife **8** is driven at a high speed such as is necessary to sever from the tobacco rod up to and in excess of 2,000 sections per minute. The noise is due to turbulence or vibrations created in the surrounding atmosphere. In accordance with the present invention, such noise is either reduced or eliminated by adding to the just described parts a further part **30** which forms with the other parts an assembly whose external configuration is substantially free of protrusions or projections. The part **30** is a relatively short cylindrical envelope or jacket which includes a cupped portion having a bottom wall or first end wall **31** and a cylindrical circumferential wall **36**, and a cover or second end wall **32** which resembles the bottom wall **31** and is affixed to the wall **36** by screws **34** or like detachable fasteners. Screws **33** serve to fasten the bottom wall **31** to the forked portion **4** of the carriage **2**. The wall **36** has two tapped bores which are normally closed by screws **35**, **35***a*. The screw **35** is removed when the operator wishes to gain access to the head of the screw **26** in order to disengage the pawl **20** from the ratchet wheel **19**, and the screw **35***a* is removed when the operator wishes to turn the feed screw **13** preparatory to removal of the knife **8**. An opening **37** in the wall **36** serves to permit protrusion of a portion of the knife **8** beyond the external surface of the envelope **30**. The heads of screws **33**, **34**, **35**, **35***a* are preferably recessed into the envelope **30** to further reduce the likelihood of turbulence or vibration of surrounding air. For the same reason, the external surface of the envelope **30** is preferably smooth so that the friction between the envelope and the surrounding mass of air is minimal.

It is clear that the shape of the envelope **30** can deviate from a cylinder. For example, the wall **36** can be replaced with one having a convex external surface which can but need not taper in a direction from the cover **32** toward the bottom wall **31** or vice versa. Also, the wall **36** can be assembled of two or more mutually inclined sections. For example, and as shown in FIG. 2, the circumferential wall **236** of the envelope **230** can be provided with a cylindrical median portion and two frusto-conical end portions. The bottom wall of the envelope **230** is shown at **231**. The cylindrical portion of the

wall **236** has an opening or cutout **237** for a portion of the knife **208**.

FIG. 3 shows an envelope or jacket **330** having a bottom wall **331** and a circumferential wall **336** whose external surface is convex and which is provided with an opening or cutout **337** for a portion of a knife **308**. The dimensions of each of the openings **37**, **237**, **337** are selected with a view to permit requisite movements of the knives **8**, **208**, **308** with reference to the respective envelopes.

In order to further reduce the number of sharp edges and other parts which are likely to create noise during rapid rotation of the drive shaft, the envelope **30**, **230** or **330** can be provided with a plug or like closing means for the unoccupied portion of the opening **37**, **237** or **337**. A modified cutting mechanism wherein the opening for the knife **408** is closed all around the knife is illustrated in FIGS. 4 and 5. With the exception of the novel noise reducing means, the mechanism of FIGS. 4–5 is similar to the one disclosed in British Pat. No. 1,017,238. It comprises a carriage **402** which supports the knife **408**, and an envelope or jacket **430**. The knife **408** is mounted between two plates **409**, **410**. The gears **414**, **415**, the shaft **452**, the worm **451** on the shaft **452** and the worm wheel **453** shown in FIG. 4 form part of a feed for advancing the knife **408** so as to compensate for wear. A spring-biased ball **454** is employed to increase the pressure with which the plates **409**, **410** bear against the knife **408** in response to increasing rotational speed.

The carriage **402** is driven by a shaft **470** which receives torque from a transmission or motor **471**. The axis of the shaft **470** is shown at **455**. During each revolution of the shaft **470**, the knife **408** is rocked once back and forth about the axis of a shaft **456**. The means for effecting such rocking movements includes a suitable universal joint, not shown.

The envelope **430** comprises a bottom wall or end wall **431** which is secured to the carriage **402** by screws or like fasteners **433**. The cover or second end wall **432** is secured to the carriage **402** by screws **434**. The circumferential wall **436** of the envelope **430** has a round aperture or opening **430***a* for a rounded closing member **459**. The latter has an arm or extension **458** secured to a bearing sleeve **460** on the shaft **452** by a screw **457**. This arrangement permits the closing member **459** to turn in the aperture **430***a* and to thus participate in similar movements of the knife **408**.

A hollow shaft **472** which is mounted in a bearing **473** corresponds to the shaft **5** of FIG. 1 and serves to accommodate a portion of the feed for the knife **408**.

The configuration of the wall **436** is similar to that of the wall **336** in FIG. 3; however, such configuration can be changed to resemble that of the wall **36** or **236**.

An important advantage of the envelope **430** is that it imparts to the cutting mechanism of FIGS. 4 and 5 an external configuration which is capable of keeping the noise to a minimum. The sole protrusion is that portion of the knife **408** which extends beyond the closing member **459**, and the opening for the knife is completely closed at all times. The external surface of the envelope is smooth. Experiments with my cutting mechanism have shown that the envelope can reduce noise well beyond expectations. For example, by applying the envelope **30**, **230**, **330** or **430**, one can reduce the noise from 103 to 88 Phon. Moreover, the envelope **430** of FIGS. 4 and 5 prevents entry of dust, particularly of particles of tobacco which are present in the surrounding atmosphere if the material to be severed is a tobacco rod.

It is also within the purview of our invention to omit the envelope and to combine the parts which support, orbit, reciprocate and feed the knife in such a way that these parts together form an assembly which is substantially or entirely free of protuberances to thus minimize turbulence and noise. The invention can be embodied in cutting mechanisms wherein the knife is fixedly mounted

in a carriage as well as in those where the knife can move back and forth relative to the carriage. Instead of using an envelope, the mechanisms shown in the drawings could be provided with lightweight parts which complement the carriage, the counterweights and the feed to form therewith an assembly having an external configuration which is free or substantially free of protuberances. However, the envelope is preferable for application to existing cutting mechanisms because it can be produced and mounted at a reasonable cost.

What is claimed as new and desired to be protected by Letters Patent is:

1. In a cutting mechanism for travelling tobacco rods or like elongated bodies, a combination comprising knife means; and a plurality of parts for supporting said knife means and for moving the latter with reference to at least one axis at speeds which are high enough to cause the generation of noise in response to turbulence created in the surrounding atmosphere by protrusions of moving parts, said parts together forming a rotating assembly and at least one of said parts forming an envelope which rotates with and imparts to said rotating assembly an external configuration which is substantially free of protrusions to thus minimize turbulence in the surrounding atmosphere.

2. A combination as defined in claim 1, wherein said assembly resembles a body of rotation and wherein solely said knife means extends substantially radially of said assembly.

3. A combination as defined in claim 1, wherein said assembly of parts includes a circumferential wall provided with a substantially convex external surface.

4. A combination as defined in claim 1, wherein said external configuration is the configuration of a body of rotation whose axis coincides, at least substantially, with said one axis.

5. In a cutting mechanism for travelling tobacco rods or like elongated bodies, a combination comprising knife means; and a plurality of parts for supporting said knife means and for moving the latter with reference to at least one axis at speeds which are high enough to cause the generation of noise in response to turbulence created in the surrounding atmosphere by protrusion of moving parts, said parts together forming an assembly having an external configuration which is substantially free of protrusions to thus minimize turbulence in the surrounding atmosphere, said assembly of parts including an envelope which imparts thereto said external configuration and includes a circumferential wall having an aperture and a closing member movably and sealingly received in said aperture, said knife means comprising a portion extending outwardly through and being movable with said closing member.

6. A combination as defined in claim 5, wherein said closing member is round.

7. In a cutting mechanism for travelling tobacco rods or like elongated bodies, a combination comprising knife means; and a plurality of parts for supporting said knife means and for moving the latter with reference to at least one axis at speeds high enough to cause the generation of noise in response to turbulence created in the surrounding atmosphere by protrusion of moving parts, said parts together forming an assembly having an external configuration which is substantially free of protrusions to thus minimize turbulence in the surrounding atmosphere, said parts of said assembly including a carriage rotatable about said axis, a feed having portions supported by said carriage and operatively connected with said knife means to feed the same substantially radially of said axis in order to compensate for wear of said knife means, counterweight means provided on said carriage to balance the mass of said knife means and of said feed, and an envelope fixed to said carriage and accommodating the latter as well as said feed and a portion of said knife means, said envelope having a smooth external surface and including two halves which are mirror symmetrical with reference to a plane which is substantially normal to said axis.

8. In a cutting mechanism for travelling tobacco rods or like elongated bodies, a combination comprising knife means; and a plurality of parts for supporting said knife means and for moving the latter with reference to at least one axis at speeds which are high enough to cause the generation of noise in response to turbulence created in the surrounding atmosphere by protrusion of moving parts, said parts together forming an assembly having an external configuration which is substantially free of protrusions to thus minimize turbulence in the surrounding atmosphere, said assembly including an envelope arranged to rotate about said axis and providing a substantially airtight enclosure for the remainder of said assembly and for a portion of said knife means.

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U.S. Cl. X.R.

83—329