March 26, 1968 A. SCHMERMUND 3,374,699

SHARPENING ARRANGEMENTS

Filed July 28, 1965 2 Sheets-Sheet 1

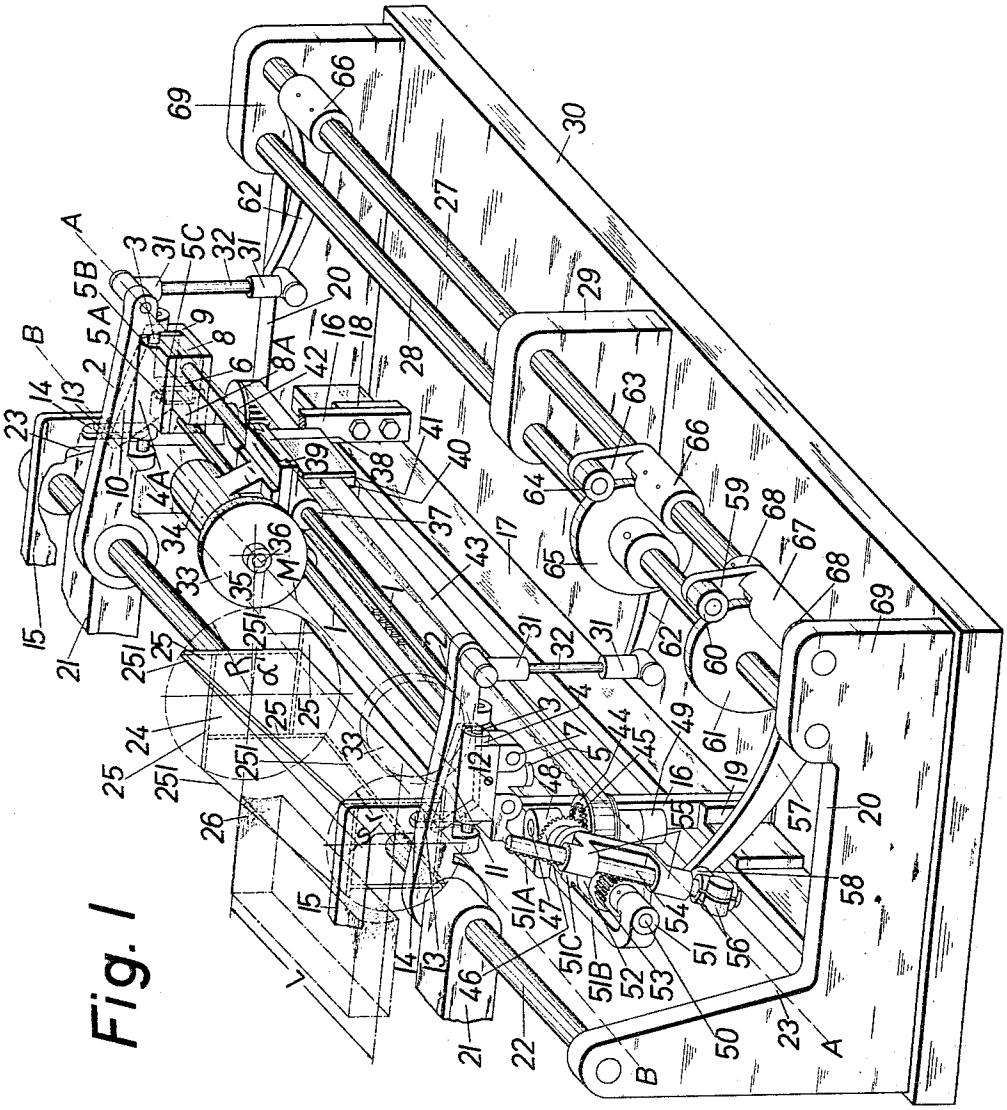

Fig. 1

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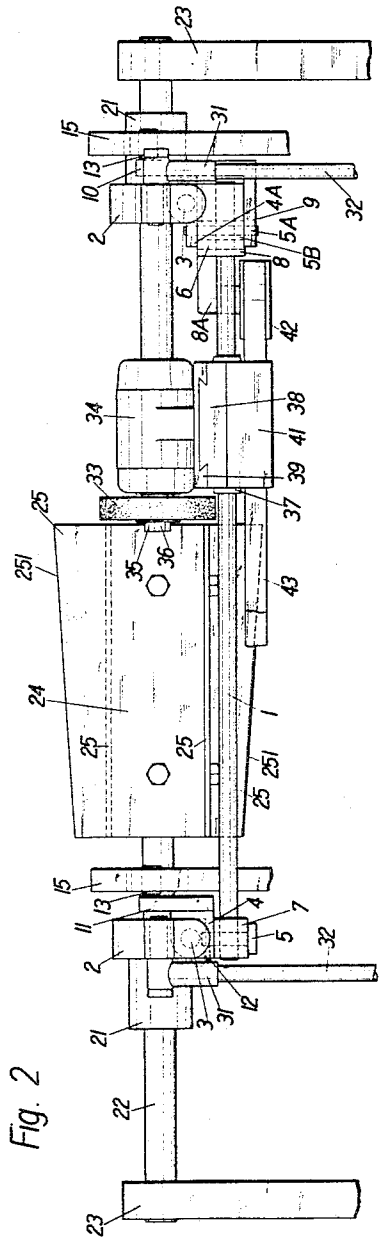

Fig. 2

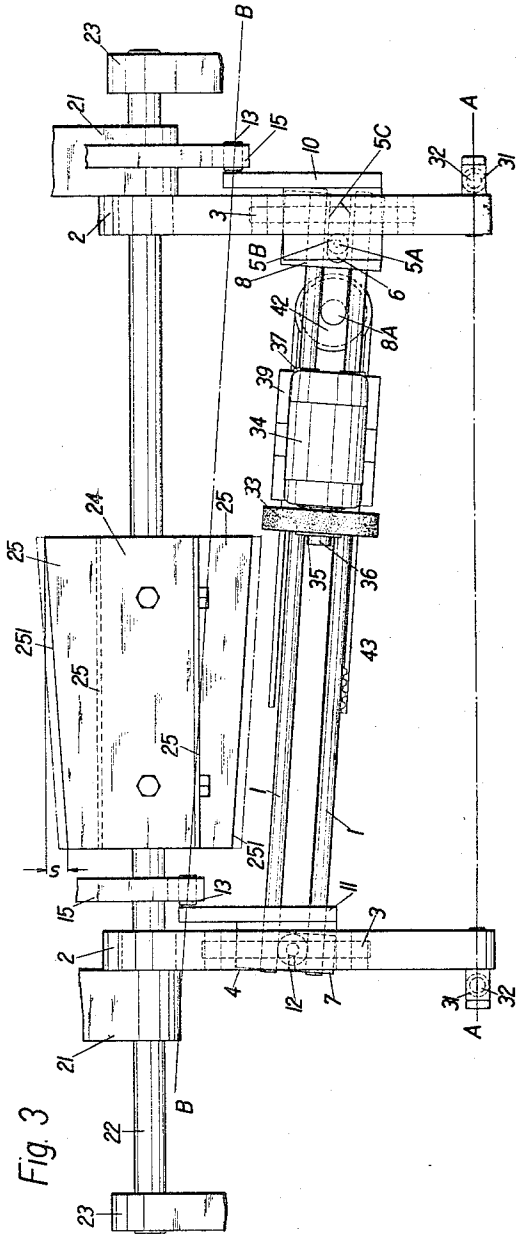

Fig. 3

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SHARPENING ARRANGEMENTS

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ABSTRACT OF THE DISCLOSURE

A rotary cutting device is described to cut, for example, tobacco, in which straight rotating cutting edges are inclined relative to the axis of rotation so that each cutting edge engages the tobacco progressively to obtain a slicing action rather than a chopping action. The invention provides a rotatable disc for sharpening the cutting edges while they are rotating. For ensuring that the cutting edges, notwithstanding repeated sharpening, remain straight, the sharpening disc is mounted in a lever arrangement operable by cams which are rotatable synchronously with the cutting edges so that the disc is reciprocated in the direction of the cutting edge which is being sharpened and is oscillated in a curved path transversely to the axis of rotation of the rotatable sharpening disc; means may be provided for feeding the sharpening disc towards the cutting edges.

Description of invention

The invention relates to arrangements for sharpening rotating cutting edges.

When cutting, for example, tobacco by means of rotatable cutters, it is desirable to sharpen the cutting edges of the cutters while the cutters and therewith their edges are rotating. It is also desirable that during its rotation, each cutting edge progressively engages the tobacco to be cut in order to obtain a slicing action rather than a chopping action. It is further desirable to employ cutters having straight cutting edges, since such cutters are less expensive to manufacture than cutters having curved cutting edges.

In order to achieve a slicing action, it has been proposed to incline each straight cutting edge relatively to the axis of rotation so that the cutting edge when rotating describes a hyperboloid of revolution. An arrangement has further been proposed for sharpening such an inclined straight cutting edge while rotating, the arrangement comprising a sharpening device movable rectilinearly at an inclination to the axis of rotation of the cutting edge, said inclination corresponding to the inclination of the cutting edge relatively to its axis of rotation.

The proposed arrangement has proved to be generally satisfactory.

However, if the straight cutting edge is given a comparatively great inclination relative to its axis of rotation, it has been found that an initially straight cutting edge is liable to become curved owing to repeated sharpening.

It is an object of the present invention to provide an arrangement for sharpening a straight cutting edge while it is rotating.

It is a further object of the invention to provide such a sharpening arrangement which permits sharpening of a rotating cutting edge which is inclined to the axis of rotation.

It is a still further object of the invention to provide an arrangement for sharpening a straight, inclined rotating cutting edge without curving the initially straight cutting edge during repeated sharpening.

It is another object of the invention to provide such an arrangement for sharpening a plurality of cutting edges of a cutting device having a plurality of rotatable cutters.

These and other objects and advantages of the invention will become apparent to those skilled in the art from the following detailed description when read in conjunction with the accompanying drawings which are given by way of example and in which:

FIG. 1 is a perspective view, partly broken away, of a specific arrangement of the invention;

FIG. 2 is an elevational view of a part of the arrangement of FIG. 1; and

FIG. 3 is a plan view seen from above of the part illustrated in FIG. 2, FIGS. 2 and 3 being on a larger scale than FIG. 1.

The arrangement illustrated comprises a base **30** provided with opposite side walls **20** having extensions **23** in which a shaft **22** is rotatably mounted. A carrier **24** is fixed to the shaft **22** and carries four cutters **25** each having a rectilinear cutting edge **251**. The cutting edges are inclined relative to the axis of rotation of the shaft **22**, so that each cutting edge on rotation describes a hyperboloid of revolution. One end of each cutting edge **251** is rotatable along a circle of radius R, the opposite end of each cutting edge being rotatable along a circle of radius *r*. Means for displacing a disc **33** for sharpening the cutting edges **251** in a direction parallel thereto comprise two rods **1** which are arranged parallel to each cutting edge **251** when in position for sharpening and which thus are inclined to the shaft **22**, the inclination corresponding to the difference between the radii R and *r*. The rods **1** are mounted at one end in a holder **7** and at the other end in a holder **8**. The holder **7** is rotatable about a stud **5** held by a screw **12** in a guide member **4**. The holder **8** is mounted on a bracket **9** fixed to a guide member **4A** and is provided with a groove **5C**.

In the holder **8** and the bracket **9**, a stud **5A** is provided which carries a roller **5B** engaging the groove **5C**. Thus, the guide rods **1** together with the holders **7** and **8** are mounted on the guide members **4** and **4A**. The guide members **4** and **4A** are displaceably mounted on parallel guide rods **3** extending in transverse direction to the rods **1**, the guide rods **3** being fixed on arms **2** which by means of bushings **21** are rotatable about the shaft **22**, and thus the guide members **4** and **4A** together with the holders **7** and **8** are rotatable about the shaft **22**. The arms **2** are of equal length, and are connected to operating rods **31**, **32** which are linked to arms **62** mounted on a shaft **27** by means of hubs **66**. One of the arms **62** is provided with a roller arm **63** carrying a roller **64** which co-operates with a cam **65** mounted on a control shaft **28**. By means of the cam **65** the arms **2** and thereby the rods **1** with the sharpening disc **33** are rotatable about the shaft **22**.

The guide member **4** carries a guide link **11**, and the guide member **4A** carries a similar guide link **10**. The guide links **10** and **11** are each provided with a roller **13** rectilinearly movable in a stationary slot **14** provided in a bracket **15**, each bracket **15** being fixed at its lower end **16** to a traverse **17** by means of angular pieces **18** and **19**, the traverse **17** being mounted on the sidewalls **20**. The other end of each bracket **15** is fixed on a stationary part (not shown) of the machine.

The holder **8** has an extension **8A** which carries a toothed wheel **42**. On the holder **7**, holding arms **51A** and **51B** are provided which comprise bearings **51**, **51C**, **48** and **49** in which shafts **50** and **47** are mounted which are angularly inclined to each other.

On the shaft **47** a toothed wheel **44** and a bevel gear wheel **45** are mounted. A toothed driving belt **43** is trained around the toothed wheels **42** and **44**. On the shaft **50**, a pinion **53** and a further bevel gear wheel **46** are mounted, the further bevel gear wheel **46** meshing with the bevel gear wheel **45**. The bearing **51C** has a cylindrical exten-

sion on which guides **55** and a holder **52** for the guides **55** are rotatably provided. A rack **54** is mounted in the guides **55** and meshes with the pinion **53**. At one end, the rack **54** carries a clamp **56**, a projection **58** of which is pivoted to an arm **57** which has a hub **67** rotatably mounted on the shaft **27** and secured against axial displacement by retaining rings **68**. The arm **57** has a roller arm **59** carrying a roller **60** co-operating with a cam **61** rotatable by the control shaft **28**. The control shaft **28** and the shaft **27** are mounted in portions **69** of the side walls **20** and are additionally supported by a support wall **29**.

A guide member **37** for the sharpening disc **33** is slidably mounted on the rods **1** and carries an angular member **40** to which the driving belt **43** for displacing the guide member **37** is fixed by means of a clamp **41**. The guide member **37** is also provided with a transverse guide **38** on which a feed slide **39** is displaceable. On the feed slide **39** a motor **34** is mounted for rotating the sharpening disc **33** fixed thereto by means of a nut **35**.

A tobacco rod to be cut is indicated by reference numeral **26**. The width of the carrier **24** for the cutters **25** equals approximately the length L of the cutters **25** which in turn approximately equals the width of the tobacco rod **26**. A—A indicates a line passing through the centre of pivots connecting the operating rods **31**, **32** to the arms **2**. The distance *s* is indicative of the inclination of the cutting edge **251** relative to the axis of rotation of the carrier **24**.

B—B indicates a line which connects the points of contact between the sharpening disc **33** and a cutting edge **251** when the sharpening disc **33** is in its uppermost position. α indicates an angle through which the sharpening disc **33** can be turned upwards from a centre position; the sharpening disc **33** can be turned downwards by an equal angle so that the total angle of oscillations of the sharpening disc **33** amounts to 2α and is determined by the shape of the cam **65**.

While the sharpening disc **33** is oscillated through the angle of 2α by the cam **65**, the slide **39** is reciprocated by means of the cam **61**, rollers **60**, the roller arm **59**, the arm **57**, the clamp **56** with its projection **58**, the rack **54**, the pinion **53**, the shaft **50**, the bevel gear wheels **46** and **45**, the toothed wheel **44**, the belt **43**, the angular member **40** and the clamp **41**. While the sharpening disc **33** oscillates, the bearing **52** with the rack guides **55** follows the oscillations on the projections of the bearing **51C**. This is enabled by the projection **58** forming a pivot and the rollers **13** being movable in the slots **14**, so that the entire sharpening mechanism is moved by means of the guide members **4A** in the transverse direction along the guide rods **3**.

The feed of the sharpening disc **33** to the cutting edges **251** is effected by means of the transverse guide **38** and the feed slide **39** in known manner. The reciprocating and oscillating movements are controlled in timed relationship by the cams **61** and **65** which are jointly rotatable by the control shaft **28** which is driven by any suitable drive which also drives the shaft **22** for rotating the cutters **25**. The cams **61** and **65** are shaped and keyed to the control shaft **28** in such a manner that during sharpening a line connecting the centre of the sharpening disc **33** to the instantaneous point of contact between the sharpening disc **33** and the rotating cutting edge **251** which is just being sharpened passes through the axis of the shaft **22**, that is to say through the axis of rotation of the cutting edge **251**.

When this condition has been met the cutting edges will not be curved by repeated sharpening. It will be recognized that apart from the feed movement of the sharpening disc, a reciprocating movement of the same parallel to the cutting edges is required so that the cutting edge can be sharpened along its entire length. Furthermore, without the oscillatory movement the said connecting line would not, at any instant, pass through the said axis and therefore an irregular shape would be obtained for the cutting edge.

It should be clearly understood that the arrangement described and illustrated is given by way of example only. In fact, modifications, omissions and additions are possible without departing from the spirit of this invention.

I claim:

1. An arrangement for sharpening a rotatable straight cutting edge while rotating, comprising a rotatable carrier, at least one cutter attached to said carrier for rotation therewith, said cutter having a straight cutting edge inclined relative to the axis of rotation of said carrier so as to describe, when rotating, a surface of revolution of second order, a rotatable disc for sharpening said cutting edge while rotating, means for reciprocating said disc rectilinearly in the direction of said cutting edge while being sharpened, means for oscillating said disc in a curved path transversely to its own axis of rotation, and means for feeding said disc towards said cutting edge.

2. An arrangement as defined in claim **1**, wherein a plurality of cutters are attached to said carrier.

3. An arrangement as defined in claim **1**, and further comprising an electric motor for rotating said disc, said motor having a rotatable shaft carrying said disc.

4. An arrangement as defined in claim **3**, wherein said feeding means comprise a feed slide on which said motor is mounted, and means for guiding said feed slide in a direction transverse to the axis of rotation of said disc.

5. An arrangement as defined in claim **1**, wherein said feeding means comprise a feed slide carrying said disc, and means for guiding said feed slide in a direction transverse to the axis of rotation of said disc.

6. An arrangement as defined in claim **5**, wherein said reciprocating means comprise a toothed driving belt, gear means meshing with said toothed driving belt, means for alternatingly rotating said gear means in opposite senses, thereby reciprocating said toothed driving belt, and means for fixing said guiding means to said driving belt.

7. An arrangement as defined in claim **1**, wherein said reciprocating means comprise a toothed driving belt, gear means meshing with said toothed driving belt, means for alternately rotating said gear means in opposite senses, thereby reciprocating said toothed driving belt, and means for linking said disc to said belt.

8. An arrangement as defined in claim **7**, wherein said means for alternately rotating said gear means in opposite senses comprise a rotatable cam, a follower co-operating with said cam, a rack, linking means between said follower and said rack to reciprocate said rack, and means operatively connecting said rack to said gear means.

9. An arrangement as defined in claim **8**, wherein said oscillating means comprise a second rotatable cam, a second follower co-operating with said second cam, a linkage between said follower and said disc for oscillating the same, said arrangement further comprising a rotatable shaft, said cam and said further cam being keyed to said shaft for joint rotation, whereby the operation of said reciprocating means is correlated to the operation of said oscillating means.

10. An arrangement as defined in claim **1**, wherein said oscillating means comprise a rotatable cam, a follower co-operating with said cam, and a linkage between said follower and said disc for oscillating the same.

11. An arrangement as defined in claim **10**, wherein said linkage comprises a first shaft, a first arm connected to said follower and oscillatable about said shaft, a second arm connected to said first arm and oscillatable about said shaft, a second shaft, a rod pivoted to said second arm, a third arm pivoted to said rod and oscillatable about said second shaft, and a carrier rod carrying said disc and connected to said third arm.

12. A tobacco cutting arrangement comprising a rotatable carrier, at least one cutter attached to said carrier for rotation therewith, said cutter having a straight cutting edge inclined relative to the axis of rotation of said carrier so as to describe, when rotating, a surface of revolution of second order, a rotatable disc for sharpening

said cutting edge while rotating, the axis of rotation of said disc being substantially parallel to said cutting edge while being sharpened, means for reciprocating said disc rectilinearly in the direction of its own axis of rotation, means for oscillating said disc in a curved path transversely to its own axis of rotation, and means for feeding said disc towards said cutting edge.

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