Feb. 9, 1965
D. BARDEHAGEN ET AL. 3,168,848
CUTTING MECHANISM FOR ROD-MAKING MACHINES
Filed Aug. 7, 1962
4 Sheets-Sheet 3

Fig. 5

Fig. 6

Fig. 7

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The present invention relates to a cutting mechanism for cigarette rod making machines or the like, provided with one or several orbiting knife blades which cooperate during certain periods of time with locally fixed, freely rotatable grinding and honing tools.

The locally fixed, freely rotatable grinding and honing work tools are, with such types of cutting mechanisms, set into rotation to a greater or lesser extent during the temporary engagement of the rotating knife blade, especially of a curved sickle-like knife blade during each orbit of the blade. The degree of rotation of the grinding and honing work tools depends on the area of engagement and on the engagement pressure of the orbiting knife, whereby in particular the engagement pressure is subject to changes.

According to the present invention, there is imparted to the grinding and honing work tools an additional positive or forcible rotation by the fact that impeller blades or vanes are coordinated to the locally fixed, freely rotatable grinding and honing work tools which are adapted to be driven by an air stream directed against the same.

The air stream may be produced by operatively associating with these impeller blades or vanes blower nozzles directed thereagainst.

In one preferred embodiment according to the present invention, the air stream is produced by means of the cutting mechanism itself by coordinating one or several radially arranged transverse blades or wing members to the rotating part of the cutting mechanism which produces this air stream.

In one particularly simple embodiment according to the present invention, there is secured to the front end of the rotating knife holder for the knife, a radially arranged transverse blade or wing member.

The present invention offers particularly great advantages with cutting-mechanisms provided with rotating, re-adjustable curved sickle-like knife blades since the readjustment of the curved knife blade never coincides exactly with the extent of wear thereof. Most of the re-adjustable curved knife blades are advanced or fed intermittently because a continuous adjustment thereof requires only small expenditures by reason of the extraordinarily slight continuous adjusting value and because additionally the continuously operating adjusting mechanism operates inaccurately. With the intermittently re-adjustable curved knife blades, the abutment pressure against the grinding and honing work tools is largest shortly after the adjustment, and decreases continuously up to the next adjustment.

Additionally, in such installations, it happens that the abutment pressure of the curved knife blade becomes too small that the formerly engaged one is no longer still during the rotation of the grinding and honing work tool. The cutting edge of the curved knife blade therefore sharpens at one given place of the stationary grinding and honing work tools, the granular layer of which, serving for grinding purposes, thereby cuts grooves into the cutting edge of the curved knife blade so that the grinding edge receives a saw-like configuration. Additionally, the layer serving for the grinding purposes is abraded or worn off at this place of the grinding and honing work tools and becomes useless, and the danger that the grinding disk, after it has made a further rotation, comes to a standstill at this place, is particularly large. Since the freely rotatable grinding and honing work tools are driven by the air stream with a comparatively small but even pressure, the relative movement between the cutting edge of the curved knife blade and the grinding and honing work tools is smaller with a stronger abutment pressure of the curved knife blade and is larger with a smaller abutment pressure of the curved knife blade so that the grinding effect also remains approximately the same with differing abutment pressures. The mechanism according to the present invention differs thereby from the known prior art installations with driven grinding and honing work tools in which the relative movement between the cutting edge of the curved knife blade and these work tools is always the same independently of the abutment pressure, so that with stronger pressure considerably more material is ground off in such prior art mechanisms than is necessary for keeping the curved knife blade sharp. The edge life of the curved blade is therefore correspondingly short in the prior art constructions.

If the locally fixed, freely rotatable grinding and work tools consist of disks on the plane surfaces of which, facing the knife blade, grinding material is attached, then according to a further feature of the present invention it is proposed that the air vanes or impeller blades be arranged on the side of the disks opposite the plane grinding surfaces thereof. These air vanes or impeller blades are slightly curved in a preferred embodiment according to the present invention and are so aligned to the prevailing air stream that they can be readily set into rotation by the prevailing air stream without the formation of vortices or eddying currents.

The transverse blade or wing member at the knife holder is preferably provided with a curvature directed oppositely to the curvature of the air vanes or impeller blades on the work tool disks.

In order to prevent any possible damming-up of the air at the sleeves of the disks, the impeller blades or vanes terminate at a predetermined distance from these sleeves so that the air driving the impeller blades may leave in an unimpaired manner out of the area of the impeller blades. If the knife holder is surrounded by a housing, the front surface of which, arranged transversely to the direction of rotation, has a sufficient size, then a separate transverse blade or wing member may be dispensed with. It is thereby not even necessary to construct this housing in a manner corresponding to the transverse blade or wing member because this rotating housing produces sufficient air. In order to prevent the supply of air to the impeller blades within undesired areas, there are provided sheet-metal shielding members engaging into the air stream and covering or shielding a part of the impeller blades. This is particularly advantageous if the cutting mechanism is surrounded by a hood-shaped member and the distance between this hood-shaped member and the disks is comparatively small, because their exists with such type of arrangement the danger that the air is dammed up between the disks and the hood-shaped member so that no rotation of the disks is possible any longer. If the same grinding materials are bonded to both of the disks since they have the same task and merely sharpen or dress the curved knife blade. Nevertheless, for purposes of differentiation in the instant application, one of the disks will be referred to hereinafter as grinding disk and the other as honing disk.

Accordingly, it is an object of the present invention
to provide a cutting mechanism for rod-shaped articles, and more particularly a sharpening mechanism for the knife blade members thereof which effectively obviates the shortcomings and inadequacies encountered with the prior art constructions.

It is another object of the present invention to provide a knife blade sharpening mechanism for cutting installations having rotating knife means which assures at all times correct and sufficient sharpening of the knife blade, irrespective of the prevailing abutment pressure between the knife blade means and the work tools and irrespective also of the extent of wear.

A further object of the present invention resides in the provision of sharpening means for sharpening the cutting edges of rotating knives in cutting mechanisms for rod-shaped articles in which the sharpening work tools are positively rotated, particularly by an air stream in such a manner as to automatically compensate for differences in abutment pressure between the blade edges and the work tools.

Still a further object of the present invention resides in the provision of a sharpening mechanism for sharpening the edges of rotary knife means in cutting mechanisms for rod-shaped articles, particularly of the type utilizing an air stream for positively rotating or driving the work tools, which is simple in construction, does not involve expensive manufacturing and complicated assembly, is extremely reliable in operation and assures fully satisfactory sharpened cutting edges during the life and commensurate with relatively long working service of the cutting edges.

A further object of the present invention resides in the provision of means for assures proper operation of the positive drive arrangement for the rotating work tools in a sharpening mechanism for sharpening the cutting edges of rotating knives of cutting mechanisms, without the danger of producing undesirable air eddying or vortexing effects of the air stream, liable to endanger proper operation of the installation.

These and further objects, features and advantages of the present invention will become more obvious from the following description when taken in connection with the accompanying drawings which show, for purposes of illustration only, several embodiments in accordance with the present invention, and wherein

FIGURE 1 is a perspective view of a rotary knife-blade cutting mechanism for rod cigarette making machines to show the main shaft of the knife holder and with a sharpening means for the cutting edges of the knife blades in accordance with the present invention;

FIGURE 2 is an end view, on an enlarged scale, of the honing disk without the adjusting knob and support thereof, as viewed in the direction of arrow A thereof;

FIGURE 3 is an end view, on an enlarged scale, of the honing disk without the adjusting knob and support thereof, as viewed in the direction of arrow B of FIGURE 1;

FIGURE 4 is a partial perspective view, on an enlarged scale, of the knife holder of FIGURE 1 in accordance with the present invention;

FIGURE 5 is an end view, similar to FIGURE 2, of a modified embodiment of a grinding disk in accordance with the present invention;

FIGURE 6 is an end view, similar to FIGURE 3, of a modified embodiment of a honing disk in accordance with the present invention;

FIGURE 7 is an end elevational view of a modified embodiment of the knife holder in accordance with the present invention, provided with a housing covering the movable parts thereof;

FIGURE 8a, is an elevational view, partly in cross section, of the right portion of the cutting mechanism as viewed in the same direction as FIGURE 8a.

Referring now to the drawing wherein like reference numerals are used throughout the various views to designate like parts, and more particularly to FIGURE 1, this figure shows in perspective view the cutting mechanism of a cigarette-rod making machine. The cutting mechanism itself is mounted in an adjustable manner on two blocks which are secured to the machine frame. These blocks are not shown in the drawing for sake of clarity since they are unimportant insofar as the present invention is concerned and which would only obscure certain parts in the drawing of importance to the present invention.

These blocks (not shown) support with the inclined mounting surfaces thereof the securing and mounting surfaces 1 and 2a of the cutting mechanism. The manner of securing and of adjusting the cutting mechanism may be of any known type, and more particularly of the type described more fully in the copending application Serial No. 90,772, entitled "Device for Cutting Cigarette Rods," the subject matter of which is incorporated herein by reference insofar as necessary.

The mounting surface 2a forms a part of a flange generally designated by reference numeral 2 on which is mounted the driving gear box 3. A bearer member 4 for the grinding disk 5 and the honing disk 6 is secured at the driving gear box 3. The grinding disk 5 and the honing disk 6 are mounted, with the engaging surfaces thereof directed oppositely one another, on shafts 7 and 8 and 9 by means of sleeves 7a and 9a, respectively. The shafts 7, 8 and 9 are rotatable within bushes 10 and 11. Each of these bushes 10 and 11 is, as may be seen in connection with the bushing 11, axially displacable in a slotted disk support 12 and adapted to be clamped by means of clamping bolts or screws. The disk support 12 is secured at a bearer extension 13 by means of bolts 14 so as to enable swinging movements thereof approximately in a horizontal direction and secure clamping of the disk support 12 in any desired position. The bearer extension 13 is adapted to be displaced in the longitudinal direction thereof within a parallel guide system 15 and is adapted to be held fast in any desired position by means of bolts 16.

The knife supporting shaft 20 is rotatably supported in the driving gear box 3. The drive of the knife supporting shaft 20 takes place by means of intermediate drive means from a drive shaft 21, the drive of which is itself derived from the main shaft of the rod cigarette making machine. The knife disk 22 is secured at the knife supporting shaft 20, and the knife holder generally designated by reference numeral 23 is pivotally secured within the knife holder 22 by means of a cross shaft 24. The knife holder 23 consists, for example, of a knife receiving member 25 and of a counter plate member 26 between which is securely clamped a curved sickle-shaped knife-blade 27. The knife holder 23 may be of any suitable known construction, for example, as disclosed in the aforementioned copending application Serial No. 90,772 or as described in the copending application Serial No. 201,586, filed June 11, 1962, and entitled "Knife Mounting and Cutting Devices for Rod Making Machines, Particularly Cigarette Rod Making Machines."

For purposes of swinging the knife holder 23 about the shaft 24, the knife holder 23 is operatively connected in a Cardan-like manner with a rotating pin, schematically illustrated in the drawing by the dash line 28 which is rotatable within a bearing 29. This bearing 29 is provided, as mentioned hereinabove, with the inclined mounting surface 1. According to the present invention, the side of the grinding disk 5 opposite the grinding surface thereof is provided with impeller blades or vanes 17. The arrangement and construction of these impeller blades 17 is
shown more fully in FIGURE 2. Impeller blades or vanes 18 (see also FIGURE 3) are secured in a similar manner to the side of the honing disk 6 opposite the grinding surface thereof. A transverse blade or wing member 19 cooperates with the impeller blades 17 and 18 which is threadably secured at the knife receiving member 23 of the knife holder 123 (FIGURE 4).

The illustrated cutting mechanism is provided with an intermittently operable adjusting mechanism for the curved knife-blade thereof. The intermittently operable adjusting mechanism may be of any conventional type, and preferably of the type described in the aforementioned copending application Serial No. 90,772. This last-mentioned copending application also shows the details of a construction for controlling the pivotal movement of the knife support about the axis of the pivot shaft 24.

An adjusting knob 30 adapted to be moved in the direction of arrow 31 is also illustrated in FIGURE 1 of the drawing. The corresponding adjusting shaft associated with the adjusting knob 30 rotates, via a locking transmission, gear wheels and an intermediate drive, pressure rollers which engage the curved knife blade 27.

The pressure rollers displace, during rotation thereof, the curved knife blade 27 radially outwardly in the direction of arrow 32. A cutting tube 36 guiding a cigarette rod C (FIGURE 5) is arranged below the cutting mechanism which is adapted to reciprocate with the tube carriage 37 thereof on slide rod 38 in the direction of arrows 39.

**Operation**

The operation of the installation illustrated in FIGURES 1 to 4 is as follows:

During rotation of the knife support 22, the transverse blade or wing member 19 produces an air stream in the direction of arrow 33 (FIGURES 1 and 4). This air stream acts on the impeller blades 17 and 18 and thereby rotates the grinding disk 5 as well as the honing disk 6 in the direction of arrows 34 and 35, respectively (FIG. 1). The extent of rotation depends on the construction and size of the impeller blades 17 and 18 as well as of the transverse blade 19.

FIGURE 5 illustrates a modified embodiment of a grinding disk generally designated by reference numeral 105, the impeller blades or vanes 117 of which terminate at a distance from the bushing 107 mounted on the shaft 106. The ends 117a of the impeller blades 117 run out approximately tangentially into an imaginary circle the radius of which is larger than the outside radius of the bushing 107 by the aforementioned distance. As a result thereof the air flowing between the impeller blades 117 which is blown or discharged from a blower nozzle 147 coordinated thereto, may flow out in an unimpeded manner at the bushing 107 whereby any damming-up or eddying of the air disturbing the even rotation of the grinding disk 105 is prevented.

FIGURE 6 illustrates the honing disk generally designated by reference numeral 106, the impeller blades or vanes 118 of which are arranged in a mirror-image-like manner to the impeller blades 117 of the grinding disk 105. The ends 118a of the impeller blades 118 are, like the ends 117a of the impeller blades 117, at a distance from the bushing 107a seated on the shaft 109 and extend in the same direction. A blower nozzle 145 is coordinated to the honing disk 106.

FIGURE 7 illustrates a further modified embodiment of the knife holder in accordance with the present invention and generally designated by reference numeral 123 which is mounted with the knife receiving element 125 thereof on the cross shaft 124. The curved knife blade 127 is retained within the knife receiving member 125 by the counter plate 126. The movable parts supported in the knife holder 123 are protected by a housing 149 which is supported on the front surface 119 of the housing 140 is operable as transverse blade or wing member and produces the requisite air stream.

FIGURE 8a and 8b show the arrangement of the disks 105 and 106 within a hood-shaped member generally designated by reference numeral 141 which covers the cutting mechanism. FIGURE 8a illustrates the honing disk 106 at a comparatively small distance 142 from the boundary wall 141a of the hood-shaped member 141. There exists within this area the danger that the air is dammed up therewithin or the air stream affects in some other undesired manner the impeller blades 117. A sheet metal shielding member 143 secured at the hood-shaped member 141 and arranged below the honing disk 106 covers the endangered area against the air stream which is produced by the front wall 119 during rotation of the knife holder 123 mounted on the honing disk 106 and rotates the same. The effect of the air stream is maintained during and also a short period of time after the passage of the curved knife blade 127 through the cutting tube 136 for purposes of cutting the cigarette rod C. Subsequent thereto, the curved knife blade 127 comes into contact with the honing disk 106 and imparts thereto an additional rotation during the honing operation. During the further rotation of the knife holder 123, the air flowing in the direction of arrow 146a then drives the grinding disk 105 and rotates the same. During the subsequent engagement of the curved knife blade 127 at the grinding disk, this rotation is continued during the grinding operation. However, with a construction according to the present invention, it is assured that the grinding disk or honing disk rotates in every case prior to and during the respective grinding or honing operation. The support of the disks 105 and 106 is constituted in such a frictionally rotatable manner that only very slight friction losses occur. For that purpose, the usual lubricant is washed out of the bearings thereof and the same are filled with a relatively thin oil.

While we have shown and described several embodiments in accordance with the present invention, it is understood that the same is not limited thereto, but is subject to many changes and modifications within the spirit and scope of a person skilled in the art. For example, the present invention is not limited to cutting mechanisms of cigarette rod making machines. Instead, it is applicable also with equal success and advantage to the cutting mechanisms of other rod-shaped objects, for example, for rods of cigars, cigaretteillos, smoking-tobacco packages, filters or the like.

Accordingly, it is obvious that the present invention is not limited to the particular embodiments shown and described herein, but is susceptible of numerous modifications within the spirit and scope thereof, and we therefore do not wish to be limited to the details shown and described herein, but intend to cover all such changes and modifications as are encompassed by the scope of the appended claims.

We claim:

1. A cutting mechanism for cigarette rod making machines or the like, comprising knife means, means for orbiting said knife means in a predetermined path, relatively fixedly mounted but freely rotateable work tool means adjacent to a portion of said path to temporarily cooperate with said knife means during each of its orbits for sharpening the same, and impelling means, respectively associated with said work tool means for driving
said work tool means by an air stream directed against said blade means.

2. A cutting mechanism for cigarette rod-making machines or the like having parts, comprising rotating knife means, means for orbiting said knife means in a predetermined path, relatively fixedly mounted but freely rotatable work tool means adjacent to a portion of said path to temporarily cooperate with said knife means during each of its orbits for sharpening the same, impeller blade means operatively associated with said work tool means for driving said work tool means by an air stream directed against said impeller blade means, and means provided on said orbiting means for producing said air stream.

3. A cutting mechanism for cigarette rod-making machines or the like having rotating parts, comprising knife means, drive means for orbiting said knife means in a predetermined path, relatively fixedly mounted but freely rotatable work tool means adjacent to a portion of said path to temporarily cooperate with said knife means during each of its orbits for sharpening the same, impeller blade means operatively associated with said work tool means for driving said work tool means by an air stream directed against said impeller blade means, and a substantially transversely extending air wing driven by said drive means for producing said air stream.

4. A cutting mechanism for cigarette rod-making machines or the like, comprising knife means including knife holder means, means for rotating said knife holder means and for thereby orbiting said knife means in a predetermined path, relatively fixedly mounted but freely rotatable work tool means adjacent to a portion of said path to temporarily cooperate with said knife means during each of its orbits for sharpening the same, impeller blade means operatively associated with said work tool means for driving said work tool means by an air stream directed against said blade means, and a substantially transversely extending blade at the front side of said knife holder means for producing said air stream.

5. A cutting mechanism for rod-shaped articles, particularly for cigarette rod-making machines, comprising a knife, a knife holder for said knife, means for rotating said knife holder and for thereby orbiting said knife in a predetermined path, sharpening work tools including disk-like members relatively fixedly mounted but freely rotatable adjacent to a portion of said path and provided with grinding material on the plane surfaces thereof facing the cutting edges of said knife so as to sharpen the cutting edges during each orbit of the knife, impeller blades mounted on the opposite plane surfaces of said work tools to enable positive driving thereof by an air stream directed thereagainst, said impeller blades being curved, and means provided on and arranged to rotate with said knife holder for producing said air stream during rotation thereof, said last named means having a curvature oppositely directed to the curvature of said impeller blades.

6. A cutting mechanism for cigarette rod-making machines or the like, comprising knife-blade means, means for orbiting said knife-blade means in a predetermined path, relatively fixedly mounted but freely rotatable work tool means operable to be advanced in a step-like manner and adjacent to a portion of said path to temporarily cooperate intermittently with said knife-blade means for sharpening the same during each orbit of said knife blade means, and impeller blade means operatively associated with said work tool means for driving said work tool means by an air stream directed against said blade means in such a manner as to automatically and substantially compensate for changes in ambient pressure between said knife-blade means and work tool means to maintain substantially constant the extent of sharpening action during each engagement between said knife-blade means and said work-tool means.

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