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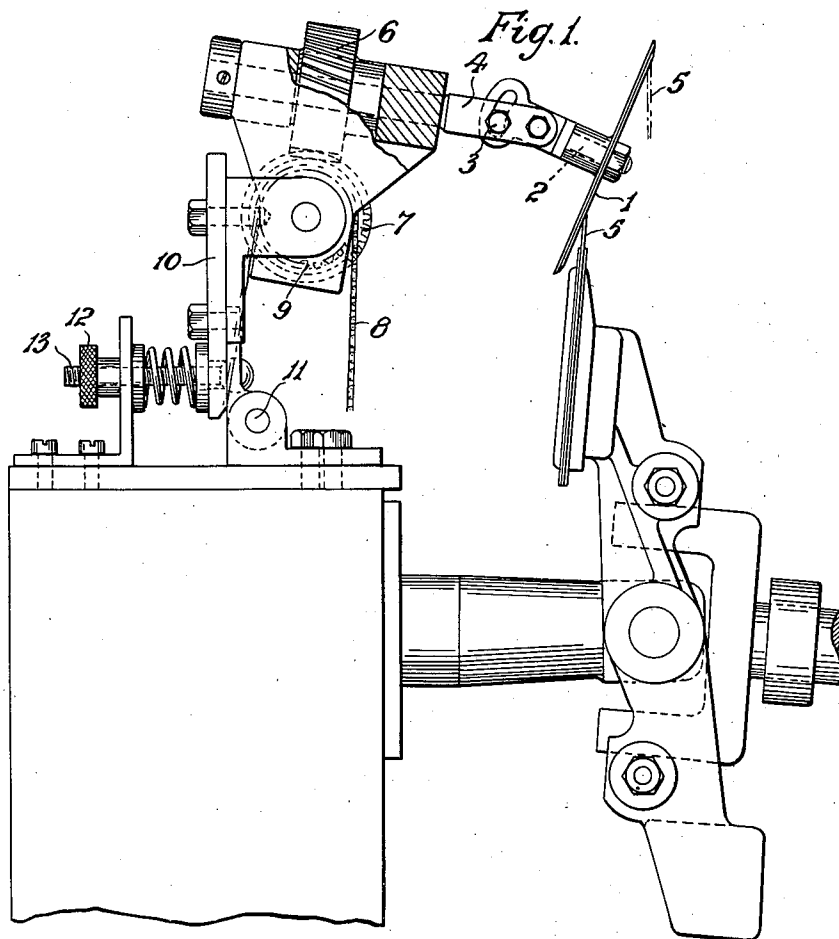
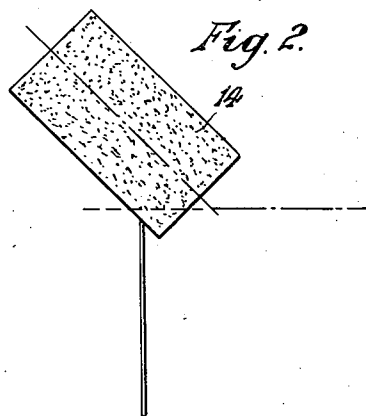
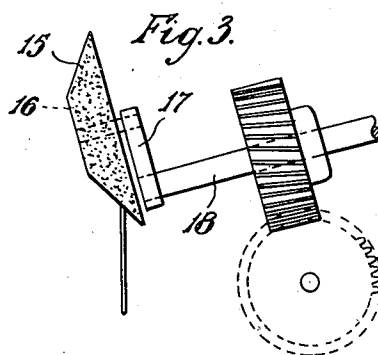
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GRINDING OF ROTATING ECCENTRIC KNIVES

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2 Sheets-Sheet 1



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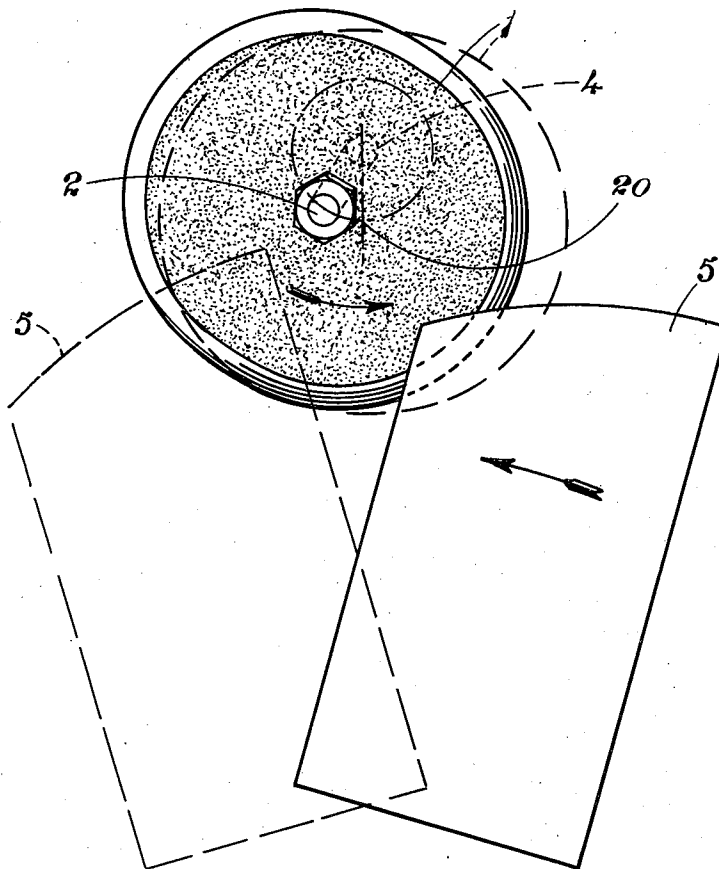


Fig. 4.

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UNITED STATES PATENT OFFICE

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GRINDING OF ROTATING ECCENTRIC KNIVES

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1 Claim. (Cl. 51—246)

This invention is for improvements in or relating to the grinding of rotating eccentric knives of the type in which the knife is mounted on a rotatable carrier and has its edge eccentric to the axis of rotation of the knife and carrier whether the knife rotates about an axis offset from the axis of the knife carrier, or whether the knife is fixed angularly relatively to the axis of the knife carrier, and whether or not the knife edge executes a movement in the direction of the axis of the knife carrier during the act of cutting.

According to the present invention there is provided a method of grinding knives of the type described which comprises the steps of rotating the knife and knife carrier about the axis of the latter, passing at least a portion of the knife edge as it rotates across a grinder that is inclined to the plane of the knife, and, as the knife edge sweeps past the grinder, changing the effective angle of inclination of the grinder relatively to the knife about a point which is at some distance from the part of the knife edge which is at the moment in contact with the face of the grinder (e. g. outside the plane of the knife). The purpose of changing the inclination of the knife about a point lying at a distance from that part of the knife edge which is touching the grinder is to allow for the change in the radial distance from the axis of the knife carrier to different parts of the knife edge. In this way it is possible to grind the edge of an eccentric knife whether or not the latter reciprocates in an axial direction. An advantage obtained with knives of the type described in which the knives reciprocate axially, is that with a moving grinder, it is possible to grind a knife having a greater radius of eccentricity to the axis of the knife carrier than would be possible if the grinder were fixed and at substantially the same angle of inclination to the knife edge, since for a given angular movement of knife about the carrier, the relative movement between knife edge and grinder can be increased, thus ensuring a better practical grinding angle as well as maintaining a sufficient radial increase of knife edge from the axis of the carrier, (for example more than the diameter or depth of the object to be cut).

Further, according to the present invention another method of grinding knives of the type described comprises the steps of rotating the knife and knife carrier about the axis of the latter, passing at least a portion of the knife edge as it rotates across a grinder that is inclined to the plane of the knife, and, as the knife edge sweeps past the grinder moving the grinder in a

direction that has a component at right angles to the axis of the cutter.

In one form of the present invention, apparatus for grinding knives of the type described comprises in combination a grinder inclined to the plane of the knife, a rotatable support for the grinder (e. g. having its axis inclined to the axis of the grinder), and means for driving the rotatable support at an angular speed that is equal to or an exact multiple of that of the knife carrier. Preferably the grinder is so mounted on the rotatable grinder support, that the axis of the latter intersects the face of the grinder.

In a modified construction according to the present invention, apparatus for grinding knives of the type described comprises in combination a grinder having a conical or convex grinding face, an axial spindle carrying the grinder and a rotatable shaft on which the grinder spindle is eccentrically mounted.

The invention will be more particularly described with reference to the accompanying drawings in which:—

Figure 1 shows a side elevation of apparatus constructed in accordance with one form of the invention.

Figure 2 shows diagrammatically a modified form of the invention.

Figure 3 shows another modified form of the invention.

Figure 4 is an elevational view taken from the right of Figure 1 and shows the relative position of the grinder and knife during the grinding operation.

Like reference numerals refer to like parts throughout the specification and drawings.

Referring to Figure 1, the grinder 1 is mounted so as to rotate freely on the spindle 2 that is adjustably clamped at 3 to a rotatable grinder support 4. This construction permits the knife to engage different parts of the grinder disc. The axis of the spindle 2 carrying the grinder 1 coincides with the axis of the grinder itself, and is inclined to the axis of the rotatable support 4. The axis of this latter may be either parallel to the axis of the knife, or inclined as desired.

The grinder is located in a suitable position so that as the knife rotates the grinder is brushed thereby.

The rotatable grinder support 4 is driven by 50 gears 6, 7, positively connected through the chain 8 and sprocket 9 to the drive for the knife itself, and the angular speed of the grinder support is either equal to, or an exact multiple of that of the knife (for example ratios of 1:1, 2:1, 3:1, 4:1, 55

etc.) so that the inclination of the grinder to the plane of the knife will be the same each time that the knife begins to make contact with the grinder.

5 Owing to the fact that the grinder is inclined to the rotatable support, the axis of the grinder sweeps a conical path, and the knife is so arranged that it engages a point of the grinder disc at some distance from the axis of the rotatable grinder support, so that as the latter rotates, the effective portion of the grinder face, (that is, the portion which is at the moment engaged by the knife edge) is gradually moved, so that the angle of inclination of the grinder to the knife is continually changing while the knife edge is being ground.

The arrangement of the parts is preferably such that the grinder spindle 2 which is adjustable angularly relatively to the rotatable grinder support 4 is sufficiently short or the angle of inclination of the spindle to the support sufficiently small that when the grinder is in its normal working position the axis of the rotatable support would, if produced, intersect the face of the grinder disc as seen in Figure 1.

In Figure 4 the knife 5 and the grinder 1 are shown in their relative positions at the beginning and at the end of the grinding operation. The dotted lines show the grinder and knife at the end of the grinding operation and the full lines show the relative positions at the beginning of the grinding operation. The arrows indicate the directions in which the center of the grinder and the knife are revolving. At the end of the grinding operation the center of the spindle 2 is at the position marked 20 in Figure 4. In this way the grinder follows the eccentric knife edge during the time of grinding, and the effect of this arrangement is to give the grinder an apparent tumbling movement about a point which at all times intersects the grinder face, thereby enabling for any particular size of grinder disc a relatively larger change in the effective angle of inclination of the grinder than would be the case if the axis of the grinder support lay outside the face of the grinder.

The grinder may be so arranged that the circular path traced out by the centre of the grinder disc lies within the circular path traced out by the knife edge viewed in the direction of the axis of the knife carrier as shown in chain lines in Figure 1.

In such a case the grinder would be so arranged that grinding occurs on that portion of the grinder that is above the axis of the latter. Instead of the grinder spindle being adjustably clamped to the grinder support, the spindle may be formed integrally with the grinder support.

In order to further facilitate the adjustment of the apparatus the grinding apparatus is carried on a frame 10 which is pivoted at 11 and a nut 12 co-operating with a screw 13 attached to the frame 10 is operable to move the grinding apparatus bodily towards or away from the knife 5.

In the alternative construction of the apparatus shown in Figure 2, the grinder is constituted by a roller 14 which is mounted so as to rotate freely on a spindle that is adjustably clamped to the grinder support in a similar manner to that in the last previously described construction. In this case, however, the axis of the rotatable grinder support is inclined to the axis of the knife carrier, and if desired, the arrangement may be such that the axis of the grinder sup-

port if produced will intersect the grinder face.

The motion of the grinder axis is in this case similar to that of the previous construction, and the effect of the rotation of the grinder support is to change the effective angle of inclination of the grinder to the plane of the knife as the latter sweeps past the grinder.

These constructions can be used for any eccentric knives whether or not they reciprocate axially during the cutting operation. In the case of knives which do not reciprocate axially, the eccentricity of the edge is maintained by the changing of the grinding angle of the grinder to the knife edge, thus allowing an increase of radius of the knife edge, measured from the axis of the knife carrier.

In the case of axially reciprocating knives, the same construction can be used, and the movement of the grinder may be used to supplement the normal axial movement of the knife, thereby ensuring a better angle of grinding and maintaining a satisfactory radius of eccentricity of knife edge.

In continuous rod cigarette machines it is customary to use knives which reciprocate in a direction parallel to the cigarette rod and which are mounted on the knife carrier in such a manner that they are fixed against angular movement relatively to the latter and have their edges eccentric to the axis of the carrier. These knives which are usually very thin are known in the trade as sickle knives.

It is found in practice that when thin sickle knives are employed the grinder should not be at too acute an angle to the plane of the knife thereby giving a very flat chamfer, because owing to the flexibility of the knife, the edge of the latter is bent over rather than ground, unless the angle between the knife and the face of the grinder is comparatively large.

With the grinders constructed according to the present invention, it is possible to obtain a steeper chamfer than would be obtained with a stationary grinder.

It is true that the angle of inclination of the grinder varies during the grinding operation, but it is found that the slight variation in inclination which does occur, does not adversely affect the cutting properties of the knife in any way.

It will be seen that many modifications may be made to the features of the invention without departing from the scope thereof, for example, the grinder may be fixedly attached to a spindle which is inclined to the face of the grinder, thereby providing a similar movement to that described with the constructions previously discussed.

Alternatively, a similar motion could also be obtained by mounting a grinder on an axial shaft, and giving the shaft a conical movement.

In another alternative, as shown in Figure 3, the grinder may comprise a conical or convex grinding face 15.

The grinder is mounted so as to rotate freely on a spindle 16 that is co-axial with the axis of the grinder. The spindle is mounted on one end of an arm 17 the other end of which is fixed on a rotatable shaft 18, which latter is positively driven so that its angular speed is equal to or is an exact multiple of that of the knife carrier. The axis of the rotatable shaft preferably intersects the grinder face. The grinder and its shaft have their axes parallel to the axis of the knife carrier. The shape of the grinder face enables the desired chamfer to be ground on the

knife edge, and the movement of the grinder towards and away from the axis of the knife carrier, enables an eccentric edge to be ground and maintained, whether or not the knife is reciprocating or possesses an equivalent movement in an axial direction.

What we claim as our invention and desire to secure as Letters Patent is:—

Apparatus for grinding rotating eccentric edged knives, comprising in combination a rotatable support for an eccentric edged knife, a grinding element having a working surface, a

rotatable supporting member on which the grinding element is eccentrically mounted, means to rotate said supporting member in timed relation with said rotatable knife support, said supporting member having a fixed axis of rotation, the said fixed axis when produced intersecting the said working face of the grinding element and the said working surface being also inclined to the said fixed axis.

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