Feb. 28, 1939. E. REANEY 2,149,230

COMPENSATING BLADE CLAMP

Filed Aug. 6, 1937

FIG. 1

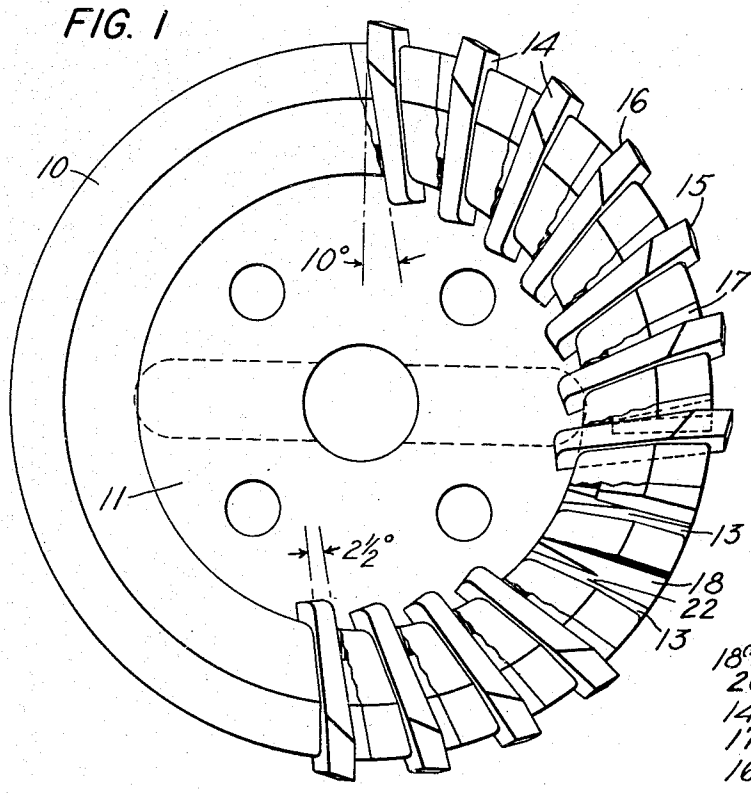


FIG. 2

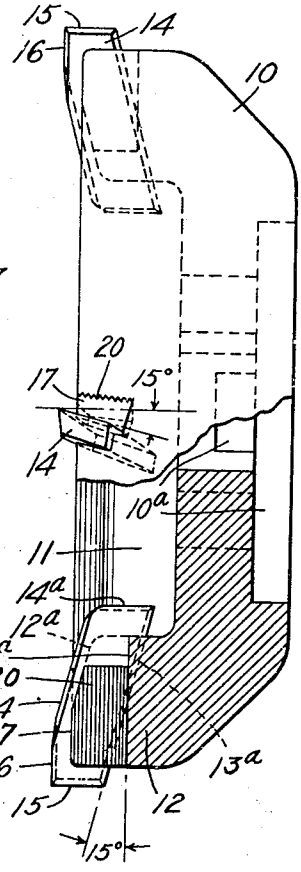


FIG. 3

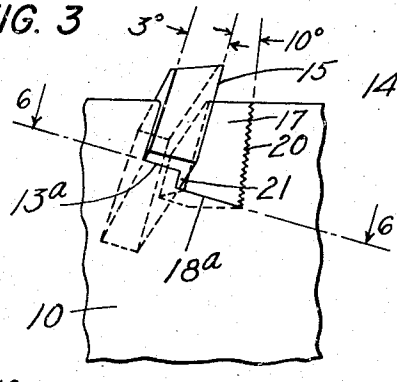


FIG. 4

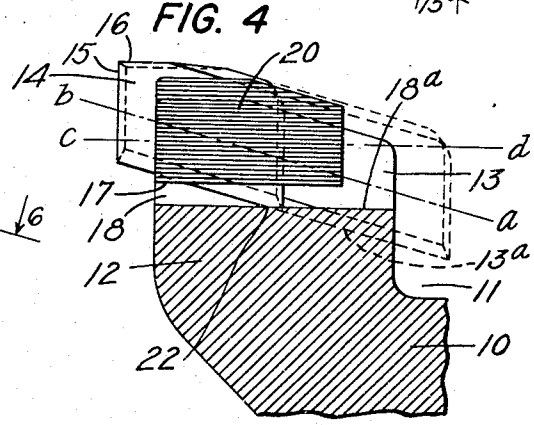


FIG. 5

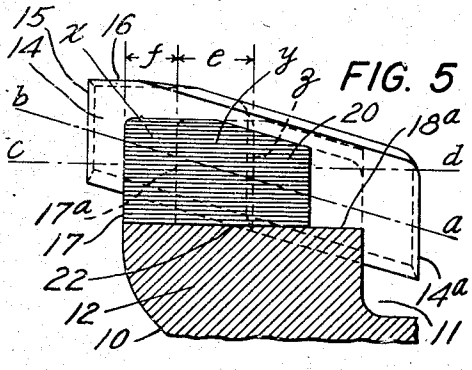
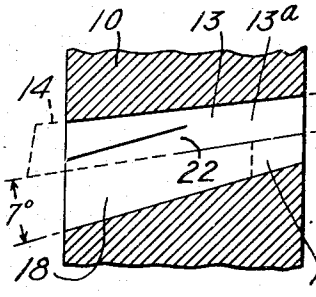


FIG. 6



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2,149,230

COMPENSATING BLADE CLAMP

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4 Claims. (Cl. 29—105)

The present invention relates to improvements in the clamping means for inserted blade cutters and has for its primary objective to obtain a firm clamping of the blade over an extensive area and particularly at regions close to the cutting edges in all positions of blade adjustment.

A further aim of the invention is to obtain a firm clamping of the blade against its front, rear, and bottom sides by a single rectilinearly movable element and which clamping becomes more firm and rigid as the tooling forces acting upon the blade increase in intensity.

Still another objective of the invention is to obtain compound adjustments of the blade member, that is, an adjustment in two directions simultaneously in one resetting and thereafter to effect a firm clamping of the blade in the region of the cutting edges in its reset position of adjustment.

The invention further aims to render available a blade clamping structure whereby the above ends may be attained and which may readily be adapted to single or multi-bladed cutters. And by way of additional improvements, to render available an inserted blade cutter in which blades may be repeatedly and independently readjusted to compensate for wear and regrinding of the cutting edges, and which is constructed of relatively few parts of simple design and easy manufacture having all of the advantages of a solid cutter plus the additional advantages of compound adjustment and blade replacement.

In realizing the aims of the invention, it is proposed to construct the cutting element in two parts, a blade member proper and a locking member. Each element is tapered longitudinally and also in a direction of its width and both elements fitting a complemental compoundly tapered and open sided recess formed in a body member. The general axis of the blade seating portion of the recess is inclined at an angle with respect to the general axis of the body so that when the blade member is adjusted longitudinally therein the cutting edges, formed at the projecting corner of the blade, advance forwardly and outwardly in a ratio dependent upon the angle of incline given to the blade seating surface.

The tapered locking member is adapted to lie adjacent the face of the blade and to move therealong in a direction transverse the longitudinal axis of the blade, that is to say, while the blade seating surface is inclined downwardly and rearwardly from the cutting end of the blade, the seating surface for the locking member, or at least its direction of movement, is rearwardly and upwardly relative to the blade. The relative longitudinal movement between the two members is such that one crosses the other.

In effecting a clamping action, the blade and locking members are inserted in the recess with their wide longitudinal edges toward the bottom and outer ends and the blade adjusted longitudinally on its inclined seat to the position required. Thereafter the wedge is driven inwardly to clamp the blade between its front and rear surfaces. By reason of the longitudinal and transverse tapers on the blade, inward movement of the wedge tends to shift the blade longitudinally and simultaneously inwardly firmly to engage the lower seating surface. In this way the blade is effectively clamped on three sides.

As the cutting edges on the blade become dulled, the blade may be adjusted outward along the inclined seating surface thereby causing the outer cutting edges to be advanced forwardly and laterally. The lock piece when next driven into clamping position would normally be caused to take up a new position further inwardly due to the reduction in the thickness of the blade as the latter is shifted outwardly. The inward movement of the wedge also moves its clamping affect on the blade, further rearwardly and away from the cutting edges. This is a disadvantage commonly found in prior structures for the reason that the more distant is the clamping affect, the greater is the tendency toward vibration and chatter. Furthermore, as the lock piece progressively moves to the rear and the blade progressively moves forward as it becomes used up, the point is soon reached where the lock piece overlaps the end of the blade a substantial amount. This overlapping reduces the effective clamping areas of the blade and lock piece to but a fraction of their original amount and places this small fraction at the tail end of the blade instead of at the cutting end thereof.

The present invention overcomes these difficulties and maintains a firm clamping action at the forward end of the blade in all positions of relative adjustment of the members. These ends are achieved by interlocking the lock piece with the cutter body so that it may be stepped bodily laterally to bring the lower and wider longitudinal edge thereof nearer the smaller dimensions of the recess. Thus, as the blade member is moved outwardly and reduces in thickness, the lock piece is moved bodily laterally and in effect increases in thickness thereby compensating for the loss in blade thickness without changing its position in an endwise direction. With this ar-

rangement the clamping action of the lock piece is maintained effective at the forward and cutting end of the blade throughout the life of the blade.

Other objects and advantages will be in part indicated in the following description and in part rendered apparent therefrom in connection with the annexed drawing.

To enable others skilled in the art so fully to apprehend the underlying features hereof that they may embody the same in the various ways contemplated by this invention, a drawing depicting a preferred typical construction has been annexed as a part of this disclosure and, in such drawing, like characters of reference denote corresponding parts throughout all the views, of which:

Figure 1 is a face view of a cone type milling cutter embodying the present invention.

Fig. 2 is a side view thereof partly in section.

Figs. 3 and 4 are respectively end and side sectional views of the blade clamp in different positions.

Fig. 5 is a variant of Fig. 4.

Fig. 6 is a plan view, taken along line 6—6 of Fig. 3, illustrating the relation of the surfaces at the bottoms of a blade and lock piece slot formed in the holder.

The milling cutter disclosed in Figs. 1 and 2 illustrates a preferred embodiment of the invention and which comprises a base or body member 10 recessed on its front face at 11 to provide annular upstanding flange 12 within which blade slots 13, extending in a general radial direction, are formed. The back of the body is recessed and slotted as at 10a to fit a standard spindle.

As is usual with blade type of cutters, the blades are inclined with respect to the diameter approximately 10° as shown in Fig. 1 and also inclined relative to the axis approximately 15° as shown in Fig. 2, in order to give the front face of the blade the proper cutting pitch relative to the work. In accordance with this invention, the blades and corresponding blade slots 13 are given a further incline in their pitched plane of approximately 15° as illustrated in Figs. 2 and 4, for a purpose later to be explained.

A blade member 14 provided with cutting edges 15 and 16 at its outer end, is adapted to be inserted in each of the blade slots 13 and clamped therein by locking member 17. Preferably the locking member 17 engages the front face of the blade, and to attain that relation an additional recess 18, in communication with the blade recess 13, is formed in the body member.

The blade and lock piece members are tapered longitudinally, the blade taper being approximately 2½°, and the lock piece taper approximately 7°, and the apposition side walls of the blade slot and locking member slot being correspondingly tapered. In addition to the longitudinal tapers on the members each member and adjacent side wall of the recess is also tapered in a direction of its width. This transverse taper being, in the case of the blade, approximately 3°, and in the case of the locking member approximately 10°, and both members being positioned in their related recesses with their widest edges toward the bottom and toward the outer or cutting ends.

As previously stated, the bottom wall 13a of the recess 13 inclines downwardly and rearwardly. The bottom wall 18a of the wedge receiving recess, however, extends rearwardly and upwardly relative to the bottom wall 13a with the result that as the wedge piece moves inwardly in a direction of its longitudinal axis *c*, *d*, it crosses the longitudinal axis *a*, *b*, of the blade member. By virtue of the transverse taper on the blade, longitudinal movement of the wedge inwardly tends to urge the blade member downwardly firmly against its seating surface 13a. Longitudinal movement of the blade member is resisted during the clamping action by reason of the longitudinal taper formed upon the back surface of the blade. The net result being, that the blade member is clamped firmly at its front, rear and bottom sides by the action of a transversely moving wedge piece. The clamping action, it will be seen, becomes more firm as the tooling forces acting upon the cutting edges 15 and 16 increase, for in that event, the blade member is also urged in a clamping direction.

To compensate for wear and regrinding of the cutting edges 15 and 16, the blade member is released from the body and adjusted outwardly along the incline surface 13a, which has been predetermined to effect an advance of the edges 15 and 16 in a ratio commensurate with the rates at which those edges wear and require resharpening. When the wedge piece 17 is reinserted it would ordinarily take up a position further rearwardly as represented in dotted lines 17a in Fig. 5 and the effect of its clamping action on the blade as shifted from the region marked *x* to the region marked *y* in Fig. 5. The further away this clamping region is from the cutting edges of the blade the less secure is the blade clamp. Furthermore, as the tail end 14a of the blade progresses upwardly along the inclined seating wall 13a, it finally will reach a position *z* wherein the wedge member considerably overlaps the end of the blade and the total clamping area on the blade is reduced to the small fraction indicated by the area *e* in Fig. 5, and this fraction applied at the extreme tail end of the blade instead of at its forward end.

A further disadvantage experienced in moving a wedge piece longitudinally the entire distance necessary to take up the loss in blade thickness is, that a substantial portion of the slot represented by the area *f* in Fig. 5 at the cutting end of the blade remains open. This opening will not only become jammed with chips but be severely mutilated by their cutting action, and in consequence when blade replacements are to be made, the wedge members no longer fit their recesses properly and insecure clamping results.

In order to eliminate the foregoing disadvantages, it is proposed to interlock the wedge member 17 with the body member by a series of interfitting formations such as serrations 20 extending between the adjacent faces of the wedge and body members. Preferably the serrations are relatively fine pitch, having an included angle of approximately 90° and a spacing of approximately .03, or approximately thirty-four to the inch. The interfitting serrations extend in the direction of the longitudinal axis of the wedge piece, that is, parallel to the line *c*, *d*, in Fig. 4, and which in cooperation with the transverse taper on the wedge affords lateral adjustability and a means for compensating for the loss in blade thickness without shifting the wedge inwardly the distance normally required to take up that loss.

Referring to Figs. 3 and 4 of the drawing, it will be seen that the wide edge of the wedge is toward the bottom and if it is stepped bodily outwardly one or more of the fine serrations, the

wide part of the wedge ordinarily would engage more narrow portions of the recess and the wedge piece would not move inwardly as far as it did originally. However, as the blade member reduces in thickness as it moves outwardly and thereby in effect increasing the dimensions of the recess, the bodily lateral movement of the wedge piece compensates for that variation. When the wedge is again driven home it occupies substantially the same position in an endwise direction as it did originally. This results in maintaining a firm clamping action at the forward end of the blade, in all positions within the normal life of the blade, while at the same time affording clamping action over a relatively large area by reason of the fact that the wedge member remains, in effect stationary and only the blade moves, whereas, in the variant disclosed in Fig. 5, both members move.

This mode of adjustment also has the further advantage that that portion of the blade and wedge receiving recess adjacent the cutting edges remains effectively closed under all positions of blade adjustment. Hence, the chips incident to the cutting operation cannot force their way into the aperture and mutilate or enlarge the opening.

By arranging the axis of movement of the blade and wedge members at an angle to each other, as indicated in the drawing, and by starting the lower wall 18a of the wedge receiving recess at a point such that it will intersect the wall 13a of the blade recess approximately midway its end, the effective clamping area of the wedge increases as it is stepped laterally outward. To obtain this result a lateral clearance space 21 entering the lower supporting wall 13a of the blade recess must be provided for the overlapping lower wedge portions. This clearance aperture 21 disappears at the point of intersection 22 of the lower walls 13a and 18a.

A tool holder embodying the foregoing explained clamping principle has the further advantage that the blades, in the case of a multi-bladed cutter, need not be all of the same length initially and it matters not whether the respective blades due to some inherent property or non-uniformity in their heat treatment, wear differently or dull faster than others, for each blade is capable of independent adjustment. In the specific cutter illustrated in the drawing, it will be seen that although the wedge members are driven inwardly in a radial direction, the tendency of the body to split whereby succeeding blades project different distances, is effectively eliminated by reason of the closed peripheral portions of the body member proper. As shown in Fig. 2, the blade slots are relatively shallow as compared to the axial length of the body member which portion may be left in the solid.

The incline of the blade slots and also of the end surface 12a of the body not only provides an exaggerated relief for the major portion of the blade so that it does not rub on the surface being machined but provides ample clearance space for the chips and freedom in their movement toward the large central cavity 11. The incline of the blades in the plane of their pitch makes it possible to use relatively narrow stock for the blades while nevertheless affording ample material for regrinding operations.

Without further analysis, the foregoing will so fully reveal the gist of this invention that others can, by applying current knowledge, readily adapt it for various utilizations by retaining one or more of the features that, from the standpoint of the prior art, fairly constitutes essential characteristics of either the generic or specific aspects of this invention and, therefore, such adaptations should be, and are intended to be, comprehended within the meaning and range of equivalency of the following claims:

Having thus revealed this invention, I claim as new and desire to secure the following combinations and elements, or equivalents thereof, by Letters Patent of the United States:

1. An inserted blade cutter combining a body member having an open sided and open ended blade receiving opening therein, the said opening having a blade seating inner wall inwardly inclined; a blade member insertable in said opening and seating on said inner wall, said blade member being tapered in the direction of its longitudinal axis and also tapered in the direction transverse thereto and positioned in said opening with its widest longitudinal edge toward the said inner wall and front end; a wedge member for clamping the blade in position in the opening comprising an elongated member tapered in the direction of its longitudinal axis and also tapered in the direction transversely thereto and adapted to be positioned in the said opening adjacent the blade with its widest portions inward and outward and the longitudinal axis thereof extending in a direction transverse the longitudinal axis of said blade whereby said wedge when moved longitudinally in the direction of its axis crosses the longitudinal axis of the blade and effects clamping of said blade member between the lateral walls of the said opening and in a transverse direction against said inner inclined seating wall of the opening.

2. A metal cutting tool combining a body member having a blade receiving recess therein; a blade and a blade clamping member in said recess, said blade member seating on an inner wall of the recess and said blade receiving recess being inwardly inclined with its longitudinal axis rearwardly inclined relative to end and lateral cutting edges formed on the blade and said clamp member being inwardly inclined with its longitudinal axis forwardly inclined relative to said blade member whereby the axes of said two members cross each other at an angle of approximately 15°, said clamp member in moving in a clamping direction tending to move the blade member longitudinally along its inclined seating surface and simultaneously in a transverse direction firmly against said inner wall of the recess; and interengaging means between said clamp member and a wall of said recess for adjusting said clamp member laterally in the recess in positive increments thereby to compensate for the reduction in thickness of said blade member as the latter is progressively advanced outwardly along its inclined seating surface.

3. A cutting tool combining a body member having a blade receiving recess provided therein; a blade and a wedge member insertable in the recess; the said recess having an inner wall inclined relative to the face of the body affording a seating surface for the blade; the longitudinal axis of said wedge member and blade member being mutually inclined whereby the wedge member diagonally overlaps the blade member at its larger end, said blade seating surface having a clearance aperture formed therein for receiving the said overlapping portion of the wedge member as the clamping surface thereof

moves laterally and inwardly to clamped position against the blade.

4. An inserted blade cutter combining a body member having a blade receiving recess therein, the said recess having an inner wall inwardly inclined relative to the face of the body; a blade member insertable in said recess and seating on said inner wall, said blade member being tapered in the direction of its longitudinal axis and also tapered in the direction transverse thereto and positioned in said recess with its widest longitudinal edge inwardly and toward the front end; an elongated wedge member tapered in the direction of its longitudinal axis and also tapered in the direction transversely thereto positioned in the said recess adjacent the blade with the longitudinal axis thereof extending at an angle to the longitudinal axis of said blade whereby said wedge when moved in the direction of its axis effects the clamping of said blade member in a transverse direction against said inner inclined seating wall of the recess; said blade and wedge members also having smooth opposed faces and said wedge member having a series of parallel serrations extending in the direction of its longitudinal axis formed on its opposite face; a series of complemental serrations on the side wall of the body member, said series of serrations affording means for adjusting said wedge member bodily laterally relative to the blade and positively holding said wedge member in laterally adjusted position to compensate for reduction in blade thickness incident to progressive outward adjustment along its inner seating surface and serving as guide means for said wedge member during movement longitudinally in effecting clamping action.

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