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SELF ADJUSTING KNIFE SHARPENING HEAD

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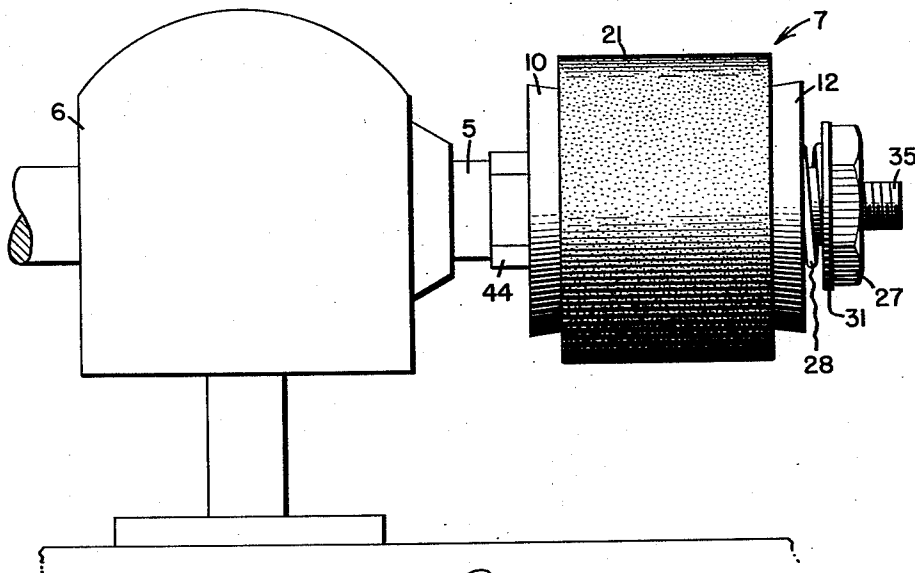


Fig. 1

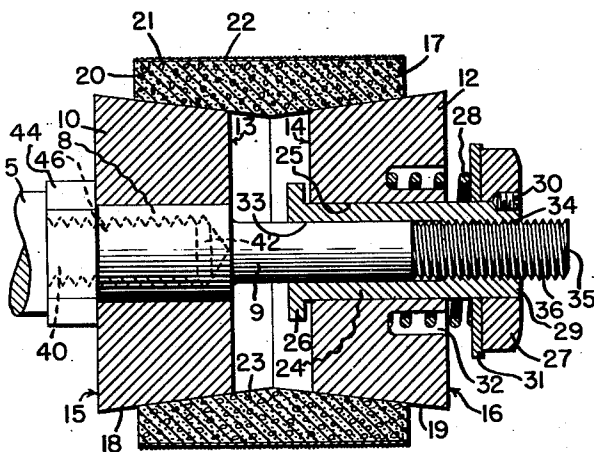


Fig. 2

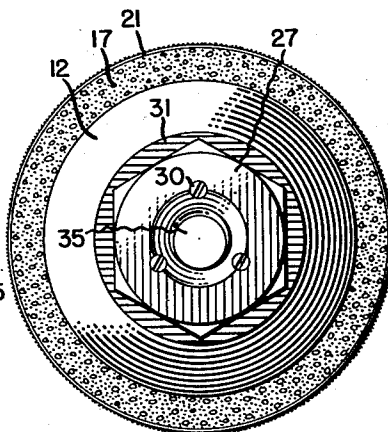


Fig. 3

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SELF ADJUSTING KNIFE SHARPENING HEAD

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7 Claims. (Cl. 51—190)

This invention relates to a self-adjusting knife sharpening head, which is adapted to sharpen or grind knives in such a manner as to preserve the original shape or contour thereof.

An object of the invention is to provide a self-adjusting sharpening head which is constructed so as to minimize and practically eliminate the possibilities of inadvertent over-grinding at any location along the length of a knife blade, irrespective of the skill on the part of the workman performing the grinding operation.

Another object of the invention is to provide a self-adjusting knife sharpening head which is self-equalizing, whereby to render it uniformly effective in its grinding function during extended periods of use, and which at the same time retains true balance and freedom from vibration.

Still another object of the invention is to provide a self-adjusting knife sharpening head which may be securely though releasably associated with the spindle of a conventional grinder for providing a highly resilient expansion rim immediately beneath an abrasive belt secured to and carried thereby.

A further object of the invention is to provide a device having the hereinabove described characteristics, which may be manufactured very simple and economically, with structurally durable parts of such nature as to require a minimum of servicing or repairs.

Still another object of the invention is to facilitate and expedite periodic replacement of the abrasive belt or element of the sharpening head, as may be necessary from time to time, utilizing simple and effective unitary means for the purpose.

These and other objects are attained by the means described herein and as disclosed in the accompanying drawings, in which:

Fig. 1 is a side elevational view of a grinder embodying the teachings of the present invention, shown applied to spindle 5 of a conventional grinder.

Fig. 2 is an enlarged vertical cross-sectional view of the self-adjusting knife sharpening head of Fig. 1.

Fig. 3 is an end elevational view of the sharpening head looking from right to left of Fig. 2.

In the grinding or dressing of certain types of knives or blades it is quite important to maintain the original shape or contour thereof if the knives or blades are to render maximum and efficient service. This is particularly true in those instances where the knives or blades constitute elements of a machine, and are required to operate in coordinated relationship to other knives and other elements of the machine. Under such conditions it is of utmost importance that the knives be subjected to no severe treatment in grinding or dressing, such as might alter their shape or configuration. The use of any ordinary hard grinding surface or wheel for sharpening or dressing the knives has been found destructive of the shape, contour and balance thereof to the extent of reducing the effectiveness of the knives, particularly in the event of hand grinding methods used by persons other

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than expert grinders. It is accordingly an objective of the present invention to provide improved means in the form of a self-adjusting knife sharpening head for the grinding of knives while preserving the original shape or contour thereof without requiring the employment of skillful grinding techniques.

With reference now to the drawings, the numeral 5 denotes generally the rotatable shaft or spindle of a conventional grinder which includes a motor or other power means 6 which may be employed for rotating the spindle and the sharpening head indicated generally by the numeral 7.

As best illustrated in Fig. 2, a mounting arbor 8 is secured to, axially aligned with and carried by spindle 5, it being noted that the forward end of the spindle terminates in a forwardly projecting externally threaded stud 40 receivable within an internally threaded socket 42 of the mounting arbor 8. Preferably, the enlarged end of the mounting arbor terminates in a nut-like portion 44 for permitting the use of a wrench to mount or remove the mounting arbor with reference to spindle 5.

The mounting arbor includes a forward section 9 of reduced diameter, the outer end of which is externally threaded as at 35. The manner of securing mounting arbor 8 to spindle 5 may be conventional, and forms no material part of the present invention, the only requirement being that the grinder spindle rotates with said spindle.

A pair of truncated cones 10 and 12 are provided having their minor faces 13 and 14 in spaced parallelism interiorly of the sharpening head. The major or base faces 15 and 16 of the conical members are exposed exteriorly of the structure. Frusto-cone 10, which is a fixed cone, may be press-fitted or otherwise fixedly secured upon portion 8 of the spindle for rotation therewith, whereas frusto-cone 12, which is the floating or equalizing cone, is mounted on the spindle for axial relative movement therewith. Both frusto-cones preferably are formed from a hard, inelastic or rigid material, for example, metal, fiber or other dense material which may provide firm support for an annular, continuous, substantially cylindrical elastic expansion rim 17 that embraces the peripheral smooth outer faces 18 and 19 of the frusto-cones.

The opposite ends of the elastic expansion rim 17 may be substantially parallel to one another and the outer cylindrical face 20 is adapted to resiliently support a continuous encircling band, belt or tube 21 provided with an exterior coating or layer of grit or other abrasive indicated generally by the numeral 22. The tubular band or belt 21 may, if desired, be formed of emery cloth, although in some cases it may be fabricated from other forms of flexible sheet material carrying any suitable abrasive having the desired cutting qualities.

It is imperative for the proper functioning of the head that the abrasive band or belt 21 be flexible in character and that rim 17, which supports it, be of a soft, compressible, preferably elastic substance, such as porous or cellular rubber, or its equivalent. A highly satisfactory material from which to form the elastic expansion rim 17 is sponge rubber, either natural or synthetic, having the desired characteristics of softness, compressibility and elasticity. When the rim 17 is made of such material, it will yield to any appreciable force applied to the flexible band or belt 21, and will readily conform to the shape of an object pressed against the belt or band. Hence the abrasive band or belt and its supporting elastic expansion rim 17 will be deformed in conformity with the shape or contour of the object being ground or dressed, so that as the grinding progresses the object undergoing grinding will retain substantially its original shape or

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configuration, uninfluenced by the normal shape of the abrasive surface of the sharpening head.

From the foregoing, it will be readily understood that a knife, for example, having a specified shape or curvature of cutting edge, may be applied to the rotating sharpening head for sharpening or dressing purposes, without danger of having the sharpening head impart to the cutting edge a shape or configuration other than that originally characterizing the cutting edge, even though the workman performing the grinding operation may be relatively unskilled in the art of grinding.

With reference again to Fig 2, it will be noted that in the preferred form of the invention the inner wall 23 of the elastic expansion rim may be preformed to accommodate the tapers of frusto-cones 10 and 12 as shown; however it is entirely practical to form the elastic expansion rim 17 with uniform wall thickness throughout its length, since the cones 10 and 12 will necessarily deform the elastic material as the cones are slidably inserted endwise into opposite ends of the elastic expansion rim, with the inelastic but flexible belt or band 21 serving to establish the maximum outside dimension and shape the elastic rim.

Means are provided for insuring easy and expeditious replacement of the abrasive band or belt 21. Such means, as herein disclosed, may be in the form of a single adjustable unit comprising the floating, equalizing frusto-cone 12 and suitable elements for advancing and retracting said frusto-cone relative to the elastic expansion rim 17 so that the disassembly of the head structure will not result in loss or misplacement of parts. It will be understood that if the abrasive band 17 is unattached from the outer face of the elastic expansion rim 17, it may be possible to slide the band endwise off the head structure after loosening or partially retracting floating frusto-cone 12 from the mounting armor. On the other hand, if the elastic expansion rim 17 and the abrasive band 21 are supplied as a unitary replacement assembly, it may then be advisable to effect replacement by physically removing the frusto-cone 12 from arbor 9, however the invention is not to be limited to either of the hereinabove mentioned procedures.

The floating, equalizing frusto-cone 12 and retaining means may comprise a unitary cylindrical frusto-cone adjusting bushing 24 loosely received in a central axial bore 25 of the floating, equalizing frusto-cone 12, and arranged for fixation at various positions of adjustment along the length of arbor 9. One end of the bushing 24 may be provided with a head or other abutment means 26 engageable by minor face 14 to retain and limit the travel of the floating or equalizing frusto-cone 12 toward fixed frusto-cone 10, whereas the opposite end of the bushing may be provided with a fixed knob or actuator 27 serving as an abutment for compression spring 28, which normally urges frusto-cone 12 toward head 26 of the bushing.

It will be noted that spring 28 constantly exerts a compressive force, the amount of which is determined by the position of the knob indicator 27 on the outer end 29 of the bushing 24. In other words, the compressive force of spring 28 may be regulated by removing the anchor means or screws 30 for re-locating actuator 27 axially along the bushing. However, such preloading of the spring, once established at the factory, need not ordinarily be disturbed thereafter.

The free outer end of spring 28 may abuttingly engage the inner face of actuator 27, or a washer 31, as illustrated, where as the inner end of the spring abuts and is received within an annular depression or groove 32 extending inwardly from major face 16 of the frusto-cone, whereby the frusto-cone is normally and yieldingly held against bushing head 26.

The outer end of bushing 24 may be internally threaded as at 34 for engagement with external threads 35 on the outer end 36 of the mounting arbor 9. Thus, by grasping actuator 27 and rotating it in one direction, then bushing

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24 may be rotated and advanced along and onto mounting arbor 9 to force the floating, equalizing frusto-cone 12 into the elastic expansion rim 17, for distending the rim and securely locating the latter on the tapered outer walls 18 and 19 of cones 10 and 12, respectively. Once frusto-cone 12 has reached the limit of advancement as permitted by the elasticity of the elastic expansion rim material, any further advancement of bushing 24 by actuator 27 will result in a separation of bushing head 26 from minor face 14 of the frusto-cone, with a consequent increase of compression imposed on the equalizer spring 28. This is the normal operating condition of the parts of the sharpening head. With the parts so adjusted and related, a proper maximum or allowable compacting of the elastic expansion rim 17 is achieved for insuring the most grinding results without damage to the elastic rim and/or the object being ground.

It should be understood that a knife or other object being ground may impose varying degrees of force in different directions and at various angles upon the abrasive belt or rim 21 with the resultant tendency to deform the grinding area of the belt in correspondence with the shape or contour of the object being ground, the degree of deformity being proportional to the amount of force applied. Consequently, by reason of the soft elasticity of the material of the elastic expansion rim, a major portion of the force applied by the knife or object undergoing grinding is absorbed by the elastic material of rim 17, and is thereby nullified or reduced as a grinding force. Therefore, the grinding area of the sharpening head is precluded from making severe cuts into the material of the knife, which, in the case of a rigid or hard grinding wheel, would promptly alter the shape or contour of the knife.

The self-encircling characteristics of the frusto-cones of the sharpening head assembly presents a distinct advantage in that it insures uniformity in the density of the elastic expansion rim throughout the grinding operation. In making the adjustments of the frusto-cone assembly, the actuator-knob 27 will be advanced to a position intermediate the limits of slidability of bushing 24 as established by actuator 27 and head 26 so that the equalizer spring 28 may serve to modify any floating motions of the equalizing frusto-cone 12 during the grinding operation.

It will be understood that various changes and modifications may be made within the structural details of the device, within the scope of the appended claims, without departing from the spirit of the invention.

What is claimed is:

1. Grinding apparatus adapted to avoid alteration of the contour of an object undergoing restoration by grinding, said apparatus comprising, in combination, a rotatable spindle having an end to be driven, and an opposite outer end, a screw thread on said outer end, a truncated cone-shaped support member axially bored and fitted tightly upon the spindle near the driven end thereof, said cone having a peripheral tapered surface inclined inwardly toward the threaded outer end of the spindle, an elongate bushing rotationally supported upon the threaded end of the spindle, an abutment on one end of the bushing, and an actuator fixed upon the opposite end of the bushing, a floating equalizer cone axially bored to slidably receive the bushing and to move axially thereon between limits established by the abutment and the actuator of the bushing, means yieldingly urging the floating, equalizing cone axially toward said abutment and away from the actuator, thread means on the bushing cooperating with the thread of the spindle, for advancing and retracting the bushing and the cone supported thereon axially of the spindle, the floating, equalizing cone having a peripheral tapered surface inclined inwardly toward the drive end of the spindle, on an inclination corresponding substantially with the inclination of the tapered surface of the fixed cone first mentioned, an elastic tubular rim spanning the tapered

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surfaces of the cones and supported thereon axially for rotation with the fixed cone and the spindle, and means providing an abrasive surface about the elastic tubular rim exteriorly thereof.

2. Grinding apparatus as defined in claim 1, in which the peripheral tapered surfaces of the cones are smoothly finished, to aid self-equalization of the floating cone relative to the fixed cone and the elastic tubular rim supported thereon, in the course of a grinding operation.

3. In a device of the class described, the combination of a rotatable spindle having an end to be driven, and an opposite outer end, a screw thread on said outer end, a truncated cone-shaped support member axially bored and fitted tightly upon the spindle near the driven end thereof, said cone having a peripheral tapered surface inclined inwardly toward the threaded outer end of the spindle, an elongate bushing axially bored and fitted about the spindle near the threaded end thereof for rotation relative to the spindle, an abutment on one end of the bushing, and an actuator fixed upon the opposite end of the bushing, a floating equalizer cone axially bored to slidably receive the bushing and to move axially thereon between limits established by the abutment and the actuator of the bushing, yielding means under constant compression acting upon the bushing to yieldingly urge the bushing abutment into contact with one end of the floating equalizer cone, thread means on the bushing cooperating with the thread of the spindle, for advancing the bushing and the cone supported thereon axially of the spindle, the floating, equalizing cone having a peripheral tapered surface inclined inwardly toward the drive end of the spindle, on an inclination corresponding substantially with the inclination of the tapered surface of the fixed cone first mentioned, an elastic tubular rim having an inner wall resting upon and spanning the tapered surfaces of the cones in concentricity therewith, and a flexible inelastic tubular band surrounding the elastic tubular rim and limiting outward expansion of the latter, said inelastic band having an abrasive outer face exposed for grinding purposes.

4. A device as defined in claim 3, in which the elastic tubular rim is of readily deformable porous rubber-like material adapted to conform with distortions imposed upon the inelastic tubular band by an object undergoing grinding.

5. Grinding apparatus adapted to avoid alteration of the contour of an object undergoing restoration, by grind-

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ing, said apparatus comprising in combination, a pair of axially aligned, laterally spaced frusto-cones having smooth, continuous, outer faces, a tubular rim of soft elastic material having a flat cylindrical outer surface and an inner surface which tapers uniformly outwardly from a maximum thickness at the center to a minimum thickness at the opposite ends thereof, said tubular rim carried by and spanning portions of the outer faces of said cones with the respective center and outer ends thereof unsupported and unconfined, and a flexible tubular band having an outer abrasive grinding surface embracing the outer surface of the rim, said rim forming a deformable backing member for said band.

6. Grinding apparatus as specified in claim 5, wherein the rim of soft elastic material comprises sponge rubber.

7. Grinding apparatus adapted to avoid alteration of the contour of an object undergoing restoration, by grinding, said apparatus comprising in combination, a pair of axially aligned, laterally spaced frusto-cones, a tubular rim of soft elastic material having a flat cylindrical outer surface and an inner surface which tapers outwardly from a maximum thickness at the center to a minimum thickness at the opposite ends thereof, said tubular rim carried by and spanning said cones with the respective center and outer ends thereof unsupported and unconfined, a flexible tubular band having an outer abrasive grinding surface embracing the outer surface of the rim, said rim forming a deformable backing member for said band, means for rotatably supporting said cones, and means for yieldably urging one cone axially toward the other to expand the elastic rim within the encircling abrasive band, with predetermined compressive force upon the material of said rim.

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