Sept. 1, 1925. 1,551,659

J. GOULDBOURN

ABRADING

Filed Feb. 10, 1922 2 Sheets-Sheet 1

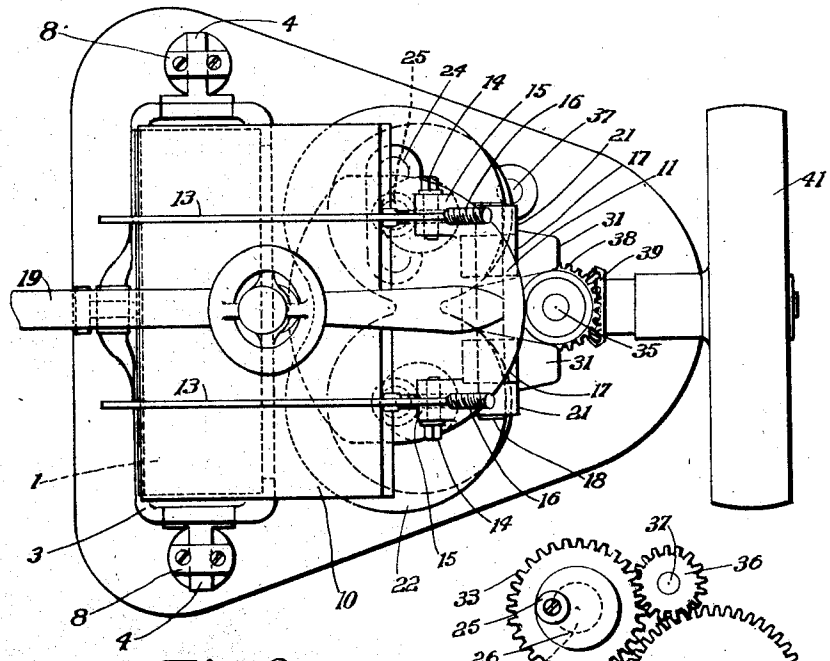


Fig. 2.

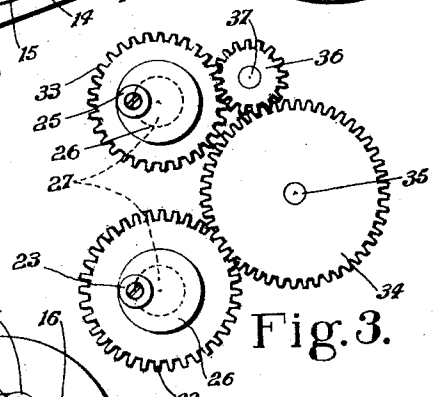


Fig. 3.

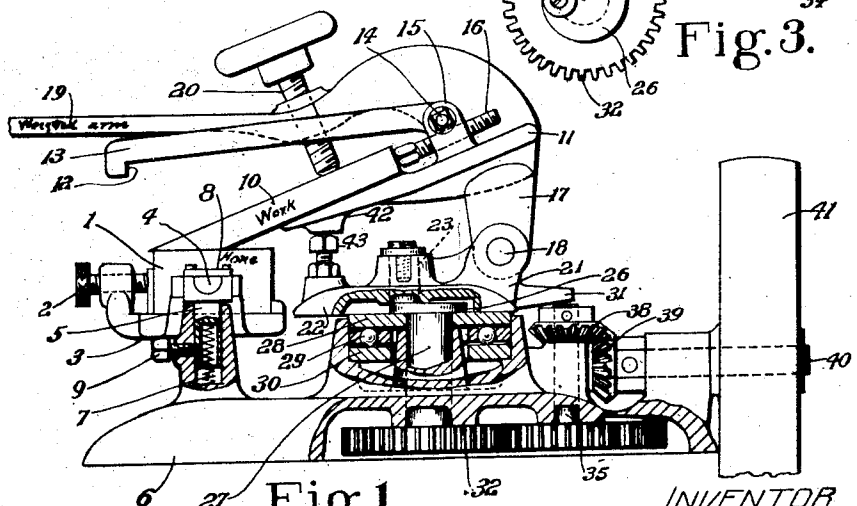


Fig. 1.

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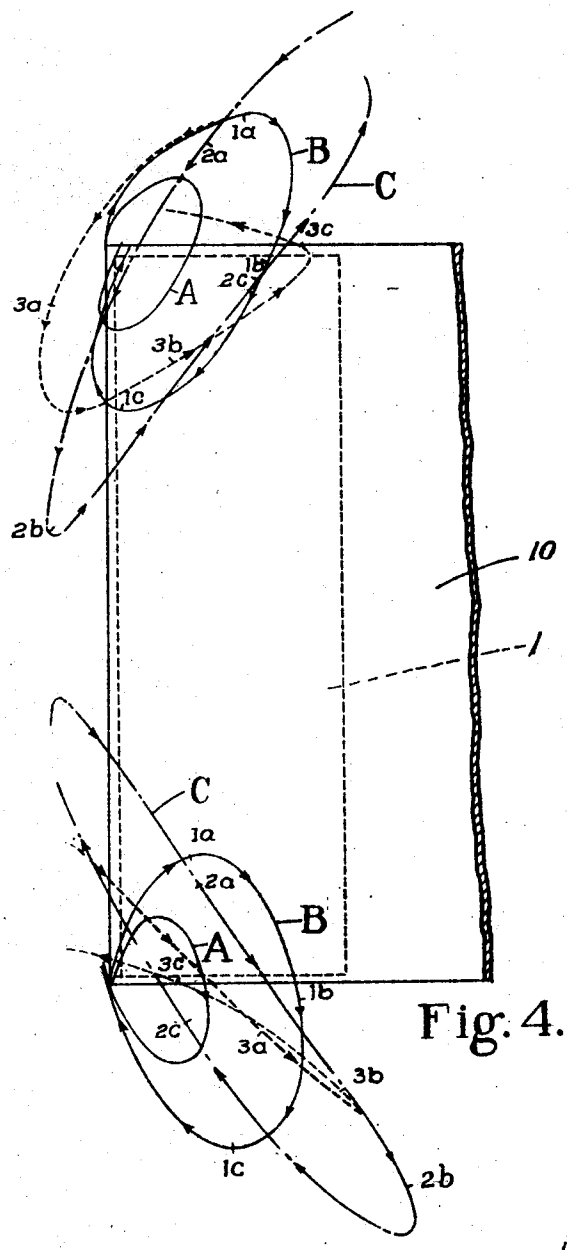


Fig. 4.

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Patented Sept. 1, 1925. 1,551,659

UNITED STATES PATENT OFFICE.

JOSEPH GOULDBOURN, OF LEICESTER, ENGLAND, ASSIGNOR TO UNITED SHOE MACHINERY CORPORATION, OF PATERSON, NEW JERSEY, A CORPORATION OF NEW JERSEY.

ABRADING.

Application filed February 10, 1922. Serial No. 535,530.

To all whom it may concern:

Be it known that I, JOSEPH GOULDBOURN, a subject of the King of England, residing at Leicester, Leicestershire, England, have invented certain Improvements in Abrading, of which the following description, in connection with the accompanying drawings, is a specification, like reference characters on the drawings indicating like parts in the several figures.

This invention relates to abrading and is herein shown as embodied in an apparatus for sharpening edge tools such, for example, as the blades of leather splitting machines.

The operation of sharpening such blades has commonly been a slow hand operation in which it has not been possible to hold the tool at a constant inclination to the surface of the abrading element and at the same time move the tool in the proper path to preserve the abrading element in a good working condition. The regularity of the movement and the tendency to use only the middle portion of the abrading element causes it to become glazed and wear down in the middle, leaving marginal ridges.

Important objects of this invention are to provide an improved abrading apparatus which will accurately and quickly sharpen tools of the nature described and provide for even wear of the abrading element and prevent it from glazing. In the illustrated construction the apparatus is substantially automatic and comprises a flat surfaced oil stone, a carriage, a tool holder pivoted to the carriage, and mechanism for actuating the carriage in such manner that the tool edge will be given a series of orbital movements progressively varying in amplitude so that the tool edge will traverse the whole surface of the oil stone in a path of considerable complexity. The carriage is moved by a pair of actuators in the form of crank pins which are revolved at different speeds to the end that the tool edge is caused to travel in a series of non-coincident orbital paths which at one time lie along the oil stone and at other times across it. Thus oil is worked well in between the tool and the abrading element to prevent glazing. Preferably, also, the movement of the edge of the tool is such as to carry it at different times beyond all four edges of the abrading element, thus insuring even wear and preventing the formation of marginal ridges.

These and other objects of the invention will appear from a consideration of the following specification in connection with the accompanying drawings in which,

Fig. 1 is a side elevation of the machine partly in section;

Fig. 2 is a plan view of the machine;

Fig. 3 is a diagram in plan view showing certain gearing of the machine; and

Fig. 4 is a view showing in plan the knife and the hone and various paths of movement traversed by the corners of the knife edge in the course of a complete cycle of movements of the knife edge.

In this machine a hone 1, which may be a plane-surfaced oil stone, extends across the front of the machine and is clamped by a thumb-screw 2 in a horizontal holder 3 which has at each end a horizontal trunnion 4. Each trunnion has a bearing in the upper end of a vertical plunger 5 slidably mounted in a bearing formed on the machine frame 6. The plungers are supported by springs 7 positioned in the bearings below the plungers. The trunnions allow the holder 3 to rock on a horizontal axis and the plungers allow a slight tipping lengthwise of the stone. If desired, however, the stone may be prevented from rocking by clamping the trunnions 4 in their bearings in the upper ends of the plungers 5 as by means of plates 8, 8 fastened to the upper faces of the plungers and engaging flat faces formed on the trunnions. The tipping may also be prevented when desired by clamping the plungers in their bearings in the machine frame as by set screws 9. The edge of the knife 10 to be honed is positioned in a holder 11 against gage faces 12 formed on bars 13, 13. The bars are pivoted on screws 14, 14 passing through lugs 15, 15 formed on the holder 11. The lugs are split to receive the ends of the bars and to allow the screws 14, 14 to clamp a pair of adjusting screws 16, 16 which bear against the back of the knife to move its edge against the gage faces 12.

In operation the knife is placed on the holder 11 and the screws 14, 14 slackened. The bars 13, 13 are then turned about the

screws 14, 14 until the under faces of the bars rest on the upper face of the knife. The screws 16, 16 are adjusted to bring the front edge of the knife into engagement with the faces 12 on the bars 13 and (after the knife is clamped by a clamp screw 20 referred to below) the bars are raised and the screws 14, 14 tightened to clamp the bars in raised position and the screws 16, 16 in adjusted position.

The knife holder 11 has downwardly projecting lugs 17, 17 which are fulcrumed on a horizontal shaft 18 substantially in the plane of the surface of the stone and parallel to the knife edge, and the holder has a forwardly extending horizontal arm 19 extending perpendicularly of the knife edge over the knife and stone, on which is adjustably mounted a weight (not shown) whereby the knife is pressed down on the stone. A clamping screw 20 threaded through this arm bears on the top face of the knife to clamp it on the holder.

The horizontal shaft 18 is mounted in lugs 21, 21 projecting upwardly from a member 22 which, towards one end, has a bearing for a vertical crank pin 23 and, towards its other end, a rectilinear lost motion slot 24, parallel to the knife edge and in which moves a second vertical crank pin 25. The bearing is on an extension of the line of the slot. The crank pins project from collars 26, 26 formed on the upper ends of vertical shafts 27, 27 carried in bearings formed in the machine frame 6. The member 22 is recessed on its lower face to receive the collars from which the crank pins extend, and its plane lower face rests on hardened steel disks 28 housed in the machine frame and respectively loosely surrounding the crank pin shafts 27, 27. To reduce friction, the steel plates rest on ball-races 29 which themselves are supported by steel plates 30 housed in the frame. To support the holder 11 in raised position during the removal or positioning of the knife, the member 22 has projecting rearwardly from it two lugs 31, 31 which, when the knife holder is swung upwardly about the horizontal shaft 18, engage the downwardly projecting lugs 17, 17 on the holder.

The member 22 and holder 11 are given their working movement by the vertical crank-shafts 27, 27 having fixed to their lower ends gear wheels 32, 33 which are driven from a third gear-wheel 34 mounted on the lower end of a vertical shaft 35, positioned centrally between, and to the rear of, the two vertical crank-shafts and having a bearing in the machine frame. The gear-wheel 34 meshes directly with the gear-wheel 32 and drives the gear-wheel 33 through an idler 36 mounted on the lower end of a vertical shaft 37 having a bearing in the machine frame. The gear shaft 35 has, at its upper end, a bevel pinion 38 which meshes with a bevel pinion 39 on the end of a horizontal, rearwardly extending shaft 40 mounted in a bearing formed on the machine frame and having, on its outer end, a driving pulley 41 which may be connected to a suitable source of power.

To determine the extent of honing to which the knife shall be subjected, a boss 42 is provided on the under side of the knife holder 11, which boss, as the knife is ground away, encounters a screw 43 threaded into the member 22 and thereby prevents further downward movement of the holder 11 about the shaft 18 and consequently stops further honing action. By adjusting the screw the amount of honing action may be varied.

When honing a knife beveled equally on each side of its edge the knife will first be honed on one side until the boss 42 and the screw 43 meet and then reversed and the other side honed until the boss and screw again meet, the boss and screw in this case determining that the edge in the honed knife is properly located in relation to the body of the knife.

The gear wheels on the lower ends of the crank shafts have respectively a different number of gear teeth, for example, the gear wheel 32 may have thirty-six teeth and the gear 33 thirty-one teeth. Owing to this difference in the number of teeth, the crank pins will, during each revolution of say the gear 32, gradually change their relative positions and this change will continue until, after thirty-one revolutions of the gear 32, the relationship of the crank-pins will again be the same as at the commencement of the thirty-one revolutions and thereafter the sequence of gradual changes in the relationship of the crank pins will be repeated. As the movements of the knife holder are positively controlled by the movements of the cranks, the knife edge will move in varying paths, and after thirty-one such movements the sequence of movements will be repeated.

During the revolutions of the gears 32 and 33, the movement of the knife edge is a complex one comprising a series of dissimilar orbital movements of different amplitudes, each end of the knife edge tracing a different complex curve, with the result that honing action between the knife and hone occurs in all directions, sometimes as a result of largely rectilinear movement, at other times largely as the result of swinging movement and, at yet other times, as the result of various combinations of movements and, consequently, practically the whole surface of the hone is covered in all directions before the cycle of movements begins to be repeated. As a result, oil is worked well between the knife edge and the hone at all times and glazing of its surface is avoided.

Moreover, while the necessary difference

of the number of teeth between the gears 32 and 33, one of which is a relatively high prime number, is established to ensure a complex knife path, the difference between these numbers is kept sufficiently small to ensure that both ends of the knife receive adequate movement. Again, it should be pointed out that the face of the knife to be honed is carried in its movements to positions in which it, at different times, extends beyond all four edges of the hone so that every portion of the hone receives its due share of wear and the formation of marginal ridges on it is avoided.

In Fig. 4 are illustrated some of the complex paths traversed by the ends of the knife edge. The small curves A show the paths actually traversed by the ends of the knife edge during a chosen first of the thirty-one revolutions of the gear 32 aforementioned (being the first revolution from the position shown in Fig. 3) and the larger curves B show these same paths but to a larger scale. In the curves B the points marked 1^a, 1^b and 1^c indicate the relative positions of the opposite ends of the knife edge at different points of the paths. The paths C in dot-and-dash lines and the paths D in dotted lines illustrate, on the larger scale, the paths of movement of the ends of the knife edge during the tenth and twenty-fourth revolution of the gear 32 (i. e., the ninth and twenty-third after that shown by the curves B) respectively and the points 2^a, 2^b, 2^c and 3^a, 3^b and 3^c indicate relative positions of the opposite ends of the knife edge at different points in these paths. The movement of each end of the knife edge is influenced by both crank pins so that these paths are more complex than those of the crank pins.

Although the invention has been shown and described by reference to a specific embodiment, it should be understood that the invention is not necessarily limited thereto.

Having thus described my invention, what I claim as new and desire to secure by Letters Patent of the United States is:

1. A cutting tool sharpening apparatus having, in combination, a plane surfaced abrading element, a tool holder for holding the edge of a tool against the abrading element, and mechanism including a plurality of actuators directly connected with the tool holder for producing relative movement between the tool edge and the abrading element in a predetermined irregular path of great complexity.

2. A cutting tool sharpening apparatus having, in combination, a plane surfaced abrading element, a tool holder constructed and arranged to present a tool to the abrading element at an appropriate inclination, and mechanism including a plurality of actuators movable at different speeds and directly connected with the tool holder for moving the tool edge over the abrading element in a series of non-coincident orbital paths to prevent glazing of the latter.

3. A cutting tool sharpening apparatus having, in combination, a plane surfaced abrading element, a tool holder for pressing the tool against the abrading element, and actuating mechanism constructed and arranged to move the tool edge over the abrading surface in a series of predetermined dissimilar orbital movements of different amplitudes.

4. A cutting tool sharpening apparatus having, in combination, an abrading element, a carriage, a tool holder pivoted to the carriage, means to press the edge of a tool in the holder against the abrading element, and actuating mechanism for moving the carriage through a series of orbital movements progressively varying in amplitude to cause the tool edge to traverse the element in a manner to avoid glazing of the abrasive surface.

5. A blade sharpening apparatus having, in combination, a flat abrading element, a blade holder for holding a blade against the abrading element at a suitable inclination, and mechanism for moving the blade holder to insure that the blade edge will traverse the entire surface of the abrading element to avoid the formation of marginal ridges upon the latter, said mechanism comprising two driving elements movable through successive cycles at different speeds and connected to impart independent oscillatory movements to the blade holder.

6. A tool sharpening apparatus having, in combination, an abrading element, a tool carriage, and mechanism for actuating the carriage to cause a tool edge to traverse a complex path on the abrading element, said mechanism comprising a pair of crank pins, means for causing the crank pins to revolve at different speeds, and a connection between each crank pin and the carriage.

7. A tool sharpening apparatus having, in combination, an abrading element, a carriage, a tool holder pivoted to the carriage and having means to press a tool against the abrading element, and mechanism for actuating the carriage to cause the tool to traverse a complex path on the abrading element, said mechanism comprising a pair of crank pins, gearing for revolving the crank pins at different speeds, and connections between the crank pins and the carriage.

8. A cutting tool sharpening apparatus having, in combination, a plane surfaced abrading element, a tool holder for pressing the tool against the abrading element, and mechanism constructed and arranged to move the tool edge over the abrading surface in a series of predetermined orbital movements of different amplitudes arranged

to define a continuous complex path covering the entire surface of the abrading element and overlapping the entire marginal edge of the abrading surface.

9. A tool sharpening apparatus having, in combination, a flat abrading element, a movable support, a tool holder pivoted to the support and movable toward the support to press a tool on the holder against the abrading element, means comprising a pair of crank pins for actuating the support to move the tool over the face of the abrading element, and cooperating means on said holder and said support for limiting the movement of the tool holder toward the abrading element to stop the abrading action.

10. A blade sharpening apparatus having, in combination, an abrading element, a blade holder, an arm pivoted to the blade holder and having a gage face to contact with one edge of a blade to be sharpened, an adjustable member engaging the opposite edge of the blade to move the first edge into alinement with the gage face, and means for clamping the gage arm in an out of the way position.

11. A blade sharpening apparatus having, in combination, an abrading element, a blade holder, a gage arm pivoted to the blade holder and arranged to contact with the edge of a blade to be sharpened, an adjustable member for engaging the opposite edge of the blade to move it into contact with the gage arm, a clamp for securing the blade in adjusted position on the holder, and a pivotal mounting for the blade holder whereby the latter may be swung away from the abrading element when inserting or removing a blade.

In testimony whereof I have signed my name to this specification.

JOSEPH GOULDBOURN.