

April 25, 1944.

S. A. PLATT

2,347,503

BAR GRINDING APPARATUS

Filed Aug. 27, 1943

3 Sheets-Sheet 1

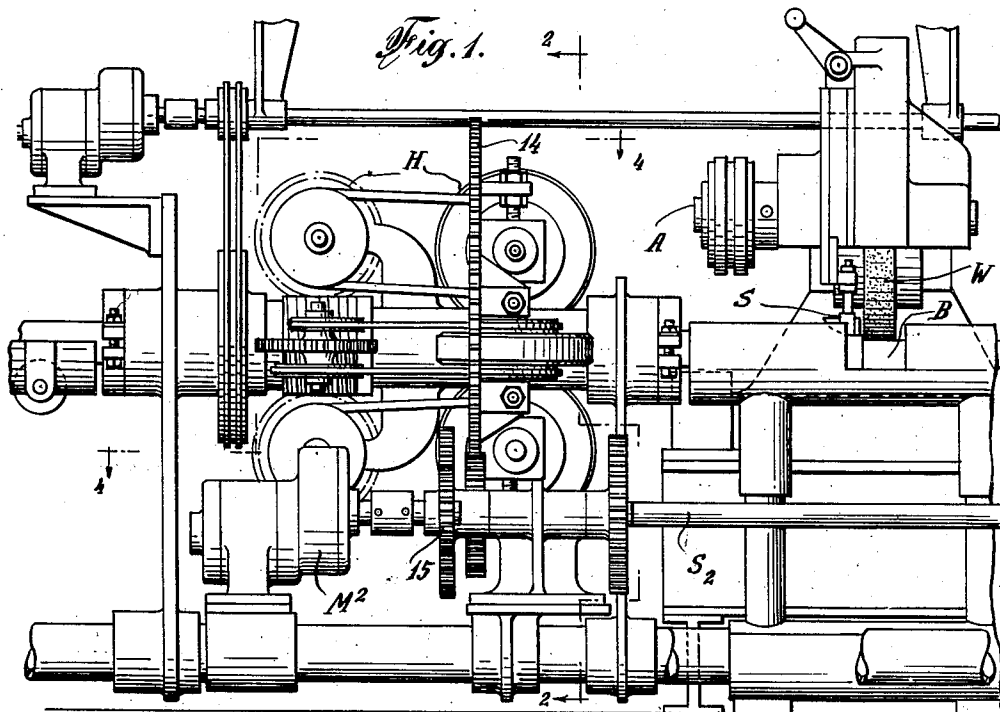
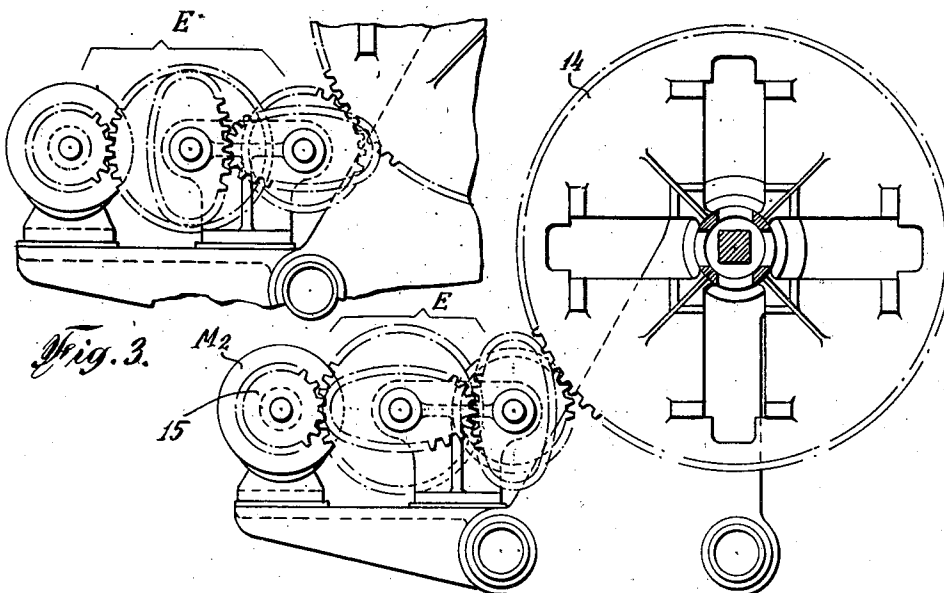


Fig. 2.

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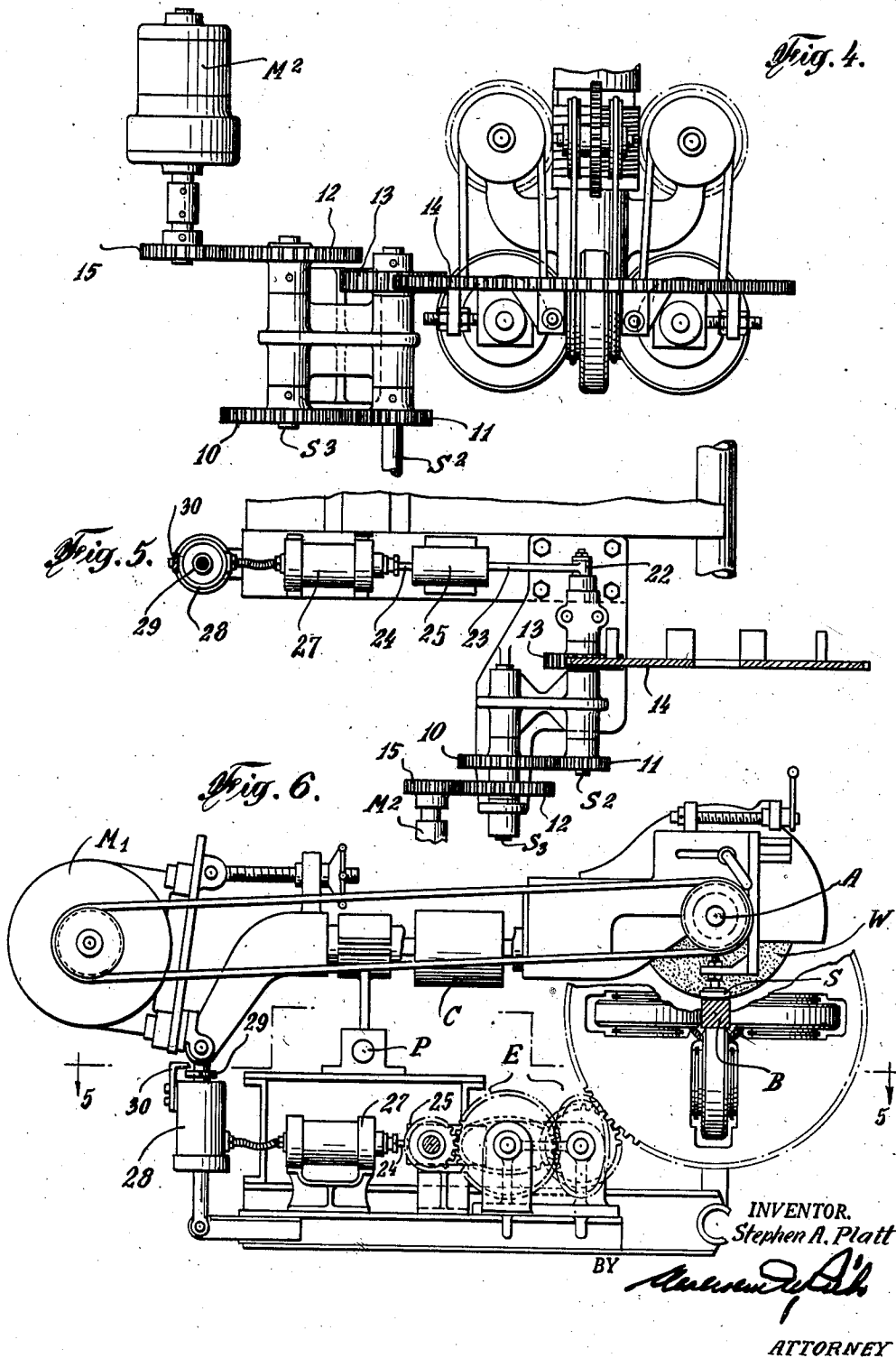
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3 Sheets-Sheet 2



UNITED STATES PATENT OFFICE

2,347,503

BAR-GRINDING APPARATUS

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Application August 27, 1943, Serial No. 500,214

9 Claims. (Cl. 51-79)

This invention relates to grinding apparatus and more particularly to bar-grinding apparatus and is an improvement invention of the invention described and claimed in my co-pending application Serial No. 466,756 filed November 24, 1942, which application is assigned to the same assignee as the present invention.

One of the objects of the present invention is to provide means in the apparatus of said co-pending application to compensate for variations in the area of contact between the axially rotating bar and the grinding wheel thereby to obtain a substantially uniform depth of removal of material from the bar over its entire surface.

Another object is to provide means, in the apparatus of said co-pending application, to vary the time of bar rotation or the grinding wheel pressure or both, thereby to obtain a substantially uniform depth of grinding cut on the bar surface.

Still another object is to provide means to maintain the cutting power of the wheel in determined relation to the area of contact of the wheel with the axially rotating bar, thereby to effect a substantially uniform depth of cut on the bar surface as the area of contact of the grinding wheel varies during bar rotation.

Other objects will be apparent as the invention is more fully hereinafter disclosed.

In accordance with these objects I have found that in the bar-grinding apparatus of my said co-pending application, the area of contact between the grinding wheel, and the axially rotating bar, each rotating at a substantially constant speed, varies as the corners and sides of the bar contact the wheel and that in order to obtain substantially the same depth of cut at the corners as on the sides, means must be provided to compensate for this variation of the area of contact. This compensation may be effected by varying the time interval of contact, shortening this time as the area of contact decreases, or by varying the pressure of wheel contact, lessening the pressure as the area of contact decreases or by a combination of the two means. The present invention aims to provide means to accomplish this desired result.

Before further disclosure of the present invention reference should be made to the accompanying drawings, wherein:

Fig. 1 is a side elevational view of the forward end of the bar-grinding apparatus of my prior invention provided with means to vary the rate of bar revolution thereby to vary the time interval of contact of the constant rotat-

ing grinding wheel with the bar surface with respect to the corner and side areas thereof in contact with the wheel thereby to obtain a substantially uniform depth of grinding cut over the bar surface;

Fig. 2 is an enlarged view along plane 2-2 showing the particular means employed to vary the rate of bar rotation;

Fig. 3 is a second view of the same showing the means in another quadrant of rotation;

Fig. 4 is a top view of the means of Figs. 2 and 3 taken along plane 4-4 of Fig. 1;

Fig. 5 is a sectional view illustrating the combination of the means of Figs. 1 to 4, inclusive, with a means for varying the pressure of the grinding wheel upon the surface of the bar;

Fig. 6 is a side elevational view of the same;

Fig. 7 is an enlarged side elevational view illustrating the improvement of the bar-grinding apparatus of my said co-pending application by the provision of means to vary the pressure of the grinding wheel upon the surface of the rotating bar; and

Fig. 8 is a sectional view of the same along plane 8-8 of Fig. 7.

Referring to the drawings, the present invention consists, as hereinabove noted, of providing in the bar-grinding apparatus of my said co-pending application, means to regulate or control the cutting power of the grinding wheel with respect to the area of contact of the wheel with the axially rotating bar surface thereby to obtain a substantially uniform depth of cut in the bar surface.

The apparatus of my said co-pending application consists essentially in the combination of a rotating grinding wheel W sustained to be rotatable about a horizontal axis A (Fig. 6) and to be movable vertically in both directions but normally weighted (by weight C) to move vertically downwardly, a guide shoe means S secured to the said grinding wheel and depending downwardly adjacent one side thereof, the said shoe means S being provided with a bottom face having an angle of curvature approximating that of the grinding wheel W and a segment length greater than the width of the bar B, the said bottom arcuate face being disposed in concentric but inwardly spaced relation to the arcuate face of the grinding wheel W, and means H to feed the bar axially with simultaneous axial rotation to the grinding wheel W with the bar axis substantially parallel to the axis of grinding wheel rotation at a horizontal level and in a vertical plane bringing the guide shoe S and the grinding

wheel W into weighted contact with the upper surface of the axially moving and axially rotating bar B and with the guide shoe S making prior contact therewith.

In the arrangement shown in said co-pending application one constant speed motor M₁ (Fig. 6) is employed to rotatively drive the grinding wheel W and a second constant speed motor M₂ driving shaft S₂ is provided to actuate means H by the engagement of gear drive 15 on shaft S₂ with gear wheel 14.

The direct connection of gear wheel 14 with gear drive 15 keyed to rotate with shaft S₂ provides for the rotation of gear wheel 14 at a substantially constant speed determined by the speed of rotation of shaft S₂ and the gear ratio between gear drive 15 and gear wheel 14.

The rotation of gear wheel 14 in this manner actuates the means H provided to axially feed with simultaneous axial rotation the bar B to the wheel W in a manner described in said co-pending application but forming no part of the present invention except in combination with the means illustrated in Figs. 1 to 4, inclusive, whereby the rate of rotation of wheel 14 is varied in such manner as to increase the speed of rotation as the bar corners come into contact with the grinding wheel surface and to retard the speed of rotation as the side faces of the bar come into contact with the grinding wheel surface, thereby effecting a substantially uniform depth of cut in the bar surface.

This means, as illustrated in Figs. 1 to 4, inclusive, consists of an elliptical gear train E interposed between gear 15 and gear wheel 14, driven by gear 15 and converting the constant speed rotation of gear 15 into alternate high and low speeds rotation for driving gear wheel 14. The gear train E, per se, is old and well known in the art and apart from its combination with the remaining apparatus elements of the present invention, forms no part of the present invention.

The elliptical gear train E consists essentially of two elliptically shaped gears 10 and 11, one gear 11 being mounted on the main drive shaft S₂ and the other gear 10 being mounted in meshing engagement with the gear 11 upon a shaft S₃ rotatively sustained in parallel spaced relation to shaft S₂. Gear 15 is then connected by means of an engaging gear 12 mounted on shaft S₃ to rotate shaft S₃ and elliptical gear 10 thereon at the constant speed provided by motor M₂. Elliptical gear 11, in meshed engagement with elliptical gear 10 thereby drives shaft S₂ in alternate high and low speeds, four highs and four lows being obtained with each complete revolution of gear 10. This is obtained by reason of the mounting of the elliptical gears such that the center of the small end of one is in meshing engagement with the center of the side of the other. By an appropriate selection of elliptical gear size with respect to the size of bar B, the alternate periods of high and low speeds may be adapted to occur as the corners and sides, respectively, of bar B come in contact with the grinding wheel W. This alternate high and low speed rotation of shaft S₂ is then transmitted to gear wheel 14 by means of a drive gear 13 mounted on shaft S₂ in a position to mesh with gear wheel 14.

By the arrangement shown, as the area of contact of the grinding wheel with the bar surface decreases, for example, as when the bar B during axial rotation presents a bar corner to the wheel, the rate of axial rotation of the bar B, obtained by rotation of gear wheel 14, is accelerated and

the time interval of contact of the grinding wheel with this surface decreased with resultant decrease in the amount of material removed from the bar surface at the corners. At the same time the rate of feed of bar B endwise to the grinding wheel is simultaneously increased with the net result that the time interval of contact of the bar corner with the grinding wheel surface is materially shortened.

Referring next to Figs. 7 and 8, an alternate means of accomplishing the same result is shown. This means consists of means to vary the pressure of the wheel W upon the surface of bar B. In the apparatus of my said co-pending application, wheel W is mounted upon one end of a lever L₁—L₂ pivotally sustained to move vertically up and down about pivot point P. On the opposite end of the lever L₁—L₂ is located the motor M₁ operatively connected by belt drive D to forwardly drive wheel W at a constant speed of rotation. On arm L₁ of lever L₁—L₂ is provided a sliding weight means C to regulate the normal downward pressure exerted by wheel W upon the surface of bar B.

Bar B is axially rotated with simultaneous endwise movement towards wheel W by an actuating means set in motion by rotation of gear wheel 14 by drive gear 15 driven by a second constant speed motor M₂ (not shown in Figs. 7 or 8). By adjusting the weight C to provide the maximum pressure of wheel W on the surface of bar B at the corner areas to obtain the desired depth of cut and by providing means to increase this pressure as the rotation of the bar B brings the side areas of the bar into contact with wheel W, to an extent sufficient to maintain this depth of cut in the side areas, a substantially uniform depth of cut over the entire surface of the bar B may be effected.

I accomplish this result by providing a power takeoff gear 20 mounted on shaft 21 having a gear ratio with respect to gear wheel 14 of 1 to 4. To shaft 21 is keyed crank arm 22 connected through arms 23 and 24 and sliding block 25 to piston 26 adapted to be reciprocated in hydraulic cylinder 27. Reciprocation of piston 26 in cylinder 27 applies power to hydraulic ram 28, the ram arm 29 of which is operatively connected to arm L₂ of lever L₁—L₂ to raise and lower arm L₂ in response to the application of power thereto. By a proper control over the thrust of ram arm 29, such as by stop means 30 limiting the thrust to a determined maximum, it is believed apparent that any desired increase in pressure of wheel W on the surface of bar B may be obtained. By maintaining a gear ratio of 1 to 4 between gears 20 and 14, the application of increased pressure of wheel W on the bar surface as the side areas of the bars are presented to the grinding wheel W may be effected, as any one skilled in the art will recognize. It is believed apparent that during axial rotation of bar B the area of contact of grinding wheel W with the bar surface remains substantially constant over substantially the entire side areas and changes relatively abruptly as the corner areas are presented to the grinding wheel surface.

Referring now to Figs. 5 and 6, a combination of the means of Figs. 1 to 4 and of Figs. 7 and 8 is illustrated, the advantage of the combination being that with the means of Figs. 1 to 4, inclusive, the speeding up and slowing down of the rate of rotation of bar B as the corners and sides respectively come into contact with grind-

ing wheel W is not always effective to prevent some rounding of the bar corners nor is the means of Figs. 7 and 8 always effective to maintain a uniform depth of cut particularly in the side areas of the bar, but by combining the two said means, and synchronizing the operation of the means of Figs. 7 and 8 with the means of Figs. 1 to 4, inclusive, the two means acting jointly produce a more consistently uniform result and depth of cut on both sides and corners, with minimized rounding of the corners due to the effect of the lessened pressure of the means of Figs. 7 and 8.

As indicated in Fig. 5, the hydraulic ram means of Figs. 7 and 8 is operatively connected to shaft S₂ and is actuated intermittently in accordance with the rate of rotation imparted to shaft S₂ by elliptical gear train E including gears 10 and 11. By maintaining a 1 to 4 gear ratio between gears 15 and 14 the operation of the hydraulic ram may be synchronized with the periodicity of bar rotation irrespective of the alternate rates of speed variations provided by the interposed elliptical gear train E, thereby imposing upon the intermittent speed variations of the elliptical gear means the effect of the determined light and heavy pressures of the means 7 and 8, both of which pressures may be regulated and varied with respect to the metal composition to obtain in the time intervals set by the elliptical gear means the desired depth of cut in the metal surface.

Having hereinabove described the present invention generically and specifically it is believed apparent from the specific embodiment of the same described in the specification and illustrated in the drawings that the invention is adapted to wide modification without substantial departure therefrom and all such modifications and adaptations are contemplated as may fall within the scope of the following claims.

What I claim is:

1. Grinding apparatus for removing the surface of elongated bars of substantially square cross-sectional area, said apparatus comprising in combination a rotating grinding wheel sustained to be rotatable about a horizontal axis and to be movable vertically in both directions but normally weighted to move vertically downward, a guide shoe means secured to said grinding wheel and depending downwardly adjacent one side thereof, said shoe being provided with a bottom face having an angle of curvature approximating that of the said grinding wheel and a segment length greater than the width of said bar, the said bottom arcuate face being disposed in concentric but inwardly spaced relation to the arcuate face of the said grinding wheel, means to feed the bar axially with simultaneous axial rotation to the said grinding wheel with the bar axis substantially parallel to the axis of grinding wheel rotation at a horizontal level and in a vertical plane adapted to permit the guide shoe and the grinding wheel to make weighted contact with the upper surface of the axially moving and axially rotating bar with the guide shoe making prior contact therewith, and means to vary the cutting power of the said grinding wheel as the area of contact of the wheel with the upper surface of said bar varies thereby to maintain a substantially uniform depth of cut on the surface of said bar.

2. The combination of claim 1, wherein said last mentioned means comprises means to shorten the time interval of contact of the said

wheel with the bar surface as the said area of contact decreases and to increase the said time interval of contact of the said wheel with the bar surface as the said area of contact increases.

3. The combination of claim 1, wherein said last mentioned means comprises means operative to increase the rate of axial rotation of said bar as the corner areas of the bar come into contact with the said wheel and to retard the rate of axial rotation of the said bar as the side areas of the bar come into contact with the said wheel.

4. The combination of claim 1, wherein said last mentioned means comprises an elliptical gear means interposed between the prime mover and the means actuated by the prime mover to axially feed the said bar with simultaneous axial rotation to the said wheel, said elliptical gear means being operatively connected on one side to the said prime mover to be actuated thereby and on the side to drive the said bar feeding and rotating means and being arranged with respect to said bar feeding and rotating means to synchronize the frequency of alternate maximum and minimum speeds produced therein with the frequency of contact of the bar corners and sides respectively with the said grinding wheel.

5. The combination of claim 1, wherein said last mentioned means comprises means periodically to increase the contact pressure of the said grinding wheel with the said bar surface from a minimum value to a maximum value, the operation of said means being regulated with respect to the frequency of grinding wheel contact with the minimum and maximum areas of contact of the grinding wheel with the said bar surface respectively.

6. The combination of claim 1, wherein said last mentioned means comprises means operatively connected with the said bar feeding and rotating means to periodically increase the contact pressure of the said grinding wheel with the bar surface from a minimum value to a maximum value, the periodicity of said means being synchronized with the frequency of corner and side contact, respectively, of the said bar with the said wheel.

7. The combination of claim 1, wherein said last mentioned means comprises means operative to periodically increase and decrease the rate of rotation of said bar is provided, the said means being synchronized with the frequency of contact of said wheel with the corners and flat sides respectively, and wherein means operative to periodically increase and decrease the contact pressure of said wheel with the surface of said bar from a minimum to a maximum value is provided, the frequency of the same being synchronized with the frequency of corner and side contact of the said bar with the said grinding wheel.

8. Grinding apparatus for removing the surface of elongated bars of substantially square cross-sectional area, said apparatus comprising means to progressively feed the said elongated bar endwise with simultaneous axial rotation horizontally, means to alternately speed up and slow down the axial rotation and the said end feeding means as the corners and sides of the said bar are presented by axial rotation to the highest horizontal level, a rotatable grinding wheel and means sustaining the same at a horizontal level above the said bar bringing the grinding surface thereof into contact with the upper surface of the bar and with the rotating

axis of the wheel in parallelism with the axis of bar rotation, and means alternatively to decrease and increase the pressure of grinding wheel contact with the said bar surface between determined maximum and minimum limits as the said corners and sides of the said bar alternatively are presented to the said grinding wheel by the axial rotation of said bar.

9. Grinding apparatus for removing the surface of elongated bars of substantially square cross-sectional area, said apparatus comprising means to progressively feed the said elongated bar endwise with simultaneous axial rotation horizontally, means to alternately speed up and slow down the axial rotation and the said end feeding means as the corners and sides of the said bar are presented by axial rotation to the highest horizontal level, a rotatable grinding wheel and means sustaining the same at a hori-

zontal level above the said bar bringing the grinding surface thereof into contact with the upper surface of the bar and with the rotating axis of the wheel in parallelism with the axis of bar rotation, and means alternatively to decrease and increase the pressure of grinding wheel contact with the said bar surface between determined maximum and minimum limits as the said corners and sides of the said bar alternatively are presented to the said grinding wheel by the axial rotation of said bar, and a guide shoe means contacting the rotating surface of said bar ahead of the said grinding wheel to rise and lower the said grinding wheel in response to variations in horizontal level of the upper bar surface above the bar axis during bar rotation.

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