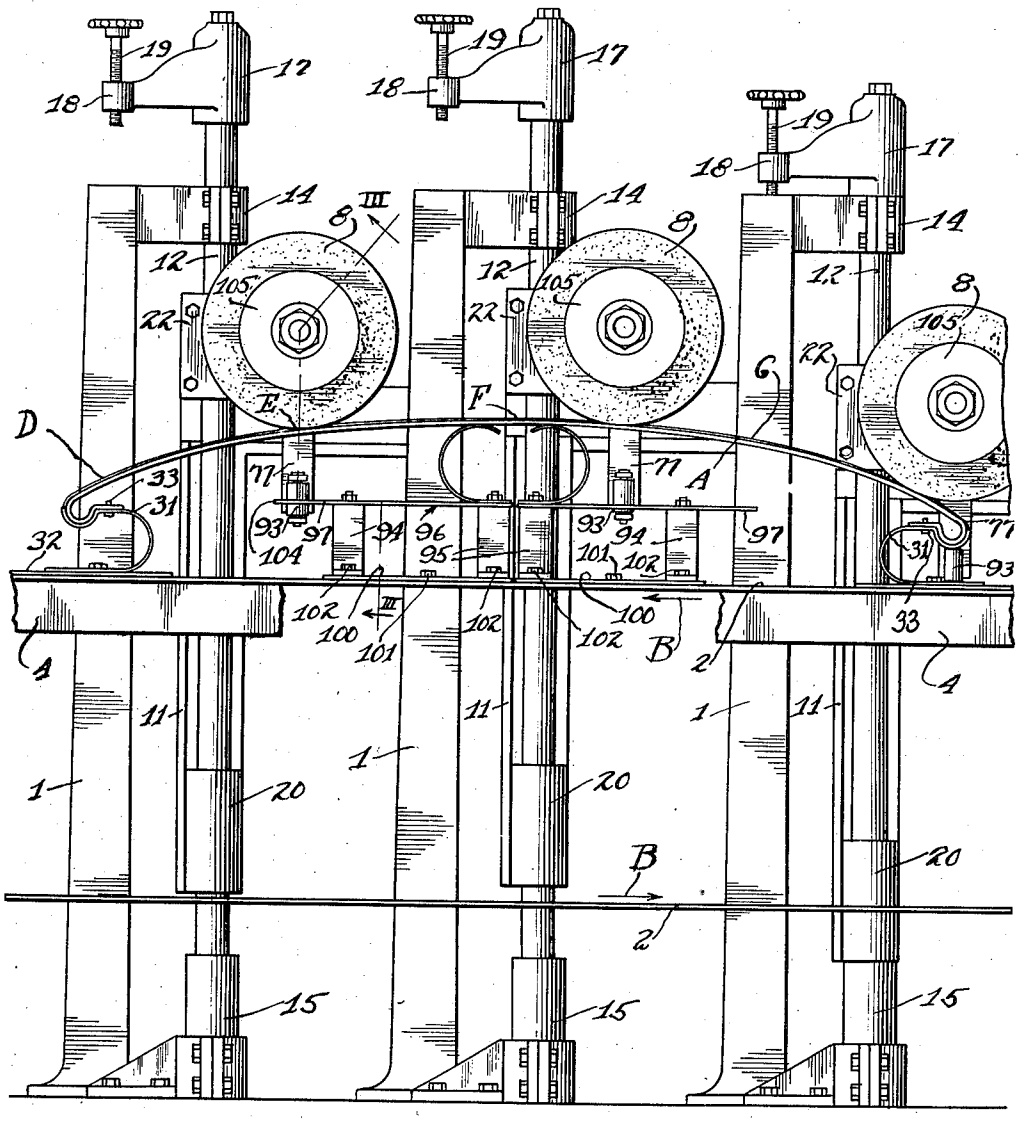
March 16, 1937. O. DOUTT 2,073,786

POLISHING MACHINE

Filed Nov. 14, 1932 5 Sheets-Sheet 1

Fig. 1.



Inventor

Owen Doutt.

by Charles W. Hills Atty.

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POLISHING MACHINE

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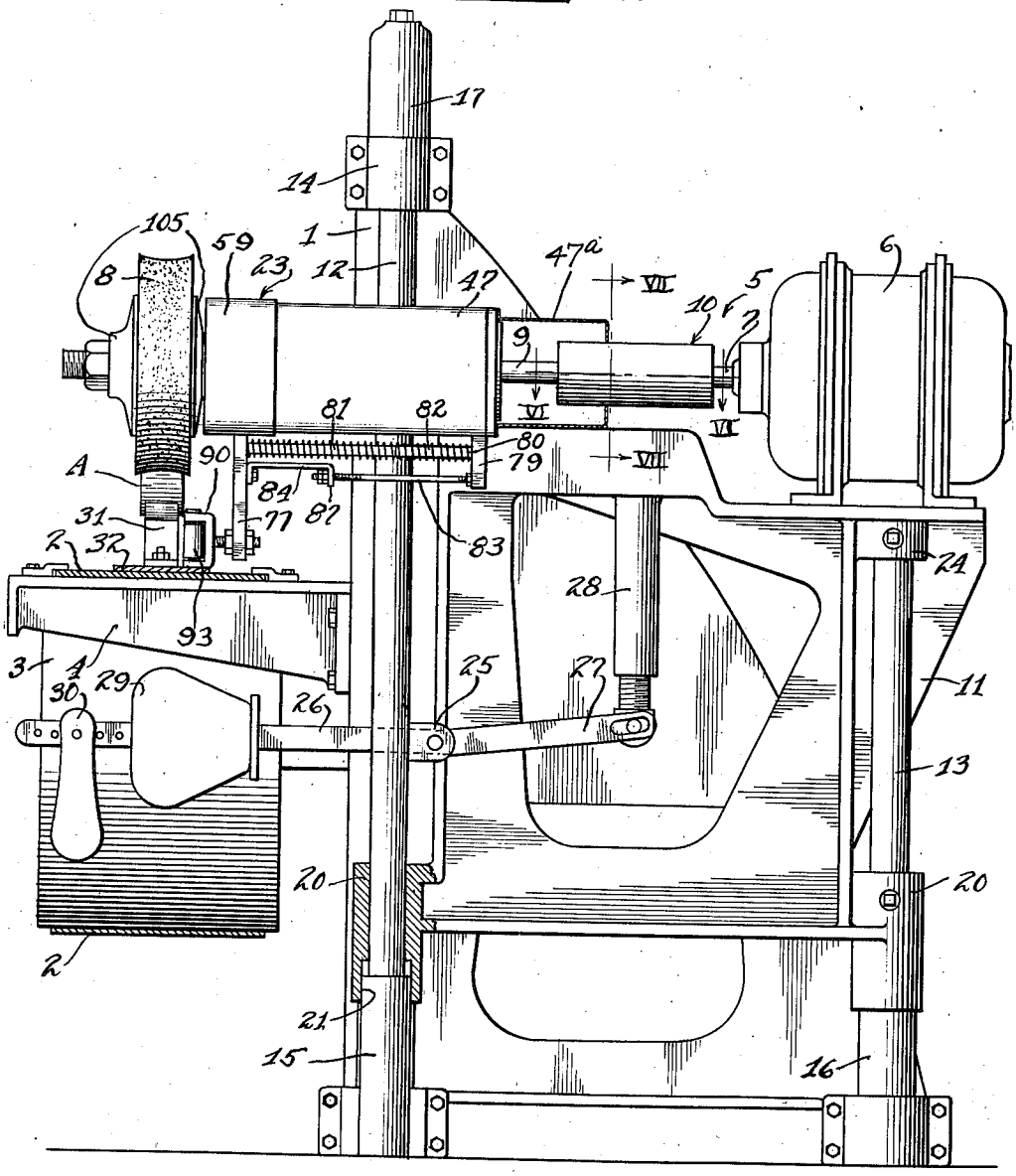
Fig. 2.



Inventor

Owen Doutt.

by Charles O. Fields Attys.

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POLISHING MACHINE

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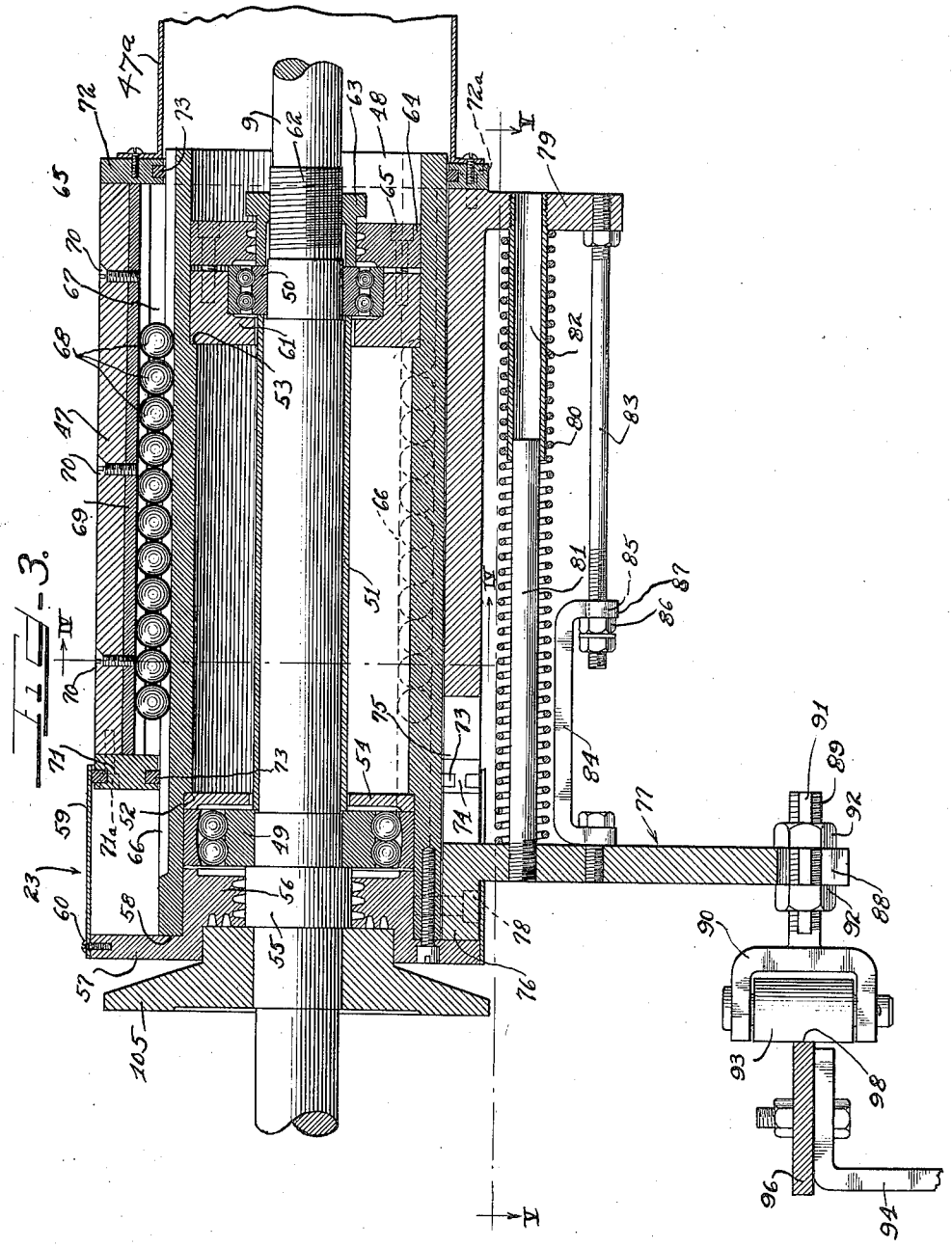

Fig. 3.

Inventor

Owen Doutt.

by Charles F. Wells Atty

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POLISHING MACHINE

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Fig. 6.

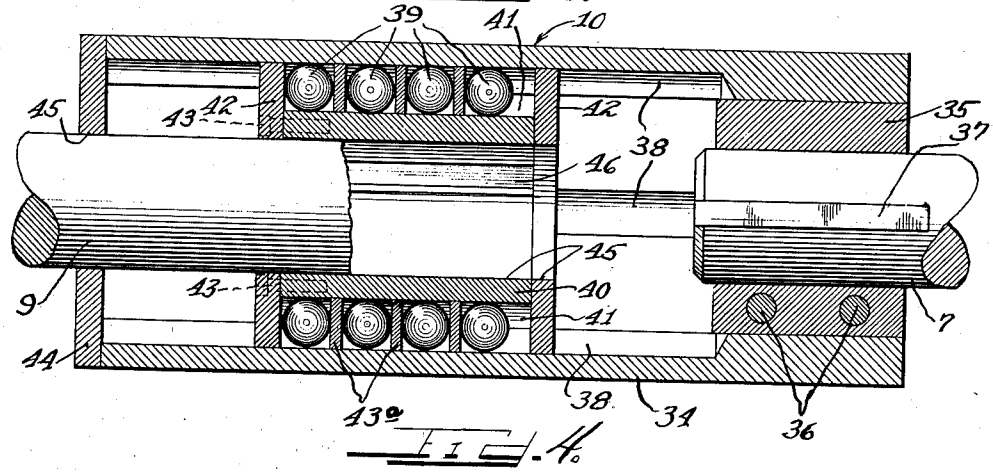


Fig. 4.

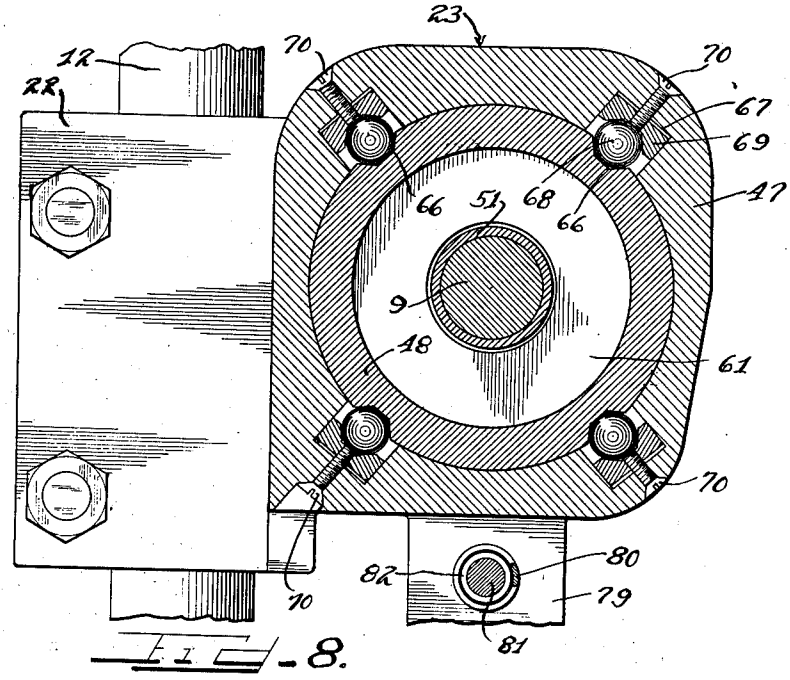
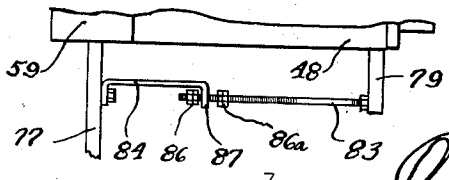


Fig. 8.



Inventor
Owen Doutt.

By Charles Grill Attys.

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POLISHING MACHINE

Filed Nov. 14, 1932 5 Sheets-Sheet 5

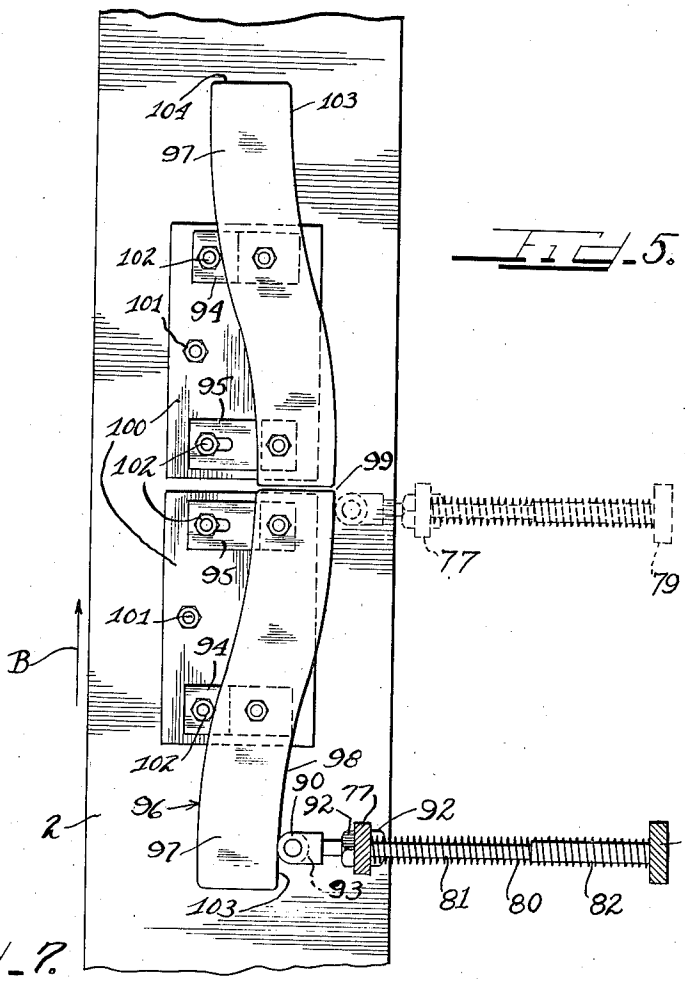
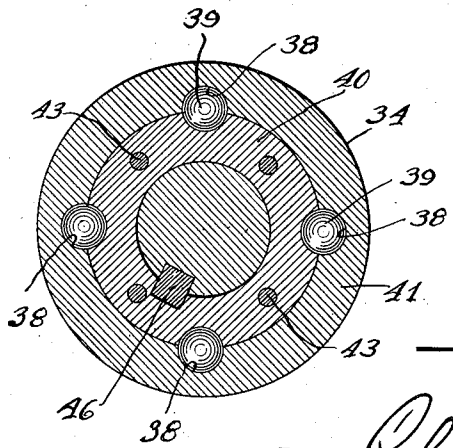


Fig. 5.

Fig. 7.



Inventor

Owen Doutt.

By Charles O. Wells Atty

Patented Mar. 16, 1937 2,073,786

UNITED STATES PATENT OFFICE

2,073,786

POLISHING MACHINE

Owen Doutt, Detroit, Mich., assignor to General Spring Bumper Corporation, Detroit, Mich., a corporation of Michigan

Application November 14, 1932, Serial No. 642,478

7 Claims. (Cl. 51—38)

This invention has to do with machines for polishing or grinding work such as bumper bars and has for one of its essential objects to provide a machine of this character for grinding bumper bars of irregular or offset contour.

In the course of rolling, bending and heat treatment to which bumper bars are subjected preliminary to the grinding and polishing operations, at least one edge of practically every bar becomes somewhat uneven. In grinding bars which have plane impact surfaces, and whose edges do not include substantially offset or bent portions, no difficulty is ordinarily encountered since the grinding wheel used in grinding such bars has a grinding face of such width that the entire surface to be ground lies between the planes of the sides of the wheel. Where, however, the impact surface of the bar is transversely crowned or otherwise non-rectilinear, and its edge or edges are irregular, considerable difficulty arises since the rigid mounting of the grinding wheel makes it impossible for the wheel, whose grinding face in such case is correspondingly transversely shaped, to follow the irregularity even though the latter is very slight. Oftentimes heretofore when three or more wheels operated simultaneously on a bar such as one with edge irregularities and transversely crowned, for example, even where the bar was mounted for slight lateral play, some portions of the crowned or like surface and of the edges of the bar were ground less than others, and some not at all, and a defective bar was produced.

Numerous bumper designs in vogue at present require flat and crowned or other non-rectilinear bars, portions of which are substantially offset or bent edgewise. In the case of flat bars the grinding could be effected by employing wheels of sufficient width, but their initial cost and upkeep would be prohibitive. With a crowned or like surface, as we have seen, grinding of the offset portions with grinding machines heretofore in use cannot be effected. The edgewise offset portions of the flat and crowned surfaces to be ground have heretofore been ground by hand in conjunction with a grinding wheel. This has involved great expense in the manufacture of each bar.

It is accordingly an essential object of the invention to provide means by which it is possible for the grinding wheel to follow the irregularities and offset edges of a piece of work such as a bumper bar.

It is another object of this invention to provide a floating mounting for a grinding wheel by which it is possible for the wheel to move axially while it is rotating and thereby follow the irregularities and offset edges in the bar which is being ground.

Another object of the invention resides in the provision of a machine of this character including means for positioning a plurality of polishing wheels at different heights and in different planes in operative relation to the bars to be polished, for simultaneous engagement with the bar.

A further object of the invention resides in the provision of a polishing machine for bumper bars embodying means cooperating with the bar for properly positioning a plurality of polishing wheels in simultaneous operative relation to the bar.

Another object of the invention resides in the provision of a polishing machine including means for affording the positioning of a polishing wheel at different elevations and in different planes according as the surface of the bar to be ground or polished is vertically inclined and includes laterally offset portions.

It is still a further object of the invention to provide a machine of this character which embodies a carrier for the work to be polished, the carrier being provided with means cooperating with means movable with the polishing wheel for properly positioning the wheel at different elevations and in different planes in accordance with the location of the surface to be ground or polished.

Another object of the invention consists in the provision of a polishing wheel and a prime mover therefor, the two being so connected that the polishing wheel is capable of being positioned at different distances from the prime mover while the polishing wheel is being driven therefrom.

Another object of the invention involves the provision of a flexible coupling between a polishing wheel and its prime mover, and means independent of these parts for automatically causing the wheel to be positioned at different distances from the prime mover while the same is being driven thereby.

It is also an object of the invention to provide in a flexible coupling between a polishing wheel and its prime mover, instrumentalities for yieldably holding the polishing wheel in its outermost position relative to the prime mover.

In accordance with the general features of one form of the invention, there is provided a conveyor provided with resilient supports for the ends of a bumper bar whereby the surface to be polished is positioned uppermost. A template is

arranged to travel with the conveyor and is provided with one or more laterally offset portions according as the part to be ground is provided with laterally offset or displaced portions. A polishing machine frame is provided in cooperative relation to the conveyor and carries for vertical displacement therealong a plurality of motor-polishing wheel units, one or more of which may be arranged for cooperation with the same template. A flexible coupling between each motor and its cooperating polishing wheel affords relative axial movement therebetween, and a follower arranged for movement with the mounting for the polishing wheel is spring pressed toward and into engagement with the template so that the latter moves the polishing wheel into different planes in accordance with the lateral offset of the different portions of the bar.

In another form, the wheel is mounted to float freely in both directions axially between limits determined by the maximum lateral extent of the transversely crowned or other impact surface of a bar whose edges are not substantially offset but at least one of whose edges is irregular.

With this construction, it is possible to maintain the polishing wheel in operative relation to the entire surface of the bar to be ground without the need of manual and time-wasting effort for shifting either the polishing wheel into a different plane for engagement with correspondingly offset portions of the bar, or shifting the bar to position an offset portion of a surface thereof into a position to be ground by the polishing wheel. This shifting of the polishing wheel is automatic and requires no attention whatever, and this construction may be built at a low cost of manufacture.

Further objects and advantages of the invention will appear as the description proceeds.

This invention (in preferred forms) is illustrated in the drawings and hereinafter more fully described.

On the drawings:

Figure 1 is a fragmentary front view of a polishing machine constructed in accordance with the principles of the present invention.

Figure 2 is an end view of the structure shown in Figure 1, looking from the right, certain portions including the conveyor belt being shown in section.

Figure 3 is a longitudinal sectional view taken approximately in the planes indicated by the line III—III in Figure 1, certain parts being shown fragmentarily.

Figure 4 is a sectional view taken approximately in the plane indicated by the line IV—IV in Figure 3.

Figure 5 is a sectional view taken substantially in the plane indicated by the line V—V in Figure 3, showing a portion of the conveyor belt.

Figure 6 is a longitudinal sectional view taken substantially as indicated by the line VI—VI in Figure 2, showing a flexible shaft coupling, the shafts being illustrated fragmentarily.

Figure 7 is a sectional view taken substantially in the plane designated by the line VII—VII in Figure 2.

Figure 8 is a fragmentary elevation of a modified floating grinding wheel mounting.

Referring now more particularly to the drawings, the machine comprises a frame work including a plurality of stanchions 1 arranged in tandem beside a conveyor belt 2 which is preferably endless and travels over pulleys 3 having a suitable source of power (not shown). A table or apron 4 is secured to the stanchions and extends substantially throughout the length of the machine for supporting the portion of the belt which is uppermost as shown in Figure 2. Each stanchion 1 carries a motor-polishing wheel unit 5 including a motor 6 having a driving shaft 7 and a grinding wheel 8 having a driven shaft 9, the two shafts being connected through a flexible coupling 10 for relative axial movement without disturbing the driving relationship therebetween. Each of these units is carried by a support 11 including the rods 12 and 13 which are slidable vertically in bearings carried stationarily by the stanchion or main frame, the rod 12 having upper and lower bearings 14 and 15 and the rod 13 having the lower bearing 16.

The slide rod 12 projects upwardly through the bearing 14 and carries at its upper end a sleeve 17 provided with an arm 18 which is tapped to receive a threaded adjusting member 19. The member 19 is engageable at its lower end with the top of the stanchion 1 to limit the downward movement of the motor-grinding wheel unit support 11, and obviously the member 19 may be adjusted to vary the extent of vertical movement thereof.

The support 11 is secured to the rod 12 at its lower end by means of a sleeve 20 which is counterbored at 21 to receive the upper end of the bearing sleeve 15, and bracket means 22 associated with the grinding wheel head 23 is secured to the intermediate portion of the rod 12 by bolts. The support 11 is provided with a second sleeve 20 which cooperates with the bearing sleeve 16 in exactly the way in which the previously described sleeve 20 cooperates with the bearing sleeve 15, and is of substantially the same construction. The support 11 is further provided with an upper sleeve 24 which is suitably secured to the upper end of the rod 13. The grinding wheel head 23 includes axially stationary and relatively movable parts, and it is the axially stationary part 47 which is secured through the bracket means 22 to the rod 12.

In order that the pressure which is exerted by the grinding wheel 8 upon the bar to be ground due to the weight of the motor-grinding wheel unit and its support 11 may not be excessive, the latter are counterbalanced. To this end, a bracket 25 is secured to the stanchion 1 and pivotally carries a bar 26 intermediate the ends of the latter. One end 27 of the bar 26 has a loose pivotal connection with an adjustable rod 28 depending from the support 11, and on the other part of the arm 26 are provided stationary and adjustable counter weights 29 and 30, respectively, whereby the weight of the unit 11 and the parts carried thereby is largely overcome. It has been found advantageous to so counterbalance the parts as to provide a pressure of approximately 15 pounds of the grinding wheel 8 upon the bar to be ground, but it is obvious that the pressure may be varied as desired.

The bar to be ground may be supported in any suitable fashion, the method herein disclosed being presented for illustrative purposes only. As here shown, yieldable brackets 31 are spaced apart in accordance with the length of the bar to be ground and are secured through an intermediate plate 32 to the conveyor 2 in position to receive the ends of the bar to which said brackets are temporarily secured as at 33. The ends of the bumper bar are here shown as rounded, and cooperating portions of the brackets 31 cor-

respondingly shaped, but it will be understood that this is for illustrative purposes only since the invention hereinafter more fully described may be practiced regardless of the form which the ends of the bar and the corresponding portions of the brackets supporting the same may take. While the brackets 31 may be rigid, they are preferably made of leaf springs or otherwise constructed to provide resilient supports for the ends of the bumper bar.

The flexible coupling 10 providing for relative axial movement between the motor shaft 7 and grinding wheel head shaft 9 is shown in detail in Figures 6 and 7. This structure comprises a tube 34 provided at one end with a liner 35 which is securely held therein by any suitable means such as dowels 36. The liner 35 is keyed at 37 to the motor shaft 7 so that there can be no relative axial movement between the tube 34 and the shaft 7. The remainder of the tube 34 is provided with a plurality of preferably equally spaced longitudinal internal grooves 38 constituting outer races for a corresponding number of series of bearing balls 39. The tube 34 slidably accommodates a bearing sleeve 40 provided with a plurality of longitudinal external grooves 41 for registering with the grooves 38. The grooves 41 provide inner races for the balls 39. End caps in the form of ring-like members 42 are formed with external contours corresponding with the internal contour of the tube 34 and thereby provide end closures for the cylindrical spaces provided by each pair of registering grooves 38 and 41. The end caps 42 are securely fastened to the ends of the sleeve 40 by screws 43 or the like. The balls 39 are separated from each other by suitable rings 43*a* arranged for a slidable fit in the registering grooves 38 and 41. There is thereby established a substantially frictionless spline connection between the tube 34 and the sleeve 40 and associated parts.

A ring shaped end cap 44 is securely fastened to that end of the tube 34 opposite the liner 35 by screws or any other suitable means (not shown). The caps 42, the sleeve 40, and the liner 35 are bored centrally at 45 to substantially the same diameter to receive the respective shafts 9 and 7, the grinding wheel shaft 9 being keyed at 46 to the bearing sleeve 40. Thus regardless of the position of the shaft 9 relative to the shaft 7 there will at all times be a driving relation therebetween.

The grinding wheel head is designated generally by the numeral 23 and is supported by a sleeve 47 which carries the bracket 22 by means of which the same is mounted on and supported by the slide rod 12. A tubular member 48 is mounted for rotation relative to the grinding head shaft 9 by means of bearings 49 and 50 which are spaced apart on the shaft 9 by means of a sleeve 51. The ends of the tube 48 are counterbored for accommodating the bearing structures, thereby providing shoulders 52 and 53. An oil shield 54 is positioned in engagement with the shoulder 52 on one side and a face of the outer race of the bearing 49 on the other side, the opposite face of the bearing 49 at the inner race engaging a collar 55 on the shaft 9, thereby positioning the bearing 49. A bearing retaining ring 56 is arranged outwardly of the bearing 49 and is provided with an outwardly extending flange 57 which engages the adjacent end 58 of the tube 48 and extends therebeyond. A dust guard 59 is secured at 60 to the flange 57 and extends substantially cylindrically in coaxial relation to the shaft 9 and sleeve 48.

The bearing 50 is received in a bearing holder 61 which fits in the other counterbore of the sleeve with a press fit and engages the shoulder 53. The shaft 9 is threaded at 62 to receive a bearing retainer nut 63 by which the bearing 50 is held in engagement with the sleeve 51. The outer race of the bearing 50 is properly positioned and held in place by virtue of the cooperation between the bearing retaining ring 64 and the bearing holder 61, the two parts being secured together as shown at 65. The sleeve 48 is thus journalled about the shaft 9 but is held against axial movement relative to the shaft 9.

The tube 48 is provided with a plurality of preferably equally spaced longitudinal substantially V-shaped ball races 66 which cooperate with registering grooves 67 in the supporting sleeve 47 to receive anti-friction balls 68 and thereby establish a sliding connection. The mounting sleeve 47 is provided with an individual preferably case hardened ball race 69 for each groove 67 and preferably coextensive therewith. Each race 69 is adjustably secured as at 70 so that it may be adjusted toward and away from the corresponding groove 66 in the tube 48 for proper engagement with the balls 68. The balls thus function as keys to prevent rotation of the tube 48 but permit its movement axially of the sleeve 47.

It will be seen from the foregoing that the grinding head shaft 9 is journalled in and yet is capable of longitudinal movement relative to the mounting sleeve 47.

To insure against escape of the anti-friction balls 68, ball retaining rings 71 and 72 are secured to the ends of the mounting sleeve 47 in any suitable manner as by screws 71*a* and 72*a*. The rings 71 and 72 are provided with internal gaskets 73 which engage the outer cylindrical surface of the tube 48. The portions of the mounting sleeve 47 provided with the grooves 67 are somewhat enlarged radially to accommodate the said grooves, and the rings 71 and 72 are correspondingly shaped.

The ring 71 and mounting sleeve 47 are provided with registering slots 74 and 75, respectively, in which the offset arm 76 of a bracket 77 is slidable. The arm 76 is secured as by one or more screws 78 to the tube 48 and moves therewith, and serves as an additional means whereby the tube 48 and the parts secured thereto are splined throughout part of the movement with respect to the mounting sleeve 47.

The mounting sleeve 47 is provided at a point remote from the bracket 77 with a depending lug 79, and the lug 79 and bracket 77 are yieldably urged away from each other by a spring 80 disposed therebetween and surrounding telescopic elements 81 and 82, removably secured to the parts 77 and 79.

The lug 79 has also removably secured thereto a rod 83 extending toward the bracket 77, and the bracket 77 has removably secured thereto a guide member 84 which extends toward the lug 79 and is provided with a hole 85 through which the rod 83 extends. Stop means such as lock nuts 86 are applied at a desired location along the rod 83 for engagement with the portion 87 of the guide member 84 which is telescoped about the rod 83, to limit the movement of the bracket 77 away from the lug 79 under the influence of the spring 80.

The bracket 77 is provided adjacent its lower

end with a slot 88 through which the threaded shank 89 of a clevis 90 is adjustably received. The shank 89 is flattened on opposite sides as shown at 91 to fit in the slot 88 so that the shank 89 is slidable but not rotatable therein. Adjusting nuts 92 applied to the shank 89 on opposite sides of the bracket 77 serve to adjust the clevis 90 both vertically and horizontally respecting the bracket 77.

The clevis 90 carries a roller 93 which operates as a follower in conjunction with a cam to be hereinafter fully described.

Referring now more particularly to Figures 1 and 5, brackets 94 and 95 for a cam indicated generally at 96 and consisting for illustrative purposes only of two parts 97 having edges 98 are secured to the conveyor 2 between the supporting elements 31 for the bar A to be polished or ground. The cam 96 is formed preferably from another bumper bar and consists of that portion of the bumper bar which includes the offset edges, and is retained in the flattened or uni-planar condition as shown in Figure 1. Where the length of the cam will permit, it may be made in one piece; otherwise, it is made in two or more pieces as shown in order that the conveyor 2 may traverse the pulleys upon which it is mounted, without difficulty. The width of the cam 96 is immaterial, but it is necessary that at least one of its edges, preferably the edge 98 adjacent the roller or follower 93, conform exactly to the corresponding edge of the bar A to be ground, and this will of course be the case since the cam is made from a bar which is identical with the bar A. The parts 97 of the cam are sufficiently close together as shown at 99 to establish substantial continuity of the edge 98.

Preferably two brackets 94 and 95 are employed for supporting each cam part 97, although it will be understood that one or any other number of supports for each part 97 may be provided so long as the same is properly positioned to perform the intended function. Plates 100 are disposed between the belt 2 and brackets 94 and 95, and are secured to the belt 2 as at 101. The brackets 94 and 95 are mounted on the plates 100 by pin and slot connections 102 so that the same may be adjusted to thereby adjust the cam 96 laterally.

It will be observed that the follower 93 is arranged so that when the guide member arm 87 abuts the stop means 86, the follower contacts the edge 98 where the latter is not offset as at 103. Assuming that the belt 2 moves as indicated by the arrows B, the bar A will be engaged by the grinding wheel 8 substantially at D since the adjustable stop 19 is arranged to prevent the wheel 8 occupying a lower position. The follower 93 at that time will be positioned at a point spaced from the forward end 104 of the cam 96, the wheel 8 being positioned in proper grinding relation to the bar A by the spring 80 and the engagement of the stop instrumentalities 86 and 87. The wheel 8 is maintained in the same plane by the same instrumentalities throughout that portion of the bar A which is straight, i. e., until the point E in the bar A is reached where the edge of the bar begins to deviate or bend. At this point, the follower 93 of that particular wheel is positioned as shown at the left in Figure 1, in substantial engagement with the extreme forward portion 103 of the cam edge 98. During the movement of the wheel 8 from the position D to the position E, the wheel is raised by a cam action afforded by the fact that the bar A between these two points is bowed.

As the bar A continues forward, the follower 93 is shifted laterally by the offset cam edge 98 causing the wheel 8 to shift exactly in accordance with the shape of the bar A from the point E to the point F which for illustrative purposes is shown as located at the center of the bar A and at which point the maximum amount of shift of the wheel 8 has been effected by the cam 96. It will be observed that the roller 93 is of such length and is so adjusted in the slot 88 of the bracket 77 as to compensate for the bow in the bar A throughout the portion of the bar which is offset, namely from the point E to substantially the point F in the upward movement of the wheel 8, and from F to G corresponding to the point E but on the down side of the bar A. This accounts for the showing in Figure 1, wherein the roller 93 at the left is shown engaging the cam 96 at approximately half the height of the roller, and the roller in the middle of the figure engaging the cam 96 adjacent the lower end of the roller. Obviously the stop means 86 may be positioned elsewhere along the rod 83 according to the extent to which the edges of the bar to be ground are offset, and the clevis 90 may be adjusted vertically of the bracket 77, and the size of the clevis and roller carried thereby correspondingly varied for bumpers which are more or less bowed.

By reason of the fact that the grinding wheel head is floatingly supported, the grinding wheel, which conforms transversely to the transverse contour of the surface to be ground (in this instance the surface to be ground is convex) is enabled to be shifted by the bumper bar itself in accordance with the slight unevenness of its edges resulting from the various treatments to which the bar is subjected in the formation of the same as a bumper bar Thus the entire surface of the bar to be ground will be polished with an even smooth finish, without high spots or dull spots.

To the end that any bumper bar having a surface to be ground which is other than straight, transversely, such as a transversely convex bar herein illustrated, but whose edges are not offset, may be given a uniform finish, the telescoping parts 81 and 82, the cooperating spring 80, the clevis 90, roller 93, cam 96, and associated instrumentalities may be dispensed with. As explained in a previous paragraph, the shape of the bar and grinding wheel, transversely, is such as to cause the wheel to follow all inaccuracies in the edges of the bar, thereby affording a smooth finish for the surface to be ground. In such event, the stop instrumentalities comprising the guide element 84 and rod 83 are retained and a second stop means 86*a* employed in conjunction with the stop means 86. The two stop means 86 and 86*a* are preferably spaced apart sufficiently to allow the guide arm 87 to have a travel therebetween to an extent somewhat in excess of the width of the bar to be ground, so that the grinding wheel 8 may travel sufficiently laterally of the bar in accordance with the irregularity in the edges thereof. Such irregularities as may exist in the edges of the bar will be slight and the grinding wheel will float between the two stop means 86 and 86*a*, so that the wheel will readily pass into proper position onto the following bar without the need of any special positioning means. It will thus be apparent that by establishing what amounts substantially to a tongue and groove relationship between the bumper bar

and the polishing wheel, as by employing a grooved wheel when grinding a flat or crowned bar, or a transversely convex surfaced wheel for a transversely concave bar, a uniformly polished surface on the bar will be obtained in spite of edge irregularities therein. In addition this relationship makes it possible for the wheel, by reason of its ability to move freely in an axial direction, to shift in accordance with the offset in the bar, the bar itself in such cases serving as the means for shifting the wheel and holding the same in proper position for polishing. With the bar having one or more edge offset portions and this relationship established, the stop means 86a may be removed and a spring means such as that described above employed for urging the grinding wheel head outwardly. Such a spring need only be of sufficient strength to overcome whatever resistance is offered by the ball spline connection and would not be sufficient to cause the wheel to grind one portion of a transversely non-rectilinear bar more than another portion thereof. The spring would, however, position the grinding wheel so that upon leaving one bar it would be correctly positioned to readily engage the proper portion of the surface of the succeeding bar to be ground.

It will be seen from the foregoing that in accordance with the present invention there is provided means for grinding a longitudinally flat or bowed bar in such a manner that the surface operated upon will have a uniform finish, regardless of edge irregularities or offsets in the bar and regardless whether the surface to be ground is transversely rectilinear or non-rectilinear.

It will be noted that clamp flanges 105 are applied on the shaft 9 on opposite sides of the grinding wheel 8 for holding the same in proper operative position. If desired, shims or washers may be employed in conjunction with these flanges for the purpose of adjusting the wheel 8 along the shaft 9.

I am aware that many changes may be made and numerous details of construction may be varied through a wide range without departing from the principles of this invention, and I, therefore do not purpose limiting the patent granted hereon otherwise than necessitated by the prior art.

I claim as my invention:

1. In a machine for polishing a longitudinal substantially sinuous surface of a bumper bar, a support for holding such a bar in a position to be engaged by a polishing wheel, a polishing wheel having a polishing surface of a width substantially equal to the maximum dimension of the bar surface at right angles to the plane of rotation of the wheel, means for driving the wheel rotatably, means for causing relative movement between the support and the wheel in a direction parallel to the plane of the wheel, means for causing the wheel to automatically shift axially relative to the bar as the wheel passes along the diagonal part of the bar to thereby polish the sinuous surface of the bar, and means providing a support for the wheel so that the same may float up and down in a plane of its axis, to enable the wheel to polish vertically offset portions of the surface of the bar.

2. In a machine for polishing edge-offset bars, a movable support for such a bar, a template movable with the support and having an edge parallel to an offset edge of the bar, a plurality of polishing wheels, means supporting the wheels for axial movement, and a follower for said template and movable with each of said wheels, whereby said wheels will simultaneously polish relatively offset portions as well as relatively alined portions of the bar during continued movement of the latter.

3. In a machine for polishing edge-offset bars, a movable support for such a bar, a template movable with the support and having an edge parallel to an offset edge of the bar, a plurality of polishing wheels, means supporting the wheels for axial movement, and a follower for said template and movable with each of said wheels, whereby said wheels will simultaneously polish relatively offset portions as well as relatively alined portions of the bar during continued movement of the latter, and means for yieldably holding the followers in engagement with the template.

4. In a machine for polishing edge-offset bars, a movable support for such a bar, a template movable with the support and having an edge parallel to an offset edge of the bar, a plurality of polishing wheels, means supporting the wheels for axial movement, and a follower for said template and movable with each of said wheels, whereby said wheels will simultaneously polish relatively offset portions as well as relatively alined portions of the bar during continued movement of the latter, and means for limiting axial movement of the wheels so that the followers are in position to engage the suceeding templates for enabling the wheels to polish succeeding bars.

5. A polishing machine including a rotary polishing member for polishing a bar, said bar having portions relatively offset transversely with respect to a plane of rotation of said member, and means for conveying the bar relative to said member in the general direction of the length of the bar, said member being supported for movement transverse to said plane and being formed to have a cam and follower relation with the bar so that said member will be shifted transversely of said plane by the bar as the bar is conveyed, and means for holding the polishing surface and the surface to be polished interengaged under pressure during the polishing operation.

6. A polishing machine including a polishing member for polishing a plurality of bars each having a portion relatively offset transversely with respect to a plane of rotation of said member, and means for conveying said bars relative to said member in the general direction of the length of the bars, said polishing member being supported for movement transverse to said plane and being formed to have a cam and follower relation with each bar so that said member will be shifted transversely by each bar as the bar is conveyed, means for holding the polishing surface and the surface to be polished interengaged under pressure during the polishing operation, and means for supporting the bars in a longitudinal series with the rear end of each aligned in tandem with the front end of the succeeding bar, whereby upon becoming separated from the rear end of one polished surface said member becomes engaged with the front end of the succeeding surface to be polished, without adjustment.

7. In a machine for polishing bars such as bumper bars, a plurality of rotary polishing wheels, means for supporting the bars longitudi-

nally substantially parallel to the wheels, means for moving the support in a direction parallel to said wheels, means mounting each of the wheels for independent and combined axial and cross-axial movement in addition to its rotation, so that the same polishing area thereof may polish selectively a straight bar, a bar having an edge offset in a plane parallel to the wheel axis, a bar whose edges are offset in a plane at right angles to the wheel axis, and a bar having portions of its edges offset in neither of said planes, said wheels being spaced longitudinally to such an extent as to be engageable with spaced portions of the same bar, and means for holding the wheels in polishing engagement with such spaced portions of a bar, regardless whether such portions are relatively offset.

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