July 13, 1943. E. E. MURRAY 2,324,416

BUFFING OR POLISHING MACHINE

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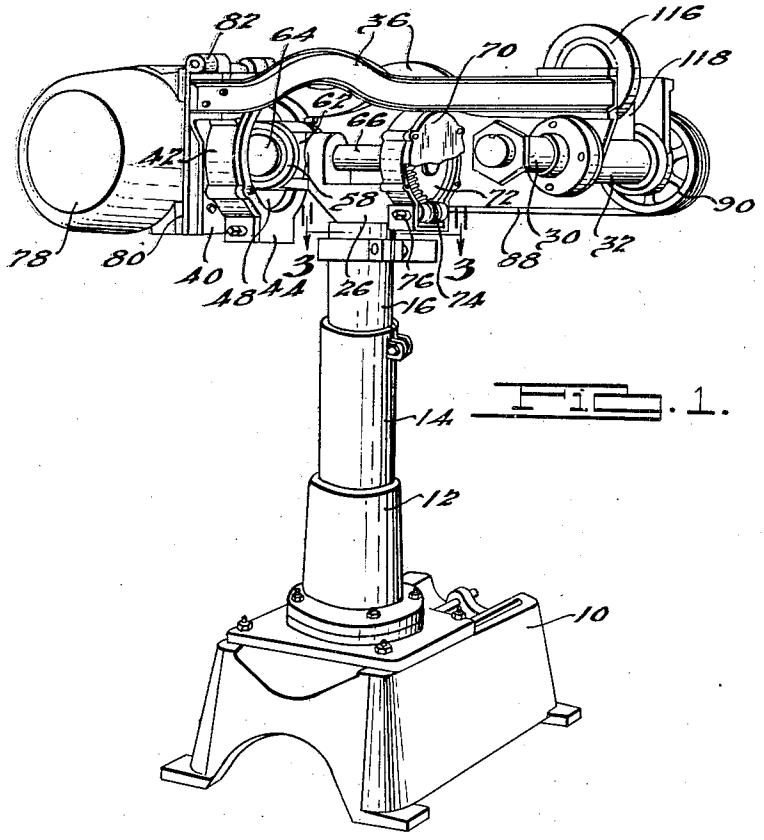


Fig. 1.

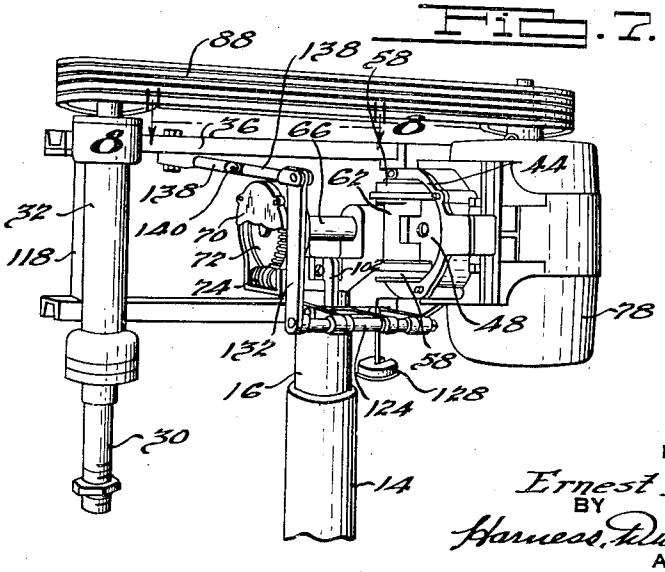


Fig. 2.

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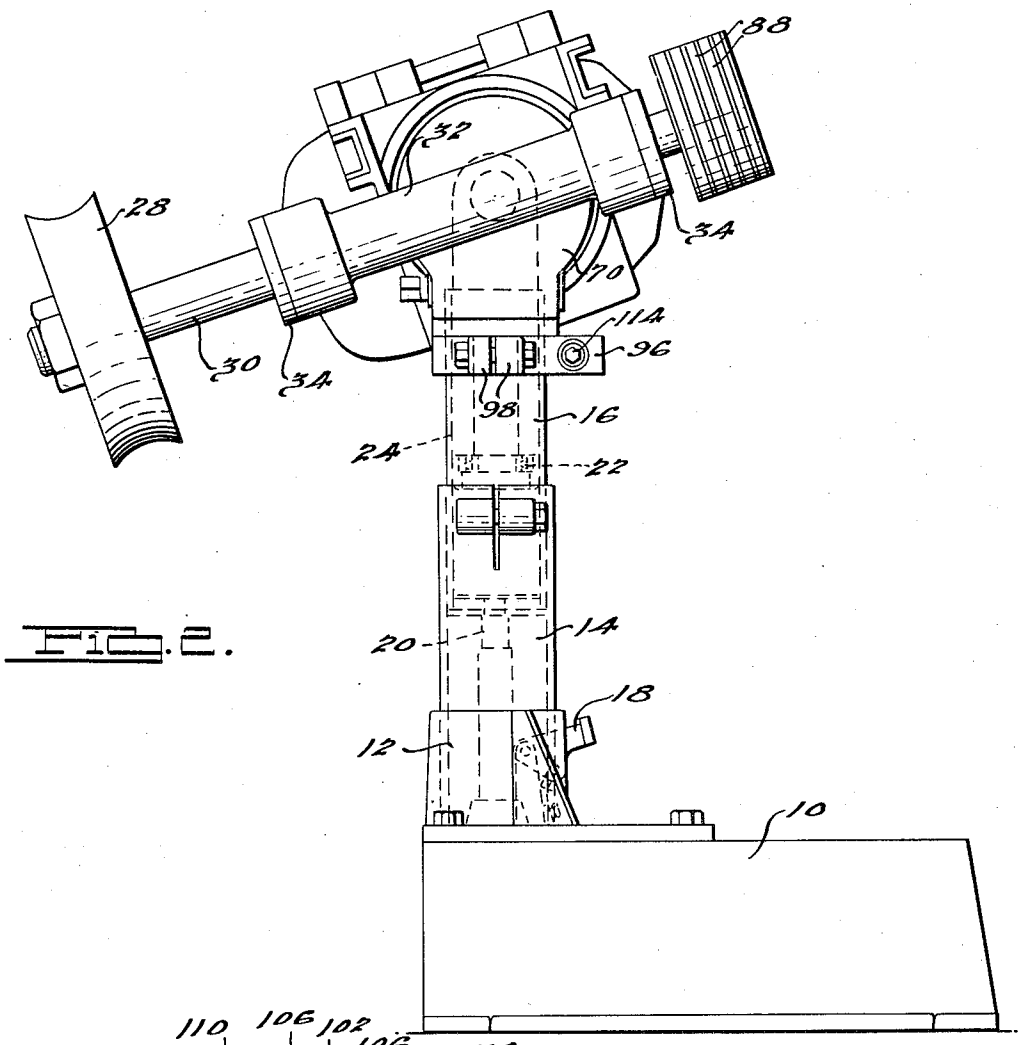


FIG. 2.

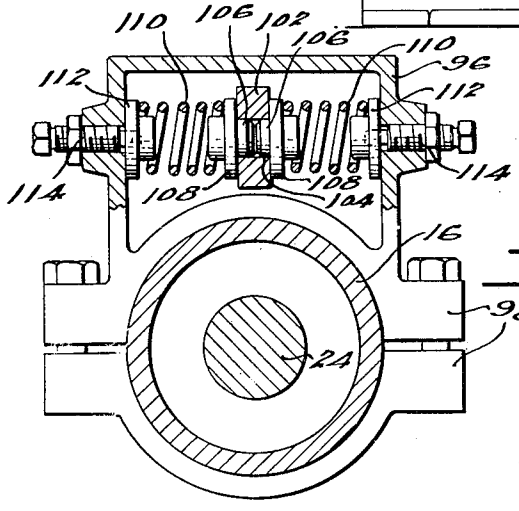


FIG. 3.

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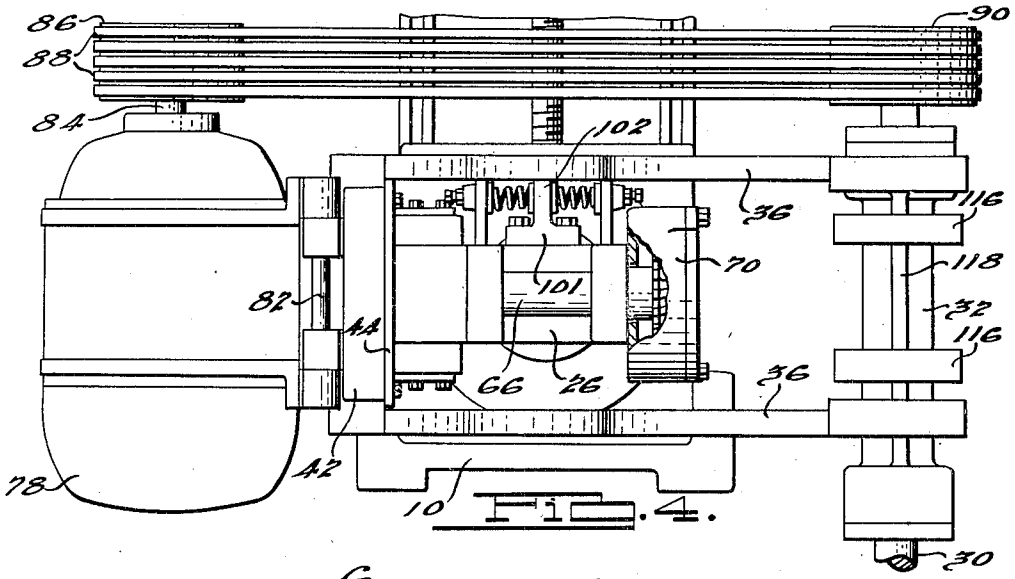


Fig. 4.

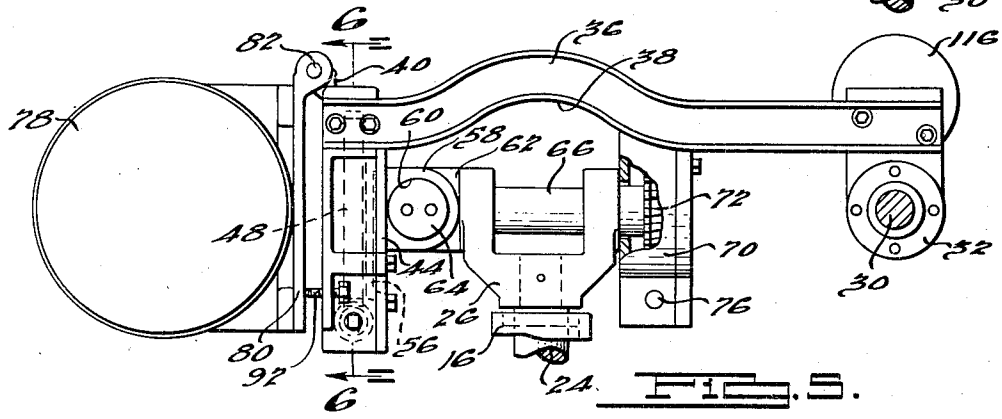


Fig. 5.

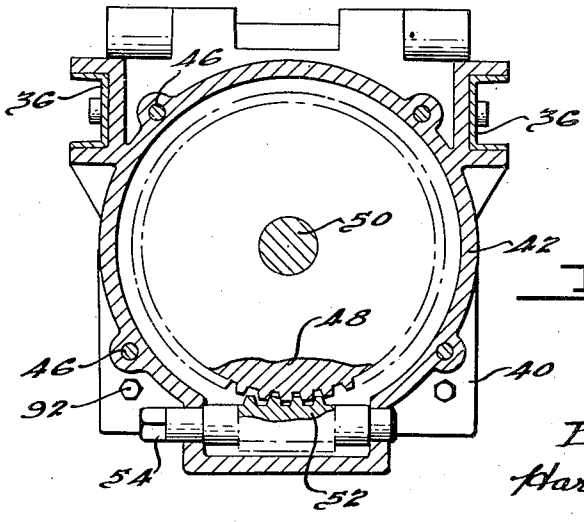


Fig. 6.

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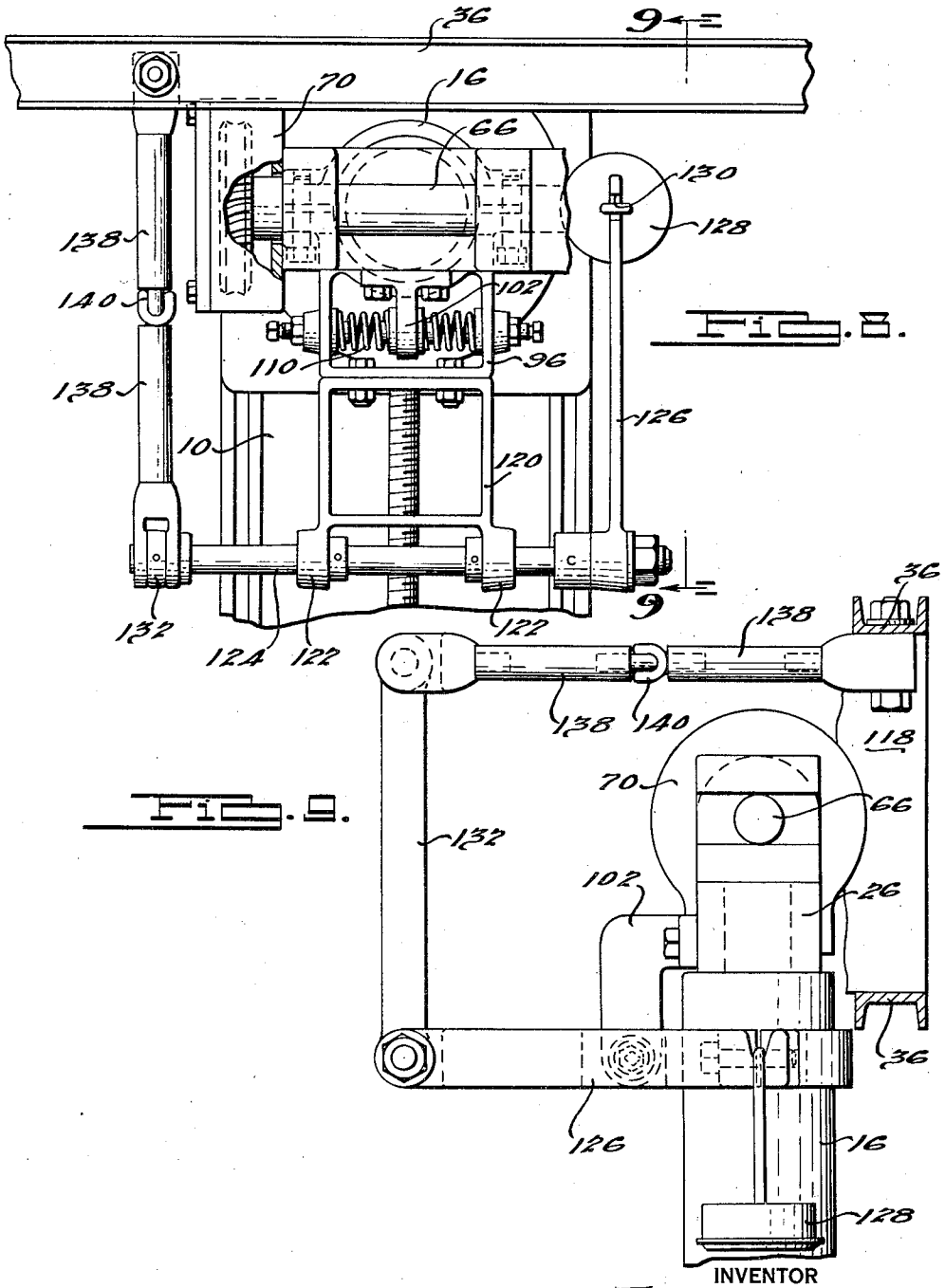


Fig. 8.

Fig. 9.

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BUFFING OR POLISHING MACHINE

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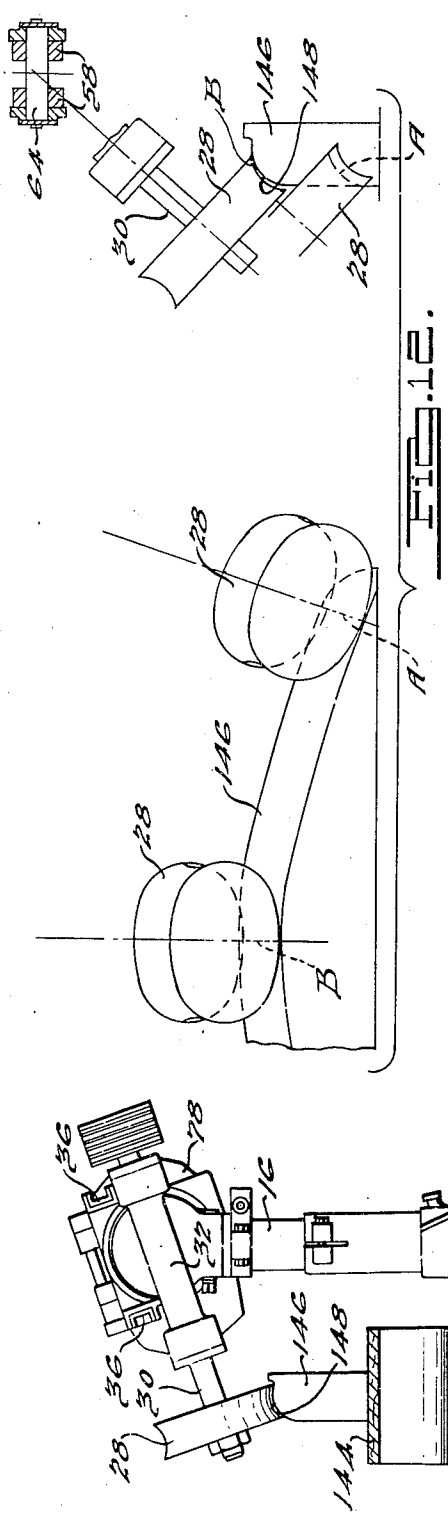


Fig. 12.

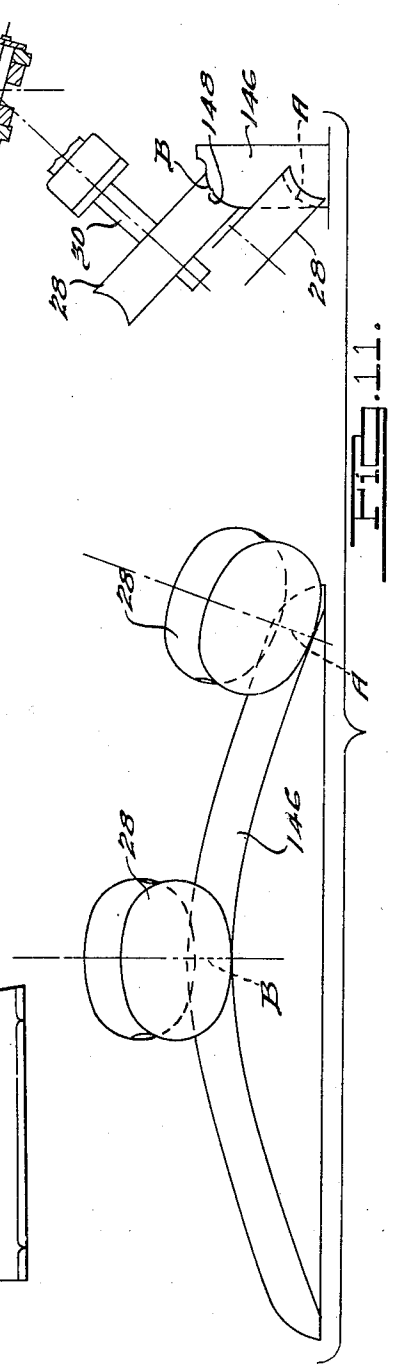


Fig. 11.

Fig. 10.

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UNITED STATES PATENT OFFICE

2,324,416

BUFFING OR POLISHING MACHINE

Ernest E. Murray, Detroit, Mich.

Application April 22, 1941, Serial No. 389,790

13 Claims. (Cl. 51—166)

The present invention relates to finishing or polishing machines and particularly relates to improvements in the heads for mounting polishing machines.

One of the primary objects of the present invention is to provide improvements in power driven finishing or polishing machines whereby, regardless of the angle of the polishing wheel to the work and regardless of the contour of the work, the wheel is caused to follow the proper path in contact with the work as the work and wheel mounting are moved with respect to each other.

Another object of the invention is to provide improvements in machines of the type mentioned, in which the wheel may be set with respect to the work so that such wheel is caused to follow a predetermined path in contacting the work to compensate for shifting of the point of tangency of the wheel in contacting the work at different points therealong.

Another object of the invention is to provide improvements in machines of the type mentioned, in which the wheel may be set with respect to a cambered work article so that such wheel is caused to follow a predetermined path in contacting the work along the camber to compensate for wheel misalignment due to shifting of the point of tangency of the wheel and/or due to changes in spindle angle as the wheel moves along the camber of the article in contact therewith.

Another object of the invention is to provide improvements in mountings for power driven polishing wheels for polishing elongated articles having a longitudinal camber therein and having a transversely inclined surface in which, when the wheel is disposed at an angle between the vertical and horizontal, it is caused to follow a predetermined path in contacting the work to compensate for shifting in the tangency of the wheel in contacting the work at different points therealong.

A further object of the present invention is to provide a universal, power driven polishing machine in which the wheel properly contacts the work at all points along the work whether such wheel is disposed on a vertical, a horizontal, or an inclined axis.

A further object of the invention is to provide improvements in machines of the type mentioned which are so constructed that it will permit a wheel to "hunt" within practical limits so that the contour of the wheel may properly align itself with the contour of the work.

A more specific object of the invention is to provide improvements in the means for adjustably mounting the axis of the polishing wheel so that such axis may be disposed horizontally, vertically, or on an incline of the vertical, and when disposed on the incline may be so set with respect to the work as to cause it to follow a predetermined path to compensate for shifting in the tangency of the wheel in contacting the work at different points therealong.

Another object of the present invention is to provide improvements in machines of the type mentioned, in which improved means are provided for urging the wheel toward the work into engagement therewith when such wheel is mounted to rotate on a vertical axis.

Other objects of the invention will become apparent from the following specification, the drawings relating thereto, and the claims hereinafter set forth.

In the drawings, in which like numerals are used to designate like parts in the several views throughout:

Figure 1 is a front perspective view of a power driven polishing machine employing features of the present invention and showing the machine set with the wheel axis in a substantially horizontal position;

Fig. 2 is an end elevational view of the machine shown in Fig. 1 from the right hand side thereof, and showing the wheel axle tilted at an incline to the vertical;

Fig. 3 is an enlarged cross-sectional view taken substantially along the line 3—3 of Fig. 1;

Fig. 4 is a top plan view of the structure shown in Fig. 1;

Fig. 5 is a front elevational view of the top portion of the structure shown in Fig. 1;

Fig. 6 is an enlarged cross-sectional view taken substantially along the line 6—6 of Fig. 5;

Fig. 7 is a rear perspective view of the structure shown in Fig. 1, showing the wheel spindle in a vertical position and illustrating an attachment in position for urging the wheel toward the work when the spindle is so disposed;

Fig. 8 is an enlarged top plan view taken substantially along the line 8—8 of Fig. 7;

Fig. 9 is an end elevational and cross-sectional view taken substantially along the line 9—9 of Fig. 8;

Fig. 10 is an elevational view of a polishing machine according to the present invention and showing such machine in operative position on a workpiece disposed on a conveyer;

Fig. 11 diagrammatically illustrates the correct

action of the present invention when engaging an elongated, bowed workpiece; and

Fig. 12 illustrates an incorrect action, for purpose of comparison, so that the present invention may be readily appreciated.

It has been the practice in polishing articles having an elongated camber therein, such as automobile bumpers, to mount such articles on an endless conveyer and carry the articles past a plurality of power driven polishing machines which are disposed beside the conveyer at spaced points therealong. Such machines are so positioned that the polishing wheels thereof engage the surface of the bumper to finish or polish such surface as the articles are passed thereby. It was found in such practice that the surfaces of the bumpers were not evenly polished and often contained scratches or other forms of imperfections which were caused by the polishing wheels and which usually had to be remedied by hand polishing. It was not until the present invention that the cause of these defects in this above mentioned practice was realized nor could such causes be corrected until the present invention.

It was discovered that the cause of the imperfect polishing was due to the shifting of the point of tangency of the polishing wheel in contacting the cambered work article at different points therealong and was also due to the changes in the spindle angle as the wheel moves along the camber of the article in contact therewith. According to the present invention, a construction is provided in which the polishing wheel may be so disposed with respect to the work, regardless of whether it is on a vertical, inclined, or horizontal axis, so that the polishing wheel is caused to follow a predetermined path in contacting the work along the camber thereof to compensate for wheel misalignment due to this shifting of the point of tangency of the wheel and/or due to changes in spindle angle as the wheel moves along the camber of the article in contact therewith.

For a better understanding of the invention, reference may be had to the drawings and particularly to Figs. 1 through 10 thereof in which the polishing wheel spindle is illustrated as being disposed in various positions. Such polishing machine comprises a base **10** having an upstanding standard mounted thereon for lateral adjustment along ways on the base. The standard is formed of a plurality of telescoping sections **12**, **14**, and **16**. A jack **18** having operating elements **20** is associated with the telescoping sections and engages with the operating members connected to the lower end of the telescoping section **16**, so that such upright standard may be adjusted as to height.

A bearing **22** is mounted within standard section **16** and receives thereon an upright pivot pin pin **24** which projects upwardly through the top thereof and which is connected to a forked or bifurcated mounting member **26**, so that such member **26** may pivot with respect to the standard about the longitudinal axis of pin **24**.

A power driven polishing wheel **28** is mounted to the standard through the yoke arm **26** in a manner now to be described. Such polishing wheel is fixed to a driving spindle **30** to be driven thereby; and such spindle **30** is mounted within a tubular frame member **32** having bearings **34** disposed at the ends thereof and through which the shaft **30** extends. The member **32** is secured to the ends of longitudinally extending frame arms **36** which may be of channel section and which may be bowed as indicated at **38** in order to provide clearance when such frame is tilted to certain of its positions. The opposite ends of the frame arms **36** are connected to a mounting plate **40** adjacent the upper edge thereof.

A gear housing **42** is fixed to the forward face of the plate member **40**, or may be formed integral therewith, and an annular clamping plate **44** is fixed to the front annular edge of the housing **42** by means of bolts **46**. A gear or worm wheel **48** is disposed within the housing **42** and is rotatably mounted upon a stub shaft **50** which is mounted to the rear face of the housing **42** or to the plate **40**. A worm **52** is mounted in the housing **42** in mesh with the gear **48** and has a projecting end **54** which may be engaged by a suitable tool so that the worm **52** may be turned, thereby turning the gear **48** with respect to the housing **42**.

The plate **48** is provided with an inwardly projecting annular flange **56** (Fig. 5), which is adapted to abut against the face of the gear **48** so that said face plate may be drawn tightly against the gear to act as a brake and to fix such gear in position.

The gear **48** is formed with a pair of integral ears or lugs **58** which are normal to the face of the gear and which have aligned bearing apertures **60** therein so that such lugs **58** project forwardly through the opening in the housing **42** and through the opening in the clamping ring **44**. A cross arm **62** has a transverse pivot shaft **64** pivotally received within the bearing apertures **60** of the projections **48**. Such arm **62** has an integral or fixed pin **66** connected thereto which is disposed at substantially a right angle to the axis of the shaft **64**; and such pin **66** is received through aligned openings in the forked arms of the bifurcated member **26**.

It will thus be seen that the wheel **28**, together with the spindle **30** and the frame **36**, may be pivoted with respect to the supporting standard about the pivots **64**.

The shaft or pin **66** projects through the arms of the bifurcated element **26** into a gear housing **70** which may be mounted upon the forward arm of the member **26**. A gear or worm wheel **72** is disposed within the housing **70** and keyed to the shaft **66**. Such gear **72** may be rotated with respect to the housing by means of a worm **74** which is mounted within the housing in mesh with the gear **72** and which has a projecting end **76**. Such projecting end may be engaged by a suitable tool for the purpose of rotating the worm and for therefore rotating the gear **72** and the shaft **66**, together with the shaft **64**, with respect to the standard. It will thus be seen that when the shaft **66** is rotated, the lugs **58** are caused to rotate through their connection with the pivot shaft **64** so that the housing **42**, together with the frame members **36** and the spindle **30**, are correspondingly rotated.

The driving means for the wheel **28** comprises an electric motor **78** which is secured to a mounting plate **80**. Such mounting plate **80** is hingedly connected to the upper end of the plate member **40** by means of a suitable hinge and pintle construction **82**. Motor **78** has a drive shaft **84** to which a pulley **86** is keyed, and a plurality of driving belts **88** are trained about the pulley **86** and are also trained about a drive pulley **90** which is keyed to the driving spindle **30**. In order to tighten such belts, a set screw, or screws, **92** is received through a tapped opening in plate member **40** and is so disposed that the inner end

thereof abuts against the back of mounting plate 90. It will thus be seen that by adjusting the set screws 92, the belts 88 may be tightened.

In order to permit a slight hunting movement of the wheel 28, or a slight lateral movement of such wheel, a box-like bracket 96 is clamped to the standard 16 by means of a split clamp 98 which engages the section 16 adjacent the upper end thereof. A member 101, having a depending finger 102, is fixed to one side of the base of the bifurcated member 26 and is so positioned that the finger 102 projects downwardly within the housing 96. Such finger 102 is provided with an opening 104 therethrough adjacent the lower end thereof which receives therein the stub ends of pins 106. Such pins 106 have annular flanges 108 thereon which abut against the opposite faces of the member 102 with pins projecting outwardly of such flanges 108. Spiral springs 110 abut against the flanges 108 with the pin projections preventing displacement of such springs and the opposite ends of such springs abut against annular stops 112 which are adjustably mounted to the sides of the housing 96 by means of adjustable screws 114. The members 112 also have inwardly projecting portions which prevent displacement of the outer ends of springs 110. It will thus be seen that the depending finger 102 is resiliently urged to a central position through the action of the springs 110, but that a slight movement is permitted due to the resiliency of such springs, in order to permit a slight hunting action of the wheel 28.

The spindle, together with the wheel 28, is counterbalanced about the pivot 64, when the spindle is in a horizontal or inclined position, by means of removable scale weights 116 which are provided with radial slots through the periphery thereof so that such weights may be mounted upon a transversely extending plate member 118. Such weights are preferably chosen so that the weight of the motor is slightly overbalanced and so that the wheel 28 is urged into engagement with the work.

Such weights 116 are used only when the spindle is in a horizontal or inclined position, and when the spindle 30 is disposed in a vertical position, as shown in Figs. 7, 8, and 9, another attachment is mounted to the machine for urging the wheel against the work. Such other attachment includes a boxlike mounting bracket 120 which may be removably attached to the outer edge of the mounting bracket 96. Such bracket 120 is formed with a pair of spaced bearings 122 which receive therethrough a pivot shaft 124. Such pivot shaft 124 has a normally horizontal arm 126 fixed to one end thereof and to which suitable scale weights 128 may be hung within a notch 130 formed in the opposite end of the arm 126. Another, normally vertical, arm 132 is fixed to the opposite end of the pivot shaft 124. The upper end of the arm 132 is connected to one of the frame members 36 by means of a link 133 which is formed with a universal joint 140 therein. The one end of the link 133 is pivotally connected to the upper end of arm 132 and the opposite end of the link 133 is pivotally connected to one of the frame members 36. It will thus be seen that the scale weights 128 act on the frame members 36, through members 133, 132, and 124, to urge the wheel against or toward the work. The universal connection 140 permits this action to take place as the spindle pivots about the upright standard.

In Fig. 10, the machine is illustrated as being disposed beside an endless conveyer 144 which has a workpiece 146 mounted thereon. Such workpiece 146 may be an automobile bumper or the like and, as illustrated, has a longitudinal camber therein and has curved surfaces 148 which are transversely curved in the direction of movement of the article 146. The wheel 28 is illustrated as engaging a portion of the side of the surface 148 with the spindle 30 inclined to the vertical.

It will be understood that the wheel 28 has the contour of that portion of the workpiece that it engages and that such wheel rotates at a high speed in contact with the workpiece as the workpiece is moved past the polishing machine on the moving conveyer 144.

It will also be understood that the various machines which are disposed along the conveyer have their spindle axes at various angular positions with respect to the work. Each wheel engages only a limited transverse position of the article being worked upon and certain of the spindles will be on a horizontal axis, others will be inclined to the vertical, and others may be vertical, of course depending upon the contour of the particular piece being finished.

In the operation of the machine of the present invention, when the polishing wheel is positioned to engage the top or substantially horizontal portion of the workpiece, the spindle 30 is disposed substantially horizontally and the pivot 64 is also disposed substantially horizontally. As the workpiece is carried past that particular machine by the conveyer, the point of tangency of the wheel with the work lies in a vertical plane, which is parallel to the direction of travel of the work so that there is no lateral shifting of the point of tangency on the workpiece as the cambered workpiece moves past the machine. The pivotal movement of the spindle about the parallel pivot pin 64 will cause the point of tangency of the wheel with the work to remain in the aforementioned vertical plane.

When the spindle 30 is disposed vertically, the pivot pin 64 is disposed substantially parallel thereto and there is no need to compensate for any shift in the point of tangency.

This positioning of the spindle either horizontally, vertically, or on an incline to the vertial, is accomplished through rotation of the worm 74. The pivot 64 may be adjusted with respect to the axis of the spindle 30 through the worm 52. It will thus be seen that the relative angles of the axes of pin 64 and spindle 30 may be varied with respect to each other.

When the spindle 30 is inclined to the vertical so as to engage an inclined portion of the workpiece, as shown in Figs. 10, 11, and 12, according to the present invention the pivot 64 is positioned with respect to the angle of the spindle 30 so as to compensate for the shift in the point of tangency and/or the variations in the angular position of the spindle 30 with respect to the work as the cambered workpiece is moved past the polishing machine. For a better understanding of this, reference may be had to Figs. 11 and 12 in which this is diagrammatically illustrated. The wheel 28 is shown inclined to the vertical and is shown in contact with the workpiece 36 at positions A and B. It will be seen by comparing these two figures that the point of tangency on the wheel 28 is different at point A than it is at point B. It will thus be seen that as the workpiece 46 moves from position A to position B, the point of tangency of the wheel

therewith shifts. These points of tangency, due to the inclination of the wheel, are in different vertical planes in the direction of travel of the work.

With the pin **64** in a horizontal position, as shown in Fig. 12, as the wheel **28** travels up over the camber of the workpiece **146** from position A to position B, the wheel **28** pivots about pin **64**; so that with the wheel in proper engagement at point A, the wheel in moving to the position shown at B would not properly engage the workpiece. This will be seen in the righthand view of Fig. 12 wherein there is a gap between the surface of the wheel and the surface of the workpiece and such workpiece is contacted by the wheel only along one edge thereof. This misalignment, with resultant scratches and imperfections in the workpiece, is due to this shifting of the point of tangency and due to the variations in the angular position of the spindle **30** in moving from position A to position B.

These are compensated for in Fig. 11 by shifting the axis of shaft **64**, as indicated in the righthand view of Fig. 11. It will then be seen that in moving from position A to position B, the spindle and wheel pivot about the axis **64**, which, in this case, is tilted slightly off the horizontal in a clockwise direction. Such adjustment of the pivot **64** compensates for the shifts in the points of tangency and the variations in the angular position of the spindle **30** so that at all positions between positions A and B, the wheel **28** is in proper contact with the workpiece.

It has been found that machines of the present invention, with the multiple adjustments of the spindle and pivot axes, may be very quickly set up to compensate for the above mentioned variations in tangency and shift of the spindle angle when working on complicated contours as in polishing automobile bumpers. The extent of adjustment is a matter of observation for a trial piece of the machines may be quickly set by the skilled operators.

While only one specific embodiment of the present invention has been here illustrated, it is to be understood that formal changes may be made in the specific embodiment shown without departing from the spirit and substance of the broad invention, the scope of which is commensurate with the appended claims.

What is claimed is:

1. In polishing apparatus wherein an article having a longitudinal camber therein and having portions of the surface thereof disposed at an incline to the vertical transversely thereof is disposed longitudinally on a conveyor for line movement therewith, the combination of a polishing machine comprising a power driven spindle, a polishing wheel mounted thereon and driven thereby, and means mounting said spindle at an incline to the vertical for movement when said wheel engages said article along the camber thereof, said last named means including restricting means for controlling the movement of said spindle and the wheel thereon, said restricting means being so constructed that the point of tangency of said wheel with the article is caused to follow in a vertical plane parallel to the direction of travel of the article.

2. In a polishing machine, a power driven spindle, a polishing wheel mounted thereon and driven thereby, a support, means pivotally mounting said spindle on said support, said last named means including a pivot fulcrum for said spindle, means for adjustably setting said spindle on a horizontal, vertical, or inclined position, and means for adjustably varying the axis of the pivot fulcrum with respect to the axis of the spindle.

3. In a polishing machine, a power driven spindle, a polishing wheel mounted thereon and driven thereby, a support, means pivotally mounting said spindle on said support, said last named means including a pivot fulcrum for said spindle, means for adjustably setting said spindle together with said pivot fulcrum on a horizontal, vertical, or inclined position, and means for adjustably varying the axis of the pivot fulcrum with respect to the axis of the spindle.

4. In a polishing machine, an upright standard, a power driven spindle, a polishing wheel mounted thereon and driven thereby, an arm member having the spindle mounted on one end thereof, and means pivotally connecting the opposite end of said arm to said standard, said last named means including means providing a pivot fulcrum for said arm about which said spindle pivots, adjustable means for setting said spindle at a predetermined position with respect to the vertical, and means for adjustably varying the fulcrum axis with respect to the axis of the spindle.

5. In a polishing apparatus wherein an elongated article having a longitudinal camber therein and having portions of the surface thereof disposed at an incline to the vertical is disposed longitudinally on a conveyor for line movement therewith, the combination of a polishing machine mounted adjacent said conveyor comprising a power driven spindle, a polishing wheel mounted thereon and driven thereby, a support, means pivotally mounting said spindle on said support, said last named means including a pivot fulcrum for said spindle so that said spindle together with said wheel is moved about said fulcrum in engaging said article along the camber thereof, means adjustably setting said spindle together with said fulcrum on a horizontal, vertical, or inclined position, and means for adjustably varying the axis of the pivot fulcrum with respect to the axis of the spindle, to thereby compensate for any shifting of the point of tangency of the wheel in contacting the article along the camber thereof.

6. In a polishing apparatus wherein an elongated article having a longitudinal camber therein and having portions of the surface thereof disposed at an incline to the vertical is disposed longitudinally on a conveyor for line movement therewith, the combination of a polishing machine comprising a power driven spindle, a polishing wheel mounted thereon and driven thereby, a support, means pivotally mounting said spindle on said support, said last named means including a pivot fulcrum for said spindle so that said spindle, together with said wheel, is pivoted about said fulcrum in engaging said article along the camber thereof, and means for adjustably setting said spindle and said fulcrum at a predetermined position with respect to the vertical and means for varying the axis of the pivot fulcrum and the axis of the spindle with respect to each other to thereby compensate for any shifting of the point of tangency of the wheel in contacting the article along the camber thereof.

7. In a polishing machine, an upright standard, a power driven spindle, a polishing wheel mounted thereon and driven thereby, an arm member having a spindle mounted on one end thereof, and means pivotally connecting the op-

posite end of said arm to said standard, said last named means including means providing a pivot fulcrum for said arm about which said spindle pivots in one direction, a pivot element having its axis substantially normal to the axis of said fulcrum about which said spindle pivots in another direction, means to adjust said spindle about the pivot element axis and means to adjust said fulcrum axis with respect to the axis of the spindle.

8. In a polishing machine, an upright standard, a power driven spindle, a polishing wheel mounted thereon and driven thereby, an arm member having a spindle mounted on one end thereof, and means pivotally connecting the opposite end of said arm to said standard, said last named means including means providing a pivot fulcrum for said arm about which said spindle pivots in one direction, a pivot element having its axis substantially normal to the axis of said fulcrum about which said spindle pivots in another direction, means to adjust said spindle about the pivot element axis to a set position with respect to the vertical, and means to adjust said fulcrum axis with respect to the axis of the spindle.

9. In a polishing machine, an upright standard, a power driven spindle, a polishing wheel mounted thereon and driven thereby, an arm member having a spindle mounted on one end thereof, and means pivotally connecting the opposite end of said arm to said standard, said last named means including means providing a pivot fulcrum for said arm about which said spindle pivots in one direction, a pivot element having its axis substantially normal to the axis of said fulcrum about which said spindle pivots in another direction, means to adjust said spindle about the pivot element axis to a set position with respect to the vertical, and means independent of said last named means to adjust said fulcrum axis with respect to the axis of the spindle.

10. In a polishing machine, an upright standard, a power driven spindle, a polishing wheel mounted thereon and driven thereby, an arm member having a spindle mounted adjacent one end thereof, and means pivotally connecting said arm to said standard for pivotal movement of said arm about a vertical axis and lateral movement of said wheel with respect to the axis of said standard, said last named means including means limiting such pivotal movement and urging said wheel to a predetermined position to thereby permit limited lateral movement of said wheel.

11. In a polishing machine, an upright standard, a power driven spindle, a polishing wheel mounted thereon and driven thereby, an arm member having a spindle mounted adjacent one end thereof, and means pivotally connecting said arm to said standard for pivotal movement of said arm about a vertical axis and lateral movement of said wheel with respect to the axis of said standard, said last named means including resilient means limiting such pivotal movement and resiliently urging said wheel to a predetermined position to thereby permit limited lateral movement of said wheel out of said predetermined position.

12. In a polishing machine, an upright standard, a power driven spindle, a polishing wheel mounted thereon and driven thereby, an arm member having a spindle mounted on one end thereof, and means connecting the opposite end of said arm for pivotal movement with respect to said standard, said last named means including means providing a pivot fulcrum for said arm about which said spindle pivots in one direction, a pivot element havng its axis substantially normal to the axis of said fulcrum about which said spindle pivots in another direction, means to adjust said spindle about the pivot element axis and to adjust said fulcrum axis with respect to the axis of said spindle, means pivotally connecting said pivot element to said standard for pivotal movement of said arm and lateral movement of said wheel with respect to the axis of said standard, said last named means including means limiting such last named pivotal movement to thereby permit limited lateral movement of said wheel.

13. In a polishing machine, an upright standard, a power driven spindle, a polishing wheel mounted thereon and driven thereby, an arm member having a spindle mounted on one end thereof, and means connecting the opposite end of said arm for pivotal movement with respect to said standard, said last named means including means providing a pivot fulcrum for said arm about which said spindle pivots in one direction, a pivot element having its axis substantially normal to the axis of said fulcrum about which said spindle pivots in another direction, means to adjust said spindle about the pivot element axis and to adjust said fulcrum axis with respect to the axis of said spindle, means pivotally connecting said pivot element to said standard for pivotal movement of said arm and lateral movement of said wheel with respect to the axis of said standard, said last named means including resilient means limiting such last named pivotal movement and resiliently urging said wheel to a predetermined lateral position to thereby permit limited lateral movement of said wheel.

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