June 5, 1923. 1,457,979

S. H. LEAVENWORTH

METAL SURFACING OR ABRADING MACHINE

Filed Nov. 13, 1920 4 Sheets-Sheet 1

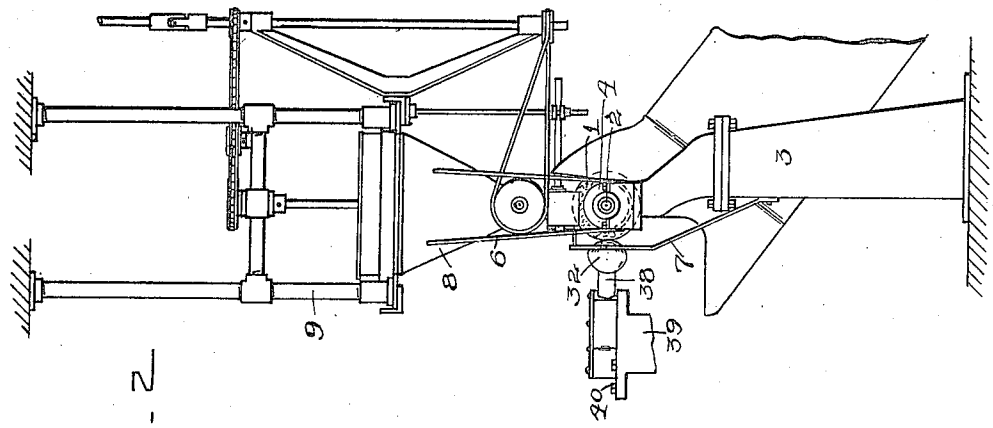


FIG. 2

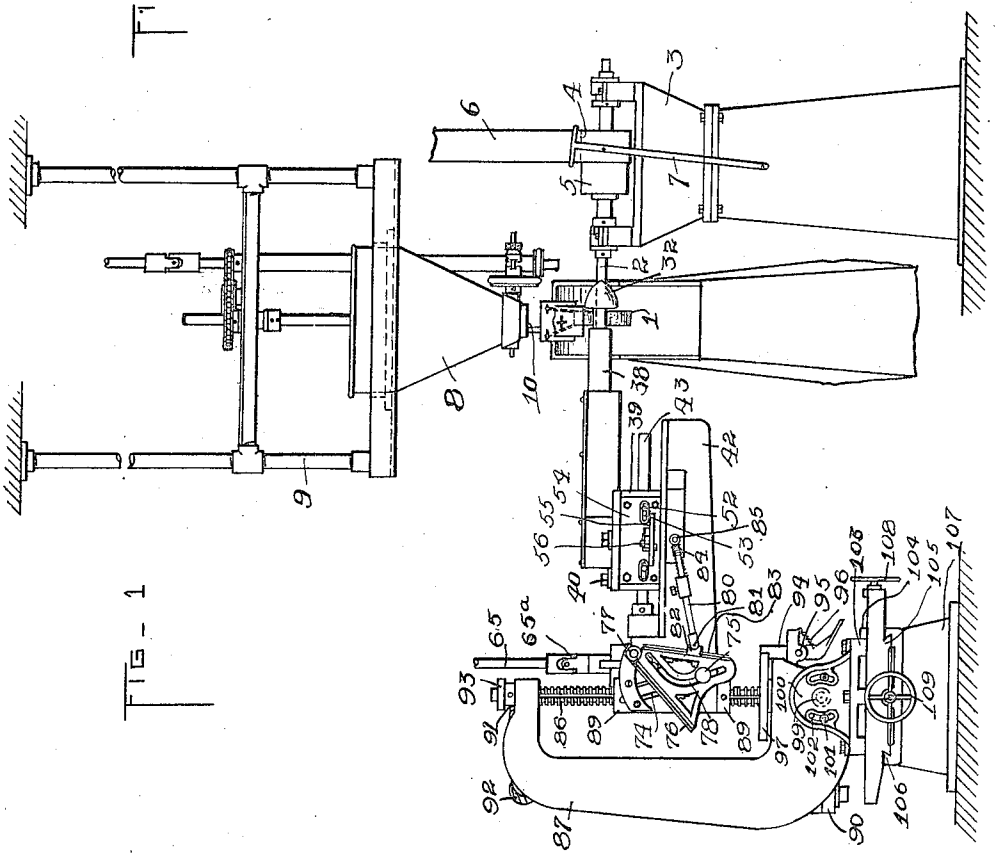


FIG. 1

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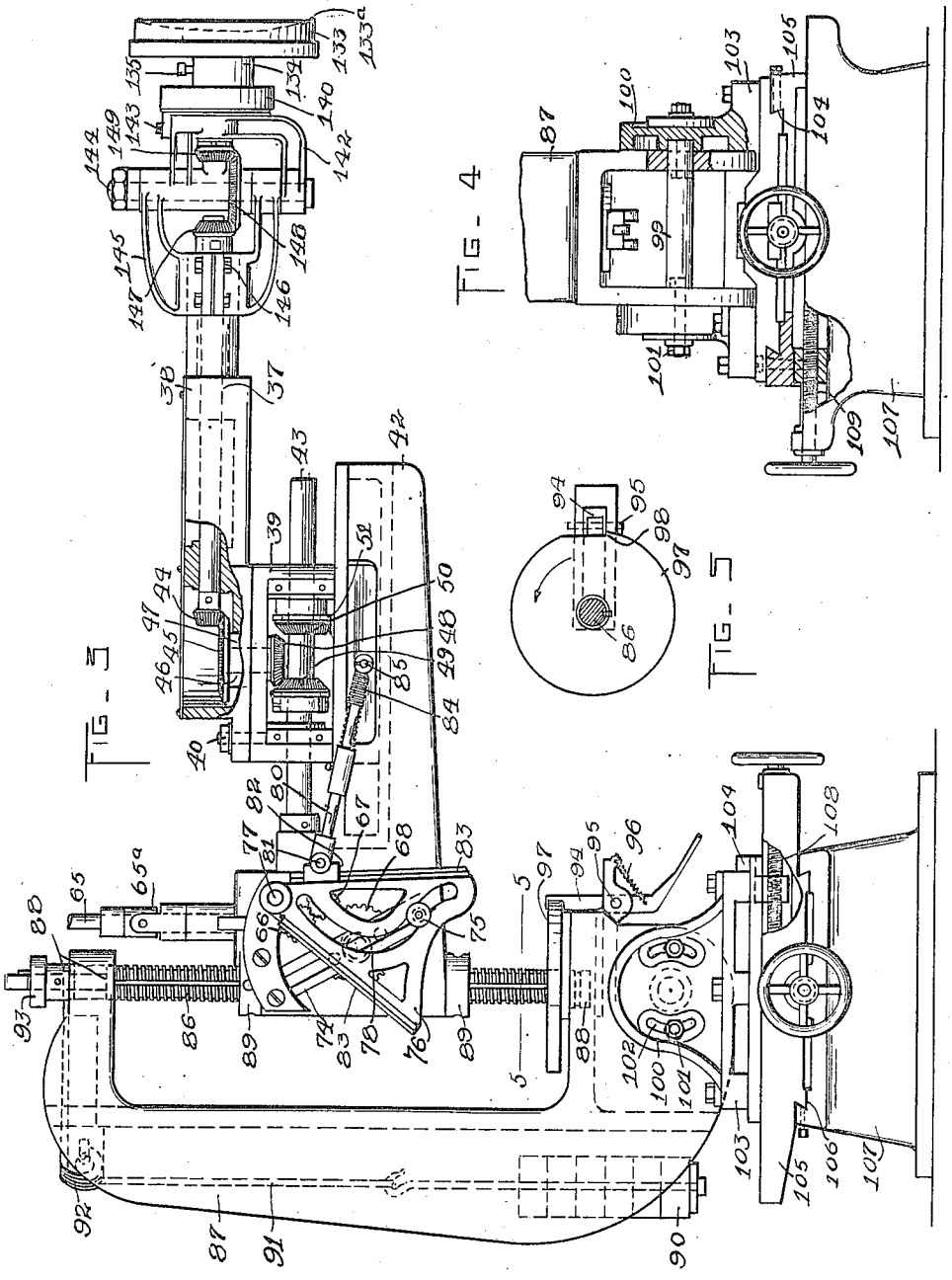


FIG. 3

FIG. 4

FIG. 5

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June 5, 1923.

1,457,979

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METAL SURFACING OR ABRADING MACHINE

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4 Sheets-Sheet 3

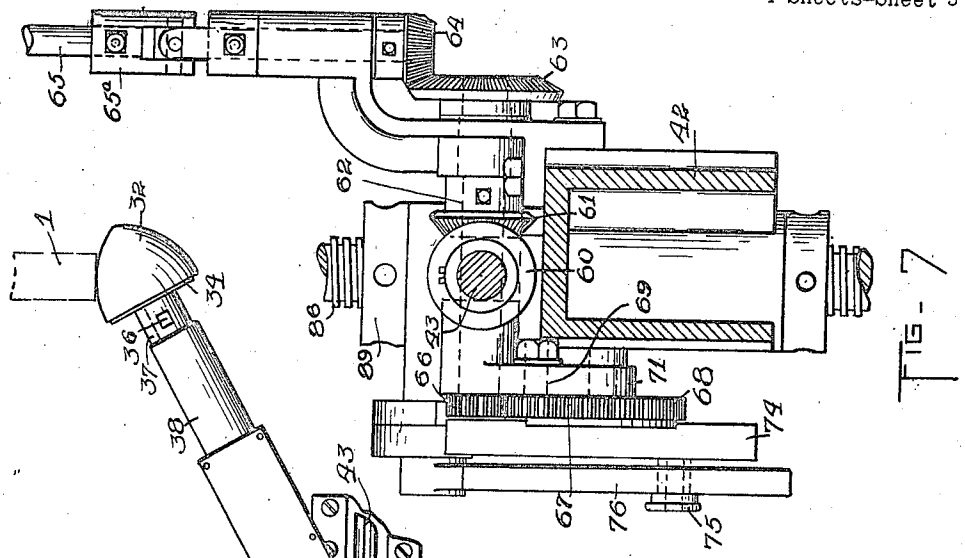


FIG. 7

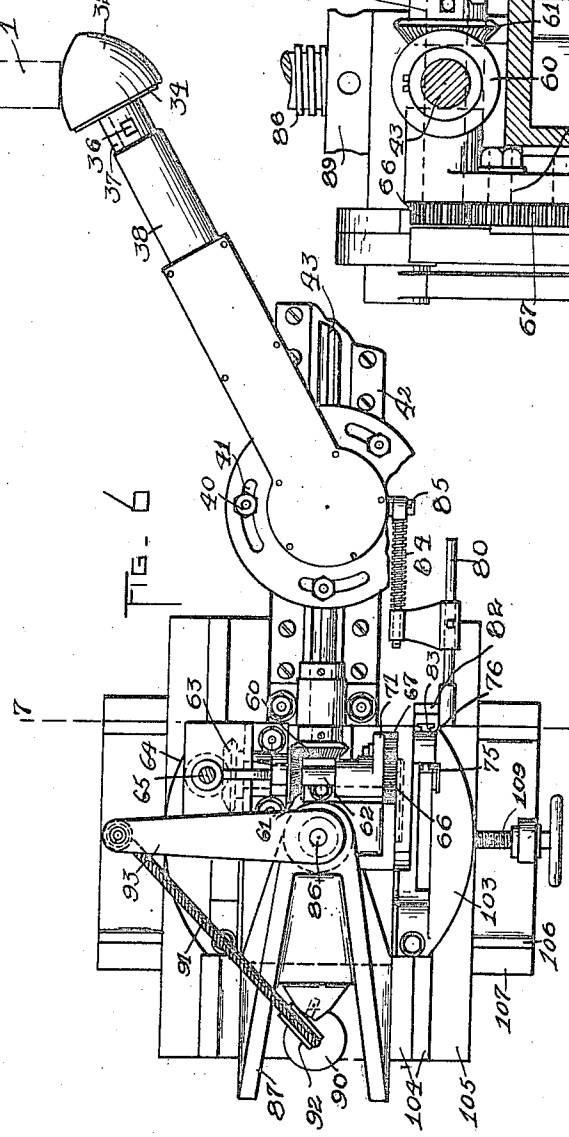


FIG. 6

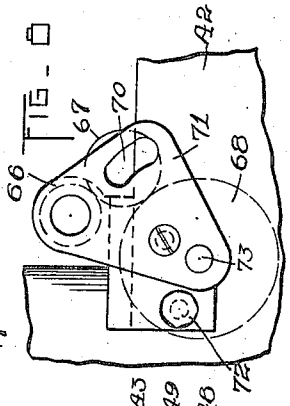


FIG. 8

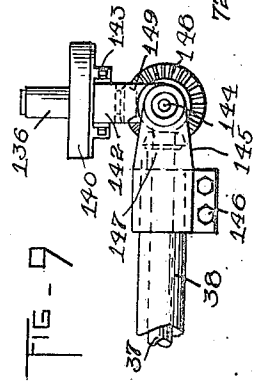


FIG. 9

Seth H. Leavenworth INVENTOR

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June 5, 1923.

1,457,979.

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METAL SURFACING OR ABRADING MACHINE

Filed Nov. 13, 1920

4 Sheets-Sheet 4

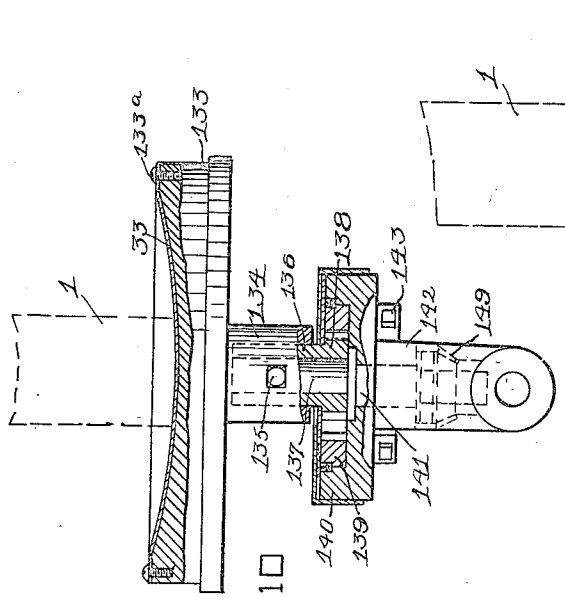


FIG. 10

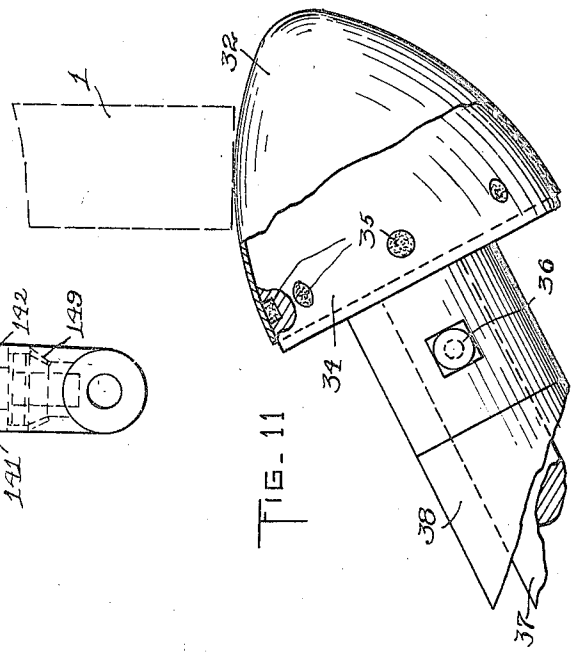


FIG. 11

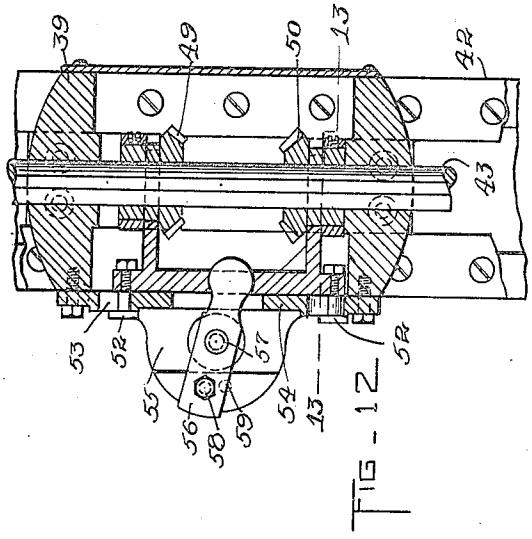


FIG. 12

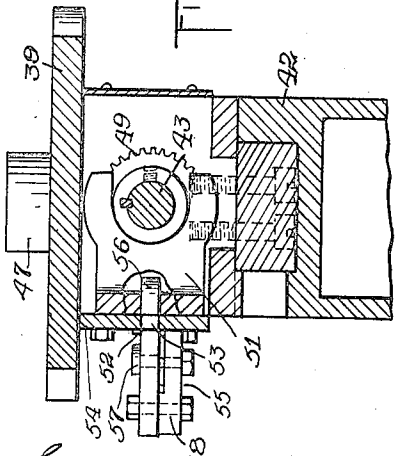


FIG. 13

Seth H. Leavenworth INVENTOR.

BY

Davis Tinnio ATTORNEYS.

Patented June 5, 1923. 1,457,979

UNITED STATES PATENT OFFICE.

SETH H. LEAVENWORTH, OF ROCHESTER, NEW YORK.

METAL SURFACING OR ABRADING MACHINE.

Application filed November 13, 1920. Serial No. 423,970.

To all whom it may concern:

Be it known that I, SETH H. LEAVENWORTH, a citizen of the United States, and resident of Rochester, in the county of Monroe and State of New York, have invented certain new and useful Improvements in Metal Surfacing or Abrading Machines, of which the following is a specification.

The present invention relates to metal surfacing or abrading machines, this application being a division of an application filed by me on February 24, 1920, Serial No. 360,657 and now U. S. Patent No. 1,413,171, granted April 22, 1922. An object of this invention is to support the work in cooperative relation to the abrading or surfacing element in such a manner that the surface may be treated notwithstanding its size or form within, of course, certain limits. A further object of the invention is to prevent the abrading element from operating too long a time on some portions of the work piece and too short a time on other portions of the work piece as when the work piece has surfaces to be treated at different distances from the axis of rotation of such work piece.

To these and other ends the invention consists of certain parts and combinations of parts, all of which will be hereinafter described, the novel features being pointed out in the appended claims.

In the drawings:

Fig. 1 shows in front elevation, a metal surfacing machine constructed in accordance with this invention, the machine being adjusted for operating on deep receptacles or elongated work;

Fig. 2 shows in side elevation, the work supporting mechanism with the abrasive feeding mechanism, the work supporting mechanism being only partially shown;

Fig. 3 is a side elevation of the work supporting mechanism with parts in section, showing the machine provided with the angle attachment permitting the surfacing of flat or shallow work, the angle attachment being shifted to an abnormal position for facilitating illustration;

Fig. 4 is a fragmentary sectional view of the lower portion of the work supporting frame;

Fig. 5 is a section on the line 5—5, Fig. 3 showing the detaining means for holding the work away from the abrading element;

Fig. 6 is a plan view of the work supporting mechanism showing the machine adjusted for operating on elongated or deep work pieces;

Fig. 7 is a section on the line 7—7, Fig. 6;

Fig. 8 is a detail view showing a bracket which supports the train of gearing in the mechanism which produces the reciprocation of the work and which is adjustable to alter the rotation and the stroke of the work;

Fig. 9 is a detail view of the angle attachment for shallow, flat or substantially flat work;

Fig. 10 is a sectional view through the angle attachment showing the manner in which the latter cooperates with the abrading element or tool;

Fig. 11 is a detail view showing the manner in which deep work pieces are supported in cooperation with the abrading element;

Fig. 12 is a detail sectional view showing the manner in which the direction of rotation of certain parts may be changed to correspond to the work piece; and

Fig. 13 is a section on the line 13—13, Fig. 12.

Referring to the embodiment of the invention herein illustrated, 1 indicates the abrading or polishing element which may be of a form most desirable for the work operated upon. In this embodiment, this abrading element is a disk shaped rotary member formed of fabric or other suitable yielding material and mounted upon a shaft 2 supported in bearings upon a frame 3, the shaft having an idler 4 and a fixed pulley 5 thereon for engagement by a belt 6, which may be shifted from one pulley to the other through the shifter 7.

The abrasive material, such as pumice stone, may be contained in a hopper 8 supported above the abrading element 1 preferably by a frame 9 suspended from the ceiling of the building in which the apparatus is arranged. The flow through the discharge opening 10 of the hopper may be controlled in any suitable manner as, for instance, that described in the parent application aforesaid.

The machine has been shown as adapted for working upon two types of work pieces, one indicated at 32 being of elongated construction and the other indicated at 33 being of flat or shallow construction. When used for operating on deep or elongated work pieces, a head 34 is employed of a

shape preferably to fit within the elongated work piece 32, said head preferably having at intervals, pieces 35 of yielding or friction producing material which will engage the interior wall of the hollow work piece 32 for sustaining the work piece upon the head. The head is rotated in a manner to cause the work piece to be rotated in contact with the abrading element 1, being in this instance, secured by a set screw 36 to a shaft 37 which turns in a frame or arm 38.

When used for abrading or polishing flat or shallow objects 33, the latter is held against a head 133 by suitable holding means such as a screw 133ª and the head is rotated preferably about two parallel axes out of alignment with each other for the purpose of crossing the cuts made by the abrasive material and destroying the tendency of the abrading element to cut spiral lines on the work piece. It also enables the abrading element to cut across the center of the work piece without having a high point of slowest surface speed at a fixed axis of center. This result may be secured by forming the head with a sleeve 134 detachably secured by a set screw 135 to a sleeve 136 in which a crank pin 137 is mounted to turn. The sleeve 136 has a pinion 138 at its inner end which meshes with an internal gear 139 on a non-rotating part 140 in which a shaft 141 turns, said shaft 141 carrying the crank or wrist pin 137 eccentrically thereto so that when the shaft 141 is rotated, the wrist pin 137 will be caused to revolve and carry the head 133 with the work piece 33 in a circle while at the same time the work piece 33 will be caused to rotate about an axis concentric therewith through the meshing of the gear 138 with the internal gear 139. The shaft 141 is mounted in a frame 142 to which the part 140 is detachably secured at 143 so that direct drive may be obtained by fastening the sleeve 134 to the shaft 141. The frame 142 is pivotally connected by a pin 144 with a bracket 145 formed in two parts and detachably secured by bolts 146 to a frame 38, thus permitting the frame 142 to swing at an angle to the frame 38. To the end that a stub shaft 141 may be driven from the shaft 37, a bevel gear 147 is detachably secured to the shaft 37 to mesh with a bevel gear 148 which turns on the pin 144 and in turn meshes with a bevel gear 149 on the shaft 141.

The shaft 37 is supported and moved so that work pieces of various sizes and shapes may be treated upon the machine. In this embodiment the frame 38 is mounted to turn about an upright axis on another frame 39, the frame 38 being held in an adjusted position on said frame 39 by bolts 40 carried by the frame 39 and operating in arcuate slots 41 concentric with the axis of turning of the frame 38. The frame 39 is preferably mounted to reciprocate on a frame 42 provided with horizontal guides, the frame 42 carrying a shaft 43 parallel with the line of movement of the frame 39 for transmitting motion to the shaft 37 on the frame 38. In this instance, this motion is transmitted through a bevel gear 44 on the shaft 37 meshing with a bevel gear 45 on a stub shaft 46 which turns in the bearing 47 forming the pivotal connection between the frames 38 and 39. The stub shaft 46 also carries a bevel gear 48 which is adapted to mesh with either one of two pinions 49 or 50 arranged on the shaft 43 to turn with said shaft but to move axially thereof. In this instance these two pinions are connected together by a sliding frame 51 mounted in a housing formed by the frame 39 and being supported for sliding movement by headed bolts 52 which operate in slots 53 formed in the cover 54 of the housing. This cover 54 also has a bracket 55 on the exterior of the housing on which a lever 56 is pivoted at 57, said lever being extended into engagement with the slide frame 51 and having its opposite end adapted to be secured by a bolt 58 in either one of two openings 59. When secured in one of said openings, the gear 49 will lie in mesh with the gear 48 whereas, when secured in the other opening, the gear 50 will lie in mesh with the gear 48 and this meshing will be maintained notwithstanding the reciprocation of the frame 39 on the frame 42. The purpose of this change is to permit the work piece to be rotated in one and the same direction notwithstanding the use of the angle attachment for flat work which, if this change gear were not provided, would give the work piece a movement in the opposite direction.

The shaft 43 may be driven in any suitable manner as for instance by a bevel gear 60 which in turn meshes with a bevel gear 61 on the shaft 62 at the inner end of the frame arm 42. The shaft 62 also carries a bevel gear 63 meshing with a bevel gear 64 on a vertical shaft 65 journalled on the frame arm 42 and driven in any suitable manner but preferably having a universal joint 65ª therein to permit the bodily movement of the work piece.

Mechanism is provided for imparting a reciprocatory motion to the frame or carriage 39 and this reciprocatory motion is so controlled that it will cause the movement of the motion of the reciprocatory frame 39 to dwell longer at those points where the abrading element is operating on the work piece farthest from the axis of rotation of the work piece and shorter at those points where the abrading element is working on the work piece nearest the center of rotation of the work piece, the purpose of this being to prevent any portion of the work piece be-

ing surfaced or abraded greater than another portion for it will be apparent that if the work piece is held in engagement with the abrading element, the same length of time nearest its center of rotation as it is farthest removed from the center, then the portion nearest the center will receive more polishing than the portion farthest removed from the center. A desirable form for this reciprocating mechanism comprises a gear wheel 66 mounted on the shaft 62 which meshes with a pinion 67 in turn meshing with a pinion 68. The pinion 67 is supported on a shaft 69 which is adjustable in a slot 70 formed in a bracket 71 which is detachably secured to the frame 42 by bolts 72. The slot 70 in the bracket 71 is concentric with the bearing opening 73 of the gear 68 and provides for the substitution of a larger gear 66 on the shaft 62 so that a variation in the speed of the gear 68 may be obtained, and thus a change in the ratio of movement between the rotation of the work piece and the reciprocation or bodily movement of the work piece is secured. The gear 68 has secured to its outer face a guide piece 74 which extends diagonally of the gear, projecting from both sides of the latter and having a crank pin 75 adjustable therein to different positions so that said crank pin may be situated at different distances from the center of rotation of the gear 68 in order to cooperate with different portions of a curved or irregularly formed way in a swinging member 76 detachably pivoted at 77 to the frame 42. The curved way 78 is formed in such a manner that a movement may be imparted to the swinging member through the crank pin 75 which will correspond to the desired bodily movement of the work piece so that the abrading element will operate on the work piece an amount substantially equal to the distance the field of operation is situated from the axis of rotation of the work piece. The swinging member 76 is removable so that a swinging member having another form of way may be used when the one herein shown does not provide the proper movement. The connection between the swinging member 76 and the reciprocatory carriage 39 may be established through a pitman 80 which is pivoted at 81 to a block 82 adjustable on a way 83 formed on one side of the swinging member 76, the swinging member having also a similar way 83 on the opposite side so that by reversing the swinging member a movement in the opposite direction is provided which will give still further adjustments. The pitman 80 has a resilient portion 84 and is pivotally connected at 85 with the reciprocatory carriage 39, the resilient portion being provided to prevent any undue strain between the work piece and the abrading element.

The frame 42 is preferably mounted to swing about an upright axis and it is also preferably vertically adjustable. This result is secured in this instance, by providing a screw 86 on a frame 87 and mounting said screw to turn in bearings 88 at its upper and lower ends. Two nuts 89 are provided on the screw and between these nuts the frame 42 is secured, the adjustment of the nuts on the screw effecting the vertical adjustment of the swinging frame 42 and the turning of the screw in its bearing providing for the swinging of the frame about an upright axis. The frame 42 is vertically adjustable in order that the axis of the work piece may be substantially arranged in a horizontal plane with the axis of rotation of the rotary abrading element and the swinging of the frame about a vertical axis is provided in order that the work may be yieldingly held toward the abrading element so that the work may swing toward and from the abrading element to accommodate machines to different portions of the work piece. The yielding in this instance, is preferably secured by providing a counter-weight 90 which is suspended by a flexible cable 91 passing about a pulley 92 at the top of the frame 87 and connecting with an arm 93 on the screw 86. For the purpose of holding the work piece away from the abrading element, a detent 94 may be provided pivoted at 95 and held under the action of a spring 96 into cooperation with the periphery of a disk 97 which permits the ordinary swinging of the frame 42, but when the frame is swung to a certain position, a shoulder or abutment 98 on this disk will be engaged by the detent 94 and hold the work piece away from the abrading element.

The frame 87 may be mounted to swing about a horizontal axis and also to move horizontally in two directions at right angles to each other. The first of these results is for the purpose of causing the work piece to be presented to the abrading element at an angle so that lines left on the work piece by previous operations such as spinning will be obliterated, preferably obtained by pivoting the frame at 99 on a shaft which is supported by two brackets 100, adjusting devices in the form of bolts 101 and slots 102 in one of the brackets securing the frame 87 in its adjusted position about its axis 99. The brackets 100 are preferably formed on a carriage 103 which is guided on ways 104 on another carriage 105, the latter moving on ways 106 formed on a base 107. Adjusting screws 108 and 109 may be provided respectively, for moving the carriage 103 on the carriage 105 and the carriage 105 on the base 107.

A metal surfacing machine constructed in accordance with this invention makes it possible to dispense with skilled labor for surfacing metal ware goods. It performs

the work in a manner similar to the usual sand bobbing process. The work piece is given a bodily movement, which corresponds to the form, shape and size of such work piece. Provision is made whereby the abrading element whether near to or far from the axis of rotation of the work piece, has sufficient time to properly surface such work piece. The mechanism as a whole is simple in operation and is provided with adjustments which permit articles of various forms, shapes and sizes to be worked upon.

What I claim as my invention and desire to secure by Letters Patent is:

1. In a metal surfacing machine, the combination with an abrading element and a rotary support for a work piece, of means for imparting to the rotary support simultaneously with the rotary movement, a bodily movement at a variable speed to correspond with the distance that the point being surfaced is situated from the axis of rotation of the work piece so that the abrading element operates upon each portion of the surface, a substantially equal amount notwithstanding the distance of the portion from the center of rotation of the work piece.

2. In a metal surfacing machine, the combination with an abrading element and a rotary support for the work piece, of mechanism for moving the work piece support in the direction of its axis of rotation, and mechanism for impartment to said rotary support simultaneously with its rotary movement, a movement in the direction of its axis at a speed corresponding to the diameter of that portion of the work piece being engaged by the abrading element so that each portion of the work piece is acted upon by the abrading element an equal amount, notwithstanding the distance of such portion from the axis of rotation.

3. In a metal surfacing machine, the combination with an abrading element, and a rotary support for a work piece adapted to cooperate with said element, of a swinging arm on which said rotary support is mounted to turn, mechanism for moving the axis of rotation of said arm to shift the arm bodily, and means acting on said arm to permit said arm to move about its axis toward and from the abrading element.

4. In a metal surfacing machine, the combination with an abrading element and a rotary support for the work piece, of mechanism for moving said support axially having provision for varying the speed of said axial movement to correspond with the distance the portion of the work piece being operated upon by the abrading element is situated from the axis of rotation of the rotary support.

5. In a metal surfacing machine, the combination with an abrading element and a rotary support for the work piece, of a swinging frame on which the rotary support is mounted to turn, said frame also being bodily movable, means for moving said frame bodily to impart to the work piece a body movement variable to correspond to the distance that the point being engaged by the abrading element is situated from the axis of rotation of the work support, and means acting on said swinging frame to hold the work piece yieldingly in cooperation with the abrading element.

6. In a metal surfacing machine, the combination with an abrading element and a rotary support for the work piece, of a swinging arm on which said support is mounted to turn, a frame on which said arm is mounted to turn, mechanism for moving said frame to cause said work piece to travel over the abrading element during the rotation of such work piece and means acting on said swinging arm to hold the work piece yieldingly in cooperation with the abrading element.

7. In a metal surfacing machine, the combination with an abrading element and a rotary support for the work piece, of an arm on which said rotary support is mounted to turn a frame on which said arm is adjustable about a suitable axis, and mechanism for imparting a movement to said frame at a variable speed to cause the abrading element to operate on the work piece a substantially like amount at all points notwithstanding the different distances at which the abrading element is operating from the axis of rotation of the work piece.

8. In a metal surfacing machine, the combination with an abrading element and a rotary support for the work piece, of an arm on which said rotary support is mounted, a frame on which said arm is adjustable about a suitable axis, a vertically adjustable frame on which the first mentioned frame is mounted to reciprocate, and mechanism for reciprocating said first mentioned frame on the vertically adjustable frame.

9. In a metal surfacing machine, the combination with an abrading element and a rotary work support, of an arm on which said rotary work support is mounted, a frame on which said arm is adjustable about a suitable axis, a second frame on which said first mentioned frame is mounted to reciprocate, mechanism for reciprocating said first mentioned frame on the second mentioned frame, and a third frame on which the second mentioned frame is vertically adjustable.

10. In a metal surfacing machine, the combination with an abrading element and a rotary work support, of an arm on which said rotary work support is mounted, a frame on which said arm is adjustable about a suitable axis, a second frame on which said first mentioned frame is mounted to reciprocate, mechanism for reciprocating said first men-

tioned frame on the second mentioned frame, and a third frame on which the second mentioned frame is vertically adjustable and is also mounted to swing about an upright axis.

11. In a metal surfacing machine, the combination with an abrading element and a rotary work support, of an arm on which said rotary work support is mounted, a reciprocatory frame on which said arm is adjustable about a suitable axis, a vertically adjustable frame mounted also to swing about an upright axis and carrying said reciprocatory frame, and a frame on which said swinging and vertically adjustable frame is mounted, said last mentioned frame being mounted to swing about a horizontal axis.

12. In a metal surfacing machine, the combination with an abrading element and a rotary work support, of an arm on which said rotary work support is mounted, a reciprocatory frame on which said arm is adjustable about a suitable axis, a vertically adjustable frame mounted also to swing about an upright axis and carrying said reciprocatory frame, and a frame on which said swinging and vertically adjustable frame is mounted, said last mentioned frame being mounted to swing about a horizontal axis and also to be adjusted horizontally in two directions at right angles to each other.

13. In a metal surfacing machine, the combination with an abrading element and a rotary work support, of means for sustaining said work support comprising a frame mounted to swing about a horizontal axis, a frame vertically adjustable on the first mentioned frame and mounted to swing about an upright axis on said first mentioned frame, and means for supporting said work piece holder from said vertically adjustable and swinging frame.

14. In a metal surfacing machine, the combination with an abrading element and a work piece support, of a frame mounted to turn about a horizontal axis, an upright screw mounted to turn on said frame, a frame vertically adjustable on said screw, means for supporting the work piece holder on said last mentioned frame and means for swinging the last mentioned frame to hold the work piece against the abrading element.

15. In a metal surfacing machine, the combination with an abrading element and a rotary work piece holder, of means for supporting said work piece holder comprising a frame, a screw rotatable on said frame about an upright axis, and a second frame supporting the work piece holder and vertically adjustable on the screw.

16. In a metal surfacing machine, the combination with an abrading element and a rotary work piece holder, of means for supporting said work piece holder comprising a frame, a screw rotatable on said frame about an upright axis, a second frame supporting the work piece holder and vertically adjustable on the screw, and means acting on said second mentioned frame to hold the work piece holder yieldingly in cooperation with the abrading element.

17. In a metal surfacing machine, the combination with an abrading element and a rotary work piece holder, of means for supporting said rotary work piece holder comprising a frame adjustable about a horizontal axis, means for supporting said frame for movement horizontally in two directions at right angles to each other, and a frame on which the rotary work piece holder is supported adjustable vertically on the first mentioned frame.

18. In a metal surfacing machine, the combination with an abrading element and a rotary work piece holder, of means for supporting said rotary work piece holder comprising a frame adjustable about a horizontal axis, means for supporting said frame for movement horizontally in two directions at right angles to each other, a frame on which the rotary work piece holder is supported adjustable vertically on the first mentioned frame and mounted to swing about an upright axis on said first mentioned frame, and means acting on said second mentioned frame yieldingly to hold the work piece in cooperation with the abrading element.

19. In a metal surfacing machine, the combination with an abrading element, a rotary work piece holder, of means for supporting said rotary work piece holder comprising a frame adjustable about a horizontal axis, a frame on which the rotary work piece holder is supported, adjustable vertically on the first mentioned frame and mounted to swing about an upright axis on said first mentioned frame, and means acting on said second mentioned frame yieldingly to hold the work piece in cooperation with the abrading element.

20. In a metal surfacing machine, the combination with an abrading element, and a rotary work piece holder, of means for holding the work piece holder in cooperation with the abrading element comprising a frame mounted to swing about a horizontal axis, means for supporting said frame for movement horizontally in two directions at right angles to each other, a screw rotatable about an upright axis on the first mentioned frame, a frame adjustable vertically on said screw and mounted to turn therewith, a frame mounted to reciprocate on said second mentioned frame, a frame mounted to turn about an upright axis on the reciprocatory frame and carrying the work piece holder, and a weight acting on the swinging frame to hold the work piece holder toward the abrading element.

21. In a metal surfacing machine, the

combination with an abrading element and a rotary work piece holder, of means for supporting said work piece holder in cooperation with the abrading element comprising a frame mounted to swing about an upright axis, a reciprocatory frame mounted to move on said first mentioned frame, a frame mounted to turn about an upright axis, on the reciprocatory frame and supporting the work piece holder, and means acting on the first mentioned frame to hold the work piece holder in cooperation with the abrading element.

22. In a metal surfacing machine, the combination with an abrading element, a rotary work piece holder for cooperation with said abrading element, of means for supporting said work piece holder in cooperation with the abrading element comprising a frame carrying said work piece holder, adjustable about a vertical and a horizontal axis, and means acting on said frame yieldingly to hold the work piece holder in cooperation with the abrading element.

23. In a metal surfacing machine, the combination with an abrading element and a work piece holder, of mechanism for turning said work piece holder in cooperation with the abrading element simultaneously about two axes parallel with each other and out of alignment.

24. In a metal surfacing machine, the combination with an abrading element and a work piece holder, of mechanism for turning said work piece holder in cooperation with the abrading element about two axes parallel with each other and out of alignment, said mechanism embodying a gear connected with the work piece holder to turn therewith, an internal gear, and means for revolving the work piece holder so that the first mentioned gear meshes with the internal gear during the revolution of the work piece holder and at the same time rotates the work piece holder about another axis.

25. In a metal surfacing machine, the combination with an abrading element and a work piece holder, of a frame mounted to reciprocate and to swing about an upright axis, means for supporting said work piece holder for rotation on the frame about two axes out of alignment and parallel with each other, and means acting on the frame for yieldingly holding the work piece holder in cooperation with the abrading element.

26. In a metal surfacing machine, the combination with an abrading element and a work piece holder, of a frame mounted to reciprocate and to swing about an upright axis, a driving shaft mounted on said frame, means for changing the direction of rotation of said driving shaft, a frame detachably connected to the first named frame, another frame pivotally mounted to the detachable frame to swing about an upright axis, and a work piece holder mounted to rotate on said second mentioned frame and having a driving connection with the shaft on the reciprocatory and swinging frame.

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