July 15, 1947. E. W. LAISNE 2,423,941

METAL WORKING MACHINE

Filed March 6, 1944 5 Sheets-Sheet 1

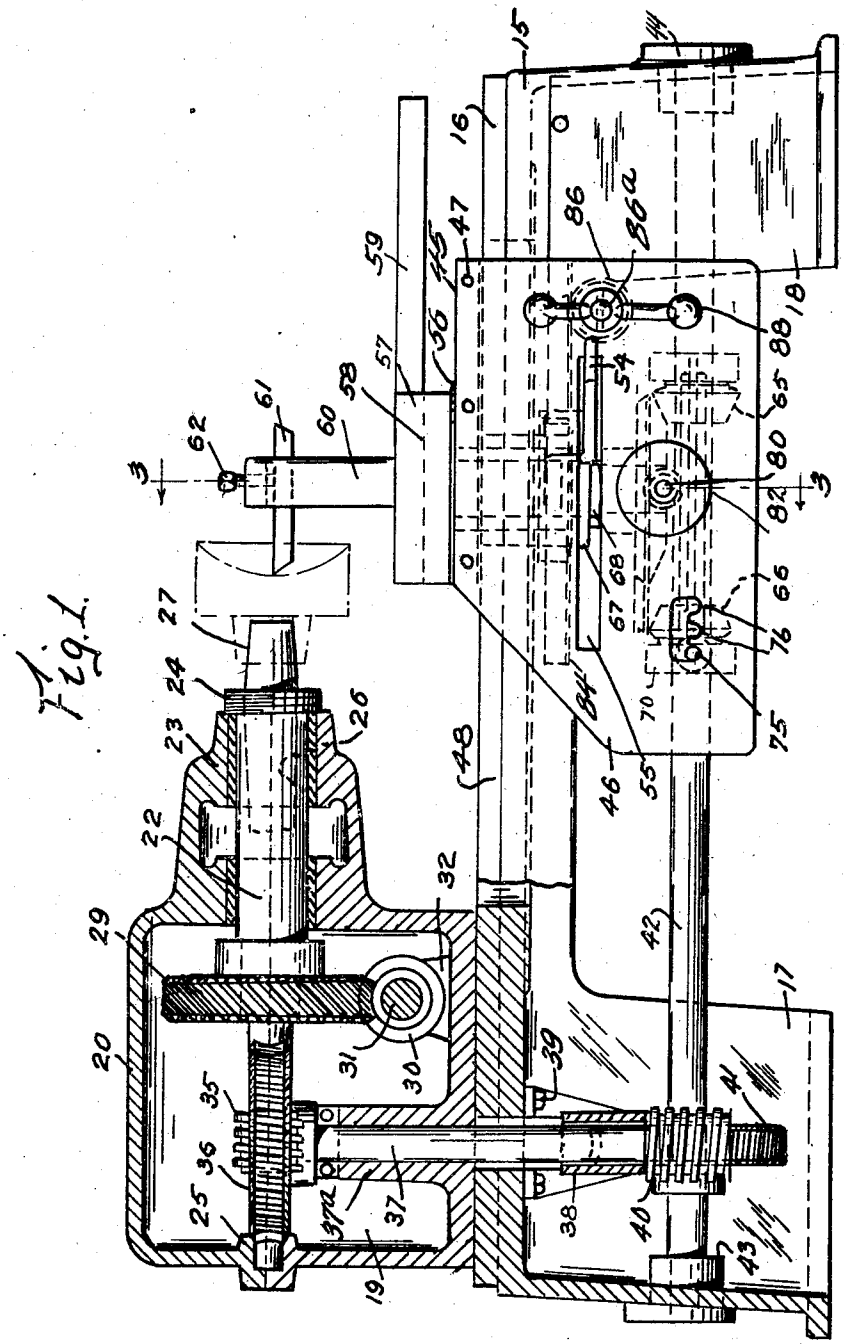


Fig. 1.

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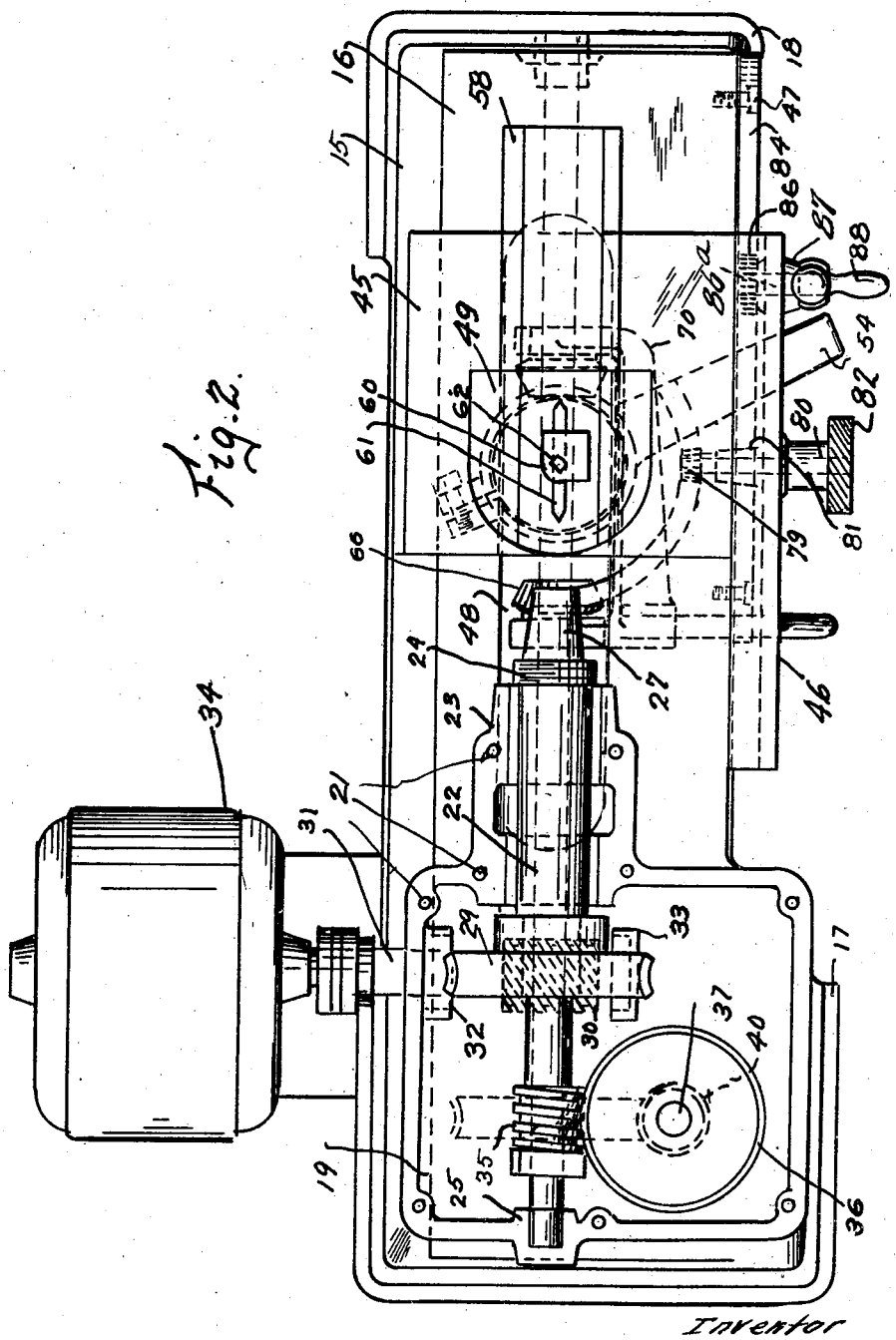


Fig. 2.

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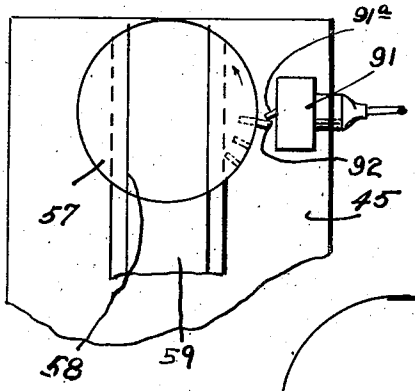


Fig. 5.

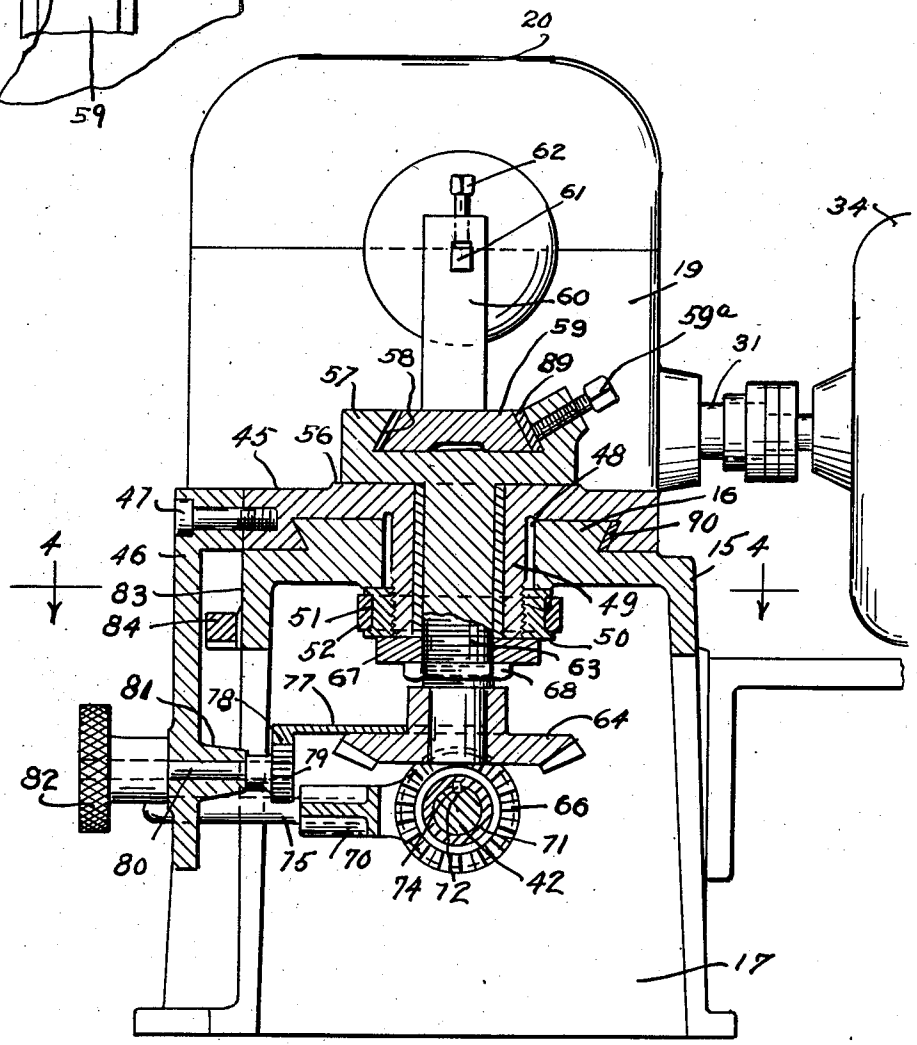


Fig. 3.

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Fig. 4

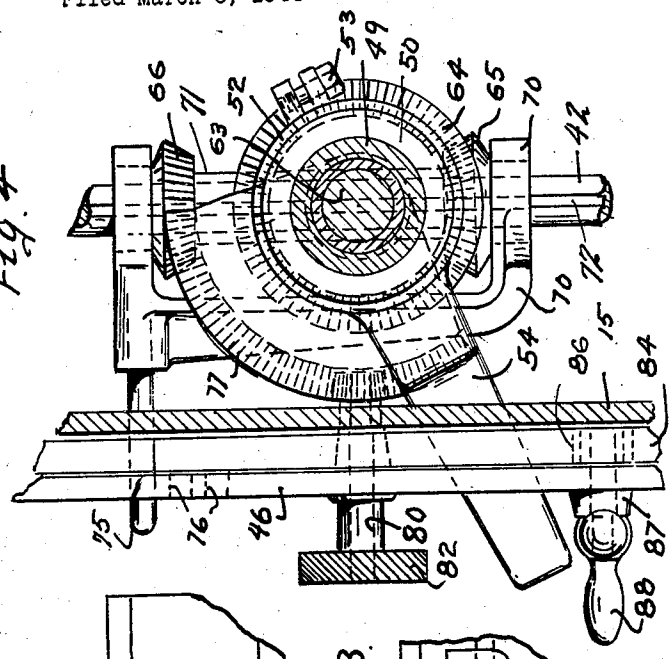


Fig. 6

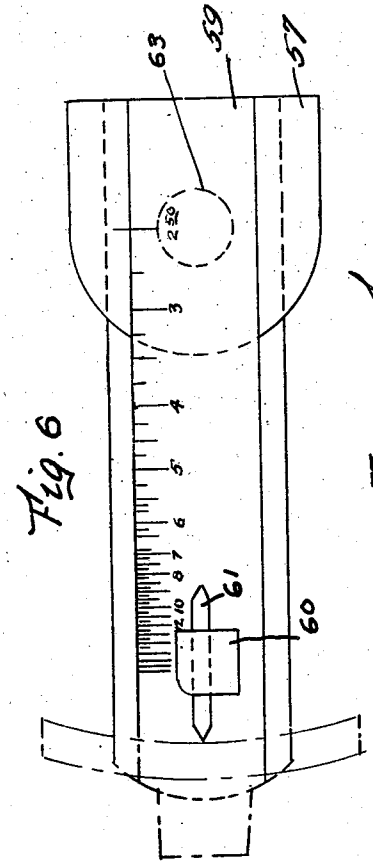


Fig. 7

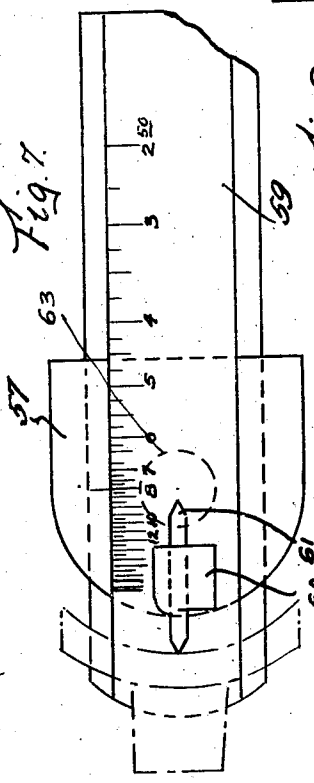
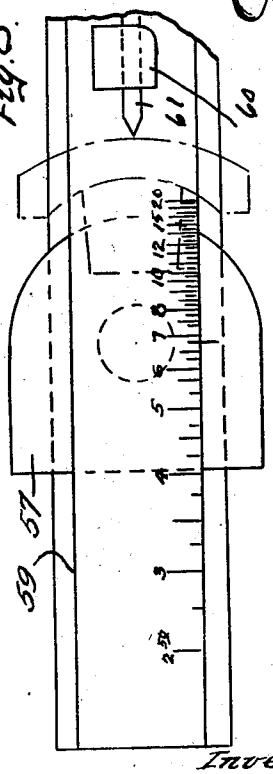


Fig. 8



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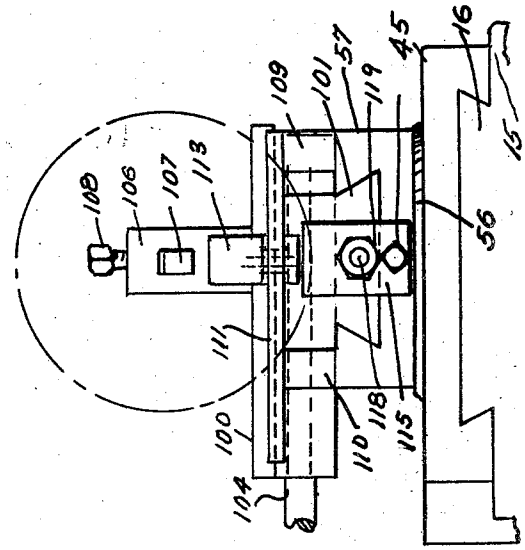


Fig. 11.

Fig. 9.

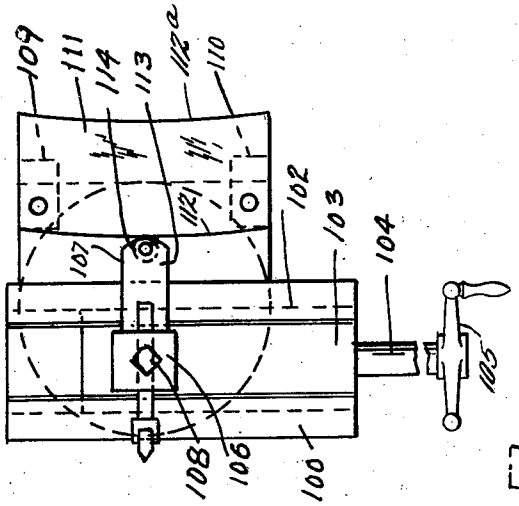
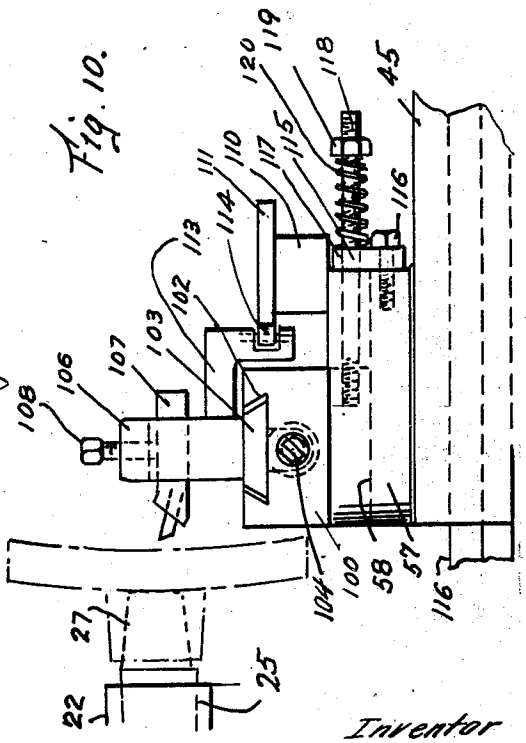


Fig. 10.



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UNITED STATES PATENT OFFICE

2,423,941

METALWORKING MACHINE

Eugene W. Laisne, Fresno, Calif.

Application March 6, 1944, Serial No. 525,249

4 Claims. (Cl. 82—12)

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The present invention relates primarily to a metal working machine of a type particularly adapted for operation upon spherical concave or convex surfaces in machining operations, such as facing, turning or truing of such surfaces.

The object is to provide a machine of such character which can be easily and quickly adjusted for truing spherical surfaces of various radii, according to the object to be worked upon.

Another object is to provide a machine of such character which, while simple and inexpensive in construction, and simple in operation, is of maximum efficiency and requires a minimum amount of upkeep.

Other objects and advantages will appear hereinafter, and while the preferred form of the invention is shown and hereinafter described, it is to be understood that the invention is not limited to such preferred form, as various changes and adaptations may be made therein without departing from the spirit of the invention.

In the drawings accompanying and forming a part hereof:

Fig. 1 is a front elevation, partly in section, showing the machine adapted for truing a concave lens lap.

Fig. 2 is a top plan of Fig. 1.

Fig. 3 is a vertical section, on an enlarged scale, taken on the line 3—3 of Fig. 1.

Fig. 4 is a horizontal section, taken on the line 4—4 of Fig. 3.

Fig. 5 is a fragmentary top plan of a portion of the machine, illustrating the electrical control means.

Figs. 6, 7 and 8 are enlarged diagrammatic views showing adjustments of the machine for concave and convex surfaces, and

Figs. 9, 10 and 11 are detail views of means for adapting the machine for producing spherical surfaces of extra large radii.

As shown in the drawings, the machine comprises a base 15, the top of which supports dovetail ways 16, and the lower end of which is provided with feet 17—18, one at each end, which support the ways 16 at a suitable height above a bench or other desired place of use.

Rigidly mounted upon one end of the member 15, to extend lengthwise thereof is a housing 19, provided with a detachable cover 20, this housing and cover being secured together by bolts 21.

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Mounted within the housing 19 lengthwise thereof is a spindle 22, one end of which projects through the bearing 23, provided at one end of said housing and terminates in a screw threaded end 24. The other end of shaft 22 is reduced in size and is rotatably mounted in a bearing 25, provided in the other end of housing 19.

Formed in the projecting end 24, of spindle 22, is a tapered socket 26, adapted for the reception of a tapered arbor 27, upon which the various laps to be worked upon are adapted to be mounted.

Rigidly mounted upon spindle 22, about centrally of its length and within housing 19 is a worm wheel 29, arranged for engagement with a worm 30, rigidly mounted upon the inner end of a shaft 31, rotatably mounted in bearings 32—33 projecting upwardly from the floor of housing 19. The other end of shaft 31 projects through the rear wall of the housing 19, and is connected to a motor 34, or other suitable prime mover, by means of which the shaft 31 is rotated and through worm 30 and wheel 29, spindle 22 is likewise rotated.

Rigidly mounted upon the reduced end of spindle 22, at one side of worm wheel 29 is a worm 35, in operative engagement with a worm wheel 36, rigidly mounted upon the upper end of shaft 37, positioned vertically within housing 19.

Shaft 37 extends downwardly through a bearing 37a extending upwardly from the bottom wall of housing 19, and has its lower end supported in a bearing 38 secured to the under side of the ways 16, by means of bolts 39 or otherwise.

A worm 40 is rigidly mounted upon the lower end of shaft 37 in operative engagement with worm wheel 41 secured upon a shaft 42, near one end thereof, to rotate therewith. Shaft 42 extends lengthwise of the frame 15, and is rotatably mounted at each end in bearings 43—44, provided in the end walls of said frame 15.

Slidably mounted upon the ways 16, and in dovetail engagement therewith is a carriage 45, upon the front face of which is provided a downwardly depending apron 46, secured thereto by screws 47 or other suitable means.

Provided lengthwise through the ways 16 of the frame 15 is an elongated opening 48, and

projecting downwardly through this opening is a boss 49, the upper end of which is integrally connected to the carriage 45. The lower end of boss 49, immediately below the under side of ways 16, is exteriorly screw threaded for the reception of a locking collar 50, the use of which will be hereafter explained.

Provided in the outer periphery of the collar 50, is an annular groove 51, and positioned within this groove to surround said collar is a split annulus 52, held positioned by a bolt 53, by means of which said annulus may be tightened or loosened for adjustment of the relative position of said annulus and the collar 50.

Projecting from the side wall of the annulus 52, integral therewith and preferably opposite the bolt 53, is an outwardly and downwardly projecting handle 54, which projects through a slot 55 in the apron 46, and provides means for rotating said collar 50 as will be obvious.

Provided upon the upper face of carriage 45, centrally of one end thereof is a pad 56, and rotatably mounted upon this pad to rotate in a horizontal plane is block 57, in the upper face of which is provided a dovetail ways 58, normally extending parallel with the ways 16.

Slidably mounted within the ways 58, is a tool slide 59, from the upper face of which projects, at one end thereof, a tool post 60, the upper end of which is arranged for a cutting tool 61, held in position by screw 62.

Extending downwardly from the under face of block 57, through the boss 49 and concentric therewith is an integral stud 63, on the lower reduced end of which is rigidly mounted a bevel gear 64, adapted for engagement with similar gears 65—66, carried by the shaft 42.

The lower end of stud 63, immediately above the bevel gear 64 is screw threaded and carries an adjusting nut 68, and loosely mounted upon said stud 63 between nut 68 and the collar 50 is a collar 67.

With the above construction it will be obvious that by rotating the collar 50 in a direction to cause it to move upwardly on boss 49 said collar 50 will be caused to frictionally engage the under face of the ways 16 and prevent relative movement of carriage 45 and said ways while permitting relative rotation of the block 57, but rotation of said collar 50 in a reverse direction to cause it to move downwardly on boss 49 said collar 50 will clamp collar 67 tightly between it and nut 68 and thus prevent relative rotation of stud 63 and boss 49 thereby locking carriage 45 and block 57 together against relative movement while permitting relative movement of the carriage 45 and ways 16.

As best shown in Fig. 4, the bevel gears 65—66 are rotatably mounted at opposite ends of a carriage 70 and are held suitably spaced apart by a spacer 71, slidably mounted upon the shaft 42.

Shaft 42 is provided with a longitudinally extending key way 72, in which are positioned splines or keys 74 carried by the gears 65—66, whereby said gears are caused to rotate with said shaft and permitted to slide therealong. Extending from one end of the carriage 70 is an operating bar 75, which projects through the wall of apron 46 and provides means for adjusting the position of said carriage 70 to bring either one of the gears 65 or 66 into operative engagement with the gear 64 according to the desired direction of rotation of block 57, or to disengage both said gears, recesses 76 being provided in

said apron for the reception of said handle to retain said carriage in its adjusted position.

Rigidly mounted upon the upper face of gear 64 is a segmental plate 77, around the outer periphery of which is secured, a toothed segment 78, the teeth of which extend downwardly and are in operative engagement with the teeth of a gear 79. Gear 79 is rigidly mounted on the inner end of the shaft 80, rotatably mounted in a bearing 81, formed on the inner face of apron 46, and projects therethrough to beyond the outer face of apron 46, and terminates in an adjusting nut 82, to provide means for manually rotating said shaft as hereafter explained.

Detachably mounted on the outer face of the front wall 83, of frame 15, is a toothed rack 84, which extends lengthwise and is adapted for operative engagement by the gear wheel 86, rigidly mounted upon the inner end of a shaft 86a rotatably mounted in a bearing 87, in the front wall of apron 46, a crank 88 being provided on the outer end of said shaft for rotating said gear to cause carriage 45 to travel lengthwise relative to the ways 16. It will be understood that suitable gibs 89 and 90 will be provided to compensate for wear between the dovetail portions of the ways and blocks.

Mounted upon the upper face of the carriage 45 at one side of the block 57 is a toggle switch 91, the finger 91a of which is positioned to project into the path of a pin 92 projecting radially from the periphery of said block 57 and be tripped thereby upon a predetermined period of rotation of said block, it being understood said pin may be adjusted to varying positions around said block 57 to permit more or less rotation as desired or found advisable. Switch 91 is inserted in the power circuit from a source of power to the motor in the usual well known manner whereby tripping of said toggle switch 91 by the pin 92 will open said circuit and interrupt the flow of energy to the motor 34 thereby preventing operation thereof. It is obvious that the foregoing construction will provide means for automatically discontinuing operation of my machine upon a predetermined amount of rotation of the block 57.

In Figures 9–10–11, I have shown my device as adapted for operation upon the tools of extra large curvature. In the use of this form I substitute for the slide 59 and tool post 60, a block 100 provided with a downwardly extending dovetail 101, for engagement within the ways 58 of the block 57.

Provided in the upper face of said block 100 at right angles to the dovetail 101, is a dovetail recess 102, and in this recess is slidably mounted a cross slide 103, moveable by means of the screw 104 and handle 105, and projected upwardly from near one end of member 103 is a tool post 106, which carries a tool holder 107, held in position by a screw 108. Positioned upon the upper face of block 57, at the ends of the rear wall thereof, are abutments 109—110. Detachably mounted upon these abutments are templates 111, the opposed edges 112—112a of which normally determine the path of the block 100. Extending rearwardly and then downwardly from the rearmost wall of tool post 106, is an inverted L shape bracket 113, and near the lower end of the downwardly depending leg is mounted a roller 114, adapted for engagement with the adjacent edge of the template 111.

Secured to the rear wall of block 57 is an upwardly extending plate 115, by means of bolt 116

and provided through this plate is an opening 117 through which projects an elongated stud 118, the inner end of which is rigidly secured to block 100 through dove-tail 101. Stud 118 projects for a distance beyond the outer wall of plate 115, and is screw threaded and provided with a retaining nut 119. Positioned upon stud 118 between nut 119 and plate 115 is a coil spring 120, the object of which is to maintain the roller 114 in close contact with the template 111 to cause block 100 and tool post 106 to follow the curvature of the said template as the block 100 is projected across the face of the work.

In the operation of my device, the motor 34 will be connected to a suitable source of electrical energy through switch 91. The pin 92 will be suitably positioned in periphery of block 57 to permit the predetermined degree of rotation. The operation of motor 34 will, through worm 30 and wheel 29, rotate spindle 22 in a counter-clockwise direction, or towards the front of the machine. The rotation of spindle 22 will through worm 35 and wheel 36 rotate shaft 37, and the rotation of shaft 37 will through worm 40 and wheel 41, rotate shaft 42 and with it gears 65 and 66, which will in turn rotate gear 64 and, thru stud 63, block 57, the direction of rotation being determined by the engagement between gear 64 and the respective gear 65 or 66. The rotation of block 57 will cause the cutting tool to pass across one half the face of the lap being worked upon, the radius of curvature thereof being determined by the position of the slide 59 and its tool post relative to block 57, it being understood that the center of rotation is through the vertical center of block 57, so that the greater the distance between the cutting tool point and the block 57, the greater the radius of curvature and vice-versa.

It will also be obvious that if the cutting tool point is positioned between the work and the center of rotation of block 57, Figs. 6 and 7, the result will be a concave curvature, while if the center of rotation is at the opposite side of the work and the cutting tool as in Fig. 8 the result will be convex curvature.

By means of the carriage 70, either one of the gears 65 or 66 may be brought into engagement with bevel gear 64, to determine the direction of rotation of block 49 for either concave or convex cutting.

Figs. 6–7–8, I have shown diagrammatically the method of varying the path of curvature of the cutting tool by adjustment of the relative positions of slide 59 and block 57, indicia being provided upon the upper face of slide 58 for co-action with index upon block 57 to assist in quick selection of path of curvature desired.

It will be understood that when work is being performed upon a lens tool or other spherical surface it is advisable to lock carriage 45 against movement along the ways 16, and when it is desired to adjust the position of carriage 45 along said ways it will be advisable to lock block 57 against rotation relative to carriage 45. In the former instance handle 54 will be moved to move collar 51 upwardly against the lower face of the ways 16. In the latter case the reverse will be the case.

Tool slide 59 may be rigidly secured in its adjusted positions relative to block 57 by means of the set screw 59*a* as will be obvious.

The present invention enables spherical surfaces, either concave or convex, and of different

radii, to be produced on tools or other objects or pieces of work by simply locating the center of the arc through which the cutting or other operating tool swings at the appropriate distance either in front of or behind the piece of work being operated upon.

The invention also provides a machine in which all of the operations necessary to produce such results may be performed by simple adjustments of the machine.

For example, if a concave surface is to be produced on the work piece employing the set-up of the machine as shown in Figs. 1 to 8 inclusive, the slide 59 is adjusted in the block 57 to set the cutting edge of the tool at a distance from the axial center of said block corresponding to the radius of the curvature of the surface to be formed on the work piece, and the carriage 45 is shifted longitudinally of the base 15 toward the right in Fig. 1 to bring the axial center of the block 57 into a position in front of the work piece, Fig. 1 showing the machine so adjusted for the forming of a surface of relatively short radius and Figs. 6 and 7 showing different adjustments of the slide 59 and different positions of the vertical center of the block 57 for forming curved surfaces of different larger radii.

If a convex surface is to be produced on the work piece, the block 57 is rotated through a half revolution from the position shown in Fig. 1 or into the reverse position shown in Fig. 8, and the slide 59 is adjusted in the block 57 to position the tool for swinging movement in an arc of a radius corresponding to that of the convex surface to be produced, and the carriage 45 is shifted along the base to the left in Fig. 1 so that the vertical center of the block 57 passes beneath the work piece and assumes a position at the opposite or left hand side thereof, as indicated in Fig. 8, to bring the tool into working relation with the work piece.

With the machine set up in either of the manners just described, gear 65 or 66, according to whether a concave or convex surface is to be produced, is meshed with gear 64, and when the electric circuit for the motor 34 is completed by closing the switch 91, the motor will drive the work spindle 22 to rotate the piece of work relatively to the tool 61 and will simultaneously rotate the block 57 to cause the tool to traverse the work piece from its center to its periphery, the traversing operations of the tool being repeated until the curved surface on the work piece is finished. Each traversing operation of the tool is terminated automatically, when completed through a given angle, by engagement of the pin 92 on the block 57 with the switch arm 91*a*. During each traversing movement of the tool, the carriage 45 is preferably clamped in stationary position on the base 15 by operating the handle 54 in the appropriate direction, and the carriage 45 may be unclamped by operation of the handle 54 as the operation of the tool on the work piece proceeds, and the carriage shifted along the base by manually turning the handle 88 in the direction to advance the tool toward the work piece, the carriage being re-clamped to the bed preparatory to the next traversing operation of the tool.

In employing templates for producing concave or convex surfaces of large radii, as shown in Figs. 9, 10 and 11, in which the cross slide 100 is substituted for the slide 59, the block 57 may be adjusted rotatably by operation of the handle 82 to bring the cross slide 100 into a position 90 degrees to the axis of the work spindle 22 and

locked in that position by operating the handle 54 in the direction to clamp the block 57 to the base 15, and the carriage 45 is shifted along the base to bring the working edge of the tool into working relation with the piece of work, the roller 114 on the tool post engaging the surface 112 or 112a of a template 111 having the desired curvature. While using the template arrangement, the gears 65 and 66 are both disengaged from the gear 64 by setting the handle 75 in the middle recess 76, so that the motor will not rotate the block 57, but the operation of the motor will rotate the work piece, and as the tool operates upon the work piece, the tool is traversed across the face of the work piece a suitable number of times by manually rotating the screw 104. As the operation progresses, and between the traversing operations, the tool may be fed toward the work piece by manually turning the handle 88 in the direction to shift the carriage 45 and the tool thereon toward the work piece. By employing templates each having a convex curvature 112 on one edge and a concave curvature 112a on its opposite edge, each template may be used for producing either a concave or convex surface by mounting the template to bring its appropriate edge into position to guide the roller 114, and by having a supply of templates with curvatures of different radii, curved surfaces of different desired radii may be produced on the work pieces, this being particularly advantageous in the making of metal laps such as those used in the grinding of lenses.

I claim:

1. In a metal working machine of the character described a rectangular base member having ways on its upper face to extend lengthwise thereof; a work spindle rotatably mounted on the upper face of said bed parallel with, but spaced above, the ways; a work holding means on the inner end of said spindle; a carriage mounted on said ways to slide therealong; manually operable means between said carriage and bed for moving said carriage along the bed; a tool block mounted upon the upper face of said carriage rotatable around an axis at right angles to the axis of the spindle; an adjustable tool slide carried by said tool block extending at right angles to the axis of the tool block and normally substantially parallel to the spindle; a tool holder projecting upwardly from one end of said slide arranged for the reception of a cutting tool; means between said spindle and tool block for causing the same to rotate in unison; means included in said last means for selecting the direction of rotation of the tool block relative to the spindle or to disconnect the same; an electrically operated power unit; and means inserted in the power circuit of said unit adapted upon a predetermined rotation of said tool block to interrupt said power circuit and discontinue operation of the power unit.

2. In a metal working machine, a bed; ways extending longitudinally of said bed; a work spindle rotatably mounted at one end of said bed parallel with, but spaced above, the same; a carriage mounted upon said ways to slide therealong; manually operable means between said bed and carriage for moving said carriage along the bed; a tool block mounted upon the upper face of said carriage to rotate around an axis at a right angle to the axis of the spindle but in the same plane; a tool slide adjustably mounted in the upper face of said tool block at right angles to the axis thereof to normally extend substantially parallel to and adjustable towards or away from the spindle; means to lock said slide in its adjusted position on said tool block; a tool holder mounted upon one end of said tool slide; a cutting tool carried by said tool holder; means between said spindle and tool block for causing the same to operate in unison including manually operable means for selecting the relative direction of rotation of the block and spindle or for disconnecting the same; and an electrically operated prime mover adapted to be actuated by said tool holder upon a predetermined rotation thereof to render said prime mover inoperative.

3. In a metal working machine of the character described a rectangular base member having ways on its upper face to extend lengthwise thereof; a work spindle rotatably mounted on the upper face of said bed parallel with, but spaced above, the ways; a work holding means on the inner end of said spindle; a carriage mounted on said ways to slide therealong; manually operable means between said carriage and bed for moving said carriage along the bed; a tool block mounted upon the upper face of said carriage rotatable around an axis at right angles to the axis of the spindle; an adjustable tool slide carried by said tool block extending at right angles to the axis of the tool block and normally substantially parallel to the spindle; a tool holder projecting upwardly from one of said slide arranged for the reception of a cutting tool; means between said spindle and tool block for causing the same to rotate in unison; means included in said last means for selecting the direction of rotation of the tool block relative to the spindle or to disconnect the same; an electrically operated power unit; and means inserted in the power circuit of said unit and adapted upon a predetermined rotation of said tool block to interrupt said power circuit and discontinue operation of the power unit, and means carried by said tool block rotatable in one direction to lock the carriage and bed against relative movement while permitting rotation of said block, and operable in a reverse direction to lock said carriage and block against relative movement while permitting relative movement of said bed and carriage.

4. In a metal working machine of the character described a rectangular base member having ways on its upper face to extend lengthwise thereof; a work spindle rotatably mounted on the upper face of said bed parallel with, but spaced above, the ways; a work holding means on the inner end of said spindle; a carriage mounted on said ways to slide therealong; manually operable means between said carriage and bed for moving said carriage along the bed; a tool block mounted upon the upper face of said carriage rotatable around an axis at right angles to the axis of the spindle; an adjustable tool slide carried by said tool block extending at right angles to the axis of the tool block and normally substantially parallel to the spindle; a tool holder projecting upwardly from one end of said slide arranged for the reception of a cutting tool; means between said spindle and tool block for causing the same to rotate in unison; means included in said last means for selecting the direction of rotation of the tool block relative to the spindle or to disconnect the same; a boss extending downwardly from said carriage thru which the tool block rotating means extends; a collar carried by the tool block rotating means adjacent the end of said boss; a collar screw threadedly mounted upon the lower end of said boss adapted when rotated in one di-

rection to bear against the underside of the ways and lock said carriage and ways against relative movement and when rotated in a reverse direction to bear against said first collar and lock the carriage and tool block against relative movement.

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