July 31, 1945. W. J. JOYCE ET AL 2,380,446

MACHINE FOR GENERATING CURVED SURFACES

Filed May 21, 1943 2 Sheets-Sheet 1

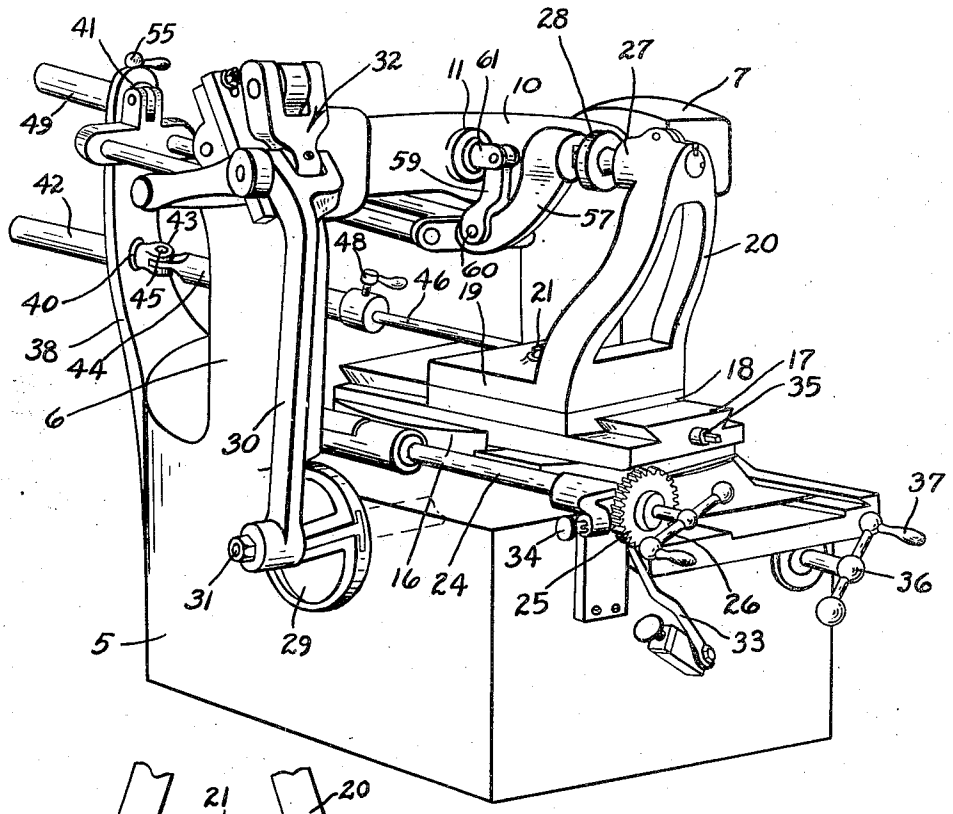


Fig. 1

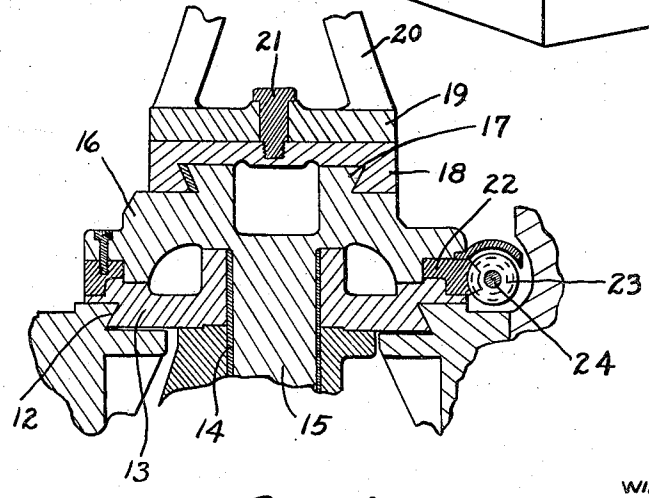


Fig. 4

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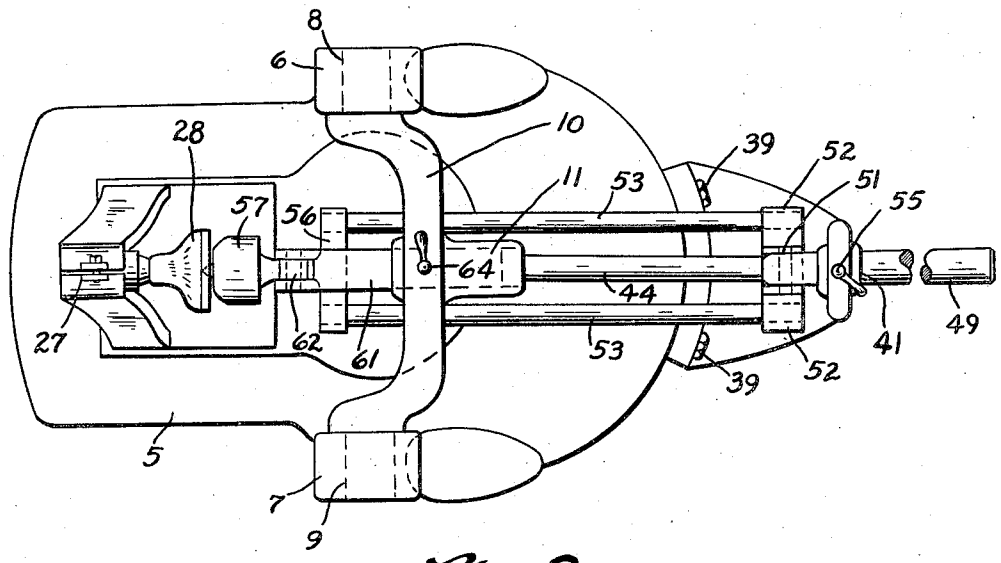


Fig. 2

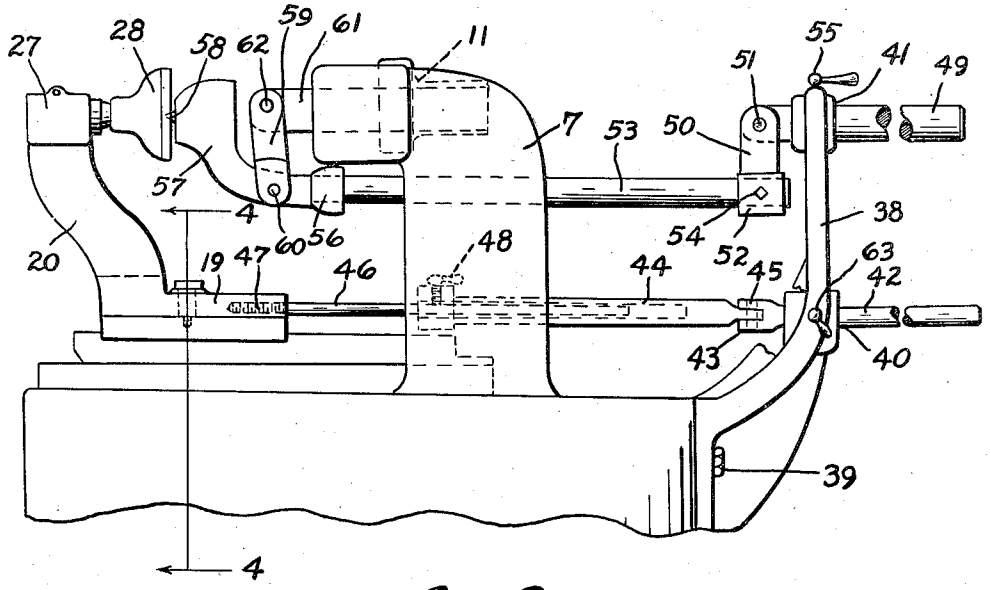


Fig. 3

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Patented July 31, 1945 2,380,446

UNITED STATES PATENT OFFICE

2,380,446

MACHINE FOR GENERATING CURVED SURFACES

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Application May 21, 1943, Serial No. 487,908

5 Claims. (Cl. 90—24)

This invention relates to curve generating devices and has particular reference to an auxiliary attachment adapted for use with standard curve generating devices commonly known in the art as lap truing machines for producing tools for generating curved surfaces on lenses and method of making the same.

The principal object of the invention is to provide an auxiliary attachment for lap truing machines adapted particularly to increase the curve generating range of such machines whereby surfaces of relatively long radii of curvatures beyond the range obtainable by the inherent lap truing machines may be obtained.

Another object of the invention is to provide an auxiliary attachment for standard lap truing machines which may be quickly and easily supported in operative position without altering the general initial operating characteristics of the lap truing machine.

Another object is to provide an auxiliary attachment readily attachable to a standard lap truing machine whereby the power generating parts of said machine are utilized to obtain the operative function of said auxiliary attachment.

Other objects and advantages of the invention will become apparent from the following description taken in connection with the accompanying drawings and it will be apparent that many changes may be made in the details of construction, arrangement of parts and methods shown and described without departing from the spirit of the invention as expressed in the accompanying claims. We, therefore, do not wish to be limited to the exact details of construction, arrangement of parts and methods shown and described as the preferred forms only have been given by way of illustration.

Referring to the drawings:

Fig. 1 is a perspective view of a standard lap truing machine showing the auxiliary attachment of the invention in operative position.

Fig. 2 is a plan view of the device illustrated in Fig. 1;

Fig. 3 is a fragmentary side elevation of said device; and

Fig. 4 is a fragmentary enlarged sectional view taken as on line 4—4 of Fig. 3.

Machines to which the device embodying the invention are applied are commonly known in the art as lap truing machines which are capable of generating different surface curvatures on laps used in forming curved surfaces on lenses. Lap truing machines of this nature, in the past, have been limited as to the number of different surface curvatures which they were capable of producing with the limitations being primarily in weak or shallow curve generations, such curves being commonly known as those having a relatively long radius of curvature. The reason for such limitation was that machines of this nature are commonly used by lens dispensers who, in most instances, do business in office buildings which are limited in area requiring such machines to be restricted as to size. Without this limitation it would be possible to produce substantially all of the curve generations required. In the past, when shallow curved laps were required, such laps were in most instances obtained from optical manufacturers who have the facilities for producing them. This was with a view to enabling the commercial lap truing machines to be practical for small shop use. Although the prior art lap machines did not produce the full range of curvatures of laps required they did produce some of the most essential curve generations. This, however, has been a decided handicap to lens dispensers as considerable time has been lost in the past in having to send to the factory for shallow curve laps when such laps were required.

The present invention, therefore, is adapted particularly to overcome this difficulty through the provision of an auxiliary attachment through which the required shallow curve generations could be obtained particularly without requiring redesigning of the commercial lap truing machines already in use.

Referring more particularly to the drawings wherein like characters of reference designate like parts throughout the several views, in the figures there is illustrated one of the commonly known commercial lap truing machines. This lap truing machine comprises a base 5 having spaced uprights 6 and 7 in which is pivotally supported, as illustrated at 8 and 9, a yoke 10 having a centrally located bearing 11 thereon in eccentric relation with a line extending through the spaced bearings 8 and 9. The base 5 is provided with a slideway 12 in which a slide plate 13 is mounted. This is best shown in Fig. 4. The plate 13 is provided with a central bearing 14 in which the pivot projection 15 of a plate member 16 is rotatably supported. The plate member 16 is, in turn, provided with a slideway 17 to which a slide plate 18 is slidably connected. The slide plate 18 has the base 19 of an upright 20 pivotally secured thereto by a suitable pivot member 21. The plate member 16 is provided with a worm gear sector 22 meshing with a worm gear 23.

The worm gear 23 is carried by a shaft 24 having a ratchet wheel 25 secured adjacent the end thereof opposite the worm gear 23 and having a manually operable crank member 26 thereon.

The purpose of this arrangement is to provide means for rotating the plate 16 about its pivot member 15 as is common practice in the art and will be described more in detail hereinafter but so far all the descriptive matter relates to commonly known lap truing machines. The upright 20 has a bearing 27 adjacent the upper end thereof. The bearing 27 is adapted to support a lap 28 which is to be surfaced. The bearing 11, in conventional use, is adapted to support the cutting tool for engaging the lap 28 when the yoke 10 is reciprocated about its pivots 8 and 9. This causes the cutting tool to move in vertical strokes transversely of the face of the lap 28 and such motion is imparted to the yoke through a power driven disc 29 having a connecting rod 30 eccentrically pivoted thereto as illustrated at 31. The connecting rod 30 is connected with motion transfer lever means to the yoke 10 which through rotation of the disc 29 and the eccentric pivot 31 will cause the connecting rod 30 to operate said motion transfer lever means 32 and cause the yoke 10 to be reciprocated about its pivot members 8 and 9. The extent of said reciprocal movement is sufficient to cause the cutting tool to traverse the entire width of the face of the lap 28 which is to be machined. Simultaneous to this function a power driven adjustable stroke pawl 33 engages the ratchet wheel 25 and advances said ratchet wheel an amount equal to the tooth displacement of the pawl. A suitable spring pressed plunger 34 having an engagement portion with teeth of the ratchet wheel is adapted to hold said ratchet wheel in advanced position. This causes the ratchet wheel 25 to rotate and to, in turn, rotate the worm gear 23. The worm gear 23 which is in meshed relation with the gear sector 22 will cause the support 20 to be swung in an arc about the pivotal member 15. The above causes the lap to move in a direction substantially normal to the path of movement of the reciprocating cutting tool carried by the yoke 10. This is merely general description of a conventional lap truing machine. During such rotary movement of the plate 16 the base 19 of the upright 20 is locked in fixed relation with the slide plate 18 by any suitable means not shown.

It is to be understood that prior to causing the cutting tool to reciprocate transversely of the face of the lap 28 and to simultaneously cause said lap to move in a path substantially normal to the path of movement of the cutting tool the lap and cutting tool are initially adjusted relative to each other, that is, with respect to the center of the pivotal supports 15 and 8 and 9 respectively to obtain the curve generations desired.

It is also to be understood that the lap support 20 is initially adjusted in a sidewise direction an amount sufficient to clear the lap prior to starting the cutting operation whereby the cutting tool will traverse the entire surface area of the lap. The position of the tool relative to the center of rotation of the yoke 10 determines the curvature generated on the lap in the vertical meridian and the adjustment of the face of the lap which is to engage the tool relative to the center of rotation of the pivot 15 determines the curvature generated in the horizontal meridian of the lap. Again the above is merely descriptive of a conventional lap truing machine. The length of the slideway 17 controls the limit of curvature as to long radius curve generation.

The above describes the forming of a concave surface on the lap 28. When it is desired to generate a convex curvature the lap is supported by the bearing 11 and the cutting tool is supported by the bearing 27 causing the curvature opposite to the direction of the concave curvature described above to be generated.

The slide plate 18 is movable longitudinally of the slideway 17 by a suitable conventional thread adjustment member 35. The slide member 13 is movable longitudinally of the slideway 12 by a similar conventional adjustable screw member 36 operated by the hand lever 37.

The device embodying the invention, which is in the form of auxiliary attachable parts, comprises an upright member 38 which may be detachably connected with the base 5 by any suitable means, such as bolts 39, as shown in Figs. 2 and 3. The upright 38 is provided with spaced openings 40 and 41. The opening 40 is adapted to support a bar member 42 having a pivot coupling 43 adjacent one end thereof to which a hollow rod-like member 44 is pivotally attached, as indicated at 45. The hollow rod-like member has an additional rod-like portion 46 in telescopic relation therewith, which additional rod-like member 46 is threadedly connected with the base 19 of the upright 20, as shown at 47 in Fig. 3. A suitable clamp screw 48 is provided for locking the rod 46 in proper adjusted relation with the hollow rod-like member 44 and a suitable clamp screw 63 locks the bar-like member 42 in the opening or bearing 40. It is to be noted that the axis of the pivot 45 is disposed substantially in a vertical direction so as to permit sidewise movement of the base 19 carrying the upright 20.

The opening 41 is adapted to receive an adjustable bar member 49 having a bracket member 50 pivotally attached thereto as illustrated at 51. The said bracket member is provided with spaced bearing members 52 into which spaced rod-like members 53 extend and which are locked therein by suitable set screws or the like 54. The bar member 49 may be locked in desired adjusted position in the opening or bearing 41 by means of a suitable clamp screw or the like 55. The spaced rod-like members 53 are secured at their ends, opposed to the bearings 52, to a bracket member 56, having a tool carrying head or holder 57 formed integrally therewith and in which a suitable cutting tool or the like 58 is secured. The head or holder 57 is so formed as to permit the attachment of the lap 28 thereto instead of the tool 58 if desired. The bracket member 56 has a driving link 59 pivoted thereto as illustrated at 60. The said driving link is, in turn, pivotally connected to a bar member 61 as illustrated at 62. The bar member 61 is adapted to extend within and to be secured in the bearing 11 of the yoke 10.

With the auxiliary attachment, such as set forth above, the feed screw means 35 is disassociated with the slide 18 so as to permit said slide 18 to be moved freely longitudinally of the slideway 18. The base 19 is disconnected from the plate 18 so as to permit free pivotal movement of the base 19 relative to the pivot 21. Power is then applied to rotate the disc 29 and to operate the drive pawl 33. As the disc 29 rotates, the connecting rod 30 through the motion transfer lever means 32, imparts an up and down reciprocating movement to the yoke 10. This movement is transferred through the link

59 to the bracket 57 and causes the cutting tool 58 to reciprocate in a vertical direction about the center 51 as the center of rotation. This causes the tool to move about an arc whose radius of curvature is equivalent to the distance between the center of the pivot 51 and the point of the cutting tool 58. Simultaneous to this up and down movement of the tool the upright 20, carried by the base 19, and which is threadedly connected with the telescoping rod-like members 46 and 44 respectively, will be caused to move in a sidewise direction about an arc swinging about the pivot 45 as the center of rotation. This causes the lap 28 to move in said arc and the radius of curvature generated along the horizontal meridian of the lap 28 will be equivalent to the distance between the center 45 and the point of the cutting tool measured along a line parallel with the axis of the rod-like members 44 and 46 and intersecting a plane parallel to that line and touching the point of the cutting tool. This arcuate movement is imparted to the lap 28 through the combined sliding movement of the plate 18 on the slideway 17 and the pivotal movement on the base 19 relative to the plate 18.

It is to be understood that the radius of curvature generated along the vertical meridian by the stroke of the cutting tool may be varied by loosening the set screws 54 and 55 and by adjusting the bar member 49 inwardly of the bearing 41 and simultaneously causing the bearing 52 to be adjusted inwardly longitudinally of the spaced rod-like members 53. When the required radius of curvature is obtained the respective set screws 54 and 55 are moved to locking position. Independently of this adjustment the curvature generated in the horizontal meridian through the horizontal movement of the lap may be controlled by loosening the set screws 48 and 63 respectively whereby the hollow rod-like member 44 is moved inwardly longitudinally of the rod-like portion 46 which, in turn, simultaneously moves the bar portion 42 inwardly of the opening or bearing 40. When the proper radius of curvature is obtained the respective set screws 48 and 63 are moved into proper adjusted position. Suitable gauge means may be provided for obtaining accurate adjustments as is conventionally employed and commonly known in the art. The bar member 61 is secured in adjusted position in the bearing 11 by a suitable set screw or the like 64.

Prior to starting the cutting operation it is to be understood that by operation of the hand lever 26 the lap 28 may be moved sidewise an amount sufficient to clear the tool which, when the cutting operation is started, the said cutting tool will traverse the entire face of the lap 28. This is a conventional adjustment commonly known in the art.

The above describes the method of forming concave laps 28. When it is desired to form convex laps the cutting tool 58 is supported by the bearing 27 and the lap 28 is supported by the head 57.

With the above arrangement, it is possible to generate surface curvatures of a considerably longer radius of curvature than is possible with the initial conventional curve generating machine and this therefore greatly increases the obtainable range of curvatures.

From the foregoing description it will be seen that simple, efficient and economical means and methods have been provided for accomplishing all of the objects and advantages of the invention.

Having described our invention, we claim:

1. A device for use with a curve generating machine having means for moving a work support and a tool support in substantially perpendicularly related directions of movement, said device comprising a bracket attachable to the machine and having spaced bearings therein, means adjustably supported in said bearings, a rod-like member pivotally connected to one of the means adjustably supported in said bearings and having means for attachment to one of the supports of the machine for causing said support to move in a path about the center of the pivot of said rod-like member, a second rod-like member pivotally connected to the other of said adjustable means in said bearings and having means for attachment to the other of said supports of the curve generating machine for causing said support to move about the center of the pivot of said latter rod-like member when the said supports are moved in said perpendicularly related directions.

2. A device for use with a curve generating machine having means for moving a work support and a tool support in controlled directions, said device comprising a bracket having means for attachment to the machine and having spaced bearings therein, a bar-like portion adjustably mounted in each of said bearings, each having a pivotal connection adjacent one end thereof, a plurality of rod-like members, one pivotally connected to each of the bar-like portions, one of said rod-like members having telescoping portions, means for securing said telescoping portions in fixed relation with each other, one of said rod-like members having means for attachment with one of the supports of the curve generating machine and the other of said rod-like members having a holder portion adjacent the end thereof opposed to its pivotal connection with its respective bar-like portion and link means connecting said holder portion with the other of said supports of the curve generating machine.

3. A device for use with a curve generating machine having means for moving a work support and a tool support in substantially perpendicularly related directions, said device embodying a detachable bracket having spaced bearings therein, means adjustably carried by said spaced bearings having pivotal means adjacent one end thereof, rod-like members pivotally connected with each of the respective pivotal means, one of said rod-like members being detachably connected adjacent its opposed end with one of the supports of the machine for controlling the path of movement of said support in its direction of movement and the other of said rod-like members having a holder portion thereon, means adjustably supported in the other of said supports of said machine and link means having a pivotal connection with the holder portion and with the means adjustably supported in the other of said supports.

4. A device of the character described comprising a work support and a tool support movable in perpendicularly related directions, a bracket having spaced bearings therein, means adjustably supported in said bearings, a plurality of rod-like members having pivotal connections adjacent one end thereof to said means adjustably supported in said bearings, one of

said rod-like members being attached to the work support and another of said rod-like members being attached to the tool support and means for moving said work and tool supports relative to each other in said substantially perpendicularly related paths of movement.

5. A device of the character described comprising a work support and a tool support movable in perpendicularly related directions, a bracket having spaced bearings therein, a bar-like portion adjustably supported in each of said bearings and having a pivotal connection adjacent one end thereof, a rod-like member pivotally connected with each of the bar-like portions, one of said rod-like members having telescoping portions with means for securing said portions in adjusted relation with each other, means for securing said rod-like member to one of said supports and the other of said rod-like members having a holder portion adjacent the end thereof opposed to its pivoted end, link means connecting said holder portion with the other of said supports and means for moving said supports in said substantially perpendicularly related paths of movement.

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