March 29, 1949. L. E. OBADIAH 2,465,393

RADIUS TURNING ATTACHMENT

Filed Sept. 17, 1945 2 Sheets-Sheet 1

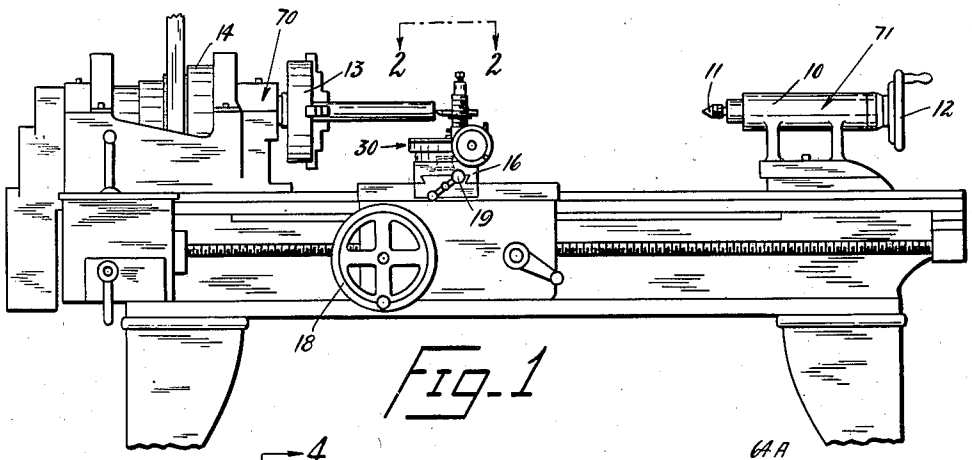


FIG. 1

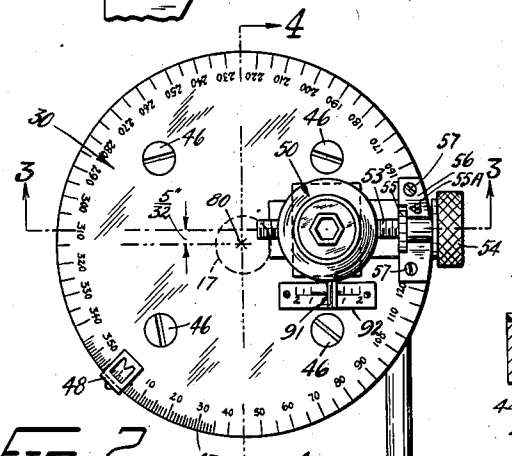


FIG. 2

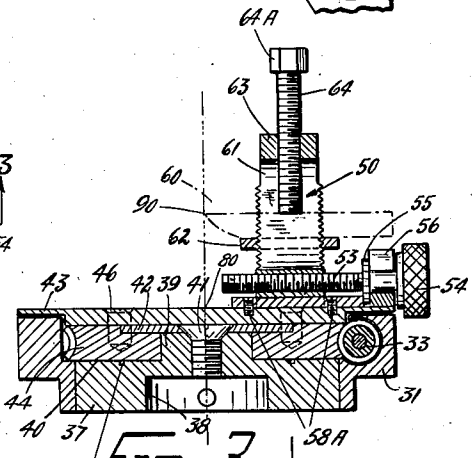


FIG. 3

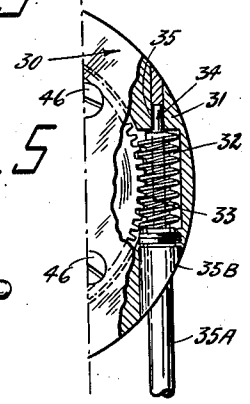


FIG. 5

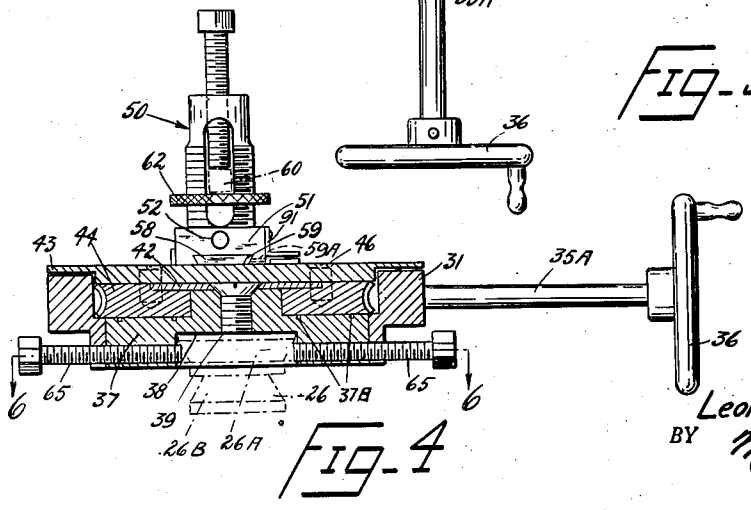


FIG. 4

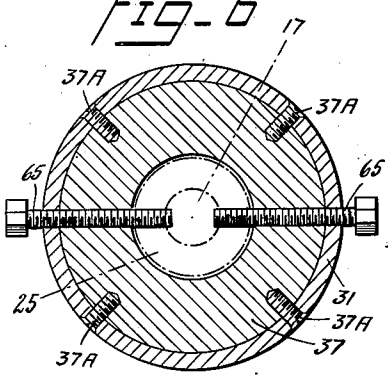
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Filed Sept. 17, 1945 2 Sheets-Sheet 2

Fig. 6



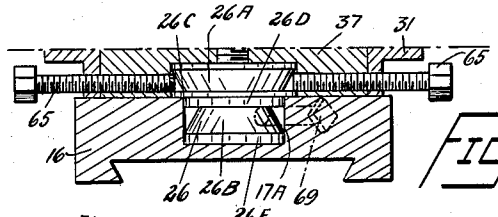


Fig. 7

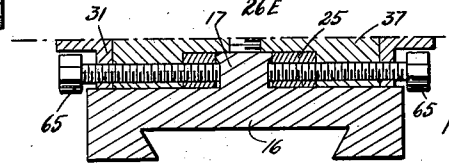


Fig. 8

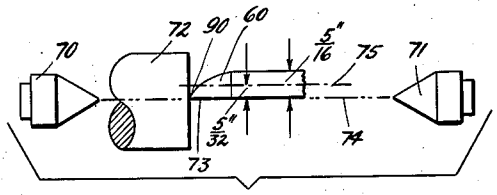


Fig. 9

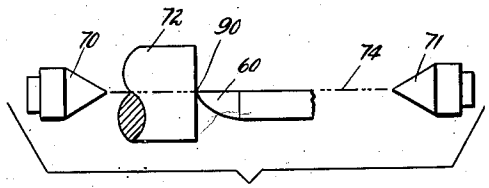


Fig. 10

Fig. 11

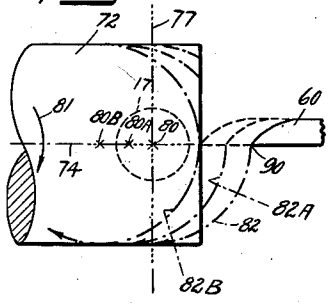
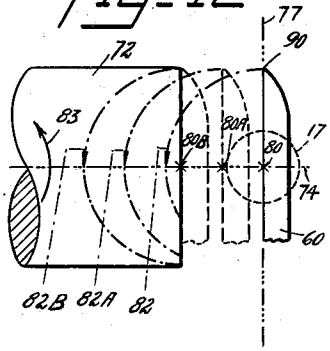


Fig. 12



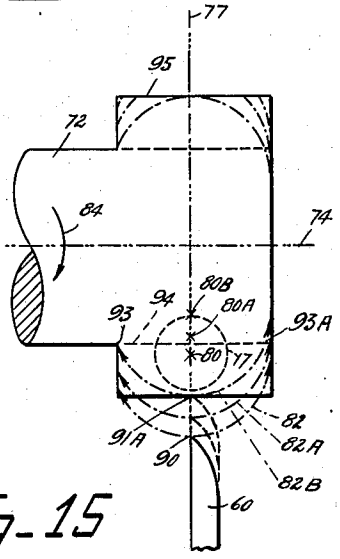


Fig. 15

Fig. 13

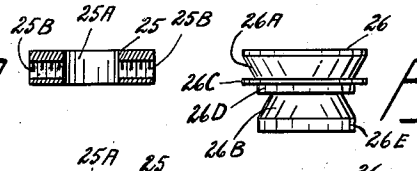


Fig. 14

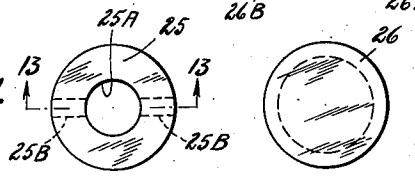


Fig. 16

Fig. 17

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UNITED STATES PATENT OFFICE

2,465,393

RADIUS TURNING ATTACHMENT

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Application September 17, 1945, Serial No. 616,936

5 Claims. (Cl. 82—12)

(Granted under the act of March 3, 1883, as amended April 30, 1928; 370 O. G. 757)

1

This invention relates to lathes, and more particularly to a radius turning attachment for lathes.

The object of the invention is to provide an attachment for lathes which may be easily attached to any standard lathes, and when attached serves for the cutting of tores or radii on the work piece, either at the end, convex or concave, or along the side of the work piece. This attachment, complete in itself, may, by means of adaptors, be secured to the cross slide of a lathe, after the usual standard parts have been removed from the cross slide. The attachment is self-contained and may be readily attached to and taken off the lathe.

This invention comprises a self-contained radius turning attachment for lathes and similar turning machine tools, having a housing over a bearing plate or a disc with a recess on its bottom, adjusting screws in said housing entering said recess, a turntable having a center coincident with the center of said recess, means for rotating the turntable, and a toolholder on said turntable for adjustably supporting a tool having its point centered in relation to said turntable center, said attachment being adapted to be detachably attached to a standard cross-slide of a lathe centered to the centerline of the headstock and tailstock of the lathe.

The invention consists further in the combination of such an attachment with adaptors, one a ring shaped adaptor to surround a post of the conventional cross-slide, and one a conical adaptor to engage a recess of a cross-slide, either adaptor being used depending on whether the cross-slide has a post or a recess.

Screws or other suitable securing means are provided on the attachment to engage the adaptor to secure the adaptor to the attachment, and the attachment to the post of the cross-slide, and in the case of the conical adaptor, screws or other securing means are provided to secure the adaptor to the attachment, and other screws or securing means are provided to secure the conical adaptor to the cross-slide.

The invention consists further in a precision instrument in which the turntable is provided with a degree scale and the housing with a pointer indicating the degree of circular movement of the tool point, and in which the tool support has linear graduated means indicating the amount of radial movement of the tool point from its centering position in either direction, which amount of movement in one or the other direction determines the radius of the arc of

2

circular movement of the cutting point of the tool, whereby the attachment may function for either convex or concave cutting of the end of the work piece, or toric cutting laterally of the work piece.

The invention will be further described, an embodiment thereof shown in the drawings, and the invention will be finally pointed out in the claims.

In the accompanying drawings,

Fig. 1 is a side view of a conventional lathe, with the improved attachment applied thereto;

Fig. 2 is a plan view of the attachment;

Fig. 3 is a transverse vertical section on line 3—3 of Fig. 2;

Fig. 4 is a transverse vertical section on line 4—4 of Fig. 2;

Fig. 5 is a fragmentary plan view, with parts broken away;

Fig. 6 is a horizontal section on line 6—6 of Fig. 4;

Fig. 7 is a cross section of a cross-slide having a recess, and showing a conical adaptor connected therewith, and with the bottom of the attachment;

Fig. 8 is a cross section of a cross-slide having a post, and showing a ring adaptor connected therewith, and with the bottom of the attachment;

Figs. 9 and 10 are diagrammatic views, Fig. 9 in plan and Fig. 10 in side view, showing the tool point centering to the headstock and tailstock center line;

Fig. 11 is a diagrammatic plan view of a work piece, and the different cutting positions of the tool, in convex cutting;

Fig. 12 is a diagrammatic plan view of a work piece, and the different positions of the tool, in concave cutting;

Figs. 13 and 14 is a central section and plan view, respectively, of a ring adaptor;

Figs. 15 and 16 is a side view and plan view, respectively, of a conical adaptor, and

Fig. 17 is a diagrammatic plan view of a work piece, and the different positions of the tool, in toric cutting.

Similar characters of reference indicate corresponding parts throughout the various views.

Referring to the drawings a known or conventional lathe is shown in Fig. 1, showing the improved attachment applied thereto.

As known, the tailstock 10 has a spindle 11, movable longitudinally by a hand wheel 12. The work piece support 13 is rotated by known means 14. The cross-slide 16 supporting the known

compound rest and tool holder is movable longitudinally along the bed of the lathe by the hand wheel 18. The cross-slide 16 is movable transversely to the longitudinal line of the lathe by a handle 19. The cross-slide 16 may have either a recess or a post as known, to which the compound rest and toolholder support is connected. The compound rest is removed leaving the known cross-slide 16 either with a recess such as 17A (Fig. 7), or a cross-slide 16 with a post such as 17 (Fig. 8), depending on the type of the lathe.

The attachment itself, indicated generally by 30 as seen in Fig. 2, consists of a housing 31, having a recess 32 (Fig. 5) into which a worm screw 33 fits, one end 34 of the screw fitting into the bearing 35, and the shaft 35A, and held in place by a screw bushing 35B and extending outside of the housing 31 and having a handwheel 36. Seated within the housing 31 is a non-rotatable bearing plate or disc 37, having a recess 38 at its lower side, and a central shoulder 39 at its upper side. The axes of the shoulder portion 39 and recess 38 are coincident. The bearing plate 37 and the housing 31 are secured together by screws 37A. This shoulder portion has a bore which is screwthreaded to engage the screw 41, the head of which holds down a washer 42 against the shoulder portion 39. Between the extending part of the washer 42 and the bearing plate 37 a peripheral worm gear 44 is provided which rides on the surface 40 of the bearing plate 37 and against the shoulder portion 39 and engages the worm 33. Oil grooves 37B are provided. The gear 44 has secured to it a rotatable disc or turntable 43 by means of four screws 46. The upper surface of this turntable 43 is provided with circumferentially arranged degree markings 47, visible also through a pointer 48, as shown in Fig. 2, which pointer 48 is secured to the housing 31.

Upon the turntable 43, there is secured a tool holder generally indicated by 50 (Figs. 2, 3, and 4). This tool holder 50 consists of a base 51 resting on the turntable 43. The base 51 has a screwthreaded bore 52, which is engaged by a dial screw 53 having a knurled end 54. On this dial screw 53 there is a dial 55 having a circular graduated portion on its periphery, each line indicating a thousandths of an inch rotation. The knurled end 54 and the dial 55 are spaced from each other to allow a dial bracket 56 to support the dial screw 53, the bracket 56 being secured to the turntable 43 by the screws 57. A pointer 55A points towards the markings on the dial 55 to indicate the reading. The base 51 moves over a dovetail slide 58, having a gib 59, for adjustment purposes, and tightened or loosened by set screws 59a. The slide 58 is secured to the turntable 43 by screws 58A.

As seen in Figs. 3 and 4, the base 51 has a tool post 61, which has exterior screwthreads to engage a rotatable adjusting screwthread ring 62, upon which the tool 60 rests. The tool post 61 is slotted to permit the passage of the tool 60. The top 63 of the tool post 61 has a screwthreaded bore engaged by a screw 64, with a bolt head 64A. By raising or lowering the ring 62, and correspondingly the screw 64, the tool 60 may be raised or lowered. Also the tool 60 may be moved axially, until clamped in operative position by the screw 64.

The base 51 has a pointer 91 extending therefrom, which extends over the zero position on the radius scale 92 shown in Fig. 2. To either side of the zero linear graduated markings are arranged. These graduations are in fractions of an inch, but it is understood that any type of linear calibration or vernier scale could be used. When the tool 60 is in normal position, the pointer 91 is on zero. When the tool 60 is moved in either direction, by the base 51 moving over the slide 58, by the turning of the end 54 of the screw 53, the pointer 91 shows the amount of movement. This amount of movement is indicative of the length of the radius of the circle through which the cutting edge 90 of the tool 60 passes, the circle having its center coincident with the center point 80 of the attachment.

As illustrated in Fig. 4, at the lower side of the bearing plate 37, diagrammatically opposed screws 65 are provided which pass through the housing 31, and through the bearing plate 37, and have their free ends enter the recess 38. This recess 38 is made sufficiently large in diameter, to be larger than any diameter of a post 17 as used on standard lathes. These screws 65 are shown as engaging the upper conical portion 26A of the conical adaptor 26, which is shown in dotted lines in Fig. 4. The lower part 26B of the conical adaptor 26 fits into a recess 17A of the cross-slide 16 as shown in Fig. 7. This conical adaptor 26 is shown in detail in Figs. 15 and 16. A collar 26C is disposed between the conical portions 26A and 26B, and the lower surface of this collar 26C rests on the cross-slide 16. It will be noted that the lower surfaces of the bearing plate 37 and the housing 31, rest upon the upper surface of the cross-slide 16. The ends of the screws 65 engage between the upper conical portion 26A and the collar 26C.

The adaptor 26 is held in position on the cross-slide 16 by a screw 69 as shown in Fig. 7, which screw engages the lower conical surface 26B of the adaptor 26, and between it, and a collar 26D which has the same diameter as the recess 17A, as shown in Fig. 7. The collars 26D and 26E have the same diameter.

If the cross-slide 16 has a post 17 as known and shown in Fig. 8, then a ring adaptor 25 as shown in Figs. 13 and 14, is employed, and the screws 65 are passed through screwthreaded portions 25B and are tightened against the post 17. It may be noted that the bore 25A of the adaptor 25 snugly fits against the upper part of the post 17. Thereby the attachment 30 is operatively secured to the cross-slide 16 of the lathe when the cross-slide 16 has a post 17.

In Figs. 4, 6, 7 and 8 these screws 65 are shown parallel with the line of the shaft 35A, but in practice it is preferred to have them at 45°; as in many lathes, adjustment is simpler when the screws 65 are at 45°.

In Fig. 9, which is a plan view, the headstock 70 is aligned with the tailstock 71. The work piece 72 is secured in support 13 accordingly. The face 73 of the tool 60 is aligned with the headstock 70, tailstock 71, center line 74, but the axial center line 75 of the tool 60 is spaced $\frac{5}{32}$ of an inch from the line 74, the width of the tool 60 being $\frac{5}{16}$ of an inch, so as to use the full length of the tool 60 and obtain a maximum of 90° on a concave radius or a 180° concave hemisphere.

A side view of the parts shown in Fig. 9, is shown in Fig. 10.

The turntable 43 shown in Fig. 2, is graduated for 360°. The zero mark is at the pointer 48. The cutting edge 90 of the tool 60 is in its headstock 70 tailstock 71 center line 74, as shown in Fig. 9, and the cutting edge 90 is coincident with the dead center point 80 of the attachment, as shown in Fig. 3, and the height of the cutting

edge 90 is in line with the headstock 70 tailstock 71 longitudinal center line 74, all as diagrammatically shown in Figs. 9 and 10. The pointer 91 is over the zero position of the radius scale 92, and the pointer 55A is on the zero reading of the dial 55.

By turning the handle 36, the turntable 43 may be moved in either direction, and the tool cutting edge 90 moves in a circle. By turning the knob 54, the tool 60 may be moved forwardly or rearwardly.

When the dial screw 53 is rotated clockwise, the cutting edge 90 of the tool 60 is brought back to the right side of the center line 80 for convex cutting; and by turning the dial screw 53 counter clockwise, the cutting edge 90 is advanced to the left side of the center line 80 and concave cutting is made possible. The size of the radius (convex or concave) is indicated by the pointer 91 over the radii scale 92, and the pointer 55A over the dial 55, both starting from zero in either direction.

In order to cut the work piece 72 into an exterior convex curved surface, the body of the work piece 72 to be cut is placed over and beyond the dead center point 80 of the attachment 30 as shown in Fig. 11. The distance from the center point 80 to the final end cutting arc is the radius of the final cutting, and this is noted on the radius scale 92 on the right side of zero. The work piece 72 is rotated clockwise in the direction of the arrow 81 as seen in Fig. 11, looking in the direction from the headstock 70 to the tailstock 71. The tool cutting edge 90 is moved in an arc 82, which, as seen, cuts the corner of the work piece 72. The hande 36 is rotated and the tool 60 is moved clockwise, the cutting action of the tool 60 on the work piece 72 being in the clockwise direction upon and from the axis of the work piece 72 radially outwards. The rotation of the work piece 72 clockwise as shown by the arrow 81 during the cutting action of the tool 60 resulting in the convex spherically shaped end of the work piece 72. The tool 60 is returned to its initial position by the rotating of the handle 36 in counterclockwise direction. The attachment 30 is then moved longitudinally 74 on the lathe by rotating the handle 18, and this brings the tool 60 to the second dot-dash line position 82A shown in Fig. 11, and the center 80 of the attachment 30 is thereby moved to 80A. The handle 36 is then rotated and the tool cutting edge 90 is moved in an arc and cuts off the work piece 72 along the next arc 82A shown in second dot-dash line in Fig. 11. The tool 60 is then brought back, and the attachment 30 is again advanced by turning the handle 18, so that the center point 80 of the attachment 30 takes the position 80B. The handle 36 is turned and the work piece 72 cut along arc 82B. These arcs are shown only as examples. In practice, the skilled operator makes many more cuttings, until the desired shape has been attained.

If it is desired to enlarge the convex spherical cutting, this can be carried out by continuing the rotation of the turntable 43 until the markings of about 170° (or complete 340°) register with the pointer 48, a supporting stem on the work piece 72 being necessary to be maintained.

If it is desired at the end of the 90° operation, to cut the work piece 72 axially, the entire attachment 30 is shifted by the operation of the lathe hand wheel 18, and the ordinary cylindrical cutting is carried out without moving the turntable 43.

In order to cut the work piece 72 into an interior concave curved surface, as seen diagrammatically in Fig. 12, the tool cutting edge 90 is moved to the left of the center 80. The control by the radius scale 92 is carried out as heretofore described, but on the left side of the zero. The work piece 72 is now rotated counter clockwise, as shown by the arrow 83, and the cutting edge 90 of the tool 60 follows the cutting arc 82. The movement of the turntable 43 is now counter clockwise, starting with 90° reading on pointer 48, during the cutting action of the tool 60. The cutting action is in the direction of the curved arrows shown which arrows begin at the edge 90 in Fig. 12; and this cutting action thrust of the edge 90 ends at the axis of the work piece 72. As the work piece 72 is rotating, a concave cut is obtained, as shown by the extensions beyond the arrow heads in Fig. 12. The cutting edge 90 after it has reached the longitudinal axis 74 of the work piece 72 is moved back out of the concavity already formed, by rotating the turntable 43 clockwise, the tool 60 having a pivot point at 80 in Fig. 12. Thus, when arc 82 has been cut, the tool 60 is returned to its initial position, and the attachment 30 is moved by the handle 18 until the center point 80 arrives at 80A. Then the handle 36 is rotated to turn the turntable 43 counterclockwise, and the arc 82A is cut. The tool 60 is then brought back to its initial position. The center point is shifted from 80A to 80B, and the arc 82B is cut. Again a skilled operator will repeat these actions until the cutting is completed as desired. It will be noted that for a concave radius cutting not more than a 90° quadrant or a total of 180° concave hemisphere can be cut.

The operation is as follows:

The known tool holder and compound rest of the lathe is removed leaving the cross-slide 16 with its post 17 or recess 17A exposed. This post 17 or recess 17A is then centered in line with the headstock 70, tailstock 71, longitudinal center line 74, as well known.

The attachment 30 is secured to the cross-slide 16 as previously described. The turntable scale 47 is moved so that the zero degree is readable through the pointer 48; the zero reading on the radius scale 92 is registered with the pointer 91; and the zero reading on the dial 55 is registered with the pointer 55A. The cutting edge 90 of the tool 60 is now placed in the longitudinal axial line 74 as shown in Fig. 9, and the height of the tool 60 is adjusted by moving adjusting ring 62 and screw 64A up or down until cutting edge 90 is coincident with the center line 74 in Fig. 10. It might be noted here that the maximum diameter capacity of this attachment is double the height of the center line 74 in Fig. 10 to the top of the turntable 43, this height varying on different lathes.

Referring to Fig. 11, the tool 60 is moved to the full line position and it with its point 90 is rotated by the handle 36 from its full line position, to chip off the portion 82. The rotation of the work piece 72 is clockwise as shown by the arrow 81, and the cutting edge 90 of the tool 60 is at the right side of the center 80. The progressive cuttings are made as described until the cutting has been completed.

The same general operation takes place when a concave cutting is desired, as shown in Fig. 12, only the rotation is counterclockwise as shown by the arrow 83, and the tool cutting edge 90 is on the left side of the center line 80.

The attachment 30 is also capable of being used for turning toric surfaces laterally of the longitudinal axis 74 of the work piece 72. For turning such a toric surface, one first turns a cylindrical portion 95 on the work piece 72 in the known manner, the work piece 72 rotating clockwise in the direction of the arrow 84 as seen in Fig. 17. The turntable 43 is now rotated from the zero position shown in Fig. 2, to a position where 90° shows on the pointer 48. The radius scale pointer 91 is placed on the right side of the scale 92 to indicate the radius to be cut. The tool 60 is then moved to the position shown in full line in Fig. 17.

The handle 19 of the lathe is then rotated in order to move the entire attachment 30, transversely to the longitudinal line 74 or the lathe, along the line 77.

Now, by rotating the handle 36 alternately in a clockwise and counterclockwise manner, the work piece 72 is chipped off along the arc, and the tool 60 is intermittingly advanced, and cuttings made along the arcs 82—82A and 82B, while the center 80 is moved to 80A and 80B respectively, until the cutting coincides with the perimeter point 91A, which is on the original or initial line 95. The toric surface is then completed in accordance with the desired curvature or size. The points 91A and 80 are in a plane 77 transverse to the longitudinal axis 74 of the work piece 72, and the ends 93 and 93A of the tore are in a plane 94 parallel with the axis of the work piece 72. In Fig. 17, the cutting extends beyond the point 93A, in order to indicate the possibility of extending the circular cut if desired.

It may be further added that it is possible to turn an inside toric surface by the use of a C-shaped offset tool, the procedure being a combination of convex toric turning and concave radii turning.

The improved attachment 30 differs from the prior art in that the said attachment 30 has the bottom recess 38, the center of which is the controlling center for the turntable 43 and to which the cutting edge 90 of the tool 60 is centered. The tool 60 being on the turntable 43 is under the control of the scale 47. The tool 60 is also under the control of the dial screw 53 and radii scale 92, and thereby is a precision instrument. The improved attachment 30 is self-contained. When the desired radius turning has been completed, the self-contained attachment 30 is removed from the lathe, and put away until it is again desired to be used, the lathe being then used for its usual purposes.

Though the attachment 30 may be used for other purposes, it is especially useful for preparing convex or concave gauges, dies, laps, cutting tools, or form tools on any material or plastic, etc., where radii are required, or used for.

The attachment 30 may, if desired, be used on a lathe to take the place of the known compound, for regular work, with the only limitation under the present construction being the limited travel of the tool as compared to the present compound. Any known shaped tool, threading or cutting, can be used.

I have described several forms of my invention, but obviously various changes may be made in the details disclosed without departing from the spirit of the invention as set out in the following claims.

The invention described herein may be manufactured and used by or for the Government of the United States of America for governmental purposes without the payment of any royalties thereon or therefor.

I claim:

1. In a self-contained radius turning attachment for lathes, the combination with a housing having a recess in its bottom, adjusting screws in said housing entering said recess, a turntable for said housing having a center coincident with the center of said recess, means for rotating the turntable, and a tool holder on said turntable for adjustably supporting a toolbit centered in relation to said turntable center, said housing being adapted to be detachably attached to a standard cross-slide of a lathe centered to the centerline of the headstock and tailstock of the lathe, a ring-shaped adaptor engaging said recess of the housing, and engaged by said screws, said screws engaging a post on said cross-slide, when said attachment has been applied to the cross-slide.

2. In a self-contained radius turning attachment for lathes, the combination with a housing having a recess in its bottom, adjusting screws in said housing entering said recess, a turntable for said housing having a center coincident with the center of said recess, means for rotating the turntable, and a tool holder on said turntable for adjustably supporting a toolbit centered in relation to said turntable center, said housing being adapted to be detachably attached to a standard cross-slide of a lathe centered to the center line of the headstock and tailstock of the lathe, a conical shaped adaptor engaging said recess of the housing, said screws engaging the conical surface of the adaptor, said adaptor engaging also a recess on the cross-slide, when the attachment is applied to the cross-slide, and screws on the cross-slide engaging the conical adaptor for holding the adaptor to the cross-slide.

3. In a radius turning attachment for lathes, the combination of a housing, a disc within the housing having a circular recess in its bottom, a worm gear for said disc, a worm for the worm gear, a turntable movable with the disc, and having a scale, a pointer on the housing, a tool support on the turntable, means determining the position of the tool point when a tool is in said support, means indicating the position of the tool point in respect to the center of the disc, and an adaptor for said recess in said disc, said adaptor being adapted to secure the attachment to the cross-slide of the lathe.

4. In a radius turning attachment for lathes, the combination of a housing, a disc within the housing having a circular recess in its bottom, a worm gear for said disc, a worm for the worm gear, a turntable movable with the disc, and having a scale, a pointer on the housing to indicate the amount of turning of the turntable from a zero position, a tool support on the turntable, means determining the position of the tool point when a tool is in said support, said means including increment indications showing the amount of movement, means indicating the position of the tool point in respect to the center of the disc, and an adaptor for said recess in said disc, said adaptor being adapted to secure the attachment to the cross-slide of the lathe.

5. In a radius turning attachment for lathes, the combination of a housing, a disc within the housing having a circular recess in its bottom, a worm gear for said disc, a worm for the worm gear, a turntable movable with the disc, and

having a scale, a pointer on the housing to indicate the amount of turning of the turntable from a zero position, a tool support on the turntable, means determining the position of the tool point when a tool is in said support, said means including increment indications showing the amount of movement, means indicating the position of the tool point in respect to the center of the disc, an adaptor for said recess in said disc, said adaptor being adapted to secure the attachment to the cross-slide of the lathe, and means turning an inside toric surface combining convex toric turning and concave radius turning.

LEONARD E. OBADIAH.

REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
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