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FORMING TOOLS

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2 Sheets-Sheet 1

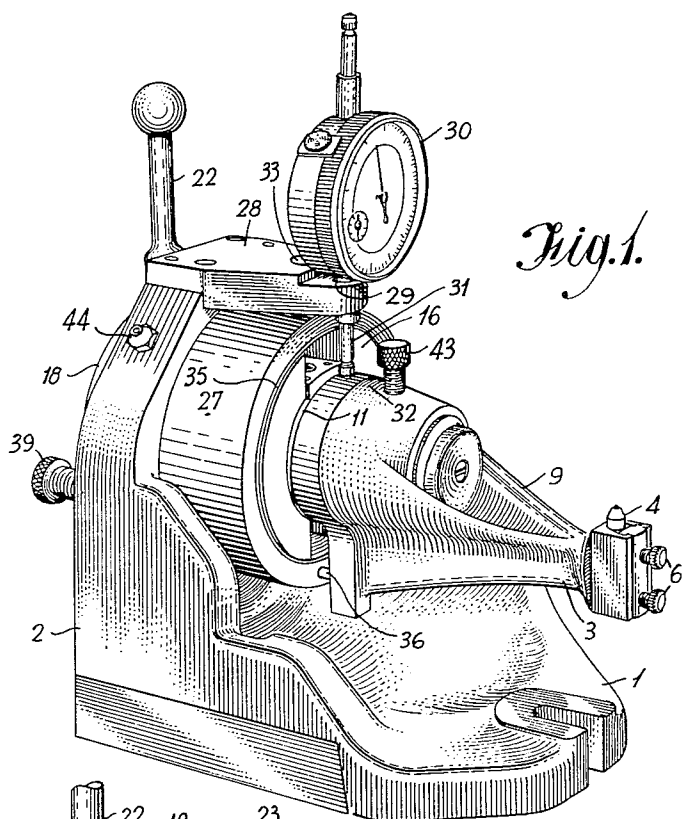


Fig. 1.

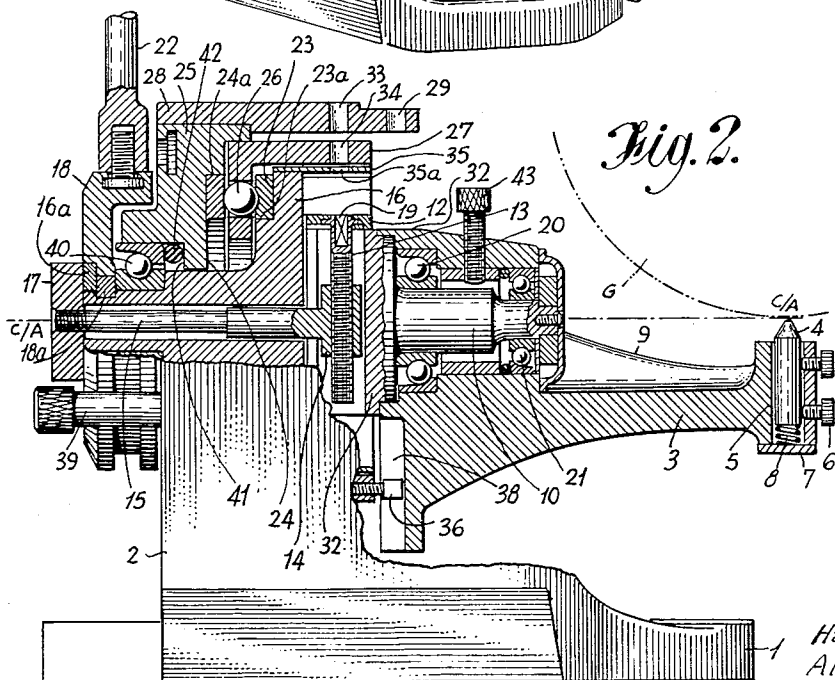


Fig. 2.

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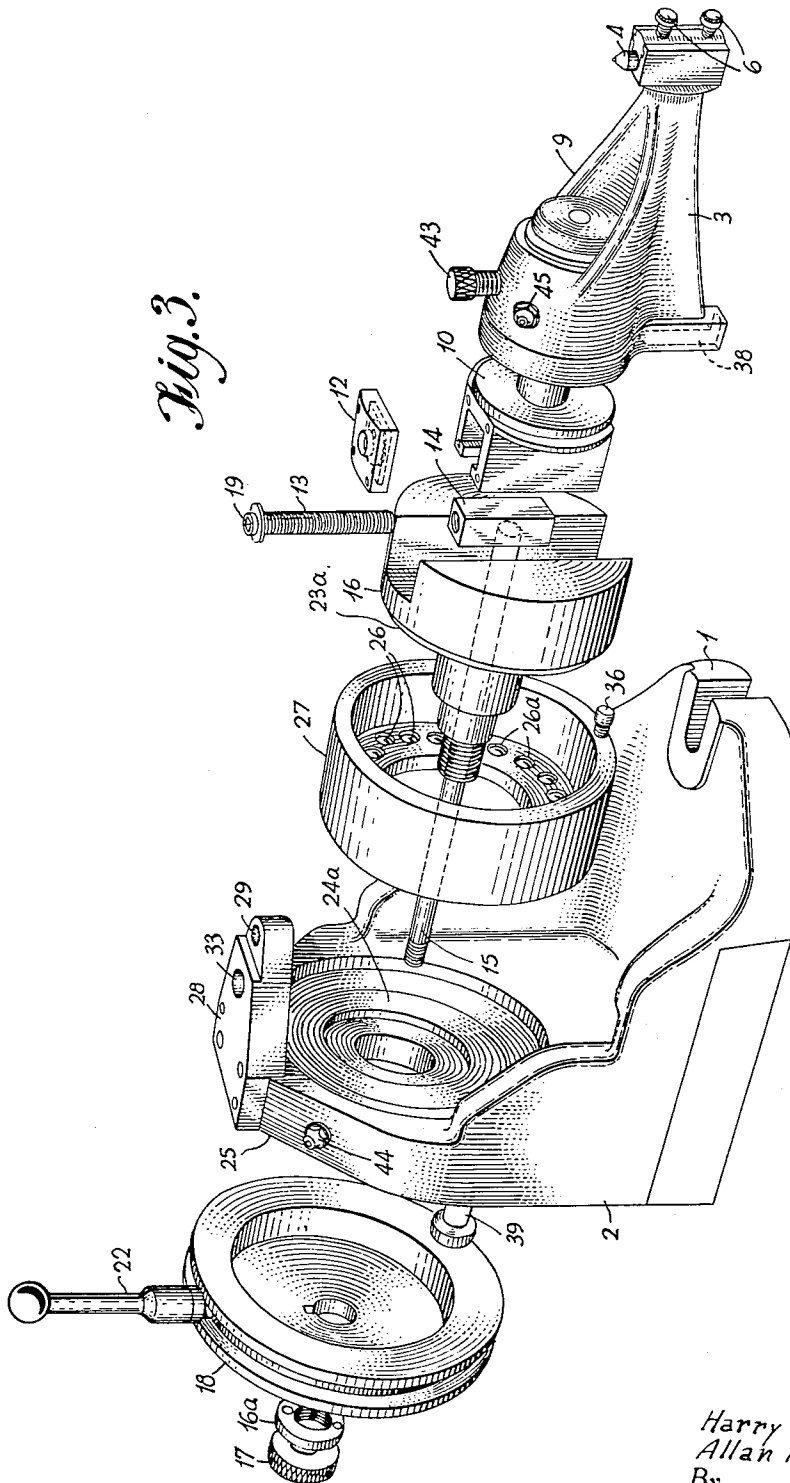
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FORMING TOOLS

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13 Claims. (Cl. 125—11)

The present invention relates to forming or cutting tools and has for its object improvements in such tools.

The invention is more particularly concerned with tools held in a tool holder adapted to effect a curved traverse across a work-piece, in order to form or cut a substantially semi-circular concavity or convexity in the surface of said work-piece, as the case may be. The work-piece may be circular and be caused to rotate during the traverse of the tool whereby to fashion a groove or rib of substantially semi-circular cross-section in the circumference thereof. For example, the work-piece may be a grinding wheel which it is desired to profile and for this application the tool may be diamond-tipped.

It is a more specific object of the invention to provide a device for forming or cutting such a concavity or convexity whose radius is smaller than the diameter of the tool shank, although it will be well understood that the invention is not to be considered limited to such a specific application.

It is another object of the invention to make the position of the pivot axis for the tool holder adjustable to allow the radius of the profile formed or cut to be adjusted.

In order that the invention may be more clearly understood, reference will now be made to the accompanying drawings which show one specific embodiment thereof by way of example, and in which

Fig. 1 shows an outside view of a completed apparatus in perspective.

Fig. 2 shows a side elevation partly in section, and

Fig. 3 shows an exploded view of Fig. 1.

In the drawings, the cutting tool, which is adapted for the profiling of a circular grinding wheel, is assumed to be horizontally mounted upon a base 1 having a vertical bracket 2. The tool holder is shown at 3 comprising a stem horizontally disposed with respect to the vertical bracket 2 and carrying at one end the tool 4 which may be a diamond tipped tool, in a cylindrical socket 5, the tool 4 being held in position by means of screws 6. The socket 5 is terminated at its base by a plate 7 which forms a bearing surface for a spring 8 upon which the tool 4 rides, the purpose of the spring being to allow the tool to be easily adjustably positioned and set with the aid of a micrometer. The tool holder 3 is recessed at 9 on the side facing the grinding wheel G (Fig. 2). The tool holder 3 is pivotally carried upon a tool pivot shaft 10, which shaft projects from a saddle slide 11, the saddle slide 11 being movable in a vertical direction in such a manner that the tool holder carried thereby is also vertically adjustable.

The vertical adjustment is effected in the following way. The saddle slide 11 has a cap 12 to close its upper end, which cap forms a seating for a rotatable screw 13 threaded through a nut 14 forming an extension of a shaft 15. The saddle slide is of U-section as shown in Fig. 3 to accommodate the nut 14. The shaft 15 carries a nut 17 which screws down onto a nut 16a which in turn locks a first rotary member 16 to the rear face of a cap 18 through the key 18a. Therefore the first rotary member

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is locked on the tool pivot shaft 10 through the fit of saddle 11 in the slot in member 16. Radially between the first member 16 and the blackplate 25 is a ball-bearing 40 and axially between the bearing 40 and the annular shoulder 41 of the back plate 25 there may be provided a rubber ring 42 to take up the thrust and effect loading. The upper part of the screw 13 is adapted for rotation by a key slot 19 whereby a key inserted therein can cause rotation of the screw to effect vertical adjustment of the tool pivot shaft 10 and tool holder 3.

Suitable bearings 20, 21 are interposed between the tool pivot shaft 10 and the tool holder 3 to allow the tool holder 3 to rotate freely about said shaft.

Thus, rotation of the cap 18 will effect rotation of the member 16, driving the tool pivot shaft 10. To effect this rotation there is provided a handle 22.

The first member 16 has a shoulder 23 accommodating a bearing ring 23a and between the bearing ring and a similar bearing ring 24a on a surface 24 on the rear wall 25 of the vertical bracket 2 there is provided a ball bearing generally indicated at 26. This ball bearing is located within apertures 26a in a second rotary member 27. Since the member 25 is fixed, when the first member 16 is moved with respect to it, the ball-bearing 26, following a well-known rule of mechanics, rotates at half the speed of the member 16 so that therefore during rotation of member 16 the second rotary member 27 carried by ball-bearing 26 will move at only half the speed of member 16, the ball-bearing therefore acting as a 2:1 friction reduction gear.

The rear plate 25 of the vertical bracket 2 is provided with an upper member 28 projecting above the second rotary member 27 and provided at its free end with an aperture 29 through which a dial gauge 30 shown only on Fig. 1, may be inserted so that its plunger 31 may ride on the outer face 32 of the tool holder 3. This gauge is used to measure and indicate the degree of eccentricity of tool pivot 10 with respect to the axis C/A.

The upper member 28 is also provided with a further aperture 33 which can be brought into register with an aperture 34 in the second rotary member 27 and with an aperture 35a in a cylindrical shroud 35 enclosing the first rotary member 16 for setting of the parts. The parts 35 and 35a are not shown in Fig. 3, so as to make that drawing easier to follow.

Between the second rotary member 27 and the tool holder there is provided a slide connection in the form of a carrier pin 36 attached to the second rotary member 27 and slidable in a slot 38 in the tool holder 3.

With the parts as so far described, rotation of the member 18 by handle 22 will effect rotation of the first or fast member 16 about a central axis C/A of the apparatus. If the tool pivot shaft 10 be adjusted by adjustment of screw 13, so that the pivot axis is on the central axis C/A, then the carrier pin 36 will remain at the same position in the slot 38 and the tool point will travel only around the central axis C/A, provided that the tool point also be adjusted to the central axis, and no cutting action will be performed. However, if the adjusting screw 13 is turned to raise the tool holder 3, as the member 18 is moved to rotate the first or fast member 16, the tool point will have a correcting movement imparted to it from the second rotary member 27 via the carrier pin 36 which will slide in slot 38 and the tool pivot shaft 10 will travel in an arc during the traverse having a radius equal to the eccentricity of shaft 10 with respect to axis C/A. This arc will correspond to the forming radius. This assumes a true point on the diamond tool but in practice this is not achieved and the tool point itself has a radius. Therefore the tool point is adjusted, by motion of the tool 4 in socket 5, off centre of the tool pivot shaft by an amount equal to

half the radius of the diamond point radius and in the same direction from axis C/A as the tool pivot axis 10 is adjusted and this offsetting of the tool point is counterbalanced by a corresponding and opposite shifting of the eccentric axis of the tool pivot shaft 10.

During traverse of the tool head, the pin 36 slides along the slot 38 so that while the tool point moves through 180°, its shank moves through only 90°. Therefore, even if the diameter of the tool shank is larger than the radius of cut, there is no fouling by the tool shank when the cut is formed in the work-piece.

With the tool point above the axis C/A, the tool will cut concavities in the surface of the work-piece and with the tool point below the axis C/A it will cut convexities.

In order to limit the degree of angular travel of the handle 22, stop pins 39 are provided which may be set in conjunction with a scaled back plate, not shown.

If it is desired to use the tool with an uncorrected swing, the tool holder and first rotary member are removed from the apparatus by unscrewing the nut 17 and withdrawing the shaft 15 and tool holder from the apparatus and removing pin 36 so that on reassembly there is no connection between the second rotary member 27 and the tool holder 3. At the same time a screw 43 provided in the outside of the tool holder 3 is tightened down until it locks the tool holder on the shaft 10.

It is preferable to incorporate dust-exclusion means and this is effected in the specific embodiment by filling the interstices between the moving parts with grease during assembly and grease nipples are provided as at 44, 45, for replenishment of the lubrication.

What we claim is:

1. Apparatus for forming concavities or convexities in a work-piece, comprising a first rotary member, a tool holder on a pivot bearing located on said first rotary member and carrying a forming tool, a second rotary member, reduction gearing between said first and said second rotary members whereby on rotation of said first member said second member moves through approximately half the angular distance moved by said first member, said rotary members being mounted for rotation about a common axis upon a relatively fixed support member, a slideway on said tool holder spaced from said pivot bearing and facing said second rotary member, a slide member projecting from said second rotary member and into said slideway, and means for adjusting the position of said tool holder on said first rotary member to move the axis of said pivot bearing between limits on either side of said common axis.

2. Apparatus for forming concavities or convexities in a work-piece, comprising a support member, two relatively rotatable members mounted upon said support member, means for rotating one of said members approximately twice as fast as the other of said members, a tool holder having a tipped forming tool, a part of said tool holder being mounted on a pivot bearing connected to the faster of said two members, the tip of said tool being substantially in alignment with the axis of the pivot bearing, and a slide member projecting from the slower of said rotary members and slidable in a slideway in a part of said tool holder remote from said pivot bearing, whereby upon relative rotation of said rotary members the pivot bearing of said tool holder moves in an arc during the traverse of the tool in relation to the work-piece.

3. Apparatus for forming concavities or convexities in a work-piece, comprising a first rotary member, a tool holder carrying a forming tool and having a part mounted at one end on a pivot bearing mounted on said first rotary member, a second rotary member, a support member, said rotary members being mounted on said support member for rotation about a common axis with reduction gearing between said first and said second rotary members whereby the first of said members may be rotated approximately twice as fast as the second of said members,

and a slide member projecting from said second rotary member and slidable in a slideway in a part of said tool holder spaced from said pivoted end.

4. Apparatus for forming concavities or convexities in a work-piece, comprising a first rotary member, a tool holder pivotally mounted on a pivot bearing located on said first rotary member and carrying a tipped forming tool, a second rotary member, said first and second rotary members being movable for rotation about a common axis on a relatively fixed support, reduction gearing between said first and said second rotary members whereby on rotation of said first member said second member moves through approximately half the angular distance moved by said first member, said tool holder having a part spaced from its pivoted part with a slideway therein, a slide member projecting from said second rotary member and into said slideway, the arrangement and disposition of the parts being such that the forming tip of the tool is always substantially in alignment with the axis of the pivot bearing of the tool holder but the said pivot bearing moves in an arc during the traverse of the tool in relation to the work-piece, and means for adjusting the position of the tool holder relative to said first rotary member to move the axis of the pivot bearing between limits on either side of said common axis.

5. Apparatus as claimed in claim 4 and further comprising means for adjusting the position of said tool holder in relation to said first rotary member to move the axis of said pivot bearing between limits on either side of said common axis.

6. Apparatus for forming concavities or convexities in a work-piece, comprising a support member, two relatively rotatable members mounted coaxially upon said support member, means for rotating one of said members approximately twice as fast as the other of said members, a tool holder having a tipped forming tool, a part of said tool holder being mounted on a pivot bearing connected to the faster of said two members, the tip of said tool being substantially in alignment with the axis of said pivot bearing, a slide member projecting from the slower of said rotary members and into a slideway in another part of said tool holder, whereby upon relative rotation of said rotary members the pivot bearing of said tool holder moves in an arc during the traverse of the tool in relation to the work-piece, and means for adjusting the position of the tool holder relative to the faster of the two rotary members to move the axis of the pivot bearing between limits on either side of said common axis.

7. Apparatus for forming concavities or convexities in a work-piece, comprising a first rotary member, a tool holder pivotally mounted on said first rotary member and carrying a tipped forming tool, a second rotary member, a fixed surface behind said second rotary member, a ball bearing located in said second rotary member, the balls of which run between said first rotary member and said fixed surface to form reduction gearing between said first and said second rotary members whereby on rotation of said first member said second member moves through approximately half the angular distance moved by said first member, said rotary members being coaxially mounted upon a relatively fixed support member containing said fixed surface, a slideway in a part spaced from the pivoted part of said tool holder, a slide member projecting from said second rotary member and into said slideway, the arrangement and disposition of the parts being such that the forming tip of the tool is always substantially in alignment with the pivot bearing of the tool holder but the said pivot bearing moves in an arc during the traverse of the tool in relation to the work-piece, and means for adjusting the position of the tool holder relatively to the said first rotary member to move the axis of the pivot bearing between limits on either side of the said common axis of the said rotary members.

8. Apparatus for forming concavities or convexities in a work-piece, comprising a relatively fixed support mem-

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ber, two relatively rotatable members mounted coaxially upon said support member, one of said rotary members carrying a ball bearing, the balls of which run between a surface on said fixed support member and a surface on the other rotary member whereby said other rotary member may be rotated approximately twice as fast as said one rotary member, a tool holder having a tipped forming tool, a part of said tool holder being mounted on a pivot bearing connected to the faster of said two members, the tip of said tool being substantially in alignment with the axis of said pivot bearing, a slide member projecting from the slower of said rotary members and slidable in a slideway formed in another part of said tool holder, whereby upon relative rotation of said rotary members the pivot bearing of said tool holder moves in an arc during the traverse of the tool in relation to the work-piece, and means for adjusting the position of the tool holder relatively to the faster rotary member to move the axis of the pivot bearing between limits on either side of the common axis of the said rotary members.

9. Apparatus for forming concavities or convexities in a work-piece, comprising a first rotary member, a tool holder carrying a tipped forming tool and having a part mounted at one end on a pivot bearing mounted on said first rotary member, a second rotary member, a relatively fixed support member, means for mounting said first rotary members on said support member for rotation, a ball bearing carried by said second rotary member, the balls of said bearing running between a surface on said fixed support member and a surface on the first rotary member thereby constituting reduction gearing between said first and said second rotary members whereby the first of said members may be rotated approximately twice as fast as the second of said members, the said second rotary member being coaxial with said first rotary member, a slide member projecting from said second rotary member and into a slideway in a part of said tool holder spaced from said pivoted end, and means for adjusting the position of said tool holder relatively to said first rotary member to move the axis of said pivot bearing between limits on either side of the common axis of rotation of said rotary members.

10. Apparatus for dressing grinding wheels comprising a relatively fixed base member, a support flange integral with and projecting substantially at right angles from said base member, a first rotary member mounted upon a spindle, a second rotary member comprising a round plate

having an annular flange located around said first rotary member, a bearing aperture in said support flange, said spindle passing through an aperture in said round plate of said second rotary member and through said bearing aperture in said support flange, an operating member secured to said spindle and located externally of said support flange, a tool holder carrying a forming tool, a pivot shaft for said tool holder, a saddle slide mounted on the free end of said pivot shaft, a slideway in said first rotary member, said saddle slide riding in said slideway, means for fixedly locating said saddle slide with respect to said slideway for adjusting the axis of the tool holder pivot shaft with respect to the axis of said spindle, a slideway in a portion of said tool holder spaced from said pivot shaft and facing towards said rotary members, a slide member projecting from said second rotary member and slidable in said slideway, and reduction gearing between said first and secondary rotary members.

11. Apparatus as claimed in claim 10, in which said reduction gearing comprises a ball bearing located in said second rotary member, the balls of which bearing run between said first rotary member and said support flange.

12. Apparatus as claimed in claim 10 in which said slide member is screwed into said second rotary member so as to project therefrom and into said slideway of said tool holder but be removable from said second rotary member, and further comprising locking means for locking said tool holder to its pivot shaft.

13. Apparatus as claimed in claim 12, in which said reduction gearing comprises a slide member screwed into said second rotary member so as to project therefrom and into said slideway of said tool holder but be removable from said second rotary member, a ball bearing located in said second rotary member, the balls of which run between said first rotary member and said support flange.

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