Jan. 28, 1947. O. E. HILL 2,415,010

GRINDING WHEEL TRUING APPARATUS

Filed Dec. 28, 1944 3 Sheets-Sheet 1

FIG. 1

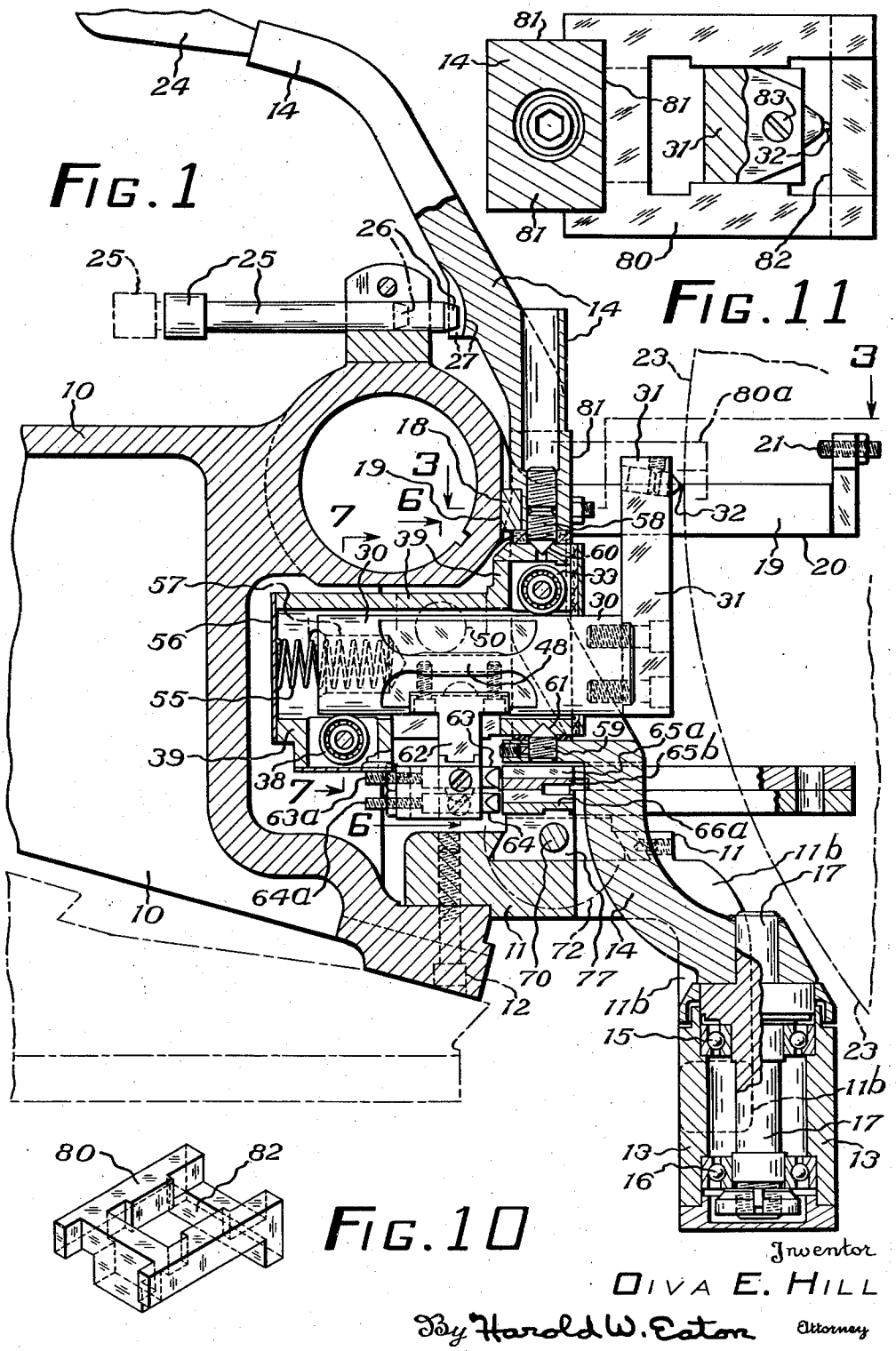


FIG. 11

FIG. 10

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Jan. 28, 1947. O. E. HILL 2,415,010

GRINDING WHEEL TRUING APPARATUS

Filed Dec. 28, 1944 3 Sheets-Sheet 2

FIG. 6

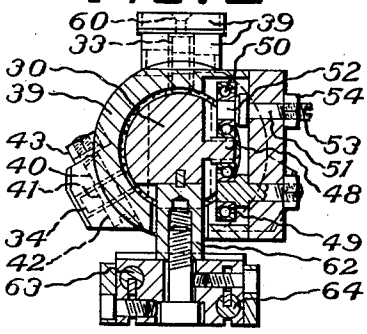


FIG. 7

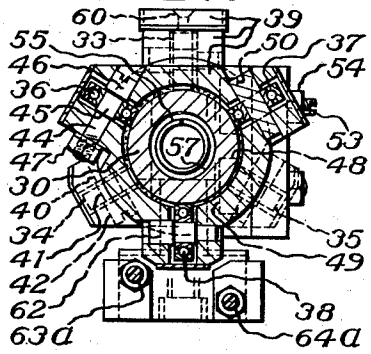


FIG. 8

FIG. 9

FIG. 2

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GRINDING WHEEL TRUING APPARATUS

Filed Dec. 28, 1944 3 Sheets-Sheet 3

FIG. 3

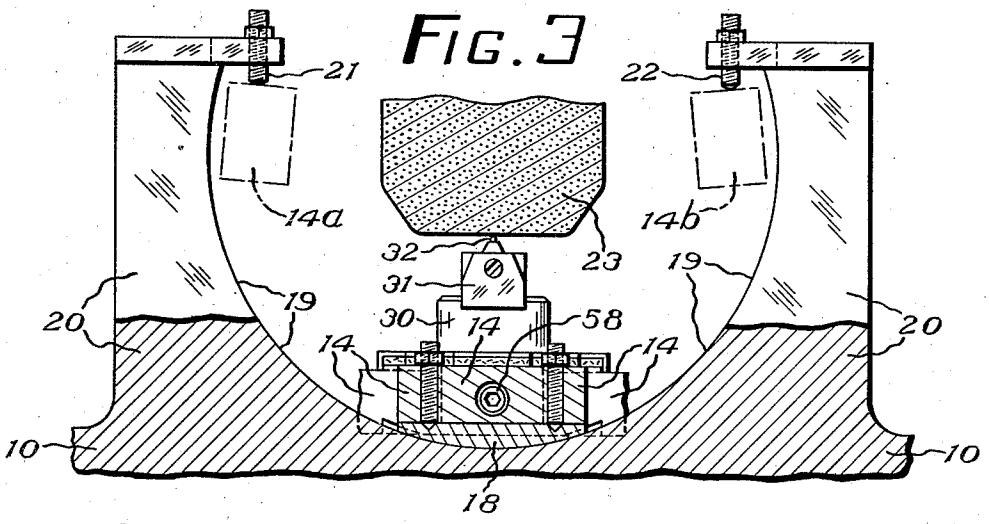
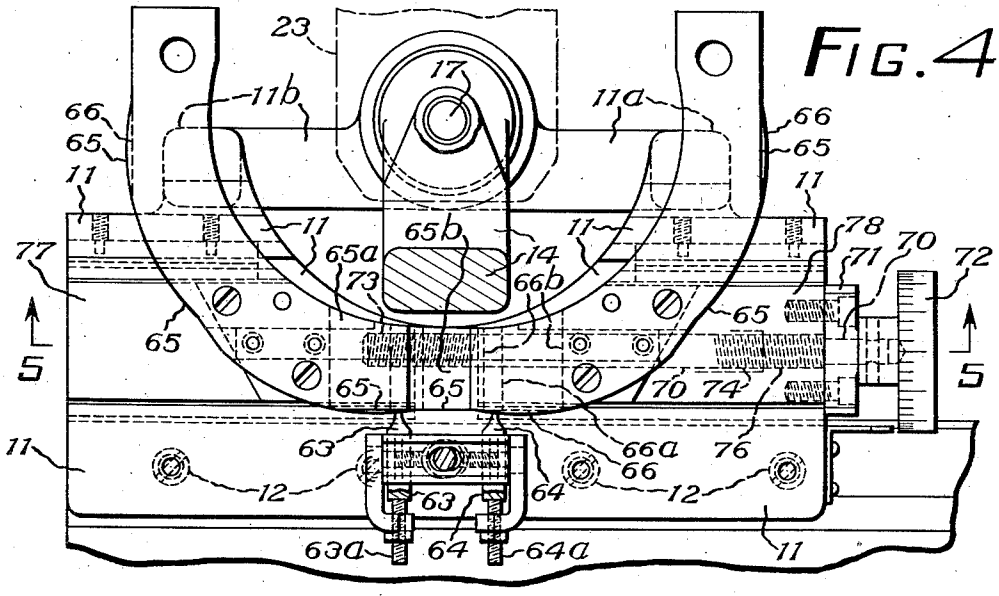


FIG. 4



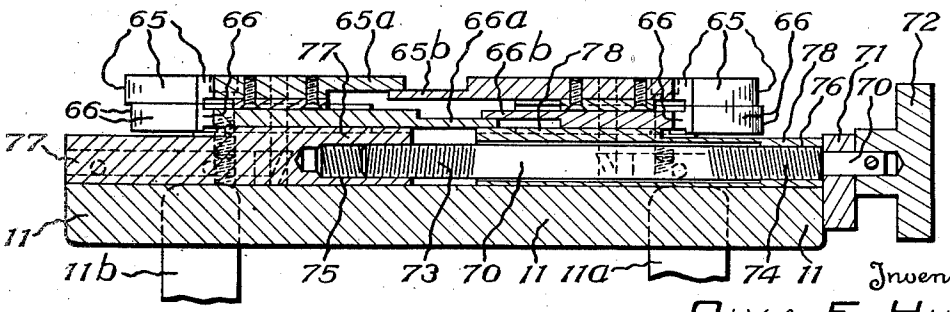


FIG. 5

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2,415,010

GRINDING WHEEL TRUING APPARATUS

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6 Claims. (Cl. 125—11)

1

This invention relates to grinding machines, and more particularly to a grinding wheel truing apparatus for generating a predetermined form on the operative face of the grinding wheel.

One object of the invention is to provide a simple and thoroughly practical formed wheel truing apparatus. Another object of the invention is to provide an improved grinding wheel forming apparatus which permits producing irregular curved faces and shapes upon the operative face of a grinding wheel while maintaining the truing tool or diamond in a substantially predetermined angular relation with the surface being trued.

A further object of the invention is to provide a radial type truing apparatus adapted for producing an irregular form on the operative face of the grinding wheel, in which a cam mechanism is provided to control the movement of the diamond to generate a predetermined form on the wheel and in which the axis of the diamond is at all times maintained in a position at right angles to a tangent plane passing through the point of contact between the diamond and the grinding wheel.

Another object of the invention is to provide a radial type truing apparatus with a slidably mounted diamond which is in turn pivotally mounted and in which the sliding and pivotal movement of the diamond is accurately and precisely controlled by means of a cam and follower mechanism. Other objects will be in part obvious or in part pointed out hereinafter.

The invention accordingly consists in the features of construction, combinations of elements, and arrangement of parts, as will be exemplified in the structure to be hereinafter described, and the scope of the application of which will be indicated in the following claims.

In the accompanying drawings, in which is shown one of various possible embodiments of the mechanical features of this invention,

Fig. 1 is a vertical sectional view, taken approximately on the line 1—1 of Fig. 2, through the improved truing apparatus;

Fig. 2 is a front elevation of the truing apparatus as shown in Fig. 1;

Fig. 3 is a horizontal sectional view, taken approximately on the line 3—3 of Fig. 1, showing the guide for the radial frame of the truing apparatus;

Fig. 4 is a horizontal sectional view, taken approximately on the line 4—4 of Fig. 2, showing the cam and follower mechanism for controlling the transverse and swinging movements of the truing tool;

2

Fig. 5 is a vertical sectional view, taken approximately on the line 5—5 of Fig. 4 through the cams which control the transverse and swinging movements of the truing tool;

Fig. 6 is a fragmentary sectional view, taken approximately on the line 6—6 of Fig. 1, showing the roller guides for the truing tool slide;

Fig. 7 is a fragmentary sectional view, taken approximately on the line 7—7 of Fig. 1, showing the roller support for the truing tool slide;

Fig. 8 is a fragmentary elevation showing the adjustable eccentric mount for one of the guiding rollers shown in Fig. 6;

Fig. 9 is a similar fragmentary elevation showing the adjustable eccentric mounting for one of the supporting rollers for the truing tool slide shown in Fig. 7;

Fig. 10 is a perspective view of a gauge block for use in setting the truing tool relative to the pivot axis of the radial truing frame; and

Fig 11 is a fragmentary sectional view through a portion of the truing apparatus showing the gauge block in position for adjusting the position of the truing tool.

A grinding wheel truing apparatus has been illustrated in the drawings which is of the footstock type, that is, supported on a footstock 10 of a grinding machine.

A bracket 11 is fixedly supported on the footstock 10 by means of screws 12. The bracket 11 is provided with a pair of spaced downwardly extending arms 11*a* and 11*b*, the lower ends of which are formed integral with a hollow boss 13 which serves as a support for a pivotally mounted frame 14. A pair of anti-friction bearings 15 and 16 are provided within the boss 13 and serves as rotatable supports for a shaft 17 which is fixedly mounted relative to the lower end of the swinging frame 14.

In order to guide and steady the upper portion of the frame 14, an arcuate shoe 18 is fixedly mounted on the frame 14 and is arranged to slide in engagement with an internal cylindrical surface 19 which is formed on a bracket 20 which is in turn formed integrally with or fixedly mounted on the footstock 10. In order to limit the extent of the swinging movement of the frame 14, a pair of adjustably mounted stop screws 21 and 22 are provided on the bracket 20 so that the frame 14 is swung to true a predetermined operative face of a grinding wheel 23. The upper end of the swinging frame 14 is provided with a manually operable handle 24 to facilitate movement of said frame for a truing operation.

A slidably mounted plunger 25 is provided with

a frusto-conically shaped end portion 26 which is arranged to engage a notch 27 formed in the frame 14. If it is desired to true a straight cylindrical face on a grinding wheel, the plunger 25 may be moved toward the right (Fig. 1) so that the frusto-conical end portion 26 engages the notch 27 in the frame 14 so as to lock the frame 14 to maintain the truing tool in a fixed position to true a cylindrical face on the work piece.

In truing a grinding wheel, due to the shape of the diamond or truing tool, it is desirable to maintain the diamond in a predetermined position as it is moved across the operative face of the wheel so that the same portion of the diamond contacts with the face of the wheel during the entire truing operation. In truing an irregularly shaped face on a grinding wheel, such as that shown in Fig. 3, it is desirable that the truing apparatus be so arranged that as the frame 14 is swung to traverse the truing tool across the face of the wheel, a controlled transverse movement of the truing tool will be obtained and at the same time the axis of the truing tool will be swung so that it bears a definite relationship with the portion of the wheel being trued, namely, so that the axis of the truing tool will at all times be substantially normal to a tangent plane passing through the point of tangency between the truing tool and the grinding wheel. To accomplish this result, the frame 14 is provided with a transversely movable slide 30. The slide 30 is provided with an upwardly extending arm 31 which supports a diamond or truing tool 32 adjacent to its upper end.

The slide 30 is preferably supported by anti-friction bearings which are arranged in two spaced sets of three each. The forward end of the slide is supported by rollers 33, 34 and 35. The rear or left-hand end of the slide 30 is supported by rollers 36, 37 and 38. The rollers 33 to 38 inclusive are rotatably supported on studs which are supported in a housing 39. One roller of each set is provided with an eccentric adjustment whereby the desired sliding relationship may be maintained so that the slide 30 will move freely within the housing 39 while supported by anti-friction mounted rollers 30 to 38 inclusive. As illustrated in Fig. 6, the roller 34 of the forward set is supported by a stud 40 which is provided with an eccentric portion 41. The eccentric portion 41 supports the anti-friction roller 34. By means of a rotary adjustment of the stud 40, the position of the roller 34 may be adjusted relative to the housing 39. The enlarged head 42 of the stud 40 is provided with a slot to facilitate such adjustment and a clamping nut 43 is provided on the other end of the stud to facilitate locking the stud in adjusted position.

Similarly, the roller 36 of the second set of supporting rollers is supported by a stud 44. The stud 44 is provided with an eccentric portion 45. The enlarged head 46 of the stud 44 is slotted to facilitate a rotary adjustment of the eccentric portion 45 so as to position the axis of the roller 36 in the desired position. A clamping nut 47 is provided for locking the stud 44 in the desired adjusted position.

The bearing surfaces of the slide 30 are preferably cylindrical in shape. It is, therefore, desirable to provide suitable means for holding the slide against rotary motion so that the truing tool 32 may be maintained in a fixed position during a truing operation. In order to hold the slide 30 against rotation, a guide portion 48 is provided by milling out portions of the slide 30 so as to

form a pair of parallel integral guiding faces which are engaged by a pair of spaced anti-friction mounted rollers 49 and 50 supported by the housing 39. The roller 50 is supported by a stud 51 which is provided with an eccentric portion 52. The eccentric portion 52 serves as a support for the roller 50. By a rotary adjustment of the stud 51, the position of the roller 50 may be adjusted as desired so as to take up lost motion between the rollers 49 and 50 and the guiding faces formed on the guiding member 48. The right-hand end of the stud 51 (Fig. 6) is provided with a threaded portion 53 having a nut 54 by means of which the stud 51 may be locked in an adjusted position.

A compression spring 55 is provided for normally urging the slide 30 in a right-hand direction (Fig. 1). One end of the spring bears against an end cap 56 which is fixedly mounted on the end of the housing 39. The other end of the spring 56 is located within an aperture 57 formed in the left-hand end of the slide 30 (Fig. 1).

In order to maintain the axis of the truing tool 32 in the desired relationship with the face of the grinding wheel 23 being trued, it is desirable to provide a pivotal support for the housing 39 so that the axis of the truing tool 32 may be readily swung during the traverse of the truing tool across the face of the grinding wheel. The frame 14 is provided with a pair of pivot screws 58 and 59 which are provided with conical bearing surfaces. The conical bearing surfaces of the screws 58 and 59 engage conical bearing surfaces 60 and 61 formed in the housing 39. It will be readily apparent from the foregoing disclosure that the slide 30 is free to slide in a transverse direction, being supported by the three sets of anti-friction rollers above described, and the housing 39 which supports the slide 30 is arranged to swing about a vertical axis so as to maintain the axis of the diamond or truing tool 32 in the desired relationship with the face of the grinding wheel 23 as it is traversed across the same.

In order to impart the desired transverse and swinging movement to the truing tool 32 so as to generate a predetermined form on the grinding wheel, a cam mechanism is provided. The slide 30 is provided with a downwardly extending block 62 which serves as a support for a pair of spaced adjustable staggered followers 63 and 64. The adjusting screws 63*a* and 64*a* are provided to facilitate adjustment of the followers 63 and 64, respectively, relative to the block 62. The follower 63 is arranged to engage a cam face 65 and the follower 64 is arranged to engage a cam face 66. These two cams are arranged one above the other. The shape of the cam faces 65 and 66 is such that when the frame 14 is swung in an arcuate path to traverse the truing tool 32 across the operative face of the grinding wheel 23, the followers 63 and 64 simultaneously engaging the cam faces 65 and 66, respectively, will impart a predetermined transverse movement to the slide 30 and also a predetermined swinging movement to the housing 39 so that the desired and predetermined form will be produced on the face of the grinding wheel 23. The swinging movement of the housing 39 is so controlled that the axis of the truing tool or diamond 32 is at all times substantially at right angles to a tangent plane passing through the point of contact between the truing tool 32 and the grinding wheel 23.

In truing a shape on the periphery of a grinding wheel 23 such as that shown in Fig. 3, the

truing tool 32 trues not only the peripheral face of the wheel but also the divergent angular faces, the radii connecting these two faces, and also a portion of each side face of the grinding wheel 23. In order that the side faces may be trued, after the wheel has worn away, it is desirable to provide an adjustment so that when the truing tool frame 14 is in its extreme end positions, namely, 14*a* or 14*b*, the diamond may true the desired amount off the side face of the wheel. It is desirable to provide an adjustment for the cams so that as the diamond is swung into its extreme end positions, it may be advanced to true the side faces of the grinding wheel. As illustrated in Fig. 5, each of the cams 65 and 66 is preferably formed in two parts. The cam 65 has an overlapping center portion comprising a projection 65*a* on one half of the cam and a projection 65*b* on the other portion of the cam. Similarly, the cam 66 is provided with overlapping or telescoping portions 66*a* and 66*b*. In order to expand or contract the portions of the cam, a nut and screw mechanism is provided comprising an adjusting screw 70. The right-hand end of the screw 70 is rotatably supported against endwise movement in an end cap 71.

An adjusting knob 72 is mounted on the right-hand end of the screw 70. The screw 70 is provided with a pair of spaced threaded portions 73 and 74 one of which is formed with a right-hand thread and the other with a left-hand thread. The threaded portions of the screw 70 are screw threaded into apertures 75 and 76 formed in dovetailed slides 77 and 78, respectively. The slide 77 serves as a support for the left-hand portions of the cams 65 and 66 (Fig. 5) and the slide 78 serves as a support for the right-hand portions of the cams 65 and 66 (Fig. 5). It will be readily apparent from the foregoing disclosure that a contracting or expanding adjustment may be obtained for adjusting the end positions of the truing tool by means of a rotary adjustment of the knob 72 so that the side faces of the grinding wheel may be trued to the desired extent as they wear away.

It is desirable that the diamond or truing tool 32 be precisely located relative to the pivotal axis of the frame 14 to facilitate setting up the machine and also to compensate for wear on the diamond or truing tool 32. A gauge block 80 is provided (Figs. 1, 10 and 11) which is arranged to be placed in position against a locating surface 81 formed on the frame 14. When the gauge block 80 is positioned as shown in broken lines 80*a* (Fig. 1), the diamond or truing tool 32 may be adjusted toward or from the wheel axis until the diamond or truing tool bears against the gauge surface 82, thus locating it in a predetermined position relative to the axis of the frame 14. When the truing tool 32 has been adjusted to the desired position, it may be clamped in position by a clamping screw 83 which is screw threaded into the upper portion of the bracket 31.

The drawings illustrate the improved truing apparatus as mounted or supported on a grinding machine footstock. If desired, the truing apparatus may be arranged so that it may be readily clamped on the work table in the conventional manner.

The operation of this improved truing apparatus will be readily apparent from the foregoing disclosure. A pair of cams 65 and 66 must be designed for each shape to be trued. These cam parts may be readily interchanged on their supporting slides. Assuming the desired cams have been positioned on the truing apparatus and the desired adjustments have been previously made, the gauge block 80 is positioned as above described initially to locate the diamond 32 in the desired position relative to the pivotal axis of the frame 14. After this has been accomplished, the grinding wheel may be advanced by an amount equal to that required for the truing operation, after which the plunger 25 is withdrawn and, by means of the manually operable knob 24, the frame 14 may be swung in an arcuate path as determined by the end stops 21 and 22. During this swinging movement of the frame 14, the truing tool will be moved transversely and also the axis of the truing tool will be swung about the axis of the pivot studs 58 and 59 so as to generate or true the predetermined contour on the peripheral face of the wheel while maintaining the axis of the diamond or truing tool in a position substantially normal to a plane of tangency passing through the point of contact of the cutting tool and the grinding wheel.

It will thus be seen that there has been provided by this invention apparatus in which the various objects hereinabove set forth together with many thoroughly practical advantages are successfully achieved. As many possible embodiments may be made of the above invention and as many changes might be made in the embodiment above set forth, it is to be understood that all matter hereinbefore set forth or shown in the accompanying drawings is to be interpreted as illustrative and not in a limiting sense.

I claim:

1. A truing apparatus for a grinding machine having a base, a pivotally mounted frame on said base which is arranged to swing in a circular path, a pivotally mounted housing on said frame, a truing tool slide slidably supported on said housing, a truing tool fixedly mounted on said slide, and means including a cam and follower mechanism to move said slide transversely relative to said housing and frame and to swing said housing relative to said frame as the frame is swung about its pivot to cause the truing tool to true a predetermined shape on the grinding wheel while maintaining the axis of the truing tool in a predetermined relationship with the face being trued.

2. A truing apparatus for a grinding machine having a base, a pivotally mounted frame on said base which is arranged to swing in a circular path, a pivotal bearing for the lower end of said frame, means including a circular slide surface to guide the upper end of said frame, a pivotally mounted housing on said frame, a truing tool slide slidably supported within said housing, a truing tool fixedly mounted on said slide, and means including a cam and a follower to move said slide transversely relative to said housing and frame and to swing said housing relative to said frame as the frame is swung about its pivot to cause the truing tool to true a predetermined shape on the grinding wheel while maintaining the axis of the truing tool in a predetermined relationship with the face being trued.

3. A truing apparatus for grinding machines having a base, a pivotally mounted frame which is arranged to swing in a circular path, means including a pair of adjustable stops to limit the swinging movement of said frame, a pivotally mounted housing on said frame, a truing tool slide slidably supported within said housing, a truing tool fixedly mounted on said slide, and means including a cam and follower to move said slide

transversely relative to said housing and frame and simultaneously to swing said housing relative to said frame as the frame is swung about its pivot to cause the truing tool to true a predetermined shape on the grinding wheel while swinging the axis of the truing tool so as to maintain it in a predetermined relationship with the face being trued.

4. A truing apparatus for grinding machines having a base, a pivotally mounted frame which is arranged to swing in a circular path, a pivotally mounted housing on said frame, a truing tool slide slidably supported within said housing, a truing tool fixedly mounted on said slide, a pair of spaced staggered followers adjustably supported on said slide, means independently to adjust said followers relative to said slide, and a pair of cams, said followers and cams being arranged to move said slide transversely relative to the housing and frame and simultaneously to swing said housing as the frame is swung about its pivot to cause the truing tool to true a predetermined shape on the grinding wheel while maintaining the axis of the truing tool in a predetermined relationship with the face being trued.

5. A truing apparatus for a grinding machine having a base, a pivotally mounted frame which

is arranged to swing in a circular path, a pivotally mounted housing on said frame, a truing tool slide slidably supported on said housing, a truing tool fixedly mounted on said slide, a depending block on said slide, a pair of spaced staggered followers adjustably mounted on said block, means independently to adjust said followers relative to said block, a pair of cams arranged one above the other, yieldable means between said slide and said housing normally to maintain said followers in operative engagement with said cams respectively, said cams being shaped and arranged to impart a controlled transverse movement to said slide and said truing tool to true a predetermined shape on said grinding wheel and also to impart a controlled swinging movement to said housing so as to maintain the axis of the truing tool in a predetermined relationship with the face being trued.

6. In a truing apparatus for a grinding machine as claimed in claim 5, the combination with the parts and features therein specified, said pair of cams each being formed with overlapping parts, and means including a nut and screw adjusting mechanism to facilitate adjustment of said cam parts toward and from each other.

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