March 9, 1943. G. A. DE VLIEG 2,313,055

GRINDING TOOL DRESSER

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Fig. 1.

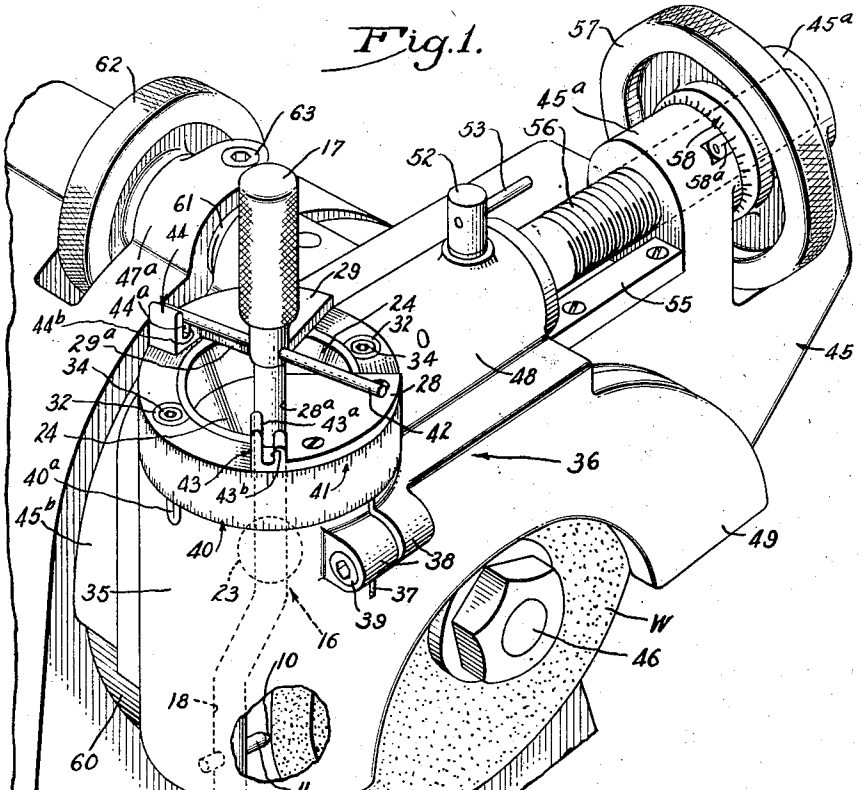
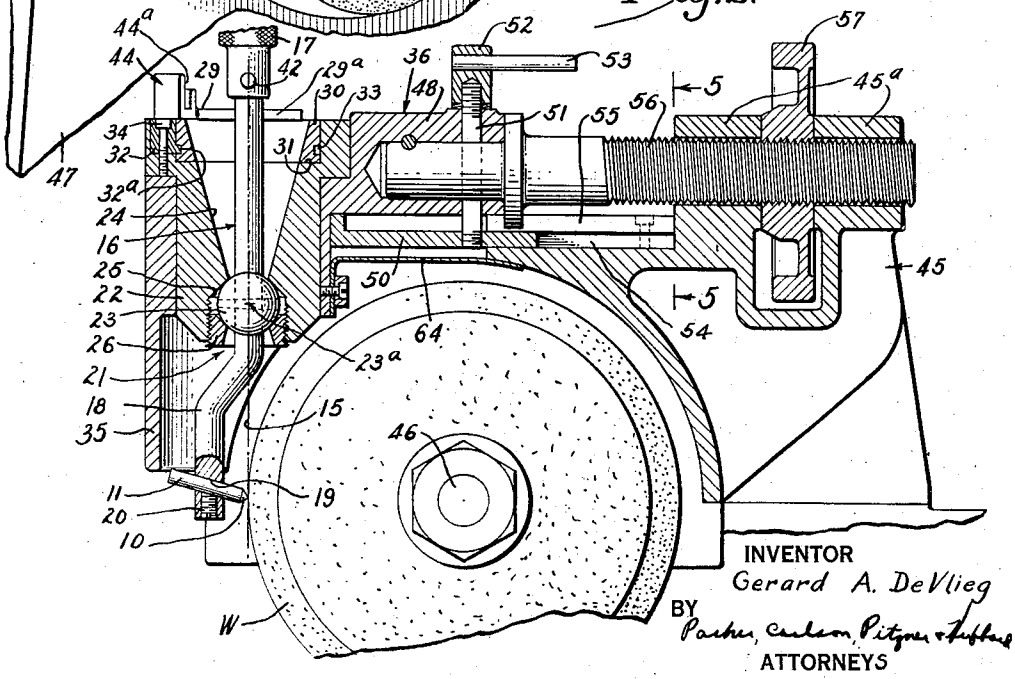


Fig. 2.



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Fig. 3.

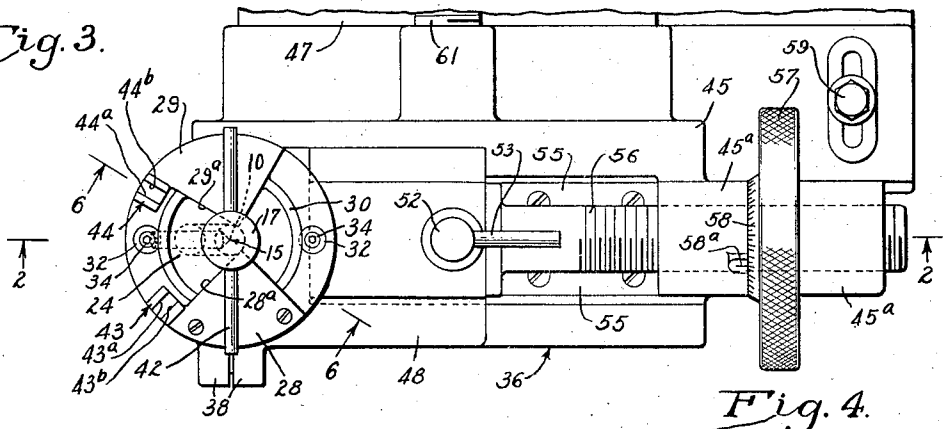


Fig. 4.

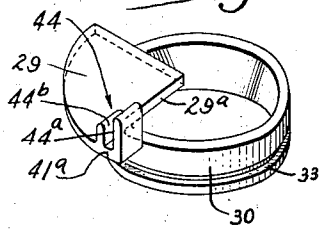


Fig. 5.

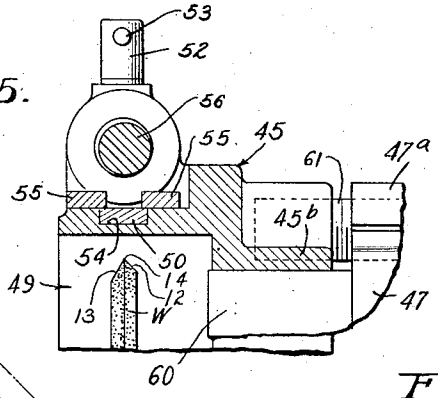


Fig. 6.

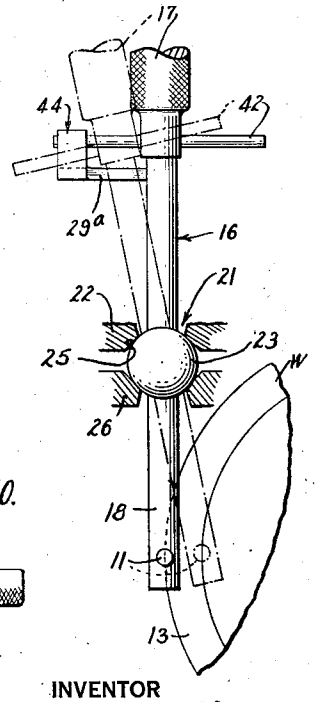


Fig. 7.

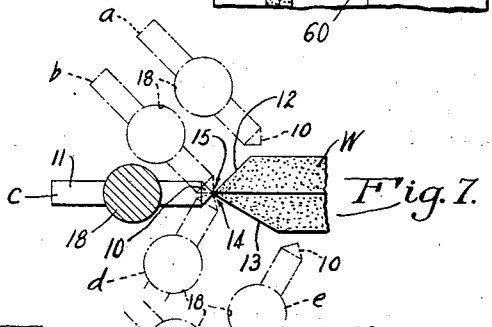


Fig. 8.

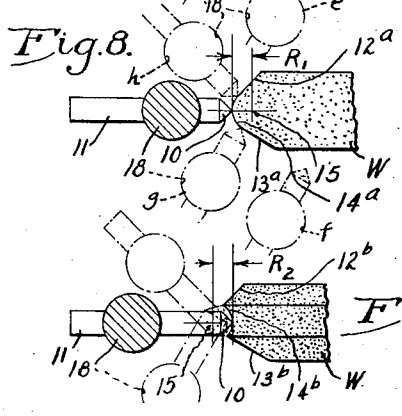


Fig. 10.

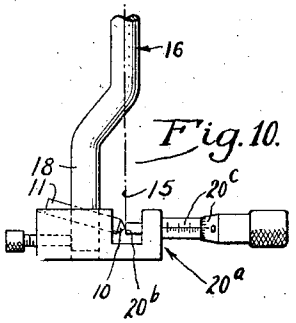


Fig. 9.

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UNITED STATES PATENT OFFICE

2,313,055

GRINDING TOOL DRESSER

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Application August 2, 1940, Serial No. 349,815

19 Claims. (Cl. 125—11)

The invention relates to the dressing of the grinding wheels to different contours and the general object is to provide a mechanism which is simple in construction, which is convenient to operate, and which employs a single dressing point guided in a novel manner to generate a wide variety of selectively variable contours.

Another object is to provide for the dressing of a grinding wheel to contours controllable selectively and each composed of contiguous portions which are of different shapes and merge accurately with each other.

A further object is to provide for adjustment of the dressing tool guide in a novel manner that enables convex or concave contours to be produced selectively.

Still another object is to provide a novel adjustable mounting and guide for a tool by which different portions of the grinding wheel periphery are dressed by different characteristic movements of the tool support.

The invention also resides in various novel combinations and arrangements of the parts by means of which accuracy and precision of operation are combined with ruggedness and low cost of construction and convenience of adjustment in service use.

Further objects and advantages of the invention will become apparent as the following description proceeds, taken in connection with the accompanying drawings, in which

Figure 1 is a general perspective view of a dresser attachment embodying the invention.

Fig. 2 is a vertical sectional view taken substantially along the line 2—2 in Fig. 3.

Fig. 3 is a plan view of the dresser.

Fig. 4 is a detailed perspective view of one of the dresser guide elements.

Fig. 5 is a detailed sectional view taken substantially along the line 5—5 in Fig. 2.

Fig. 6 is a detailed sectional view taken substantially along the line 6—6 in Fig. 3.

Figs. 7, 8 and 9 are schematic views illustrating the dressing point positions in dressing various wheel shapes.

Fig. 10 is an elevational view of a gage for facilitating adjustment of the dresser point.

By way of exemplification, the invention has been illustrated herein as embodied in a wheel dressing attachment of a form developed for use in a multi-purpose machine tool for grinding reamers, hobs, cutters, fluted shafts, etc. It will be understood by those skilled in the art, however, that grinding tool dressers embodying the present invention may be adapted to a large variety of other machines. Accordingly, even though one particular embodiment of the invention has been shown and described in some detail, there is no intention to thereby limit the invention to such embodiment, but on the other hand, I intend to cover all modifications and alternative constructions falling within the spirit and scope of the invention as expressed in the appended claims.

In the instant embodiment, the dresser includes a single dressing tool or point 10, such as a diamond or other extremely hard material, fixed on the end of a pin 11 and adapted to dress the periphery of a grinding wheel W. The wheel in turn is used to shape a workpiece to a desired contour corresponding to the cross section to which the periphery of the grinding wheel is dressed. In accordance with the present invention, the improved tool mounting and guide are adapted to dress the wheel periphery in a wide variety of selectively variable shapes, thereby affording a high degree of versatility in the machine operation. For example, the wheel W may be dressed as indicated in Fig. 7 with two angularly disposed flanks 12 and 13 merging in a sharp edge 14 encircling the wheel. Alternatively, the point 10 may be used to dress an edge 14^a of convex cross section and merging into angled flanks 12^a and 13^a as shown in Fig. 8, or with an edge 14^b of concave cross section disposed between angled flanks 12^b and 13^b, as shown in Fig. 9.

Two different motions of the dressing point 10 are combined in generating the variety of wheel periphery shapes indicated above. The wheel flanks are dressed by swinging the point 10 in a direction generally toward and away from the wheel axis (see Fig. 6) while guiding this oscillating movement with a suitably adjusted template, the position of whose guiding edges corresponds to the desired angularity of the wheel flanks. On the other hand, the curved contour is produced during turning of the point 10 about an axis (indicated at 15 in Fig. 2) extending generally tangentially of the wheel. Thus, if it is desired to form a convex edge 14^a as shown in Fig. 8, the point 10 is displaced laterally outward from the axis of oscillation 15 a distance R_1 equal to the desired radius of curvature. With the dressing point so located, oscillation of it about the axis 15 between the positions shown in phantom will cause it to generate the convex edge shown. Similarly, to use the point 10 to dress a concave edge 14^b as shown in Fig. 9, the point is displaced on the opposite side of its axis of oscillation 15, the amount of displacement being equal to the

desired radius R_2 for the concavity. Then, by oscillating the point about its axis 15, it will generate the groove of concave cross section. Finally, if simply a sharp edge is desired for the grinding wheel, the tip of the grinding point 10 is located precisely on its axis of oscillation as shown in Fig. 7, so that the position of the tip will not change as the grinding point is oscillated about the axis 15. In this case, actual dressing of the wheel is accomplished wholly by swinging the dressing point along the flanks 12 and 13.

To provide for movement of the dressing point in the different paths as described above, it is supported on a lever or bar 16 mounted to turn on a longitudinal axis, the axis 15 above referred to, and also to fulcrum universally about transverse axes preferably disposed intermediate the bars ends. The bar 16 has an offset lower end portion 18 with a generally transverse bore 19 (Fig. 2) in which the pin 11 is slidably mounted for endwise movement, the bore 19 being angled downward slightly as shown. A set screw 20 threaded in the lower end of the bar releasably holds the pin 11 in position. The point 10 may thus be shifted toward and away from the longitudinal bar axis 15 (for varying the radius of the point's oscillatory movement as described above) by loosening the set screw 20 and shifting the pin 11 the necessary amount. If desired, this may be accomplished conveniently with the aid of a micrometer gauge 20^a (Fig. 10) adapted to fit on the lower end of the bar 18 and having an abutment 20^b against which the point 10 is brought to position the point a distance from the axis 15 corresponding to the reading on scales 20^c.

A ball and socket mounting, designated generally as 21, is provided for supporting the dresser bar 16 within a generally tubular housing or sleeve 22 (Fig. 2). This includes a spherical enlargement or ball 23 rigid with the bar intermediate the ends of the latter and having its center 23^a lying on the longitudinal axis 15 of the bar. The sleeve 22 has a longitudinally tapered bore 24 in its upper portion terminating in an undercut recess 25 at its lower end in which the ball 23 is socketed. A collar 26, threaded in the lower end of the recess 25, engages the lower side of the ball 23 and completes the socket. It will be apparent that with such a mounting the dresser bar 16 can be revolved freely about its longitudinal axis 15 and can also be tilted in any desired direction about the center 23^a of the ball 23, this center lying on the axis 15.

Herein, the bar 16 is guided during its swinging movements and located while turning by edges 28^a and 29^a on templates 28 and 29 which coact with the upper end portion of the bar. The latter is of arcuate contour with its center of curvature coincident with the axis 15. The plates are of generally sector shape and their edges coact to define a V-notch embracing the bar and locating the axis of the latter coincident with the axis 15 when the bar is seated at the root of the notch as shown in Fig. 3. In this position, the dresser bar may be oscillated about its longitudinal axis 15, or, alternatively, the bar may be swung so that it rides along one or the other of the edges 28^a or 29^a. This swinging movement is, as explained above, used in dressing the flanks of the grinding wheel W, and the angularity of the flanks so dressed is controlled by the angle included between the guide edges. The contour produced on the flanks 12 and 13 corresponds to the shape of the guide surfaces 28^a and 29^a. Herein, these are straight so as to produce straight flanks. By properly curving the guides, any other desired shape of flank may be obtained. A handle 17 on the upper end of the bar may be grasped conveniently and utilized either to turn the bar while holding it seated in the guide notch or to swing the bar along either of the edges 28^a or 29^a while pressing the bar against such edge.

To enable the angles of the wheel flanks 12 and 13 to be varied individually relative to the plane of rotation of the wheel, the templates 28 and 29 are mounted for independent bodily adjustment around the axis 15. For this purpose, the plate 28 is screwed to the peripherally flanged upper end of the sleeve 22 (Figs. 1 and 3). The plate 29 is fixed to a ring or collar 30 (Figs. 2 and 4) seated in an annular recess 31 in the upper end of the sleeve 22 and coaxial with the latter. This ring 30 is normally held in angularly adjusted position by a pair of cylindrical clamp blocks 32 having nose portions 32^a projecting into an annular peripheral recess 33 in the ring, the blocks 32 being pressed down into locking position by socket head screws 34 which pass through them and are threaded in the sleeve 22. Upon release of these screws 34, the ring 30 can be swiveled around to set the guide plate 29 in any desired angular position. The sleeve 22 can be swiveled about its longitudinal axis to adjust the position of its guide plate 28, the sleeve fitting into a split sleeve 35 depending from a housing designated generally as 36. Lugs 38 on the opposite sides of the split 37 are drawn together by a socket head screw 39 to clamp the sleeve 22 rigidly in its adjusted position.

The angular adjustment of the plates 28, 29 is indicated by a pair of scales 40, 41 engraved on the periphery of the enlarged upper end of the sleeve 22 (see Fig. 1). The lower scale 40 cooperates with an index mark 40^a on the split sleeve 35 to indicate the angular position of the guide plate 28 while an index mark 41^a (see Fig. 4) on the periphery of the guide plate 29 cooperates with the scale 41 to show the angular position of this latter guide plate.

To enable the entire contour to be dressed by the same portion of the point 10, it is necessary at all times to maintain the pin 11 at the same angle, perpendicular in the present instance, to the part of the contour it is engaging. This involves turning the pin 11 about the axis 15 between the dressing of the intersecting wheel flanks 12 and 13 as in Fig. 7 as well as when an intermediate curve 14^a is generated as in Fig. 8. Moreover, the extent of the turning movement must be gauged accurately in order that the contiguous surfaces of the different angles or shapes will merge accurately. Positively acting means is therefore provided for limiting the turning of the bar 16 to a range corresponding to the angle included between the guide edges 28^a and 29^a. In the present instance, this means comprises a cross bar 42 extending through and fixed to the bar 16 above the plates 28 and 29 and arranged to cooperate with stop lugs 43 and 44 rigid with and upstanding from the plates beyond the outer ends of the guide surfaces 28^a and 29^a. The active stop surfaces 43^a and 44^a extend parallel to and are spaced laterally from each guide surface toward the other guide surface a distance determined by the diameters of the bar 16 and the cross pin 42. This spacing is such that when the bar is pressed into the notch defined by the guide surfaces and rotated until one end of the pin en-

gages one stop, the pin 11 carrying the dressing point will be disposed exactly perpendicular to one of the guide surfaces and, therefore, to the wheel surface that will be dressed by movement of the bar outwardly along this guide surface.

Auxiliary stops 43b and 44b are also carried by the plates 28 and 29 and spaced from the stops 43 and 44 a distance equal to the diameter of the cross pin 42. These are lower than the main stops so that as the bar 16 is turned while seated in the root of the V-notch, the ends of the cross pin will pass over the auxiliary stops. Then, as the bar is swung outwardly along one guide surface, the pin end will be lowered sufficiently, as shown in phantom in Fig. 6, to render the auxiliary stop effective in preventing reverse turning of the bar. In this way, the dressing point is held positively in the correct position as it is oscillated along the guide surface.

Provision is made for bodily adjustment of the dressing attachment in the plane of rotation of the wheel to be dressed and also perpendicular to this plane or parallel to the wheel axis. For this purpose, the housing 36 in which the sleeve 22 fits is mounted to slide on a frame 45 (Fig. 1) in a direction transverse to the axis of an arbor 46 which carries the grinding wheel W. The frame 45 is, in turn, mounted on a main frame 47 for adjustment in a direction paralleling the arbor.

More particularly, the housing 36 includes a cylindrical central body portion 48 and an integral depending semicircular wheel guard 49 (Fig. 1). A combined guide and clamp shoe 50 of rectangular shape (Figs. 2 and 5) is disposed beneath the body portion 48 of the dresser housing and is fixed on the lower end of a pin 51 extending upwardly through the body portion 48. A head 52 is threaded on the upper end of this pin 51 and has an operating handle 53 fixed to it. The shoe 50 is held in place in a longitudinal guideway 54 in the top of the frame 45 by gib plates 55. Accordingly, when the clamp actuating handle 53 is shifted to screw the head 52 down on the pin 51, the shoe 50 is drawn up against the overlying gib plates and holds the dresser housing 36 rigidly in position. On the other hand, when the handle 53 is turned to release the shoe 50 the latter guides the dresser housing for free sliding movement along the guideway 54.

To move the dresser housing 36 with respect to the frame 45, a non-rotatable lead screw 56 fixed in the body portion 48 of the dresser housing is used. This screw 56 extends through alined bores in a pair of spaced guide lugs 45a on the frame 45. Between these lugs, and threaded on the screw 56, is a knurled thumb wheel 57. Rotation of this thumb wheel 57 thus serves to shift the lead screw 56 axially and to move the dresser housing 36 correspondingly along its guideway. A micrometer gauge is provided for indicating the adjusted position of the housing, including a scale 58 engraved on the hub of the wheel 57 and an index mark 58a on the adjacent portion of the front lug 45a. (See Fig. 1.)

A similar thumb-wheel-operated screw arrangement is provided for shifting the frame 45 to and fro with respect to the wheel spindle housing 47. In this connection, observe that the frame 45 includes an arcuate wheel guard portion 45b on its inner side overlying a complementally shaped guard projection 60 (Fig. 5) on the housing 47 and having a pin and slot connection 59 with it which guides the movement of the frame (Fig. 3). A non-rotatable lead screw 61 is fixed to the frame 45 and passes through a split sleeve 47a on the wheel spindle housing 47 (Figs. 1 and 5). A knurled thumb wheel 62, like the thumb wheel 57 described above, is threaded on this lead screw 61 and is revolved to shift the screw in and out for shifting the frame 45 and parts carried by it. To clamp the screw 61 against movement, a socket head screw 63 is turned to tighten the split sleeve 47a.

The dresser housing 36 and frame 45 cooperate to form a guard for the grinding wheel W. As heretofore noted, the dresser housing includes a guard portion 49 (Fig. 1) which overlies the upper front side of the wheel and which, it may be noted, incidentally slides along the front face of the frame 45 during positional adjustment of the dresser housing. As indicated in Fig. 2, the lower sides of the dresser housing and frame are shaped to receive the wheel and a resilient sheet metal plate 64 spans the gap between them preventing entry of grit and dirt into the guideway 54.

Operation

Let it first be assumed that the periphery of the wheel W is to be formed with straight flanks 12 and 13 intersecting at a sharp edge 14 as shown in Fig. 7. As a preliminary to such dressing, the guide edges 28a, 29a are adjusted to positions corresponding to the desired angles of the wheel flanks 12 and 13. For this adjustment, the screw 39 (Fig. 1) is loosened to release the split clamping sleeve 35 and the inner sleeve 22 is turned until the scale and marker 40, 40a show the guide edge 28a to be located in precisely the desired angular position for the flank 12, whereupon the clamp is tightened. Then the screws 34 are loosened to release the clamps 32 and the ring 30 is turned around until its guide edge is positioned at the precise angle required for the other flank 13, the angular relation of this guide edge to the sleeve 22 being shown by the scale 4 and marker 41a. Thereafter, the ring 30 is, of course, again clamped tightly in position.

Next, the dressing point 10 is adjusted so that its active tip lies precisely on the longitudinal axis 15 of the dresser bar. For this purpose, the set screw 20 is loosened and the pin 11 is shifted axially against the abutment 20b on the micrometer gauge with the latter positioned on the bar 16 as shown in Fig. 10 and set with its scale reading zero.

With the guides set up as described, the dresser housing 36 and frame 45 must also be preliminarily positioned. For this purpose the operator grasps the handle of the dresser bar 16 and pulls it into the root of the notch defined by the guide edges 28a, 29a, so as to locate the point 10 in a fixed plane in which the point 14 of intersection will be formed. The clamp sleeve 47a (Fig. 1) is loosened and the lead screw 63 run out, or drawn in, by rotation of the thumb wheel 62 until the dresser point 10 is located at a point relative to the width of the wheel at which the edge 14 is to be formed. Thereupon the sleeve 47a is again tightened and the handle 53 swung to loosen the shoe 50 from its gibs 55 so that the dresser housing 36 can be fed toward the wheel periphery sufficiently to take the first cut across the latter.

After such adjustment of the dressing point, the motor (not shown) for rotating the wheel W is started. Actual dressing of the wheel may be

started at any desired point along the contour to be generated as dictated by the contour of the wheel at the start. For example, if the wheel has been previously dressed to the approximate contour desired, the operation may be started at the point of intersection 14. In such a case, the bar 16 would first be pressed into the root of the notch between the guides 28a and 29a as shown in Fig. 3 the pin 11 and the point 10 being disposed in the full line position c (Fig. 7) so as to engage the wheel at the desired point of intersection of the flanks 12 and 13. If the flank 13 is the first to be dressed, the handle 17 is, as a preliminary, turned counter-clockwise as viewed in Fig. 3 until the cross pin comes against the stop 44 (Fig. 6) thereby bringing the dressing pin 11 to the position d (Fig. 7), the point 10 remaining on the axis 15 of the bar 16. Next, the bar 16 is swung outwardly along the guide surface 29a while being maintained in contact therewith. A cut is thus taken across the flank by swinging of the bar to the position shown in phantom in Fig. 6. The point 10 may pass beyond the flank 13 to the position e (Fig. 7) where the movement of the bar is limited by engagement with the interior of the collar 30.

To dress the flank 12, the bar is swung reversely along the guide 29a to the apex of the notch and then turned clockwise until the pin 42 engages the stop 43, the dressing pin being thereby moved to position b (Fig. 7) with the point 10 coincident with the axis 15 and the wheel point 14. The flank 12 is dressed by swinging the bar 16 outwardly along the template surface 28a to the position a (Fig. 7).

If additional cuts are to be taken, the dressing assembly is again advanced through the medium of the screw 56 after which the bar is moved reversely from position a to position c then turned counter-clockwise to position d and moved along the surface 29a to position e thereby taking a cut across the flank 13. This procedure may be repeated as many times as may be necessary in order to reduce the wheel to the desired peripheral contour. When the bar is in either of the positions a or e, it will be observed that the dressing point is out of the way and the dressed wheel thus conditioned for use as desired. To this end the thumb wheel 57 is rotated to move the dresser housing along its guideway 54 on the frame 45. Customarily the dresser housing is moved until the dresser point 10, positioned with the bar 16 at the root of the guide notch, barely touches the periphery of the grinding wheel.

Next to be considered is the case in which the grinding wheel W is to be formed with an edge portion 14a of convex cross section intermediate the flanks 12a and 13a as shown in Fig. 8. In such case the guide plates 28, 29 are preliminarily adjusted so that their edges are precisely positioned to generate the flanks 12a and 13a in the same general manner as described above. To reposition the point 10 for generating the convex contour 14a, the set screw 20 is loosened and with the aid of the gauge 20a (Fig. 10), the pin 11 is retracted to shift the dressing point 10 away from the axis 15 a distance R1 equal to the radius of the curve 14a. The direction of the shift is away from the grinding wheel axis and toward the offset lower end 18 of the bar 16. After tightening the screw 20 to lock the pin 11, the attachment is advanced by adjustment of the nut 57 to bring the point 10 into cutting position.

After the preliminary set up just described, the cross pin 42 may be in engagement with the stop 44 and the bar 16 swung outwardly along the guide 29a, the pin 11 and point 10 being disposed beyond the wheel flank 13a in the position f (Fig. 8). To dress this flank, the bar is rocked backwardly across the guide 29a to position the pin 11 as indicated at g whereupon the bar 16 will be disposed in the root of the guide notch. Then, the handle 17 is turned clockwise to generate the curve 14a by the point 10 as the pin passes through the full line position and reaches position h at which time the cross pin will engage the stop 43. The flank 12a is then dressed as the bar is moved out along the guide 28a. It will be observed that when the point 10 is at the points of mergence between opposite ends of the arc 14a and the flanks 12a and 13a, that is in positions g and h (Fig. 8), the dressing pin extends perpendicular to these surfaces and remains perpendicular to the flank or the curve in moving across the latter. As a result, the contiguous surfaces, although of different contour, are perfectly blended together.

Substantially the same procedure is followed in dressing the grinding wheel W with the concave cross section 14b as indicated in Fig. 9 except that as in the preliminary set-up of the parts the tip of the dressing point 10 is displaced beyond or to the right (as viewed in Figs. 2 and 9) of the axis 15 rather than to the left of it as was the case in forming a convex cross section edge. As before the setting of the pin 11 and therefore the radius of curvature R_2 for the groove or concave section is determined with the aid of the gauge 20a the parts being disposed as shown in Fig. 9.

In this case, a somewhat different procedure is followed in actual dressing of the wheel because it will be observed from Fig. 9, the flanks 12b and 13b and the curve 14b cannot be dressed in the same relative setting of the dressing point and wheel. Instead, the flanks are first dressed following the procedure described above in connection with the flanks 12 and 13 (Fig. 7) and then the curve 14b is generated separately by indexing the point 10 toward the wheel axis and after each such adjustment turning the bar 16 between the positions shown in phantom in Fig. 9. During this, the bar is of course held seated in the guide notch and not oscillated along the guide surfaces.

It will be apparent from the foregoing that the invention provides a gauge for guiding a single dressing tool with great accuracy to produce innumerable wheel contours which may be varied selectively as desired. In spite of its flexibility, the attachment is easy to adjust and to operate, no special skill being required. The contours generated are precise and the differently shaped sections always merge accurately to form a smooth continuous wheel surface.

I claim as my invention:

1. In a machine for dressing a grinding wheel, the combination of a frame, means supporting said frame and a rotary grinding wheel for adjustment longitudinally and transversely of wheel axis, a bore in said frame extending generally tangentially of said wheel, a sleeve adjustably journaled in said bore, a ring journaled in said sleeve for adjustment about the sleeve axis, templates respectively carried by said sleeve and ring and having guide surfaces coacting to define a V-notch, a bar extending through said notch and sleeve and rotatably supported with its longitudinal axis coincident with said sleeve axis when the bar is seated in the root of said

notch, said bar also being fulcrumed intermediate its ends for universal swiveling about a point lying on said axis, one end of said bar being engageable with and guided by said surfaces and the other end being offset laterally from said axis, a dressing point supported by said offset end for adjustment transversely of said axis and engageable with the periphery of said wheel.

2. In a machine for dressing a grinding wheel, the combination of a frame, a bore in said frame extending generally tangentially of said wheel, a sleeve fitting in said bore and adjustable angularly, a ring rotatably supported in said sleeve for adjustment about the sleeve axis, templates respectively carried by said sleeve and ring and having converging guide surfaces, a bar extending through said sleeve and rotatably supported with its longitudinal axis coincident with said sleeve axis when the bar is pressed against both of said surfaces, said bar also being fulcrumed for universal swiveling about a point lying on said axis and guided by said surfaces during such swiveling, a dressing point supported by said bar for adjustment transversely of said axis and engageable with the periphery of said wheel.

3. In a machine for dressing a grinding wheel, the combination of a frame, a bore in said frame extending generally tangentially of said wheel, a sleeve fitting in said bore and adjustable angularly, a ring rotatably supported in said sleeve for adjustment about the sleeve axis, templates respectively carried by said sleeve and ring and having guide surfaces coacting to define a V-notch, a bar extending through said notch and sleeve and supported to turn on an axis coincident with said sleeve axis when the bar is seated in said notch, said bar being swingable about transverse axes in moving along said guide surfaces, a dressing point supported by said bar for adjustment transversely of said first axis and engageable with the periphery of said wheel, and stops limiting the turning of said bar in opposite directions about said first axis to define positions of the tool bearing a fixed relation to the respective guide surfaces.

4. In a machine for dressing a grinding wheel, the combination of a frame, means supporting said frame and a rotary grinding wheel for adjustment longitudinally and transversely of wheel axis, guide surfaces on said frame coacting to define a V-notch, a bar embraced by said surfaces and supported to turn on a longitudinal axis and and to swivel about transverse axes intersecting said longitudinal axis, one end of said bar being engageable with and guided by said surfaces and the other end being offset laterally from said first axis, a dressing point supported by said offset end for adjustment transversely of said axis and engageable with the periphery of said wheel.

5. Mechanism for dressing the periphery of a rotary grinding wheel having, in combination, an elongated bar, a bar and socket supporting said bar intermediate its ends to turn on its longitudinal axis and to swivel universally about transverse intersecting axes, a dressing point mounted on one end of said bar, and means coacting with the other end of said bar to locate it during rotation and guide it during oscillation about one of said transverse axes.

6. Mechanism for dressing the periphery of a rotary grinding wheel having, in combination, an elongated bar mounted to turn on an axis extending generally longitudinally of the bar and to swivel universally about transverse intersecting axes, a dressing point engageable with said wheel and mounted on said bar, a pair of guides coacting to form a notch for locating said bar on one of said axes, said guides being engageable with said bar to guide its swiveling movements, and means supporting said guides for individual adjustment around said first mentioned axis.

7. Mechanism for dressing the periphery of a rotary grinding wheel having, in combination, an elongated bar mounted to turn on an axis extending generally longitudinally of the bar and to swivel universally about transverse intersecting axes, a dressing point engageable with said wheel and mounted on said bar, a pair of straight guides mounted for individual adjustment around said longitudinal axis and coacting to form a V-notch, said bar being disposed on said first axis when pressed into the root of said notch.

8. Mechanism for dressing the periphery of a rotary grinding wheel having, in combination, an elongated bar mounted to turn about a predetermined axis extending generally tangentially of said wheel and to swivel universally about transverse axes intersecting on said axis, a dressing point engageable with said wheel and mounted on said bar for adjustment transversely of and across said first axis, and means coacting with said bar to locate it on said first axis during rotation of the bar and to guide its movement during oscillation about a transverse axis.

9. Mechanism for dressing the periphery of a rotary grinding wheel having, in combination, an elongated bar mounted to turn on an axis extending generally tangentially of said wheel and to swivel universally about a transverse axis, a dressing point engageable with said wheel and mounted on said bar, an arcuate surface on said bar concentric with said axis, and means providing converging guide surfaces locating the bar to turn on said axis when the bar is pressed against both said surfaces and guiding the bar when the latter is swiveled about said transverse axis.

10. Mechanism for dressing the periphery of a grinding wheel having, in combination, an elongated bar mounted to turn on its longitudinal axis and also swing in different directions about transverse axes, surfaces embracing said bar and guiding the same during said swinging movements, a member projecting laterally from and transversely of said bar and carrying a dressing point engageable with said wheel, and stops limiting the relative movement of said bar about said longitudinal axis to positions in which said pin extends transversely of the respective guide surfaces in directions substantially at right angles thereto.

11. Mechanism for dressing the periphery of a grinding wheel having, in combination, an elongated bar mounted to turn on its longitudinal axis and also swing in different directions about transverse axes, surfaces embracing said bar and guiding the same during said swinging movements, a member projecting laterally from and transversely of said bar and carrying a dressing point engageable with said wheel, and means limiting the turning movement of said bar in opposite directions to positions in which said pin will be disposed at the same predetermined angle relative to the respective guide surfaces.

12. Mechanism for dressing a rotary grinding wheel to form angularly disposed flanks on opposite sides of the wheel periphery and an intervening surface of convex cross section, said mechanism having, in combination, a dressing tool mounted to turn about one axis to generate

said convex surface and to oscillate about other axes to dress said flanks, and means guiding said tool throughout its successive movements and operable when maintained effective during such movements to hold the tool at a constant angle to the wheel surface at all points across the latter.

13. Mechanism for dressing a rotary grinding wheel to form angularly disposed flanks on opposite sides of the wheel periphery and an intervening surface, means supporting said tool and guiding the same for dressing movement successively across one of said flanks, said surface and the other flank, means for adjusting said guiding means selectively to vary the position and angle of the individual flanks relative to each other, and independent means for adjusting said tool to vary the curvature of said surface while providing for accurate mergence of the contiguous wheel surfaces dressed by the tool.

14. Mechanism for dressing a rotary grinding wheel to form substantially straight flanks on opposite sides of the wheel periphery, said mechanism comprising a dressing tool, means supporting and guiding said tool along different paths to dress the respective shanks while permitting of angular adjustment of the tool when the latter is disposed between said paths, and means limiting said angular adjustment to positions in which said tool is disposed at the same angle to the respective flanks while the latter are being dressed.

15. Mechanism for dressing the periphery of a rotary grinding wheel having, in combination, a member mounted to turn about one axis and to tilt about a transverse axis, a dressing tool carried by said member and engageable with said wheel to dress different contiguous peripheral portions thereof during the rotational and swiveling movements of said member, and means positively limiting the rotative movement of said member in one direction to establish a fixed angular relation between the tool and wheel surface during swiveling movement of the member.

16. Mechanism for dressing the periphery of a rotary grinding wheel having, in combination, a member mounted to turn about one axis and to tilt about a transverse axis, a dressing tool carried by said member and engageable with said wheel to dress different contiguous peripheral portions thereof during the rotational and swiveling movements of said member, a stop limiting rotative movement of said member in one direction, and an auxiliary stop rendered effective in the initial swiveling movement of said member while engaging said first stop to prevent reverse rotation of the member.

17. Mechanism for dressing the periphery of a rotary grinding wheel having, in combination, a member mounted to turn about one axis and to tilt about a transverse axis, a dressing tool carried by said member and engageable with said wheel to dress differently contoured contiguous peripheral portions thereof during the rotational and swiveling movements of said member, and stop means operable to maintain a constant angular relation of said tool to the wheel surface during a continuous movement of said member to dress said contiguous portions successively.

18. Mechanism for dressing the periphery of a rotary grinding wheel having, in combination, a member mounted to turn about one axis and to tilt about a transverse axis, a dressing tool carried by said member and engageable with said wheel to dress different contiguous peripheral portions thereof during the rotational and swiveling movements of said member, and means rendered effective in the initial swiveling movement of said member to prevent rotation of the member in one direction during the continued swiveling.

19. Mechanism for dressing the periphery of a rotary grinding wheel having, in combination, a member mounted to turn about one axis and to tilt about a transverse axis, a dressing tool carried by said member and engageable with said wheel to dress differently contoured contiguous peripheral portions thereof during the rotational and swiveling movements of said member, said member having an external surface of arcuate contour, a template engageable with said arcuate surface and guiding said tool to generate said contours during said rotational and swiveling movements, and means supplementing the action of said template during certain positions of said swiveling movement to hold said member against said rotational movement.

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