March 2, 1943. S. MADSEN 2,312,347

DRESSING DEVICE

Filed Jan. 4, 1941 3 Sheets-Sheet 1

Fig. 1

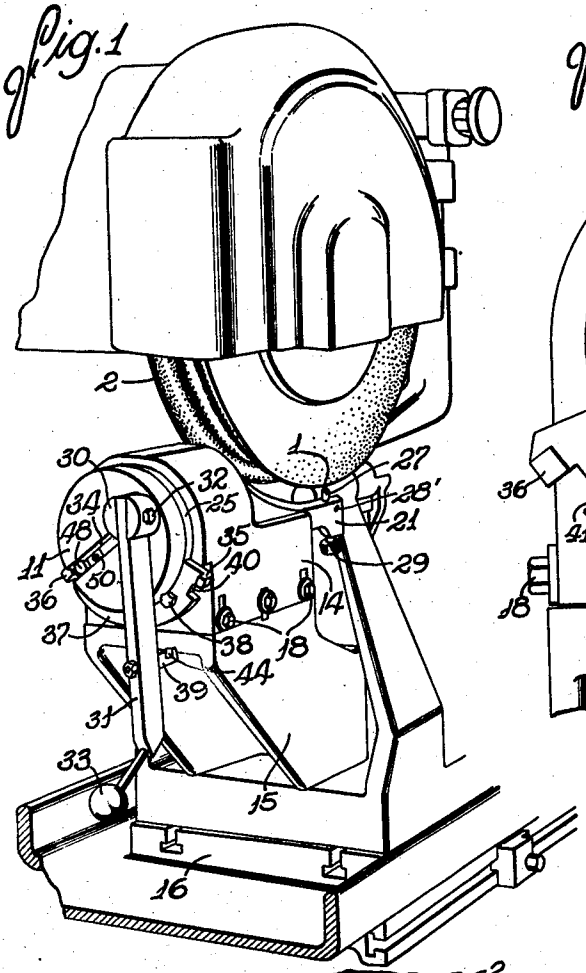


Fig. 2

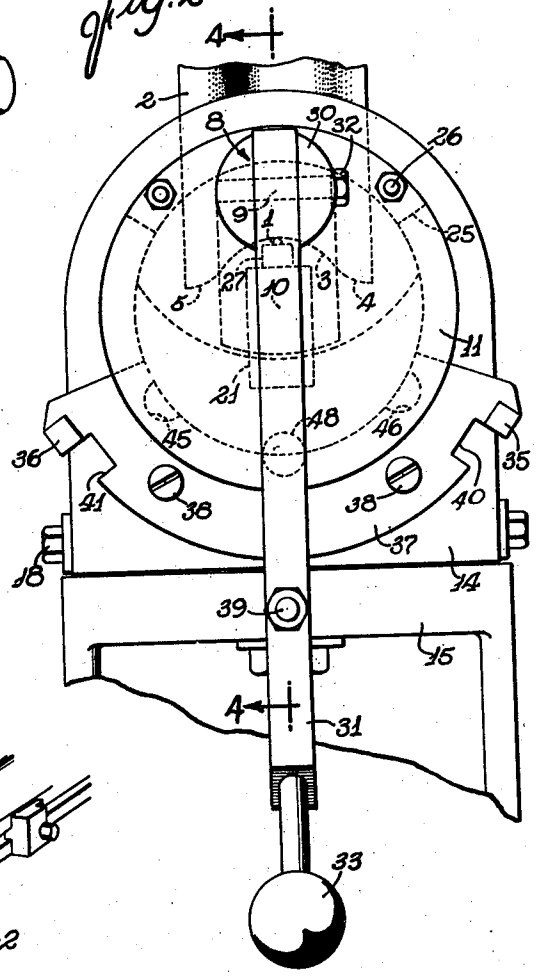
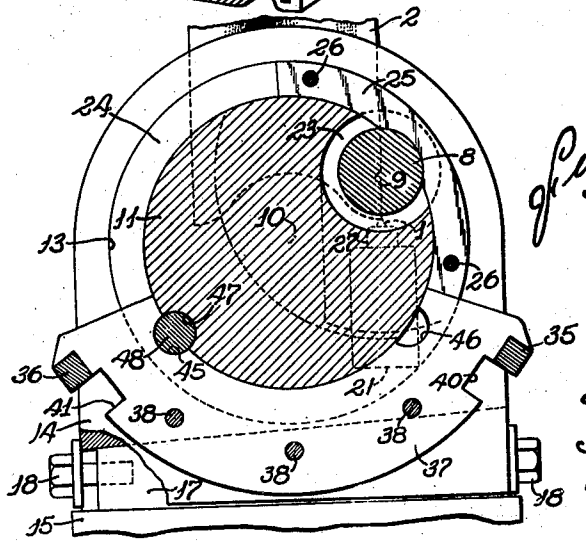


Fig. 3



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Fig. 4

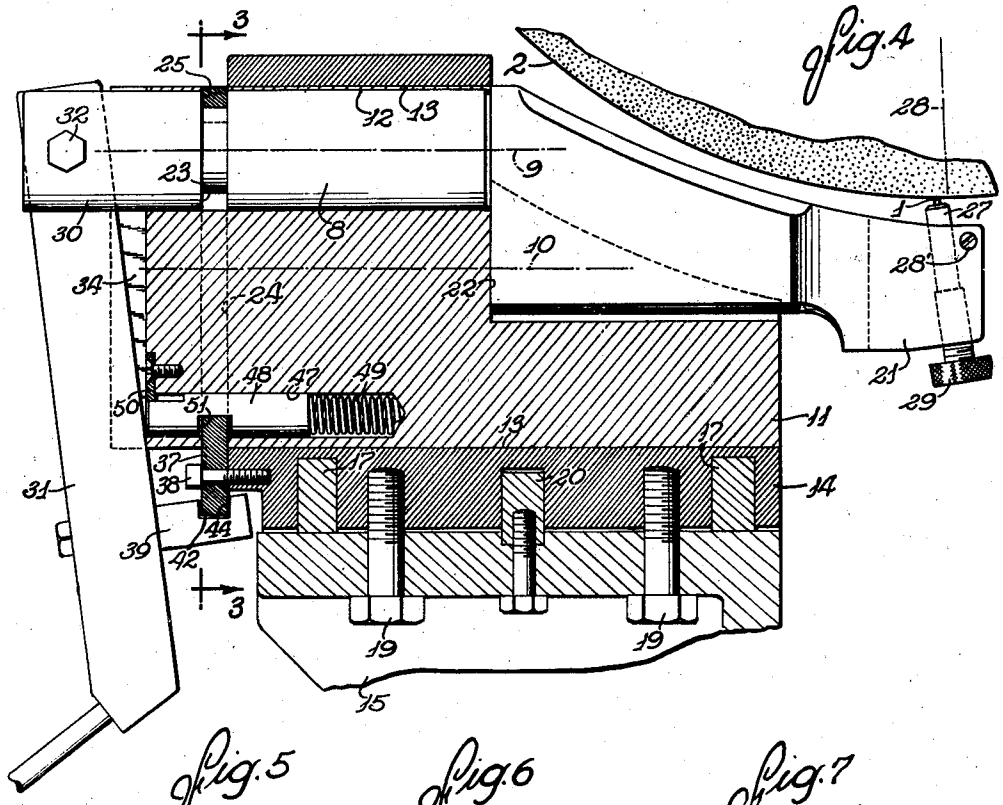


Fig. 5

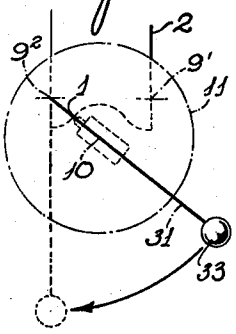


Fig. 6

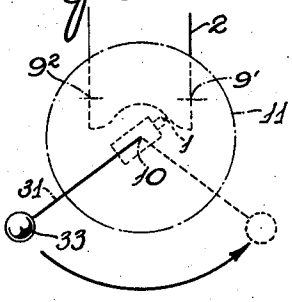


Fig. 7

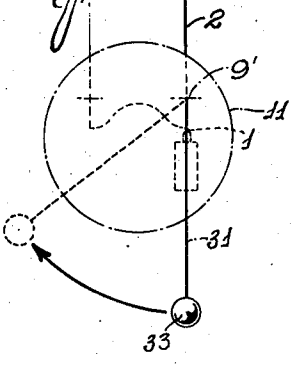
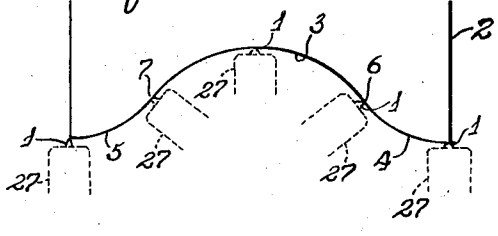


Fig. 8



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Fig. 9

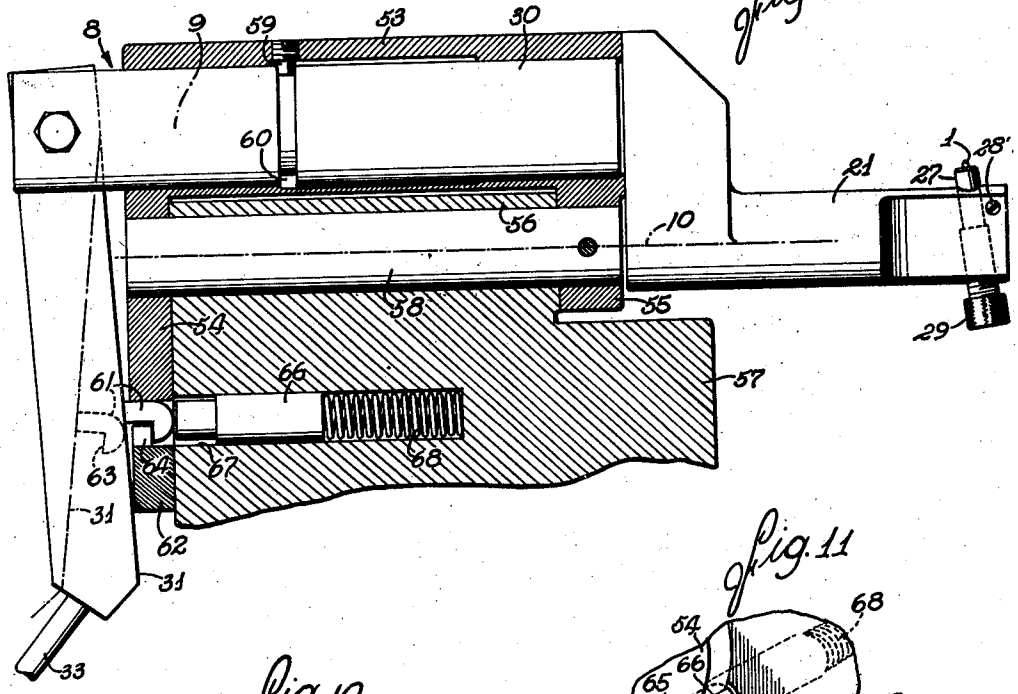


Fig. 11

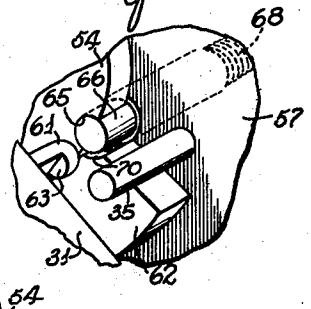
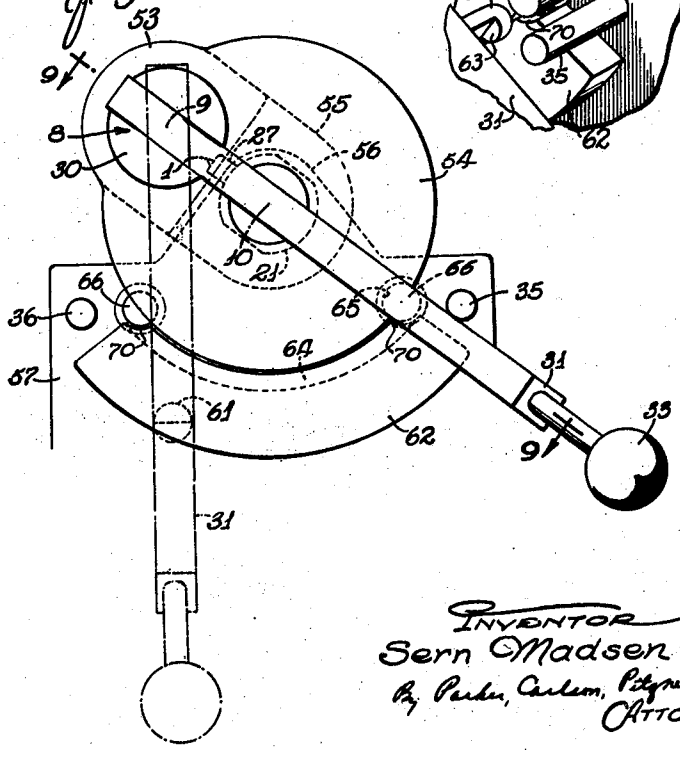


Fig. 10



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UNITED STATES PATENT OFFICE

2,312,347

DRESSING DEVICE

Sern Madsen, Rockford, Ill., assignor to Mattison Machine Works, Rockford, Ill., a corporation of Illinois

Application January 4, 1941, Serial No. 373,083

24 Claims. (Cl. 125—11)

This invention relates to a device for dressing the periphery of a grinding wheel to an irregular contour.

One object is to provide for a novel device for generating a plurality of contiguous arcuate surfaces on a wheel periphery by means of a single dressing point.

Another object is to generate contiguous reverse arcs by swinging a dressing point successively about spaced parallel axes.

A further object is to provide novel means for insuring the maintenance of a constant angle between the dressing tool and the wheel surface during generation of the different contours.

Still another object is to provide adjustment of the radii of the curves generated.

It is also an object to provide a dressing device which is readily adaptable to a so-called surface grinder.

Another object is to interlock the moving parts of the dressing tool mounting in a novel manner such as to render the device simple and foolproof in operation.

The invention also resides in the novel construction of the tool mounting which contributes to simplicity in construction, convenience in operation, and precision in the location and mergence of the differently curved surfaces.

Other objects and advantages of the invention will become apparent from the following detailed description taken in connection with the accompanying drawings, in which—

Figure 1 is a perspective view of a wheel and dressing device embodying the present invention.

Fig. 2 is a fragmentary end elevational view.

Fig. 3 is a transverse sectional view taken along the line 3—3 of Fig. 4.

Fig. 4 is a longitudinal section taken along the line 4—4 of Fig. 2.

Figs. 5, 6 and 7 are diagrammatic views illustrating the motions of the tool actuating member in dressing different portions of the grinding wheel surface.

Fig. 8 is a fragmentary view of the dressed grinding wheel showing the dressing tool in different positions.

Figs. 9 and 10 are views similar to Figs. 4 and 2 showing a modified form of the invention, Fig. 9 being a section taken along the line 9—9 of Fig. 10.

Fig. 11 is a fragmentary perspective view of a portion of Fig. 10.

While the invention is susceptible of various modifications and alternative constructions and of application in various ways, it has been shown in the drawings and will be described herein for forming a particular contour on the abrasive wheel 2 of a so-called surface grinder to which the device is well suited. It will be understood, however, that I do not intend to limit the invention by such exemplary disclosure but aim to cover all modifications, alternative constructions and uses falling within the spirit and scope of the invention as expressed in the appended claims.

The operation of dressing a grinding wheel in accordance with the present invention involves moving a single dressing point or diamond 1 laterally across the periphery of a wheel 2 to be dressed while the latter is power rotated about a fixed axis. In the case of the surface grinder shown, the dressing point is located directly beneath the wheel and is supported from one end of the horizontally reciprocable work table 16 in a position such that the tool is not brought into engagement with the wheel during the normal grinding stroke. The wheel is mounted for vertical adjustment toward the dressing point to determine the depth of the cut taken by the latter.

The movements of the dressing point are controlled in a manner such as to generate arcuate sections of different curvatures with the contiguous sections merging precisely. In the present instance, one concave arcuate section 3 at the center of the wheel is flanked by sections 4 and 5 of convex curvature merging with the central section at the points 6 and 7 (Fig. 8) of tangency of the contiguous arcs. Generation of this contour is accomplished by swinging the dressing point successively about spaced parallel axes and through accurately defined angular limits. To this end, the point 1 is carried by and projects laterally from a tool holder in the form of a horizontal shaft 8 which is swingable about its own axis 9 but in two different positions 9^1 and 9^2 (Figs. 5 and 7) thereof to generate the arcs 4 and 5 and is also bodily swingable about a parallel axis 10. The latter extends horizontally and generally tangentially of the wheel 2 and is spaced, in this instance, on the side of the dressing point opposite the shaft axis 8 so as to generate the reversely curved or concave intermediate arc 3.

Referring first to the form of the invention shown in Figs. 1 to 8, the axis 10 is that of a shaft 11 larger than the shaft 8 and having a bore 12 in which the smaller shaft is journaled. The shaft 11 is journaled intermediate its ends in a bearing 13 formed in a block 14 supported by a bracket 15 on the work table 16 which may be moved beyond its normal working range to move the dressing device into and out of operative position relative to the wheel. To provide

for vertical and some angular adjustment of the block, the latter is supported by wedges 17 which may be shifted endwise by screws 18 after which the block is clamped to the bracket by screws 19. The longitudinal position of the block is maintained by a transverse key 20.

The shaft 8 is held against endwise movement relative to the supporting shaft 11. For this purpose, the offset forward end 21 is backed by a vertical surface 22 on the shaft 11. Intermediate its ends, the shaft 8 is formed with an annular groove 23 opening outwardly and registering with a similar groove 24 in the shaft 11. A segmental key 25 is fastened in the groove 24 by pins 26 and is disposed in the groove 23 thereby locking the shaft 8 against forward axial movement.

The dressing tool 1 is carried in the forward end 21 of the shaft 8 which end is offset and disposed substantially in alinement with the axis of the shaft 11. The shaft end is cut away on top to clear the wheel 2. Beyond the forward end of the block, the shaft end 21 is formed with a transverse bore from which projects a pin 27 to which the point or diamond 1 is fixed in the usual way. As is common in practice, the pin 27 is inclined slightly relative to a radius 28 of the wheel. The pin is clamped in place by a screw 28' and is backed by a screw 29 threading into the other end of the bore and providing a simple means by which the position of the point relative to the axes 9 and 10 may be adjusted conveniently.

The rear end 30 of the shaft 8 projects from the larger shaft 11 and carries means for oscillating the shafts individually and performing several additional functions. In the present instance, this actuating means comprises an arm 31 having its upper end disposed in a slot in the shaft end 30 and pivoted on a screw 32 threaded therein. The arm is thus coupled to the shaft 8 to oscillate the latter and is also swingable longitudinally of the shaft about the transverse axis defined by the screw 32. A knob 33 projecting rearwardly from the lower end of the arm provides a convenient handle for grasping the arm. To facilitate manipulation of the device, the shaft slot preferably is formed at an angle such that the arm and the dressing point 1 are always disposed in the same plane.

Movements of the actuating arm in opposite directions about its pivot 32 are utilized to select the axis about which the dressing point is next to swing, that is, to couple the shaft 11 to the arm or to free this shaft and permit independent oscillation of the shaft 8. For this purpose, a slot 34 slightly wider than the thickness of the arm is formed in the rear end of the shaft 11 and extends diametrically across the shaft from the shaft 8. When the arm is in register angularly with this slot, it will move into the slot as shown in Fig. 4 as the arm is pushed forwardly. The side walls of the slot thus constitute lugs which coact with the arm to couple the latter to the larger shaft 11, the latter being oscillated as the arm is moved back and forth. During this movement, the tool 1 is swung about the axis 10 to dress the arcuate portion 3 of the wheel surface. Now, when the arm is pulled rearwardly out of the slot 34, it is disconnected from the shaft 11 and only the shaft 8 may be oscillated by swinging the arm.

Stops are provided for limiting the range of oscillation of the shaft 11 when coupled to the arm 31, thereby defining the length and position of the wheel surface 3. Herein, two stationary stops 35 and 36 project rearwardly into the path of the arm in positions to interrupt the movement of the arm when the dressing point 1 reaches either of the points 6 and 7 of tangency after traversing the arc 3 or either of the arcs 4 and 5. These stops comprise lugs formed on an arcuate plate 37 which is fastened by screws 38 to the block 14 beneath the shaft 11.

A mechanical interlock is provided for preventing the actuating arm from being coupled to or uncoupled from the shaft 11 except when in a limit position against one of the stops. This includes a bar 39 rigid with and projecting forwardly from the arm in position to register with notches 40 and 41 in the plate 37 when the arm is in a limit position against one of the stops. When the arm is pushed forwardly into the slot 34 (Fig. 4) to couple it to the shaft 11, an upwardly opening notch 42 in the bar 39 registers with the lower edge portion of the plate 37. Thus, the arm is free to swing away from the stop and in this movement the shoulder 44 on the bar moves in behind the plate 37 thereby locking the arm against outward movement until the other plate notch is encountered.

The coupling and uncoupling movements of the arm 31 are also utilized to effect automatic operation of an interlock for holding the shaft 11 against turning when it is uncoupled from the arm and while the shaft 8 is being turned individually. To form this interlock, the upper edge of the plate 37 is disposed in the groove 24 of the shaft 11 and formed with semi-circular notches 45 and 46 in the same angular positions as the notches 40 and 41. On the side of the shaft 11 opposite the shaft 8 and at the bottom of the slot 34, the shaft 11 is formed with a bore 47 positioned to aline with the notches 45 and 46 in the opposite limit positions of the arm. A pin 48 received in this bore is urged endwise and outwardly by a compression spring 49, such movement being limited by a plate 50 on the end of the shaft 11. A notch 51 is formed in the pin in position to register with the upper edge of the plate 37 when the arm 31 is pressed into the slot 34. Then the shaft is free to turn. However, when the arm is withdrawn to uncouple it from the shaft in either of its limit positions, the pin 48 will be alined with one of the notches 45 and 46 and will move into the latter (see Fig. 3) locking the shaft to the stationary plate.

Figs. 9 to 11 show a somewhat simplified construction in which the dressing point as before is carried on the offset end 21 of the shaft 8 which at its rear end is pivotally connected to the actuating arm 31 and handle 33. The shaft bearing is supported by a yoke 53 having depending arms 54 and 55 which snugly straddle an upstanding portion 56 of a supporting block 57 and are pinned to a shaft 58 journaled in this portion to turn on the axis 10 previously referred to. A key 59 projecting into a groove 60 in the shaft holds the latter against endwise movement.

The stops 35 and 36 which limit the movements of the actuating arm in this instance comprise pins projecting from the rear end of block 57. Projecting forwardly from the arm 31 is a hook 61 of semicircular cross-section which hook, in either limit position of the arm, is adapted to pass through a notch 70 at the end of an arcuate locking plate 62 secured to the block end. Thus, as the arm is pushed forwardly, the shoulder 63 of the hook passes a flange 64 on the plate 62 after which the arm is free to swing away from the stop

but cannot be again retracted until it reaches the other stop.

As in the form of the invention first described, forward movement of the arm 31 couples it to the yoke 53 and also frees the latter for oscillation. The coupling is effected by entry of the hook 61 in a semi-circular notch 65 at the edge of the yoke arm 54 which thus becomes connected to the actuating arm through the medium of the hook (Figs. 9 and 10). Retraction of the arm withdraws the hook from the notch 65 to the position shown in phantom in Fig. 9, thereby uncoupling the arm from the shaft 56 so that the shaft 8 alone will oscillate with the arm.

In the forward movement of the arm 31 to couple it to the yoke, the hook 61 engages the end of a pin 66 which is disposed in a bore 67 in the block 57 and urged rearwardly by a spring 68. The forward end of the pin is adapted to project into the notch 65 in the yoke arm 56 as the actuating arm is retracted. This locks the yoke against turning about the axis 10. Then, when the arm is moved to couple to the yoke arm 56, the pin is pushed out of the notch 65 by the hook and the yoke and dressing tool are freed for oscillation about the axis 9. There is a pin 66 at each end of the locking plate 62 coacting with the hook 61 in each limit position of the actuating arm.

Operation of the improved dressing device in either of the forms above described involves the same manipulation of the handle 33. For convenience, the operation will be described with reference to the form shown in Figs. 1 to 8, assuming that the wheel has been dressed previously to the desired contour and is now to be redressed. As a preliminary, the dressing device is moved into operative position with the tool disposed below the center of the wheel as shown in Fig. 4. Next the wheel is lowered to produce the desired depth of cut, the point 1 being disposed to one side of the wheel, for example the right hand side.

Assuming that the parts are disposed as shown in Figs. 1, 3 and 7, the point 1 will be at the outer end of the arc 4, the actuating arm 31 will be retracted from the slot 34 and hanging downwardly, and the pin 48 will project into the notch 45 locking the shaft 11 against turning. At this time, the axis of the shaft 8 will occupy its right hand position indicated at 9^1 in Fig. 7. With the wheel rotating, the actuating arm is first swung to the left slowly to the dotted position shown in Fig. 7 where it will encounter the stop 36. In this movement to the position shown in full lines in Fig. 6, the point 1 moves laterally and about the axis 9^1 across the arcuate surface 4 to the point 6 of tangency. A convex surface is thus formed on the wheel.

Next, the actuating arm is pushed forwardly into the slot 34 (Fig. 4) and is thereby coupled to the shaft 11. In this movement, the active portion of the pin 48 is pushed out of the notch 45 and the notch 51 in the pin is brought into register with the plate 37 thereby freeing the shaft 11 to swing with the arm. Also, the bar 39 is projected through the notch 41 and the notch 42 therein is brought into alinement with the plate 37. The device is now conditioned for movement of the dressing point about the axis 10 to true the concave surface 3. This is effected simply by moving the actuating arm reversely from the full line position to the dotted line position shown in Fig. 6. The motion is terminated at the proper point 7 by engagement of the arm with the stop 35, the axis of the shaft 8 having been shifted to its left hand position 9^2.

To condition the device for dressing of the surface 5, the arm 31 is retracted from the slot 34 as an incident to which the bar 39 is withdrawn through the notch 40 and the pin 48 moved by the spring 49 into the notch 46 thereby locking the shaft 11. Then, the arm is swung to the left to vertical position carrying the dressing point about the axis 9^2 and in a convex path to the left side of the wheel. One pass across the wheel is thus completed. If additional passes are to be made, the wheel is usually set down a small increment and the operations described above repeated but in reverse order.

Although the wheel surface 3 is of a different radius and of a different shape than the adjacent surfaces 4 and 5, the dressing tool is always maintained at the same angle, ninety degrees herein, relative to the surface it is truing. This angle is maintained by virtue of the fact that in each of its three movements the dressing point moves about a fixed axis, either 10, 9^1 or 9^2. The relation does not change during the transfer of the dressing point from one curve to the other because the transfer is made with the point disposed at the point of tangency of the two curves. As a result, the curves join to form a continuous smooth surface across the wheel periphery.

The transfer points are defined accurately by the limit stops for the actuating arm. These stops coacting with the various interlocks make it impossible to move the dressing point accidentally beyond the proper position or to shift from one axis to the other in the course of dressing any one of the three arcuate surfaces. Thus, the device is foolproof in operation and the interlocks as well as all of the movements of the dressing point are controllable by a single hand lever.

It will be observed that the radii of the arcs 3, 4 and 5 may be changed as desired so long as the two are varied by equal amounts. This may be accomplished simply by adjusting the screw 29 which moves the dressing point closer to one of the axes 9^1 and 9^2 and away from the other by a corresponding amount.

I claim as my invention:

1. In a wheel dressing device, the combination of a support pivoted to swing about one axis, a tool holder mounted on said support to swing independently about a parallel axis, a dressing tool carried by said holder, an actuating member pivoted on said holder to swing about a transverse axis and couple the member to or uncouple it from said support for movement of the support by the member, an arcuate stationary plate including the arc of movement of said member about one of said axes, and a transverse shoulder on said member coacting with said plate to hold said member in coupled position during a predetermined arc of movement and then to pass the plate when the member is uncoupled.

2. In a wheel dressing device, the combination of a support pivoted to swing about one axis, a tool holder mounted on said support to swing independently about a parallel axis, a dressing tool carried by said holder and movable along tangent arcuate paths during swinging of said holder and support respectively, an actuating member pivoted on said holder to swing about a transverse axis and couple the member to or uncouple it from said support, a pin for locking said support against turning, and means actuated by the coupling and uncoupling movements of said member to move said pin to inactive and active positions respectively.

3. In a wheel dressing device, the combina-

tion of a support pivoted to swing about one axis, a tool holder mounted on said support to swing independently about a parallel axis, a dressing tool carried by said holder and movable along tangent arcuate paths during swinging of said holder and support respectively, an actuating member pivoted on said holder to swing about a transverse axis and couple the member to or uncouple it from said support, means to prevent shifting of said member about said transverse axis except when said tool is at the point of tangency of said paths, a pin movable between active and inactive positions to lock said support against turning or to release the support, and means actuated by the coupling and uncoupling movements of said member to move said pin to inactive and active positions respectively.

4. In a wheel dressing device, a dressing point, means supporting said point to swing about spaced parallel axes in arcuate paths tangent to each other, an actuating member mounted to swing said supporting means about either of said axes and to swing about a transverse axis to select one or the other of said paths, and means coacting with said member during movement of the point about either selected path to lock the member against movement about said transverse axis, said locking means being released when said point is disposed at the point of tangency of said paths.

5. In a wheel dressing device, a dressing point, means supporting said point to swing about spaced parallel axes, an actuating member mounted to swing said supporting means about either of said axes and to swing about a traverse axis between two positions, means coacting with said member in one of said positions to lock the same against movement about one of said first mentioned axes and in the other position to prevent swinging of the member about the other axis, and means locking said member against movement about said transverse axis except when said point is in a predetermined angular position.

6. In a wheel dressing device, a dressing point, means supporting said point to swing about spaced parallel axes, an actuating member mounted to swing said supporting means about either of said axes and to swing independently of the supporting means about a transverse axis between two positions, and means coacting with said member in one of said positions to lock the same against movement about one of said first mentioned axes and in the other position to prevent swinging of the member about the other axis.

7. Mechanism for truing the periphery of a rotary grinding wheel having, in combination, a member mounted to rotate about an axis disposed generally tangentially relative to said wheel, a shaft journaled in said member to turn about an axis parallel to said first axis and having opposite ends projecting from the member, a dressing tool carried by one of said ends and movable across the wheel periphery by oscillation of said member or said shaft, an actuating arm pivoted on the other end of said shaft to swing about a transverse axis, and interengaging lugs between said arm and said member operable by swinging of the arm about said third axis to couple the arm to said member or to release the arm therefrom for independent oscillation of the shaft.

8. Mechanism for truing the periphery of a rotary grinding wheel having, in combination, a member mounted to rotate about an axis disposed generally tangentially relative to said wheel, a shaft journaled in said member to turn about an axis parallel to said first axis and having opposite ends projecting from the member, a dressing tool carried by one of said ends and movable across the wheel periphery by oscillation of said member or said shaft, an actuating arm pivoted on the other end of said shaft to swing about a third transverse axis, interengaging lugs between said arm and said member operable by swinging of the arm about said third axis to couple the arm to said member or to release the arm therefrom for independent oscillation of the shaft, and means automatically responsive to release of said arm from said member to lock the latter against turning.

9. In a wheel dressing device, a dressing point, a support therefor swingable about spaced parallel axes to move the point along tangent arcuate paths, an actuating member mounted to swing said support about either of said axes and for movement independently of said support to select one or the other of said paths, and means coacting with said member to lock it against said independent movement during movement of said point along a selected path but to release the member when said point reaches the point of tangency of said paths.

10. Mechanism for truing a rotary grinding wheel having, in combination, a dressing point, means supporting said point for engagement with the periphery of said wheel and for oscillation about spaced axes and in arcuate paths tangent to each other, and means limiting the movement of said point in one direction along one of said paths to the point of tangency between the paths while permitting continued movement of the point in the same direction past said tangent point and along the other of the paths.

11. Mechanism for truing a rotary grinding wheel having, in combination, a dressing point, means supporting said point for engagement with the periphery of said wheel and for oscillation about spaced axes and in arcuate paths tangent to each other, means limiting the movement of said point in one direction along one of said paths to the point of tangency of the paths while permitting continued movement about the other axis, and means limiting reverse movement of said point about said last mentioned axis to said point of tangency while permitting continued movement about the first axis.

12. Mechanism for truing a rotary grinding wheel having, in combination, a dressing point, means supporting said point for engagement with the periphery of said wheel and for oscillation about spaced axes and in arcuate paths tangent to each other, a single actuating member, and mechanism actuated by selective movements of said member to cause said point to move successively along said arcuate paths about the different axes.

13. Mechanism for truing a rotary grinding wheel having, in combination, a member mounted to turn on an axis extending generally tangentially of said wheel, a bar mounted on said member to turn about an axis offset laterally from said first axis, said bar having a projecting end offset from said second axis and disposed adjacent said first axis, and a dressing tool engageable with the periphery of said wheel and projecting laterally from said bar end.

14. Mechanism for truing a rotary grinding wheel having, in combination, a member mounted to turn on an axis extending generally tangentially of said wheel, a tool holder mounted

on said member to turn about an axis offset laterally from said first axis, and a dressing tool on said holder engageable with said wheel.

15. Mechanism for truing a rotary grinding wheel having, in combination, a member mounted to turn on an axis extending generally tangentially of said wheel, a holder mounted on said member to turn about an axis offset laterally from said first axis, and a dressing point on said holder positioned for engagement with the wheel periphery along paths disposed between said axes.

16. A wheel dressing device having, in combination, a dressing tool, means supporting said tool for movement successively along tangent arcuate paths of different curvature while maintaining a constant angle between the tool and the path being traversed, actuating means for said supporting means operable selectively when said tool is at the point of tangency of said paths to transfer the movement from one path to the other, and interlocking means operable automatically to prevent deviation of the dressing tool at any time from the path being traversed.

17. A wheel dressing device having, in combination, a dressing tool, means supporting said tool for movement successively along tangent arcuate paths of different curvature, actuating means for said supporting means operable selectively when said tool is at the point of tangency of said paths to transfer the movement of said point from one of said paths to the other, and locking means acting selectively to confine movement of said tool to the path being traversed at any one time.

18. A wheel dressing device having, in combination, a dressing tool, means supporting said tool for movement successively along tangent arcuate paths of reverse curvatures while maintaining the tool at a fixed angle to the path being traversed, actuating means operable selectively to transfer the tool motion from one of said paths to the next, and means rendered operative as an incident to transfer of said tool from one path to the other and operable to confine the tool movement positively to the path being traversed while permitting reversal of the tool movement along the selected path.

19. In a wheel dressing device, the combination of a support pivoted to swing about one axis, a tool holder on said support to swing independently about a parallel axis, a dressing tool carried by said holder, and an actuating member for oscillating said holder mounted for independent movement longitudinally of said axes to lock said holder and support together for oscillation in unison about said second axis.

20. In a wheel dressing device, the combination of a support pivoted to swing about one axis, a tool holder on said support to swing independently about a parallel axis, a dressing tool carried by said holder, an actuating member for oscillating said holder mounted for independent movement longitudinally of said axes to lock said holder and support together for oscillation in unison about said second axis, a locking element on said member providing a transverse notch, and a stationary plate coacting with said notch to hold the member coupled to said support during a predetermined oscillation thereof and then to free the member for uncoupling from the support.

21. Mechanism for truing the periphery of a rotary grinding wheel having, in combination, a shaft mounted to rotate about an axis disposed generally tangentially relative to said wheel, a second shaft journaled in said first shaft to turn about an axis parallel to said first axis and having opposite ends projecting from the first shaft, a dressing tool carried by one of said ends and movable across the wheel periphery by oscillation of either of said shafts, and actuating means connected to the other end of said second shaft and operable selectively to turn either one of said shafts.

22. A wheel dressing device having, in combination, a support, a yoke straddling said support and pivoted thereon, a tool holder pivoted on said yoke to turn about an axis parallel to the yoke pivot, said holder having an end offset substantially into alinement with said yoke pivot, a dressing point mounted on said offset end, and actuating means connected to the opposite end of said holder and operable selectively to swing said yoke or said holder about their respective axes.

23. A wheel dressing device having, in combination, a dressing tool, means supporting said tool for movement successively along tangent arcuate paths of different curvatures, actuating means for said tool supporting means, and means controlling the motion of said actuating means to maintain a continuous directional motion of said tool across the point of tangency of said arcuate paths and in only one of said paths at any time.

24. In a wheel dressing device having, in combination, a dressing tool, means supporting said tool for movement successively along tangent arcuate paths each described by rotation about predetermined centers, actuating means for said tool supporting means operable selectively to shift the tool movement successively from one center to the other, and means operable automatically to restrict the motion of the tool by said actuating means to the selected one of said centers.

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