Jan. 25, 1944. W. B. LOCKE 2,340,192

DRESSING MECHANISM

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Fig. 1.

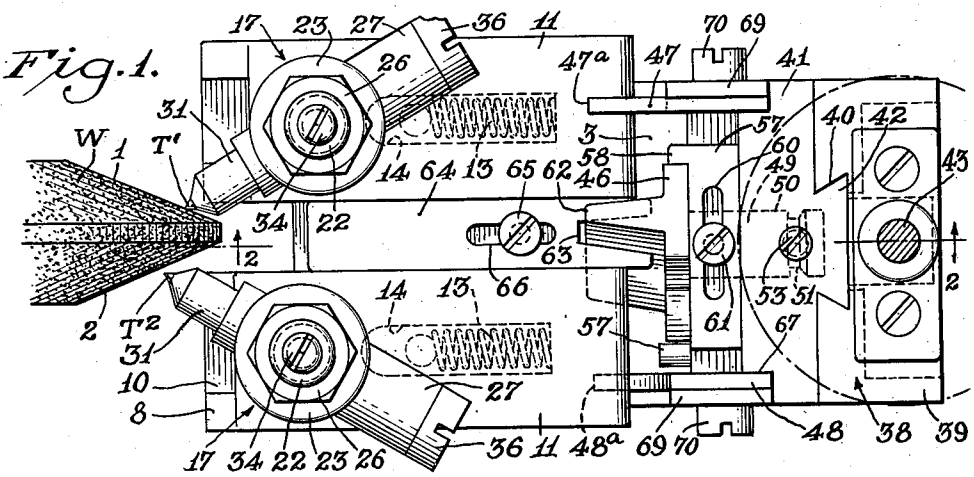


Fig. 2.

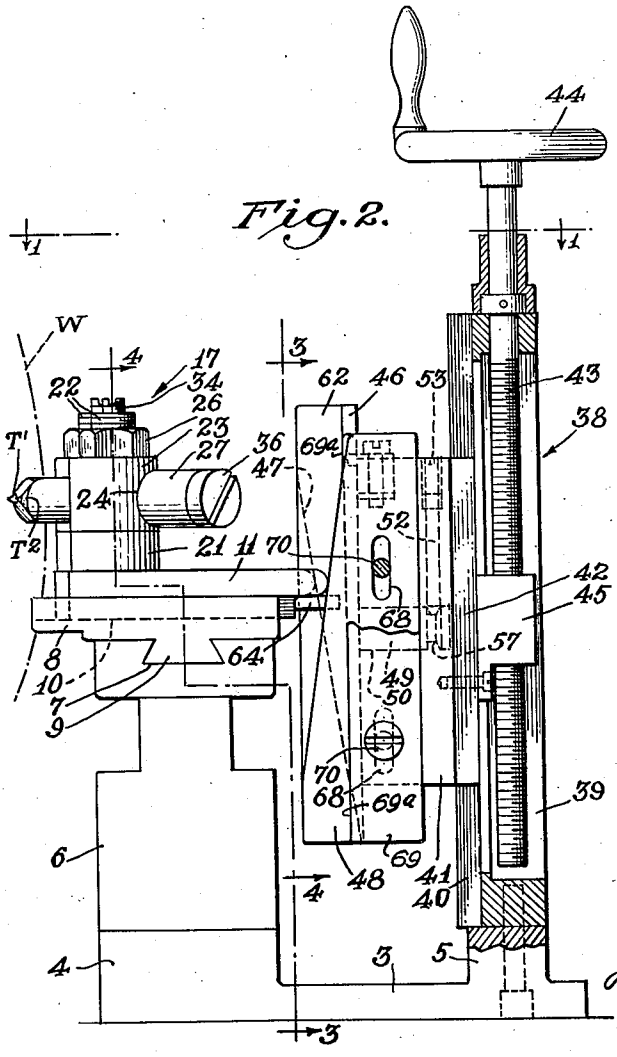
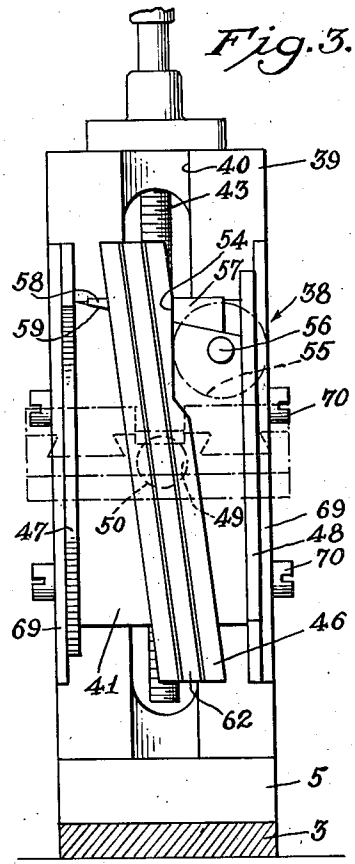


Fig. 3.



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Fig. 4.

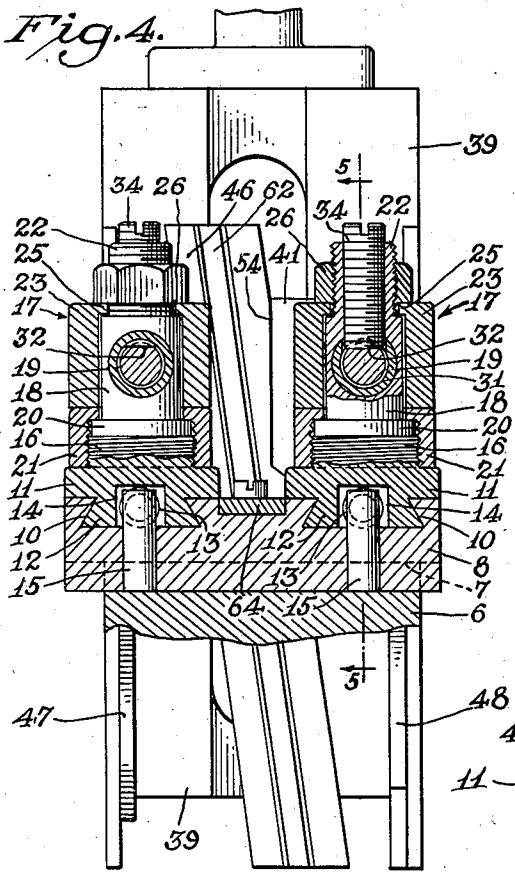


Fig. 6.

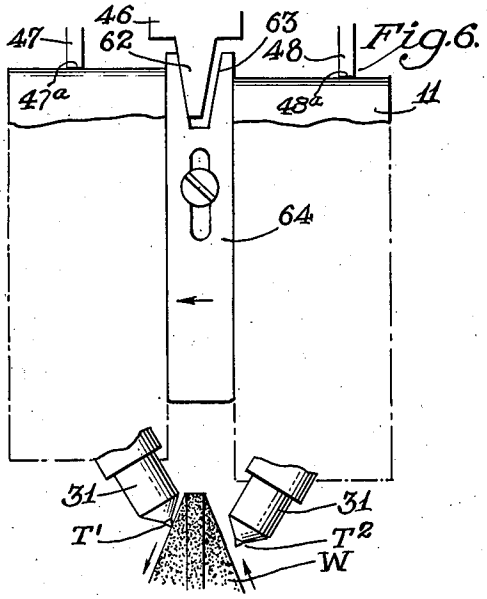


Fig. 7.

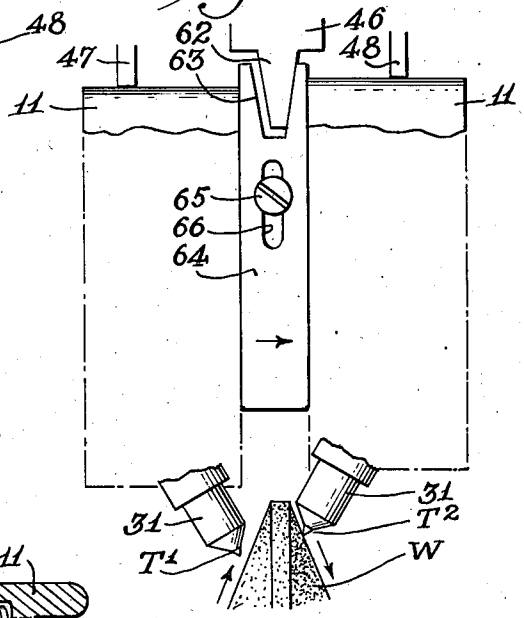
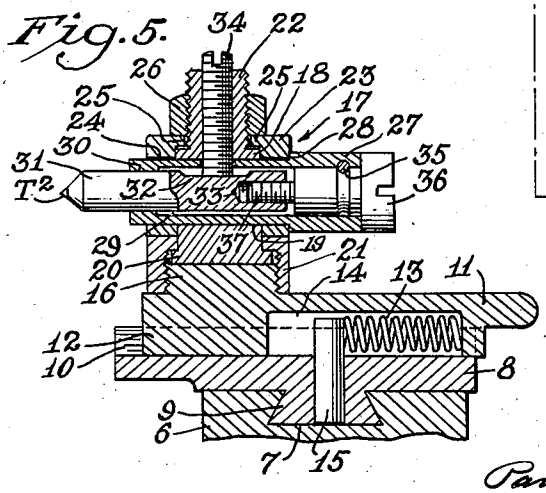


Fig. 5.



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UNITED STATES PATENT OFFICE

2,340,192

DRESSING MECHANISM

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Application January 1, 1942, Serial No. 425,296

15 Claims. (Cl. 125—11)

The present invention relates to improvements in dressing mechanisms for grinding wheels and has particular reference to a dressing mechanism for dressing a single rib thread form on the external periphery of a grinding wheel adapted for use in thread grinding machines to grind a complemental thread form on the periphery of a workpiece.

One of the objects of the invention is to provide a novel dressing mechanism including an adjustable sine bar for translating the dressing tool in one direction and cam means for simultaneously translating the dressing tool in a perpendicular direction so as to cause the tool to describe a path of predetermined configuration.

Another object is to provide a new and improved dressing mechanism of the foregoing character including a lost motion connection between the sine bar and the dressing tool so that the paths of movement of said tool in opposite directions will be similar but displaced from each other.

Other objects and advantages will become apparent as the description proceeds.

In the accompanying drawings:

Figure 1 is a plan view partially in section along line 1—1 of Fig. 2 of a dressing mechanism embodying the features of my invention.

Fig. 2 is a side elevational view partially in vertical section along line 2—2 of Fig. 1 of the dressing mechanism.

Fig. 3 is a vertical sectional view taken along line 3—3 of Fig. 2.

Fig. 4 is a fragmentary vertical sectional view taken along the broken line 4—4 of Fig. 2.

Fig. 5 is a fragmentary detail sectional view taken along line 5—5 of Fig. 4.

Figs. 6 and 7 are fragmentary plan views of the dressing mechanism illustrating the cycle of operation.

While the invention is susceptible of various modifications and alternative constructions, I have shown in the drawings and will herein describe in detail the preferred embodiment, but it is to be understood that I do not thereby intend to limit the invention to the specific form disclosed, but intend to cover all modifications and alternative constructions falling within the spirit and scope of the invention as expressed in the appended claims.

Referring more particularly to the drawings, the dressing mechanism constituting the exemplary embodiment of the invention is adapted to be mounted as a unit on a suitable support, such as a dresser slide (not shown), for movement into active relation with the periphery of a grinding wheel W, and has two dressing tools T_1 and T_2 for dressing the opposite flanks 1 and 2 of the wheel. The periphery of the grinding wheel W is generally of V contour, but it is to be understood that the specific contour may be varied as required for grinding threads of different forms, such as sharp V, U. S. Standard, Acme, Whitworth, etc. Thus, the periphery may be sharp, truncated or rounded at the apex and also at the base.

The dressing mechanism comprises a base plate 3 having spaced front and rear pedestals 4 and 5. The front pedestal 4 supports the dressing tools T_1 and T_2 for joint movement generally longitudinally of the axis of the grinding wheel W, and for independent movement generally transversely of the axis, so that each tool describes a path which is the resultant of two movements. By varying the component movements, various configurations are obtainable on the wheel W to grind any desired complementary thread form in the work.

The tool support comprises a riser block 6 fixed on the pedestal 4, and formed at the top with a dovetail guideway 7 extending generally longitudinally of the grinding wheel axis. A slide 8 is mounted on the block 6, and has a dovetail guide 9 adjustably disposed within the guideway 7. The longitudinal slide 8 is formed in the top with two parallel dovetail guideways 10 extending transversely of the guideway 7. Two similar tool slides 11 are mounted on the slide 8, and have dovetail guides 12 slidably disposed in the guideways 10. Each of the slides 11 is urged resiliently in a direction away from the grinding wheel W. In the present instance, the means for this purpose comprises a coil compression spring 13 disposed within a longitudinal groove 14 in the underside of the associated slide. The forward end of the spring 13 abuts against a pin 15 projecting upwardly from the longitudinal slide 8, and the rear end abuts against the rear end of the groove 14.

The forward end portion of each transverse slide 11 is formed with an upstanding externally threaded boss or projection 16 supporting a dressing tool holder 17 for swivel adjustment. A cylindrical body or post 18, having a diametrical bore 19, is mounted vertically on the projection 16. The post 18 has a circular base flange 20 confined in position for rotary or swivel adjustment by means of a flanged nut 21 threaded onto the projection 16. Projecting axially from the upper end of the post 18 is a threaded stud 22.

A tubular spacer 23, having diametrically opposite openings 24 in alinement with the bore 19, encircles the post 18, and bears at its lower end against the top of the nut 21. The upper end of the spacer 23 has an internal flange 25 encircling the stud 22, and engaging over the upper edge of the post 18. A lock nut 26 is threaded onto the stud 22 against the flange 25, and when tightened serves to secure the holder 17 rigidly in position of angular adjustment.

A sleeve 27 extends through the bore 19 in the post 18 and the openings 24 in the spacer 23, and is located in endwise position by a shoulder 28. The sleeve 27 is formed with an axial bore 29 which at the forward end is slightly reduced in size to provide a guide 30. Projecting slidably through the guide 30 into the bore 29 is a tool shank 31 with a flat face 32 in the top side and an axial threaded bore 33 in the inner or rear end. One of the diamond dressing tools T_1 or T_2 is conventionally mounted on the projecting forward end of the shank 31. A locking screw 34 extends from the top axially through the post 18 into end engagement with the flat face 32, and serves to confine the shank 31 against rotation and when tightened to lock the shank rigidly in axial position. Rotatably confined by means of a key 35 in the rear end of the bore 29, and having a head 36 bearing against the rear end of the sleeve 27, is an adjusting screw 37 in threaded engagement with the bore 33 in the inner end of the tool shank 31.

It will be understood that the two tool holders 17 are alike in construction. In each instance, the tool shank 31 may be adjusted axially by releasing the screw 34 and rotating the screw 37, and then may be locked in adjusted position by tightening the screw 34. Also, the tool shank 31 may be adjusted into the proper angular position in relation to the grinding wheel W by loosening the nut 26 and swiveling the post 18. When the nut 26 is tightened, the plug 18 is securely locked in position. Since the two tools T_1 and T_2 are arranged respectively to dress the inclined flanks 1 and 2 of the grinding wheel W, they are normally inclined in opposite directions so as to provide cutting clearance.

The dressing tools T_1 and T_2 are translated through their cycles by an actuating mechanism 38 mounted on the rear pedestal 5, and coacting with the longitudinal slide 8 and the transverse slides 12. Each tool is caused to dress the related flank only upon movement from the apex to the base of the wheel form, and to avoid contact with the flank during the return movement. The two tools are arranged to dress the related wheel flanks in alternate strokes, so that as either tool moves inwardly in its dressing stroke, the other tool moves outwardly in its free return stroke.

In its preferred form, the actuating mechanism 38 comprises a vertical frame 39 bolted to the pedestal 5, and formed on the front with a vertical dovetail guideway 40. A slide 41, having a guide 42 in engagement with the guideway 40, is vertically adjustable on the frame 39. Any suitable means may be provided for translating the slide 41, and in the present instance this means comprises a vertical screw 43 rotatably anchored in the upper end of the frame 39, and having a hand wheel 44. The screw 43 extends through threaded engagement with a nut 45 on the rear of the slide 41.

The actuating slide 41 carries an angularly adjustable sine bar 46 for translating the longitudinal tool slide 8, and two cam bars 47 and 48 of selected contour for translating or controlling the transverse tool slides 11. It will be understood that the angular disposition of the sine bar 46 and the shape of the cam bars 47 and 48 determine the coordinated actuation of the slides 8 and 11, and therethrough the contour produced on the grinding wheel W by the dressing tools T_1 and T_2.

The sine bar 46 is disposed against the flat front face of the slide 41, and has a pivot pin 49 substantially midway of its ends. This pin extends rotatably into a bore 50 in the front of the slide 41, and is formed with a peripheral spline groove 51. A locking pin 52 extends vertically through the slide 41 into the groove 51, and is adapted to be tightened by a lock screw 53. When the screw 53 is released, the sine bar 46 may be adjusted into the desired angular position.

To locate and hold the sine bar 46 accurately in adjusted position before tightening the pin 52, one side of the bar is formed with an abutment surface 54 adapted to be held against the periphery of a gauge disk 55 of selected diameter removably mounted on a pin 56 on the front of the slide 41. The size of the gauge disk 55 for given cams 47 and 48 determines the angularity of the sine bar 46, and hence the included angle between the flanks 1 and 2 of the wheel W. For example, a gauge disk 55 of a given diameter will result in an included angle of 30°. Another disk of larger outside diameter will result in an included angle of 60°. By appropriate selection of disks of different diameters, different included angles are obtainable.

The surface 54 is held temporarily against the gauge disk 55 by means of a latch member 57 in the form of a wedge-shaped plate having a hook 58 on one end adapted to engage the opposite side edge of the sine bar 46. The plate 57 is slidably adjustable on the upper inclined end surface 59 of the vertical slide 41, and is formed with a longitudinal slot 60. A clamp bolt 61 extends through the slot 60 into threaded engagement with the slide 41, and when tightened serves to secure the latch member 57 in position of adjustment. When the sine bar 46 is accurately located, the screw 53 is tightened to force the pin 52 into the groove 51. The rear side of the groove 51 and the corresponding side of the pin 52 are wedge-shaped so that the sine bar 46 is clamped tightly against the front face of the slide 41.

The sine bar 46 is formed on its front face with a medial longitudinal rib 62 of uniform truncated triangular form in cross section. The rib 62 is adapted to engage in a notch or bifurcation 63 of complemental shape in the rear end of the plate 64 on the longitudinal tool slide 8. In the present instance, the plate 64 is mounted on the slide 8 between the tool slides 11 for selective adjustment toward and from the sine bar 46. A bolt 65, extending through a longitudinal slot 66 in the plate 64 into threaded engagement with the slide 8, serves when tightened to secure the plate rigidly in adjusted position.

It will be evident that upon vertical movement of the sine bar 46, the slide 8, and hence the dressing tools T_1 and T_2, will be translated crosswise of the grinding wheel W. Upon downward movement of the bar 46, one side thereof will engage the adjacent side of the notch 63 to move the slide 8 from right to left (Fig. 6). Upon upward movement of the bar 46, the opposite side thereof will engage the other side of the notch 63 to move the slide 8 from left to right (Fig. 7).

The notch 63 is somewhat wider than the rib 62, although the sides of the two have substantially the same included angle. Consequently, a lost motion is provided between the rib 62 and the plate 64. This lost motion is effective at each reversal of the sine bar 46 to cause the longitudinal tool slide 8 to dwell until the inclined rib 62 in its reverse movement engages the opposite side of the notch 63. The lost motion may be varied as desired by adjusting the plate 64 to alter the depth or degree of engagement between the rib 62 and the notch 63.

The cams 47 and 48 for actuating the tool slides 11 consist of flat plates adjustably secured to opposite sides of the vertical slide 41, and formed on the forward edges with longitudinal cam faces 47*a* and 48*a* of desired configuration. Preferably, each of the cam plates 47 and 48 is seated for longitudinal adjustment in a square vertical notch 67 in one side or the other of the slide 41, and is formed with two longitudinal slots 68. A side plate 69 is positioned against the cam plate within the notch 67. Bolts 70 carried by the side plate 69 extend through the slots 68 into threaded engagement with the slide 41, and when tightened serve to clamp the cam plate rigidly in position of adjustment.

The rear ends of the tool slides 11 are straight transversely of the cam plates 47 and 48 and are rounded in a vertical plane for engagement respectively with the cam faces 47*a* and 48*a* in all positions of the slide 8. It will be understood that the springs 13 act to maintain the rear rounded ends of the slides 11 always in cooperative engagement with the cam faces 47*a* and 48*a*. Consequently, vertical movement of the cam plates 47 and 48, with the sine bar 46, by the slide 41, will cause the tools T_1 and T_2 to move in a predetermined pattern.

The cam faces 47*a* and 48*a* are oppositely inclined so that as one tool moves inwardly in its cutting stroke, the other tool moves outwardly in its free return stroke. The configuration may be varied as required to form the flanks 1 and 2 of the grinding wheel W to grind a complemental thread of any desired form in the workpiece. In the present instance, the cam faces 47*a* and 48*a* are straight and inclined. The side plates 69 also have a cam function and determine the maximum radial retraction of the respective dressing tools T_1 and T_2. More particularly, they have straight vertical faces 69*a* along their forward edges. By adjusting the cams 47 and 48 longitudinally, as permitted by the slots 68, the ends of the faces 69*a* at the points of greatest retraction of the faces 47*a* and 48*a* can be arranged to define vertical end portions, varying in extent from zero to maximum, for controlling the position of the dressing tools when fully retracted. Assuming that the cams 47 and 48 are adjusted as shown in Fig. 2 to utilize the ends of the faces 69*a*, these cams and the plates 69 will cause the tools to produce a truncated form with inclined flanks 1 and 2 on the wheel W. The degree of adjustment will determine the width of the end face on the form. If the cams 47 and 48 are adjusted to remain fully in control, a V form will be produced on the wheel W.

In operation, assume that the slide 41 is in its lowermost position. In this position, the dressing tool T_1 is located at the base of the flank 1, and the tool T_2 is located in fully retracted position to the left of the flat face of the wheel W. Upon reversing the screw 43 to initiate the upward movement of the slide 41, the slide 8 remains stationary until the lost motion between the sine rib 62 and the groove 63 is taken up. During this dwell period, the tool T_1 is retracted from the flank 1. In the continued movement of the slide 41, the slide 8 is moved from left to right (Fig. 7), and the tool T_1 is simultaneously moved outwardly in parallel spaced relation to the flank 1. The tool T_2 is initially shifted across the flat or truncated face of the grinding wheel W, and is then moved inwardly to dress the flank 2 from the apex to the base. During the end portion of this movement, the tool T_1 is moved across the flat or truncated face of the wheel W. It will be understood that the movement of the tools T_1 and T_2 across the end face is controlled by the vertical end portions of the cam faces 47*a* and 48*a*, and that the radial movement thereof is controlled by the inclined portions of the faces.

At the end of the upward movement, the screw 43 is reversed to initiate the return movement of the slide 41. Again, the lost motion is taken up between the rib 62 and the notch 63, during which period the tool T_2 is retracted from the flank 2. In the continued movement of the slide 41, the tool T_2 is moved outwardly in spaced relation along the flank 2 and then across the end face of the wheel W into initial position, and simultaneously the tool T_1 is moved across the end face and then inwardly to dress the flank 1 from the apex to the base (Fig. 6).

I claim as my invention:

1. A dressing mechanism for a rotary grinding wheel comprising, in combination, a support, a first slide mounted for reciprocation on said support longitudinally of the grinding wheel axis, a cross slide mounted for reciprocation on said first slide transversely of said axis, a post mounted on said cross slide for angular adjustment about an axis perpendicular to said slides and being formed with a diametrical bore, means for clamping said post in position of adjustment, a tool shank supporting a dressing tool and extending into said bore, means for adjusting said tool shank longitudinally in said bore, and operating means for translating said slides simultaneously in predetermined timed relation.

2. A dressing mechanism for a rotary grinding wheel comprising, in combination, a support, a first slide mounted for reciprocation on said support longitudinally of the grinding wheel axis, a cross slide mounted for reciprocation on said first slide transversely of said axis, a tool holder mounted on said cross slide for angular adjustment about an axis perpendicular to said slides, means for clamping said holder in position of rotary adjustment, a tool shank supporting a dressing tool and mounted on said holder, means for adjusting said tool shank on said holder transversely of the axis of said holder, and operating means for translating said slides simultaneously in predetermined timed relation.

3. A dressing mechanism for a grinding wheel comprising, in combination, a support, a first slide mounted on said support for movement generally in the direction of the wheel axis, a second slide mounted on said first slide for movement generally perpendicular to said axis, a third slide mounted on said support for movement perpendicularly to said first mentioned slides, a longitudinal sine bar mounted on said third slide for pivotal adjustment into different relative angular positions and having a rib coacting with said first slide to actuate the latter in timed relation to the movement of said third slide, and a rectilinear cam member mounted on said third

slide and coacting with said second slide in all positions of said first slide to actuate said second slide in timed relation to the movements of said third slide.

4. A dressing mechanism for a grinding wheel comprising, in combination, a support, a first slide mounted on said support for movement generally in the direction of the wheel axis, a second slide mounted on said first slide for movement generally perpendicular to said axis, a third slide mounted on said support for movement perpendicularly to said first mentioned slide, a longitudinally inclined sine bar mounted on said third slide and coacting with said first slide to actuate the latter in timed relation to the movement of said third slide, and a cam member mounted on said third slide and coacting with said second slide in all positions of said first slide to actuate said second slide in timed relation to the movements of said third slide.

5. A dressing mechanism for a grinding wheel comprising, in combination, a support, a slide mounted on said support for reciprocation in a predetermined direction, a dressing tool mounted on said slide, a plate mounted on said slide for transverse adjustment and being formed in one end with a truncated V-shaped notch, a second slide mounted on said support for reciprocation perpendicularly to said first mentioned slide, a longitudinal sine bar mounted on said second slide and having a truncated triangular rib engaging in said notch, said rib being complemental in shape to but narrower in width than said notch whereby to provide a lost motion engagement, the adjustment of said plate permitting variation of said lost motion, and means for reciprocating said second slide, with said first slide dwelling at each reversal during the take-up of said lost motion.

6. A dressing mechanism for a grinding wheel comprising, in combination, a support, a slide mounted on said support for reciprocation in a predetermined direction, a dressing tool mounted on said slide, means on said slide defining a notch, a second slide mounted on said support for reciprocation perpendicularly to said first mentioned slide, a longitudinally inclined sine bar mounted on said second slide and having a rib engaging in said notch, said rib being narrower in width than said notch whereby to provide a lost motion engagement, and means for reciprocating said second slide, with said first slide dwelling at each reversal during the take-up of said lost motion.

7. A dressing mechanism for a grinding wheel comprising, in combination, a support, a first slide mounted on said support, a dressing tool mounted on said slide, a second slide mounted on said support for movement perpendicularly to said first slide, a sine bar mounted on said second slide and coacting with said first slide, said sine bar having a pivot intermediate its ends rotatable in said second slide and formed with a peripheral wedge groove, gauge means for locating said sine bar in selected angular position, and wedge means engageable with said groove to clamp said sine bar securely against the face of said second slide.

8. A dressing mechanism for a grinding wheel comprising, in combination, a support, a first slide mounted on said support, a dressing tool mounted on said slide, a second slide mounted on said support for movement perpendicularly to said first slide, a sine bar mounted on said second slide and coacting with said first slide, said sine bar having a pivot intermediate its ends rotatable in said second slide and formed with a peripheral wedge groove, a removable gauge disk on said second slide for locating said sine bar in selected angular position, adjustable means for confining one edge of said bar against the periphery of said disk, and wedge means engageable with said groove to clamp said sine bar securely against said second slide.

9. A dressing mechanism for a grinding wheel comprising, in combination, a support, a first slide mounted on said support for reciprocation generally longitudinally of the grinding wheel axis, a second slide mounted on said first slide for transverse movement, a dressing tool having a shank mounted on one end of said second slide for angular adjustment, the other end of said second slide having a straight lateral edge of rounded form, a third slide mounted on said support for movement perpendicularly to said first and second slides and said edge, a longitudinal cam member mounted on said third slide and having an inclined face engaging said rounded edge of said second slide to actuate the latter, means for maintaining said edge against said cam, and means operated in timed relation to said third slide for reciprocating said first slide.

10. A dressing mechanism for a grinding wheel comprising, in combination, a support, a first slide mounted on said support for reciprocation generally longitudinally of the grinding wheel axis, a second slide mounted on said first slide for transverse movement, a dressing tool having a shank mounted on one end of said second slide for angular adjustment, the other end of said second slide being rounded, spring means for urging said second slide in one direction, a third slide mounted on said support for movement perpendicularly to said first and second slides, a longitudinal cam member mounted on said third slide and having an inclined face engaging said rounded end of said second slide to actuate the latter in opposition to said spring means, and means operated in timed relation to said third slide for reciprocating said first slide.

11. A dressing mechanism for a grinding wheel comprising, in combination, a support, a first slide mounted on said support for movement longitudinally of the wheel axis, two parallel dresser slides mounted on said first slide for independent movement transversely thereof, two dressing tools mounted respectively on said dresser slides for angular and radial adjustment, an actuating slide mounted on said support for movement perpendicularly to said first slides, an angularly adjusted sine bar mounted on said actuating slide and coacting with said first slide to reciprocate the latter, two parallel cams mounted on said actuating slide and coacting with said dresser slides to reciprocate the latter in any position of said first slide, spring means for maintaining said dresser slides in engagement with said cams, and means for reciprocating said actuating slide.

12. A dressing mechanism for a grinding wheel comprising, in combination, a support, a first slide mounted on said support, a second slide mounted on said first slide for movement in a perpendicular direction, a third slide mounted on said support for movement perpendicularly to said first mentioned slides, a dressing tool carried by said second slide, means on said third slide coacting with said first slide to reciprocate the latter generally longitudinally of the wheel axis, and two cam bars mounted on said third

slide for relative longitudinal adjustment and coacting with said second slide to actuate the latter in timed relation to said first slide, one of said cam bars having a configurated cam face and the other of said cam bars having a longitudinal cam face adapted in various positions of relative adjustment between said faces to constitute an extension of said one face to determine the point of maximum retraction of said tool radially of said wheel.

13. A dressing mechanism for a grinding wheel comprising, in combination, a support, a first slide mounted on said support for movement generally in the direction of the wheel axis, a second slide mounted on said first slide for movement generally perpendicular to said axis, a third slide mounted on said support for movement perpendicularly to said first mentioned slides, means on said third slide engaging said first and second slides for translating the reciprocatory movement of said third slide into the respective reciprocatory movements of said first and second slides, and means for reciprocating said third slide.

14. A dressing mechanism for a grinding wheel comprising, in combination, a support, a first slide mounted on said support for movement generally in the direction of the wheel axis, a second slide mounted on said first slide for movement generally perpendicular to said axis, a third slide mounted on said support for movement perpendicularly to said first mentioned slides, means on said third slide engaging said first and second slides for translating the reciprocatory movement of said third slide into the respective reciprocatory movements of said first and second slides, and means for reciprocating said third slide, the translating means between said third and first slides including a lost motion relationship.

15. A dressing mechanism for a grinding wheel comprising, in combination, a support, a first slide mounted on said support for movement generally in the direction of the wheel axis, a second slide mounted on said first slide for movement generally prependicular to said axis, a third slide mounted on said support for movement perpendicularly to said first mentioned slides, means on said third slide engaging said first and second slides for translating the reciprocatory movement of said third slide into the respective reciprocatory movements of said first and second slides, means for reciprocating said third slide, and means for modifying the movement imparted to the second slide by the translating means between the second and third slide.

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