Aug. 28, 1951 W. A. HOIER 2,565,687

PRECISION WHEEL TRUING MECHANISM

Filed June 20, 1947 2 Sheets-Sheet 1

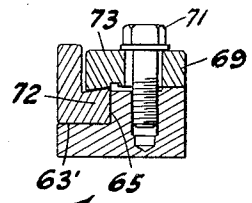

Fig. 5.

Fig. 1.

Fig. 6.

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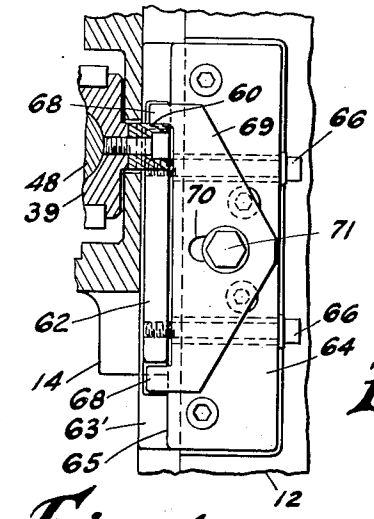


Fig. 4.

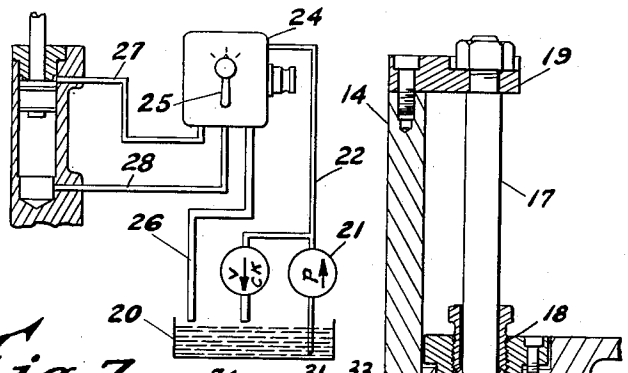


Fig. 7.

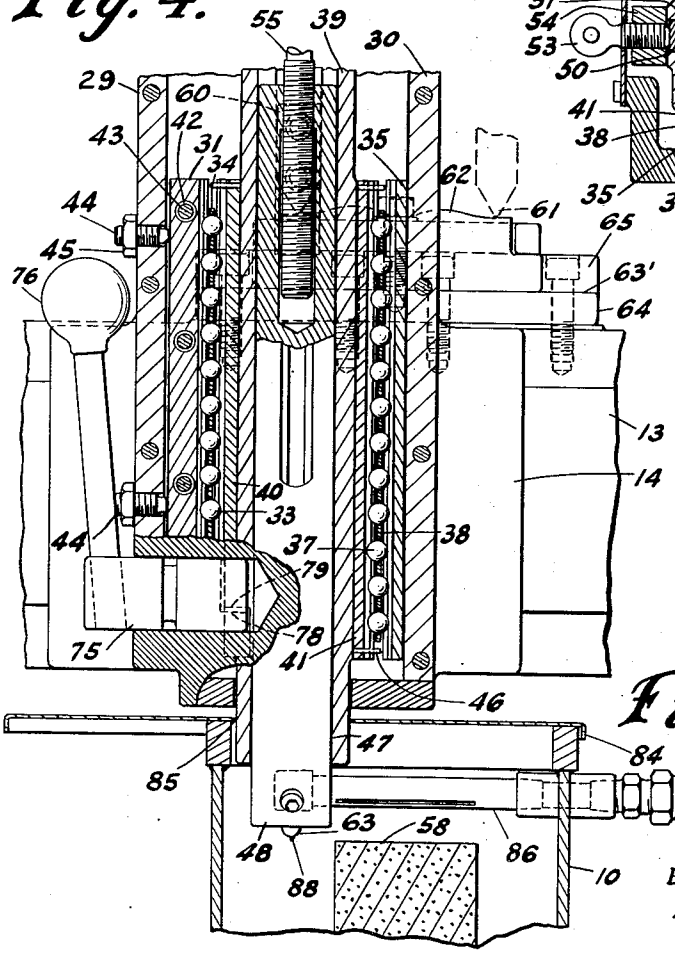
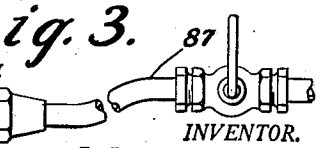


Fig. 2.

Fig. 3.



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PRECISION WHEEL TRUING MECHANISM

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5 Claims. (Cl. 125—11)

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This invention relates to improvements in wheel truing mechanism and has particular reference to an improved form of truing device adapted for use in proper formation of the surface of the grinding wheel of a precision grinding machine.

One of the principal objects of the present invention is the provision of a unitary mechanism capable of embodiment in and as a part of a grinding machine or applicable as a precision attachment to existing machines.

Another object of the present invention is the provision of a free floating mounting for a wheel truing mechanism which will facilitate the arcuate following of the shape pattern during high speed precision truing operations.

A further object of the invention is the provision of a sensitively operating truing mechanism particularly adapted for the performance of contour or profile truing operations.

A further object of the invention is the provision of improved control mechanism for effecting the necessary operations and adjustments of the truing device mechanism.

Other objects and advantages of the present invention should be readily apparent by reference to the following specification, considered in conjunction with the accompanying drawings forming a part thereof, and it is to be understood that any modifications may be made in the exact structural details there shown and described, within the scope of the appended claims, without departing from or exceeding the spirit of the invention.

Figure 1 represents a vertical sectional view of the truing mechanism as applied to the wheel housing of a grinding machine.

Figure 2 is a horizontal sectional view on the line 2—2 of Figure 1.

Figure 3 is a vertical sectional view at right angles to Figure 1 taken as on the line 3—3 of that figure.

Figure 4 is a fragmentary view partly in section and partly in plan as on the line 4—4 of Figure 1.

Figure 5 is a sectional view of an alternative form of cam clamp.

Figure 6 is a view in elevation of the profile cam and follower, the supporting parts being shown in section as on line 6—6 of Figure 1.

Figure 7 is a diagrammatic view of the hydraulic traversing means for the truing device.

In the drawings in which similar reference characters are employed to denote similar parts, the numeral 10 designates the wheel guard housing of a grinding machine which may, for example, be of the type shown in U. S. Letters Patent 2,367,759, it being understood that this housing is rigidly mounted on the bed of the grinding machine. Suitably mounted on the portion 11 of the housing is the base unit 12 of the present invention which is provided with the dovetail ways 13 for the transversely or horizontally movable slide unit 14. As shown in Figures 1 and 2, the member 12 has formed therein the cylinder chamber 15 receiving piston 16 whose rod 17 extends through the stuffing box members 18 forming a closure for the outer end of the cylinder. Terminally secured to this piston rod 17 is a drive plate 19 coupling the rod with slide 14 for transverse actuation thereof.

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As indicated in Figure 7, there is provided a hydraulic medium reservoir 20 from which actuating fluid is discharged by pump 21 into pressure conduit 22 extending to the valve block 24 containing a valve actuable by the handle 25 which in the intermediate position shown couples the pressure from line 22 with reservoir conduit 26. In its other positions of adjustment this valve connects the pressure conduit with either cylinder conduit 27 or cylinder conduit 28 and alternatively the other of these conduits with the reservoir, conduit, or exhaust line 26 so that the piston will be suitably actuated in one direction or the other for translation of the slide in accordance with the movement of control handle 25.

The slide is provided with a pair of flanges 29 and 30 forming a guide channel extending vertically or at right angles to the direction of movement of the slide as determined by the ways 13. Secured to the slide adjacent flange 29 is a guide rail 31 formed with a track or groove at 32 engageable with a series of anti-friction bearing members 33 maintained in spaced relation by the vertical cage or plate 34. Similarly secured to the flange 30 is the guide rail 35 having the track 36 for the anti-friction members 37 secured in spaced relation by the plate or cage 38. Mounted between the flange is the truing tool slide unit or housing 39 having secured to its sides the rails 40 and 41 provided with grooves to receive the anti-friction members 33 and 37. In order that the parts may be set up for the exact correct operating fit the rail 31 has fastener receiving apertures 42 formed therein slightly larger in diameter than the retaining bolts or studs 43, rendering same capable of transverse adjusting movement. This can best be effected by adjusting screws 44 carried by the flange 29 and abutting the guide bar 31 near its ends to effect exact desired positioning of same. When this has been effected the adjusting screws them-

selves are preferably locked as by nuts **45** and the rail then firmly secured by tightening of the bolts **43**.

With the parts in this position it will be noted that the unit or housing **39** is supported for extremely free vertical floating movement by the multiplicity of anti-friction bearing members **33** and **37** which, due to the relative adjustment of the outer guide bars firmly support the housing against any torsional or angular deflections. To retain the anti-friction members in proper position between the bars use is preferably made of the limiting pins **46** carried by the housing and engageable with the ball cages **34** and **38**.

As particularly indicated in Figure 2 the housing **39** is formed with the central cylindrical bore **47** to receive the truing tool holder **48** which is preferably cylindrical in form and provided at one side with a keyway **49** to receive the sliding key **50** mounted in slot **51** of the housing. Springs **52** serve to press the key inward into frictional interlocking engagement with the tool holder while a clamp screw **53** carried by removable block **54** on the side of the housing may be employed to force the key into tight clamping engagement with the tool holder. When this screw is loosened the tool holder may be longitudinally adjusted in the housing as by adjusting screw **55** swiveled in cap **56** at the top of the housing and provided with operating member or handle **57**. In this manner very fine incremental adjustments may be made on the tool holder longitudinally with respect to the housing, and it may be suitably locked in adjusted position to eliminate any possible accidental shifting due to tooling vibration or otherwise.

While the truing mechanism here illustrated can be employed for producing rounded, straight, or other peripheral transverse configurations as desired on the grinding wheel **58**, it is to be understood that it is particularly adapted for use in the production of contoured surfaces for performance of form grinding operations. To control the shape or configuration produced on the surface of the wheel there is removably secured to the rear of the slidable housing **39** a block **60** having a follower **61** in the form of a knife-edge point adapted to ride over the surface of the contoured cam **62** for controlling the movement of the diamond or truing tool **63**, relative to the surface of the wheel.

This guide cam **62** has its lower face resting on the face **63'** of mounting block **64** secured on suitable seat formed on the upper portion of the base **12**. This block is further provided with the angularly related seating face **65** for engagement with the rear of the cam guide. In Figures 1 and 4 the cam is indicated as held against face **65** by bolts **66** and as having reduced end portions **67** engaged by lugs **68** on clamp plate **69**. This plate has a slot **70** to receive bolt **71** carried by the block **64**. Loosening of the bolt permits of retraction of the plate to disengage the cam while when slid into forward position and tightened the lugs hold the cam down against the face **63'**. An alternative form of construction has been illustrated in Figure 5 in which the cam itself is formed with a dovetail portion **72** interfitting with a taper portion **73** on the clamp plate **69** so that tightening of bolt **71** serves to both hold the cam downwardly against the face **63'** and also draw the cam rearwardly against the angularly related seating face **65**. In either event the cam is firmly supported by the base portion **11**.

To facilitate raising of the truing tool and housing as a unit to move the diamond point **63** out of truing position and at the same time retract the follower **61** with respect to the cam **62**, there is journaled in the lower portion of the front closure plate **74**, mounted on the face of the slide **14**, a cylinder **75** rotatable by handle **76**. This cylinder has a notched or cutaway portion as at **77** providing the cam or lifting finger **78** adapted when the lever is in its forward or counterclockwise position as shown in Figure 1 to interengage with the lug **79** at the lower portion of the housing **39**. Continued counterclockwise movement of the handle **76** as viewed in Figure 1 will oscillate cylinder **75** and thus raise the housing until the shoulder at **80** contacts with cap plate **59**. Alternatively, when handle **76** is shifted in a clockwise direction past its dead center position, the cam finger **78** will be moved entirely out of the path of movement of lug **79** on the housing, leaving the housing free floating and neither restrained against downward movement nor having its downward movement accentuated by the weight of the handle and associated parts as would be the result if conventional rack and pinion or like mechanisms were employed for effecting this shifting movement.

It will be understood that during the performance of the truing operation, the grinding wheel is rotated at a suitable truing speed and due to this rotation tends to exert a displacing side thrust against the truing tool and its supporting mechanism as illustrated in Figure 1.

While it is preferable that the tool be absolutely free floating and without frictional restraint, to prevent any undue displacement thereof, the plate **81** is secured to the wheel housing **10** and carries the guiding **82** and **83** laterally spanning the lower rectangular portion of the shiftable truing tool housing, limiting any possible deflection thereof. To retain coolant and grit displaced during truing within the housing for proper exhaust from the operative portion of the machine, there is mounted on the guides **82** and **83** sliding cover **84** of an extent to close over the space between the guides in any position of movement of the housing, the housing **39** loosely sliding through a suitable aperture as at **85** in this cover plate.

Coolant is supplied to the griding wheel for grinding, truing and other operations in the conventional manner as by the spray pipe **86** extending inward through the housing **10** and connected by suitable piping connections **87** with the coolant source—not shown.

It is to be understood that in contour or other grinding wheel truing operations it is desirable that the tool, such as the diamond point **88**, traverse the wheel at a relatively rapid rate for removal of a very fine increment from the surface of the wheel to restore its cutting efficiency and maintain the desired curvature without production of peripheral groovings or the like tending to mar the work. It is, therefore, ordinarily necessary that the tool be held against the work with but a very light pressure, but it is absolutely essential in the case of form grinding that the movements of the truing tool exactly correspond with the form of its guide or pattern and that there be no lag or delay in its in and out movements, resulting in a different contour on the wheel surface from that of the guiding pattern. Difficulty has hitherto been experienced in this connection with ordinary types of truing de-

vices even when appreciable pressure is applied thereto in the direction of the grinding wheel.

The present invention obviates these difficulties in that the tool support and housing are mounted for extremely free floating movement, eliminating retarding friction tending to cause such lag and permitting the follower continuously to conform to the exact outline of the pattern, a matter of extreme importance as the resultant product of the grinding machine is frequently required to be to precision limits within .0001" to .0002". Production of a surface on the grinding tool of accuracy to attain such product is effectable by the use of the free floating mechanism here illustrated.

It will further be understood that under ordinary conditions the weight of the free floating parts is sufficient to hold the point 88 against the periphery of the grinding wheel 58 with adequate pressure for truing purposes but, if desired, a pressure or vibration dampening spring, such as indicated at 89 may be inserted between the end plate 59 and shoulder 80 on the truing tool housing. Additionally, the handle element 76 is manually engageable by the operator for determining or aiding and controlling the reactions of the tool.

As indicated in Figure 6, the contour pattern itself is provided with the extended shoulders 90 on which the follower 61 may rest in a displaced position at one side or the other of the grinding wheel 58 intermediate the truing operations. For performance of truing it is then merely necessary to actuate a handle 25 to effect the desired number of strokes of the truing tool across the face of the wheel.

What is claimed is:

1. A truing device for a grinding wheel or the like including a base having an external transverse guide, a truing slide mounted on the guide and reciprocable relative to the base, ways carried by the slide and extending transversely with respect to the guides for the slide, a truing unit mounted between said ways, a plurality of anti-friction bearing elements intervening the ways and the truing unit whereby the latter is supported for free floating movement with respect to the slide, said truing unit comprising an outer housing member, a contained truing tool holder, an actuator for the holder carried by the housing member having a portion engaging the holder for effecting relative adjustment of said holder and member, the tool holder being mounted for sliding movement in the housing and having a keyway formed at one side thereof, an aligning wedge key supported by the housing for movement toward and from the keyway in the tool holder, and a spring interposed between the housing member and the key for resiliently urging the key into the keyway.

2. A truing device for a grinding wheel or the like including a base having an external transverse guide, a truing slide mounted on the guide and reciprocable relative to the base, ways carried by the slide and extending transversely with respect to the guides for the slide, a truing unit mounted between said ways, a plurality of anti-friction bearing elements intervening the ways and the truing unit whereby the latter is supported for free floating movement with respect to the slide, said truing unit comprising an outer housing member, a contained truing tool holder, an actuator for the holder carried by the housing member having a portion engaging the holder for effecting relative adjustment of said holder and member, the tool holder being mounted for sliding movement in the housing and having a keyway formed at one side thereof, an aligning wedge key supported by the housing for movement toward and from the keyway in the tool holder, a spring interposed between the housing and the key for resiliently urging the key into the keyway, and a clamp carried by the housing for forcing the key into tight engagement with the tool holder to lock the same in position within the housing.

3. The combination with a grinding machine having a wheel housing of a truing mechanism including a base carried by the wheel housing having a transversely extending guide portion, a slide mounted for translation on said guide portion, said slide having a pair of spaced flanges providing a housing receiving space therebetween, a guide rail carried by one of said flanges having an elongate ball receiving groove formed therein, a second guide rail having a ball receiving groove secured to the other flange in opposed relation to the first rail, means carried by the slide for adjusting said second rail in a direction toward the first for varying the separation therebetween, a truing unit housing disposed intermediate said rails having longitudinally extending ball receiving grooves, and anti-friction bearings for floatingly mounting the housing with respect to the flanges of the slides including elongate cage plates individual to the respective opposed grooves of the housing and flange members, anti-friction balls jointly mounted in said opposed grooves and held in spaced relation by the elongated cage members, means on the housing for limiting the relative movement of the cage members with respect to the housing, whereby the balls will be retained in operative relation to the respective grooves during relative adjustment of the parts and will support the housing for free floating vertical movement while preventing tilting or twisting thereof with respect to the supporting slide, the truing unit housing having a terminal guide portion, and spaced guides carried by the wheel housing for cooperation with the guide portion of the truing unit housing, said guides extending parallel to the transversely extending guide portions of the base in spanning relation to the terminal guide portion of the truing unit housing and interfitting therewith to prevent deflection of the terminal portion thereof during truing operations.

4. A truing mechanism of the character described including a base having a transversely extending guide portion, a slide mounted for translation on said guide portion, said slide having a pair of spaced flanges providing a housing recieving space therebetween, a guide rail carried by one of said flanges having an elongate ball receiving groove formed therein, a second guide rail having a ball receiving groove secured to the other flange in opposed relation to the first rail, means carried by the slide for adjusting said second rail in a direction toward the first for varying the separation therebetween, a truing unit housing disposed intermediate said rails having longitudinally extending ball receiving grooves, and anti-friction bearings for floatingly mounting the housing with respect to the flanges of the slides including elongate cage plates individual to the respective opposed grooves of the housing and flange members, anti-friction balls jointly mounted in said opposed grooves and held in spaced relation by the elongated cage members, means on the housing for limiting the relative movement

of the cage members with respect to the housing, whereby the balls will be retained in operative relation to the respective grooves during relative adjustment of the parts and will support the housing for free floating vertical movement while preventing tilting or twisting thereof with respect to the supporting slide, and means for controlling the position of the housing including an abutment formed on the housing an actuator pivoted to the slide having a finger movable into position to engage and shift the abutment and a relieved portion movable into registry with the path of movement of the housing to permit unobstructed movement thereof.

5. A truing mechanism of the character described including a base having a transversely extending guide portion, a slide mounted for translation on said guide portion, said slide having a pair of spaced flanges providing a housing receiving space therebetween, a guide rail carried by one of said flanges having an elongate ball receiving groove formed therein, a second guide rail having a ball receiving groove secured to the other flange in opposed relation to the first rail, means carried by the slide for adjusting said second rail in a direction toward the first for varying the separation therebetween, a truing unit housing disposed intermediate said rails having longitudinally extending ball receiving grooves, and anti-friction bearings for floatingly mounting the housing with respect to the flanges of the slides including elongate cage plates individual to the respective opposed grooves of the housing and flange members, anti-friction balls jointly mounted in said opposed grooves and held in spaced relation by the elongated cage members, means on the housing for limiting the relative movement of the cage members with respect to the housing, whereby the balls will be retained in operative relation to the respective grooves during relative adjustment of the parts and will support the housing for free floating vertical movement while preventing tilting or twisting thereof with respect to the supporting slide, and means for controlling the position of the housing including an abutment formed on the housing and an actuator pivoted to the slide having a finger movable into position to engage and shift the abutment, said actuator having a portion cut away adjacent the finger to provide a recess in proximity to the abutment, and an actuating handle carried by the actuator and positionable to one side of dead center for effecting interengagement of the finger and abutment to shift the housing and shiftable to the other side of dead center to place the recess in proximity to the housing and the finger out of path of movement of the abutment whereby the housing may have free longitudinal movement on its floating bearings without interference with or accentuation of action due to the weight and inertia of the handle and associate parts.

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