Oct. 7, 1941. C. G. FLYGARE 2,258,568

GRINDING WHEEL TRUING APPARATUS

Filed Jan. 22, 1940 2 Sheets-Sheet 1

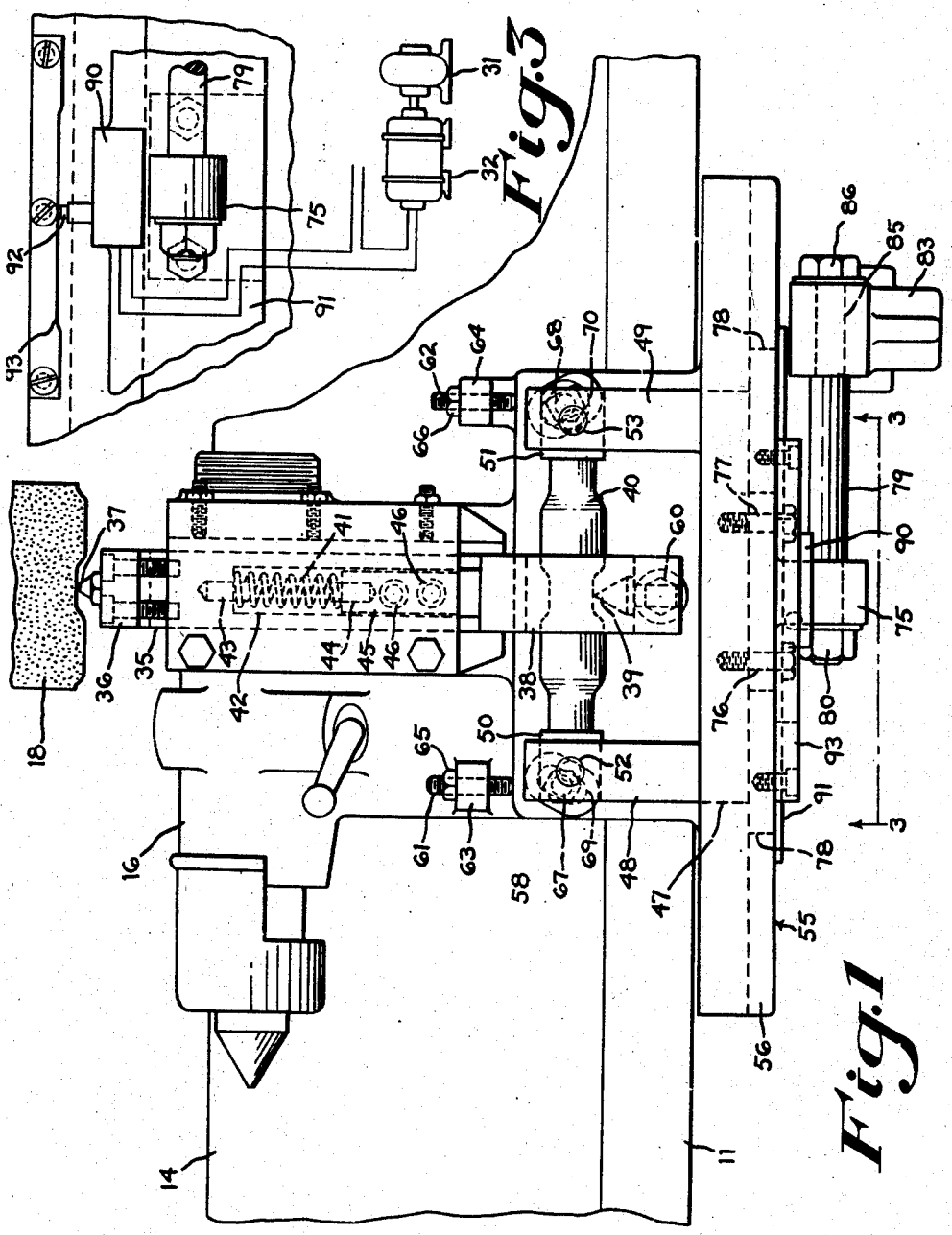


Fig. 3

Fig. 1

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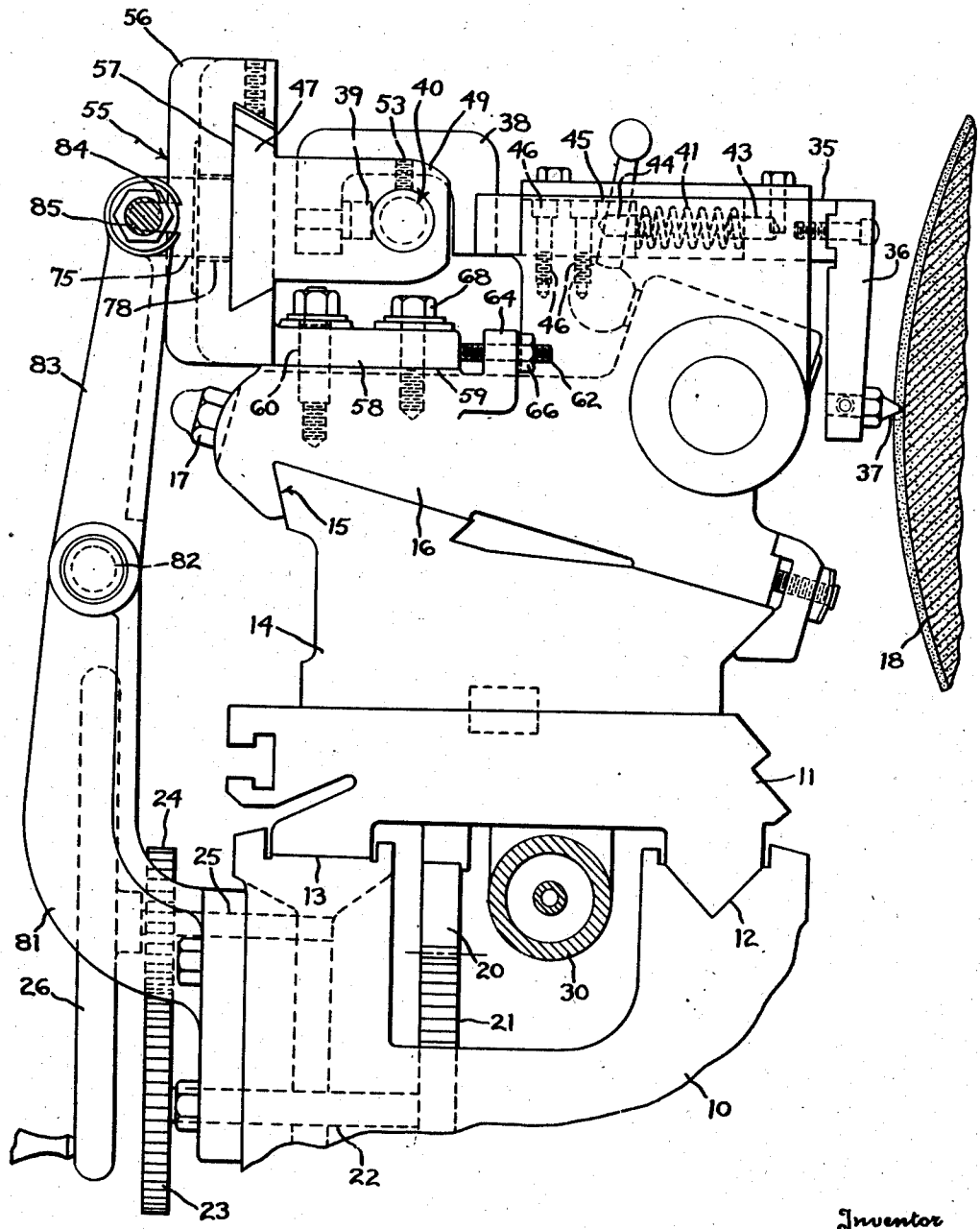


Fig. 2

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GRINDING WHEEL TRUING APPARATUS

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3 Claims. (Cl. 125—11)

The invention relates to grinding machines, and more particularly to a grinding wheel truing apparatus for truing an irregular form or shape on a grinding wheel.

One object of the invention is to provide a formed wheel truing apparatus for truing an irregular form or shape upon the operative face of a grinding wheel. Another object of the invention is to provide a footstock truing device for producing an irregular shape or form on the periphery of a grinding wheel. A further object of the invention is to provide a form truing apparatus for a grinding machine in which a follower is moved through an irregular path to produce a transverse movement of the truing tool to reproduce a desired and predetermined shape on the periphery of the grinding wheel. Other objects will be in part obvious or in part pointed out hereinafter.

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

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

Fig. 1 is a plan view of a portion of a grinding machine, showing the grinding wheel form truing apparatus in operative position;

Fig. 2 is a fragmentary end elevation of a grinding machine having the improved form wheel truing apparatus shown in an operative position.

Fig. 3 is a combined fragmentary front elevation, taken approximately on the line 3—3 of Fig. 1, and an electrical diagram of an electrical safety interlock.

A grinding machine has been illustrated in the drawings having a base 10 which supports a longitudinally movable work supporting table 11 on the usual V-way 12 and flat way 13. The table 11 supports a swivel table 14, the upper surface of which is formed as a dovetailed shaped surface which mates with a correspondingly shaped surface on the under side of a footstock 16. A clamping bolt 17 serves securely to clamp the footstock 16 in an adjusted operating position on the swivel table 14.

A rotatable grinding wheel 18 is supported on the usual wheel slide (not shown) which is arranged for a transverse feeding movement, such as is common practice in the old and well known cylindrical grinding machines such as, for example, that shown in the prior U. S. patent to Wallace H. Wood, No. 2,071,677, dated February 23, 1937. The wheel 18 is arranged to be fed transversely by means of a grinding wheel feeding mechanism (not shown) such as, for example, that shown in the prior U. S. Patent No. 2,071,677, above referred to, to which reference may be had for details of disclosure not contained herein. This feeding mechanism may be manually actuated or it may be automatically and intermittently actuated either continuously or in timed relation with the longitudinal reciprocatory movement of the table 11.

The table 11 may be traversed manually by means of a manually operable table traversing mechanism comprising a rack bar 20 depending from the under side of the table 11 which meshes with a gear 21 mounted on the inner end of a rotatable shaft 22 which is in turn journalled in suitable bearings within the base 10. The shaft 22 carries a gear 23 on its outer end which meshes with a gear 24 supported on a rotatable shaft 25. A manually operable traverse wheel 26 is also mounted on the shaft 25 and is fixedly mounted to rotate with the gear 24. It will be readily apparent from the foregoing disclosure that when the hand traverse wheel 26 is rotated in either direction, a longitudinal traversing movement will be imparted to the table 11 through the gear and rack mechanism above described.

If desired, the table 11 may be reciprocated by a power operated mechanism such as, for example, a fluid pressure cylinder 30 which is supported on the under side of the table 11 (Fig. 2). A fluid pressure pump 31 (Fig. 3) is driven by means of an electric motor 32 to convey fluid under pressure to the cylinder 30 so as to reciprocate the table 11 as desired. The hydraulically operated table reciprocating mechanism has not been illustrated in detail, since this mechanism is identical with that shown in the above-mentioned U. S. patent to Wood, No. 2,071,677, to which reference may be had for details of disclosure not contained herein.

The improved form wheel truing mechanism is preferably supported on the footstock 16 and comprises a transversely movable slide member 35 which is arranged to slide transversely within an aperture formed integral with the footstock 16. The right-hand end of the slide 35 (Fig. 2) is provided with a downwardly extending arm 36 which is rigidly fastened to the end of the slide 35. The arm 36 supports a diamond or truing tool 37 which is arranged to engage the periphery of the grinding wheel 18 at a point sub-

stantially in a horizontal plane passing through the wheel and work axis. An inverted U-shaped bracket 38 is fixedly mounted on the left-hand end of the slide 35 (Fig. 2). The bracket 38 supports a V-shaped follower member 39 which is arranged to engage the peripheral surface of a forming bar 40. The forming bar 40 is of a circular cross section so that when one surface becomes worn, the forming bar 40 may be rotated a slight amount to present a fresh, correctly shaped forming surface. The U-shaped bracket 38 straddles the forming bar 40 so that the follower bears the same relation to the forming bar 40 as the diamond truing tool 37 does to the grinding wheel 18. The follower 39 is preferably accurately shaped to correspond with the shape of the truing tool 37 so that when the follower is traversed relative to the forming bar 40, it will produce a transverse movement to form an identical shape on the operative face of the grinding wheel.

A compression spring 41 is provided for urging the slide 35 in a forward direction, that is, toward the grinding wheel 18. The spring 41 is contained within an aperture 42 formed within the slide 35. One end of the spring 41 is supported by means of a stud 43 carried by the slide 35. The other end of the spring 41 is supported by a stud 44 which is carried by a block 45 fastened to the footstock frame by means of screws 46. The spring 41, as above explained, serves normally to maintain the follower 39 in operative engagement with the surface of the forming bar 40 during a truing operation.

The forming bar 40 is supported by a slide 47 which is formed with integral projecting arms 48 and 49 (Fig. 1). The arms 48 and 49 are provided with apertures which are arranged to receive cylindrical portions 50 and 51 formed on opposite ends of the forming bar 40. Binding or clamping screws 52 and 53 are provided in the arms 48 and 49 by means of which the forming bar 40 may be rigidly secured in an operative position. When a surface of the forming bar 40 becomes worn, a new forming surface may be presented by loosening the screws 52 and 53 and then rotating the bar 40 to present a fresh forming surface.

The slide 47 is supported by a bracket 55 which is formed with a vertically extending portion 56 having a dovetailed surface 57 formed therein. The dovetailed surface 57 mates with a dovetailed slide surface formed on the slide 47. The bracket 55 is also provided with a horizontally extending base portion 58 which is supported on a plane surface 59 formed on the upper portion of the footstock 16.

In order to facilitate adjustment of the position of the forming bar 40 so as to align its axis relative to the path of travel of the table 11, the bracket 55 is preferably adjustably supported on the footstock 14 by means of a pivot stud 60. A pair of adjusting screws 61 and 62 are supported in bosses 63 and 64, respectively, which are formed integral with the footstock 16. The screws 61 and 62 bear against the upper surface of the base portion 58 of the bracket 55 (Fig. 1). By manipulating the screws 61 and 62, respectively, the bracket 55 may be swivelled about the stud 60 to position the forming bar 40 as desired. Lock nuts 65 and 66 are provided to lock the screws 61 and 62 in adjusted position. Clamping screws 67 and 68 are provided rigidly to clamp the base portion 58 of the bracket 55 rigidly in adjusted position on the footstock 16. The clamping screws 67 and 68 pass through elongated slots 69 and 70, respectively, formed in the base portion 58 and are screw threaded into the footstock 16. After the bracket 55 has been adjusted to align the forming bar 40, the clamping screws 67 and 68 may then be actuated rigidly to clamp the bracket 55 and the forming bar 40 in the desired adjusted position.

A bracket 75 is fixedly mounted on the slide 47 by means of screws 76 and 77 (Fig. 1). The bracket 75 projects through an elongated clearance slot 78 formed in the vertical portion 56 of the bracket 55. The bracket 75 supports a rod 79 which is held in a fixed position with respect to the bracket 75 by means of a nut 80 screw threaded onto the end of the rod 79. The slide 35 supporting the diamond or truing tool 37 is traversed longitudinally with the footstock 16 and the table 11 to pass the truing tool 37 across the peripheral surface of the grinding wheel 18 to true the same. In order to transmit the desired transverse movement to the slide 35, the slide 47 supporting the forming bar 40 is held stationary during the truing operation as the bracket 55 moves longitudinally with the table 11 and footstock 16.

In order to hold the slide 47 stationary, a bracket 81 (Fig. 2) is fixedly supported on the front of the machine base 10. The bracket 81 serves as a support for a pivot stud 82 which in turn supports a pivotally mounted arm 83. The arm 83 is provided with an open slot 84 at its upper end which is arranged to engage a reduced end portion 85 on the rod 79. When it is desired to true the grinding wheel, the table is moved toward the left until the arm 83 may be swung into an operative position with the slot 84 in engagement with the reduced end portion 85 on the rod 79. A nut 86 which is screw threaded onto the reduced end portion 85 serves to clamp the arm 83 fixedly to the rod 79. When the arm 83 is clamped in an operative position (Figs. 1 and 2), the table 11 may be traversed longitudinally to traverse the diamond 37 across the periphery of the grinding wheel 18. The rod 79 serves to hold the slide 47 stationary which in turn holds the forming bar 40 stationary while the table 11, the footstock 16 and the transverse slide 35 and truing tool 37 together with the bracket 55 are traversed longitudinally either by rotation of the hand wheeel 26 or by means of the hydraulic table traverse mechanism above referred to. The travel of the follower 39 along the surface of the stationary forming bar 40 serves to transmit a transverse movement to the slide 35 and to the diamond or truing tool 37 to reproduce the shape of the form bar 40 on the periphery of the grinding wheel 18.

It is desirable to provide a safety interlock in case the power traversing movement of the table is utilized. A normally closed limit switch 90 (Figs. 1 and 3) is fixedly mounted on a guard plate 91 which is fixedly mounted to the bracket 75 so that it remains stationary during the traversing movement of the bracket 55. An actuating plunger 92 of the limit switch 90 rides in engagement with a cam bar 93 which is supported on the vertical portion 56 of the bracket 55. The limit switch 90 is operatively connected with the pump motor 32 (Fig. 3). The switch 90 is opened as the bracket 55 approaches the end of its stroke before the U-shaped bracket 38 supporting the follower 39 engages either the arm 48 or the arm 49 to open the circuit and stop the motor 32 which in turn stops the pressure

pump 31, thereby stopping the table traversing movement before any of the parts become damaged. In the normal use of the power traverse of the table, the table 11 is reversed before the safety switch 90 is actuated. The safety switch 90 is provided only as a safety interlocking mechanism to prevent overrunning of the mechanism during the truing operation.

During the truing operation, the grinding wheel 18 may be manually or automatically advanced by actuating the normal wheel feeding mechanism to advance the wheel by the required amount to complete the truing operation. After the truing operation has been completed, the nut 86 is loosened and the arm 83 swung in a counterclockwise direction (Fig. 2) to disconnect it from the rod 79 so that the table 11 may be traversed longitudinally from a truing into a grinding position without transmitting any relative movement between the follower 39 and the form bar 40.

The operation of this improved truing apparatus will be readily apparent from the foregoing disclosure. The forming bar 40 is inserted in an operative position supported by the brackets 48 and 49 and is clamped in adjusted position by the screws 52 and 53. The bracket 55 is then adjusted to align the axis of the form bar 40 into a predetermined relation with the longitudinal movement of the table 11, after which the bracket 55 is clamped in adjusted position by means of the clamping screws 67 and 68. When it is desired to true the grinding wheel 18, the table 11 is traversed toward the left to position the reduced end portion 85 of the rod 79 in substantial alignment with the swinging arm 83 which is swung in a clockwise direction into the position illustrated in Fig. 3 with the slot 84 engaging the reduced end portion 85 of the rod 79. The clamping nut 86 is then tightened to lock the rod 79 relative to the base 10. The table may then be traversed longitudinally to pass the diamond 37 across the periphery of the grinding wheel. During this movement the form bar 40 is held stationary by the rod 79 so that a transverse movement is imparted to the slide 35 to generate a predetermined form or shape on the periphery of the grinding wheel 18. After the diamond 37 has been traversed once across the wheel, the wheel 18 may then be advanced by the wheel feeding mechanism above mentioned to true off an additional amount on the return traverse of the table 11. After a predetermined truing operation has been completed, the arm 83 is again disconnected and the table 11 traversed toward the right into a grinding position.

It will be readily apparent from the foregoing disclosure that any forming bar of the desired shape and contour having cylindrical end portions 50 and 51 to fit the brackets 48 and 49 may be utilized to reproduce its shape upon the periphery of the grinding wheel. It will also be readily apparent that when a surface of the form bar becomes slightly worn, the bar, as above described, may be readily rotated to present a fresh forming surface.

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

I claim:

1. A truing apparatus for a grinding machine having a transversely movable slide, a follower on said slide, a truing tool on said slide, means to traverse said slide and truing tool longitudinally, a forming bar having a surface of revolution, a slide to support said bar, a frame having a slideway for supporting said slide, a swivel adjustment for said frame whereby the axis of the forming bar may be adjusted relative to the longitudinal traversing movement of the truing tool.

2. A truing apparatus for a grinding machine having a transversely movable slide, a follower on said slide, a truing tool on said slide, a forming bar which is engaged by said follower, means including a fluid pressure mechanism having an electric motor driven pump to traverse said slide relative to the forming bar in a direction substantially perpendicular to the direction of movement of the slide to true a predetermined shape on a grinding wheel, and an electrical interlock including a limit switch to stop said motor driven pump so as to stop the traversing movement of the slide and truing tool to prevent an overrun of the truing tool relative to the forming bar.

3. A truing apparatus for a grinding machine having a transversely movable slide, a follower mounted on said slide, a truing tool mounted on said slide, a forming bar which is engaged by said follower, means including a fluid pressure mechanism having an electric motor driven pump to traverse said slide relative to the forming bar, an electrical interlock including a limit switch, and a cam actuated by the traversing movement of said truing tool to stop said electric motor driven pump so as to stop the traversing movement of the truing tool to prevent an overrun of the truing tool relative to the forming bar.

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