Feb. 13, 1940. C. C. ALVORD 2,190,132

GRINDING WHEEL TRUING APPARATUS

Filed July 2, 1938 3 Sheets-Sheet 1

FIG. 9

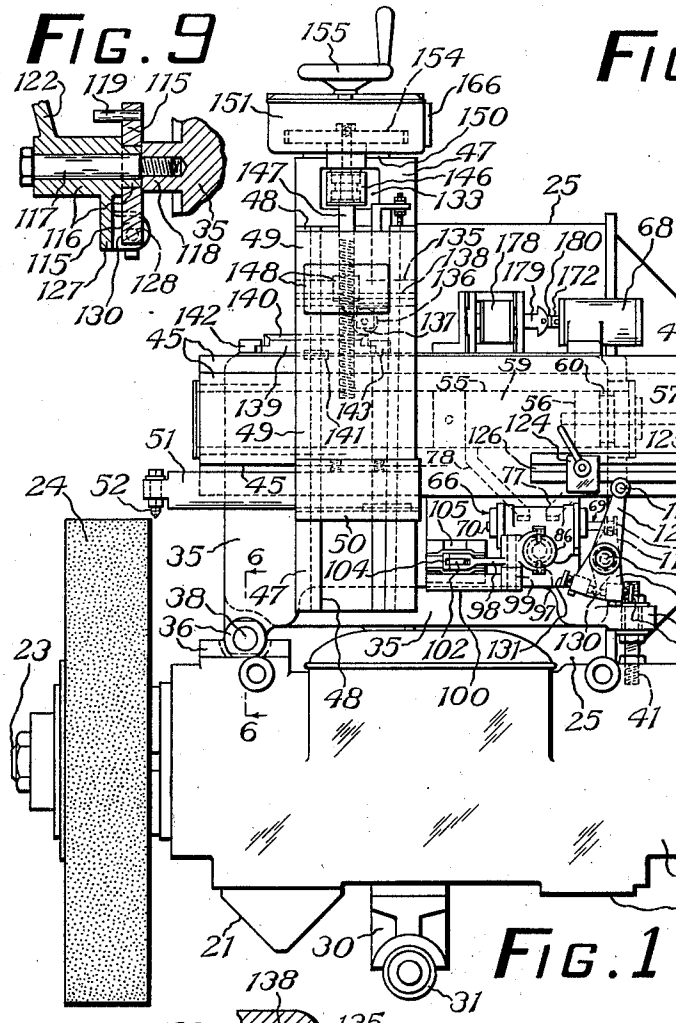


FIG. 8

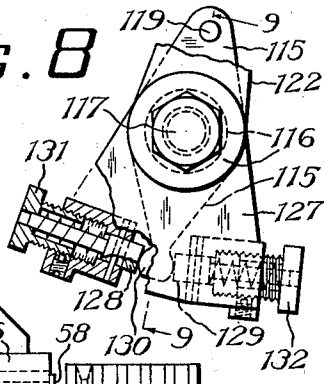


FIG. 1

FIG. 12

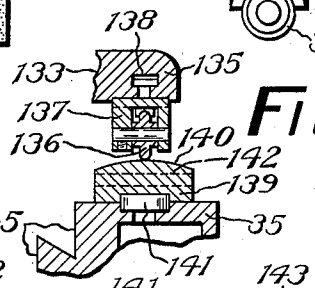


FIG. 11

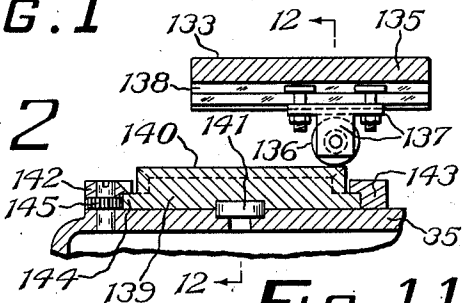
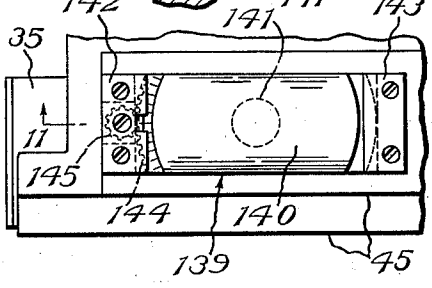


FIG. 10



Inventor

CHARLES C. ALVORD

By Harold W. Eaton

Attorney

Feb. 13, 1940. C. C. ALVORD 2,190,132

GRINDING WHEEL TRUING APPARATUS

Filed July 2, 1938 3 Sheets-Sheet 2

FIG. 5

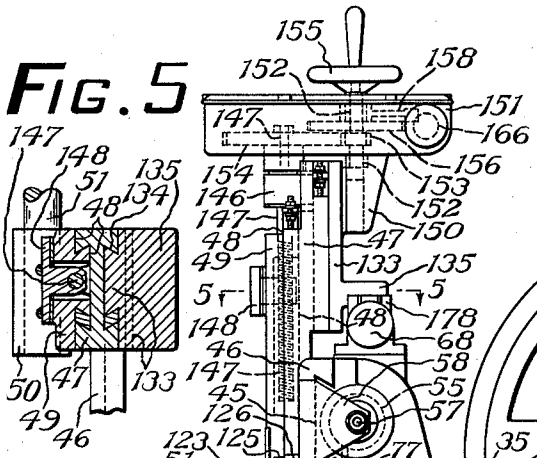


FIG. 6

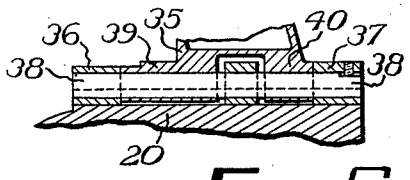


FIG. 2

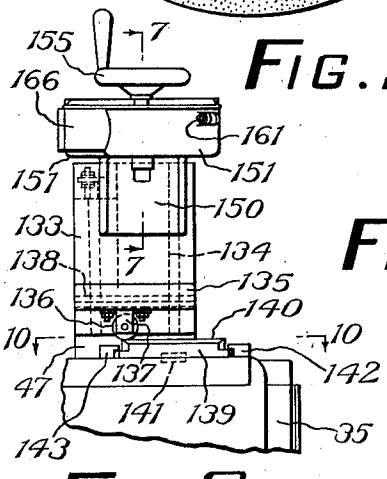


FIG. 3

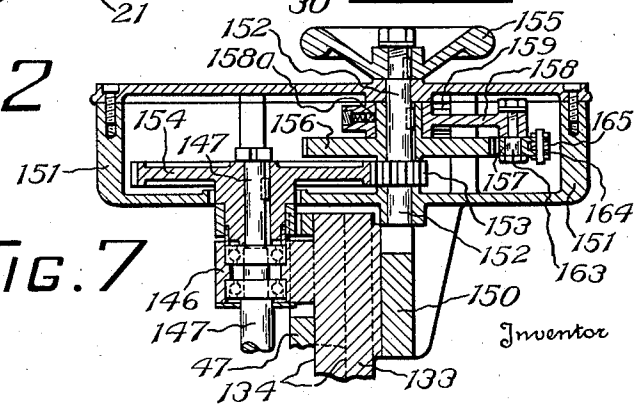


FIG. 7

Inventor

CHARLES C. ALVORD

By Harold W. Eaton Attorney

Feb. 13, 1940. C. C. ALVORD 2,190,132

GRINDING WHEEL TRUING APPARATUS

Filed July 2, 1938 3 Sheets-Sheet 3

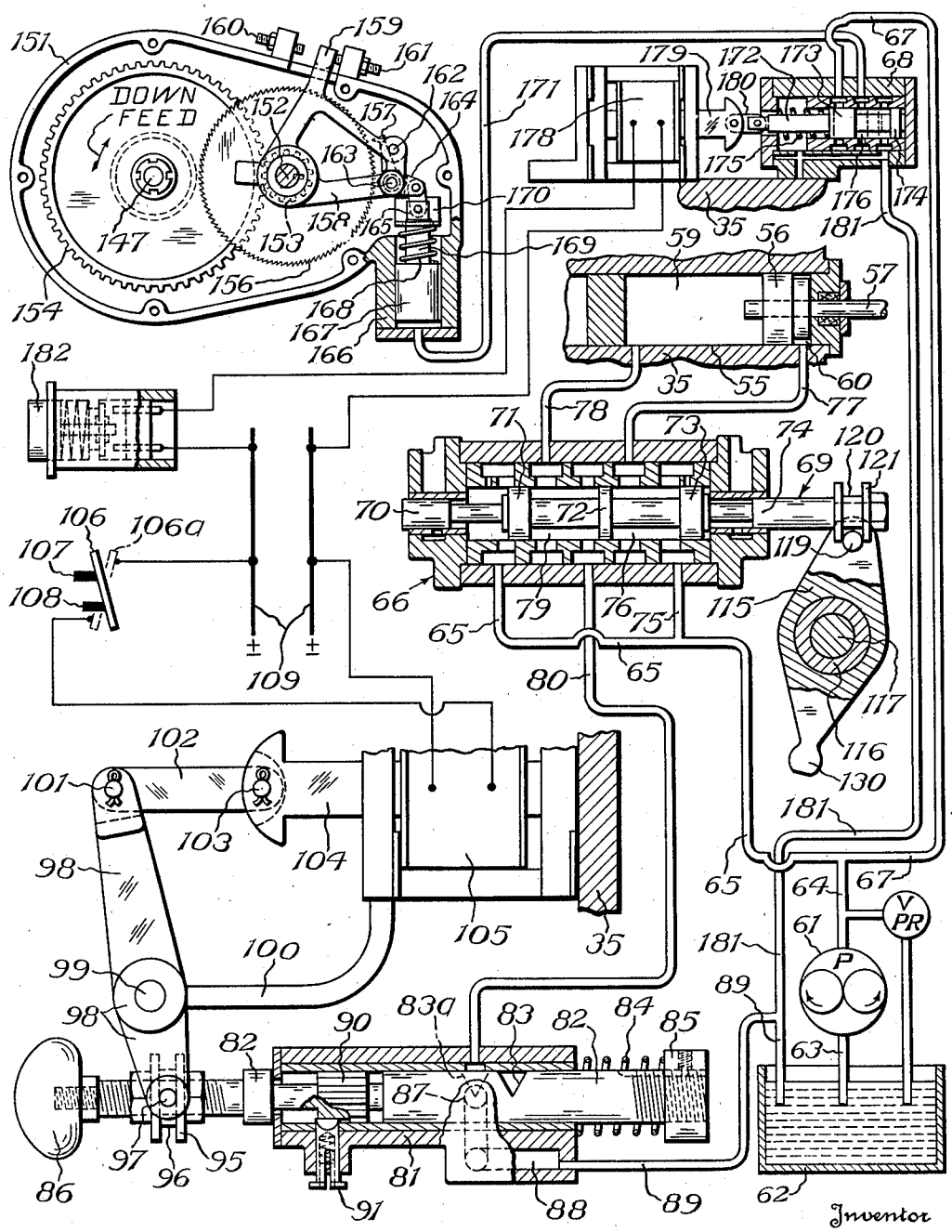


FIG. 4

Inventor

CHARLES C. ALVORD

By Harold W. Eaton Attorney

Patented Feb. 13, 1940

2,190,132

UNITED STATES PATENT OFFICE

2,190,132

GRINDING WHEEL TRUING APPARATUS

Charles C. Alvord, Worcester, Mass., assignor to Norton Company, Worcester, Mass., a corporation of Massachusetts

Application July 2, 1938, Serial No. 217,289

4 Claims. (Cl. 125—11)

The invention relates to grinding machines, and more particularly to a grinding wheel truing apparatus therefor.

One object of the invention is to provide a simple and thoroughly practical grinding wheel truing apparatus. A further object of the invention is to provide an hydraulically actuated grinding wheel truing apparatus. A further object of the invention is to provide a truing apparatus with an hydraulically reciprocated truing apparatus for a grinding machine. A further object of the invention is to provide an hydraulically operated feeding mechanism for adjusting the position of the truing tool. A further object of the invention is to provide a remote electrical control for starting and stopping the operation of an hydraulically operated wheel truing apparatus. A further object of the invention is to provide a remote electrical control mechanism for controlling the hydraulic reciprocation of the truing tool. Another object of the invention is to provide a remote electrical control mechanism for controlling the feed of the truing tool. 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:

Figure 1 is a front elevation of a grinding wheel slide, showing the improved grinding wheel truing apparatus mounted thereon;

Figure 2 is a right-hand end elevation of the wheel slide and truing apparatus shown in Figure 1;

Figure 3 is a fragmentary rear view of the upper portion of the wheel truing apparatus, showing the forming bar and follower roll;

Figure 4 is a diagrammatic illustration of the piping for the hydraulic system and hydraulic controls as well as an electrical diagram showing the electrical controls for the hydraulic mechanism;

Figure 5 is a cross sectional view, on an enlarged scale, taken approximately on the line 5—5 of Figure 2;

Figure 6 is a vertical cross sectional view, taken approximately on the line 6—6 of Figure 1, showing the pivotal support for the truing apparatus;

Figure 7 is a vertical sectional view, on an enlarged scale, taken approximately on the line 7—7 of Figure 3;

Figure 8 is a fragmentary elevation, partly broken away and shown in section, on an enlarged scale, of the load and fire reverse lever mechanism;

Figure 9 is a fragmentary sectional view, taken approximately on the line 9—9 of Figure 8;

Figure 10 is a fragmentary plan view, taken approximately on the line 10—10 of Figure 3, on an enlarged scale showing the forming bar and the adjustment therefor;

Figure 11 is a longitudinal sectional view through the forming bar, taken approximately on the line 11—11 of Figure 10; and

Figure 12 is a sectional view, taken approximately on the line 12—12 of Figure 11, showing the forming bar and the follower roller.

As illustrated in the drawings, a transversely movable grinding wheel slide 20 is provided with the usual V-way 21 and flat way 22 which mate with correspondingly shaped ways on the base (not shown). The wheel slide 20 supports in bearings (not shown), a rotatable wheel spindle 23 which supports a grinding wheel 24 adjacent to its left-hand end (Fig. 1). The wheel spindle 23 may be rotated in any suitable manner, such as is old and well known in the art. In the preferred construction, however, an electric motor 25 is adjustably mounted on the upper surface of the wheel slide 20. The motor 25 has an armature or rotor shaft 26 on the end of which is mounted a multiple V-grooved pulley 27 which is connected by multiple V-belts 28 with a multi-grooved pulley 29 mounted on the right-hand end of the wheel spindle 23 (Fig. 1).

The wheel slide 20 is mounted on the grinding machine so that it may be fed transversely to feed the grinding wheel 24 into the work piece to grind the same to the required extent. The wheel slide 20 is provided with a depending half nut 30 which meshes with a rotatable feed screw 31 which is rotatably supported in the base of the machine. The feed screw 31 may be rotated by any of the well known feeding mechanisms, such as, for example, that shown in the prior United States patent to C. H. Norton No. 762,838 dated June 14, 1904.

The improved truing apparatus is preferably mounted on the wheel slide 20 so that it travels forward and rearward with the wheel slide during the grinding operation and the diamond or truing tool is at all times maintained in a predetermined position with relation to the grinding wheel 24. A truing apparatus frame 35 is pref-

erably pivotally mounted on the wheel slide 20 so that it may be angularly adjusted in a vertical plane so that the path of movement of the truing tool is parallel to or at an angle to the axis of the wheel spindle 23. The wheel slide 20 is provided with a pair of spaced brackets 36 and 37 which support a shaft 38. The frame 35 is provided with the downwardly projecting portions 39 and 40 having apertures rotatably to receive the shaft 38 and thereby provide a pivotal connection between the frame 35 and the wheel slide 20. A pair of screw threaded studs 41 and 42 are fixedly supported in an upper surface of the wheel slide 20 (Figs. 1 and 2). The studs 41 and 42 pass through clearance holes in a pair of lugs 43 and 44 which project from the frame 35. Nuts are provided on each of the studs 41 and 42 above and below the lugs 43 and 44, respectively. By manipulation of these nuts, the frame 35 may be adjusted in a vertical plane to adjust the path of movement of the truing tool, as will be hereinafter described.

The frame 35 is provided with a horizontal extending dovetailed slide 45 which is either formed integral with or fixedly secured to the frame 35. A horizontally movable slide 46 is provided with a dovetailed slideway which mates with the dovetailed slide 45. The horizontally movable slide 46 is provided with an upwardly extending member 47 which is provided with a vertically arranged dovetailed slideway 48. A vertically movable slide 49 is provided with a dovetailed slideway which mates with the dovetailed way 48. The lower end of the vertical slide 49 is provided with a forwardly projecting boss 50 which supports a bar 51 which carries a truing tool or diamond 52 at its outer end to true the peripheral face of the wheel 24 when the horizontally movable slide 46 is reciprocated.

In the preferred form, an hydraulically operated mechanism is provided for reciprocating the horizontally movable slide 46 to traverse the truing tool 52 across the operative face of the grinding wheel 24 to true the same. A fluid pressure cylinder 55 is preferably formed integral with the frame 35. A piston 56 is slidably mounted within the cylinder 55 and is connected to one end of a piston rod 57 the other end of which is connected to a bracket 58 fixedly mounted on the end of the horizontally movable slide 46. It will be readily apparent from the foregoing disclosure that when fluid is admitted either into the cylinder chamber 59 or the cylinder chamber 60, the piston 56 and piston rod 57 will transmit a traversing movement to the horizontally movable slide 46 and the truing tool 52.

A fluid pressure system is provided for conveying fluid under pressure to reciprocate the truing tool, comprising a motor driven fluid pressure pump 61 which draws fluid from a reservoir 62 through a pipe 63 and forces fluid through pipe 64 and pipe 65 to a truing tool traverse control valve 66. The control valve 66 is mounted on the steadyrest frame 35. Fluid under pressure from the pipe 64 also passes through a pipe 67 to a truing tool feed control valve 68 to be hereinafter described.

The truing tool traverse control valve 66 comprises a valve stem 69 having formed integrally therewith valve pistons 70, 71, 72, 73 and 74. In the position of the valve 66 (Fig. 4), fluid under pressure within the pipe 65 passes through a pipe 75 into a valve chamber 76 formed between the valve pistons 72 and 73 and passes out through a pipe or passage 77 into the cylinder chamber 60 to cause the piston 56, the piston rod 57, and the horizontally movable slide 46 to traverse toward the left to pass the truing tool 52 across the periphery of the grinding wheel 24. During this movement, fluid within the cylinder chamber 59 is forced out through a pipe or passage 78 into a valve chamber 79 formed between the valve pistons 71 and 72 and passes out through a pipe or passage 80 to a feed control valve 81 which regulates the rate of exhaust of fluid from the chamber 55 and thereby controls the traversing speed of the truing tool 52.

The control valve 81 is provided with a valve stem 82 having a body portion which fits within the valve sleeve and is provided with a V-shaped notch 83. The V-shaped notch 83 is normally held in a rearward position to prevent the exhaust of fluid from the pipe 80 by means of a spring 84 which surrounds the valve stem 82 and is interposed between the end of the valve casing 81 and an adjustable collar 85 threaded on the end of the valve stem 82. A manually operable knob 86 is mounted on the outer end of the valve stem 82 and serves to facilitate manual adjustment. The valve 81, in addition to serving as a speed control valve, serves as a stop and start valve for the traversing movement. When it is desired to start the traverse of the truing tool 52, the valve stem 82 is moved manually or automatically toward the left so that the V-notch 83 assumes the position illustrated in dotted lines 83a, so that fluid exhausting through the pipe 80 may flow through the V-notch 83 out through a port 87 and a passage 88 into a pipe 89 which exhausts into the reservoir 62. In order to regulate the speed of movement of the truing tool 52, the valve stem 82 may be rotated to vary the position of the V-shaped notch 83 and thereby to vary the exposed aperture of the port 87 so as to regulate the amount of fluid exhausting through the pipe 80 and thereby to control the speed of movement of the truing tool 52. To facilitate holding the valve stem 82 in adjusted position, the valve stem is provided with a serrated portion 90 which is engaged by a spring-pressed plunger 91 carried by the casing of the valve 81, so that when the valve stem 82 is rotated by means of the knob 86, the spring-pressed plunger 91 engaging the serrations of the portion 90 will serve to hold the valve stem 82 in adjusted position but at the same time permit a longitudinal movement of the valve to stop and start the traversing movement of the truing tool 52.

The valve 81 may be operated manually, if desired, by means of the knob 86 or may be operated automatically by an electrically operated mechanism. The valve stem 82 carries a spool shaped member 95 having a groove 96. A pair of diametrically opposed pins 97 carried at the lower yoked end of the rock arm 98 (Fig. 4) ride in the groove 96. The rock arm 98 is pivotally supported on a stud 99 which is fixedly supported on a bracket 100 which is fixedly supported on the solenoid 105. The upper end of the rock arm 98 (Fig. 4) is connected by a stud 101 with a link 102. The other end of the link 102 is connected by a stud 103 with an armature 104 of the solenoid 105.

In a large cylindrical grinding machine of the type illustrated, due to the massive size of the machine, it is difficult for the operator to reach up over a large work piece and readily reach the control knob 86. It is, therefore, desirable to provide a remote control apparatus including a switch 106 which is operated by a pair of push

buttons 107 and 108. Power for the circuit is supplied as represented by the power lines 109 which are connected as illustrated with the switch 106 and the solenoid 105. In the position of the switch 106 as illustrated in Fig. 4, the circuit is open and the solenoid 105 deenergized. When it is desired to start the traversing movement of the truing tool 52 from the operator's station in front of the machine to true the grinding wheel 24, the push button 107 is actuated to shift the switch member 106 into the position 106a illustrated in dotted lines in Fig. 4 to close the circuit, thereby energizing the solenoid 105 which in turn serves through the connecting link 102 to rock the rock arm 98 in a clockwise direction to shift the valve stem 82 toward the left and thereby move the V-notch 83 into the dotted line position 83a to allow fluid to exhaust through the pipe 80 at a controlled rate.

A reversing mechanism is provided automatically to shift the traverse control valve 66 continuously to reciprocate the truing tool 52 across the face of the wheel 24 as desired. A rock arm 115 is rotatably supported on a sleeve 116 which is in turn rotatably supported on a stud 117. The stud 117 is fixedly mounted in a boss 118 which is formed integral with the frame 35 of the truing apparatus. The upper end of the rock arm 115 is provided with a pin 119 which rides within a groove 120 formed in a spool shaped member 121 mounted on the right-hand end of the valve stem 69 (Fig. 4). A reversing lever 122 is fixedly mounted on the outer end of the sleeve 116. The upper end of the reversing lever 122 is provided with a stud 123 which is arranged in the path of adjustable dogs 124 and 125. The dogs 124 and 125 are adjustably supported in a T-shaped slot 126 formed in a projection of the horizontally movable slide 46. The sleeve 116 is provided with a downwardly extending arm 127 which is provided at its lower end with a pair of opposed spring-pressed plungers 128 and 129 which are arranged to engage the opposite sides of a projection 130 formed on the lower end of the rock arm 115. The tension of the springs which actuate the plungers 128 and 129 may be adjusted by means of the threaded sleeves 131 and 132, respectively. The spring pressed plungers together with the mechanism above described serve as a load and fire mechanism whereby the control valve 66 is automatically reversed in timed relation with the traversing movement of the horizontally movable slide 46.

In cylindrical grinding operations it is frequently necessary to provide a machine which may either grind a true cylindrical surface, a tapered surface, or a curved face for grinding a curved surface on the periphery of a work piece. It is accordingly one object of this invention to provide a truing apparatus which may be adjusted for truing a true cylindrical face on the grinding wheel 24, or a tapered face thereon, or if desired a curved face. In the preferred form, the vertically extending projection 47 of the horizontally movable slide 46 is provided with a dovetailed slideway on its rear face which supports a vertically movable slide 133 having a dovetailed slideway 134 mating with the dovetailed slideway on the member 47. The lower end of the slide 133 is provided with a rearwardly extending portion 135 which serves as a support for a follower roller 136. The follower roller is supported by an adjustable bracket 137 which is adjustably secured by bolts which are positioned in a T-slot 138 formed in the lower surface of the projection 135.

The roller 136 is arranged to engage the active face of a forming bar 139 which in the present case has been illustrated as a partial cylindrical surface 140. The forming bar 139 is pivotally supported on a stud 141 on the truing apparatus frame 35 and is held in position thereon by clamping blocks 142 and 143. The forming bar 139 is arranged so that the axis of curvature of the partially cylindrical surface 140 is parallel to the path of movement of the truing tool 52 and the axis of the grinding wheel 24 to true a true cylindrical face on the grinding wheel 24, or the bar 139 may be swivelled so that the axis of curvature of the partially cylindrical surface 140 is at an angle to the axis of the grinding wheel 24 and the path of movement of the truing tool 52. In the latter case, when the horizontally movable slide 46 is traversed longitudinally, the roller 136 engaging the surface 140 of the forming bar 139 is moved in a vertical direction to move the truing tool or diamond 52 through a curved path as its supporting slide 46 is moved horizontally.

To facilitate angular adjustment of the forming bar 139, the left-hand end is provided with a segment of a gear 144 (Fig. 10) which meshes with a rotatably mounted pinion 145. By loosening the clamping blocks 142 and 143 and turning the pinion 145 by means of a screw driver or other similar instrument placed in the slot formed in the upper end face of the stud supporting the pinion 145, the forming bar 139 may be readily adjusted into the desired position and then locked in adjusted position by means of the clamping blocks 142 and 143. The left-hand end face of the forming bar 139 may be provided with a graduated scale to facilitate readily adjusting the bar to the desired predetermined position.

The vertically movable slides 49 and 133 are preferably arranged so that they both move vertically and simultaneously as controlled by the follower roller 136 and the forming bar 139.

The two slides are preferably connected by a nut and screw mechanism whereby the position of the truing tool 52 may be readily adjusted both in setting up the machine and also in adjusting or feeding the truing tool during a truing operation. The slide 133 is provided with a forwardly extending boss 146 which rotatably supports a vertically arranged feed screw 147 which in turn passes down through the slide 49 and meshes with a nut 148 which is secured to the slide 49. The upper end of the screw 147 is journalled in suitable anti-friction bearings within the boss 146 so that it is held against endwise movement relative to the slide 133. It will be readily apparent from the foregoing that the slide 133 is interconnected with or adjustably connected to the slide 49 by means of the boss 146, the feed screw 147, and the nut 148.

To facilitate adjustment of the feed screw 147, a manually operable hand wheel and a pawl and ratchet mechanism are provided whereby the screw 147 may be either rotated manually or actuated mechanically by means of a pawl and ratchet mechanism. A bracket 150 is rigidly mounted on the rear face of the slide 133 and serves as a support for a housing 151 for the truing tool feeding mechanism. A shaft 152 is rotatably supported by the housing 151 and carries at its lower end a gear 153 which meshes with a gear 154 mounted on the upper end of the

feed screw 147. The upper end of the shaft 152 projects above the casing 151 and is provided on its upper end with a manually operable hand wheel 155. By rotation of the hand wheel 155, a rotary motion is transmitted to the shaft 152, the gear 153, the gear 154, and the feed screw 147 to adjust the position of the slide 49 relative to the slide 133, so as to position the truing tool 52 as desired. The weight of the slides 49 and 133 combined with the feeding mechanism above described is sufficient weight at all times to maintain the follower roller 136 in operative engagement with the operative surface 140 of the forming bar 139 so that when the horizontally movable slide 46 is traversed for a truing operation, the follower roller 136 will follow the contour of the forming bar 139 as then adjusted.

In a large cylindrical grinding machine, such as is used for grinding large massive rolls and the like, a truing apparatus of this type is out of the reach of the operator and it requires his climbing on top of the machine manually to adjust the position of the truing tool 52. It is desirable in such a case to provide a suitable remote control apparatus whereby the truing tool may be readily adjusted and fed from the operator's control station. In the preferred form, a pawl and ratchet mechanism is provided comprising a ratchet wheel 156 which is keyed to the shaft 152. A ratchet pawl 157 is pivotally supported on a pawl carrying bracket 158 rotatably supported on a cylindrical hub portion of the ratchet wheel 156. The pawl carrying bracket 158 is provided with an outwardly extending arm 159 which is arranged between a pair of opposed screws 160 and 161 which serve to limit the movement of the pawl 157 and consequently the ratchet wheel 156. A stop pin 162 carried by the frame 158 serves to limit the movement of the pawl 157 in a clockwise direction. A spring pressed plunger 158a carried by the hub of the pawl carrying arm 158 bears against the hub of the ratchet wheel 156. The plunger 158a serves as a friction device to retard movement of the arm 158 and thereby insure the disengagement of the pawl 157 from the ratchet wheel 156 before the arm 158 starts moving. The pawl 157 is pivotally supported on a stud 163 and is preferably formed as a bell crank having an outwardly extending arm 164 which is connected to an actuating link 165.

In the preferred form, the pawl and ratchet mechanism is actuated by a hydraulically operated mechanism comprising a cylinder 166 having a piston 167 slidably mounted therein. A spring 168 surrounds a piston rod 169 projecting from the piston 167 and is interposed between the piston 167 and a bracket 170 carried by the housing 151. The spring 168 normally holds the piston 167 in a position so that the arm 159 engages the stop screw 161 and the ratchet pawl 157 is withdrawn to an inoperative position in engagement with the stop pin 162. When fluid under pressure is admitted through a pipe 171 into the cylinder 166, it causes an upward movement of the piston 167 (Fig. 4) against the compression of the spring 168 which first serves to rock the pawl 157 in a counterclockwise direction into operative engagement with the teeth of the ratchet wheel 156, and continued movement rotates the ratchet wheel 156 until the projection 159 of the pawl carrying member 158 engages the stop screw 160 which limits the feeding movement.

The admission of fluid under pressure to the pipe 171 is controlled by the feed control valve 68. This valve is preferably a piston type valve comprising a valve stem 172 having formed integrally therewith valve pistons 173 and 174. A spring 175 surrounds the valve stem 172 and is interposed between the valve piston 173 and the end cap on the valve casing and serves normally to hold the valve stem 172 and valve pistons 173 and 174 in a right-hand end position (Fig. 4) so that fluid under pressure from the pump 61 passing through the pipe 67 enters a valve chamber 176 located between the valve pistons 173 and 174 and passes out through the pipe 171 into the cylinder 166 to actuate the diamond or truing tool feeding mechanism.

In order that the truing tool 52 may be fed by means of a remote control, a solenoid 178 is provided having an armature 179 connected by a link 180 with the valve stem 172. In the position of the parts illustrated in Fig. 4, fluid within the cylinder 166 may exhaust through the pipe 171, the valve chamber 176, and out through a pipe 181 into the reservoir 62. A push button switch 182 is mounted on the front of the machine base adjacent to the operator's station. This push button switch is operatively connected between the power lines 109 and the solenoid 178. When the push button 182 is actuated, it serves to close a circuit, thereby energizing the solenoid 178 to shift the valve stem 172 toward the left (Fig. 4) so that fluid under pressure passing through the pipe 67 enters the valve chamber 176 and passes out through the pipe 171 into the cylinder 166 to actuate the pawl and ratchet mechanism and thereby feed the truing tool 52 one increment toward the periphery of the grinding wheel 24 to be trued. As soon as the operator removes his hand from the push button 182, the switch opens and the circuit is broken, thereby deenergizing the solenoid 178, and the released compression of the spring 175 shifts the valve into its right-hand position, as shown in Fig. 4, so that the fluid within the cylinder 166 may exhaust into the reservoir 62. It will thus be seen that from the operator's control station in front of the machine, the truing tool may be incrementally fed toward the grinding wheel at the will of the operator and the tool may be advanced by one or more increments as desired.

The operation of this improved truing apparatus will be readily apparent from the foregoing disclosure. Assuming the mechanism to have been previously adjusted, that is the dogs 124 and 125 adjusted for length of stroke, the stop screws 160 and 161 adjusted to regulate the incremental diamond feeding, and the valve 81 adjusted to traverse the truing tool 52 at the desired and predetermined speed, the grinding wheel 24 may be readily trued and its movement controlled by the operator from his control station in front of the machine. When it is desired to true the grinding wheel 24, the operator presses the button 107 to close the switch 106, that is, shifts it into position 106a which serves to energize the solenoid 105, thereby rocking the rock arm 98 in a clockwise direction to open the valve 81 and thereby start the reciprocating movement of the horizontally movable slide 46. During the reciprocating movement of the horizontal slide 46 and the truing tool 52, the truing tool may be incrementally fed toward the periphery of the grinding wheel 24 by one or more increments by closing the push button switch 182 to energize the solenoid 178 and thereby open

the valve 68 to actuate the feed pawl 157 through one increment. When the operator releases the push button 182, the solenoid 178 is deenergized and the valve 68 returns to its initial position, thus allowing fluid within the cylinder 166 to exhaust and the released compression of the spring 168 rocks the feeding pawl 158 into an inoperative position (Fig. 4) ready for the next feeding movement. By actuating the push button 182 either at the ends of the reciprocatory stroke of the truing tool 52 or intermediate therebetween, the tool may be readily fed to true the desired amount off the periphery of the grinding wheel 24.

It will thus be seen that 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. In a grinding wheel truing apparatus, a truing tool, means including a piston and cylinder longitudinally to reciprocate said truing tool, means including a dog actuated reversing valve to control the admission of fluid to said cylinder, a stop and start valve operatively connected to control the exhaust of fluid from said cylinder, a remote control therefor including a solenoid to actuate said valve, a remotely located switch to actuate said solenoid, means including a fluid pressure operated pawl and ratchet mechanism to feed said tool transversely, a control valve therefor, and a remote electrical control for said feed valve including a solenoid to actuate said valve, and a remotely located push button switch to control said valve whereby the tool may be incrementally fed transversely as desired.

2. In a grinding wheel truing apparatus for a grinding machine having a wheel slide to support a rotatable grinding wheel, an adjustably mounted truing apparatus frame on said slide, a longitudinally reciprocable slide on said frame, means to adjust said frame relative to said slide to adjust the path of movement of said truing tool, a transversely movable slide on said horizontal slide, a truing tool supported thereon, means including a fluid pressure operated piston and cylinder longitudinally to reciprocate said horizontal slide, means including a dog actuated reversing valve supported on said frame and arranged to control the admission of fluid to and from said cylinder, a combined stop-start-throttle valve on said frame to control the exhaust of fluid from said cylinder, means to rotate said valve to regulate the speed of said truing tool, a remote electrical control for said latter valve including a solenoid to move said valve endwise to stop or start the traverse of said truing tool, and a remotely located switch to operate said solenoid.

3. In a grinding wheel truing apparatus for a grinding machine having a wheel slide supporting a rotatable grinding wheel, a truing apparatus frame pivotally supported thereon, a horizontally movable slide on said frame, a vertically movable slide on said horizontal slide, a truing tool carried by said vertical slide, means pivotally to adjust said frame to vary the position of said horizonal slide relative to the wheel axis to vary the path of movement of the truing tool, means to adjust said vertical slide relative to said horizontal slide to feed the truing tool toward or from the grinding wheel, means including a fluid operated piston and cylinder longitudinally to reciprocate said truing tool, a dog actuated reversing switch to control the admission to and exhaust of fluid from said cylinder, a combined stop-start-throttle valve to control the exhaust of fluid from said cylinder and to regulate the truing speed of said tool, a solenoid operatively connected to actuate said latter valve, and a remote electrical control therefor including a remotely located switch to operate said solenoid.

4. In a grinding wheel truing apparatus for a grinding machine having a wheel slide and a rotatable grinding wheel, a pivotally mounted truing apparatus frame on said slide, a horizontally movable slide on said frame, a vertically movable slide on said horizontally movable slide, a truing tool carried by said vertical slide, means including a fluid pressure piston and cylinder to reciprocate said horizontal slide so as to traverse the truing tool across the periphery of the grinding wheel, means including a solenoid operated valve to stop and start the reciprocating movement of said slide, a remote electrical control including a remotely located switch to energize said solenoid, and means including a fluid pressure operated pawl and ratchet mechanism to feed said vertical slide relative to said horizontal slide, means including a valve to control the admission of fluid to and from said fluid actuated pawl and ratchet mechanism, a solenoid to actuate said valve, and a remote electrical control therefor including a remotely located switch to energize said solenoid so as to cause an incremental feeding movement of the truing tool when desired.

CHARLES C. ALVORD.