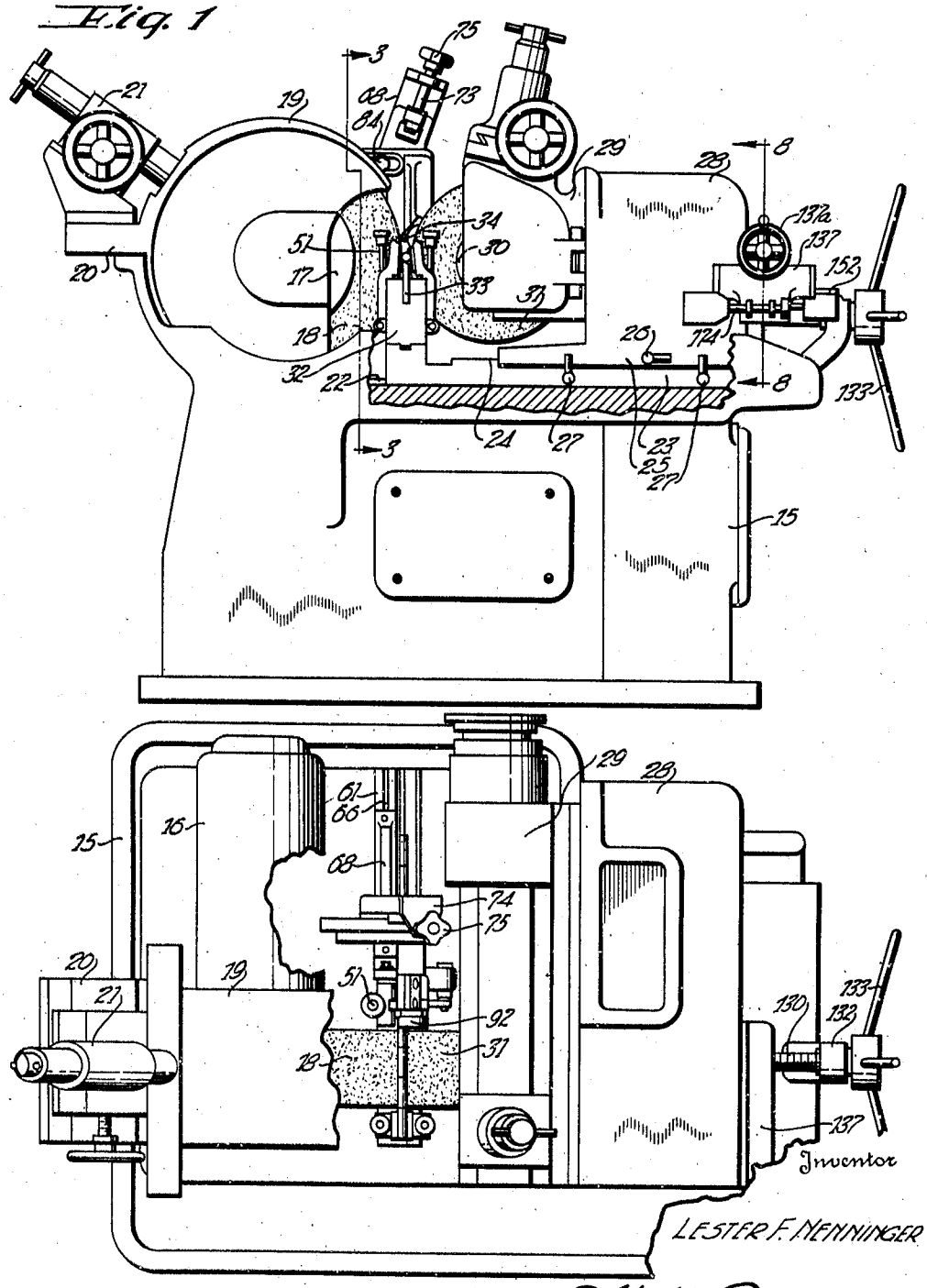
Feb. 19, 1935. L. F. NENNINGER 1,991,953

GRINDING MACHINE

Filed March 7, 1932 4 Sheets-Sheet 1

Fig. 1



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Fig. 2

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Feb. 19, 1935. L. F. NENNINGER 1,991,953

GRINDING MACHINE

Filed March 7, 1932 4 Sheets-Sheet 2

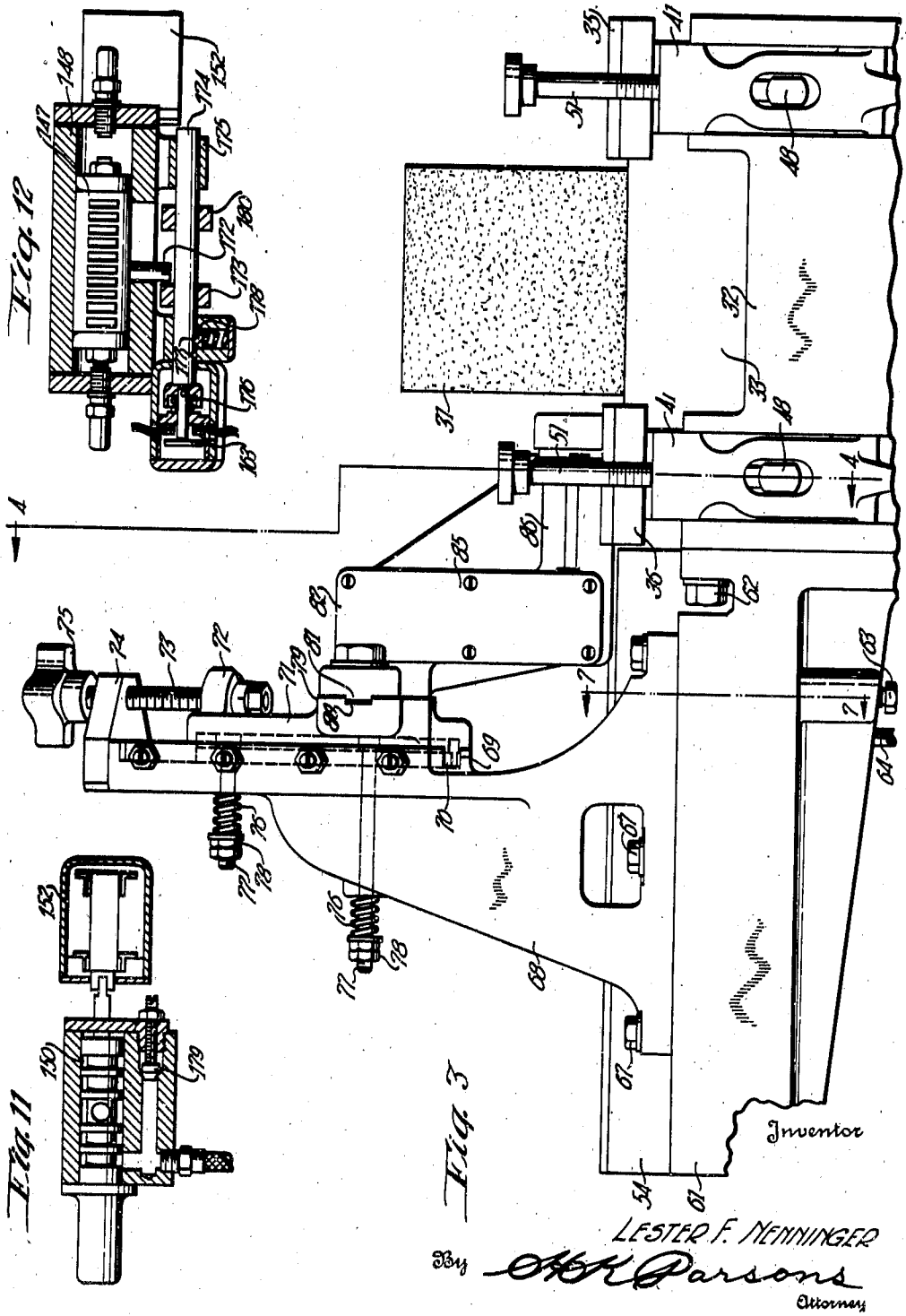


Fig. 12

Fig. 11

Fig. 3

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GRINDING MACHINE

Filed March 7, 1932 4 Sheets-Sheet 3

Fig. 7

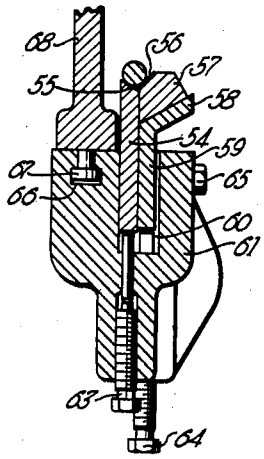
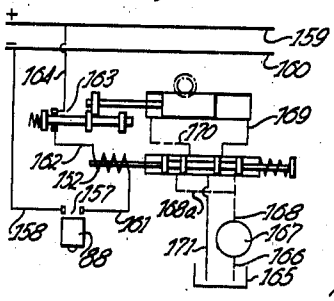


Fig. 13



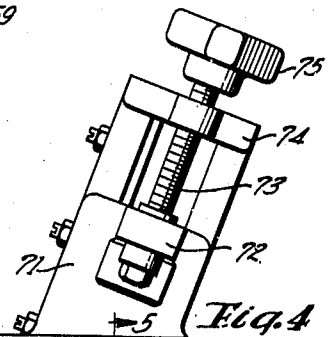


Fig. 4

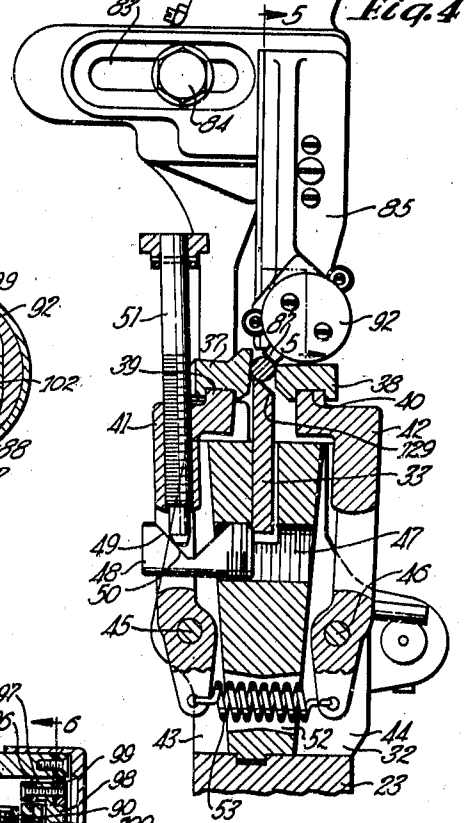


Fig. 6

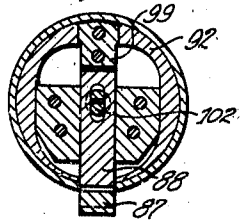


Fig. 5.

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Feb. 19, 1935. L. F. NENNINGER 1,991,953

GRINDING MACHINE

Filed March 7, 1932 4 Sheets-Sheet 4

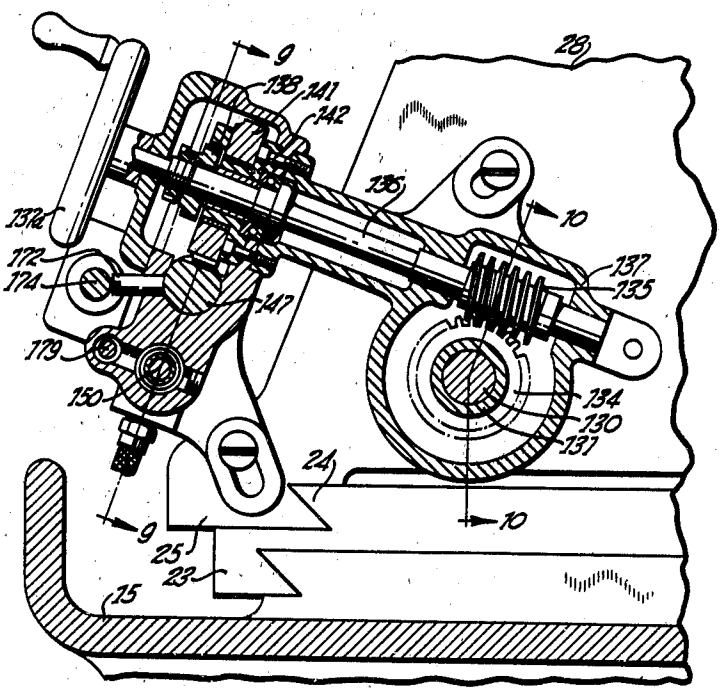


Fig. 8

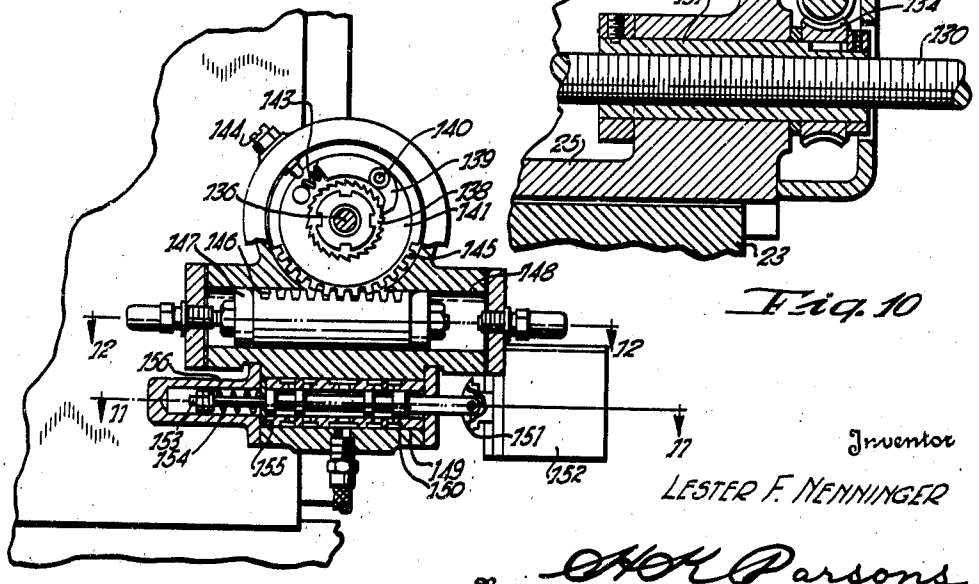


Fig. 10

Fig. 9

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Patented Feb. 19, 1935 1,991,953

UNITED STATES PATENT OFFICE

1,991,953

GRINDING MACHINE

Lester F. Nenninger, Cincinnati, Ohio, assignor to Cincinnati Grinders Incorporated, Cincinnati, Ohio, a corporation of Ohio

Application March 7, 1932, Serial No. 597,190

17 Claims. (Cl. 51—103)

This invention relates to improvements in machine tools and especially to improvements in grinding machines.

An object of the invention is the provision of improved means for controlling the automatic operation of machine tools, particularly grinding machines, to control the size of work pieces being produced thereby and insuring said work pieces being held within extremely narrow limits of size, such as one or two ten-thousandths of an inch.

Another object of the invention is the provision of an improved sizing device or mechanism that is operated by the work pieces as they pass thereby from the tools of the machine.

Another object of the invention is the provision of a sizing mechanism of the multiplication lever type having the parts thereof jointed by improved means for insuring the proper positive shift between said parts and in which all side or lateral play is positively eliminated.

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.

In the drawings:

Figure 1 is a front elevation of a grinding machine embodying the improvements of this invention.

Figure 2 is a top plan view of the machine shown in Figure 1.

Figure 3 is an elevational view of the parts forming the grinding throat of a centerless grinder as particularly seen from line 3—3 on Figure 1.

Figure 4 is a view partly in elevation and partly in section as seen substantially from line 4—4 of Figure 3.

Figure 5 is a view partly in elevation and partly in section as seen from line 5—5 of Figure 4.

Figure 6 is a sectional view taken on line 6—6 of Figure 5.

Figure 7 is a fragmentary sectional view on line 7—7 of Figure 3.

Figure 8 is a sectional view taken on line 8—8 of Figure 1.

Figure 9 is a sectional view taken on line 9—9 of Figure 8.

Figure 10 is a fragmentary sectional view taken on line 10—10 of Figure 8.

Figure 11 is a sectional view through the control valve taken substantially on line 11—11 of Figure 9.

Figure 12 is a sectional view showing the piston compensator taken substantially on line 12—12 of Figure 9.

Figure 13 is a diagrammatic view illustrating the electrical circuit involved in the invention.

Throughout the several views of the drawings similar reference characters are employed to denote the same or similar parts.

As was noted above, this invention pertains to an improved size control mechanism for machine tools, having particular reference to grinding machines. The invention is shown in connection with a centerless grinding machine, but it is to be understood that it is equally applicable to a center type and other types of grinding machines or any machine tool that removes stock from a work piece, including a feeding mechanism for the tool or work piece that is to be cut off or increased as the size of the work nears the ultimate desired point.

The grinding machine illustrated in the drawings is of the through feed centerless type, in which the work pieces are continuously passing through the grinding throat and which machine is adapted to effect a continuous production and adapted further to compensate for wheel wear or other factors when the work pieces fail to be reduced to the final desired size.

In general the machine illustrated in the drawings comprises a bed 15 having rising therefrom at one end thereof a pedestal bearing 16 in which is journaled a spindle 17 for a grinding wheel 18. The spindle and grinding wheel are adapted to be rotated at a high grinding rate of speed by any desirable means or in any desirable manner. The hood 19 enclosing the grinding wheel provides a bracket or shelf 20 supporting a truing mechanism 21 adapted to traverse the operative face of the grinding wheel 18 to maintain same in a true, sharp condition.

The bed 15 is further provided on its upper surface with guideways 22 for a slide 23 adapted to be adjusted relative to the bed toward and from the grinding wheel. The slide 23 is further provided with ways 24 for a second or upper slide 25 adapted to be actuated relative to the lower slide 23 or clamped thereto by means of a clamp 26 whereby the said slides are actuated as a unit. In order to effect the independent adjustment of the slides, clamps 27 are provided for securing the lower slide 23 to the bed. The upper slide 25 has integral therewith and rising therefrom the bracket or housing 28 to which is pivotally secured

a head or housing 29 enclosing a spindle 30 carrying at its one end a regulating wheel 31. The regulating wheel and its spindle are adapted to be rotated at a relatively slow work rotation controlling rate of speed. The grinding wheel 18 and the regulating wheel 31 are each rotated in a clockwise direction whereby their proximate portions travel in opposite directions, said portions forming between them a grinding throat in which the work is positioned to be operated upon by the grinding wheel. By oscillating the head or housing 29 about the axis of its pivotal connection the regulating wheel is canted as respects the grinding wheel and work and thereby effects an axial feed or travel of the work.

The lower slide 23 is provided at its forward end with a work rest block 32 which is positioned beneath the grinding throat and supports a work rest blade 33 peripherally supporting the work 34 as it passes through the said throat. The block 32 is provided adjacent the vertical sides of the blade 33 with guides 35 and 36, the former being at the forward end of the throat, while the latter is positioned at the rear end of the throat. As shown in Figure 4, and since they are substantially duplicates of one another it is presumed a description of one of them will suffice for the other, the guide 36 comprises opposed guide blocks 37 and 38, one positioned on each side of the blade and each having an angular groove formed in the end side thereof respectively receiving a correspondingly shaped tongue 39 and 40 formed respectively at the upper end of arms 41 and 42. The said arms are respectively received in vertical recesses 43 and 44 formed on opposite sides of the work rest block 32. The arm 41 is pivoted at 45 to the block by the pivot passing through the said recess while the arm 42 is similarly pivoted to a rod or shaft 46 extending through the recess 44. The block 32 is provided intermediate its upper and lower surface with a threaded perforation 47 in which is screw threaded a plug 48, this plug 48 having a V-shaped notch 49 formed therein to provide a cam face 50 adapted to be engaged by the end of an adjusting screw 51. The lower extremity of the arms 41 and 42 terminate in alignment with one another and on opposite ends of an opening or perforation 52 formed through the block 32 near its lower end. A spring 53 extends through the perforation 52 and has its opposite ends respectively secured to the said lower extremities of the arms 41 and 42 and this spring tends to draw said extermities to one another, thereby oscillating the arms 41 and 42 in opposite directions or tending to separate the guide blocks 37 and 38. This oscillation of the arms is restrained by the end of the adjusting screw 51 engaging with the cam face 50 and limits the separation of said blocks, which may be varied by adjusting the screw so that the end thereof engages the cam face at a point nearer the upper or lower ends of the face. This adjustment is necessary to permit the machine to handle other than a single size work piece.

The work pieces on passing from the grinding throat are supported by a blade 54 which has an inclined operative surface 55 co-operating with the inclined surface 56 of guide block 57 secured to the inclined portion 58 of a second blade 59 mounted adjacent to the blade 54. The said blades 54 and 59 through the inclined surfaces 55 and 56 form a V-shaped guide trough for guiding the work pieces after they pass from the grinding throat. The said blades are mounted in a recess 60 formed longitudinally of a bracket 61 secured in any desirable manner, such as by bolts 62 to the rear face of the work rest block 32. The blades 54 and 59 are adapted to be vertically adjusted relative to the recess 60 by means of adjusting screws 63 and 64 to take care of various sizes of work pieces and the said blades are clamped in their adjusted positions by means of clamp screws 65.

The bracket 61 is formed longitudinally thereof at its upper end with a T-slot 66 receiving the headed end of the bolts 67 which pass through suitable perforations formed in a bracket 68. This bracket 68 carries the size control mechanism and for this purpose is provided with a slide way 69 receiving the tongue 70 of a slide 71. The slide 71 has projecting from it near its upper end a boss 72 in which is rotatably journaled the inner end of an adjusting screw 73 threaded in a nut or lug 74 secured to or formed integral with the upper end of the bracket or standard 68. The screw 73 has secured to its outer end a knob 75 whereby it may be rotated for adjusting the position of the slide 71 and parts carried thereby. The slide 71 is held yieldably to its seat by means of springs 76 which surround studs or bolts 77 extending from the lower surface of the slide 71. The springs abut on one end with the rear face of the bracket or standard 68 and on the other end with lock nuts 78 secured thereto. The slide 71 is provided on its forward surface with an elongated boss 79 having formed therein a guide groove 80 receiving the tongue 81 projecting from the housing 82. The housing 82 is provided with an elongated perforation 83 through which a clamp bolt or screw 84 extends having its threaded end received in the lug 79 and whereby the housing 82 is adjusted laterally of the slide 71. As seen in Figures 3 and 5, the housing 82 is substantially L-shaped including the hollow vertical arm 85 and the cylindrical arm 86, the former containing suitable amplification levers and electrical contacts while the latter contains and supports the sizing mechanism operating parts.

The cylindrical arm 86 is adapted to be positioned beyond the grinding throat so that the work pieces in passing from the throat pass thereunder and if beyond a given size, one ten-thousandth or so of an inch, engage with feeler finger or feeler member 87. This member 87 is clamped between the fingers of a block 88 which depends below the arm 86. The block 88 is connected by means of flat fulcrum members 89 and 90 with a guide block 91 secured in any desirable manner to the swivel head 92 of the gaging mechanism. The head 92 is integral with or secured to a sleeve 93, which is journaled in a suitable bore formed in the cylindrical arm 86 of the housing 82. By this construction and as will later appear, the head 92 may be rotated or oscillated relative to the arm 86 to position the gaging finger or feeler 87 at any desired angle with respect to the work as it passes thereby. The flat fulcrum members 89 and 90 are secured to the guide screws 91 by means of clamp blocks 94 and screws 95. Any other desirable method, however, may be used for securing these members, such as welding or the like. The upper end of the vertically shiftable gage block 88 is connected by the flat fulcrum 96 to the end of arm 97 of bell crank lever 98. The bell crank lever 98 is connected by a flat fulcrum member 99 for oscillatory movement to the head 92 and is adapted to oscillate through the fulcrum member 99 in a single plane, all other movement being pro-

hibited by the said fulcrum 99. The other arm 100 of the bell crank 98 is connected by a flat fulcrum 101 with an axially shiftable rod 102 passing through a relatively large bore 103 in the sleeve 93 of the gage head 92. This rod 102 is formed on the end with a counterbore 104 in which is seated a spring 105 abutting on one end with the base of the counterbore 104 and on the other end with the end of a headed pin 106 slidable within the counterbore 104. The head 107 of the pin 106 abuts the adjacent end of a stop screw 108 adjustably threaded on the end of a comparatively long arm 109 positioned within the hollow interior of the arm 85 of L-shaped bracket 82. This arm 109 is pivoted by means of a flat fulcrum 110 which is located near the stop screw or lower end of the arm 109, being mounted in a boss or lug 111 projecting from the wall of the arm 85. The upper end of the arm 109 is in turn connected by means of a flat fulcrum 112 with a second vertically disposed arm 113 likewise pivotally mounted by means of a flat fulcrum 114 to a block or boss 115 carried by the arm 85 interiorly thereof. The lower end 116 of the arm 113 lies adjacent the end of switch contact member 117, which is adapted to have its contact 118 placed in engagement with a contact 119 on second switch contact member 120. The switch contact arms 117 and 120 are mounted on an insulation block 121 which has secured thereto the binding posts 122 and 123 for the electrical leads which extend to a compensating device, feed stop mechanism or the like as will later appear.

The operation of these parts as seen in Figure 5 is as follows. Assuming the over-sized work piece to be traveling to the left, as seen in Figure 5, it will encounter the contact member 87 thereby vertically shifting the gage block 88. This is an absolute vertical movement because the fulcrums 89 and 90 will prohibit any side play. The vertical shifting of the gage block 88 pushes upwardly through the fulcrum 96 against the arm 97 of bell crank 98 thereby oscillating it in a clockwise direction about the fulcrum 99 which again is a flat fulcrum thereby prohibiting any lateral or sidewise movement and insuring a true arcuate travel of the lever. This clockwise oscillation of the lever 98 will through the fulcrum 101 axially shift the rod 102 to the left and again since the fulcrum is a flat member prohibiting any lateral or side movement between the parts, will urge the rod in a truly axial direction. The shifting of the rod 102 through the pin 107 which is held in a fixed or stationary position due to the comparatively heavy strength of the spring 105, will oscillate the arm 109 in a clockwise direction about the fulcrum 110. Since this fulcrum 110 is a flat member no sidewise movement of the parts can take place, thereby insuring the arm oscillating through a definite plane. Since the fulcrum 110 is placed considerably nearer the lower or adjusting screw end, the upper end of the arm 109 will travel through a considerable distance compared to the travel of the lower end of the arm. This oscillatory movement of the arm 109 will through the fulcrum 112 oscillate the short arm 113 in a counterclockwise direction about the fulcrum 114 and since the fulcrums 112 and 114 are again flat fulcrums, no sidewise movement of these arms can take place insuring the proper movement of the members through the desired plane. The oscillatory movement of the arm 113 will through its end 116 force the yieldable switch arm to the right causing contact between its contact member 118 and the contact member 119 to take place, thereby completing an electrical circuit.

In order to take any back lash out of the parts within the hollow arm 85 of the L-shaped bracket 82, spring 124 is provided having one end secured at 125 to the arm 109 and the other end secured at 126 to the block 111 and exerting a pull tending to oscillate the arm 109 in a counterclockwise direction. This movement of the arm is limited by an adjustable stop screw 127 which extends through one wall of the arm 85 into contact with the adjacent face of the arm 109. The spring 105 above described and contained within the counterbore 104 likewise exerts a pressure to the right for urging the rod 102 in that direction and thereby taking the back lash out of all of the parts within the gage head 92. The adjustable screw 108 on the lower end of the arm 109 will upon actuation of the arm 109 an undue amount engage with adjustable stop screw 128 carried by one wall of the hollow arm 85 and will limit the movement of the parts within the arm 85 to prevent rupture thereof while the spring 104 would yield, to likewise prevent rupture of the parts within the gage head 92.

From the foregoing it will be noted that there has been provided a mechanism in which every effort has been made to insure the proper movement or actuation of the parts and to eliminate all possible side play and thereby cut down the ultimate shifting of the parts eliminating a possible chance of error. Furthermore it will be noted that through the large amplification in the arm 109 and the further amplification in the arm 113 very slight movement is required of the feeler member 87 and gage block 88 for closing the electrical circuit contact and that said contacts may be adjusted to a very fine degree for insuring the proper operation of the parts.

As is well known, the work rest blade 33 is provided with an operative inclined surface 129 which is varied depending upon the size of the work piece being operated upon and in order that the proper distance may be had between the operative face 129 of the blade and the knife edge contact of the feeler 87, the head which carries these parts is, as above noted, adjustable through the sleeve 93 for aligning said knife edge contact of the member 87 in parallelism with the angle top 129 of the blade. In this way a true gage is provided through which the work pieces must pass and if they are slightly over-size even though only one ten-thousandth of an inch, the member 87 will be lifted and thereby operate the parts above described for closing the electrical circuit. As was noted above, the upper and lower slides 23 and 25 are adapted to be actuated as a unit and relative to one another. The latter movement is resorted to for set up purposes to establish the proper relation between the work rest blade 33 and the operative face of the regulating wheel 31 and to position said parts with respect to the grinding wheel and establish the desired size of the grinding throat therebetween. After the parts have been once set up the clamp 26 is tightened and the clamp 27 loosened whereupon the two slides move as a unit, which movement however is only necessary to take care of wheel wear or the reduction in the size of the grinding wheel due to truing thereof. For this purpose there is provided an adjusting screw 130 having its threads received in a nut 131 rotatably journaled in the rear wall of the bracket or housing 28. The other end of the screw 130 is rotatably mounted in a

bracket 132 secured to the rear end of the bed 15 and the screw is provided beyond this bracket with a pilot or hand wheel 133 whereby it may be rotated. The nut 131 is also adapted to be rotated, for which purpose it has keyed or otherwise secured to it a worm wheel 134 meshing with a worm 135 on one end of a worm shaft 136 rotatably journaled in a swivel bracket 137. Secured to the extreme outer end of the worm shaft 136 is a hand wheel 137*a* whereby the shaft may be manually rotated to make fine adjustments of the slides 23 and 25 as respects the bed 15. Also carried by the worm shaft 136 is a ratchet 138, see Figures 8 and 9, adapted to be engaged by a pawl 139 pivoted at 140 to a segmental gear 141 loosely journaled on a sleeve 142 carried by the swivel bracket 137. A spring 143 abuts the end of the pawl 139 tending to oscillate the end of the pawl toward the ratchet. Extending through the swivel bracket 137 into the path of oscillation of the pawl 139 is a throw out screw 144 so that when the segmental gear 141 reaches the limit of its movement when rotated in a counterclockwise direction, and as seen in Figure 9, the pawl is disengaged from the ratchet so that the shaft 136 may be rotated manually through the hand wheel 137*a*.

The gear teeth 145 of the gear 141 mesh with a rack 146 secured to or formed integral with a piston 147. The piston 147 is contained within a cylinder 148 formed integral with the swivel bracket 137. The bracket 137 is further formed with a valve chamber 149 containing valve spool 150. The valve 150 has its one end 151 connected with an electrical solenoid 152 and has its other end extended in a reduced stem portion 153 which is surrounded by a spring 154 abutting on one end with a plate 155 and on the other end with lock nuts 156 secured to the stem 153.

The operation of these parts will be best understood by reference to Figure 13 in which is shown diagrammatically a switch 157 which is in the form of two contacts which are the contacts 118 and 119 and adapted to be closed upon raising of the gage block 88. As shown in this figure, an electrical lead or wire 158 extends from one of the main leads 159 or 160 terminating at one side of the switch 157. An electric wire or lead 161 extends from the other side of the switch 157 terminating at one end of solenoid 152 having extending from its other side a line 162 terminating in one contact of a switch 163 which is normally closed. The switch in turn is connected on its other side by means of a wire 164 with the remaining lead 159 or 160. There is also shown in this figure diagrammatically a tank or sump 165 containing an hydraulic medium, preferably oil, which is adapted to be drawn therefrom through a pipe 166 by a pump 167 and discharged under pressure into the conduit 168 which terminates in the valve casing 149. The spool valve 150 within the casing connects the pressure conduit 168 with a port or conduit 169 which terminates at one end of the cylinder 148, for actuating the piston therein to the left, as seen in Figure 9. The hydraulic medium ahead of the piston is discharged from the cylinder through a conduit 170 terminating in the valve casing 149 where it is connected with the discharge conduit 171. The movement of the piston rotates the segmental gear 141 which through the ratchet and pawl rotates the worm shaft 136 for rotating the worm 135 and actuating the nut 131 feeding the two slides toward the grinding wheel a predetermined fractional amount. The parts are generally adjusted to operate when the work piece is a tenth of a thousandth oversize whereupon the wheels are fed toward one another to reduce succeeding work pieces the said tenth of a thousandth. When the piston 147 reaches the end of its movement, it through a pin 172, see Figure 12, engages a dog 173 on a slide rod 174 slidable through suitable bearings 175 formed on the swivel housing 137. This movement of the rod 174 opens the normally closed switch 163 against the yielding resistance of a spring 176. The rod 174 is provided therein with a pair of notches 177 co-operating with a spring loaded detent 178 whereby the rod is held in its operative positions for either closing the switch 163 or holding same open.

It will be appreciated that the work piece being gaged is somewhat remote from the work piece actually being operated upon so that the parts cannot be returned too rapidly to their normal positions because a continuous feed would take place until the sliding gage block 88 dropped to its normal position to break the contacts 118 and 119 for opening the switch 157. Therefore, the exhaust of the hydraulic medium from ahead of the piston when rotating the worm to feed the work toward the grinding wheel is unrestricted while when the parts are being returned to their normal position the exhaust from the other end of the cylinder is restricted. Therefore, as soon as the piston 146 reaches the end of its movement to the left, as seen in Figure 9, the solenoid 152 is de-energized through the opening of the switch 63, thereby permitting expansion of the spring 155 for shifting the valve 150 to its other position, see Figure 13, thereby connecting the hydraulic pressure in pressure conduit 168*a* with the conduit 170. This causes the piston 147 to be actuated to the right, as seen in Figure 9, and exhausts the medium ahead of it out through the conduit 169. The medium then passes through the valve 150 to the conduit 171 but before the conduit 171 is reached the medium passes an adjustable choke or control valve 179 thereby retarding the movement of the piston during its reverse stroke. When the piston reaches the end of its travel in a reverse direction the pin 172 engages a second dog 180 on the rod 174 for disengaging the detent 178 and permitting the spring 176 to close the switch 163 setting the parts for the next adjustment of the grinding throat. The choke valve 179 is so adjusted as to insure that the work piece within the grinding throat at the time the wheels were fed toward one another is beneath the gage block before the next adjustment or compensation takes place, if necessary.

From the foregoing it will be noted that an improved sizing mechanism has been provided for automatically compensating for the size of work pieces being produced and insuring the production of all work pieces within the same limits of tolerance.

What is claimed is:

1. In a machine tool organization the combination of a work support, a tool adjacent the support for effecting stock removal from the work, means for actuating the work axially of itself along the work support past the tool, an axially shiftable member in the path of movement of the work and adapted to be moved if the work is above the desired size, means operable by the axial shifting of the member for effecting a relative adjustment between the work and tool to further reduce successive work pieces, said work support being adapted to peripherally support the work, and means supporting the axially shift-

able member for adjustment to dispose same in a plane parallel with the supporting surface of the work support.

2. In a centerless grinder the combination of a bed, a pair of opposed grinding and regulating wheels mounted thereon and forming a grinding throat therebetween, a work rest blade subtending the grinding throat, a trough disposed beyond the grinding throat for receiving work pieces as they pass therefrom, feeding means for shifting one of the wheels toward the other for varying the size of the grinding throat, an L-shaped bracket supported above the blade and trough and having one arm thereof cylindrical for bearing purposes, an axially shifted member supported by said bearing for contact with and adapted to be axially adjusted by the work when the said work is above the desired size, the other arm of the bracket being of hollow rectangular cross section, control means in said hollow arm for energizing the feeding means upon actuation of the axially shiftable member.

3. In a centerless grinder the combination of a bed, a pair of opposed grinding and regulating wheels mounted thereon and forming a grinding throat therebetween, a work rest blade subtending the grinding throat, a trough disposed beyond the grinding throat for receiving work pieces as they pass therefrom, feeding means for shifting one of the wheels toward the other for varying the size of the grinding throat, an L-shaped bracket supported above the blade and trough and having one arm thereof cylindrical for bearing purposes, an axially shifted member supported by said bearing for contact with and adapted to be axially adjusted by the work when the said work is above the desired size, the other arm of the bracket being of hollow rectangular cross section, control means in said hollow arm for energizing the feeding means upon actuation of the axially shiftable member, said control means including a plurality of multiplication levers adapted to complete an electrical circuit, and an electrical circuit between the control means and feeding means.

4. In a sizing mechanism for use with grinding machines the combination with a bracket, of an oscillatory gaging head mounted in the bracket, an axially shiftable member carried by the bracket for movement in a truly axial direction, means connecting the member with the head for insuring such axial movement, a bell crank pivotally mounted on the gaging head, means for connecting the bell crank with the member for oscillation in a plane parallel with the plane of movement of the member, a rod extending axially through the gaging head for axial movement upon oscillatory movement of the bell crank, and amplification levers oscillated by the axial shifting of the rod for completing an electrical circuit.

5. In a sizing mechanism for use with grinding machines the combination with a bracket, of an oscillatory gaging head mounted in the bracket, an axially shiftable member carried by the bracket for movement in a truly axial direction, means connecting the member with the head for insuring such axial movement, a bell crank pivotally mounted on the gaging head, means for connecting the bell crank with the member for oscillation in a plane parallel with the plane of movement of the member, a rod extending axially through the gaging head for axial movement upon oscillatory movement of the bell crank, amplification levers oscillated by the axial shifting of the rod for completing an electrical circuit, yieldable means for eliminating back lash between the amplification levers, and additional yielding means for eliminating back lash between the parts carried by the gage head.

6. In a sizing mechanism for use with grinding machines the combination with a bracket, of an oscillatory gaging head mounted in the bracket, an axially shiftable member carried by the bracket for movement in a truly axial direction, means connecting the member with the head for insuring such axial movement, a bell crank pivotally mounted on the gaging head, means for connecting the bell crank with the member for oscillation in a plane parallel with the plane of movement of the member, a rod extending axially through the gaging head for axial movement upon oscillatory movement of the bell crank, amplification levers oscillated by the axial shifting of the rod for completing an electrical circuit, yieldable means for eliminating back lash between the amplification levers, additional yielding means for eliminating back lash between the parts carried by the gage head, and means mounting the gage head and parts carried thereby for oscillatory adjustment relative to the bracket for aligning the member with the work as it passes thereby.

7. In a centerless grinder comprising opposed grinding and regulating wheels forming a grinding throat therebetween, a work rest blade disposed in the grinding throat and having an angled operative surface inclining in the general direction of the regulating wheel, guides mounted on opposite sides of the work rest blade and co-operating therewith to form a work receiving trough of a width substantially equal to the diameter of the work, means for adjusting the position of said guides as respects the work rest blade, a bracket exteriorly of the grinding throat, a gage mechanism carried by the bracket and including a gage head overlying the angled surface of the blade, an axially shiftable member carried by the head for contact with the work, and means mounting the gage head in the bracket for oscillatory movement relative thereto to align the operative surface of the axially shiftable member with the angled top of the blade.

8. In a centerless grinder comprising opposed grinding and regulating wheels forming a grinding throat therebetween, a work rest blade disposed in the grinding throat and having an angled operative surface inclining in the general direction of the regulating wheel, guides mounted on opposite sides of the work rest blade and co-operating therewith to form a work receiving trough of a width substantially equal to the diameter of the work, means for adjusting the position of said guides as respects the work rest blade, a bracket exteriorly of the grinding throat, a gage mechanism carried by the bracket and including a gage head overlying the angled surface of the blade, an axially shiftable member carried by the head for contact with the work, means mounting the gage head in the bracket for oscillatory movement relative thereto to align the operative surface of the axially shiftable member with the angled top of the blade, means for effecting a relative feed between the work and grinding wheel, an electrical circuit including the feeding means for effecting the relative feed between the work and grinding wheel, and means carried by the bracket operable by the axially shiftable member of the work head for completing the electrical circuit.

9. In a centerless grinder comprising opposed grinding and regulating wheels forming a grind-

ing throat therebetween, a work rest blade disposed in the grinding throat and having an angled operative surface inclining in the general direction of the regulating wheel, guides mounted on opposite sides of the work rest blade and cooperating therewith to form a work receiving trough of a width substantially equal to the diameter of the work, means for adjusting the position of said guides as respects the work rest blade, a bracket exteriorly of the grinding throat, a gage mechanism carried by the bracket and including a gage head overlying the angled surface of the blade, an axially shiftable member carried by the head for contact with the work, means mounting the gage head in the bracket for oscillatory movement relative thereto to align the operative surface of the axially shiftable member with the angled top of the blade, means for effecting a relative feed between the work and grinding wheel, an electrical circuit including the feeding means for effecting the relative feed between the work and grinding wheel, and means carried by the bracket operable by the axially shiftable member of the work head for completing the electrical circuit, said means comprising contact members in the electrical circuit, means adjusting the space between said contacts, and movement amplification levers operable by the axial shifting of the member.

10. In a sizing device for use with grinding machines comprising a bracket, an axially shiftable member for contact with the work, flat fulcrums connecting the member with the bracket whereby the member is suspended for movement in an axial direction only, a bell crank lever, a flat fulcrum supporting the bell crank, a flat fulcrum connecting the axially shiftable member with one arm of the bell crank, an axially shiftable rod, a flat fulcrum connecting the bell crank with the rod whereby axial shifting of the member effects an oscillation of the bell crank and axial shifting of the rod in a single plane, and means operated by the axial shifting of the rod for completing an operative electrical circuit.

11. In a sizing device for use with grinding machines comprising a bracket, an axially shiftable member for contact with the work, flat fulcrums connecting the member with the bracket whereby the member is suspended for movement in an axial direction only, a bell crank lever, a flat fulcrum supporting the bell crank, a flat fulcrum connecting the axially shiftable member with one arm of the bell crank, an axially shiftable rod, a flat fulcrum connecting the bell crank with the rod whereby axial shifting of the member effects an oscillation of the bell crank and axial shifting of the rod in a single plane, and means operated by the axial shifting of the rod for completing an operative electrical circuit, said means comprising oscillatory amplification levers, flat fulcrums connecting said levers to the bracket, flat fulcrums connecting said levers to one another, and electrical contacts adapted to be closed upon movement of said levers.

12. In a sizing device for use with grinding machines comprising a bracket, an axially shiftable member for contact with the work, flat fulcrums connecting the member with the bracket whereby the member is suspended for movement in an axial direction only, a bell crank lever, a flat fulcrum supporting the bell crank, a flat fulcrum connecting the axially shiftable member with one arm of the bell crank, an axially shiftable rod, a flat fulcrum connecting the bell crank with the rod whereby axial shifting of the member effects an oscillation of the bell crank and axial shifting of the rod in a single plane, means operated by the axial shifting of the rod for completing an operative electrical circuit, said means comprising oscillatory amplification levers, flat fulcrums connecting said levers to the bracket, flat fulcrums connecting said levers to one another, and electrical contacts adapted to be closed upon movement of said levers, and yieldable means operable to eliminate all back lash between the parts.

13. In a sizing device for use with grinding machines comprising a bracket, an axially shiftable member for contact with the work, flat fulcrums connecting the member with the bracket whereby the member is suspended for movement in an axial direction only, a bell crank lever, a flat fulcrum supporting the bell crank, a flat fulcrum connecting the axially shiftable member with one arm of the bell crank, an axially shiftable rod, a flat fulcrum connecting the bell crank with the rod whereby axial shifting of the member effects an oscillation of the bell crank and axial shifting of the rod in a single plane, means operated by the axial shifting of the rod for completing an operative electrical circuit, said means comprising oscillatory amplification levers, flat fulcrums connecting said levers to the bracket, flat fulcrums connecting said levers to one another, and electrical contacts adapted to be closed upon movement of said levers, yieldable means operable to eliminate all back lash between the parts, and means mounting the axially shiftable member and parts operated thereby for adjustment of the parts relative to the bracket for aligning same with the work to pass thereunder.

14. In a mechanism of the class described the combination with a bed, a tool on the bed, a work support adjacent the tool, and means for effecting a feed between the tool and work, of a sizing device for controlling the feed means, said sizing device including a contact member disposed adjacent the work support for engagement with the work as it passes from the tool when the said work is above the desired size, amplification levers associated with the sizing device, flat fulcrums connecting the levers with one another whereby they are constrained to move in a given direction, a housing containing the contact member and amplification levers, a bracket supporting the housing, and means adjusting the position of the housing relative to the bracket toward and from the work support.

15. In a mechanism of the class described the combination with a bed, a tool on the bed, a work support adjacent the tool, and means for effecting a feed between the tool and work, of a sizing device for controlling the feed means, said sizing device including a contact member disposed adjacent the work support for engagement with the work as it passes from the tool when the said work is above the desired size, amplification levers associated with the sizing device, and flat fulcrums connecting the levers with one another whereby they are constrained to move in a given direction, said contact member being mounted for adjustment to align same in parallelism with the work support.

16. The combination with a machine tool organization including a tool, a work support adjacent the tool, and means for effecting a relative feed between the work support and tool, of a sizing mechanism overlying the work support for engagement with the work as it passes from

the machine comprising a contact member, a housing supporting the contact member, amplification levers within said housing, flat fulcrums connecting said contact and amplification levers with the housing and with one another for movement in definite planes, and means further supporting the contact member for adjustment relative to the housing to permit same to be disposed parallel with the work support.

17. The combination with a machine tool organization including a tool, a work support adjacent the tool, and means for effecting a relative feed between the work support and tool, of a sizing mechanism overlying the work support for engagement with the work as it passes from the machine comprising a contact member, a housing supporting the contact member, amplification levers within said housing flat fulcrums connecting said contact and amplification levers with the housing and with one another for movement in definite planes, means further supporting the contact member for adjustment relative to the housing to permit same to be disposed parallel with the work support, hydro-electric means for actuating the feeding mechanism, and electrical contacts operable by the amplification levers for energizing the hydro-electric means and actuating the feeding mechanism.

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