Aug. 4, 1936. R. E. W. HARRISON ET AL 2,049,611

AUTOMATIC SIZING MECHANISM

Filed Sept. 27, 1929 3 Sheets-Sheet 1

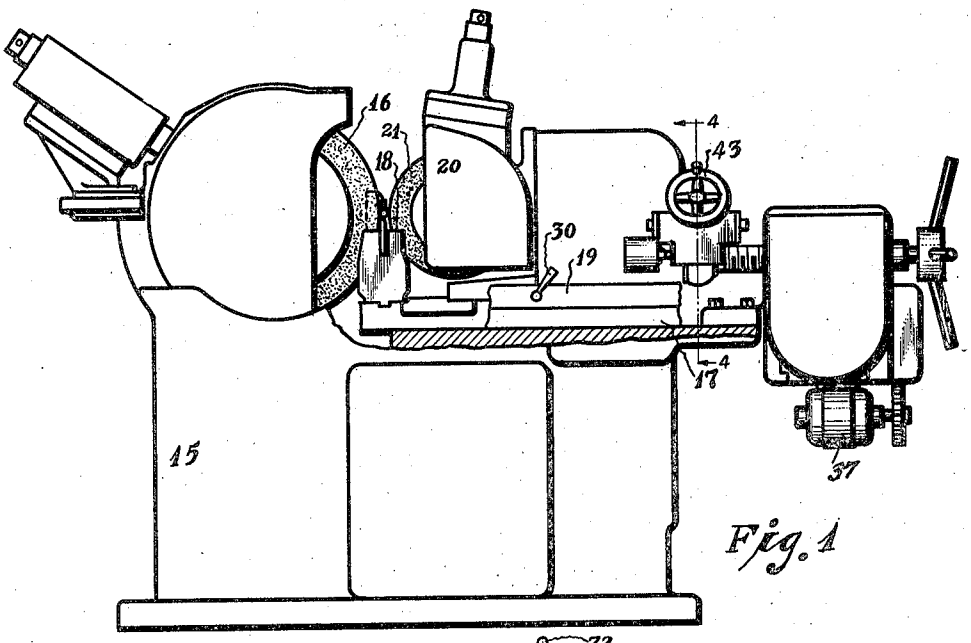


Fig. 1

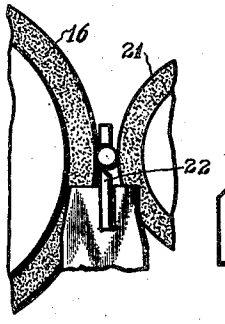


Fig. 2

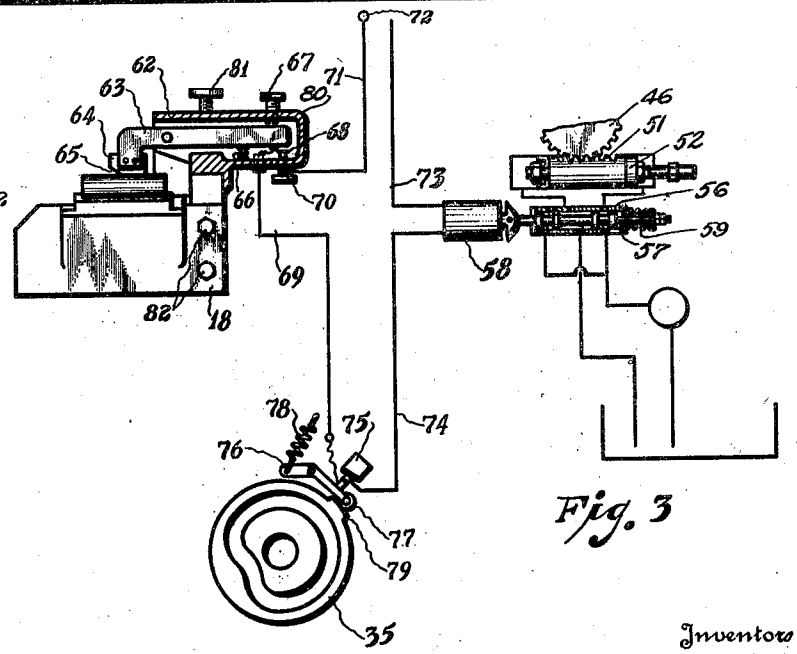


Fig. 3

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AUTOMATIC SIZING MECHANISM

Filed Sept. 27, 1929 3 Sheets-Sheet 2

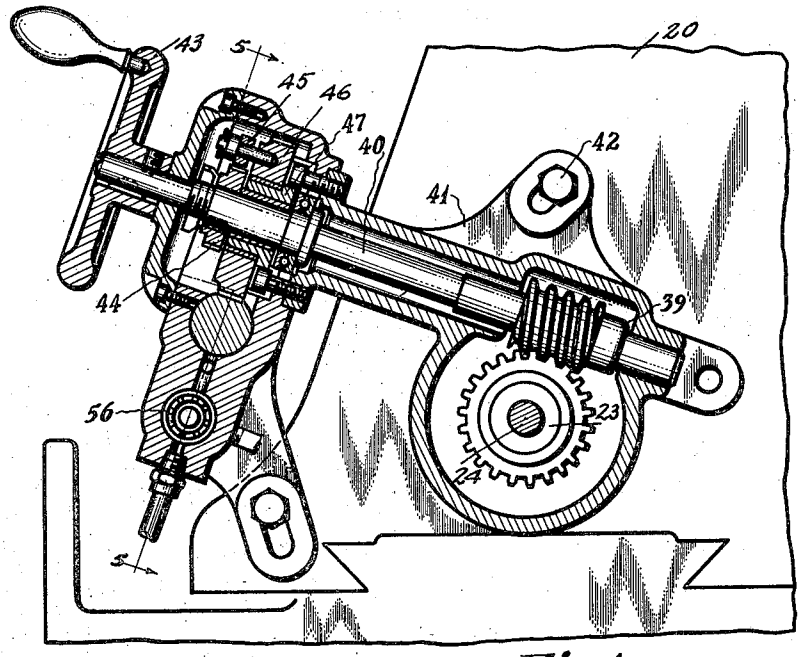


Fig. 4

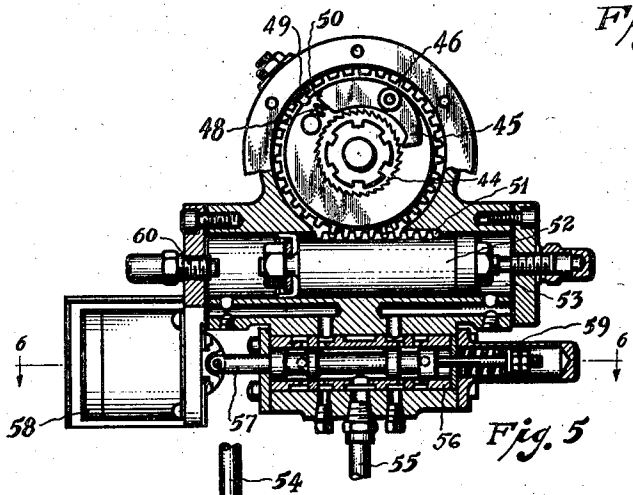


Fig. 5

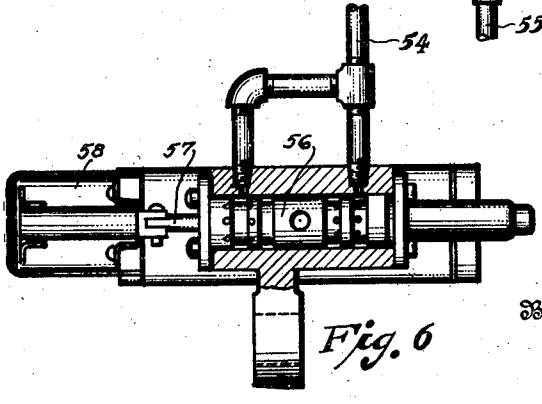


Fig. 6

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AUTOMATIC SIZING MECHANISM

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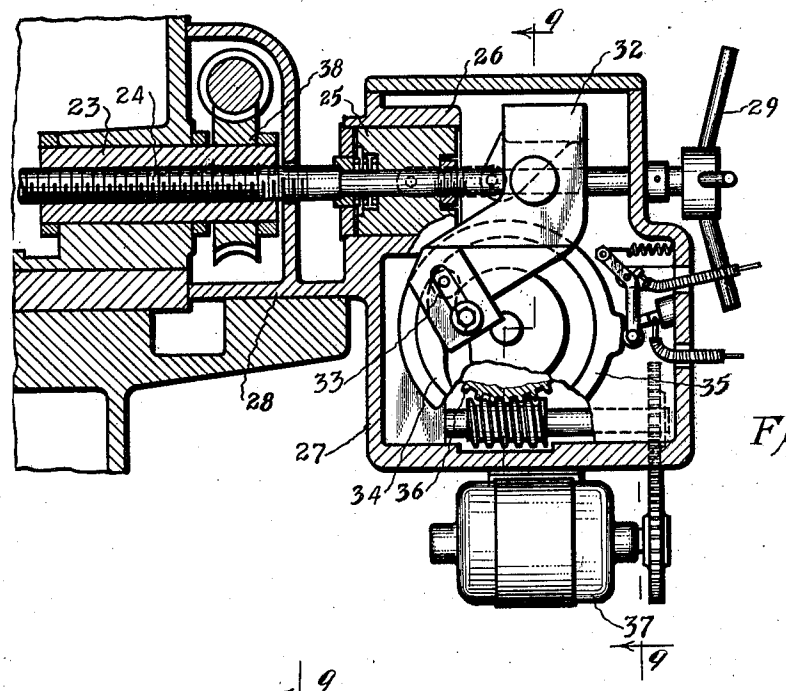


Fig. 7

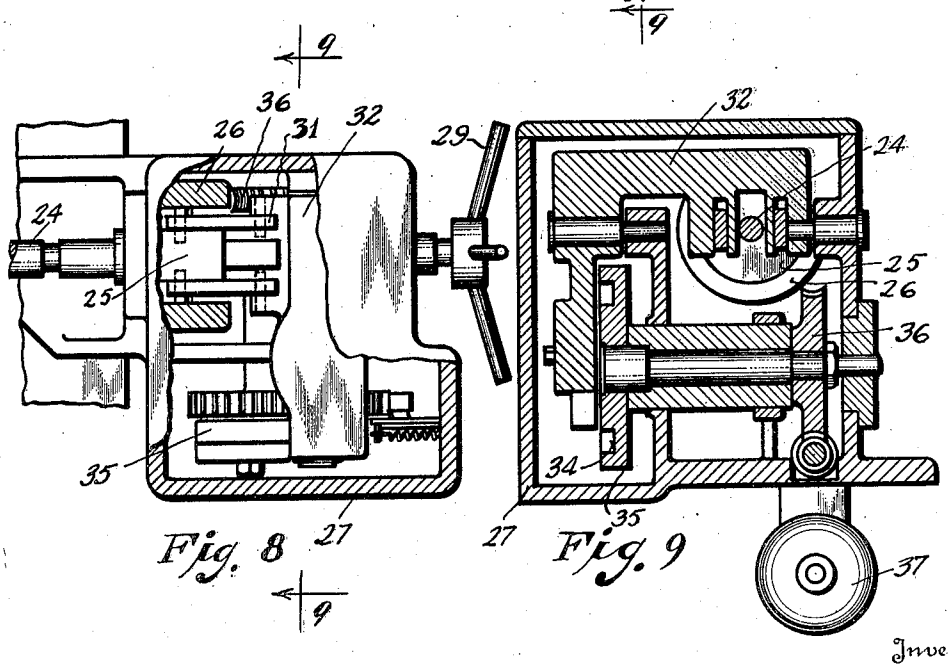


Fig. 8 Fig. 9

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UNITED STATES PATENT OFFICE

2,049,611

AUTOMATIC SIZING MECHANISM

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Application September 27, 1929, Serial No. 395,689

8 Claims. (Cl. 51—103)

This invention relates to improvements in machine tools and particularly to a mechanism for facilitating the production therein of successive work pieces of uniform size.

The invention in question is particularly applicable to metal working machines employing abrasive wheels or the like for removal of stock from the work. Ordinarily, in various forms of grinding, both surface grinding and cylindrical grinding of various types, difficulty is experienced in maintaining uniformity of size of successive work pieces, due to the fact that the abrasive member employed tends to wear down or itself decrease in diameter or vary in effective position as respects the work engagement. In precision production of cylindrical and other articles of grinding, modern tolerances have been reduced to a fractional thousandth of an inch, rendering ordinarily necessary a practically continuous manual gaging of the several work pieces produced, to determine their accuracy.

One of the objects of the present invention is the provision of a mechanism particularly useful when a series of corresponding articles are to be produced by a machine, which mechanism will serve automatically to determine the thickness or diameter of the individual work pieces and produce a feeding or adjusting movement of the machine of proper degree to compensate for size variations of the work due to wear or variance in position of the operative face of the grinding or stock removing member as respects the work supporting mechanism.

A further object of the invention is the provision of a mechanism for the purpose aforesaid which shall be operatively effective for determination of the thickness of the work, only when the normal grinding operation thereon has been completed.

An additional object of the present invention is the provision of means for automatically rendering the gage mechanism operative in predetermined relation to the normal relative feeding movements of the work and metal removing tool.

An additional object of the present invention is the provision of an improved size determining and wheel wear compensating mechanism which will be capable of ready application to and utilization in conjunction with infeed type centerless grinding machines for maintenance of proper diameter of successive work pieces produced therein.

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 will be understood that we may make any modifications in the specific structural details hereinafter disclosed within the scope of the appended claims, without departing from or exceeding the spirit of the invention.

Figure 1 is a front elevation of a centerless grinder with the improved size maintaining mechanism applied thereto.

Figure 2 is an enlarged fragmentary view of the work and associate parts at the grinding throat of the machine.

Figure 3 is a semi-diagrammatic view illustrating the work receiving throat and the control mechanisms coupled with the gage member within the throat.

Figure 4 is a section through the combined manual and automatic wheel adjusting mechanism, taken on line 4—4 of Fig. 1.

Figure 5 is a vertical section on the line 5—5 of Figure 4.

Figure 6 is a view partly in section on line 6—6 of Figure 5 with the valve bushing shown in elevation.

Figure 7 is a fragmentary sectional view through the manual and automatic wheel head position adjusting mechanism and control elements associated therewith.

Figure 8 is a plan view of said mechanism with parts broken away.

Figure 9 is a transverse section as on line 9—9 of Figures 7 and 8.

In the drawings the invention has been shown as utilized in conjunction with what is commercially known as a centerless grinder, comprising a bed 15 having suitably journaled thereon a grinding wheel 16 operable at a high grinding rate of speed in a clockwise direction, as viewed in Figure 1. Bed 15 further serves to support slide 17 carrying the work rest bracket 18 and supporting a second slide 19 movable with and relative to the slide 17. Slide 19 supports the regulating wheel unit 20, including regulating wheel 21 disposed in opposition to the grinding wheel for maintaining the work in operative engagement therewith. This latter wheel rotates in a clockwise direction at a slow rate of speed to control the rotation of the work during the grinding operation. The work itself is normally supported by a work rest blade 22 secured in member 18.

The present application of the invention is shown as utilized in conjunction with infeed grinding, which is a term employed to denote the fact that the work is normally held against axial

advance or progression between the wheels during grinding and the amount of stock removed from the work piece or, in other words, the final ultimate diameter thereof is determined by the final separation and spacing of the opposed work contacting points on the surfaces of the grinding and regulating wheels respectively.

That this distance may be automatically varied or the wheels opened and closed when dealing with successive work pieces, a nut 23 is rotatably secured to unit 20. An adjusting screw 24 is in threaded engagement with nut 23. Said screw is rotatably but nontranslatably journaled in slide block 25 carried by guides 26 of the housing 27 supported from the bed 15 by a bracket member 28. The screw 24 projects beyond this housing and bears a pilot wheel 29 for rotation of the screw within the sleeve nut 23. This varies the distance between regulating wheel unit 20 and slide block 25. It is to be noted that slides 17 and 19 are coupleable as by a clamp 30 for joint or independent adjustment through screw 24. Coupled with slide block 25, as through links 31, is an oscillatable intermediately pivoted bell crank lever 32 having a pin or roller 33 engaged in groove 34 of cam 35 driven by a worm and worm gear connection 36 from motor 37. The path of the cam is particularly illustrated in connection with Figure 3 and is of such character that oscillation of the lever 32, effected thereby, will cause a rapid movement of the regulating wheel in the direction of the grinding wheel to urge a work piece into operative engagement with the grinding wheel, followed by a slow relative feeding movement, during which the proper amount of stock may be ground from the work piece, a subsequent dwell for sparking out grinding to attain utmost accuracy in the finished work piece, followed by a rapid separation of the grinding and regulating wheels to permit removal of the finished work piece and insertion of a new part to be ground.

While the screw 24 permits of what might be termed a coarse relative adjustment of the shift block and unit, to compensate for wear of either the grinding or regulating wheels, it is preferable that an additional finer adjustment mechanism be provided. This includes a worm gear 38 carried by sleeve nut 23 actuable by worm 39 on spindle 40. This spindle is journaled in a bracket 41 adjustably secured, as by bolts 42, to unit 20 and bears on its forward end an actuating wheel 43. Within the casing or bracket 41, spindle 40 bears a ratchet 44 engageable by pawl 45 on the rack gear or segment 46 journaled for rotation on bushing 47 circumscribing the spindle 40. A spring 48 urges the pawl into operative engagement with the ratchet, while in its retracted position abutment screw 49, by engagement with inclined terminal portion 50 of the pawl, serves both to limit the retracting movement of the parts according to the particular adjustment of screw 49 and also to force and hold the pawl in disengaged relation to the ratchet, whereby spindle 40 may be readily manually rotated in either direction, as desired, for adjustment of the sleeve.

Oscillatory actuation of the pawl and its carrier member 46 may be effected as by rack 51 formed on reciprocable piston 52 sliding in cylinder 53 formed in the bracket 41. This piston is adapted to be hydraulically actuated in one direction or the other by means of a suitable actuating medium such as oil under head or pressure introduced by way of conduit 54 and exhaustible through the conduit 55. A control valve mechanism is disposed within the bracket 41, including a suitable ported sleeve or bushing 56 containing a reciprocable valve 57 movable toward the left, as viewed in Figures 5 and 6, by the action of solenoid 58 and returnable by spring 59. The porting of the several valve parts is such that when the solenoid is energized, the valve will be shifted to the position shown in Figures 3 and 5, when the flow of energizing fluid will be from conduit 54 to the righthand end of cylinder 53, urging piston 52 to the left. This will cause a clockwise rotation of the pawl carrier 46, pawl 45 then engaging with ratchet 44 partially to rotate spindle 40 and worm 39. This acts on nut 23 to attain a fine inward feeding adjustment of the regulating wheel unit with respect to its control block. The amount of this adjustment may be determined by desired positioning of the piston movement limiting abutment screws 60.

On the de-energization of the solenoid 58, spring 59 will shift the control valve in a reverse direction, reversing the flow of actuating medium to return the piston 52 and associate parts to the position indicated in Figure 4, the pawl moving idly over the ratchet and being ultimately shifted out of engagement therewith during this return movement.

The energization and de-energization of the solenoid is determined by a pair of circuit opening and closing members located in the general electrical control circuit of the machine, which has been particularly illustrated in connection with Figure 3. Secured to the work rest bracket 18 is a housing 62 having pivoted therein lever 63 formed with a work engaging feeler or shoe 64 beveled as at 65 to facilitate sliding of a work piece thereunder. A spring 66, interposed between the outer portion of the lever and the housing 62, serves to urge said portion upward and thus press the shoe downward in the direction of the work to an extent limited by the adjustable abutment screw 67. Oppositely, the lever is provided with a spring contact 68 coupled with wire or conductor 69 of one portion of the circuit. This spring contact is adapted to be held by an oversize work piece in engagement with a stationary contact 70 coupled through conductor 71 with one terminal of a source 72 for electrical current. The other terminal is connected by conductor 73 with solenoid 58, from which a conductor 74 extends for completion of the actuating circuit by way of a circuit breaker 75. The make and break contact at this point is coupled with a bell crank 76 having a roller 77 riding on the periphery of the feed control cam 35 and maintained in engagement therewith by spring 78, the circuit being normally open. When cam 35 has rotated to a position producing maximum inward movement of the regulating wheel in the direction of the grinding wheel and is maintaining the parts in this position for a sparking-out dwell, the piece presumably having been reduced to minimum diameter for the prescribed setting of the machine, riser or lug 79 on the periphery of the cam engages roller 77, rocking the bell crank and actuating unit 75 to complete the circuit between conductors 69 and 74.

At this time, if the work piece has been reduced a proper amount, the feeler 63 will have oscillated an amount sufficient to break the circuit 69—71 at a point 68—70 and there will be no energization of solenoid 58. However, if the work piece is slightly oversize, due for example

to wearing of the surface of the grinding wheel during operation on a series of pieces, the parts 68—70 will remain in circuit completing engagement when the work is at the sparking-out point, and the circuit being thus completed both at 68—70 and at 75, the solenoid will be energized and a feeding impetus given to piston 52 and its associated parts, causing an additional increment of movement to be imparted to the regulating wheel and a slight additional amount of stock to be removed from the work piece. It will be understood that this is a permanent relative adjustment of the regulating wheel and its control slide block, so that during the next cycle of movement, the regulating wheel will be moved inward this additional extent for a grinding of the subsequent piece with maintained uniformity of size.

To enable the gage mechanism to be utilized for various diameters outward and also to permit accurate adjustment thereof for control of size of work pieces of a given diameter, the member 62 is preferably provided with a slide portion 80 interengaged with the bracket 18. An adjusting screw 81 facilitates relative shifting of the parts to vary the general height of the work shoe 64 as respects the blade 22, while clamp bolts 82 or the equivalent serve to lock the parts in desired adjusted position.

It will further be noted that the member 70 is in the form of an adjustable contact screw and that by rotation of this member, a final fine determination of the make and break of the circuit at this point may be established.

From the foregoing description the operation and advantages of the present invention should be readily apparent and it will be noted that there has been provided an improved work size determining mechanism suitable for constant engagement with a work piece during the performance of a grinding or like operation thereon, a normally inoperative feed mechanism, and connections between said parts whereby the operative effect of the feed mechanism is determined by the position of the gage mechanism as determined by the diameter of the pre-ground or substantially completed work piece.

It will further be noted that there has been provided an improved automatic or self adjusting mechanism for the production of a series of corresponding work pieces wherein the grinding is effected by a relative approach and separation of work and grinding member of predetermined amplitude and in which the control mechanism is independent of said relative shifting of the parts but serves to effect a supplemental variation of position of the reciprocating member and the shift mechanism therefor, to compensate for wear of the grinding wheel or other stock removing member.

What is claimed is:

1. A machine of the character described including a tool, means for supporting work in opposition to the tool, power means for automatically effecting relative movement of said parts, one toward and from the other to operatively relate succcessive work pieces to the tool, a feed adjusting mechanism, an independent power actuator therefor, and means for automatically controlling the operation of the same in accordance with the wear of the tool, said supplemental power means including a hydraulic actuating circuit, said control means including an electrical control circuit for determining the operation of the hydraulic means.

2. A machine of the character described including a tool, means for supporting work in opposition to the tool, power means for automatically effecting relative movement of said parts, one toward and from the other to operatively relate successive work pieces to the tool, a feed adjusting mechanism, an independent power actuator therefor, means for automatically controlling the operation of the same in accordance with the wear of the tool, said supplemental power means including a hydraulic actuating circuit, said control means including an electrical control circuit for determining the operation of the hydraulic means, and means in series relation with the first mentioned source of power for determining the effective coupling of the electrical control circuit in timed relation to the feeding movement.

3. In a mechanism of the character described, the combination with a support of a tool mounted thereon, a work carrier unit mounted on the support in opposition to the tool, one of said parts being movable with respect to the other, means for causing a relative approach and separation of said parts for operatively relating successive work pieces with the tool, said means including a cam shifting the movable part in a path of prescribed amplitude, supplemental means for varying the relationship of the shifted part with respect to the cam, manual means for effecting said adjustment, and additional automatic means for adjusting the parts, said automatic means including an electrical control circuit and means on the cam for determining the operative effect of said circuit.

4. In a mechanism of the character described, the combination with a support of a tool mounted thereon, a work carrier unit mounted on the support in opposition to the tool, one of said parts being movable with respect to the other, means for causing a relative approach and separation of said parts for operatively relating successive work pieces with the tool, said means including a cam shifting the movable part in a path of prescribed amplitude, supplemental means for varying the relationship of the shifted part with respect to the cam, manual means for effecting said adjustment, and additional automatic means for adjusting the parts, said automatic means including an electrical control circuit, a normally open switch in the circuit and means on the cam for automatically closing the switch during a predetermined portion of the cycle of movement of the feed unit as effected by the cam.

5. In a centerless grinder of the class described the combination of a bed, a pair of opposed grinding and regulating wheels carried thereby and forming a grinding throat therebetween, a work rest blade sub-tending the grinding throat for peripherally supporting a work piece within the said throat, a slide supporting the regulating wheel and work support for movement toward and from the grinding wheel to effect a stock removal from the work, means for effecting said cyclic movement of the slide, means within the grinding throat and overlying the work rest blade and adapted to contact with the work while on the blade, an electrical circuit including the work contacting member for partially completing said circuit if the work is oversize, and additional means in said circuit operable at the end of the slide movement toward the grinding wheel for completing the electrical circuit and effecting a further movement of the slide.

6. In a centerless grinder of the class described

the combination of a pair of opposed grinding and regulating wheels forming a grinding throat between them, a work rest blade sub-tending the grinding throat and supporting a work piece within the throat, means for cyclically enlarging and contracting the grinding throat to produce successive work pieces to the same size, gauging means including a work feeler disposed within the grinding throat and operable by the work if of an oversize when the grinding throat is completely contracted, an electrical circuit including the work feeler, and circuit closing means associated with the throat operating means for effecting a further feed of the parts if the work piece is oversize at the conclusion of the normal feeding cycle.

7. In a centerless grinder of the class described the combination of a pair of opposed grinding and regulating wheels forming a grinding throat between them, a work rest blade subtending the grinding throat and supporting a work piece within the throat, means for cyclically enlarging and contracting the grinding throat to produce successive work pieces to the same size, gauging means including a work feeler disposed within the grinding throat and operable by the work if of an oversize when the grinding throat is completely contracted, an electrical circuit including the work feeler, circuit closing means associated with the throat operating means for effecting a further feed of the parts if the work piece is oversize at the conclusion of the normal feeding cycle, and additional manual means for varying the size of the throat.

8. In a centerless grinder of the class described the combination of a pair of opposed grinding and regulating wheels forming a grinding throat between them, a work rest blade subtending the grinding throat and supporting a work piece within the throat, means for cyclically enlarging and contracting the grinding throat to produce successive work pieces to the same size, gauging means including a work feeler disposed within the grinding throat and operable by the work if of an oversize when the grinding throat is completely contracted, an electrical circuit including the work feeler, circuit closing means associated with the throat operating means for effecting a further feed of the parts if the work piece is oversize at the conclusion of the normal feeding cycle, and hydraulically controlled feeding mechanism energizable by the completion of the electrical circuit for effecting a further feed of the parts.

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