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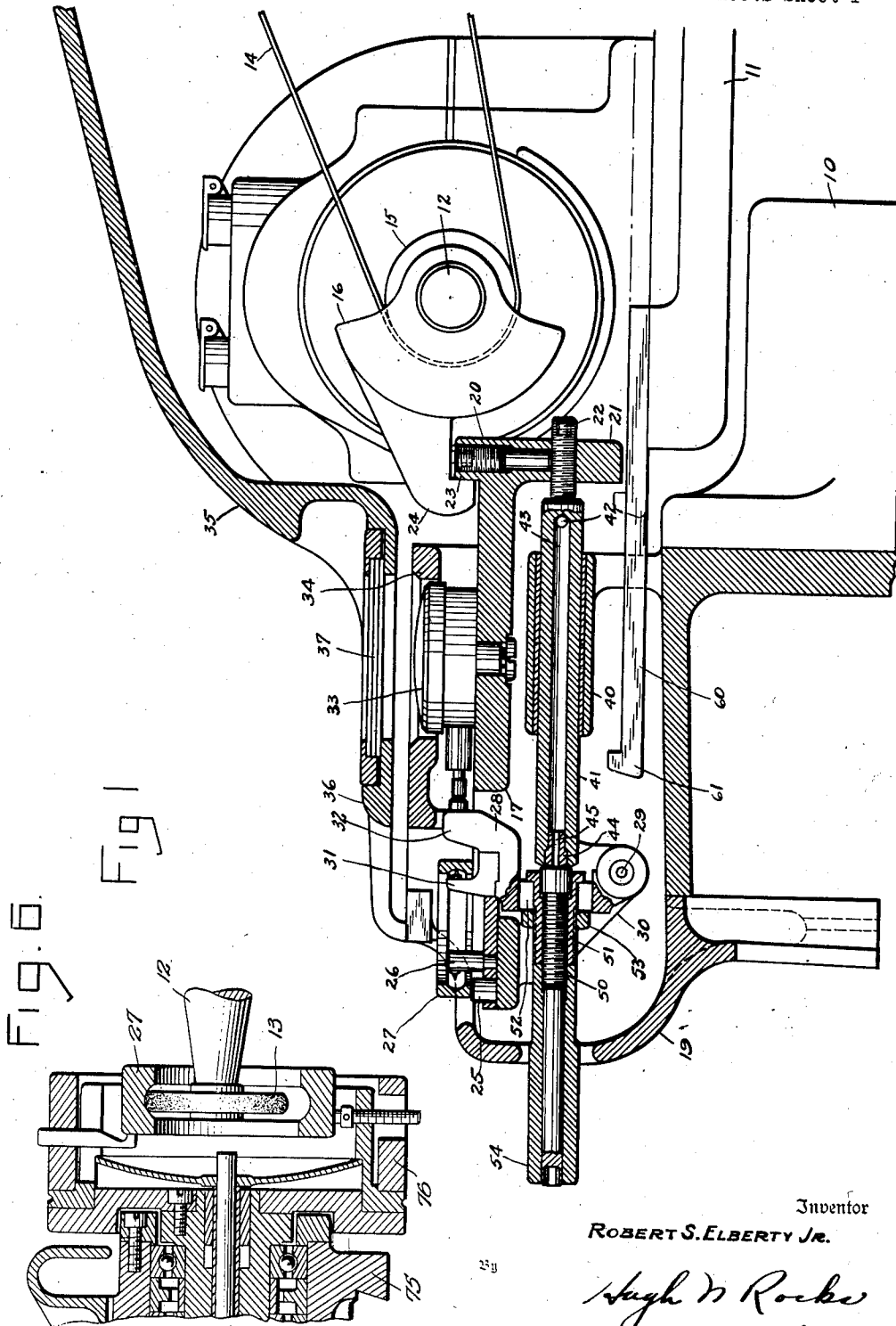
R. S. ELBERTY, JR

2,280,692

SIZE REGULATOR

Filed Oct. 13, 1939

3 Sheets-Sheet 1



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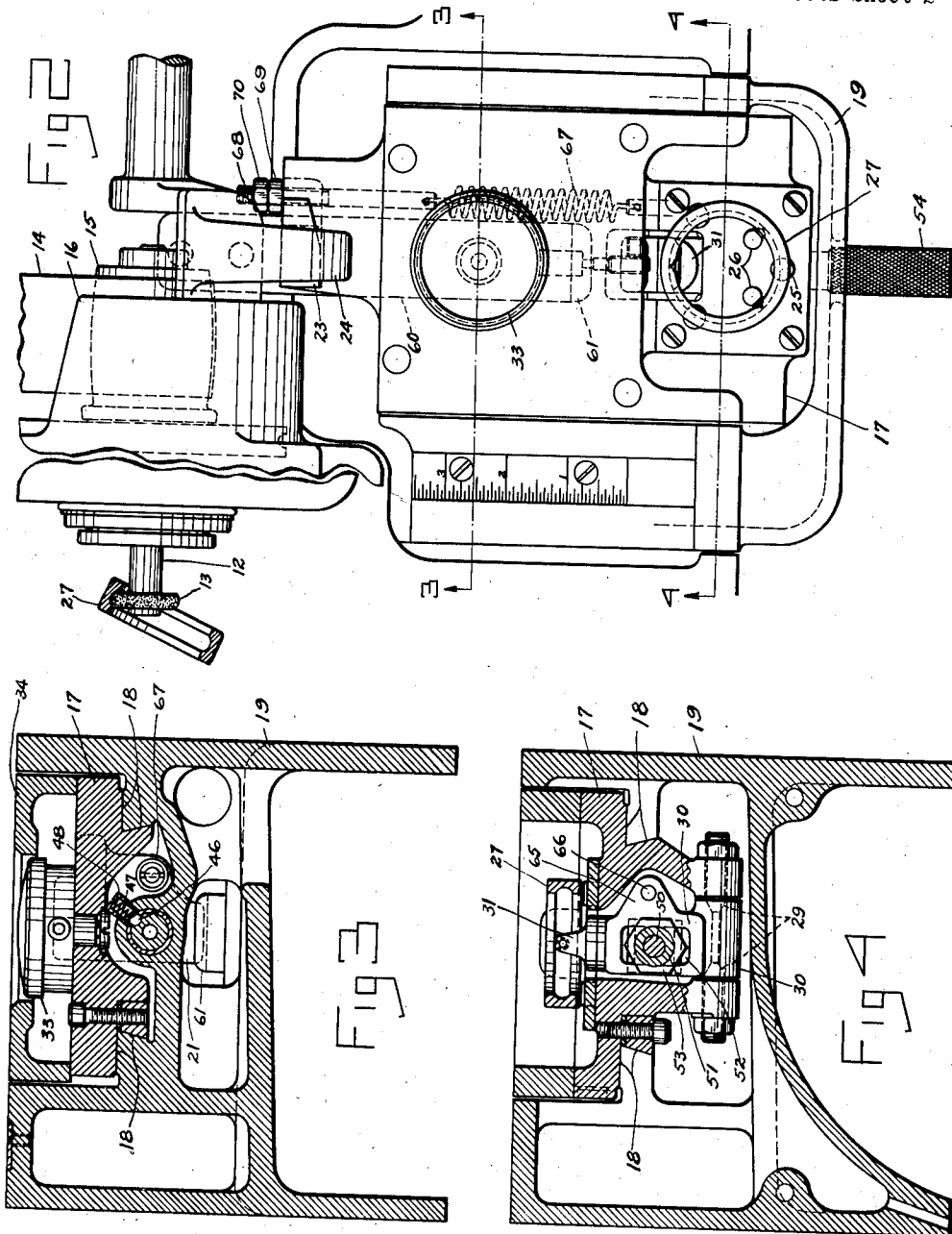
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SIZE REGULATOR

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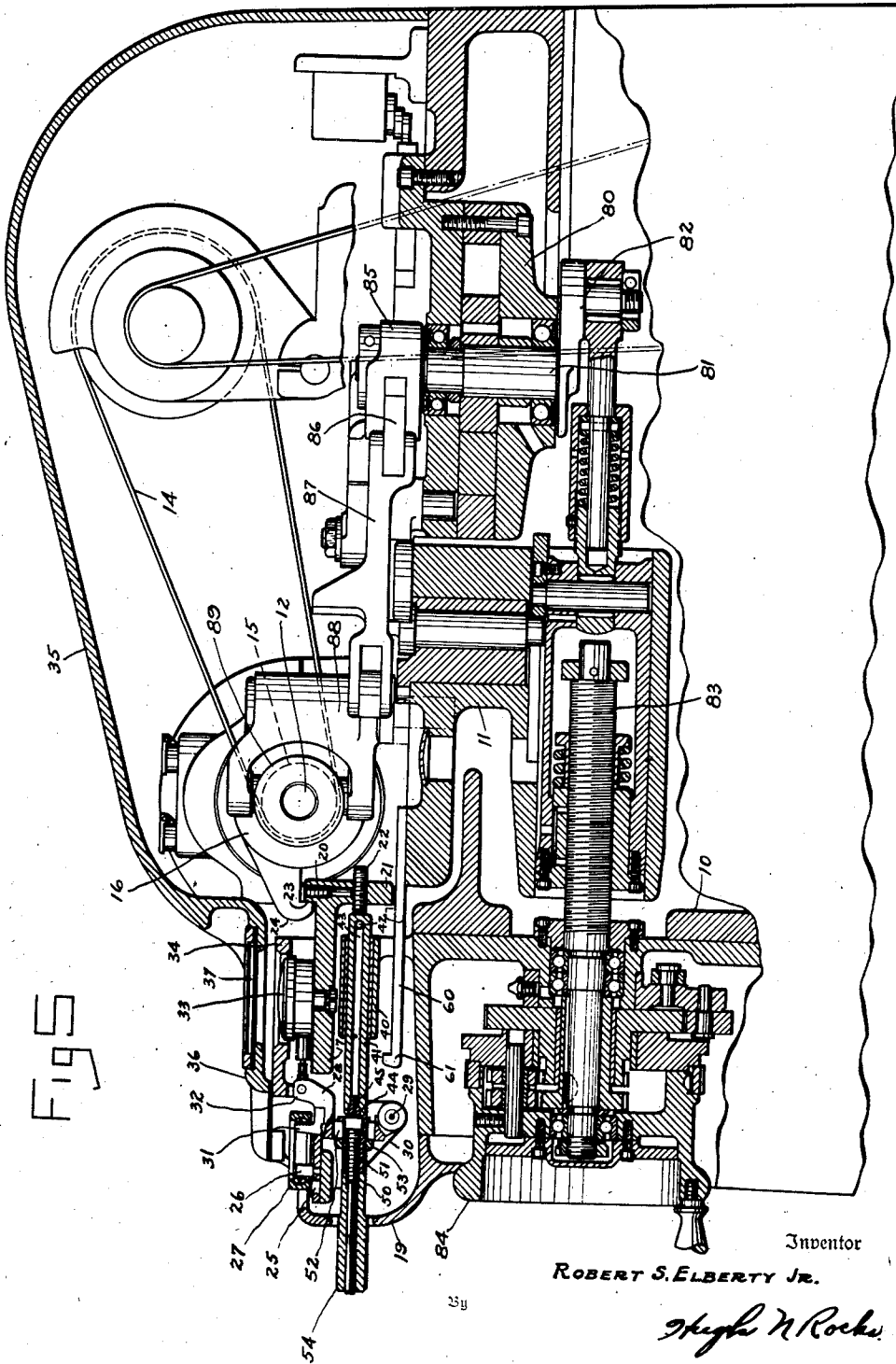
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UNITED STATES PATENT OFFICE

2,280,692

SIZE REGULATOR

Robert S. Elberty, Jr., Waynesboro, Pa., assignor
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11 Claims. (Cl. 51—165)

My invention relates to size regulating mechanisms, particularly for use on grinding machines where it is impossible or impractical to place a feeler in contact with the surface being ground.

An example of such a machine is an internal grinder for grinding very small holes. While the illustration shows a ball race grinder, the invention is applicable to my internal grinder, and in fact any grinding machine where size is appreciably affected by wheel wear.

In small wheels the amount of wear in relation to the diameter of the wheel is so great that there must be an advance in the position of the wheel support after each grinding operation.

Another variable in the use of small grinding wheels is the amount of wheel wear. This varies from piece to piece because of variation in the amount of stock removed from successive pieces or because of lack of uniformity in the wheel structure or both.

Still another variable in the wear of small wheels is the fact that as the wheel becomes smaller the rate of wear increases.

It is therefore an object of this invention to provide a size control mechanism which will compensate for wheel wear and also for variation in wheel wear.

A further object is to provide a device for effecting adjustment of the size control mechanism for a grinding operation which utilizes the piece ground during the operation immediately preceding.

Additional objects will be apparent as the description proceeds.

My invention is shown as applied to a machine such as that described in co-pending application 214,358 filed June 17, 1938, now Patent No. 2,248,172, dated July 8, 1941, and consists essentially in a member movable progressively in the direction of the grinding feed, an elongated air nozzle slidably mounted on the bed and adapted to be adjusted against a stop on said progressively movable member after each grinding operation. Mounted on the wheel support and opposed to the discharge end of said air nozzle is a vertically adjustable member for controlling the flow of air therefrom. Said control member is carried in a pivotally mounted member, one end of which has two contact members. One of said contact members actuates an indicator which is used to adjust the parts during the set-up period and which serves also as a visual size inspecting means. The other contact member engages the ground surface of a work piece. Two

other fixed contact members serve to locate said work piece in position to receive the movable member. The contact members engaging the ground surface form a caliper mechanism. The work remains on said caliper during the grinding of the next piece and determines the relative positions of the nozzle and the air flow control member. At the end of the grinding operation, the work piece is removed from the caliper, and the control member upon being released engages the nozzle and shifts it against the stop on the part adjusted by the feed movement. The newly ground piece is then placed in the caliper, adjusting the air flow control member for another grinding operation. Thus by adjusting one of the cooperating members of the sizing device an amount corresponding to wheel feed during the grinding of a given work piece, and then placing that work piece on a caliper and using one element of the caliper to adjust the other cooperating member toward or from the first member an amount corresponding to the variation in size between that piece and a standard, extremely accurate results are obtained and size variation is held within very close limits.

Figure 1 is a sectional end elevation of my device and the front end of the wheel support.

Figure 2 is a plan view of my device.

Figure 3 is a front section on the line 3—3 of Figure 2.

Figure 4 is a front section on the line 4—4 of Figure 2.

Figure 5 is a sectional end elevation showing my device in relation to the wheel feeding mechanism.

Figure 6 is a partial sectional elevation of a headstock and a chuck rotatably mounted thereon.

Numeral 10 indicates the bed of a grinding machine, 11 a grinding wheel support slidably mounted thereon, 12 a wheel spindle rotatably mounted on said wheel support, and 13 a grinding wheel on said spindle. Said wheel and spindle may be driven from a motor, not shown, thru a belt 14 and pulley 15. A belt guard 16 is mounted in front of said pulley.

The size regulator consists of a slide 17 movably mounted on guide surfaces 18 in frame 19 which is secured to bed 10. At one end of said slide is a vertical portion 20, the lower part 21 of which carries a hardened screw 22, the function of which will be described later. The upper end 23 of said vertical portion extends slightly above the level of the slide. A hook-like member 24 on guard 16 engages said part 23 to advance slide

17 to the right during the grinding feed. When the wheel and work are separated, said slide remains in the advanced position. At the front end of said slide is mounted an anvil for a caliper consisting of a hardened surface 25 on which a work piece may rest and a pair of spaced vertical pins 26 having radial projections for engaging the ground surface of a work piece 27. The movable portion 28 of said caliper is mounted on pivot 29 in a depending portion 30 of slide 17. Said movable portion 28 has a pair of feelers, one, 31, having a hardened point similar to that on pins 26 and likewise used for contacting the ground surface of a work piece. The other feeler 32 engages the stem of an indicator 33 also mounted on slide 17. A cover plate 34 having an opening for said indicator is mounted on said slide, the top of said indicator being slightly below the top surface of said cover. Another cover 35 for the wheel support has a portion 36 which covers a portion of the size regulator including the indicator. An opening in said cover over said indicator has a glass insert 37, sealed against dirt and moisture.

A cylindrical guide 40 on bed 10 in alignment with hardened screw 22 slidably supports a tubular member 41 closed at one end and having a tube connection 42 into the bore 43 thereof. At the other end is a nozzle 44 having a restricted opening 45. Said member 41 has a longitudinal groove. A ball 46 is yieldably urged into contact with the surface of said groove by a spring 47 in a hollow set screw 48 extending thru said cylinder 40. The purpose of this arrangement is to place a drag on the movement of tubular member 41.

Opposing said nozzle is an abutment member 50. Said member is threaded for adjustment in a sleeve 51 which passes thru a slot 52 in the depending portion 30 of the caliper. Said sleeve is flanged at one end to prevent passage thru said slot and threaded externally to receive a nut 53 for locking same in any position of vertical adjustment. The threaded portion of said abutment extends beyond the threaded end of sleeve 51 and an unthreaded extension thereof has a socketed end so that said member 50 may be adjusted. Another tubular member 54 which serves as a handle for moving said movable depending portion 30 also fits the threaded portion of abutment 50 and acts as a lock for the adjustment thereof.

In the normal operation of the feed mechanism and the size regulator the hook member 24 moves laterally into the position shown relative to the portion 23. Should the relation between the parts 23 and 24 be disturbed either by an accidental movement of slide 17 to the left or by an adjustment of the wheel support to the right, said parts would not move into the position shown but would collide and possibly cause serious damage.

In order to prevent such an occurrence, there is provided a bar 60 having a hook 61 at one end thereof. Said bar is attached to the wheel support 11. In the rear position of the wheel support 11, said hook normally stops a short distance from the adjacent surface of the portion 21. If the slide 17 should be accidentally moved to the left, such movement would be limited by the hook 61. If the operator should adjust the feed to the right more than the space between said hook 61 and said portion 21, the slide 17 would be shifted accordingly and the operative relation between the parts 23 and 24

would be preserved. If the slide 17 has been moved too far to the right, belt guard 16 will move it to the proper position.

A lug 65 on one side of the member 39 has inserted therein a pin 66 to which is attached a spring 67. The other end of said spring is attached to an adjusting screw 68 which passes thru an opening in the member 20. Said screw may be adjusted and locked by the nuts 69 and 70 respectively mounted thereon.

The means for rotatably supporting a work piece 27 consists of a headstock 75 shown in part in Figure 6, having a chuck 76 rotatably mounted therein.

In Figure 5 is shown the subject matter of Figure 1 in combination with a wheel feed mechanism. An oscillating hydraulic motor 80 is mounted on wheel support 11 with the shaft 81 thereof in a vertical position. Said shaft is connected thru a crank arm 82 and suitable connecting members to a feed screw 83. Said feed screw forms a part of a manual feed mechanism which may be actuated by rotating hand wheel 84 rotatably mounted in bed 10.

At the upper end of shaft 81 is mounted a cam 85. Said cam engages a roller 86 on lever 87. The other end of said lever is attached to a pivoted bracket 88. Said bracket engages a spool 89 which is connected to spindle 12. Rotation of cam 85 is effective to cause an endwise movement of the spindle 12 and wheel 13 into and out of operative relation to the work piece 27. Cam 85 is angularly positioned so that this movement occurs while the crank 82 is moving across dead center. While said crank moves from one dead center position to another, the members connecting said crank with the hand feed being stationary, the motor 80 moves transversely of the wheel spindle carrying with it the wheel support 11 and effecting a rapid positioning movement of the grinding wheel relative to the work. In the inoperative position of said wheel support, the grinding wheel is spaced laterally and transversely from the work. The first half revolution of motor 80 moves said wheel to a position substantially in axial alignment with the work but spaced laterally therefrom. While the crank 82 moves across dead center, the cam 85 and associated parts shift said wheel axially to a position inside the work. Thereafter the continued rotation of motor 80 effects a reversal of the transverse movement and the wheel engages the surface to be ground. The grinding feed is effected either by manual or power rotation of hand wheel 84.

Operation

In setting up my device preparatory to grinding a number of identical work pieces, a piece is placed in the chuck of the machine and the wheel support positioned so that the wheel just touches the ground surface. The wheel is withdrawn and the work removed from the chuck and placed in the caliper. The member 41 is positioned by the feeding movement of the wheel base. The adjustable abutment 50 supported in sleeve 51 and pivoted member 30 is urged toward nozzle 44 by spring 67. This movement is restrained by contact between the hardened point on feeler 31 and the ground surface of a work piece 27. Abutment 50 is then turned in sleeve 51 for adjustment toward nozzle 44 until the contacts in the manometer (described in Balsiger Patent 2,001,447 granted May 14, 1935) are closed. The work piece is removed from

the caliper, and abutment 50 is backed off by an amount which the operator estimates the wheel will wear. Another work piece is placed in the chuck and as the grinding wheel moves into contact with the work and gradually breaks down due to the grinding operation, the hook member 24 engages the portion 23 of slide 17 and the slide moves with the wheel base 11. As a result of this movement of slide 17, abutment 50 approaches nozzle 44 and when it reaches the point at which it had previously been set relative to said nozzle plus estimated wheel wear, the contacts are closed and the wheel is removed from the work as shown in co-pending application 214,358 filed June 17, 1938, now Patent No. 2,248,172, dated July 8, 1941. Slide 17 however remains in the position to which it has been advanced. The work piece is then released from the caliper by depressing member 54. When said member 54 is released, abutment 50 engages nozzle 44 and shifts tube 41 into contact with hardened screw 22. The extent of this movement corresponds to the feeding movement of the grinding wheel during the grinding operation just completed. Said screw 22 must be adjusted from time to time because as the wheel becomes smaller the rate of wear increases. The nozzle 44 is thus positioned for grinding the next piece. The piece just ground is placed in the caliper and abutment 50 is reset to a position depending upon whether it is larger or smaller than the nominal size. Abutment 50 may be adjusted to a point above the center of nozzle 44 to over compensate for wheel wear and below said nozzle for under compensation. Theoretically said abutment should be located half way between the pivot 29 and the point of contact member 31. For example if a piece comes .001 oversize the position of the abutment should be changed half that amount. However, it has been found that size will be held most consistently if the change in position of said abutment is a little less than half the variation in work size. Therefore said abutment should be adjusted to a point slightly below the mid point of member 30. This adjustment is made by loosening nut 53 and shifting said abutment up or down as conditions require. This adjustment must be made when changing wheel or work sizes.

Due to the combined adjustment, one always in the same direction and corresponding to change in position of the wheel, and the other in a direction and magnitude corresponding to variation in the magnitude of the first adjustment, the size of the finished work is held consistently within very close limits.

I claim:

1. In a grinding machine, a wheel support, a grinding wheel rotatably mounted thereon, a work support, means for effecting a relative feeding movement between said supports, a size control mechanism having means for calipering a finished work piece, means adjustable in accordance with the extent of said feeding movement, and means responsive to relative movement between said caliper means and said adjustable means for controlling a grinding operation.

2. In a grinding machine, a wheel support, a grinding wheel rotatably mounted thereon, a work support, mechanism for effecting a relative feeding movement between said supports, a size control mechanism having cooperating elements, means responsive to movement of one of said elements relative to the other for controlling

said feeding mechanism, means for adjusting one of said elements an amount corresponding to the feed of the grinding wheel during a grinding operation, and means for adjusting said other element an amount corresponding to the difference in size between successive work pieces.

3. In a grinding machine, a wheel support, a grinding wheel rotatably mounted thereon, mechanism for feeding said grinding wheel to effect a grinding operation, a size control mechanism having cooperating elements, means responsive to movement of one of said elements relative to the other for controlling said feeding mechanism, a caliper forming a part of said size control mechanism and effective upon placing thereon of a newly ground piece to adjust one of said elements for the next piece an amount corresponding to the difference in size between the newly ground piece and the piece immediately preceding said newly ground piece.

4. In a grinding machine, a wheel support, a grinding wheel rotatably mounted thereon, mechanism for effecting a feeding movement of said wheel support, a size regulator including cooperating members one of which may be adjusted by a ground work piece, another in accordance with said feed movement, and means to compensate for variation in wheel wear by adjusting one of the cooperating members relative to the other.

5. In a grinding machine, a wheel support, a grinding wheel rotatably mounted thereon, mechanism for effecting a feeding movement of said wheel support, a size regulator including cooperating members one of which may be adjusted by a ground work piece, another in accordance with said feed movement, means to compensate for variation in size of successive work pieces by adjusting one of the cooperating members relative to the other, and means for varying the amount of compensation.

6. In a grinding machine, a work support, a wheel support, a grinding wheel rotatably mounted thereon, mechanism for effecting a feeding movement of said wheel support, a size regulator comprising cooperating members one of which is positioned for the succeeding grinding operation by the piece just ground, another in accordance with the extent of the feed movement during the grinding of said piece.

7. In a grinding machine, a work support, a wheel support, a grinding wheel rotatably mounted thereon, mechanism for effecting a feeding movement of said wheel support, a size regulator comprising cooperating members one of which may be positioned by a ground work piece, another according to the extent of said feed movement, and means for varying the position of said work controlled member an amount corresponding to the difference in size between successive work pieces.

8. In a grinding machine, a work support, a wheel support, a grinding wheel rotatably mounted thereon, mechanism for effecting a feeding movement of said wheel support, a size regulator comprising cooperating members one of which may be positioned by a ground work piece, and means for varying the position of said work controlled member an amount less than the difference in size between successive members.

9. In a grinding machine, a work support, a wheel support, a grinding wheel rotatably mounted thereon, mechanism for effecting a feeding movement of said wheel support, a size regulator comprising cooperating members, a pivoted

support for one of said members having means for engaging the ground surface of a work piece, said member being positioned on said support between said pivot and the midpoint thereof.

10. In a grinding machine, a work support, a wheel support, a grinding wheel rotatably mounted thereon, mechanism for effecting a relative feeding movement between said supports, a size regulator comprising cooperating members, a positive stop for determining the limit of adjustment of one of said members, and means responsive to said feed movement for changing the position of said stop.

11. In a grinding machine, a wheel support, a grinding wheel rotatably mounted thereon, mechanism for feeding said grinding wheel to effect a grinding operation, a size control mechanism having cooperating elements, means responsive to movement of one of said elements relative to the other for controlling said feeding mechanism, means for effecting an adjustment between said elements to compensate for wheel wear, and means for effecting a further adjustment between said elements to compensate for variation in wheel wear.

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