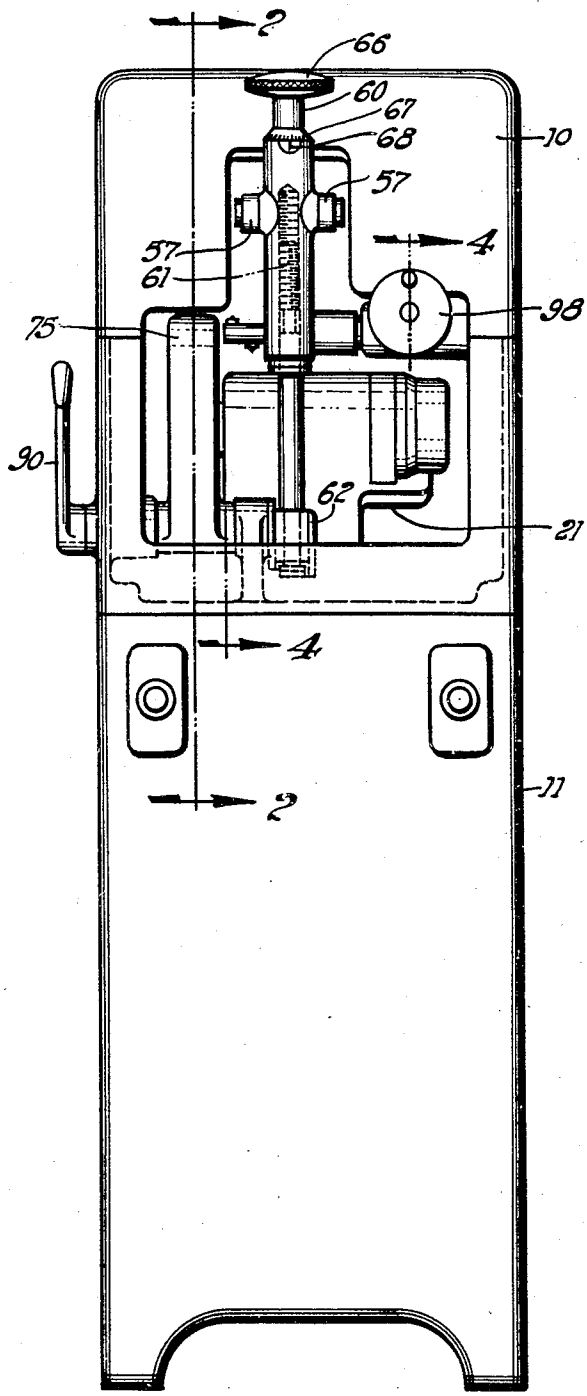
Jan. 19, 1943. G. W. BINNS 2,308,739

CENTERLESS GRINDER

Filed Dec. 15, 1941 3 Sheets-Sheet 1

Fig. 1



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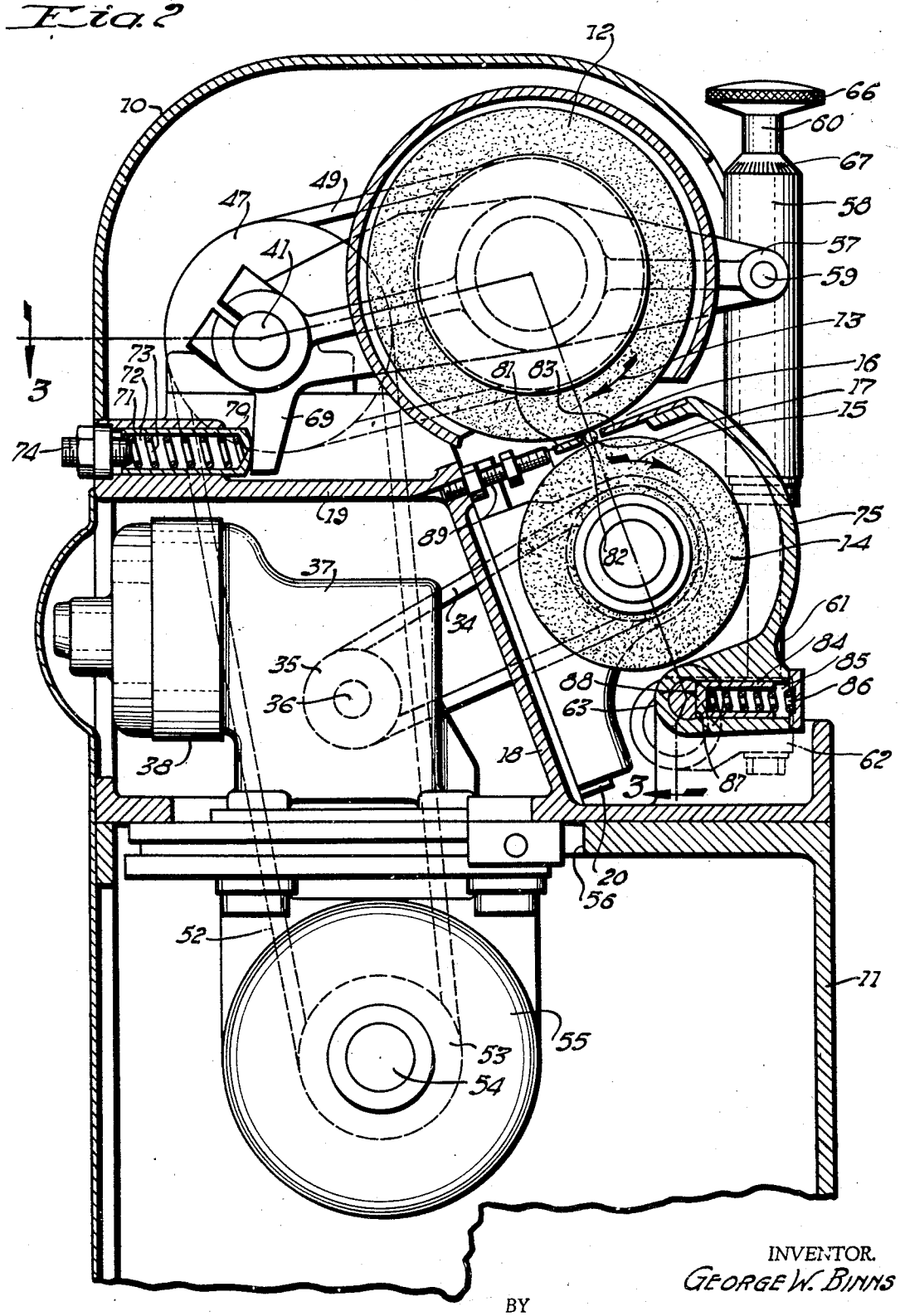
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Fig. 2



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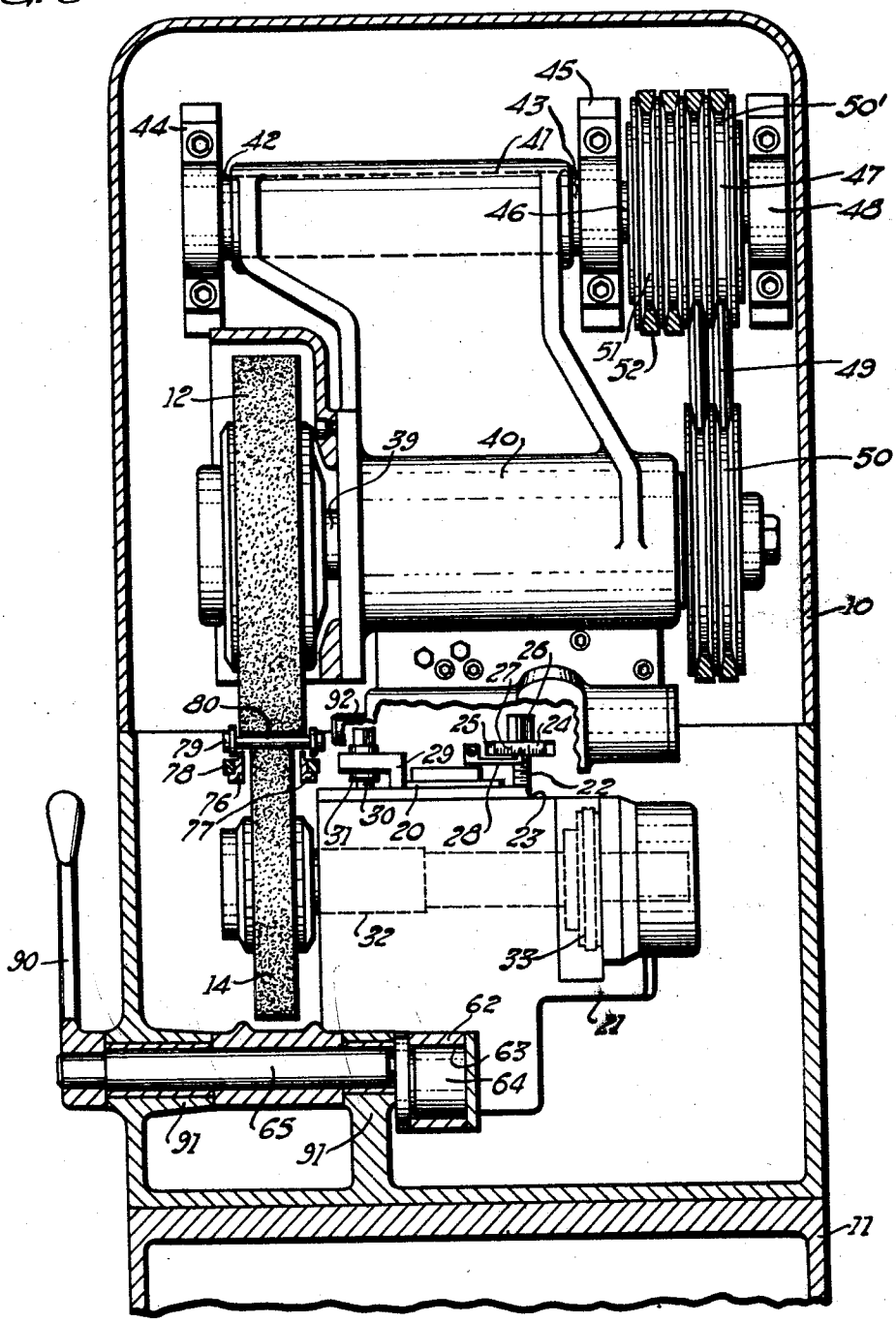
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Fig. 3



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UNITED STATES PATENT OFFICE

2,308,739

CENTERLESS GRINDER

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Application December 15, 1941, Serial No. 423,027

15 Claims. (Cl. 51—103)

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

One of the objects of this invention is to provide an improved simplified bench type centerless grinding machine.

Another object of this invention is to provide a single cycle centerless grinding machine for infeed grinding operations.

A further object of this invention is to provide a simplified centerless grinding machine for infeed grinding operations in which the entire cycle of work loading, grinding and work removal may be effected by a single manual control lever.

An additional object of this invention is to provide improved means for lateral insertion and removal of work with respect to the grinding throat of a centerless grinding machine.

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.

Referring to the drawings in which like reference numerals indicate like or similar parts:

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

Figure 2 is a vertical section on the line 2—2 of Figure 1.

Figure 3 is a section through the machine as viewed on the line 3—3 of Figure 2.

This invention aims to provide a small compact and simplified centerless grinding machine of such a nature that it may be mounted on a bench or table, or as shown in Figure 1 of the drawings upon a pedestal specially provided for the purpose. It is especially suitable for grinding small parts which are susceptible of being ground by the infeed grinding method and the machine is provided with a single manual control which is movable in one direction to effect insertion of the work and completion of the grinding operation, and in the other direction to effect retraction of the grinding wheels and removal of the work from the grinding throat, whereby the machine may be readily operated by relatively unskilled operators.

Referring now to the drawings and more particularly to Figure 1, the reference numeral 10 indicates the frame or housing of the machine proper while the reference numeral 11 indicates, in general, one form of pedestal or support upon which the machine may be mounted or supported. This machine, being of the centerless type, is provided with a pair of opposed abrasive wheels and as more particularly shown in Figure 2. The wheel 12 constitutes a grinding wheel which rotates clockwise as indicated by the arrow 13 and the wheel 14 constitutes a regulating wheel which also rotates clockwise as indicated by the arrow 15.

It will be noted, however, that the opposed peripheries of the two wheels actually travel in opposite directions, the grinding wheel 12 rotating at a relatively high speed to effect stock removal while the regulating wheel rotates at a relatively slow speed to control the rate of rotation of a cylindrical work piece located in the grinding throat 16 between the wheels and indicated by the reference numeral 17.

The interior of the machine housing is provided with an angular partition or wall, one portion 18 of which is at a steep angle and this portion intersects the horizontal portion 19. The wall 18 is provided with a dovetailed guideway 20 as more particularly shown in Figure 3 upon which a spindle housing 21 for the regulating wheel 14 is mounted for adjustment. This adjustment is effected by an adjusting screw 22 which is threaded in the housing at 23 and held against axial movement by means of an annular flange 24 which partially fits in a groove 25 formed in the face of the guideway 20. The end of the screw is provided with a square head 26 to which a suitable socket wrench may be applied for rotating the screw. The periphery of the flange 24 is provided with micrometric graduations 27 and a pointer 28 fixed to the support cooperates with these graduations to indicate the amount of adjustment effeced by rotation of the adjusing screw. A fishtail gib 29 is provided for insuring a tight fit between the guide surfaces, and an adjusting screw 30 and lock nut 31 secure the gib to the slide 21 for movement therewith.

The spindle 32 for the regulating wheel 14 is suitably journaled in the housing and is provided on the end with a driving pulley 33 which is connected by one or more V-belts 34 as shown in Figure 2 to a power pulley 35. This pulley is on the output shaft 36 of a reduction speed unit, indicated generally by the reference numeral 37 and driven by a prime mover such as the motor 38. Since the amount of movement of the regu-

lating wheel is rather limited it does not materially effect the belt drive so as to necessitate idler pulleys but if it was necessary to make allowances for this the unit 37 could be adjustably mounted on the floor of the machine housing upon which it is mounted.

The grinding wheel 12 is supported above the regulating wheel and is attached to the end of a spindle 39 which is suitably journaled in an oscillatable bracket 40. A pintle 41 is fixed in the bracket 40 and projects from opposite ends thereof to form trunnions 42 and 43 which are journaled in pillow blocks 44 and 45 which are mounted on the wall or partition 19. The pintle 41 has an extension 46 upon which is mounted an eccentrically adjustable pulley 47, and in order to adequately support the pulley an additional pillow block 48 is provided for supporting the free end of the extension 46.

The pulley 47 serves to drive the grinding wheel spindle through V-belts 49, and pulley 50 attached to the end of the spindle 39. By means of the eccentric adjustment of the pulley 47 suitable tension may be obtained in the belts 49. The pulley 47, besides having a series of grooves 50' for receiving the belts 49, also has another series of grooves 51 for receiving the V-belts 52 by which the pulley is driven by the motor pulley 53 attached to the armature shaft 54 of a motor 55. As shown in Figure 2, the motor 54 may be mounted beneath the machine and supported on the underside of the machine base and a suitable cavity cut in the top of the pedestal 11 so that the motor may be attached and made part of the machine. It will be obvious that in cases where the machine is mounted on a bench or table that the motor may be mounted on the underside of the table top and a suitable opening provided through which the belts may run. The grinding wheel is so positioned and supported by its bracket that a line passing through the centers of the grinding and the regulating wheel during the grinding operation is substantially parallel to the guideway for the regulating wheel so that any adjustment of the regulating wheel slide toward and from the grinding wheel will be more accurately indicated by the graduations on the adjusting screw for the regulating wheel housing.

In order to provide for adjustment of the grinding wheel toward and from the regulating wheel during grinding operations the bracket 40 is bifurcated to form a pair of arms 57 embracing an expansible link 58. Trunnion pivots 59 mounted in the ends of the arms 57 fit into suitably formed sockets in the opposite sides of the link 58 to form a pivoted connection therewith. The link 58 has an internally threaded rotatable sleeve 60 mounted therein which makes a threaded connection with a connecting rod 61, the connecting rod having a coupling 62 fixed to the end thereof in which is formed a bore 63 as shown in Figure 3 by which it is journaled on an eccentric portion 64 of an operating shaft 65. It will be noted from Figure 2 that the coupling 62 extends laterally with respect to the axis of the connecting rod 61 and any movement of the eccentric 64 about the axis of the shaft 65 will cause the extensible link 58 to pivot about the trunnions 59.

The sleeve 60 is manually adjusted by the knurled wheel 66 attached to the upper end of the sleve 60, and the amount of adjustment is indicated by the micrometrically graduated dial 67 which is attached to the sleeve for rotation therewith. A fixed reference mark 68, as shown in Figure 1, cooperates with the dial to indicate the amount of adjustment effected. Thus, the position of the grinding wheel with respect to the regulating wheel is determined by the rotatable position of the eccentric 65 and the adjustment of the extensible link.

Since the whole weight of the grinding wheel and part of its driving mechanism is supported on the threaded connection in the extensible link, thereby creating a large amount of friction, when adjustments are necessary and since the eccentric shaft must lift the entire weight of the grinding wheel during grinding operations, means are provided for counter-balancing all of the weight of the grinding wheel so as to provide a definite bias on the grinding wheel support structure in an upward direction, thereby necessitating a slight pull by the operator to move the grinding wheel down during the grinding operation. This is accomplished by providing a depending lug 69 from the shaft 41 for engagement by a spring pressed plunger 70 mounted in a bore 71 provided in the wall 19. The plunger 70 is provided with a bore 72 in which the spring 73 is mounted and an adjusting screw 74 is provided for varying the tension of the spring, the screw being threaded in a fixed part of the machine. Thus, the plunger exerts a counterclockwise force on the shaft 41, producing a definite upward bias on the grinding wheel 12.

The work is moved into and out of the grinding throat by an oscillatable work carrier 75 which is supported on the shaft 65 and is in the form of a housing which surrounds the regulating wheel for protection of the operator. The lateral wall portions 76 and 77, as shown in Figure 3, carry work receiving guides or supports 78 which are adapted to receive and position spool-like work pieces 79 so that the work may be placed thereon when the carrier is swung outward by the operator upon clockwise rotation of the shaft 65.

The annular surface 80 between the end flanges of the work is the surface to be ground and the grinding wheel 12 is made of sufficient width to engage the entire surface so that the grinding operation may be performed by what is known in the art as the infeed grinding method.

The regulating wheel 14 is made of sufficient width to also engage this surface with enough frictional pressure to rotate the work at a predetermined rate during the grinding operation. The walls 76 and 77 also support a work blade 81 which has a beveled edge 82 so positioned that the thrust of the grinding wheel forces the work into frictional engagement with the periphery of the regulating wheel. A backstop blade 83 is also supported by the side walls to support the work during loading operations and insure that the work is pushed into the grinding throat upon rotation of the work carrier to a grinding position. The end flanges on the work piece serve to support the work during movement to grinding position until the regulating wheel is engaged, whereupon the regulating wheel lifts the work sufficiently to support the entire weight thereof without raising the work so far that the guides 78 cannot function to center the work piece with respect to the grinding wheel and insure that the grinding wheel engages the surface 80 without contacting the sides of the end spools and the work.

The carrier 75 is connected to the shaft 65 by a yieldable connection comprising a spring pressed

plunger 84 which is slidably mounted in a bore 85 formed in the casing and a spring 86 which urges the flat end 87 of the plunger against a flat 88 formed on the side of the shaft 65.

The spring has sufficient tension to normally eliminate any lost motion between the carrier and shaft whereby during rotation of the shaft through an arc necessary to move the carrier from a grinding position to its work loading position the two move as a unit. A stop screw 89 threaded in a fixed part of the machine serves as a stop to limit the counterclockwise movement of the carrier and determine its grinding position. After the carrier engages the stop, the shaft 65 may be rotated through an additional angle to effect feeding of the grinding wheel.

This is accomplished by forcibly causing retraction of the plunger 84. From Figure 3 it will be noted that the eccentric portion 64 of the shaft is integral with the remaining portion of the shaft and that a manually operable handle 90 is attached to the end of the shaft to effect rotation thereof. Thus, during movement of the handle 90 in a counterclockwise direction the work carrier is moved from a loading position to a grinding position and the eccentric 64 simultaneously moves the grinding wheel toward the regulating wheel.

At the moment that the work carrier hits the stop screw 89 the movement of the work carrier ceases, but the movement of the grinding wheel toward the work continues until the grinding wheel has reduced the work to size.

The shaft 65 is supported by a pair of bearings 91 formed integral with the base of the machine. It should now be apparent that the work carrier is normally held in an outward position or at its work loading station with the grinding wheel elevated and that the normal grinding cycle is effected by moving the lever in a counterclockwise direction to move the work and work rest blade into the grinding throat and then effecting a downward movement of the grinding wheel to effect the grinding operation. Reverse movement of the lever of course effects retraction of the parts.

There has thus been provided an improved compact centerless grinder of the bench type which is simple in construction and operation, making it suitable for inexperienced operators, and which has improved means for inserting and removing work, and a single control for the work handling means and the wheel feeding means.

What is claimed is:

1. In a centerless grinding machine having a grinding wheel and a regulating wheel supported for rotation on parallel axes to form a grinding throat therebetween, the combination of a work carrier supported for oscillation about an axis parallel to the axes of said wheels, a work rest blade mounted on the carrier for movement into the grinding throat, additional means on the carrier for supporting a work piece adjacent said blade whereby upon movement of the work into the grinding throat the blade will absorb the grinding thrust, and stop means for limiting the movement of the carrier.

2. In a centerless grinding machine having opposed grinding and regulating wheels adjustable to form a grinding throat therebetween, the combination of a work carrier operable to move work into and withdraw work laterally from the grinding throat to position work for grinding purposes, a manual control lever, and motion transmitting connections from said lever for actuating the carrier and for relatively adjusting said wheels.

3. In a centerless grinding machine having a grinding wheel and a regulating wheel adjustably mounted in opposed relation to form a grinding throat therebetween, the combination of oscillatable means for inserting and withdrawing work laterally of the grinding throat, said means including a work rest blade for absorbing grinding thrust on the work, and a control lever operatively connected for actuation of said means and adjustment of one of said wheels.

4. In a centerless grinding machine having a grinding wheel and a regulating wheel supported in opposition to form a grinding throat therebetween, the combination of an oscillatable work carrier having means for moving work into and out of the grinding throat in a direction lateral of the axis thereof, said carrier having a work rest blade mounted thereon for movement therewith, means for infeeding one of said wheels and a control lever operatively connected for oscillating said carrier and infeeding one of said wheels.

5. In a centerless grinding machine having a grinding wheel and a regulating wheel supported in opposed relation to form a grinding throat therebetween, the combination of a work carrier movable laterally to the axis of the grinding throat for work inserting and removing purposes, said work carrier having a work rest blade mounted thereon for movement therewith, stop means for limiting movement of the carrier into the grinding throat to determine the position of the work rest blade with respect to the axis of the grinding throat, and means simultaneously movable with the carrier for adjusting one of said wheels relative to the other.

6. In a centerless grinding machine having a grinding wheel and a regulating wheel supported for rotation and in opposition to one another to form a grinding throat therebetween, the combination of means for inserting and withdrawing work with respect to the grinding throat including a work rest blade, and a backstop plate for supporting the work during movement into the grinding throat until picked up by the regulating wheel, said work rest blade being positioned to effect removal of the work during withdrawal of the carrier.

7. In a centerless grinding machine having a grinding wheel and a regulating wheel supported for rotation in opposition to one another to form a grinding throat therebetween, one of said wheels being supported for relative movement toward and from the other wheel, the combination of means for inserting and withdrawing work laterally of the grinding throat and a manually operable lever for effecting insertion of the work and relative approach between the wheels sequentially.

8. In a centerless grinding machine, the combination with a grinding wheel and a regulating wheel supported for rotation in opposition to one another to form a grinding throat, and means for supporting one of said wheels for movement toward and from the other, the combination of means for inserting and positioning a work piece in said throat, a control lever operatively connected for actuating said work inserting means and said wheel moving means and a yieldable connection for permitting subsequent movement of the wheel moving means after the work has been positioned.

9. In a centerless grinding machine having opposed grinding and regulating wheels one of which is supported for rotation about a rela-

tively fixed axis and the other of which is supported for rotation about a movable axis, the combination of a work carrier movable between a work loading position and a work grinding position, a stop for determining the grinding position of the carrier, a manual control lever, motion transmission connections between said lever and said carrier, and wheel moving means whereby upon movement of the lever in one direction the work carrier will be swung to a grinding position and relative approach will be effected between the wheels, said motion transmitting connection between the lever and work carrier being yieldable whereby the lever may be moved an additional distance after the work carrier has been positioned to effect a subsequent additional movement of the grinding wheel to effect the grinding operation.

10. In a centerless grinding machine having a grinding wheel and a regulating wheel, a spindle for supporting the regulating wheel, an adjustable housing for said spindle, said housing being guided for rectilinear movement laterally of the spindle axis, a spindle for supporting the grinding wheel, a swinging support for said spindle, a work carrier having a work loading position and a work grinding position, an oscillatable shaft having an eccentric extensible link connection between said shaft and said swinging support, motion transmitting connections between said shaft and said work carrier and manually operable means for oscillating said shaft to effect simultaneous movement of the work carrier and the grinding wheel.

11. In a centerless grinding machine having a grinding wheel and a regulating wheel, the combination of means for supporting the regulating wheel for rotation about a normally fixed axis, an oscillatable support having means for rotatably supporting the grinding wheel, said grinding wheel normally being movable by gravity toward the regulating wheel, counterbalancing means effective to normally hold the grinding wheel away from the regulating wheel, means for positioning work between the wheels, a control lever and motion transmitting connections from said lever to said work positioning means and said oscillatable support for effecting simultaneous movement thereof in directions to cause positioning of the work in a grinding position and movement of the grinding wheel toward the regulating wheel.

12. In a centerless grinding machine having a grinding wheel and a regulating wheel, said grinding wheel being supported above the regulating wheel, a swinging bracket for supporting the grinding wheel in a manner to normally cause the wheel to move by gravity toward the regulating wheel and resilient counterbalancing means effective on said support for holding the grinding wheel normally in a non-grinding position.

13. In a centerless grinding machine having a grinding wheel and a regulating wheel, the combination of means for supporting one of said wheels for relative movement toward and from the other wheel, means for positioning work between the wheels, a rotatable shaft for actuating said work positioning means and said oscillatable support simultaneously and a micrometrically adjustable extensible link between said shaft and said oscillatable support for adjusting the range of movement of the grinding wheel for the same movement of the work positioning means.

14. In a centerless grinding machine having a grinding wheel and a regulating wheel, the combination of a swinging bracket for supporting the grinding wheel for movement toward and from the regulating wheel, a swinging bracket having work supporting means in the end thereof for moving work to and from a grinding position, motion transmitting connections between said brackets for effecting simultaneous movement thereof, resiliently operable means effective on one of said brackets for normally holding the grinding wheel in an inoperative position and said work supporting means in a loading position.

15. In a centerless grinding machine having opposed grinding and regulating wheels, the combination of means for adjustably supporting one of said wheels for infeeding movement relative to the other wheel, a work carrier movable from a loading position to a grinding position between said wheels, a rotatable shaft for actuating said carrier and a link connection between said shaft and said adjustable wheel for effecting simultaneous movement of the grinding wheel and the carrier.

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