March 26, 1946. J. DECKER ET AL 2,397,131

CENTERLESS GRINDING MACHINE

Filed July 28, 1943 4 Sheets-Sheet 1

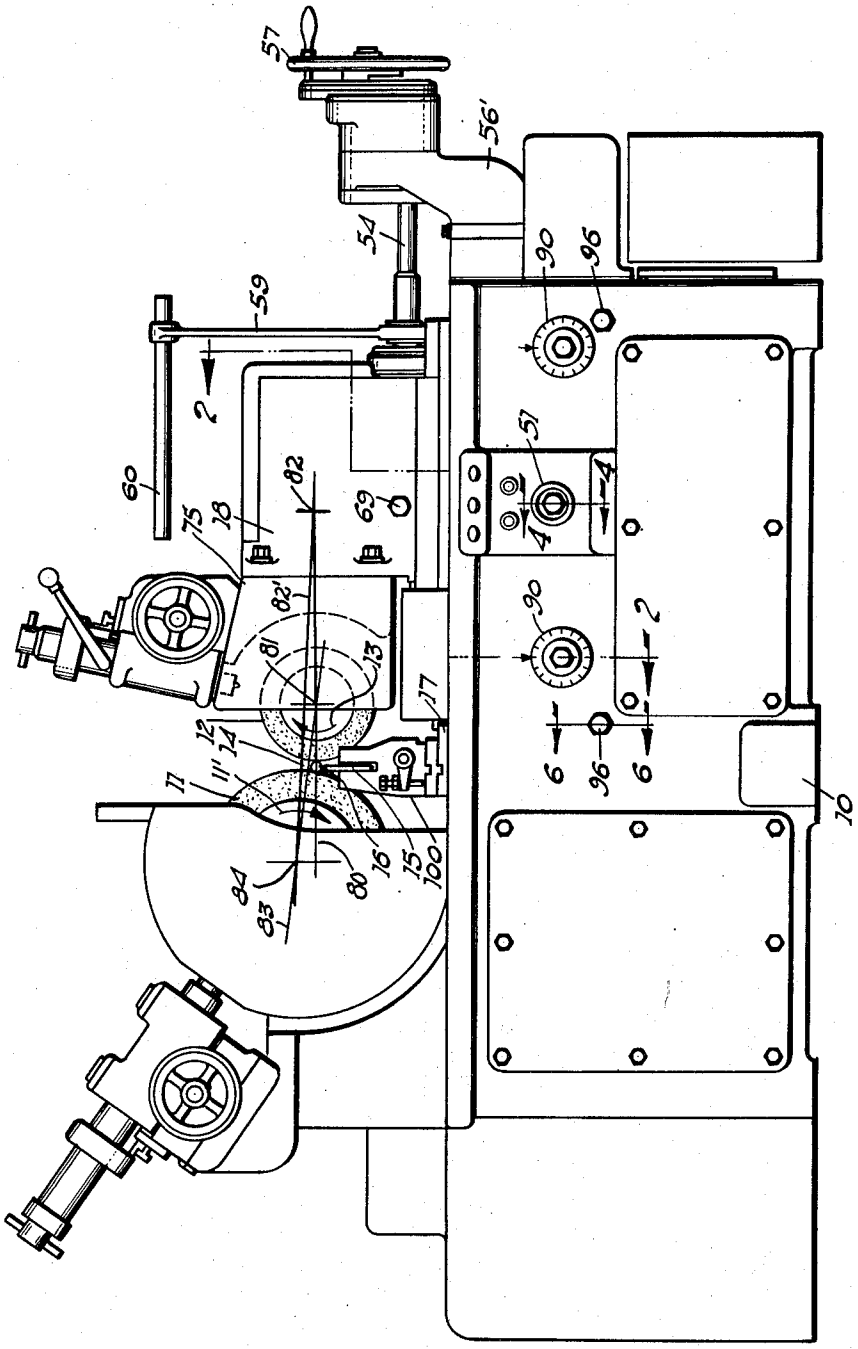


Fig. 1

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Fig. 2

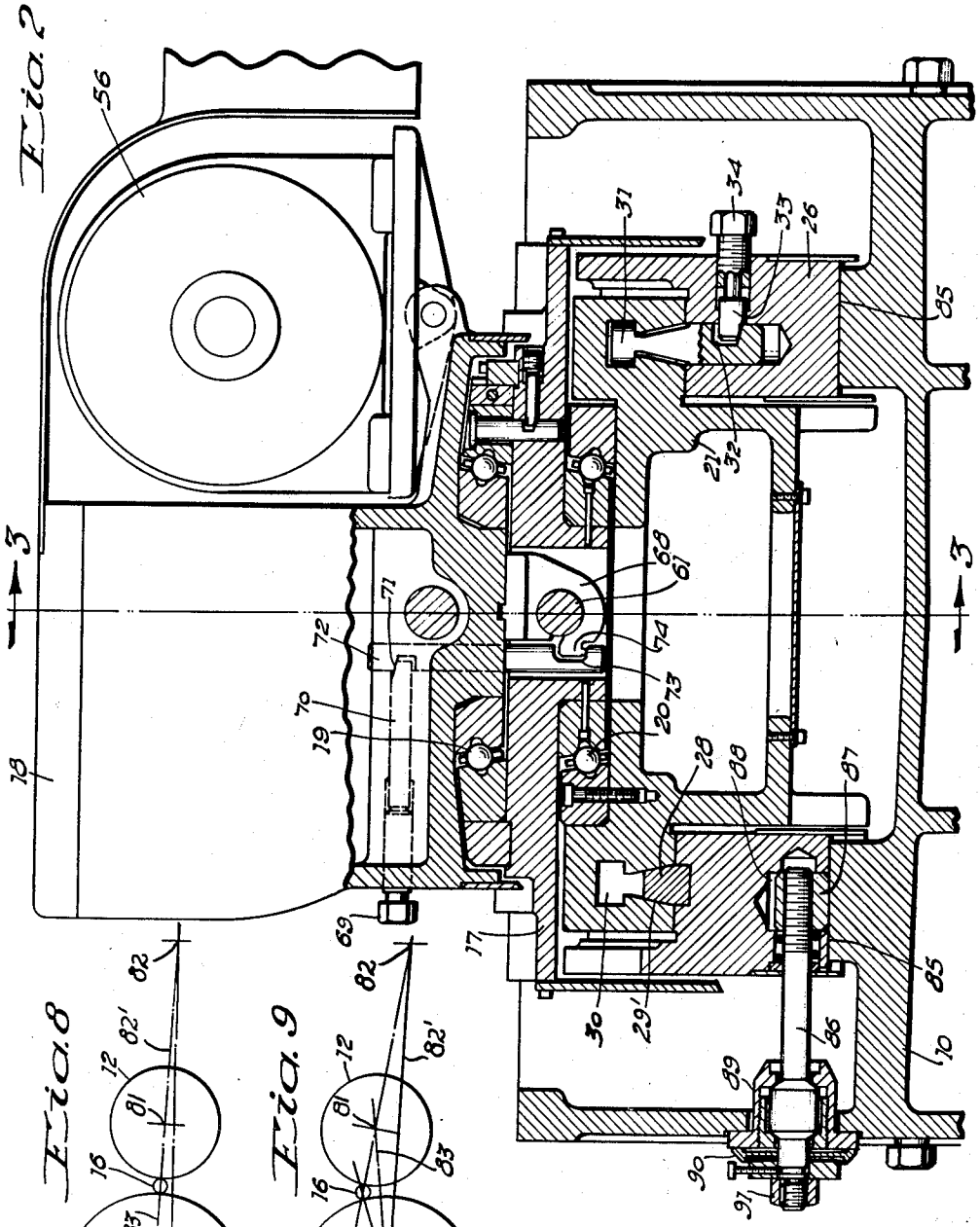


Fig. 8

Fig. 9

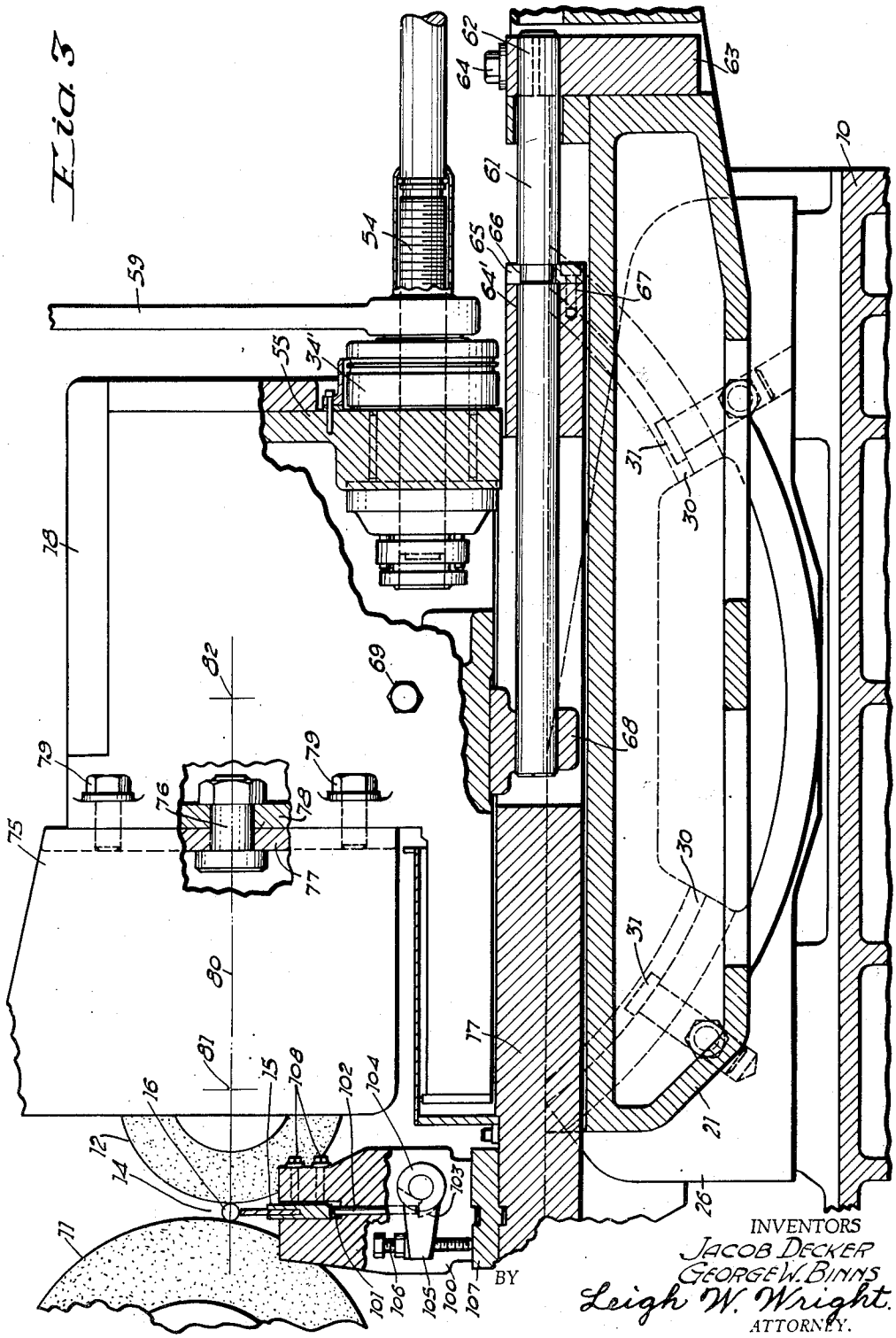
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CENTERLESS GRINDING MACHINE

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Fig. 3



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CENTERLESS GRINDING MACHINE

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Fig. 5

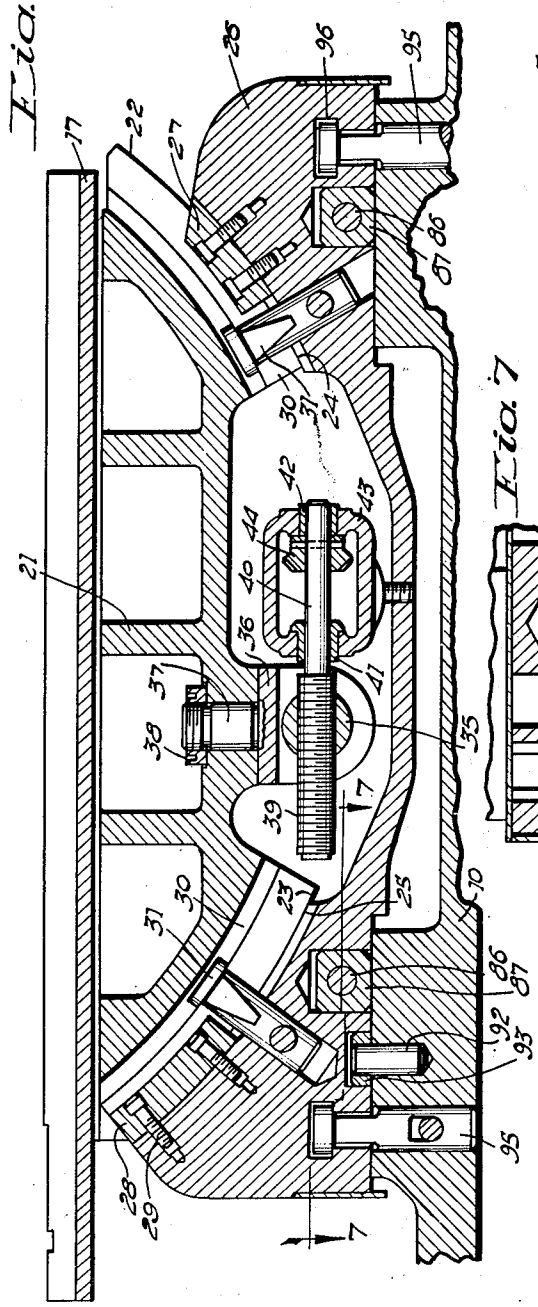


Fig. 4

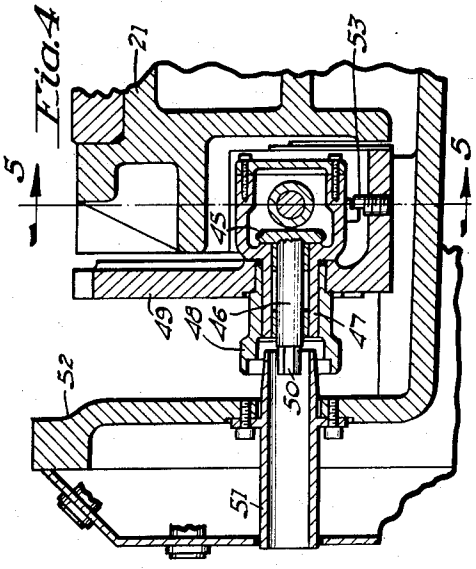


Fig. 7

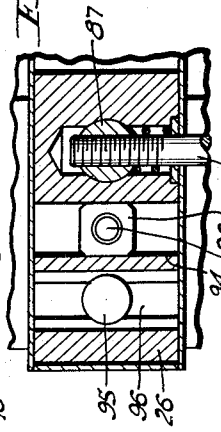
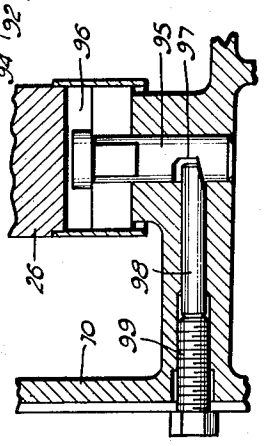


Fig. 6



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Patented Mar. 26, 1946 2,397,131

UNITED STATES PATENT OFFICE

2,397,131

CENTERLESS GRINDING MACHINE

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Application July 28, 1943, Serial No. 496,676

17 Claims. (Cl. 51—103)

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

One of the objects of this invention is to provide an improved, efficient and practical centerless grinding machine.

Another object of this invention is to improve the construction of centerless grinding machines to facilitate set-up and adjustment thereof.

A further object of this invention is to provide an improved construction in a centerless grinding machine whereby certain adjustments may be made without necessitating truing of the regulating wheel.

An additional object of this invention is to provide a new and improved structure for supporting the regulating wheel and work support for adjustment relative to the grinding wheel.

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 an elevational view of a centerless grinding machine embodying the principles of this invention.

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

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

Figure 4 is a section on the line 4—4 of Figure 1.

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

Figure 6 is a section on the line 6—6 of Figure 1.

Figure 7 is a detail section on the line 7—7 of Figure 5.

Figures 8 and 9 are diagrammatic views showing different grinding positions.

Conventional centerless grinding machines comprise a grinding wheel, a regulating or control wheel and a work rest which are grouped in such relation as to form a grinding throat in which the work is ground. The grinding wheel and the regulating wheel are arranged in peripheral opposed relation to form the grinding throat, while the work rest is variably interposed between the two wheels to support the work in various positions relative to a plane connecting or passing through the centers of the two wheels. This is true regardless of the angle that this plane is caused to assume due to the relative position of the wheels.

When the work rest blade positions the work so that the center of rotation of the work lies in the plane connecting the centers of the wheels a condition is created which is known in the art as "grinding on center." This is not the ideal condition, however, because it has been found in practice that in many cases a better rounding-up effect is obtained if the work is ground "above center" and in some cases improved results are obtained if the work is ground "below center." It follows that a general purpose machine should be capable of grinding under all of these conditions.

Due to the nature of the work, grinding operations are divided into two classes known as "through feed" grinding and "infeed grinding" operations. In the "infeed grinding" operation the axes of the two wheels and the work rest blade all lie in substantial parallel relation, and reduction of the work to size is accomplished by relatively feeding one of the wheels toward the other during which the work is held against axial movement. This is especially true in the case of work having shoulders on it. In the "through feed" grinding operation an arrangement is provided which automatically produces a feeding component on the work, thereby causing axial movement of the work past the wheels.

This feed component is developed by tilting the regulating wheel relative to the grinding wheel about a pivot perpendicular to the axis of the regulating wheel. For such an operation it is necessary to true the wheel, by passing the truing tool longitudinally of the wheel at the angle of tilt which thereby produces a hyperbolic shape on the regulating wheel. Since an element of a hyperboloid is a straight line, it is possible to maintain line contact between the work and the wheel while the angular direction in which the wheel crosses the work produces a feed component parallel to the work rest blade, thus producing automatic feeding. It should be obvious that the rate of feed will depend upon the amount of the angular adjustment or tilting of the regulating wheel.

In the practical operation of a centerless grinder it is often necessary to readjust the position of the work rest blade relative to the two wheels to obtain the best grinding condition. In through feed grinding set-ups, this naturally causes a shift of the work relative to the regulating wheel and thereby alignment with a new element of the hyperbolically-shaped regulating

wheel. Such shifting disturbs the contact relationship between the work and the regulating wheel to such an extent that it is necessary in present structures to retrue the wheel each time such a change is made.

One of the advantages of the present invention is that such shifting of the work may now be made without the necessity for retruing the regulating wheel, and since this eliminates many truing operations, the life of the regulating wheel is obviously prolonged, resulting in a more economical machine.

This advantage is obtained by mounting the work support and the regulating wheel on a common support which is adjustable in such a manner that the position of the work relative to the plane passing through the centers of the wheels may be varied without disturbing the contact relation between the work and the regulating wheel. Since no relative adjustment occurs between the work support and the regulating wheel it will be obvious that the work will remain in contact with the same element of the regulating wheel whereby retruing is unnecessary.

This, and other, advantages of the present invention will be brought out in the following description of the machine, reference now being had to the drawings and more particularly to Figure 1. In this figure the reference numeral 10 indicates, in general, the bed of the machine upon one end of which is rotatably mounted a grinding wheel 11. This wheel may be power driven in the direction of rotation indicated by the arrow 11' by any suitable form of power means, which is not shown.

A regulating wheel 12, rotatable in the direction of the arrow 13, is located in opposition to the grinding wheel, thereby forming a grinding throat, indicated generally by the reference numeral 14. A work rest blade 15 is located in the grinding throat between the wheels for supporting a work piece which is indicated by the reference numeral 16. The regulating wheel and the work rest are carried by a common slide 17 shown in Figures 2 and 3 for joint adjustment toward and from the grinding wheel 11. This slide is normally used for moving the parts in infeed grinding. The regulating wheel, however, is carried by an upper slide 18 for relative adjustment with respect to the work rest blade so that the one may be differentially adjusted relative to the other to accommodate various diameters of work. The upper slide 18 is supported by anti-friction bearings 19 for relative movement with respect to the slide 17 and the latter is supported by anti-friction bearings 20 for relative movement with respect to an oscillatable adjustable cradle 21.

Referring to Figure 5 the cradle 21 has arcuate bearing surfaces 22 and 23 which slide on complementary arcuate surfaces 24 and 25 formed on a saddle 26. The cradle is guided by wedge-shaped blocks 27 and 28 which are secured to the saddle by means of bolts 29. These wedge-shaped blocks, as shown in Figure 2, fit in complementary-shaped slots 29' formed in the underside of the cradle. These slots terminate in a T head 30 for receiving clamping bolts 31. These bolts have recesses 32 formed in the side thereof for receiving wedge-shaped clamping blocks 33 which are forced into engagement by screw-threaded bolts 34. When these are tightened, the cradle is drawn down into tight engagement with the saddle member 26. The cradle is adapted to be angularly adjusted by the means shown in Figures 4 and 5.

Referring to Figure 5, a nut 35 is pivotally supported in a bifurcated member 36 which has an upwardly extending shank 37 passing through the underside of the cradle and secured by a clamping nut 38. A screw 39 is threaded in the nut member 35 and has a reduced end 40 which is rotatably supported in bearings 41 and 42 formed in opposite ends of a rockable gear box 43. A bevel gear 44 is secured to the portion 40 in meshing relation with a bevel gear 45, which as shown in Figure 4, is attached to the end of a shaft 46 which is bearinged in a tubular extension 47 projecting from the side of the gear box 43. This tubular extension passes through a bushing 48 which is mounted in a wall 49 of the saddle 26 and thereby provides the rocking means for the gear box. The shaft 46 has a hexagon-shaped end 50 for receiving a suitable wrench which may be passed through the tube 51 mounted in the side wall 52 of the bed. This tube appears on the front of the machine as shown in Figure 1.

It will now be obvious that rotation of the shaft 46 will effect, through the interconnecting bevel gearing, rotation of the screw 39 and thereby adjustment of the cradle. Attention is invited to the fact that the gear box 43 is rotatably supported by the tubular extension 47 in the bushing 48 and is held in position by a set screw 53 which is so positioned as to permit oscillating movement of the housing in order to follow the rise and fall of the nut 35 as the cradle moves on its support.

The two slides carried by the cradle are adjusted by a screw 54 shown in Figure 3 which is in threaded engagement with a nut member 34' which is fixed in the rear end of the transmission housing 55 which is formed on the slide 18. This housing carries the transmission by which the prime mover 56 shown in Figure 2 and carried by the slide 18 is operatively connected for rotating the regulating wheel 12. The particular form of this transmission forms no part of the present invention and therefore is not shown in detail.

The slide adjusting screw 54 has its outer end journaled in an upwardly extending gooseneck arm 56', as shown in Figure 1, and a hand wheel 57 is provided for rotating the screw 54. It will now be apparent that rotation of the hand wheel 57 will effect adjustment of the slide 18 relative to the slide 17 and thus relative adjustment of the regulating wheel relative to the work support. For short feeding movements, a more convenient control is provided for the operator which is accessible from his position adjacent the grinding throat of the machine. This is accomplished by making the nut member 34' rotatable but axially fixed and connecting to it a lever 59 having a long handle 60 which extends forward to the operator's position.

The same mechanism may be utilized for moving the lower slide 17 and this is accomplished by providing a long bar 61 which has one end 62 passing through an apron 63 attached to the end of the cradle 21. The bar passes through a split bearing by which it may be clamped to the cradle by means of a clamping bolt 64. The bar 61 also passes through a bore 64' formed in a portion of the slide 17 and is permanently connected thereto by a key 65 which engages an annular groove 66 formed in the bar 61 and attached to the slide 17 by screw 67. The front end of the bar, as shown

in Figure 2, passes through a split bearing member 68 which depends from the underside of the slide 18. This split bearing member may be clamped to the bar 61 by means of a clamping screw 69, Figure 2, which forces a member 70, having a wedge-shaped end, into engagement with a wedge-shaped slot 71 formed in the side of a rod 72, thereby raising the rod. This rod has a slot 73 in the lower end which is engaged by a lug 74 projecting from the side of the member 68. As the rod 72 is forced upward, the split bearing frictionally engages the rod 61.

Thus, by loosening the clamping bolt 64, and clamping the member 68, the two slides 17 and 18 may be adjusted together. By tightening the bolt 64 and loosening the clamping bolt 69 the upper slide may be adjusted relative to the lower slide 17.

Consideration will now be given to setting up and adjusting the machine and the first adjustment to be made depends upon the size of the work. In this connection it is desirable to point out that, regardless of the diameter of the work, the center of rotation of the work should "lie on the center of the regulating wheel," the meaning of which will now be explained. As previously set forth, the regulating wheel is tilted or swiveled to determine the feed rate of the work in through-feed grinding operations and the center of this swivel or angular adjustment is shown in Figure 3. From this figure it will be seen that the regulating wheel is mounted in a housing 75 which is angularly movable relative to the housing 55 and the plane of this movement is parallel to the axis of the regulating wheel.

A swivel bolt 76 is passed through the walls 77 and 78 of the housings 75 and 55 and the axis of this swivel passes through the axis of the regulating wheel and at right angles to the plane of the swivel. Clamping bolts 79 serve to clamp the two housings together after adjustment has been made. The reference numeral 80 indicates the axis of the swivel and the reference numeral 81 indicates the center of rotation of the regulating wheel. It is the prolongation of axis 80 upon which the center of the work piece should be set and when thus positioned it is said to "lie on the center of the regulating wheel."

To accomplish this set-up, it is evident that the work rest blade 15 must be vertically adjusted either up or down and the regulating wheel slide 18 must be adjusted relative to the slide 17 in order that the work rest blade and the regulating wheel together form a two-point support for the work and hold it in the position mentioned. The slide 18 is then locked to the slide 17 and the cradle adjusted to determine the height of the work relative to the centers of the wheels in accordance with whether the work is to be ground "on center," "above center," or "below center."

The cradle has an imaginary center of rotation which is indicated in Figure 3 by the reference numeral 82 and it will be noted that this center also lies on the axis 80 and on the side of the regulating wheel opposite to the grinding wheel and below the center of the grinding wheel as shown in Figure 8. The location of the center 82 is not to be considered a limitation but is shown for illustrative purposes because it may be varied somewhat within the above limitations. It will be noted, however, that in each of the three cases shown in Figures 1, 8, and 9 that the axis of rotation of the oscillatable support lies parallel to the axis of rotation of the grinding wheel and in a plane 82' which passes through the axis of rotation of the grinding wheel and intersects the regulating wheel. It is necessary that this plane 82' intersect the regulating wheel in order to make adjustments of the work above and below center possible. The cradle is shown in its lowest position in Figures 1 and 3, that is, in a position which will locate the work at the lowest limit below center.

In this position the cradle is not horizontal but has a slight angular inclination toward the rear of the machine for coolant drainage purposes. It will be noted from Figure 1 that if a line 83 is drawn through the axis 84 of the grinding wheel 11 and the axis 81 of the regulating wheel 12, that the work piece 16 will be below this line which is equivalent to saying that it is "below center."

As the cradle is rotated in a clockwise direction about the center 82 by the means shown in Figures 4 and 5 a position will be reached in which the center 82, the center 81 and the center 84 are all in a straight line as shown diagrammatically in Figure 8, which would thus position the work "on center" between the wheels. The work is then said to be ground "on center."

Further rotation of the cradle will cause the work to rise vertically at a faster rate than the center 81 of the regulating wheel because of its greater radius with respect to the center 82 whereby the work will be elevated above the center line 83, as shown in Figure 9. The work is then said to be ground "above center."

It will now be evident that since the work rest and the regulating wheel are both carried by the cradle, adjustments of the work above or below center can be made without disturbing the relationship between the work and the regulating wheel, thereby eliminating the necessity for truing the regulating wheel every time an adjustment in height is made. This will not only save time in making adjustments after the machine has been set up, but will also lengthen the life of the regulating wheel.

With the upper slide clamped to the lower slide, adjustments can also be made in sizing the work without disturbing the relationship between the work and the regulating wheel. It will also be noted that this sizing or feeding movement will be along the line parallel to the angle of inclination of the cradle.

For in-feed grinding operations the axes of the wheels are adjusted parallel and the regulating wheel is moved to and from the grinding wheel to load and unload work.

In cases of shouldered work or slightly tapered work, it may be necessary to adjust the regulating wheel axially relative to the grinding wheel to line up the end faces of the wheel with a shoulder on the work; or to shift the axis of one wheel into or out of parallelism relative to the other as viewed in plan, the latter adjustment being made when it is desired to grind a slight taper on the work.

Provision has been made for making these adjustments by mounting the saddle 26 on flat ways 85, as shown in Figure 2, and providing micrometer adjusting screws 86 which threadedly engage nuts 87 that are mounted within a cavity 88 formed in the underside of the saddle. The adjusting screws are anchored against axial movement in bushings 89 which are mounted in the side wall 52 of the bed and the outer ends of these screws are provided with a graduated dial 90 and with hexagonal ends 91 by which the screws may be rotated by a suitable wrench. It will be noted from Figure 1 that there are two of these adjusting screws located near opposite ends of the sad-

dle 26 whereby equal adjustment of both screws will effect an axial shifting of regulating wheel while unequal adjustments will effect an angular adjustment as for taper work.

In order to prevent the saddle from creeping, since it is merely supported upon flat surfaces, and especially to keep it from creeping in a direction which might affect the size of the work, a fixed pivot has been provided comprising a stud 92 more particularly shown in Figure 7 which is driven in the bed and provided with a square block 93 which is rotatable relative to the stud. This square block fits in a rectangular slot 94 formed in the underside of the saddle and extending in a direction in which the work feeds.

It will therefore be obvious that movement of the saddle laterally or in a direction toward and from the grinding wheel is substantially prevented. It will be noted that the nut members 87 are cylindrical and therefore capable of a certain amount of rotation, which prevents binding of the screws when angular adjustments are effected.

Means are provided for clamping the saddle to the bed, and as shown in Figures 5 and 6, headed clamping bolts 95 are provided which fit in T slots 96 formed in the underside of the saddle. These clamping bolts have notches 97 formed in the side thereof, the lower face of which is tapered for engagement by a taper-ended rod 98 which may be forced by a screw 99 in a direction to exert a downward pull on the clamping bolt 95. The screws 99 are shown in Figure 1 of the drawings from which it will be seen that they are readily accessible to the operator.

One form of means is shown for adjusting the work rest blade in Figure 3 of the drawings. It will be understood that a pair of supports 100 are mounted upon the slide 17 on opposite sides of the wheels and these supports have a slot 101 formed in the top in which the blade 15 is mounted. A reciprocable rod 102 is slidably mounted in the support for engagement with the underside of the blade. A crank arm 103 engages the underside of the rod and the crank arm is mounted on a shaft 104. The outer end of this shaft is provided with an adjusting lever 105 in which is threaded a bolt 106, the lower end of the bolt engaging a plate 107.

By rotation of the bolt the lever 105 may be rotated to elevate the rod and thereby the blade 15. When the blade is at a suitable height a pair of clamping bolts 108 are tightened to hold the blade in position.

There has thus been presented a preferred embodiment of this invention but it is to be understood that the principles explained herein are equally adaptable to the condition in which the grinding wheel and the regulating wheel are arranged, one above the other, or as a matter of fact to any other angle between the horizontal and the vertical. It should be noted that the arrangement of the cradle structure and the location of its pivot makes it possible to obtain a minimum angular adjustment for the complete range of adjustment of the work from its lowest position below center to its highest position above center. This keeps the size of the machine within suitable limits.

This improved structure not only facilitates adjustment of the work after grinding operations have started but also facilitates changeovers as in cases where it is found desirable to grind work below center for the purposes of rounding up the work and then grinding it above center for sizing purposes.

An improved structure has thus been provided which facilitates set-up and adjustment for centerless grinding operations, and in a manner to eliminate certain truing operations now found necessary in present machines, thus lengthening the life of the regulating wheel whereby a more economical and universally adaptable machine is obtained.

What is claimed is:

1. In a centerless grinding machine having a grinding wheel, a regulating wheel and a work support between the wheels, the combination of means for supporting the regulating wheel and work rest for unitary movement relative to the grinding wheel, guides constraining the movement of said means about an axis lying in a plane containing the axis of the regulating wheel and located on the side of the regulating wheel opposite to the work support, and means for effecting said movement.

2. In a centerless grinder having a grinding wheel, a regulating wheel and a work rest for supporting work to be ground between said wheels, the combination of a common support for the regulating wheel and the work rest, and arcuate guides having a center of curvature located on the opposite side of the regulating wheel from the work rest for constraining movement of the support in a curvilinear path lying in a plane parallel to the plane of rotation of the grinding wheel for raising or lowering the center of the work above or below a plane passing through the centers of said wheels.

3. In a centerless grinding machine having a grinding wheel, a regulating wheel and a work support, the combination of an oscillatable support for the regulating wheel having an axis of oscillation on the side of the regulating wheel opposite to the grinding wheel, and means to adjust the oscillatable support about its axis of oscillation whereby a radial plane from the axis of oscillation and passing through the axis of the regulating wheel may be adjusted to one side or the other of a radial plane from the axis of the oscillatable support and passing through the axis of the grinding wheel.

4. In a centerless grinding machine having a grinding wheel, a regulating wheel, and a work rest located between said wheels, the combination of a common support for the regulating wheel and the work rest, means to adjust said support relative to the grinding wheel, said support having a pivot located in a plane passing through the axis of the grinding wheel and intersecting the regulating wheel to produce a vertical component of movement of the work rest at a greater rate than the vertical component of movement of the regulating wheel whereby upon angular adjustment of said support in one direction the height of the work relative to a plane passing through the centers of the grinding and regulating wheels may be increased or upon rotation in the other direction said height may be decreased.

5. In a centerless grinding machine having a grinding wheel, a regulating wheel and a work rest located between said wheels and in front of the regulating wheel, of a common support for the regulating wheel and the work rest, means for supporting said support for movement about an axis located behind the regulating wheel to cause swinging movement of the work axis transversely above or below a plane passing through

the centers of rotation of the grinding wheel and the regulating wheel.

6. In a centerless grinding machine having a bed, a grinding wheel supported for rotation on the bed, an oscillatable cradle supported by the bed, a regulating wheel and a work rest carried by the cradle in opposition to the grinding wheel, said cradle having an axis of rotation lying in a plane passing through the center of the rotation of the regulating wheel, and means to adjust the regulating wheel relative to the cradle and in a radial plane passing through the axis of the cradle.

7. In a centerless grinding machine having a bed, a grinding wheel supported for rotation on the bed, an oscillatable cradle mounted on the bed, a regulating wheel and a work rest supported by the cradle, said cradle having an axis of rotation lying in a plane passing through the axis of rotation of the regulating wheel, and means to effect relative adjustment between the regulating wheel and the work rest including a pair of slides mounted on the cradle, and means movable with the cradle to effect relative movement between said slides.

8. In a centerless grinding machine having a grinding wheel, a regulating wheel and a work rest located in the grinding throat between the wheels, the combination of means to adjust the regulating wheel relative to the grinding wheel to change the width of the grinding throat, means to adjust the work rest laterally to the grinding throat in accordance with the size of the work, additional means for adjusting the work rest vertically in the grinding throat to position the work on the center of the regulating wheel, and mean to simultaneously adjust the work rest and regulating wheel relative to the grinding wheel to position the work relative to a plane passing through the centers of the wheels.

9. In a centerless grinding machine having a grinding wheel and an opposed regulating wheel and a work rest located between said wheels, the combination of a regulating wheel housing for supporting the regulating wheel and having a swivel axis perpendicular to the axis of the regulating wheel, a common support for the work rest and regulating wheel housing, said support being mounted for oscillation about an axis lying in a plane determined by said swivel axis and the axis of rotation of the regulating wheel, means to adjust the work support relative to said common support to position the center of the work in said plane, and means to adjust said common support to change the position of the work relative to a plane passing through the centers of the grinding and regulating wheels whereby the work may be ground above or below center.

10. In a centerless grinding machine having a grinding wheel, a regulating wheel and a work rest located between said wheels, the combination with a bed for supporting the grinding wheel, of an oscillatable support carrying the work rest and regulating wheel, a saddle for supporting said oscillatable support on the bed with its axis of oscillation parallel to the axis of the grinding wheel, and means to adjust said saddle to move the axis of oscillation out of parallelism with the axis of the grinding wheel for taper grinding operations.

11. In a centerless grinding machine, the combination with a bed having a grinding wheel supported for rotation thereon, of a pair of spaced guideways formed on the bed, a saddle mounted on said guideways for angular movement about a pivot located in one of said guideways, means to effect said angular adjustment including a pair of micrometer screws operatively connected to opposite ends of the saddle and anchored in the bed, means to clamp the saddle to the bed, arcuate guideways formed on said saddle and extending transversely to the first-named guideways, a cradle supported on said arcuate guideways, a regulating wheel and a work rest carried by said cradle, means to angularly adjust said cradle to change the position of the work relative to the grinding wheel, and means to clamp the cradle to the saddle after adjustment.

12. In a centerless grinding machine, the combination with a bed having a grinding wheel supported for rotation thereon, of a pair of spaced guideways formed on the bed, a saddle mounted on said guideways for angular movement about a pivot located in one of said guideways, means to effect said angular adjustment including a pair of micrometer screws operatively connected to opposite ends of the saddle and anchored in the bed, means to clamp the saddle to the bed, arcuate guideways formed on said saddle and extending transversely to the first-named guideways, a cradle supported on said arcuate guideways, a regulating wheel and a work rest carried by said cradle, means to angularly adjust said cradle to change the position of the work relative to the grinding wheel, means to clamp the cradle to the saddle, a pair of superimposed slides mounted on the cradle, a rod extending parallel to said slides, means permanently connecting the rod to one of said slides, means to clamp one end of the rod to the cradle and the other end of the rod to the top slide, a feed screw connecting the upper slide to the cradle, and means to selectively operate said clamping means whereby one or both slides may be actuated upon rotation of said screw.

13. In a centerless grinding machine, the combination of a grinding wheel, a bed for supporting the grinding wheel for rotation, a regulating wheel, a work rest, a common support for the regulating wheel and the work rest, an independent support for the regulating wheel mounted on the common support and adjustable thereon for skewing the axis of the regulating wheel relative to the axis of the work support to provide a feeding angle, and actuating and control means for adjusting the common support angularly and bodily to shift the contact point between the grinding wheel and the work circumferentially of the periphery of the grinding wheel without disturbing the feed angle relationship between the regulating wheel and the work rest.

14. In a centerless grinding machine having a grinding wheel, a regulating wheel, and a work support for supporting work pieces between said wheels, the combination of an oscillatable support jointly supporting said regulating wheel and work support, said oscillatable support having an axis of oscillation lying in a plane passing through the axis of the grinding wheel and intersecting the regulating wheel, said axis of oscillation lying parallel to the axis of the grinding wheel, and means to adjust said oscillatable support about its axis of oscillation to thereby effect joint relative bodily shifting of said work support and regulating wheel relative to said plane.

15. In a centerless grinder having a grinding wheel, a regulating wheel and a work support operatively related to form a grinding throat, the combination of an oscillatable support having an

axis of oscillation lying in a plane passing through the axis of the grinding wheel and intersecting the regulating wheel, said support mounting the regulating wheel and work support for joint adjustment, said axis of oscillation lying parallel to the axis of the grinding wheel, and means for adjusting said oscillatable support about its axis of oscillation to effect bodily shifting of the work support and regulating wheel transversely of said plane to vary the spacing with respect to said plane.

16. In a centerless grinding machine having a grinding wheel, a work rest, and a regulating wheel, means to support the regulating wheel for angular adjustment with respect to the grinding wheel to produce a feeding angle on the work, and a common support for the regulating wheel and the work rest, said support being adjustably mounted for swinging movement about an axis lying in a plane passing through the center of the grinding wheel and intersecting the regulating wheel to shift jointly the work rest and regulating wheel transversely with respect to said plane and without disturbing the feeding angle relationship between the regulating wheel and the work rest.

17. In a centerless grinding machine having a grinding wheel, a work rest and a regulating wheel, means to support the regulating wheel for angular adjustment with respect to the grinding wheel to produce a feeding angle on the work and a common support for the regulating wheel and the work rest, said support being adjustably mounted for swinging movement about an axis lying in a plane passing through the axis of the grinding wheel and intersecting the regulating wheel for jointly shifting the work rest and regulating wheel in various spaced relationship to said plane without disturbing the feed angle relationship between the regulating wheel and the work rest, and means to clamp said common support in its various angularly adjusted positions.

JACOB DECKER.
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