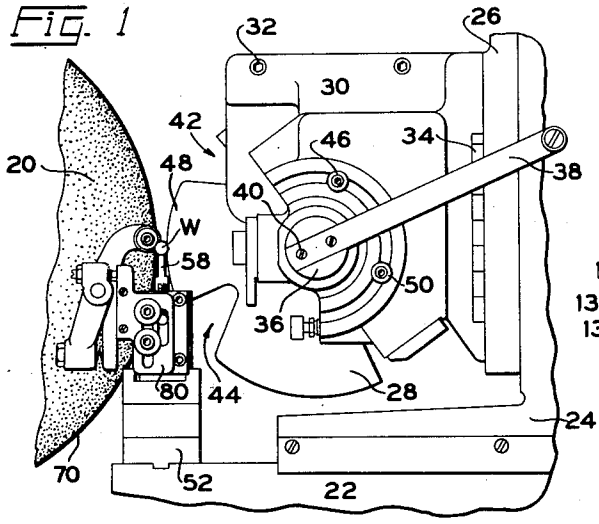
March 14, 1950 E. M. EIGENBRODE 2,500,634

WORK HOLDING FIXTURE FOR GRINDING MACHINES

Filed Dec. 3, 1946

Fig. 1



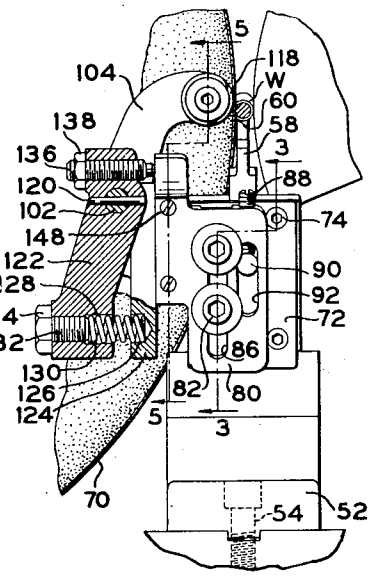


Fig. 4

Fig. 3

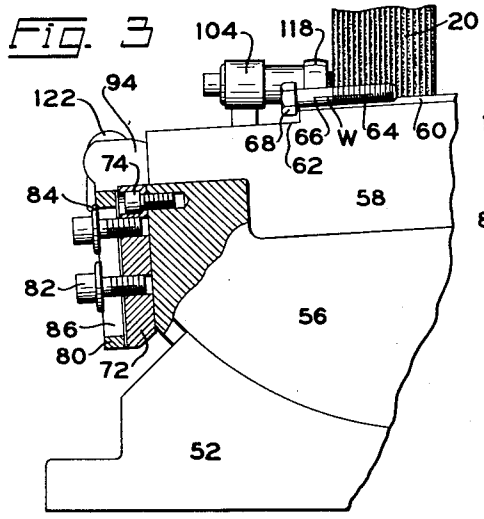
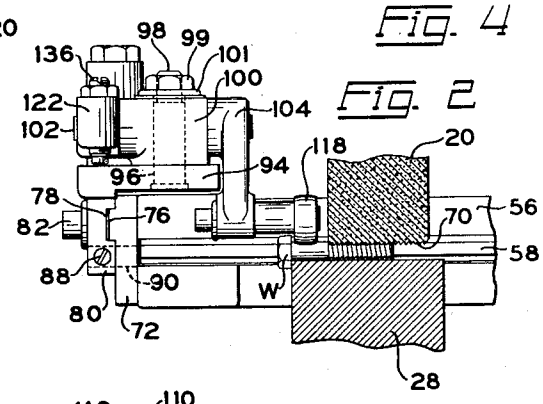


Fig. 2



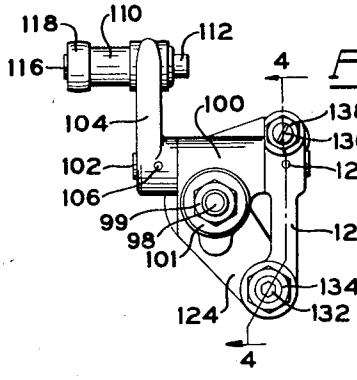


Fig. 6

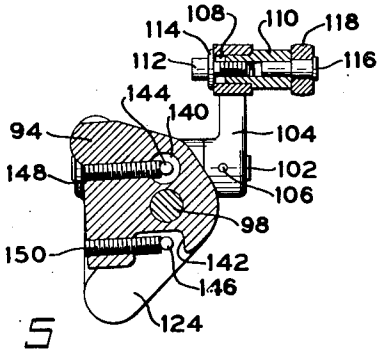


Fig. 5

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WORK HOLDING FIXTURE FOR GRINDING MACHINES

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6 Claims. (Cl. 51—103)

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This invention relates to improvements in grinding machines and the like and in particular to mechanism for supporting work-pieces in such a machine.

An embodiment of my invention is herein shown in association with a centerless grinding machine of the type shown and described in the patents of C. W. Hopkins and E. M. Eigenbrode, No. 2,427,283 and Arthur Scrivener, No. 2,427,024. In such machines the regulating or control wheel performs certain feeding and ejecting functions in addition to its customary function of controlling the rotation of the work-piece and of urging said work-piece against the grinding wheel during the grinding operation. A machine of this type is especially useful in the grinding of threads on headed members such as bolts, screws, etc., although it is by no means limited to such uses.

Such members as cap screws, for example, are threaded for only a portion of their length and therefore the thread grinding wheel can engage only such portion, leaving a considerable length of the screw unsupported. This disadvantage I propose to obviate by providing a control wheel which will engage the threaded and unthreaded portions of the screw shank, and by supplementing the opposing pressure of the grinding wheel upon the work by means of an adjustable roller mechanism. Similar mechanisms heretofore constructed cannot be used in such a centerless thread grinding machine since they lack adjustments which would permit the work engaging roller to be maintained in axially parallel relationship with the grinding wheel as the work is tilted longitudinally for the production of threads of various helix angles.

It is an object of my invention to provide a means for supporting work-pieces, to be ground by the infeed method, over substantially their entire length and thereby to improve the accuracy and finish of such ground work-pieces.

It is also an object of the invention to provide a work support to supplement the grinding wheel in cases where the grinding wheel does not engage the entire length of the work-piece, whereby continuous contact between work-piece and control wheel is insured along substantially the full length of said work-piece, thereby minimizing liability of slippage between the work and control wheel.

It is another object to provide a work support with means for adjusting the same to a position of axial parallelism with the grinding wheel regardless of the degree of relative inclination between the axes of grinding wheel and work-piece.

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An additional object resides in the provision of a novel mounting unit for a supplemental work supporting roller on one end of an adjustable cradle for the work rest blade and which embodies means for yieldingly urging the roller into pressure contact with the work as well as means for vertically positioning the roller for most effective contact with work-pieces of different forms and sizes and means for adjusting the axial position of the roller relative to the work-piece.

Other objects and advantages will be apparent from a study of the following description and the accompanying drawings illustrative of one embodiment of the invention.

In the drawings:

Figure 1 is a partial front elevation of a centerless grinding machine showing one embodiment of my novel work supporting device;

Figure 2 is a fragmentary plan view of the work supporting device and associated parts of the grinding machine;

Figure 3 is a fragmentary side elevation, partially in section on line 3—3 of Figure 4 with the work-piece inclined relative to the grinding wheel axis;

Figure 4 is a front elevation, partially in section along line 4—4 of Figure 6, of the parts shown in Fig. 3;

Figure 5 is a vertical sectional view taken on line 5—5 of Figure 4, and

Figure 6 is an elevation of the parts shown in Figure 5 but seen from the opposite direction to that of Figure 5.

Figure 1 of the drawings illustrates the principal operating parts of a centerless grinding machine for the grinding of work pieces by the infeed method. Upon a base or bed, not shown, which usually contains the motor, gears, and other mechanism for driving the rotating parts, a grinding wheel 20 is mounted in the conventional manner. A main slide 22 is also mounted on the bed for lateral reciprocation toward and from the peripheral face of grinding wheel 20. A second slide 24 is mounted on main slide 22, for reciprocation relative thereto also toward and from grinding wheel 20.

Slide 24 supports a housing 26 in which is mounted in the usual manner a control wheel 28. As is understood in the art, grinding wheel 20 and control wheel 28 are mounted so that their peripheral faces are in mutual opposition, forming a grinding throat therebetween in which

the work is supported. The connection between housing 26 and slide 24 is usually such as to permit the rocking of the axis of control wheel 28 in a vertical plane so that said control wheel axis may be inclined relative to the axis of grinding wheel 20.

A second housing 30 is secured by screws 32 and hinge 34 to the housing 26. In housing 30 a control wheel operating shaft 36 is mounted in alignment with the center of control wheel 28 and, as explained in detail in the above-mentioned patent applications, is engageable by means of a clutch mechanism, to rotate said control wheel 28. Such rotation is accomplished manually, in the present instance, by a lever 38, secured to the forward end of operating shaft 36 by screws 40.

The control wheel 28 is provided with a series of pockets in its peripheral face, two of which, designated by the reference numerals 42 and 44, are necessary for the grinding of a particular size of work-piece. The work-piece W is first placed in pocket 42 when the control wheel 28 is rotated so that pocket 42 is disposed below the grinding position. In this position lever 38 will engage the stop 46, which limits movement of lever 38 in the counter-clockwise direction. Lever 38 is then rotated in the clockwise direction and work-piece W is fed into the grinding throat and urged against the peripheral face of grinding wheel 20 by the section 48 of the periphery of control wheel 28. Grinding takes place as surface 48 is thus rotated past the grinding throat and work-piece W is subsequently discharged into the following pocket 44. At this point, lever 38 will be prevented from moving further in the clockwise direction by the stop 50. Counter-clockwise rotation of lever 38 then restores pocket 42 to its starting position and the finished work-piece W may be removed from pocket 44.

The work rest mechanism shown in the drawings is similar to that disclosed in the patent of Cecil W. Hopkins, No. 2,417,413, issued March 18, 1947. The base portion 52 of this mechanism is secured upon main slide 22 by screws 54. As described in said patent the arcuate slide or cradle 56 is mounted for rocking movement upon base 52 while the center of such rocking movement lies in the same horizontal plane as the center of rocking movement of the axis of control wheel 28.

A work rest blade 58 is secured in the usual fashion in cradle 56 and extends transversely between grinding wheel 20 and control wheel 28 to support the work-piece W in the grinding throat. The upper or work supporting surface 60 of blade 58 is inclined downwardly away from grinding wheel 20, according to well-known principles of centerless grinding, while the other details thereof must conform to the particular work-piece being ground. The blade 58 is shown (Figure 3) cut away as at 62 to provide clearance space for the head of the work-piece W.

According to recognized principles of centerless thread grinding, the axis of the work W must be inclined relative to the axis of grinding wheel 20 an amount substantially equal to the helix angle of the thread to be ground, while the axis of control wheel 28 must be inclined relative to the axis of grinding wheel 20 slightly less than twice this amount. These inclinations have not been indicated in Figures 1 and 2 of the drawings but the axes of work, grinding wheel and control wheel are all shown parallel in the interests of simplification and clarity of details with which this invention is more directly concerned.

In Figure 3, work rest cradle 56 together with work rest blade 58 is shown in rotated position to incline work-piece W at the proper angle relative to the axis of grinding wheel 20. The work-piece W, shown merely as an example, comprises three distinct portions: a threaded portion 64, a cylindrical unthreaded portion 66 and a head 68. The threads on portion 64 are formed during the grinding operation by the annular ridges and grooves 70 formed on the periphery of grinding wheel 20. Thus, since portion 66 is not ground, only threaded portion 64 is supported between the grinding wheel 20 and control wheel 28. If this condition were allowed to remain, the resultant free movement of work portions 66 and 68, especially in the case of very long work-pieces, would destroy the finish and accuracy of the threads being ground. A description of the means whereby this difficulty can be obviated follows.

A work supporting unit embodying a substantially rectangular plate 72 is attached to the forward end of work rest cradle 56 by screws 74. The forward surface of plate 72 is formed with the vertically extending, integral key 76 (Figure 2). A corresponding keyway 78, formed in the rearward face of the bracket member 80, engages key 76 to prevent relative lateral movement between bracket 80 and plate 72, to which said bracket 80 is removably secured by screws 82 and washers 84. Bracket 80 is rendered vertically adjustable by providing a slot 86 in said bracket through which screws 82 pass to engage threaded openings in the plate 72. This adjustment may be effected by rotating a set screw 88 vertically threaded in the top of bracket 80 and having abutting contact with a pin 90, which extends forwardly from plate 72 into a second slot 92 in bracket 80, (see Figure 4). The purpose of such adjustment will appear later.

Bracket 80 is formed with an integral portion 94 (Figure 2) extending rearwardly along one side of work rest cradle 56 and parallel with work rest blade 58. Portion 94 is provided with a cylindrical opening 96 in which one end of a bolt 98 is suitably fixed with its axis perpendicular to the plane of bracket part 94. A second bracket 100 is journalled for rocking movement upon the bolt 98 (Figures 2 and 6) and is retained thereon by nut 99 and washer 101. The bracket 100 has the shaft 102 journalled therethrough with its axis substantially normal to the bolt 98. On the rearward end of shaft 102 and immediately adjacent bracket 100 a lever arm 104 is affixed for rotation with shaft 102 by the pin 106.

Lever arm 104 extends upwardly and has, at its upper end the cylindrical opening 108 in which is seated the rearwardly extending spacer member 110 (Figure 5). Spacer 110 is retained in position by a screw 112 and washer 114, said screw extending rearwardly into opening 108 and threadedly engaging the forward end of spacer 110. A pin 116 is frictionally fitted into the rearward end of spacer 110 and between said spacer and the rearwardly spaced head of said pin 116 a roller 118 is rotatably mounted. As shown in Figures 2 and 3, roller 118 is thus located in close proximity to the forward side of grinding wheel 20 to engage the unthreaded portion 66 of the work-piece W.

Shaft 102 also protrudes forwardly from bracket 100 and has secured to its forward end, by a pin 120, a downwardly extending lever arm 122. Lever arm 122 is co-extensive with an extension 124 of bracket 100. Extension 124 and lever arm 122 have mutually opposed lower end

surfaces provided with openings 126 and 128 respectively, for the reception of a compression spring 130. A tension adjusting screw 132 is threadedly engaged in lever arm 122 to abut one end of spring 132 and thus adjustably control the pressure of said spring. Screw 132 is locked in adjusted position by the lock nut 134. Thus, as seen in Figure 4, lever arm 122, shaft 102, lever arm 104 and roller 118 are all resiliently urged to rotate in a clockwise direction by spring 130 which consequently provides the pressure which roller 118 exerts against the work-piece W. Rotation of lever arm 122 in clockwise direction is adjustably limited by a stop screw 136, threaded through the upper portion of lever arm 122 to abut a portion of bracket 80. Screw 136 is locked in adjusted position by a lock nut 138. Therefore, the position of screw 136 determines the initial lateral position of roller 118 with respect to the work rest 58 and this adjustment is consequently used to locate roller 118 properly for various diameters of work.

From Figure 5 it will be seen that the extension 94 of bracket 80 is provided with the opening 140 and the cutout portion 142. These openings are disposed on opposite sides of the pivot 98 and pins 144 and 146, which are frictionally secured in the side of bracket 100, project into the respective openings. Thus the rocking movement of bracket 100 relative to bracket 80 is limited by the relative size of pins 144 and 146 and openings 140 and 142. Bracket 100 may be locked in the desired rotated position relative to bracket 80 by means of the locking screws 148 and 150 which are threaded through bracket portion 94 transversely of openings 140 and 142 and engage, respectively, pins 144 and 146 to prevent relative rotation of brackets 80 and 100.

It has been found necessary to maintain roller 118 exactly parallel with grinding wheel 20. If the axis of roller 118 were inclined with work rest blade 58 and slide 56 relative to the wheel axis, said roller would exert an axial force on work-piece W in opposition to the force set up by the inclination of control wheel 28 and the lead of the resulting thread could not be controlled. Hence the necessity of the relative angular adjustment between bracket 100 which carries roller 118 and bracket 80 both of which are rocked with work rest cradle 56.

As is well understood in the art, the vertical position of work rest blade 58 and hence of the work W, is variable. The above-described adjustment of bracket 80 and the parts supported thereby, relative to plate 72, by means of slot 86 and screws 82 is provided to compensate for vertical adjustment of work rest blade 58 as well as to maintain roller 118 in proper work contacting position by eliminating the vertical displacement component caused by the tilting of cradle 56.

It will be seen that the above described device is universal in its application and that it may be employed on work having a wide range of characteristics to maintain contact between the unground portions of the work and the control wheel continuously during the grinding operation and thus prevent grinding inaccuracies and insure perfect finish of the completed work.

It will be noted that the primary elements 72, 80, 100 and 104 for adjustably mounting the work holding roller 118 are combined in a very compact unit which can be readily applied to or removed from the end of the work rest cradle 56. As will be evident from Figures 1 and 4, this unit occupies comparatively little space at the front side

of the grinding wheel to afford clear and unobstructed vision of the work piece in the grinding operation and will not be seriously impaired in its functional operation by accumulations of grinding dust. The several cooperating parts are also of simple and durable structural form and provide a work holding accessory for centerless grinders of reasonably low production cost.

The invention may be embodied in other specific forms without departing from the spirit or essential characteristics thereof. The present embodiment is therefore to be considered in all respects as illustrative and not restrictive, the scope of the invention being indicated by the appended claims rather than by the foregoing description, and all changes which come within the meaning and range of equivalency of the claims are therefore intended to be embraced therein.

What is claimed and desired to be secured by United States Letters Patent is:

1. In a centerless grinding machine, a grinding wheel and a control wheel mounted to rotate about axes disposed in parallel vertical planes and in peripherally opposed relation, with said wheels axially inclined relative to each other, a work support, means mounting said support for angular adjustment in a plane parallel to the wheel axes to support a workpiece between the wheels at an axial inclination relative to the axes of said wheels for in-feeding movement of the workpiece by the control wheel, and means rotatably mounted on said work support at the work entrance side of the grinding wheel, with its axis inclined to the axis of the workpiece in a vertical plane, to maintain continuous pressure contact of an unground section of the workpiece with the peripheral face of the control wheel.

2. A centerless grinding machine as defined in claim 1, wherein said last named means comprises a roller, and means mounting said roller to laterally urge the work piece toward the control wheel, including means for adjusting said roller about a fixed axis to establish a predetermined axial relationship between the roller and work-piece and obviate substantial restraint by said roller to the in-feeding movement of the work-piece.

3. A centerless grinding machine as defined in claim 1, wherein said last named means comprises a pressure roller to laterally urge the work-piece toward the control wheel, together with means for adjusting said roller relative to the work supporting means to a position of substantial axial parallelism with said grinding wheel.

4. An accessory work holding unit for grinding machines and the like having a work supporting member, said unit comprising a bracket for attachment to said member, a bearing member pivoted for rocking movement on said bracket, a shaft journalled in said bearing member with its axis substantially normal to the pivot thereof, an arm fixed to each end of said shaft, a work holding roller carried by one of said arms, a spring interposed between said bracket and the other arm to yieldingly urge the roller into holding contact with a work-piece, and means carried by the bracket coacting with means on said bearing member to adjustably rock the same and position the axis of said roller in predetermined angular relation to the axis of the work-piece.

5. An accessory work holding unit as defined in claim 4, together with an adjustable stop member carried by one of said arms to engage said bracket and limit movement of said roller in work-engaging direction.

6. In combination with a grinding machine

having a work control wheel, a rockable cradle for a work rest blade to support a workpiece in predetermined axial position relative to the peripheral face of said wheel, a pressure roller to engage and urge a workpiece against the face of said wheel, a mounting bracket for said roller, and means for attaching said bracket to one end of said cradle including means to vertically adjust the bracket and pressure roller relative to the cradle.

EDWIN M. EIGENBRODE.

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