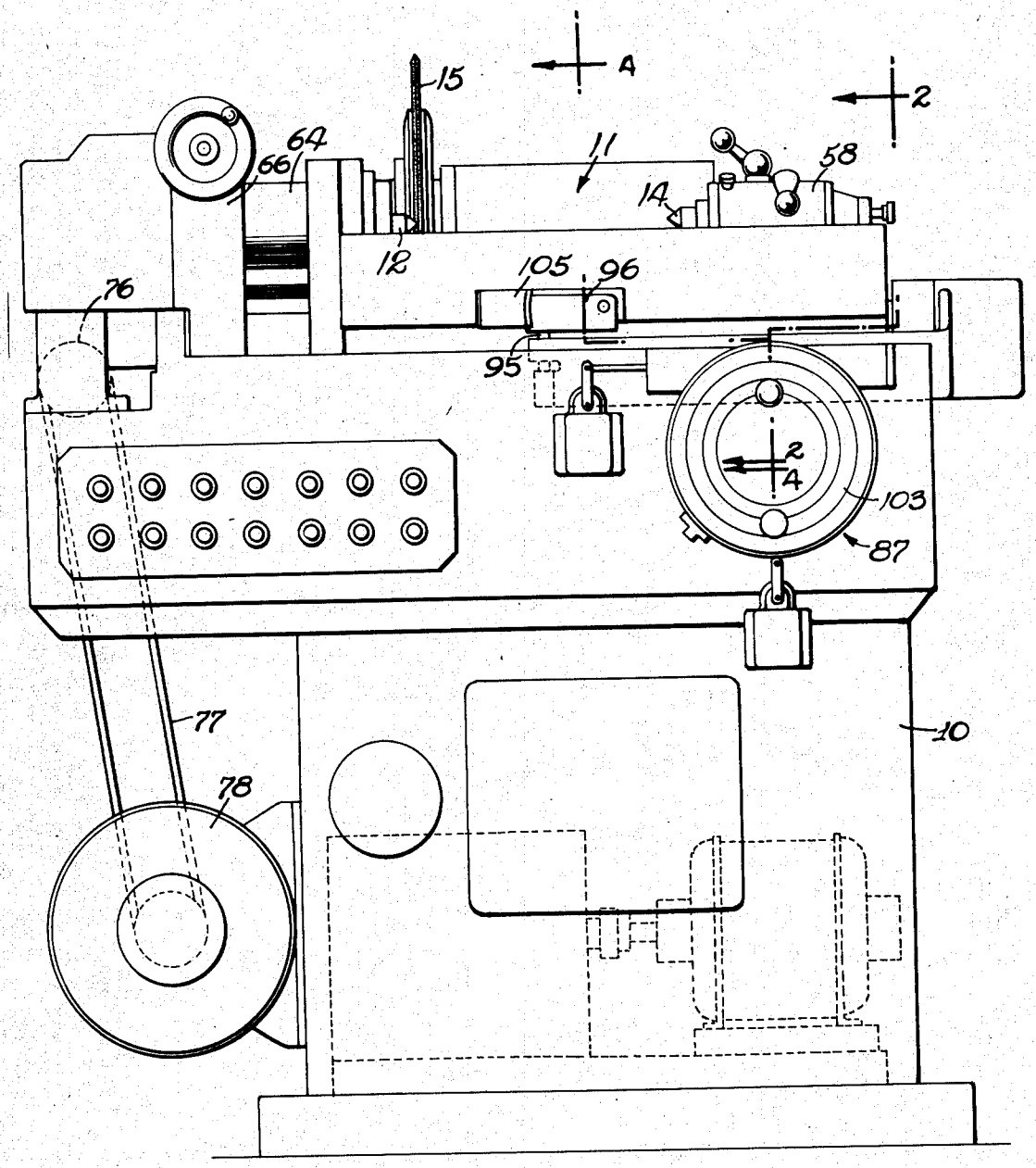
Oct. 30, 1945. A. F. MARKUS 2,388,066

DRESSER COMPENSATING MECHANISM FOR GRINDING MACHINES

Filed Aug. 28, 1944 4 Sheets-Sheet 1

Fig. 1



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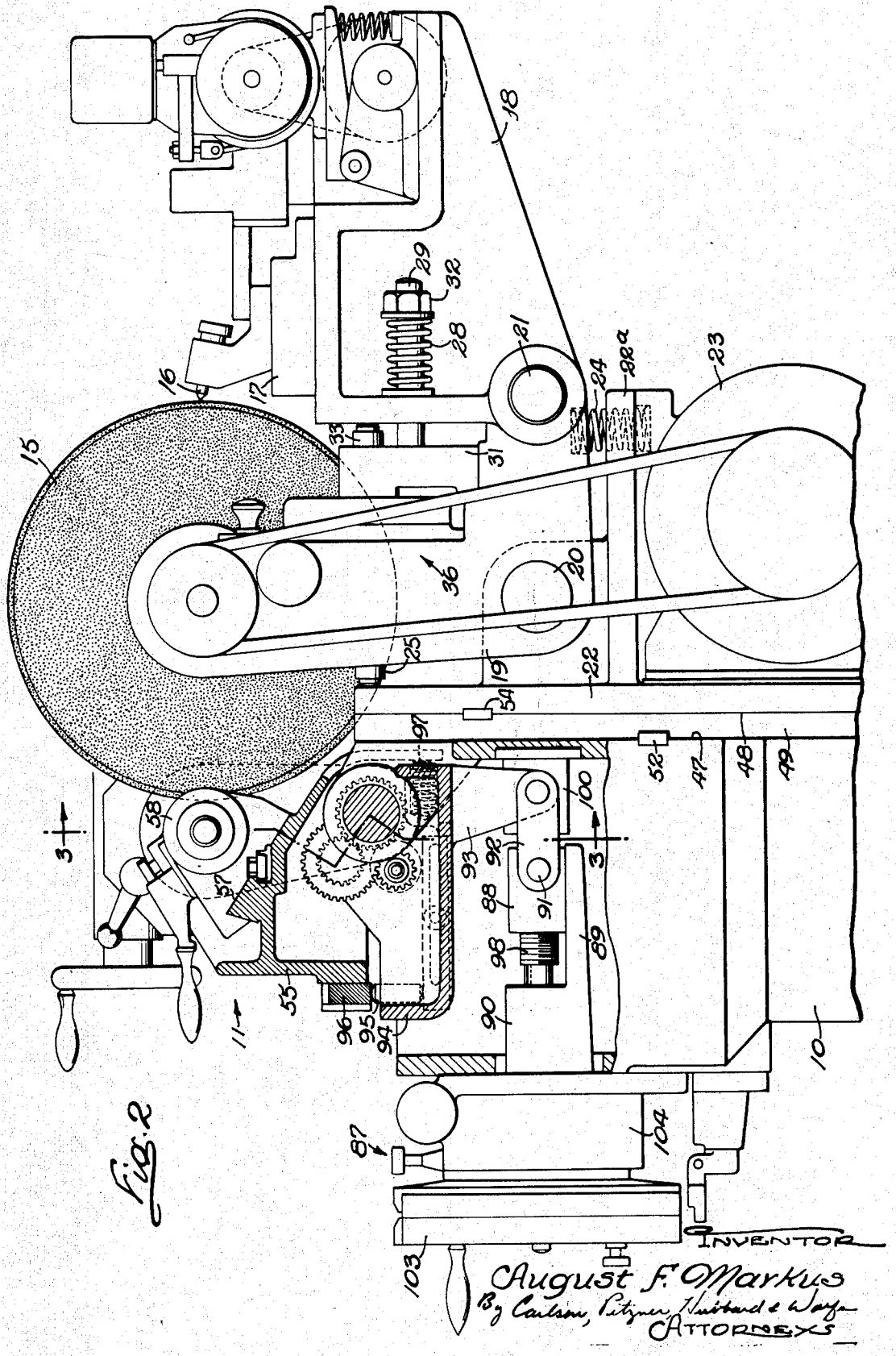


Fig. 2

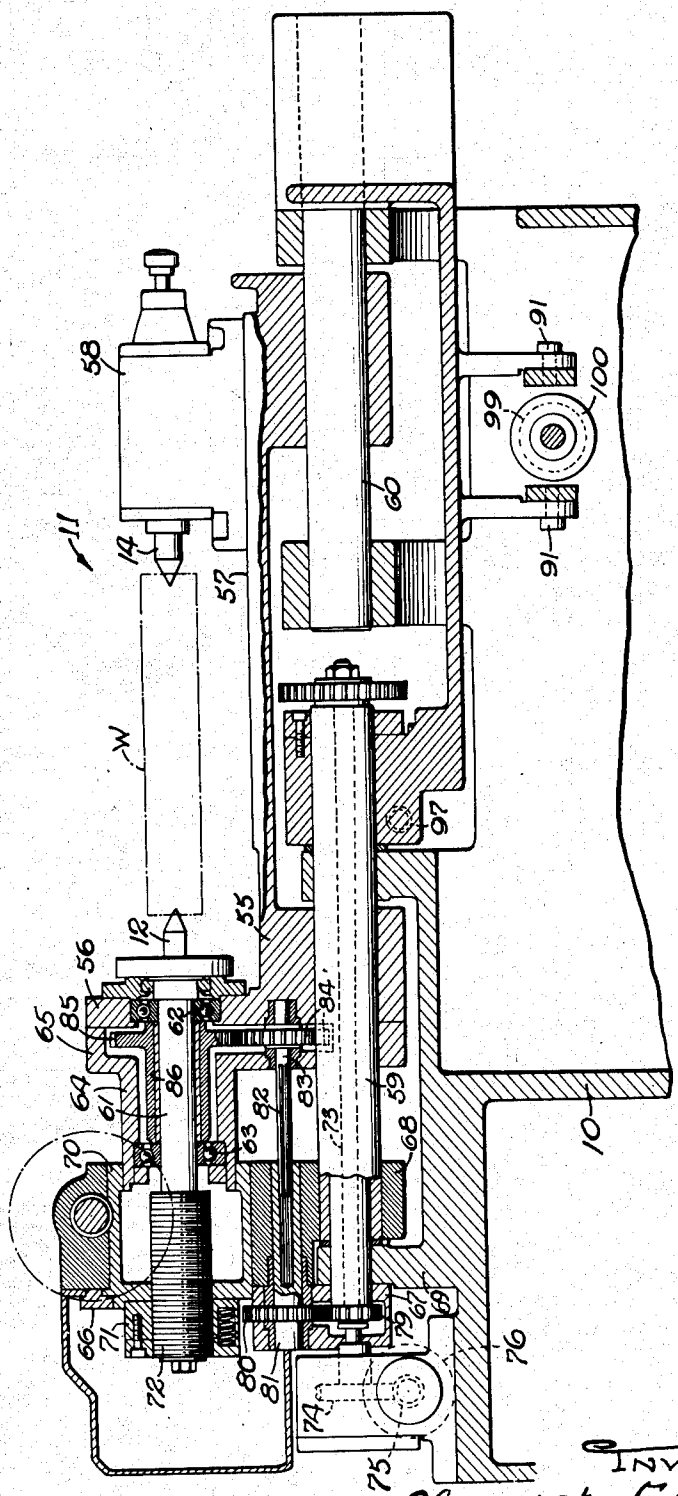
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DRESSER COMPENSATING MECHANISM FOR GRINDING MACHINES

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Fig. 3



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DRESSER COMPENSATING MECHANISM FOR GRINDING MACHINES

Filed Aug. 28, 1944 4 Sheets-Sheet 4

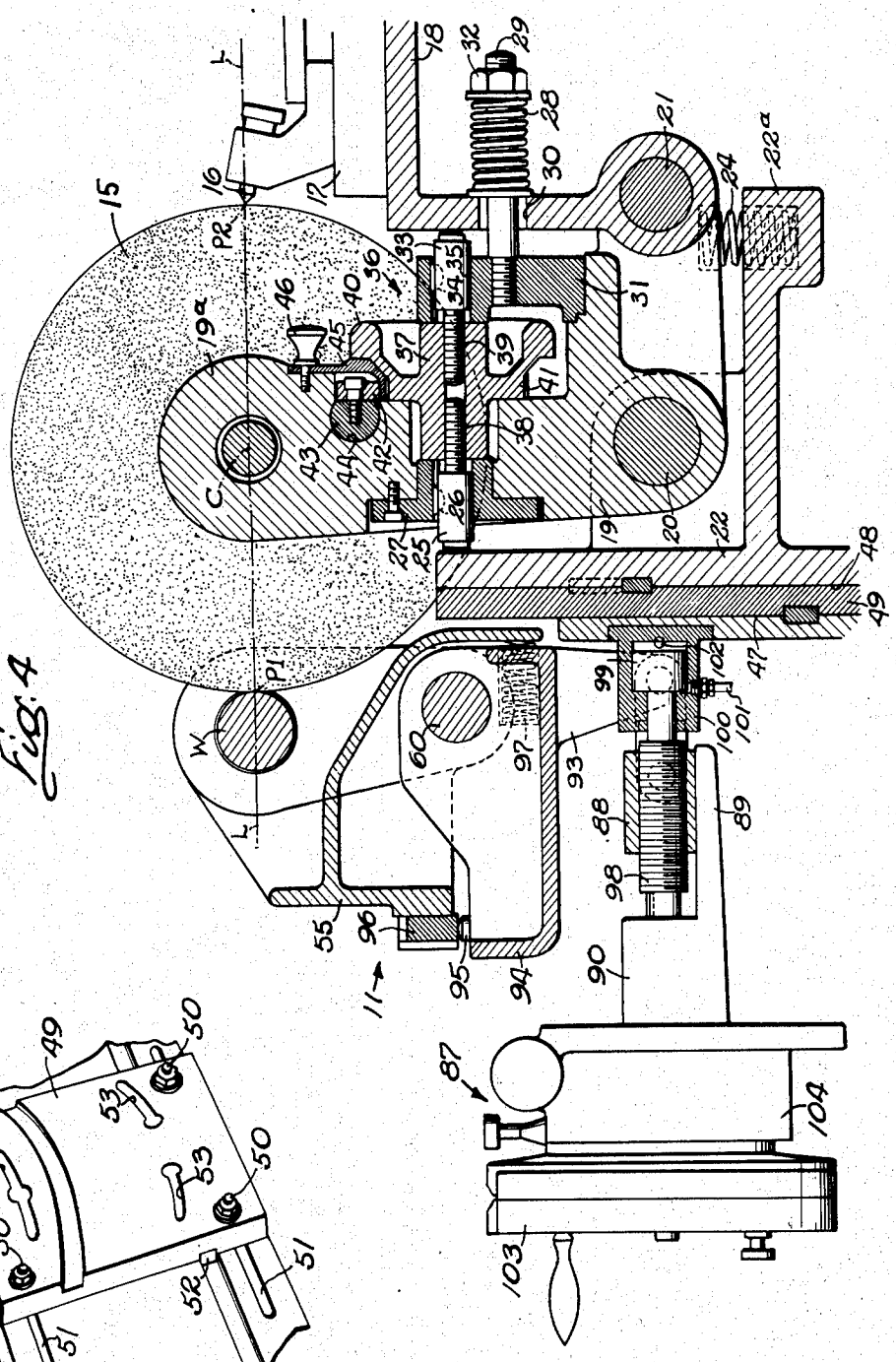


Fig. 4

Fig. 5

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UNITED STATES PATENT OFFICE

2,388,066

DRESSER COMPENSATING MECHANISM FOR GRINDING MACHINES

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Application August 28, 1944, Serial No. 551,478

16 Claims. (Cl. 51—95)

The present invention is intended for application to grinding machines such, for example, as thread grinders, and has particular reference to grinding machines incorporating that general class of mechanisms known as automatic dressing compensators which serve to modify automatically the relative displacement of grinding wheel and work by an amount requisite to compensate for the diminishment in wheel size necessarily incident to each dressing or truing of the same.

One object of the present invention is to provide in a grinding machine a mechanism of the general type indicated embodying a novel arrangement for automatically rocking the grinding wheel and dresser as a unit generally transaxially of the work through a distance proportional to adjustments in position of the dresser relative to the wheel.

More specifically, it is an object to provide in a grinding machine such a mechanism in which the work and dresser are disposed for contact with the grinding wheel at substantially diametrically opposite points on the latter, with the dresser pivoted on the wheel support for adjustment with reference to the wheel, and the wheel support itself arranged to be rocked automatically relative to the work proportionally to adjustment of the dresser, thus carrying both the wheel and dresser with it so that in each adjustment of dresser position, the wheel is compensatingly adjusted in position relative to the work but without distributing the concurrently established new positional relation of the wheel and dresser.

Another object is to provide in a grinding machine a novel and simplified mechanism of the general type indicated adapted to use threaded sections of opposite lead of an adjusting screw or screws for respectively varying the displacement of the dresser with reference to the grinding wheel and compensatingly effecting a relative shift of wheel and work.

Still another object is to provide in a thread grinding machine or the like an arrangement for adjustment of the helix angle or longitudinal position of the thread to be cut, as well as its size, all coordinated in a novel manner with an automatic dresser compensator adjustment arrangement so as to render all of such adjustments available and effective but without interference with each other.

Further objects and advantages of the invention will become apparent as the following description proceeds taken in connection with the accompanying drawings, in which:

Figure 1 is a front elevation of a thread grinding machine embodying the present invention.

Fig. 2 is an enlarged right-hand end elevation of the upper portion of the machine of Fig. 1 with the work supporting mechanism shown partially in transverse section substantially along the line 2—2 of Fig. 1.

Fig. 3 is a longitudinal sectional view through the work supporting mechanism, the same being taken substantially along the line 3—3 in Fig. 2.

Fig. 4 is a view similar to Fig. 2, but with the wheel and work supports, as well as the dresser support, shown as sectioned substantially along the line 4—4 in Fig. 1.

Fig. 5 is a fragmentary detail perspective view of the mounting pad arrangement for the wheel supporting bracket.

Referring more particularly to the drawings of the exemplary embodiment of the invention herein disclosed, the same has been illustrated as incorporated in the thread grinding machine shown in Fig. 1. Such machine comprises a base 10 on the top of which is a work support, designated generally as 11, and including centers 12 and 14 between which a workpiece (indicated at W in Fig. 3) is received and presented to a grinding wheel 15 which is revolvable about an axis generally paralleling that of the work. The particulars of the specific form of work support illustrated constitute no part of the present invention, this work support being of substantially the form disclosed in a grinding machine covered by my copending application Serial No. 542,719, filed June 29, 1944. It will, accordingly, be sufficient for the moment to note simply that the work support here shown is such as to effect rotation of the work and a timed reciprocation of the same to and fro past the grinding wheel as well as to accommodate infeed and retraction movements of the work transaxially of the latter. Somewhat more detail of the exemplary work supporting structure will appear hereinafter.

For dressing or truing the grinding wheel 15 from time to time as its periphery becomes misshapen by wear, a dresser mechanism is provided (see Fig. 2). This dresser mechanism may include one or more diamond dresser points 16 carried by a dresser slide 17 and arranged to contact the grinding wheel 15 in an area on the latter substantially diametrically opposite that at which the wheel contacts the work. The dresser slide 17 is mounted on a dresser supporting frame 18, movement of the latter being utilized in shifting the dresser step by step toward the grinding wheel for removing successive in-

crements of the latter's periphery. The dresser mechanism per se may take any desired specific form, such, for example, as that disclosed in the G. Stewart Patent No. 2,311,263, issued February 16, 1943, the same normally embodying some drive arrangement for causing the dresser point or points to execute a predetermined motion with reference to the wheel periphery and in which the point moves from a retracted position into contact with the wheel, and after truing the latter, back to its starting position. Positioning of the frame 18 determines the mean location (with reference to the grinding wheel) of the path of movement for the dresser point or points, and hence the depth of material dressed from the wheel.

Each dressing or truing of the grinding wheel diminishes the latter's diameter and the present invention is primarily concerned with a novel arrangement which compensates automatically for each such reduction in wheel size. In brief, the preferred arrangement shown (see Figs. 2 and 4) is such that a support 19 for the grinding wheel 15 is pivoted at 20 for rocking of the wheel generally transaxially of the work W so that the wheel can be rocked about this pivot toward the work through a distance such as to retain the active portion of the wheel in a fixed locus relative to the machine base 10, or in other words, with reference to the grinding position for the workpiece. On the other hand, the dresser supporting frame 18 serves to move the dresser with reference to the wheel, and is for that purpose pivoted at 21 on the wheel support 19 itself so that when the latter is rocked, the wheel and dresser both move bodily as a unit with the result that their relative location is undisturbed by the compensating positioning of the wheel with reference to the work. Moreover, the respective supports 19 and 18 for both the wheel and dresser are rock simultaneously and by a single adjustment device which retains accurate proportionality between their movements.

As to the details of the particular wheel support and dresser supporting frame shown, it will be observed that the wheel support 19 comprises a generally L-shaped casting of bell crank form, including a bifurcated upright arm 19a (Fig. 4) in which the grinding wheel 15 is journaled. At the juncture of the two arms of the bell crank, the wheel support is pivoted by the pin 20 on a bracket 22 to which the wheel drive motor 23 is also fixed, the latter being belted to the grinding wheel. A compression spring 24 interposed between the horizontally projecting arm of the wheel support 19 and the underlying horizontal integral web 22a of the bracket 22 urges the wheel support 19 to turn about its pivot 20 in a direction to shift the grinding wheel 15 toward the work (counterclockwise as viewed in Figs. 2 and 4). Such movement is limited by an abutment or stop pin 25 keyed at 26 to slide endwise within a bushing 27 fixed to the wheel support 19, such abutment being adjustable endwise to determine the location of the wheel in a manner which will appear below.

The dresser supporting frame 18 is, on the other hand, pivoted by the pin 21 on the outer end of the horizontal arm of the wheel support 19 rather than on the base. This frame 18 is urged to swing in a direction such as to move the dresser point 16 inward toward the grinding wheel 15 by a compression spring 28. The latter spring encircles a pin 29 passing through an aperture 30 in the frame 18 and anchored at its inner end to a block 31 fixed to the wheel support 19, the spring being interposed between a nut 32 on the pin 29 and an opposed face on the frame. Such movement of the dresser supporting frame 18 toward the wheel support 19 is limited by a second abutment or stop 33 keyed as indicated at 34 for endwise sliding movement within a bore 35 in the block 31 fixed to the wheel support.

Upon reference to Fig. 4, it will be seen that when utilizing a grinding wheel 15 of the particular diameter there shown, the points of contact P1 and P2 for the work and dressing points respectively, as well as the center C of the grinding wheel, all lie in a common horizontal plane indicated by the dot-dash line L—L. Changes in the diameter of either the workpiece or wheel will alter this relationship somewhat, but the relation of the parts is such that when operating on any particular workpiece the changes in wheel diameter incident to dressing result in only a negligible change in vertical position of the wheel center C with respect to its initially established position with reference to the plane of the contact points P1, P2. Such minimization in the component of vertical movement of the wheel as compared to its lateral component of movement upon rocking of the wheel support, is accomplished by making the radius between the wheel support pivot 20 and the wheel center C long. It is also to be noted that the radius between the pivot point 21 for the dresser supporting frame 18 to the dresser point 16 is of substantially the same length as that for bodily swinging of the wheel so that there is no material change in the vertical position of the contact point P2 as the wheel diameter is reduced slightly by successive dressings.

Simultaneous and proportionate positional adjustment of the abutments 25, 33 is accomplished by an adjusting mechanism designated generally as 36. The latter includes a nut 37 in which are threaded a pair of screws 38, 39 having right and left-hand threads respectively. Such screws are rigid with respective ones of the abutments 25, 33 and are thus restrained against rotation by the latter's keys 26 and 34. Turning the nut 37 in one direction causes the screws 38, 39 to draw the abutments 25, 33 inward. Recession of these abutments permits the dresser point 16 to be rocked toward the grinding wheel 15 and the wheel support 19 to rock toward the work W under the urging of the respective springs 28 and 24. Turning of the nut 37 in the opposite direction, on the other hand, projects the abutments 25, 33 outward, thereby causing the dresser point 16 to retreat from the wheel and the wheel support 19 to swing away from the work. In the present instance, the abutments 25, 33 always move simultaneously and in opposite directions through precisely equal distances so that the resultant shift in wheel position exactly compensates for changes in wheel diameter incident to movement of the dresser point with reference to it.

The adjusting nut 37 may be turned manually or, if desired, by power in an automatic dressing cycle. For manual operation, a hand wheel 40 is provided integrally with a ratchet wheel 41 which is, in turn, integral with the nut 37. For power operation the ratchet wheel 41 may be operated by a pawl 42 carried by plunger 43 reciprocable in a transverse bore 44 in the wheel support 19. An adjustable guard 45, adapted to be locked in selected position on the wheel support 19 by a thumb nut 46, overlies a selectively variable portion of the series of ratchet teeth presented to

the pawl, thus determining the angular distance of turning movement imparted to the nut 37 upon each stroke of the pawl. Any suitable means may be employed for actuating the plunger 43 in timed relation with the remainder of the machine cycle, such, for example, as the hydraulic arrangement detailed in the Ira J. Snader Patent No. 2,251,961, issued August 12, 1941. As disclosed in the latter patent, provision may be made for initiating successive cycles of the dresser mechanism upon the completion of predetermined stroking of the work past the wheel, together with means for imparting a preselected increment of rotation to the dresser control wheel (40 here) preparatory to each cycling of the dresser mechanism.

From the foregoing, it will be perceived that the grinding machine disclosed embodies a simple, rugged and yet highly precise mechanism for compensating for the changes in wheel diameter incident to dressing it. In setting up the machine initially for a particular workpiece, the dresser control wheel 40 is revolved to locate the wheel support 19, with its grinding wheel 15, in a desired starting position and the workpiece is advanced by the work support 11 into contact with the wheel. Thereafter, the work is revolved and reciprocated to and fro past the wheel with an incremental or step-by-step infeed of the work toward the wheel after each pass until a thread of predetermined depth is ground in the work, such depth being determined by limiting the advance of the work toward the wheel. At such points in this cycle of operation as may be desired, or at the end of each such complete grinding cycle, the work support 11 is caused to withdraw the work from contact with the wheel and the dresser mechanism is caused to execute its predetermined cycle of movement to contact the wheel periphery with the dresser point or points 16 and dress the wheel. Upon each advance of the dresser point into working position, the pawl 42 is actuated, thereby turning the nut 37 through a predetermined increment to withdraw the abutments 25, 33 a corresponding fixed distance. Such withdrawal of the abutments permits the spring 28 to advance the dresser incrementally toward the wheel preparatory to the next dressing operation and also permits the spring 24 to compensatingly shift the wheel support and wheel with reference to the work to relocate the wheel's periphery so that when the latter is trued by the relocated dresser point the wheel will contact the work (upon the next succeeding advance of the latter in grinding position) in precisely the position previously occupied.

To accommodate changes in the helix angle of the thread being ground, or relocation of the wheel 15 longitudinally of the work, provision is made for bodily shifting of the supporting bracket 22 (Fig. 4). Since both the grinding wheel and dresser are supported from this same bracket 22, the two are shifted bodily and as a unit or self-contained assembly upon moving the bracket, wherefore there is no disturbance of their relative locations. To accommodate such adjustable positioning of the bracket 22, accurately machined surfaces 47, 48 are provided in opposed relation on the machine base 10 and bracket 22, respectively. Such surfaces are located in parallelism with a plane normal to a line passing through the axes of the wheel and work, being vertical in this instance. A block 49 (see also Fig. 5) having flat, accurately machined, parallel opposite side faces is sandwiched between the surfaces 47, 48. This block is releasably secured to the base 10 by bolts 50 having heads received in T-slots 51 extending longitudinally of the surface 47, the block 49 being accurately guided for adjusting movement axially of the workpiece (i. e., longitudinally of the surface 47) by a key 52. The bracket 22 is, in turn, similarly secured to the block 49 by similar bolts having their heads received in T-slots 53 (Fig. 5) which are in this instance arcuate. Adjusting movement of the bracket on the block is accurately guided by an arcuate key 54. The key 54 and slots 53 are centered about a line passing through the axes of the work and grinding wheel. Both lateral and angular adjustment of the grinding wheel 15 can thus be accomplished readily and with precision.

As heretofore noted, the work support 11 serves to rotate the work and translate it axially to and fro past the grinding wheel 15 in timed relation to such work rotation, as well as to infeed and withdraw the work transaxially of the wheel. For such purpose, the work support may take a variety of forms so long as it is of such character as to locate the work accurately with reference to the machine base when the work is in position to be ground. The latter requirement arises by reason of the fact that positioning of the work and wheel relative to each other is determined by fixing the locus of each with reference to the base.

In the exemplary construction, the work support 11 includes a main frame 55 (Figs. 2, 3 and 4) having an integral upstanding headstock end plate 56 at one end and guideways 57 on the opposite end on which the adjustably clamped tailstock 58 is received. Such frame 55 is slidable axially along a pair of alined guide bars 59, 60 and is adapted to be rocked or pivoted about such bars to carry the work toward and from the grinding wheel. A work supporting spindle 61 is journaled in the headstock by antifriction bearings 62, 63, the latter bearing being carried by a tubular extension 64 in a gear housing 65 removably fixed to the upright 56.

Provision is made for translating the work support frame 55 in timed relation with the rotation of the spindle 61. For that purpose, a head is provided, the same being tiltable on the guide rod 59 with the frame 55, but restrained against translation with the latter along such guide rod. This head comprises a main frame casting 66 having a depending lower leg 67 which is bored to receive the guide rod 59, and a block 68 is fixed to the lower portion of the frame and disposed at the side of a supporting lug 69 opposite the leg 67 to coact with the latter in restraining the head against movement axially of the guide rod. In the upper portion of the head frame 66, a sleeve 70 is revolvably journaled and is open at its right-hand end. The tubular extension 64 is telescoped within this open end of the sleeve so that the two frames 66 and 55 are slidably connected for tilting movement in unison while still permitting displacement of the same relative to each other in a direction axially of the guide rods 59, 60. A feed nut 71 is clamped to the outer end of the supporting sleeve 70 and threaded on a master feed screw 72 keyed to the spindle 61. The nut 71 and its supporting sleeve 70 are normally held stationary so that turning of the feed screw 72 within the nut, incident to rotation of the spindle 61, causes the latter to be fed axially in timed relation with its rotation.

Rotation of the work spindle 61 and its feed

screw 72 is accomplished from a drive shaft 73 disposed concentrically with the axis of tilting or pivotal motion of the work support about the guide rods 59, 60 so that the drive connections will remain undisturbed during all tilting movement of the latter. This shaft 73 is journaled within the tubular shaft or guide rod 59 heretofore mentioned, and is driven by worm gear 74 fixed to its outer end and meshed with a worm 75 which is, in turn, connected by a pulley 76 and belt 77 with an electric drive motor 78 fixed to the lower portion of the machine base 10. A pinion 79 fixed to the drive shaft 73 meshes with a gear 80 carried by a shaft 81 journaled within the block 68. For the drive connection for revolving the spindle 61, the shaft 81 has a sliding spline connection 82 with a shaft 83 journaled in the main frame 55 and carrying a gear 84. The latter gear meshes with a second gear 85 rigid with a sleeve 86 keyed to the spindle 61.

Tilting motion is imparted to the work support frame 55 for moving the workpiece transaxially of the grinding wheel 15 by means of a size control mechanism designated generally as 87 (see Figs. 2 and 4). Such size control mechanism includes an axially movable nut 88 slidably guided and restrained against rotation by the rearwardly projecting portion 89 of a bracket 90 fixed to the front of the machine base 10. Laterally projecting trunnions 91 on this nut are connected by pivoted links 92 with a pair of depending feet 93 rigid with an intermediate support or apron 94 (see also Fig. 3). The latter is also pivoted on the guide bars 59, 60 although restrained against translation. The frame 55 rests directly on the intermediate support at all times in sliding engagement with it, a pin 95 on the intermediate support being disposed to contact a bar 96 attached to the frame 55. A compression spring 97 urges the frame counterclockwise to retain contact of the pin with the bar. As the nut 88 is slid outward, the intermediate support 94 is tilted toward the grinding wheel 15, carrying the work support frame 55 and workpiece with it, whereas movement of the nut in the opposite direction results in rocking the workpiece away from the grinding wheel.

The nut 88 may be moved endwise for shifting the work either by rotation of a screw 98 threaded in the nut or by non-rotative bodily endwise shifting of such screw. Such bodily endwise shifting of the screw is used herein for moving the workpiece quickly into or out of the operating zone, and for that purpose a piston 99 rigid with the inner end of the screw is received in a hydraulic cylinder 100 stationarily fixed to the machine base 10. Upon admission of pressure fluid to the cylinder through the port 101 and exhaust of fluid from the other port 102, the piston 99 is moved to the right (as viewed in Fig. 4), thus tilting the work support frame 55 counterclockwise to withdraw the workpiece quickly from contact with the wheel, whereas admission of pressure fluid through the port 102 and exhausting of fluid through the other port 101 causes the piston to move in the opposite direction to rock the work forward into juxtaposition with the wheel. The supplying and exhausting of pressure fluid for this purpose may be accomplished through the use of suitable hydraulic mechanism, various forms of which are well-known in the art, and consequently not illustrated here.

Rotation of the screw 98 while restraining it against endwise movement to move the nut 88, and thus the workpiece, is normally utilized in incrementally advancing the work in the course of grinding as, for example, with one step of advance after each pass of the work past the grinding wheel. For that purpose, the screw 98 may be revolved manually by a size control wheel 103 splined to the same or, if desired, a suitable ratchet type drive mechanism may be incorporated (not shown) in the casing 104 to turn the screw 98 incrementally in timed relation with the reciprocation of the work support. A suitable ratchet type mechanism for the purpose is disclosed in the Guenther Brinkmann application Serial No. 435,224, filed March 18, 1942, and assigned to Ex-Cell-O Corporation, assignee of the present application, but since the same constitutes, per se, no part of the present invention it need not be illustrated in detail here.

Provision may also be made in the work support for other refinements of adjustment but which again constitute, per se, no part of the present invention. For example, provision may be made for locking the bar 96 in selected positions of angular adjustment by a clamp 105 (Fig. 1) to condition the machine for grinding a thread of corresponding taper on the work. Any such adjustments being made entirely in the work supporting side of the machine, however, do not interfere with, or alter one way or another, the dresser compensating arrangement disclosed.

I claim as my invention:

1. In a grinding machine, the combination of a base, a rotatively driven grinding wheel having a support, means pivoting said support on said base for bodily rocking of the same in a direction transaxial of said wheel, work supporting means for presenting a workpiece to the periphery of said wheel, a dresser disposed for contact with said wheel at a point substantially diametrically opposite the point of wheel and work contact, and means pivotally supporting said dresser on said wheel support for rocking motion of the dresser with reference to said wheel transaxially of the latter, rocking of said wheel support serving to effect bodily movement of said wheel and dresser in unison with reference to the work.

2. In a grinding machine, the combination of a base, a rotatively driven grinding wheel having a support, means pivoting said support on said base for bodily rocking of the same in a direction transaxial of said wheel carried thereby, work supporting means for presenting a workpiece to the periphery of said wheel, a dresser disposed for contact with said wheel at a point substantially diametrically opposite the point of wheel and work contact, means pivotally supporting said dresser on said wheel support for rocking motion of the dresser with reference to said wheel transaxially of the latter, rocking of said wheel support serving to effect bodily movement of said wheel and dresser in unison with reference to the work, spring means respectively urging said wheel support to swing said wheel toward the work and said dresser to swing toward said wheel, abutment means for limiting the movement of said wheel support and dresser by said spring means, and adjustment means for altering the setting of said abutment means with reference to said wheel support and dresser simultaneously.

3. In a grinding machine, the combination of a base, a rotatively driven grinding wheel, means including a support pivoted on said base mounting said wheel for bodily rocking motion in a direction transaxial of the wheel, a work support and a dresser support disposed to present respectively a workpiece and a dresser for contact with the pe-

riphery of said wheel at substantially diametrically opposite points, means pivotally mounting said dresser support on said wheel support for movement of the former generally transaxially of said wheel, first and second bias springs acting respectively to urge said wheel support toward said work support and said dresser support toward said wheel, first and second abutments slidably mounted on said wheel support and positioned respectively to limit the rocking of said wheel support and dresser support under the urging of their corresponding springs, two screws of right and left-hand lead connected to respective ones of said abutments and restrained against rotation, and a single adjusting nut threaded on both said screws and restrained against axial movement for revolving on said screws to adjust simultaneously and in equal amount the displacement of said abutments.

4. In a grinding machine, the combination of work and wheel supports having means thereon for supporting respectively a workpiece and a rotatively driven grinding wheel with the work presented to the wheel, means pivotally mounting said wheel support for rocking motion of the same in a direction generally transversely of a workpiece carried by said work support, a dresser, supporting means pivoting said dresser for adjustable rocking motion generally transaxially of the grinding wheel carried by said wheel support, and means for effecting simultaneous rocking motion of said wheel support and dresser supporting means about their respective pivots and coordinated to alter the displacement of the wheel with reference to the work by an amount equal to the alteration in displacement of the dresser relative to the wheel.

5. In a grinding machine, the combination of work and wheel supports having means thereon for supporting respectively a workpiece and a rotatively driven grinding wheel with the work presented to the wheel and with the axes of the wheel and work generally parallel to each other, means pivotally mounting at least one of said supports for rocking motion of the same transversely of the work, a dresser, supporting means pivoting said dresser for adjustable rocking motion transaxially of the grinding wheel carried by said wheel support, and means for effecting rocking motion of said pivoted mounting means proportionate to motion of said dresser supporting means.

6. In a grinding machine, the combination of work and wheel supports having means thereon for supporting respectively a workpiece and a rotatively driven grinding wheel, a dresser, an adjustment device including a revolvably mounted member restrained against axial movement and a pair of elements restrained against rotation and threadably connected to said member by respective right and left-hand sets of threads for axial movement of such elements in respective opposite directions in response to rotational adjustment of said member, means operable in response to axial movement of one of said elements for moving said dresser relative to said wheel transaxially of the latter, and means responsive to axial movement of the other of said elements for effecting relative movement between said supports generally transversely of the work and proportionately to movement of said dresser by said one element.

7. In a grinding machine, the combination of work and wheel supports having means thereon for supporting respectively a workpiece and a rotatively driven grinding wheel, means pivotally mounting said wheel support for bodily rocking of the same with the wheel carried thereby toward and from the work support, an adjustment device including a revolvably mounted member restrained against axial movement and a pair of elements restrained against rotation and threadably connected to said member by respective right and left-hand sets of threads for axial movement of such elements in respective opposite directions in response to rotational adjustment of said member, means operable in response to axial movement of one of said elements for moving said dresser relative to said wheel transaxially of the latter, and means responsive to axial movement of the other of said elements for rocking said wheel support.

8. In a grinding machine, the combination of work and wheel supports having means thereon for supporting respectively a workpiece and a rotatively driven grinding wheel, means pivotally mounting said wheel support for bodily rocking of the same with the wheel carried thereby toward and from the work support, a dresser and a support therefor pivoted on said wheel support, an adjustment device including a member revolvably mounted on said wheel support restrained against axial movement and a pair of elements threadably connected to said member by respective right and left-hand sets of threads for axial movement of such elements in respective opposite directions in response to rotational adjustment of said member, means operable in response to axial movement of one of said elements for rocking said dresser support relative to said wheel support in a direction to move said dresser transaxially of said wheel, and means responsive to axial movement of the other of said elements for rocking said wheel support.

9. In a grinding machine, the combination of work and wheel supports having means thereon for supporting respectively a workpiece and a rotatively driven grinding wheel, a dresser, a rotatable nut restrained against axial movement and having two screws with respective right and left-hand threads threaded therein and restrained against rotation, whereby rotation of said nut serves to project or retract said screws simultaneously with reference to the nut, means responsive to axial movement of one of said screws for moving said dresser relative to the wheel generally transaxially of the latter, and means responsive to axial movement of the other of said screws for effecting relative movement between said supports generally transversely of the work and proportionately to the movement of said dresser by said one of said screws.

10. In a grinding machine, the combination of work and wheel supports having means thereon for supporting respectively a workpiece and a rotatively driven grinding wheel, a dresser carried by a support pivotally mounted on said wheel support for rocking motion of the dresser with reference to said grinding wheel transaxially of the latter, means pivoting said wheel support for rocking of the same generally transversely of a workpiece carried by said work support, and means for rocking said wheel support about its pivot in proportion to pivotal adjustment of said dresser in reference to the wheel.

11. In a grinding machine, the combination of a rotatively driven grinding wheel, a work support and a dresser support disposed to present respectively a workpiece and a dresser for contact with the periphery of said wheel at sub-

stantially diametrically opposite points, a wheel support journaling said grinding wheel for rotation and pivoted to rock the latter bodily toward and from the work presented by said work support, the axis of said pivot paralleling the axis of wheel rotation and being displaced from the latter sufficiently far that the component of movement of said wheel in a direction normal to a line passing through said points of contact is small as compared to its component of movement in the direction of said line during the rocking of said wheel, means pivotally mounting said dresser support on said wheel support for rocking of the latter about an axis paralleling that of the pivot for said wheel support, and means for coincidentally rocking said wheel and dresser supports in the same directions about their respective pivots through proportionate angular distances.

12. In a grinding machine, the combination of a rotatively driven grinding wheel, a work support and a dresser support disposed to present respectively a workpiece and a dresser for contact with the periphery of said wheel at substantially diametrically opposite points, a wheel support journaling said grinding wheel for rotation and pivoted to rock the latter bodily toward and from the work presented by said work support, the axis of said pivot paralleling the axis of wheel rotation and being displaced from the latter sufficiently far that the component of movement of said wheel in a direction normal to a line passing said points of contact is small as compared to its component of movement in the direction of said line during rocking of said wheel, mean pivotally mounting said dresser support on said wheel support for rocking of the latter about an axis paralleling that of said wheel support and displaced from the point of dresser contact with said wheel by a distance substantially equal to the distance between said wheel axis and the pivot axis of said wheel support, and means for coincidentally rocking said wheel in dresser supports in the same directions about their respective pivots through angular distances constantly maintained equal.

13. In a grinding machine, the combination of a base, a grinding wheel and dresser assembly comprising a bracket having pivoted thereon a wheel support which in turn has a rotatively driven grinding wheel journaled thereon for rotation about an axis paralleling the pivotal axis of said wheel support and a dresser support pivoted on said wheel support for rocking of a dresser transaxially of said wheel, work supporting means on said base for presenting a workpiece to the periphery of said wheel, said base and bracket presenting opposed flat mounting faces both paralleling a plane substantially normal to a line passing through the axis of wheel rotation and the point of wheel contact with the work, means interposed between said faces for accurately guiding said assembly in bodily adjusting movement thereof with reference to the base both in a rectilinear path paralleling the wheel axis and an arcuate path centered about said line, and means for releasably clamping said assembly in selected positions of adjustment thereof.

14. In a grinding machine, the combination of a base, a grinding wheel and dresser assembly comprising a bracket having pivoted thereon a wheel support which in turn has a rotatively driven grinding wheel journaled thereon for rotation about an axis paralleling the pivotal axis of said wheel support, and a dresser support pivoted on said wheel support for rocking of a dresser transaxially of said wheel, work supporting means on said base for presenting a workpiece to the periphery of said wheel, means accurately guiding said assembly in bodily adjusting movement thereof with reference to said base both in a rectilinear path paralleling the wheel axis and in an arcuate path centered about a line passing between the wheel axis and the point of contact of said wheel with the work, and means for releasably securing said assembly in selected positions of adjustment thereof.

15. In a thread grinding machine having a base with a work support thereon for effecting timed rotation and axial reciprocation of a workpiece as well as transaxial infeed and retraction of the workpiece, a grinding wheel and dresser assembly comprising a rotatively driven grinding wheel, a wheel support on which said wheel is journaled, means for pivoting said wheel support on said base about an axis paralleling that of said wheel for rocking of the latter generally transaxially of the work, a dresser support pivoted on said wheel support for rocking of a dresser point thereon toward and from the peripheral portion of said wheel opposite the work, and means for not only swinging said dresser support about its pivot toward said wheel but for also simultaneously rocking said wheel support toward said work support through an angular distance such as to displace said wheel bodily toward said work support by an amount precisely equal to the advance of said dresser point with reference to said wheel.

16. In a thread grinding machine having a base with a work support thereon adapted to effect timed rotation and axial reciprocation of a workpiece as well as transaxial infeed and retraction of the workpiece, a grinding wheel and dresser assembly comprising a rotatively driven grinding wheel, a wheel support on which said wheel is journaled, means for pivoting said wheel support on said base about an axis paralleling that of said wheel for rocking of the latter generally transaxially of the work, a dresser support pivoted on said wheel support for rocking of a dresser point thereon toward and from the peripheral portion of said wheel opposite the work, an adjustment device including a member revolvably mounted on said wheel support and restrained against axial movement as well as a pair of elements restrained against rotation and threadably connected to said member by respective right and left-hand sets of threads for axial movement of such elements in respective opposite directions in response to rotational adjustment of said member, means operable in response to axial movement of one of said elements for rocking said dresser support about its pivot, and means responsive to axial movement of the other of said elements for rocking said wheel support about its pivot.

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