Dec. 6, 1927. 1,651,432

J. BATH ET AL

RELIEVING MECHANISM FOR GRINDING MACHINES

Filed March 21, 1924 4 Sheets-Sheet 1

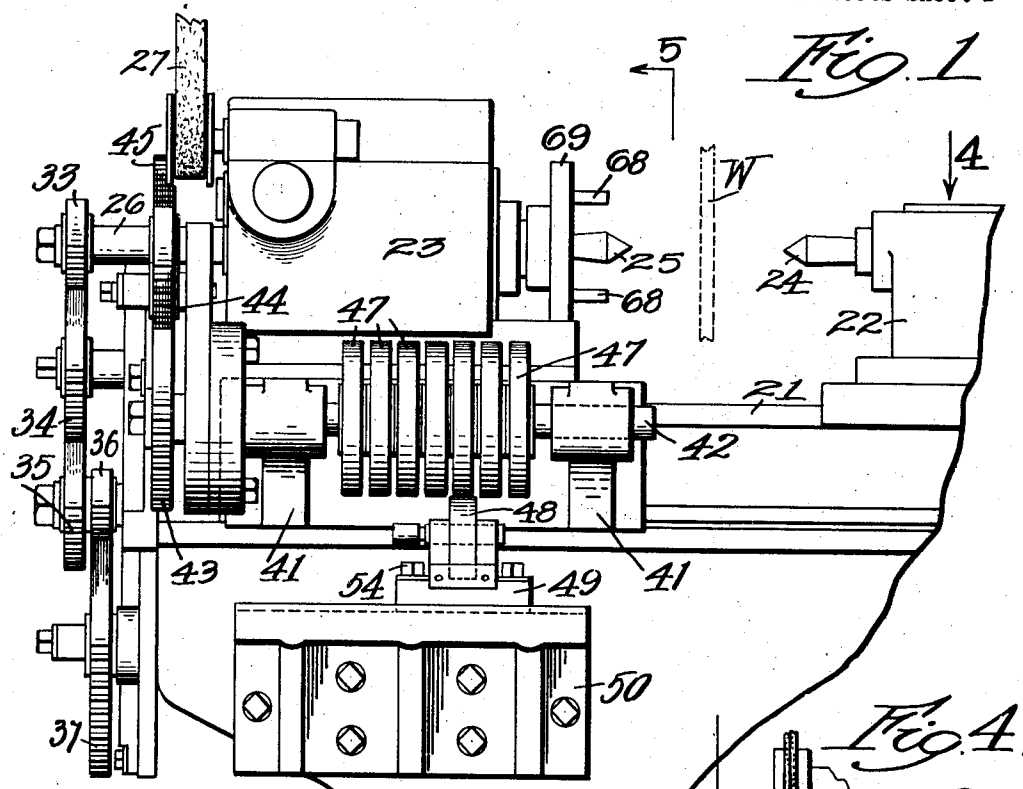


Fig. 1

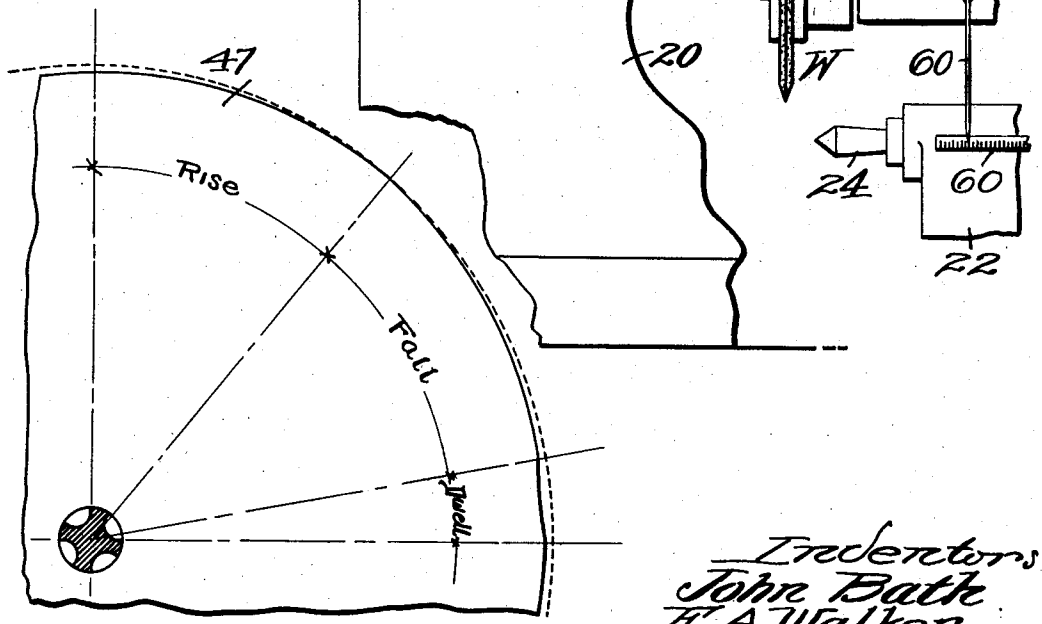


Fig. 4.

Fig. 10.

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Filed March 21, 1924 4 Sheets-Sheet 2

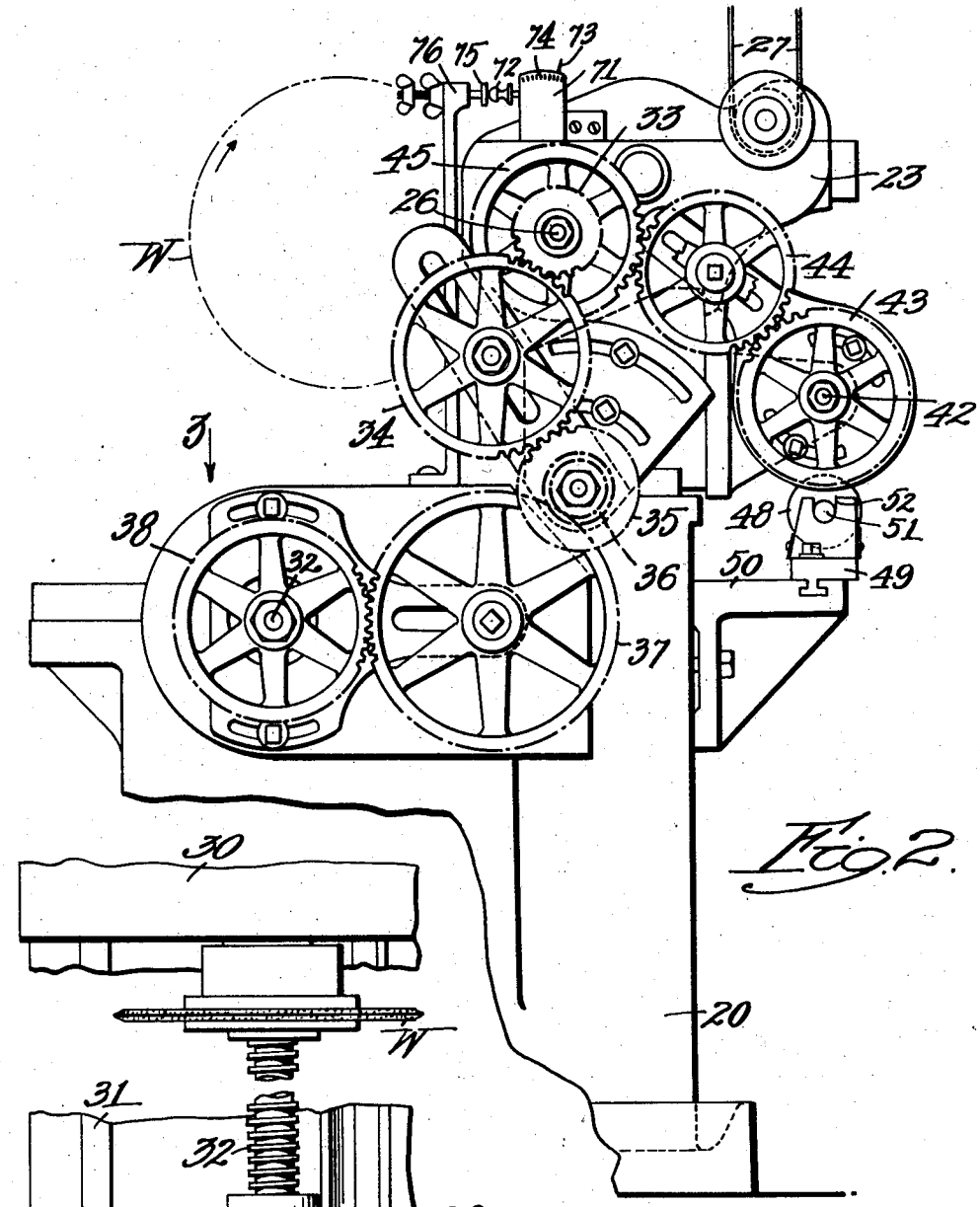


Fig. 2.

Fig. 3.

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Filed March 21, 1924 4 Sheets-Sheet 3

Fig. 5.

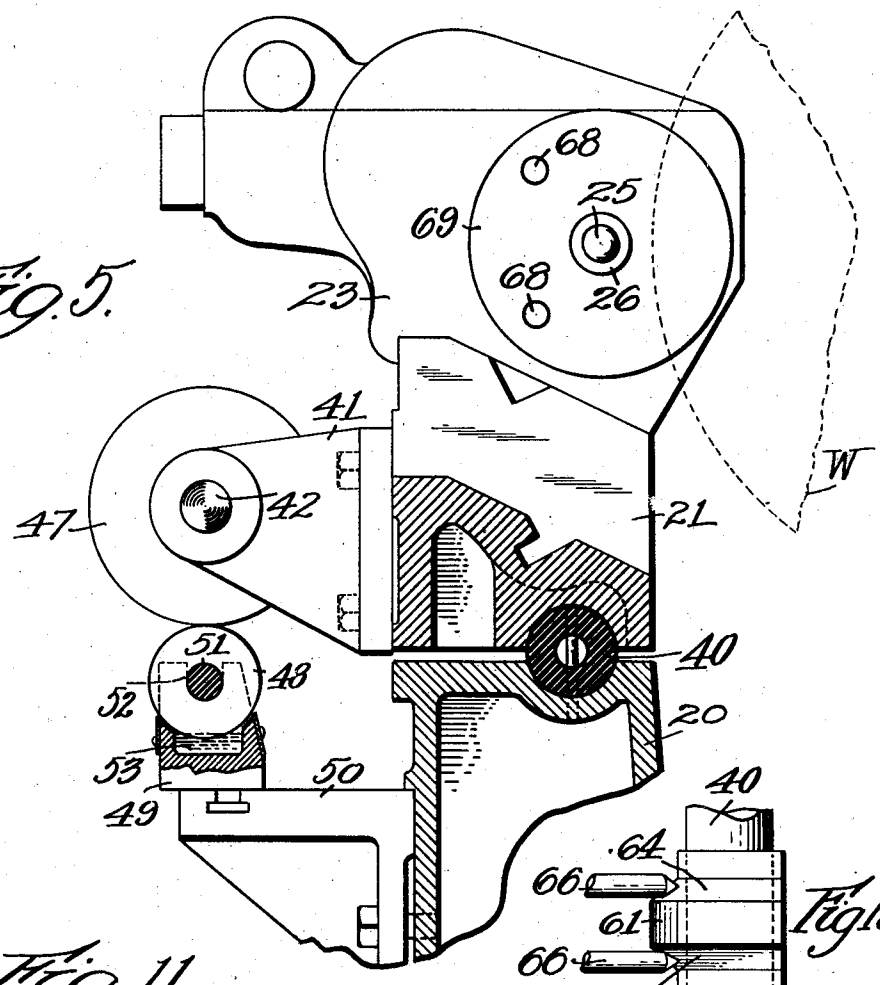


Fig. 13.

Fig. 11

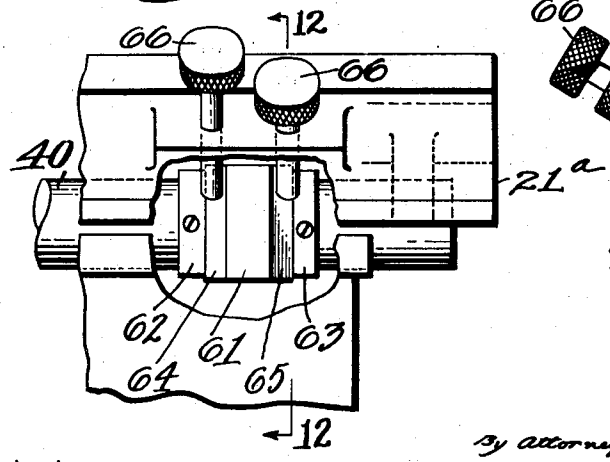
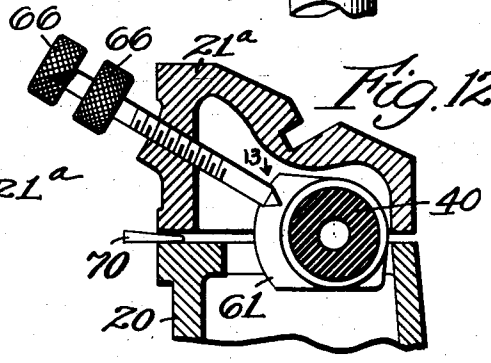


Fig. 12.



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RELIEVING MECHANISM FOR GRINDING MACHINES

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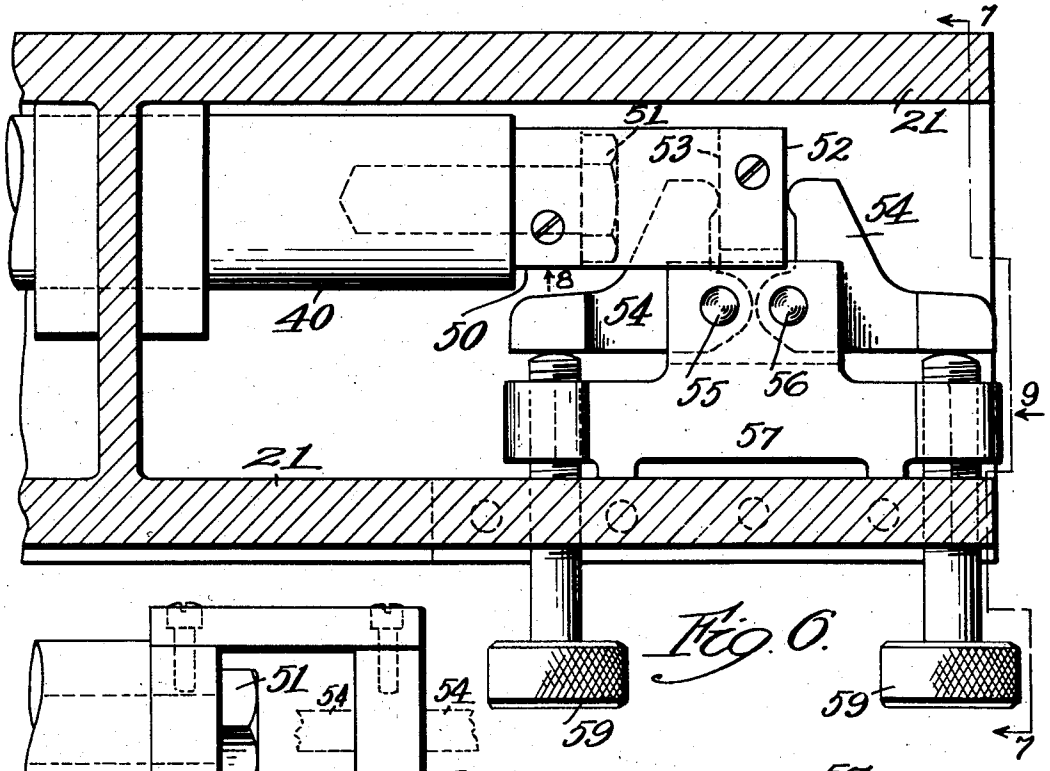


Fig. 6.

Fig. 8.

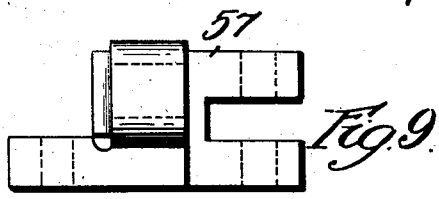


Fig. 9.

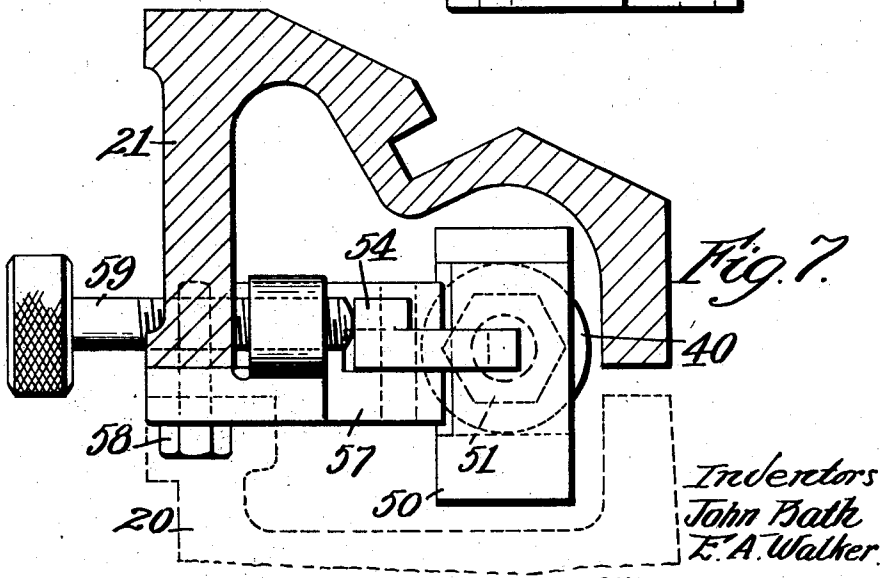


Fig. 7.

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UNITED STATES PATENT OFFICE.

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RELIEVING MECHANISM FOR GRINDING MACHINES.

Application filed March 21, 1924. Serial No. 700,930.

This invention relates to a grinding machine capable of general operation but particularly designed for grinding taps and other similar fluted articles. The taps are commonly supported upon centers during the grinding operation and are fluted lengthwise between the successive lands or rows of teeth. These flutes or grooves may be disposed either axially or spirally of the tap.

It is the general object of our invention to provide an improved construction of grinding machine by which the teeth of a tap may be relieved rearwardly, so that the frictional resistance of the teeth may be thereby largely reduced.

A further object of our invention is to provide a construction by which the teeth of a tap may be relieved whether they are arranged axially or spirally of the tap.

With these objects in view, important features of our invention relate to the provision of a work supporting table mounted for movement toward and from the grinding wheel and to the provision of a cam mechanism for moving the table in timed relation to the rotation of the work. We have also provided an improved device for longitudinally adjusting the work table; means for indicating the relative position of the wheel and the work, and other arrangements and combinations of parts which will be hereinafter described and more particularly pointed out in the appended claims.

A preferred form of the invention is shown in the drawings, in which

Fig. 1 is a front elevation of a portion of a grinding machine embodying our improvements;

Fig. 2 is a left hand end elevation thereof, looking in the direction of the arrow 2 in Fig. 1;

Fig. 3 is a detail plan view, looking in the direction of the arrow 3 in Fig. 2;

Fig. 4 is a detail plan view, looking in the direction of the arrow 4 in Fig. 1;

Fig. 5 is a partial sectional elevation, taken along the line 5—5 in Fig. 1;

Fig. 6 is a partial sectional plan view, showing mechanism for adjusting the table longitudinally;

Fig. 7 is a transverse sectional elevation, taken along the line 7—7 in Fig. 6;

Fig. 8 is a detail front elevation of certain parts, looking in the direction of the arrow 8 in Fig. 6;

Fig. 9 is an end elevation of a part to be described, looking in the direction of the arrow 9 in Fig. 6;

Fig. 10 is a partial diagrammatic view showing a selected cam lay-out;

Fig. 11 is a detail front elevation, showing a modified form of table adjusting mechanism;

Fig. 12 is a transverse sectional elevation, taken along the line 12—12 in Fig. 11; and

Fig. 13 is a detail plan view, looking in the direction of the arrow 13 in Fig. 12.

Referring particularly to Figs. 1 and 2, we have indicated portions of a grinding machine comprising a base or frame 20, a grinding wheel W, a work supporting table 21, a tail stock 22 longitudinally adjustable on the table 21, and a head stock 23 fixed to the table 21. The tail stock 22 and head stock 23 are provided with centers 24 and 25 upon which a tap or other piece of work may be mounted for rotation.

The live center 25 is carried upon a spindle 26 which is driven through reduction gearing from a suitable source of power, such as a driving belt 27. The grinding wheel W (Fig. 3) is rotatably mounted in a wheel carriage 30 which is movable longitudinally of the machine upon guideways 31 by means of a lead screw 32 mounted in fixed axial position in the frame 20 and having a positive gear drive through suitable change gearing from the spindle 26.

One arrangement of gearing is indicated in Fig. 2, and comprises a pinion 33 on the spindle 26, an intermediate gear 34, a pinion 35, a pinion 36, a second intermediate gear 37, and a gear 38 on the lead screw 32. By substituting different combinations of gears in the gear train indicated, the wheel carriage 30 and wheel W may be moved axially to correspond with the desired lead of the thread to be ground.

The table 21 is supported upon a rock shaft 40 (Fig. 5) which is longitudinally secured in a recess in an upper surface of the base or frame 20. Bearing brackets 41 are secured to the front face of the table 21 and support a cam shaft 42 which is connected

by gears 43, 44 and 45 (Fig. 2) to the work spindle 26. By changing the relative sizes of the gears 43 and 45, any desired speed relation may be secured between the spindle 26 and the cam shaft 42.

One or more cams 47 are fixed on the cam shaft 42 and are thus rotated in timed relation to the work spindle 26. A cam roll 48 (Fig. 5) is mounted in a bearing member 49 which is longitudinally adjustable in guideways on a bracket 50 fixed to the front of the base 20. A preferred form of bearing for the roll 48 is indicated in Fig. 5, in which the roll is provided with axially extended bearing portions 51 which rest in open recesses 52 in the bearing member 49. The inner portion of the member 49 may also be desirably recessed to form an oil chamber 53 from which the roll 48 is effectively lubricated.

A portion of a cam 47 is indicated in Fig. 10 in which, however, the rise, fall and dwell of the cam are much exaggerated for the sake of clearance. In the cams as actually used, the rise and fall of the cam is commonly from .002″ to .006″, an amount too small to be indicated to scale on the drawings. When a plurality of cams 47 are provided, successive cams may be provided with increasing amounts of rise and fall, or the cams may be provided with different numbers of high and low points.

The roll bearing member 49 may be adjustable manually to cause the roll 48 to cooperate with any desired cam 47 and may be secured in adjustable position by binding bolts 54 (Fig. 1). In this manner, the amount of stock removed for clearance at the rear of each row of teeth may be selected and varied as desired.

If the number of high points in the selected cam 47 corresponds to the number of rows of teeth in the tap, the cam shaft 42 will be geared to rotate at the same speed as the spindle 26, but if the cam has a different number of high points, the relative speed of the spindle and shaft will be so arranged that one high point of the cam will be presented for each row of teeth.

If the tap is spirally fluted, the rotation of the cam shaft will not correspond exactly to the rotation of the work spindle, but will vary therefrom by a differential amount so that the point of relieving action will follow the helical arrangement of the teeth.

Reference to Fig. 5 will indicate that the rock shaft 40 is at substantially equal distances from the cam roll 48 and from the work center 25 in the spindle 26. The relieving movement of the work is thus substantially equal to the actual amount of rise and fall on the cam 47. On account of the large mass and weight of the parts moved by the cam 47, the parts move smoothly and positively and the relieving is performed with exceptional accuracy.

It is desirable to provide means for slightly adjusting the table 21 longitudinally of the machine, so that the teeth of the tap mounted upon the centers 24 and 25 may accurately engage the bevelled cutting edge of the wheel W. For this purpose, we have provided the construction shown in Figs. 6 to 9 inclusive, comprising a bracket or frame 50 secured to the end of the rock shaft 40 by a bolt 51. The frame 50 is recessed to provide bearing surfaces 52 and 53 which are engaged by the rear portions of a pair of bell crank levers 54 pivoted at 55 and 56 in a bracket 57 which in turn is secured to the under side of the table 21 by bolts 58 (Fig. 7).

Adjusting screws 59 are threaded in the bracket 57 and extend through the front portion of the table 21. By turning one or the other of the adjusting screws 59, the corresponding bell crank 54 may be forced against a bearing surface 52 or 53, thus causing longitudinal movement of the table 21 relative to the frame 50 and relative to the grinding wheel W. When the desired position is attained, the screws 59 may be tightened to hold the parts firmly in adjusted position.

In Fig. 4, we have shown an index finger 60 mounted on the wheel carriage 30 and extending over a scale 61 on the tail stock 22. This index 60 is convenient for quickly resetting the wheel and work to a desired axial relation.

A modified form of table adjusting mechanism is shown in Figs. 11, 12 and 13 and comprises a member 61 loosely mounted on the rock shaft 40 between fixed collars 62 and 63. The member 61 is provided with oppositely inclined or bevelled surfaces 64 and 65 which are engaged by the conical ends of adjusting screws 66 threaded in the table 21ª. The part 61 is provided with projections or shoulders as indicated in Fig. 12 which prevent more than slight angular movement of the part 61 on the rock shaft 40. By relatively adjusting the screws 66, the table 21ª may be moved longitudinally to a limited extent for relative adjustment of the wheel and work, as with the preferred arrangement.

By providing two driving studs 68 (Fig. 1) on the driving plate 69 on the work spindle 26, the dog on the work may be placed against either one or the other of the studs, in accordance with the direction of rotation, so that taps of either hand may be ground and may be relieved by the use of the same relieving cam, and the wheel may be caused to cut in both directions of travel of the wheel carriage.

When no relieving action is desired, a wedge 70 (Fig. 12) may be inserted between

the table 21 or 21ª and the base 20, raising the cams 47 above the roll 48.

An indicating device 71 (Fig. 2) may be provided on the head stock 23. As shown, this device comprises a plunger 72 and a pointer 73 by which the motion of the plunger is reproduced, much enlarged, on a scale 74. A contact 75 is threaded in a stand 76 fixed on a portion of the base 20. As the table 21 swings forward and rearward, the plunger 72 is pressed against the relatively fixed contact 75 and shows the movement of the table, much enlarged, on the scale 74. This is of convenience in setting the work, as the cams are so nearly circular that it is difficult to distinguish the rise and fall thereon.

Having thus described our invention and the advantages thereof, we do not wish to be limited to the details herein disclosed otherwise than as set forth in the claims, but what we claim is:—

1. In a grinding machine, a grinding wheel, means to rotate said wheel, means to move said wheel axially, a work support, means to rotate the work thereon, and variably actuated relieving mechanism to move the work support to carry the work toward and from the grinding wheel.

2. In a grinding machine, a grinding wheel, means to rotate said wheel, means to move said wheel axially, a work support, means to rotate the work thereon, and variably actuated relieving mechanism to move the work support to carry the work toward and from the grinding wheel, said wheel, said work and said relieving mechanism being simultaneously actuated in timed relation to each other.

3. In a grinding machine, a grinding wheel, means to rotate said wheel, means to move said wheel axially, a work support, means to rotate the work thereon, and variably actuated relieving mechanism to move the work support to carry the work toward and from the grinding wheel, said relieving mechanism including a cam and means to rotate said cam in a definite speed relation to the rotation of the work.

4. In a grinding machine, a grinding wheel, a work table oscillatable toward and from said wheel, means to support and rotate the work thereon, a cam shaft rotatably mounted on said table, a plurality of relieving cams mounted thereon, a bearing element slidably mounted on said machine below said cam shaft and adapted to cooperate with a selected one of said cams and means to rotate said selected cam in fixed relation to the rotation of the work.

5. In a grinding machine, a grinding wheel, a work table, means to support and rotate the work thereon, means to oscillate said work table toward and from said wheel comprising a cam shaft rotatably mounted on said table, a plurality of relieving cams mounted on said shaft, means to rotate said shaft and cams in fixed relation to the rotation of the work, and a co-operating bearing element selectively movable to position for engagement with any one of said cams.

6. In a grinding machine, a grinding wheel, means to rotate said wheel, means to move said wheel axially, a work support, means to rotate the work thereon, selectively actuated relieving mechanism to move the work support to carry the work toward and from the grinding wheel, and means to actuate said relieving mechanism in differential relation to the rotation of the work, whereby spirally fluted work may be relieved.

7. In a grinding machine, a grinding wheel, a work table, means to support and rotate the work thereon, a fixed bearing on which said table is pivoted, selectively operated means to rock said table and work toward and from the wheel, and means to adjust said table longitudinally relative to the grinding wheel.

8. In a grinding machine, a grinding wheel, a work table, means to support and rotate the work thereon, a bearing for said table, means to rock said table and work toward and from the grinding wheel, a member fixed longitudinally of the machine and having opposed bearing surfaces, a pair of levers mounted on said table and engaging said opposed surfaces on said member, and manual means to separately adjust said levers and thereby move said table longitudinally relative to said grinding wheel.

9. In a grinding machine, a grinding wheel, a work table, means to support and rotate the work thereon, a bearing for said table, means to rock said table and work toward and from the grinding wheel, a member fixed longitudinally of the machine and having opposed bearing surfaces, a pair of bell crank levers mounted on said table and engaging the opposed surfaces of said member, and a pair of adjusting screws threaded in the front of said table and engaging said levers, said screws being separately and manually movable to force a selected lever against its bearing surface to move said table longitudinally in said machine in a desired direction.

10. In a grinding machine, a grinding wheel, a wheel carriage, means to move said wheel and carriage longitudinally of the work, a tail center adjustably fixed thereon and having a graduated index scale, and a pointer mounted on said wheel carriage and co-operating with said scale to indicate wheel position.

11. In a grinding machine, a grinding wheel, a work table, means to support and rotate the work thereon, a fixed bearing on which said table is pivoted, means to rock

said table and work toward and from the wheel, and means to adjust said table longitudinally relative to the grinding wheel, said means comprising a member mounted in fixed axial position and having oppositely inclined bevelled surfaces, and adjusting screws engaging said bevelled surfaces and effective to move said table axially relatively to said grinding wheel.

12. In a grinding machine, a grinding wheel, a work table, means to support and rotate the work thereon, a rock shaft on which said table is pivoted, means to rock said table and work toward and from the wheel, and means to adjust said table longitudinally relative to the grinding wheel, said means comprising a member mounted on said rock shaft in fixed axial position and having oppositely inclined bevelled surfaces and adjusting screws having substantially conical end portions engaging said bevelled surfaces and effective to move said table axially relative to said grinding wheel.

13. In a grinding machine, a grinding wheel, a work table, means to support and rotate the work thereon, relieving cams rotatably mounted on said table, a bearing element co-operating with a selected one of said cams, and an indicating device by which the movement of the table is reproduced on a greatly enlarged scale.

14. In a grinding machine, a grinding wheel, a work table, means to support and rotate the work thereon, relieving cams rotatably mounted on said table, a bearing element cooperating with a selected one of said cams, an indicating device mounted to move with said table, and a fixed element co-operating with said device to indicate thereon the movement of the table on a much enlarged scale.

15. In a grinding machine, a grinding wheel, a work table, means to support and rotate the work thereon, means to oscillate said work table toward and from said wheel comprising a plurality of relieving cams of varying contours rotatably mounted on said table, a bearing element slidable below said cams for engagement with a selected one thereof, means to rotate said selected cam in fixed relation to the rotation of the work and an oil bath for said bearing element.

In testimony whereof we have hereunto affixed our signatures.

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ERNEST A. WALKER.