Nov. 6, 1951 S. J. KOPEC 2,574,111

GRINDING MACHINE ATTACHMENT FOR GRINDING HELICAL TEETH

Filed July 1, 1947

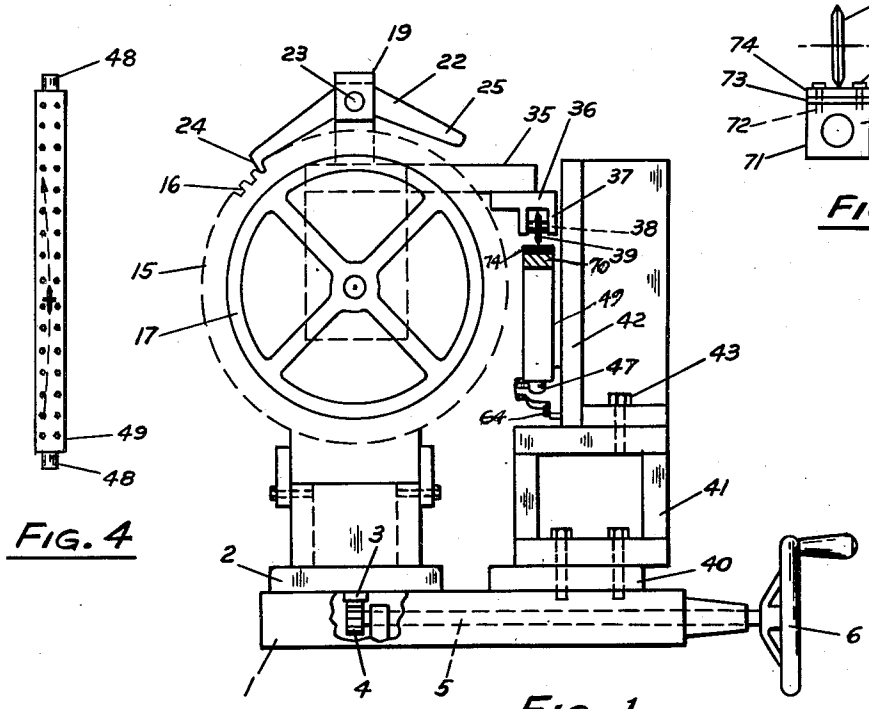

FIG. 4

FIG. 1

FIG. 3

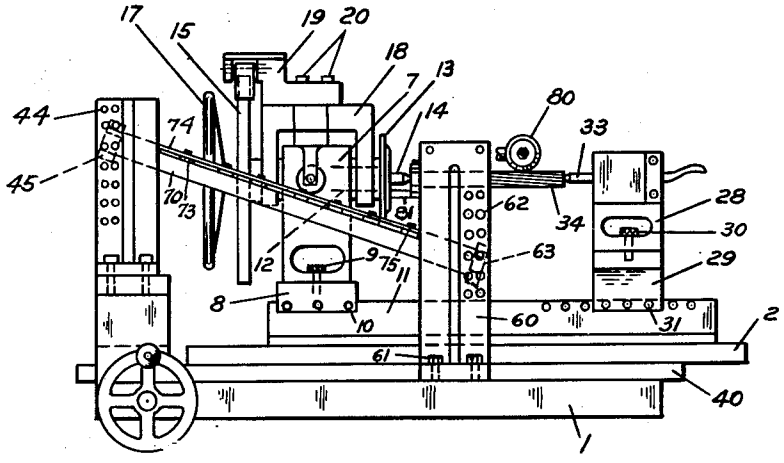

FIG. 2

INVENTOR.
Stanley J. Kopec
BY
Florian S. Miller
Atty.

Patented Nov. 6, 1951

2,574,111

UNITED STATES PATENT OFFICE

2,574,111

GRINDING MACHINE ATTACHMENT FOR GRINDING HELICAL TEETH

Stanley J. Kopec, Royal Oak, Mich.

Application July 1, 1947, Serial No. 758,292

7 Claims. (Cl. 51—232)

1

This invention relates generally to grinding machines and more particularly to a novel attachment for a grinding machine for grinding helical teeth.

It has, heretofore, been conventional to rotate the work piece while the bed of the grinding machine moves relative to the grinding wheel when grinding a helical tooth. For grinding helical teeth to very close tolerances, the conventional method is not successful and cannot be used in that there is no adjustment to provide for variations in the width of the teeth caused by use of present conventional methods. Under normal circumstances, conventional methods of grinding are permissible in that the width of the teeth may vary but in grinding teeth for a gage for helical grooves in a gun barrel, it has been found that conventional methods of grinding helical teeth cannot be used. The helix or spiral of the teeth varied as much as .005 of an inch or more with conventional attachments, and this cannot be allowed in a gage. No means have heretofore been provided to grind a helical tooth along its entire length within .0001 of an inch of error in the helix or spiral. Irregularities and wear in gears, worms and the like in prior machines has invariably produced irregular and inaccurate helical or spiral teeth.

It is, accordingly, an object of my invention to overcome the above and other defects in attachments for grinding helical teeth and it is more particularly an object of my invention to provide an attachment for a grinding machine for grinding helical teeth which is simple in construction, economical in cost, easy to set up and operate and economical in manufacture.

Another object of my invention is to provide a novel attachment for a grinding machine for grinding helical teeth which may be adjusted to grind a helical tooth to an accuracy of .0001 of an inch or less as may be required by the job over the entire length thereof.

Other objects of my invention will become evident from the following detailed description, taken in conjunction with the accompanying drawings, in which

Fig. 1 is an end elevational view with parts thereof broken away of my novel attachment on the bed of a grinding machine;

Fig. 2 is a side elevational view of my novel attachment on the bed of a grinding machine;

Fig. 3 is an end view of the guiding arm of my novel attachment; and

Fig. 4 is a plan view of my novel guide bar showing an illustration of the path of the guide wheel in dotted lines.

2

Referring now to the drawings, Figs. 1 and 2 show a base 1 with a movable bed 2 mounted thereon having a depending rack 3 for engagement with a gear 4 fixedly mounted on a transverse shaft 5 journalled in the base 1. A hand wheel 6 is disposed on the shaft 5 to move the bed 2 longitudinally.

A head stock 7 is attached to block 8 by screw bolt 9. The block 8 is in turn attached to a base block 11 on the bed 2 by screw members 10. A shaft 12 is journalled in the head stock 7 and it has a base plate 13 and center 14 on one end thereof. An indexing wheel 15 having spaced notches 16 is fixedly mounted on the shaft 12. A hand wheel 17 is also fixedly mounted on the end of shaft 12 for manual rotation thereof. A U-shaped carriage 18 straddles the head stock 7 and is mounted for free rotation on the shaft 12. Offset bracket 19 is secured to the carriage 18 by screw bolts 20. A tiltable balanced angular latching member 22 is pivoted on the member 19 by pin 23. The member 22 has a tapered engaging portion 24 for engaging the notches 16 in the indexing wheel 15 and the opposite end 25 of the member 22 is for hand engagement to lift the engaging portion 24 from the notches 16.

A tail stock 28 is attached to a block 29 by screw bolts 30. The block 29 is in turn attached to the base block 11 on the bed 2 by screw members 31. A center 33 in alignment with the center 14 in the head stock 7 is disposed in the tail stock 28. The work piece 34 is held between the centers 14 and 33 in the head stock 7 and the tail stock 28 respectively.

An arm 35 is attached to the carriage 18 by welding or any other suitable means and extends outwardly therefrom and has attached to the outer under side thereof a bracket 36 having spaced lugs 37 for rotatably receiving the shaft 38 of a hard surface wheel 39.

A longitudinally extending plate 40 is disposed on the base 1 and has mounted thereon a supporting member 41. A vertically extending supporting member 42 is attached to the supporting member 41 by screw bolts 43 and has apertures 44 for attaching a supporting bracket 45. The bracket 45 has an aperture for receiving the reduced end 48 of a guiding member 49. An upwardly extending support member 60 is attached to the plate 40 by screw bolts 61 and it has apertures 62 for attaching a bracket 63 with apertured portion 47 by screw bolts 64 for receiving the other rounded reduced end 48 of the guide member 49. The guide member 49 comprises a member 70 having parallel sides 71 with spaced threaded apertures 72 on the upper surfaces

thereof. Warping members 73 are disposed between a top guiding plate 74 and the member 70. Screw bolts 75 secure the plate 74, members 73 and the members 70 of the guide member 49 together. The warping members 73 may be of varying thicknesses and lengths, they may be tapered along any dimension, or they may be in any irregular shape to provide for the warping of the guide plate 74 of the guide member 49 at any predetermined point on the surface thereof. The guide member 49 may be rotated about its axis to any desired position, its longitudinal angular position may be changed to any desired angle, and the surface of the guide plate 74 of the guide member 49 may be warped at any point to provide for adjustment between the work piece 34 and grinding wheel 80 in its movement along the side surface of a helical tooth. The member 70 may be built up with parallel side members instead of being solid as shown.

In operation, a sample gage or the like with helical teeth is disposed between the centers 14 and 33 and a grinding wheel 80 with the desired contour is set at the desired angle required. The guide member 49 is then set at a predetermined longitudinal and transverse angle and adjustment is made so that the grinding wheel 80 will grind the tooth to fairly close tolerances. Upon determination that the grinding wheel 80 is grinding one portion of the tooth slightly more or less than other portions of the tooth, a warping member or members 73 are disposed in a predetermined position along the guiding plate 74 and the guiding plate 74 is then warped by rotation of screw bolts 75 until the tooth is being ground uniformly along its entire length to a tolerance of .0001 of an inch or less when the bed 2 is moved longitudinally by the hand wheel 6. The wheel 39 moves in a curve on the guiding plate 74 as shown in Fig. 4 thereby requiring adjustment of the transverse angle of the guide member 49 as well as its longitudinal angle. Movement of the wheel 39 over the guide plate 74, when the bed 2 is moved longitudinally, causes rotation of the carriage 18 thereby causing rotation of the work piece 34 held in the centers 14 and 33 and held against rotation by a dog 81. The index wheel 15 is rotated by means of hand wheel 17 to index the work pieces 34 so that the work piece 34 will be moved or rotated a distance equal to the distance between its teeth when the index wheel 15 moves from one notch 16 to the next notch 16. When all adjustments are made, the machine is ready for production operation with extremely close tolerances provided.

My novel attachment for grinding helical teeth on a grinding machine permits adjustment of the guiding bar longitudinally and transversely and also the guiding plate may be warped at any point to permit grinding of the tooth to a predetermined thickness at any point along its entire length to tolerances less than .0001 of an inch.

Various changes may be made in the specific embodiment of my invention without departing from the spirit thereof, or from the scope of the appended claims.

What I claim is:

1. An attachment for a grinding machine for grinding and inspecting helical teeth comprising a support member, work holding means rotatably mounted on said support member, means for moving said support member and said work holding means longitudinally, an angularly outwardly extending arm carried by said work holding means, a wheel movable longitudinally parallel with the longitudinal movement of said support member and work holding means, carried on the outer end of said arm at a fixed distance from the work holding means, an angularly extending, comparatively wide, substantially flat faced guide bar disposed laterally of said work holding means and parallel to the longitudinal movement thereof over which said wheel travels to rotate said arm to rotate said work holding means upon longitudinal movement thereof, said wheel being adapted to move over the flat faced surface of said guide bar in an arcuate path, means for securing said guide bar in different rotative positions about its longitudinal axis to change the arcuate path of said wheel over the flat faced surface of said guide bar, means for adjusting the angle of said guide bar with respect to the longitudinal movement of said work holding means, and means for raising and depressing portions of the engaging surface of said guide bar engaged by said wheel.

2. An attachment for a grinding machine as set forth in claim 1 wherein an index wheel is axially aligned and rotatable with said work holding means.

3. An attachment for a grinding machine for grinding helical teeth comprising a headstock, a shaft journalled in said headstock, means on said shaft for holding a workpiece for rotation therewith, means for moving said headstock and shaft longitudinally, an outwardly extending arm affixed on and rotatable with said shaft, a wheel carried by said arm at fixed distance from said shaft, an angularly extending, comparatively wide, substantially flat faced guide bar disposed laterally of said shaft and parallel to the movement thereof over which said wheel travels upon longitudinal movement of said shaft to rotate said shaft, said wheel being adapted to move in an arcuate path over the substantially flat faced surface of said guide bar, means for holding said guide bar in different angular rotative positions about its longitudinal axis to change the arcuate path of said wheel over the substantially flat faced surface of said guide bar, means for raising or lowering either end of said guide bar for adjusting the angle thereof with respect to the longitudinal movement of said shaft, and means for raising and lowering the portions of the surface of said guide bar engaged by said wheel.

4. An attachment for a grinding machine for grinding and inspecting helical teeth comprising a headstock, a rotatable shaft journalled in said headstock, means for moving said headstock and rotatable shaft longitudinally, an inverted U-shaped carriage mounted on said rotatable shaft and rotatable therewith, an arm extending laterally outwardly from said carriage, a wheel carried on the outer end of said arm at a fixed distance from said shaft, an index wheel having circumferentially spaced grooves on the periphery thereof carried by said shaft, a latch carried by said U-shaped carriage and engageable with the grooves of said index wheel, an angularly extending, comparatively wide, substantially flat faced guide bar disposed laterally of said headstock and parallel to the longitudinal movement thereof engaged by said wheel on said arm to rotate said shaft upon longitudinal movement thereof, said wheel being adapted to move in an arcuate path over the substantially flat faced surface of said guide bar, means for

raising and lowering either end of said guide bar to change the angularity thereof, means for securing said guide bar in different rotative positions about its longitudinal axis to change the arcuate path of said wheel over said substantially flat faced guide bar to vary the thickness of a tooth being ground or inspected at a particular point thereof in its longitudinal travel, and means for raising and lowering different points on the surface of said guide bar engaged by said wheel out of a horizontal plane passing through the top side of the engaging surface.

5. An attachment as set forth in claim 4 wherein a wheel is mounted on said shaft for rotating same manually.

6. An attachment for a grinding machine for grinding and inspecting helical teeth comprising a support member, work holding means rotatably mounted on said support member, means for moving said support member and said work holding means longitudinally, an angularly outwardly extending arm carried by said work holding means, a wheel movable longitudinally parallel with the longitudinal movement of said support member and work holding means, carried on the outer end of said arm, an angularly extending guide bar disposed laterally of said work holding means and parallel to the longitudinal movement thereof over which said wheel travels to rotate said arm to rotate said work holding

means upon longitudinal movement thereof comprising a base member, a spaced plate on said base member for engaging said wheel, warping members disposed between said top plate member and said base member, and means for securing said top plate member, warping members, and base member together; means for securing said guide bar in different rotative positions, and means for adjusting the angle of said guide bar with respect to the longitudinal movement of said work holding means.

7. An attachment as set forth in claim 6 wherein said warping members are of various thicknesses.

STANLEY J. KOPEC.

REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
1,147,214	Cross	July 20, 1915
1,419,073	Norton	June 6, 1922
1,847,167	Belden et al.	Mar. 1, 1932

FOREIGN PATENTS

Number	Country	Date
395,737	Germany	May 22, 1924