May 13, 1947. G. STEWART 2,420,504

MEANS FOR GRINDING SCREW THREADS

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Fig. 1.

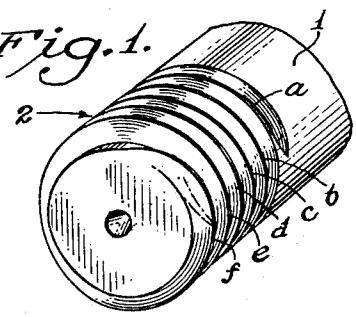
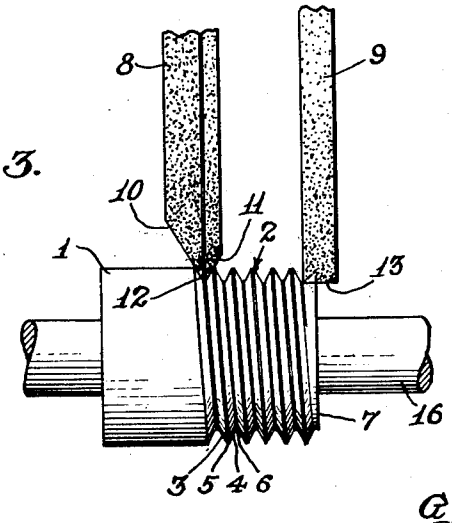


Fig. 2.

Fig. 3.



Inventor
Gilbert Stewart
BY
Parker, Carlson, Pitzner & Hattan
Attorneys.

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Fig. 4.

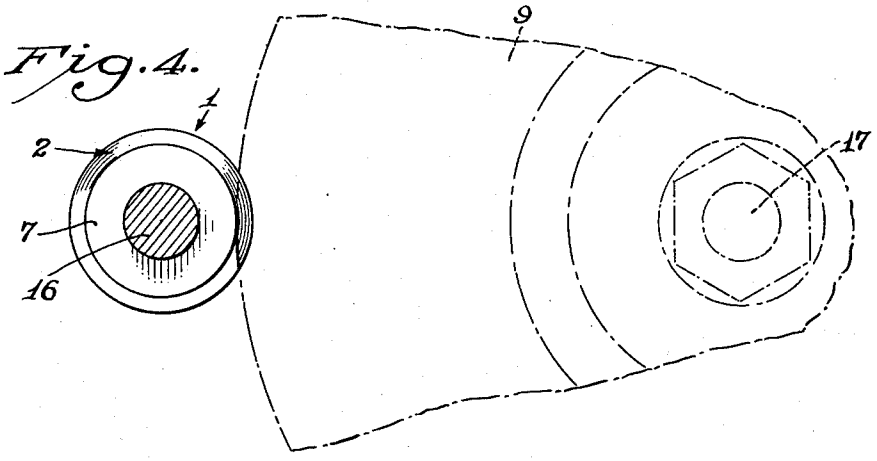
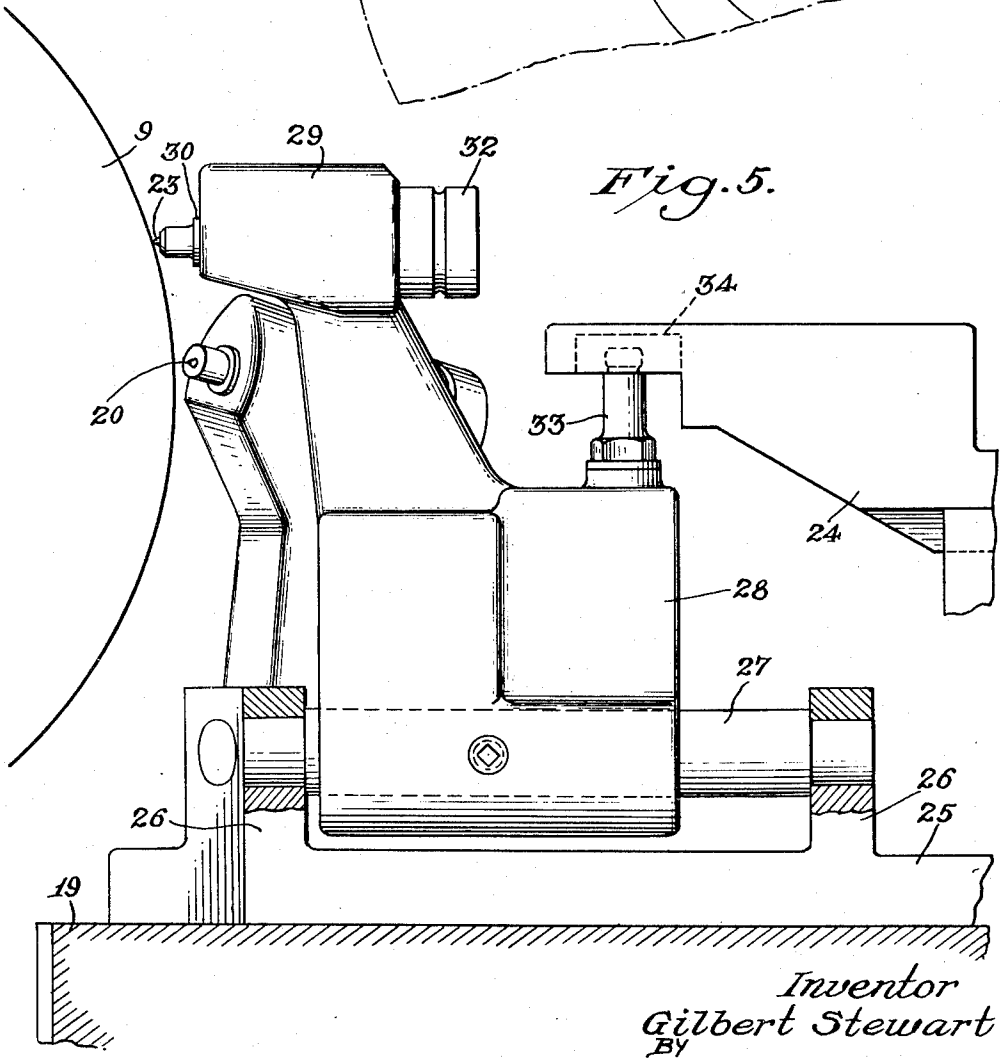


Fig. 5.



Inventor
Gilbert Stewart
By
Parker, Carlson, Pitzer & Hubbard
Attorneys.

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Fig. 6.

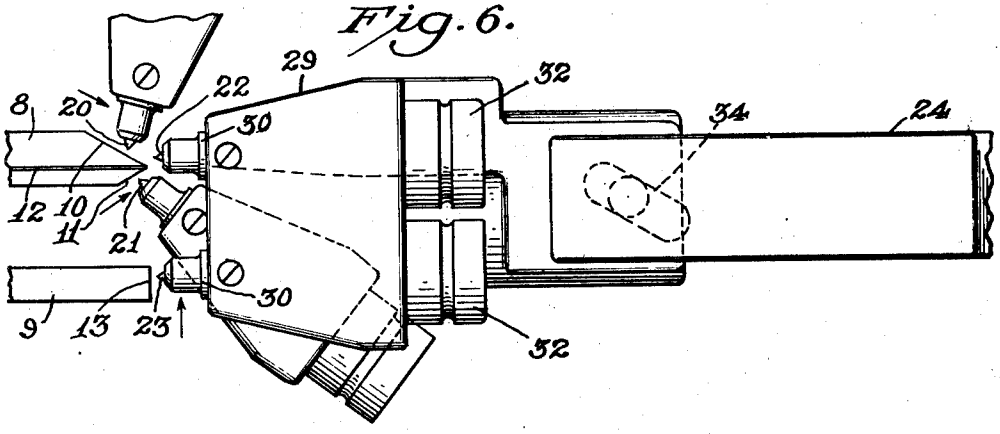


Fig. 7.

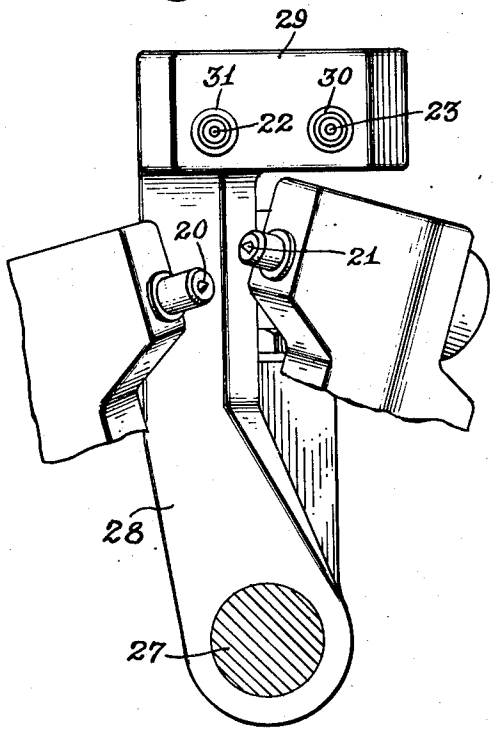
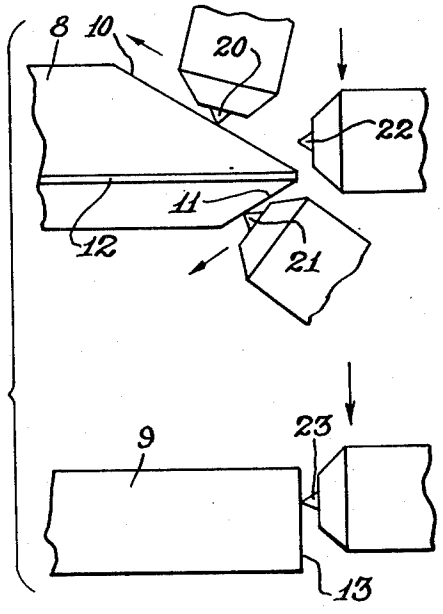


Fig. 8.



Inventor
Gilbert Stewart
BY
Parker, Carlson, Pitzner & Hubbard
Attorneys.

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MEANS FOR GRINDING SCREW THREADS

Gilbert Stewart, Detroit, Mich., assignor to Ex-Cell-O Corporation, Detroit, Mich., a corporation of Michigan

Application January 9, 1942, Serial No. 426,112

4 Claims. (Cl. 51—3)

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The present invention relates to improvements in the grinding of screw threads on the ends of shafts and other threaded parts, and has particular reference to a new and improved means therefor.

One of the objects of the invention is to provide a novel means for grinding a screw thread on the end of a work-piece, and for simultaneously grinding off the last or end thread, so as to remove the partial thread or fin which is obtained when the thread runs out to the very end of the stock.

Further objects and advantages will become apparent as the description proceeds.

In the accompanying drawings:

Figure 1 is a perspective view of a threaded workpiece to be ground.

Fig. 2 is a fragmentary plan view illustrating the two grinding wheels in operative relation to the workpiece at the start of the grinding operation.

Fig. 3 is a view similar to Fig. 2 but showing the grinding wheels in operative relation to the workpiece at the end of the grinding operation.

Fig. 4 is an end view of the workpiece showing the grinding wheel in operative relation thereto.

Fig. 5 is a fragmentary vertical sectional view of a dressing mechanism for the grinding wheels.

Fig. 6 is a fragmentary plan view of the dressing mechanism.

Fig. 7 is a fragmentary end view of the dressing mechanism.

Fig. 8 is a diagrammatic view illustrating the relationship of the dressing tools to the grinding wheels during the dressing operation.

Referring more particularly to the drawings, the present means is adapted for grinding screw threads on various types of workpieces or sections thereof, in which the thread runs out at one end to an intermediate peripheral shoulder or end surface, and simultaneously removing the last or end thread convolution. For purposes of illustration, I have shown a cylindrical workpiece 1 having an external screw thread 2 consisting of a plurality of convolutions *a* to *f*. The thread may have any desired contour, and in the present instance is shown as a V-shaped thread in cross section, with opposite inclined flanks 3 and 4 connected by a narrow flat root surface 5 and a narrow flat outer face 6. The thread may also have any given pitch and lead, and for a given number of convolutions will have a definite length G to be ground.

The last or end thread convolution *f* runs out at full depth to the transverse end surface 7 of the

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workpiece 1, and hence is not complete in form, but leaves a fin decreasing in width progressively from the full contour to a thin edge. The fin has relatively little strength, and tends to become distorted and bent in use so as to interfere with proper and expeditious threading of the workpiece into engagement with a mating part. According to the present invention, two axially spaced rotary grinding wheels 8 and 9 are arranged in cutting relation to the workpiece 1, and the latter is rotated and translated axially in timed relation to the rotation relatively through a cutting stroke across the wheels. The pitch dstance H between the grinding wheels 8 and 9 is equal to the length G of the thread 2, so that the wheel 8 will grind the length of the thread, and during the grinding of the final thread convolution *a*, the wheel 9 will grind off the last or end thread convolution *f*. If desired, less than a complete thread convolution may be removed by increasing the pitch distance between the grinding wheels 8 and 9. It will be understood that the wheel 9 follows the lead of the thread 2 the same as does the wheel 8.

The grinding wheel 8 has a contour complemental to the thread contour, and in the present instance has flanks 10 and 11 and a peripheral face 12 for grinding respectively the flanks 3 and 4 and root surface 5 of the thread 2. The grinding wheel 9 has a flat peripheral face 13 since its purpose is to remove or flat the end convolution *f*. It will also be understood that the end convolution *f* may be removed to any desired depth, and the radial depth of the wheel 9 in relation to that of the wheel 10 will be selected accordingly. Where the end convolution *f* or any desired portion thereof is to be removed to full depth, as illustrated, the end faces 12 and 13 of the wheels 8 and 9 have the same radii so as to cut to the same depth.

The grinding wheels 8 and 9 may be arranged to grind the thread 2 in one pass or stroke of the workpiece from left to right, as when taking a finishing cut, or in a plurality of such passes, with a relative lateral infeed movement after each pass until the final depth is attained.

Any suitable means may be used for rotating the workpiece 1 and grinding wheels 8 and 9, and for effecting the relative cutting traverse and the transverse incremental feed. Thus, a thread grinding machine of the automatic type, such for example as disclosed in a copending application, Serial No. 350,338, filed August 3, 1940, by Harold N. Seyferth, (now Patent No. 2,311,263) may be employed. This machine includes a live center

14 and an alined dead center 15, between which an arbor 16 is mounted for supporting the workpiece 1 for power rotation and axial translation.

The two grinding wheels 8 and 9 are fixed on a rotary power driven spindle 17, and are located thereon in predetermined axially spaced relation by an intermediate spacer 18. It will be understood that means (not shown) is provided for adjusting the spindle 17 angularly to an axial plane through the workpiece 1 at the helix angle of the thread 2.

The forms and relative radial dimensions of the grinding wheels 8 and 9 are obtained by the use of a dressing mechanism which also may be of any suitable type, and which is herein shown as of the type disclosed in my copending application, Serial No. 361,608, filed October 17, 1940 (now Patent No. 2,311,263). The dressing mechanism (see Figs. 6 to 8) is arranged for operative association with the grinding wheels 8 and 9 substantially diametrically opposite the workpiece 1.

The dressing mechanism includes an approach slide 19 adapted to be mounted on a suitable support (not shown). Three dressing tools 20, 21 and 22 normally are mounted on the slide 19 for forward and reverse movements respectively to dress the flanks 10 and 11 and truncated face 12 of the grinding wheel 8. In the present adaptation of the dressing mechanism, a fourth dressing tool 23, movable with the tool 22, is provided for dressing the peripheral face 13 of the grinding wheel 9. A power operated slide 24 is reciprocable transversely of the axis of the spindle 17 for actuating the tools 20 to 23 in timed relation through the dressing cycle.

The intermediate assembly for supporting the dressing tools 22 and 23 comprises a base block 25 mounted on the approach slide 19, and having spaced upstanding bearings 26 supporting a pivot shaft 27. A swinging vertical arm 28 is fixed at its lower end on the shaft 27 and at its free upper end is formed with a laterally projecting head or holder 29 in which the dressing tools 22 and 23 are adjustably supported. More particularly, each of the tools 22 and 23 is mounted on the end of a separate shank 30, and the two shanks are slidably disposed in two parallel laterally spaced bores 31 in the bracket 29. The spacing of the bores 31 is such that, in the oscillation of the arm 28, the tool 22 will pass across and dress the face 12 of the one grinding wheel 8, and the tool 23 simultaneously will pass across and dress the face 13 of the other grinding wheel 9 (see Fig. 8). Suitable screws 32 are provided for individually adjusting the shanks 30 within the bores 31 to locate and secure the tools 22 and 23 in the desired cutting position relative to the grinding wheels 8 and 9 and to the other tools 20 and 21. The relative axial position of the tools 22 and 23 determines the depth to which the end convolution *f* will be removed from the workpiece 1. When the tools 22 and 23 are adjusted as shown to project the same distance radially of the spindle 17, the wheel 9 will be dressed to remove the end convolution *f* to full depth.

The means for oscillating the arm 28 includes a pin 33 engaging in a longitudinally inclined slot in the actuating slide 24. For further details of the grinding machine and dressing mechanism, reference may be had to the aforesaid copending applications.

The operation will be clear from the foregoing, and briefly stated is as follows: The grinding wheels 8 and 9 are suitably spaced in accordance with the length G of the thread to be ground, and the workpiece 1 is mounted between the centers 14 and 15. The dressing mechanism is operated through a cycle to impart the desired form and relative cutting depth to each grinding wheel. In this cycle, the two dressing tools 22 and 23 are oscillated as a unit to dress the peripheral faces 12 and 13 of the two separate grinding wheels 8 and 9. The grinding wheels 8 and 9 are located in operative relation to the workpiece 1, and the latter is then rotated and translated axially in timed relation to the rotation, with the end convolution *f* in the lead. At the start, the workpiece 1 occupies the position shown in Fig. 2. During the operation, the grinding wheel 8 follows the lead of the thread 2 and takes a cut thereon. The grinding wheel 9 remains out of contact with the thread 2 during the grinding of the convolutions *b* to *f*, but progressively approaches cutting position. During the grinding of the final convolution *a* by the wheel 8, the wheel 9 engages the workpiece 1, and also follows the thread lead to grind off the entire end convolution *f* or a desired portion thereof to full depth or a desired partial depth, as determined by the selected pitch and relative radial dimensions of the wheels 8 and 9. Where a number of passes are to be taken, the grinding wheels 8 and 9 are given an automatic incremental relative infeed toward the axis of the workpiece 1 after each pass so that the thread 2 is ground and the end convolution *f* is removed, progressively to the desired depth.

It will be seen that I have provided an advantageous and expeditious means for grinding a screw thread and at the same time removing the objectionable end fin ordinarily defined by the last thread convolution. In the operation, the dressing of the grinding wheels and the grinding of the work are correlated.

I claim as my invention:

1. A screw thread grinding machine comprising, in combination, a grinding spindle, a pair of grinding wheels mounted on said spindle, the first of said wheels being shaped to grind the desired thread contour and the second of said wheels being shaped to substantially remove the thread, the radial face of said second wheel adjacent the first wheel being spaced from the root grinding portion of the first wheel a distance equal to a predetermined multiple of the pitch of the threads, and means for supporting a workpiece for rotation and for axial translation in timed relation to the rotation into grinding engagement, starting with the end of the workpiece, first with the first wheel and by continuation of such translation into grinding engagement with the second wheel, to grind the thread and remove a predetermined portion of the fragmentary convolution first ground by the first wheel.

2. A screw thread grinding machine comprising, in combination, a grinding spindle, a pair of grinding wheels mounted on said spindle, the first of said wheels being shaped to grind the desired thread contour and the second of said wheels being shaped to remove at least a portion of the thread, said second wheel being spaced from the first wheel a distance having a predetermined relation to the pitch of the threads, means for supporting a workpiece for rotation, and means for effecting relative translation between the grinding wheels and said workpiece axially of the workpiece in timed relation to the rotation of the workpiece to effect grinding engagement, starting

with the end of the workpiece first with the first wheel and thereafter with the second wheel to grind the thread and remove at least a portion of the fragmentary convolution first ground by the first wheel.

3. A screw thread grinding machine comprising, in combination, a pair of grinding wheels, the first of said wheels being shaped to grind the desired thread contour and the second of said wheels being shaped to remove at least a portion of the thread, said wheels being spaced from each other axially of the workpiece a distance having a predetermined relation to the pitch of the threads, means for supporting a workpiece for rotation, and means for effecting relative translation between said grinding wheels and said workpiece axially of the workpiece in timed relation to said rotation for effecting grinding engagement starting with the end of the workpiece first with the first wheel and thereafter with the second wheel to grind the thread and remove at least a portion of the fragmentary convolution first ground by the first wheel.

4. A screw thread grinding machine comprising, in combination, a grinding spindle, a pair of grinding wheels mounted on said spindle, the first of said wheels being shaped to grind the desired thread contour and the second of said wheels having a flat peripheral face and the same diameter as the root grinding portion of the first wheel, the radial face of said second wheel adjacent the first wheel being spaced from the root grinding portion of the first wheel a distance equal to a predetermined multiple of the pitch of the threads, means for supporting a workpiece for rotation, and means for translating said work supporting means axially of the workpiece in timed relation to the rotation of the workpiece to move the workpiece into grinding engagement starting at the end of the workpiece first with the first wheel to grind the thread and, during the grinding of the final convolution by the first wheel, into grinding engagement with the second wheel to remove a predetermined portion of the fragmentary convolution first ground by the first wheel.

GILBERT STEWART.

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