

Feb. 12, 1929.

1,702,160

E. A. HANSON

METHOD OF AND APPARATUS FOR GRINDING CONVOLUTED MEMBERS

Filed Jan. 21, 1927

Fig. 1.

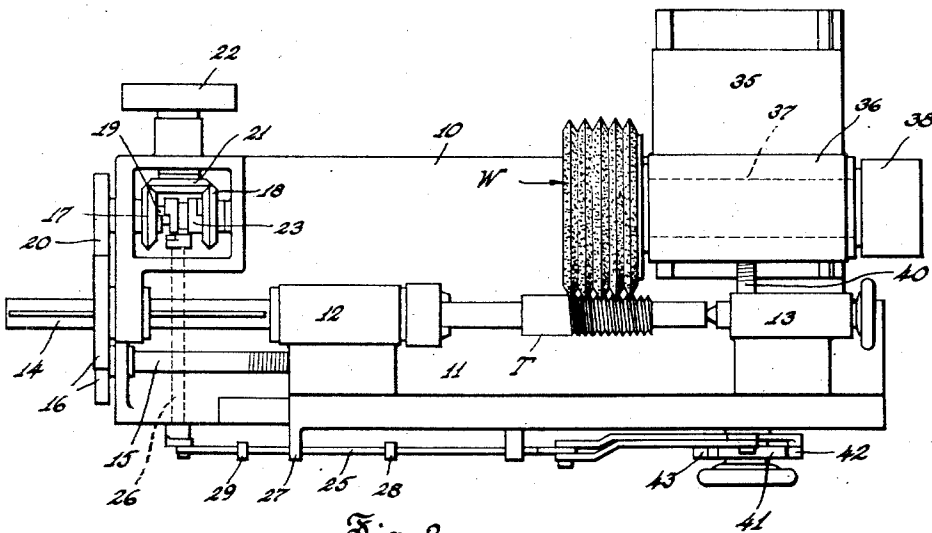


Fig. 2.

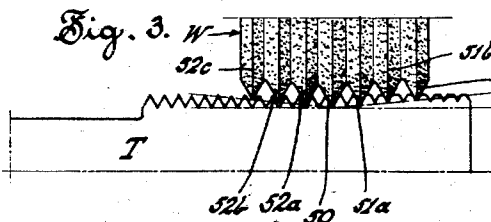
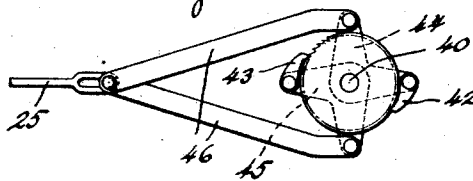


Fig. 4.



Inventor

Einar A. Hanson.

By *H. H. Lindsey*

His Attorney

UNITED STATES PATENT OFFICE.

KINAR A. HANSON, OF WEST HARTFORD, CONNECTICUT.

METHOD OF AND APPARATUS FOR GRINDING CONVOLUTED MEMBERS.

Application filed January 21, 1927. Serial No. 162,602.

This invention relates to the art of grinding, and has particular reference to grinding grooved or threaded members, such as gauges, lead screws, and thread forming tools, for instance taps, and thread cutting hobs so as to give to the grooves or threads accuracy and precision in all respects. The improvements of the present invention may be employed for forming and finishing grooves or threads for instance, or for finishing grooves or threads after the same have been roughed out, but they find peculiar adaptability in finishing grooved or threaded members after the members have been hardened.

The aim of the invention is to provide an improved method of and apparatus for grinding grooved or threaded members with extreme accuracy in all particulars at a relatively quick speed so that a superior product may be more economically produced.

More particularly, an aim of the invention is to provide an improved method of and apparatus for grinding grooved or threaded members wherein a grinding wheel of abrasive material having a plurality of circumferential serrations is employed for simultaneously operating upon a plurality of convolutions on the work, the work and the wheel being moved one relative to the other longitudinally of the work as, for instance, in accordance with the pitch of the thread operated upon, the grinding wheel being effective upon the work on both strokes thereof in order to eliminate the waste of time which would result in the event that the work is reciprocated, and the grinding wheel is effective upon the work on movement of the work in one direction but is not effective upon the work on the return movement thereof assuming, for illustration, that it is the work which is moved longitudinally with respect to the wheel.

Other objects will be in part obvious and in part pointed out more in detail hereinafter.

In the accompanying drawings, wherein I have shown, for illustrative purposes, one type of machine in which my improved method of grinding may be carried out:

Figure 1 is a top plan view of a machine equipped with my improved grinding wheel;

Fig. 2 is a detail front view of the ratchet mechanism through which the wheel is fed towards the work;

Fig. 3 is a fragmentary view showing the grinding wheel operating upon a piece of work, the illustration being greatly exaggerated; and

Fig. 4 is an enlarged diagrammatic view showing the manner in which the serrations of the grinding wheel successively cut small increments from the thread.

It is, of course, understood that my improved grinding wheel and the method of grinding resulting from the use thereof may be employed in machines of any appropriate construction or design, the machines shown being illustrated more or less diagrammatically and conventionally. In the present instance, the machine includes a base 10 on which is slidably mounted for reciprocating movement a work holder including a slide 11 carrying a head stock 12 and a tail stock 13, the head stock being provided with the usual work spindle 14. The slide 11 is moved back and forth axially of the work spindle in any suitable manner as by means of a lead screw 15 which is connected up through gears 16 with the work spindle so that the rotary movement of the work and its axial movement are properly coordinated depending upon the lead of the screw thread operated upon. For the purpose of reversing the direction of movement of the slide 11 and reversing the work spindle, the work spindle and lead screw are driven through a clutch mechanism which has a pair of oppositely disposed gears 17 and 18 loosely mounted on a shaft 19 which carries a gear 20 meshing with one of the gears 16. The gears 17 and 18 are continuously driven in opposite directions by a bevel gear 21 fixed to a shaft which carries a drive pulley 22. The clutch also includes a clutch sleeve 23 splined for sliding movement on the shaft 19. This, of course, is a conventional arrangement and any other suitable mechanism for accomplishing the desired result may be adopted. The clutch sleeve is automatically moved from clutching engagement with respect to the gears 17 and 18 by the slide 11 acting through a rod 25 and a rock shaft 26. As this arrangement is a well known one, it is sufficient to say that when the work holder has reached the end of its stroke in one direction, say to the right,

the ear 27 will engage a dog 28, thereby rocking the shaft 26 in a direction to engage the clutch sleeve with the gear 18, whereupon the work holder will be moved by the lead screw to the left and, when the work holder has completed this stroke to the left, the ear 27 will engage a dog 29, whereupon the clutch sleeve 23 will be engaged with the gear 17 with the result that the direction of rotation of both the lead screw and the work spindle will be reversed. The work is indicated by the letter T.

Mounted upon the base for movement at right angles to the axis of the work spindle is a slide 35 having a bearing 36 in which is journaled a grinding wheel spindle 37 having at one end a drive pulley 38 and at its other end my improved grinding wheel W. For the purpose of feeding the grinding wheel towards the work at the end of each stroke of the work, there is provided a screw 40 on the forward end of which is a ratchet wheel 41 with which cooperates a pair of pawls 42 and 43, respectively, carried by levers 44 and 45. These levers are connected by links 46 to one end of the rod 25. With this arrangement, when the slide 11 approaches the end of its stroke towards the right, the lever 45 is turned in the direction to cause the pawl 42 to turn the screw 40, whereupon the slide 35, together with the wheel carried thereby, will be fed slightly towards the work, and when the slide 11 approaches the end of its stroke towards the left, the pawl 43 will be caused to rotate the screw 40 to feed the grinding wheel towards the work. It is, of course, obvious that either the grinding wheel or the work may be moved longitudinally in accordance with the lead of the screw operated upon, and either the work or the wheel may be fed radially relative to the other, or either the wheel element or the work element may be given a longitudinal movement and a radial movement.

In accordance with the present invention, the grinding wheel is in the form of a cylindrical member formed of abrasive material, such as carborundum, and has on its periphery a plurality of serrations or cutting edges, these edges preferably being in the forms of separate, continuous, or concentric rings or ribs to the plane of which the axis of the wheel is perpendicular. The serrations are preferably arranged so that at any given instance each of the ribs or convolutions of the work is operated upon on one face only, the ribs preferably being spaced apart equal to a multiple of the distance between the successive grooves or convolutions of the work. The purposes of thus spacing the serrations are that the heat of the abrasive action on each convolution or rib on the work, since each convolution in any one instance is operated upon on one side face

only, is relatively less than would be the case if both side faces of a convolution were simultaneously operated upon by the serrations; passages for cooling fluid are provided between the grinding wheel and each convolution of the work at all times; and ready and accurate truing of the grinding faces of the serrations is facilitated, all as described in detail in the application of Bengt M. W. Hanson, Serial No. 18,835, filed March 27, 1925. In said Bengt M. W. Hanson application is disclosed one form of wheel having its serrations so arranged as to successively grind successive increments from each convolution on the work. In that application, the wheel is shown as having serrations of progressively increasing diameter from one end of the wheel to the other, and, with a wheel so constructed, it is possible to grind the work on only one stroke thereof, the wheel and the work being separated on the return stroke of the work.

In accordance with the present invention, the wheel is so arranged that it may be effective upon the work on each stroke of the latter, which means that the grinding operation will proceed more rapidly, no time being wasted on either stroke of the work. To these ends, the serrations on the grinding wheel are so arranged that, when the work is moved in one direction, the serrations at one end of the grinding wheel will effect increment grinding on the work, and when the work is moved in the opposite direction, the serrations on the other end of the wheel will effect increment grinding.

In the present illustrative disclosure, the grinding wheel W is shown as having serrations of progressively increasing diameter from each end of the wheel or conversely in which the serrations are of progressively decreasing diameter towards each end of the wheel. It will be noted, particularly from Fig. 3, that the central serration 50 is of the greatest diameter, and the serrations 51^a, 51^b and 51^c to one side of the central serration are of progressively less diameters, and the serrations 52^a, 52^b and 52^c to the other side of the central serration are of progressively decreasing diameters. In the drawings, the serrations of the wheel are formed to grind V-grooves or threads, but, obviously, the arrangement may be varied and the serrations may be of such shape as to grind truncated or Acme threads or Whitworth threads. When the work is moved towards the left, the serrations 51^c, 51^b, 51^a and 50 are effective to grind successive increments from each thread groove. The first serration 51^c will take out a small V-shaped increment 51^{c'} (see Fig. 4); the next serration will grind an additional increment 51^{b'}; the next, an increment 51^{a'}; and, lastly, the serration 50 will take an increment 50'. At the end of the stroke of the

work towards the left, the clutch will be automatically thrown, and the screw 40 will be turned slightly so as to feed the grinding edges towards the work for a new cut and then, as the work moves on its return stroke, that is, to the right, the serrations 52^c, 52^b, 52^a and 50 will successively grind small increments from each thread convolution. As the work completes its movement towards the right, the clutch will again be drawn to reverse the direction of rotation of the work spindle and the lead screw and the screw 40 will be turned to again slightly feed the wheel towards the work, whereupon the work will move towards the left, and this series of operations is repeated until the work has been brought down to the desired size.

As many changes could be made in the above construction and many apparently widely different embodiments of this invention could be made without departing from the scope thereof, it is intended that all matter contained in the above description or shown in the accompanying drawing shall be interpreted as illustrative and not in a limiting sense.

It is also to be understood that the language used in the following claims is intended to cover all of the generic and specific features of the invention herein described and all statements of the scope of the invention which, as a matter of language, might be said to fall therebetween.

I claim as my invention:

1. In combination, an abrasive grinding wheel having spaced circumferential serrations of progressively decreasing size towards each end of the wheel, means for rotatably supporting the work, and means for moving the work and wheel one relative to the other generally longitudinally of the work, the serrations at one end of the wheel being engageable with the work on relative movement between the work and the wheel in one direction and the serrations on the other end of the wheel being in engagement with the work when the relative movement is in the opposite direction.

2. In combination, an abrasive grinding wheel having spaced circumferential serrations of progressively increasing diameters from the extremities towards the mediate portion of the wheel, means for rotatably supporting a piece of work, means for effecting a back and forth movement between the work and the wheel longitudinally of the work, and means for effecting a feeding movement between the work and the wheel at the end of each stroke of the longitudinal movement.

3. The method of simultaneously grinding a plurality of convolutions on a metal work piece, which consists in providing a grinding wheel with a plurality of grinding serrations of progressively decreasing size towards each end of the wheel, and moving the work and wheel back and forth one relative to the other longitudinally of the work while the wheel is engaging the work.

4. The method of simultaneously grinding a plurality of convolutions on a metal work piece, which consists in providing a grinding wheel having a plurality of circumferential grinding serrations progressively increasing in diameters from the extremities towards the mediate portion of the wheel, rotatably supporting a piece of work in engagement with the wheel, effecting a back and forth movement between the work and the wheel longitudinally of the work to bring the serrations into successive engagement with each convolution on the work, and effecting a feeding movement between the work and the wheel at the end of each longitudinal stroke.

5. The method of simultaneously grinding a plurality of convolutions on a work piece, which consists in providing a grinding wheel having a plurality of spaced serrations arranged to grind successive increments from each convolution on the work, and rotating the grinding wheel while in engagement with the work and while moving the work longitudinally first in one direction and then in the opposite direction.

EINAR A. HANSON.