Aug. 20, 1935. C. E. HANDEL 2,011,761

SCREW THREAD ROLLING APPARATUS

Filed Aug. 21, 1933 3 Sheets-Sheet 1

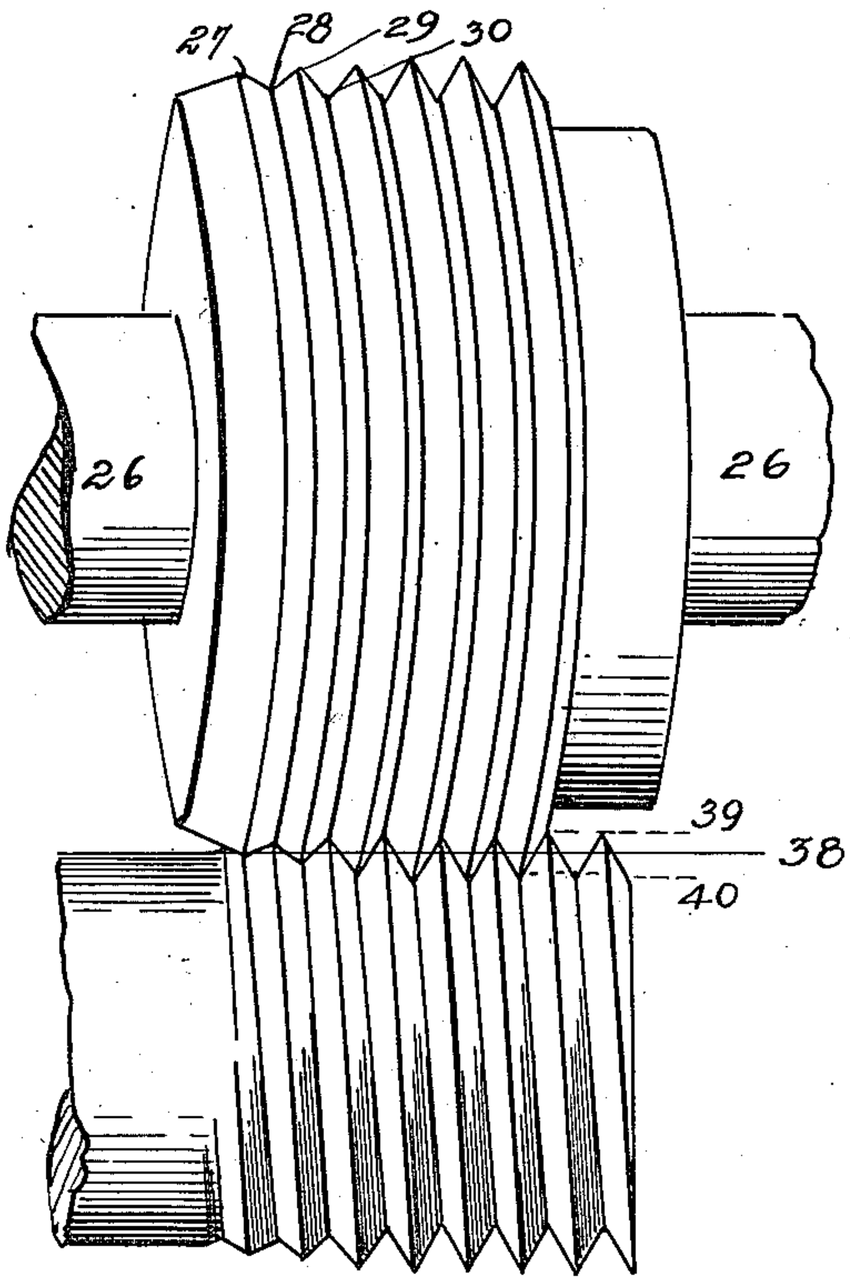

Fig. 4.

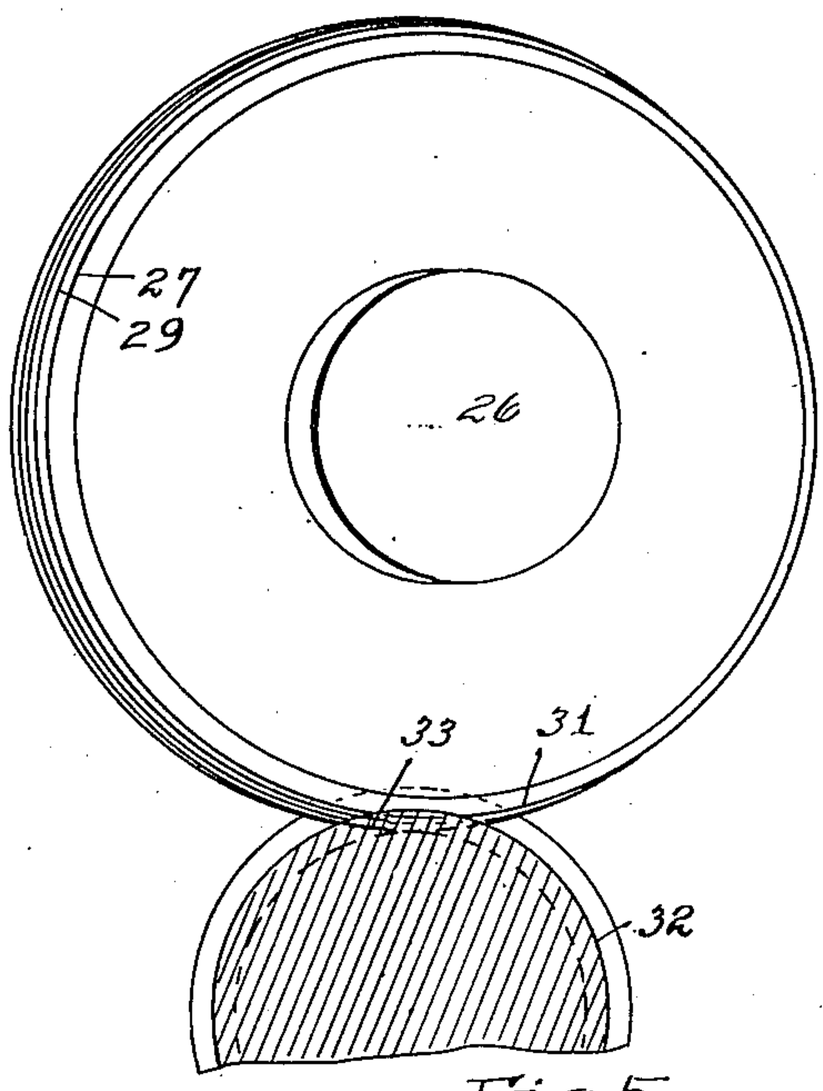

Fig. 5.

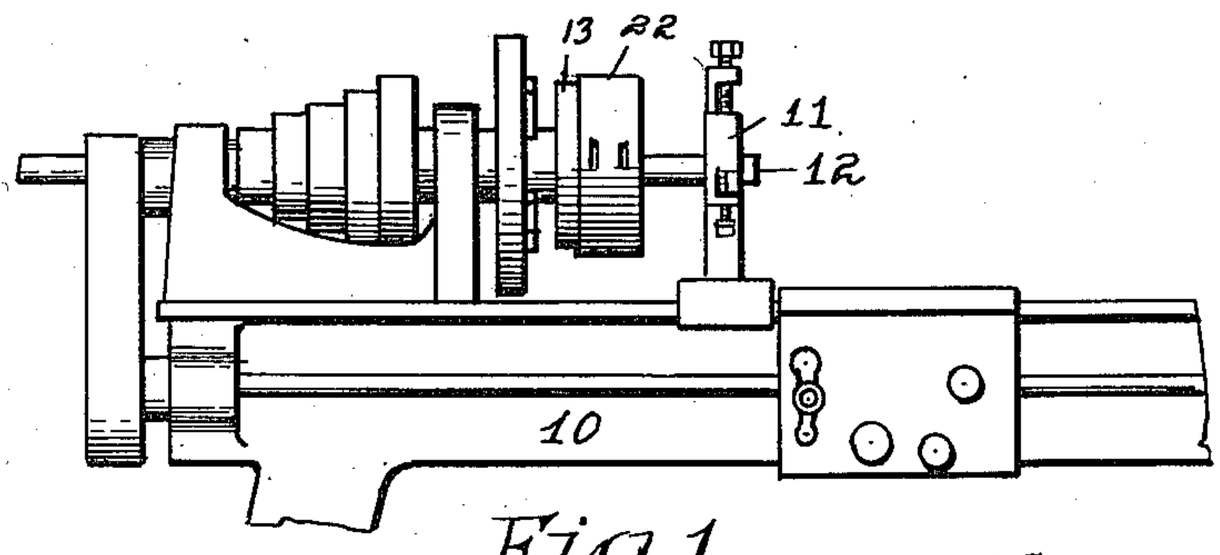

Fig. 1.

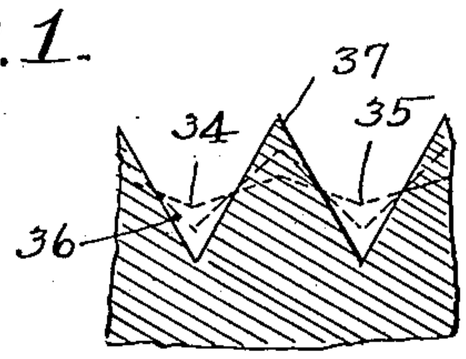

Fig. 6.

Inventor
Charles E. Handel
by Owen & Hague Atty's

Aug. 20, 1935. C. E. HANDEL 2,011,761

SCREW THREAD ROLLING APPARATUS

Filed Aug. 21, 1933 3 Sheets-Sheet 2

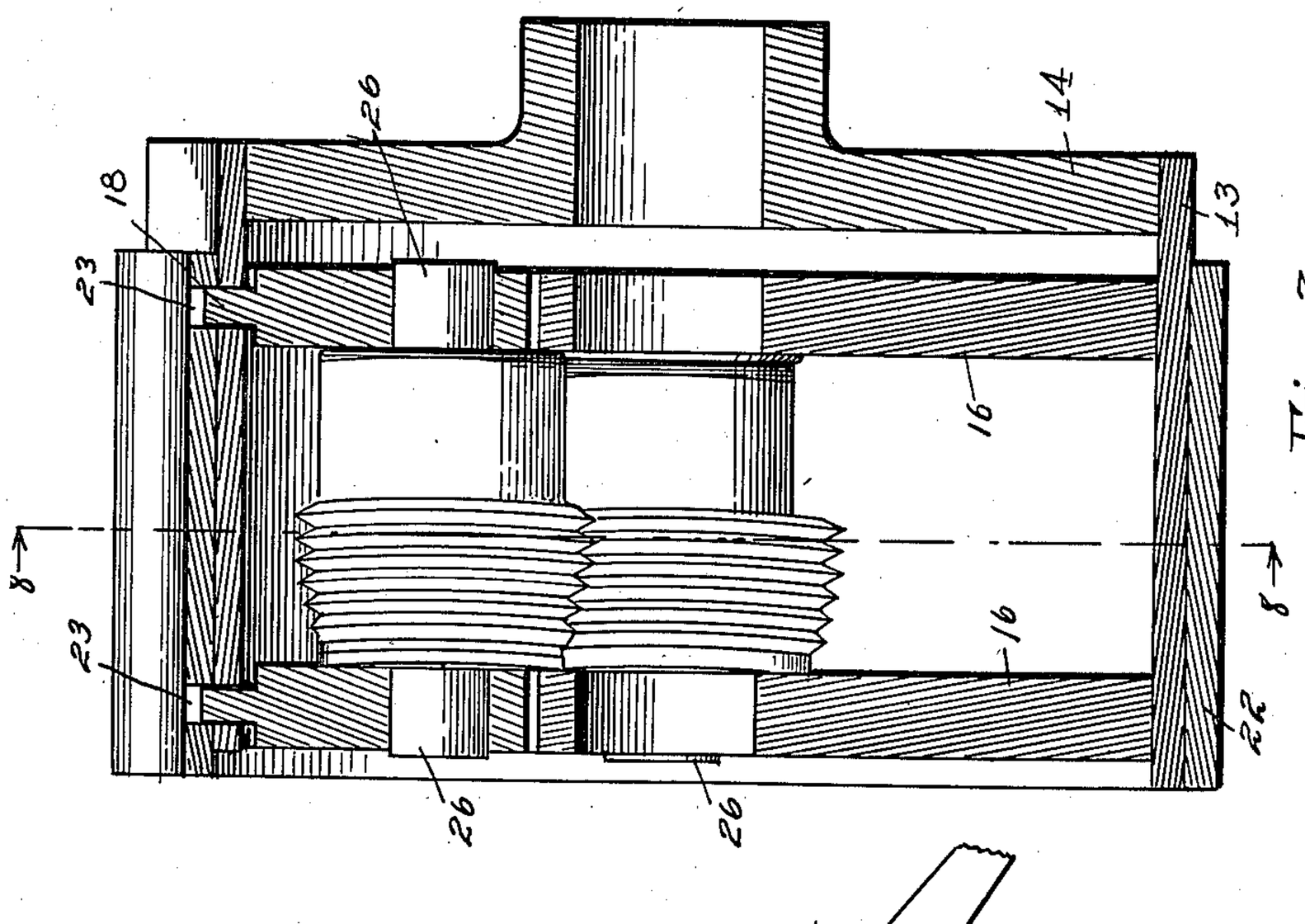

Fig. 3.

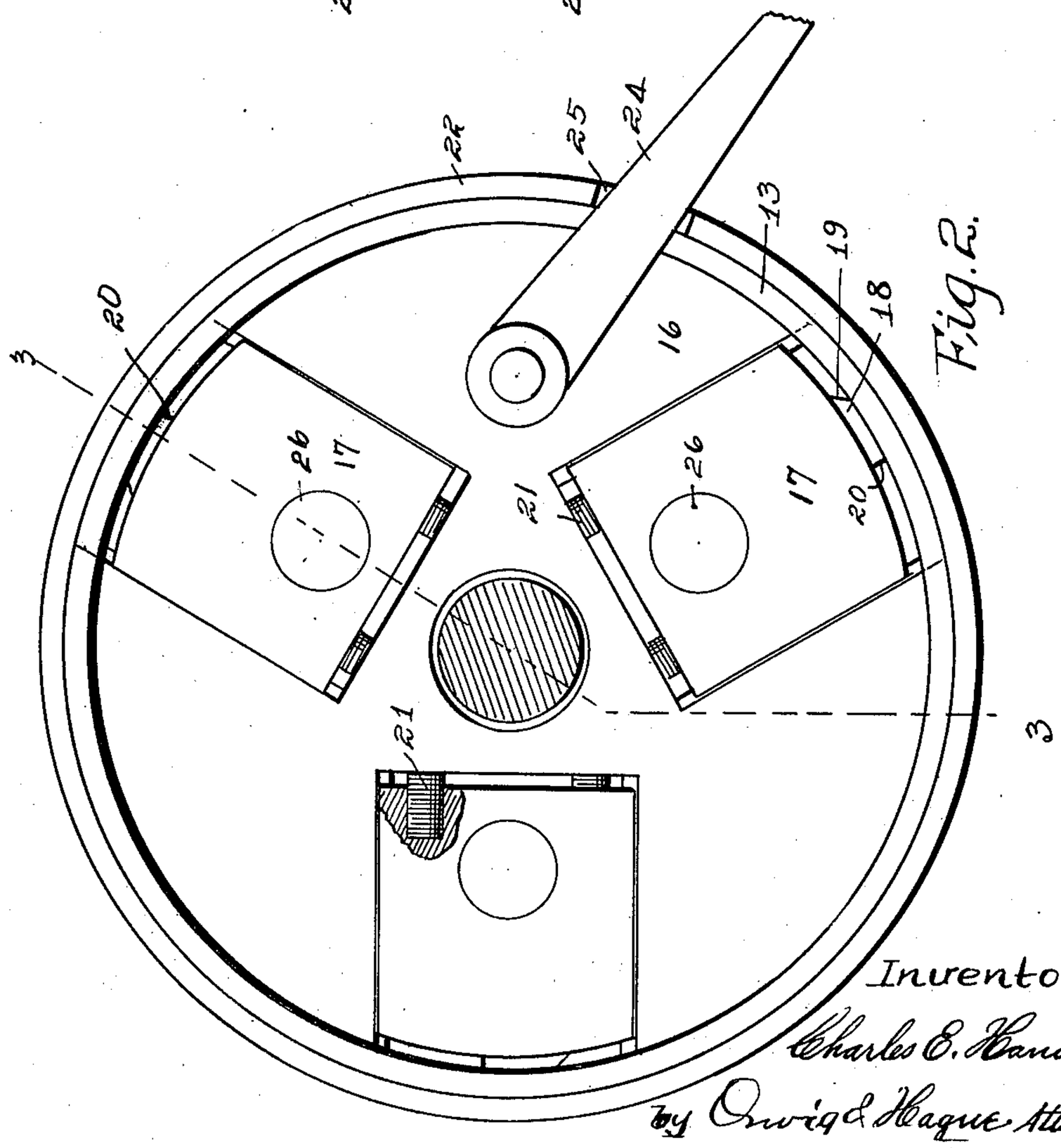

Fig. 2.

Inventor
Charles E. Handel
by Owig & Hague Att'ys

Aug. 20, 1935. C. E. HANDEL 2,011,761

SCREW THREAD ROLLING APPARATUS

Filed Aug. 21, 1933 3 Sheets-Sheet 3

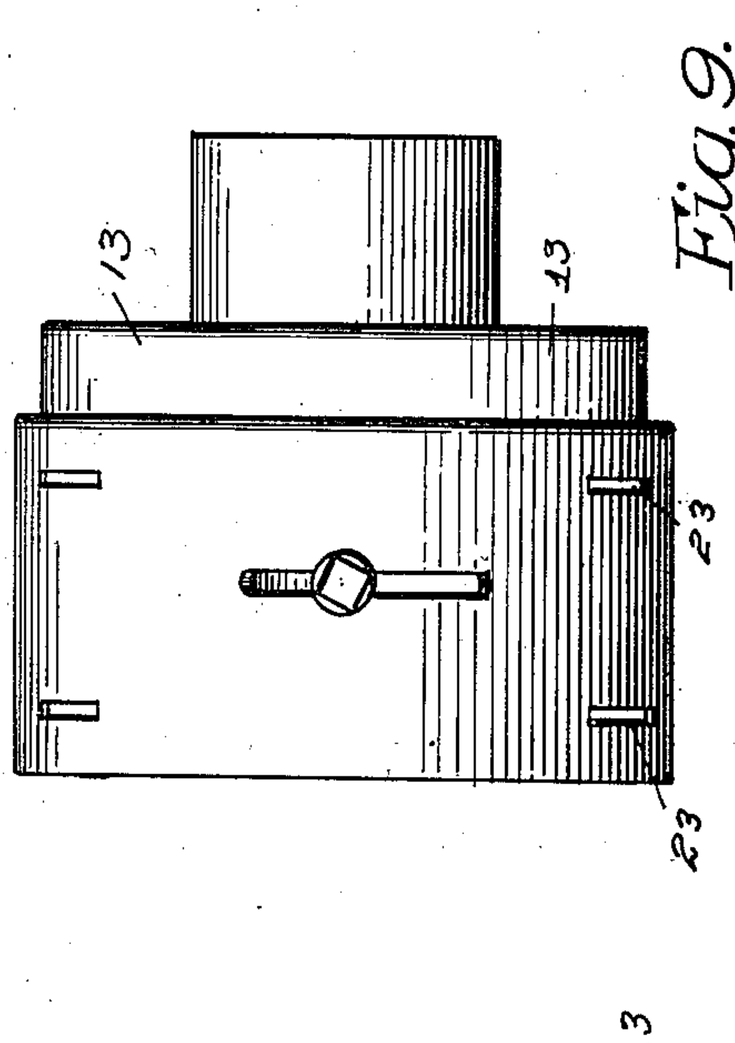

Fig. 8.

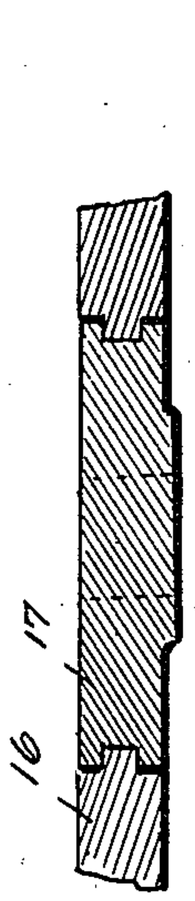

Fig. 9.

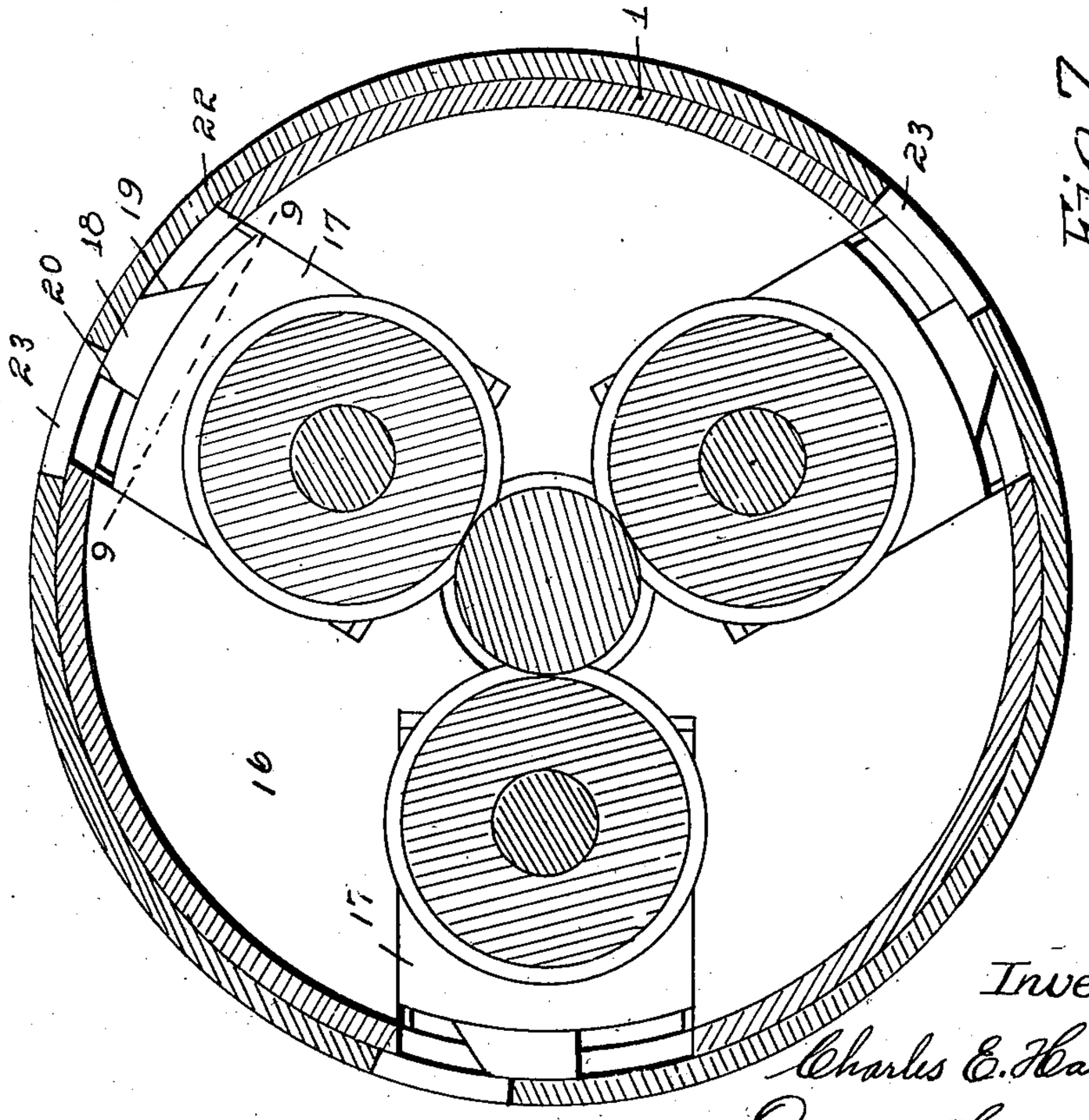

Fig. 7.

Inventor
Charles E. Handel.
by Owig & Hague Att'ys

Patented Aug. 20, 1935 2,011,761

UNITED STATES PATENT OFFICE

2,011,761

SCREW THREAD ROLLING APPARATUS

Charles E. Handel, Winterset, Iowa, assignor to Munson Manufacturing Company, Winterset, Iowa, a corporation of Iowa

Application August 21, 1933, Serial No. 686,083

3 Claims. (Cl. 80—6)

The object of my invention is to provide an apparatus of simple, durable and inexpensive construction for forming rolled threads upon round metal rods, and in which the thread rolling is accomplished by means of a series of cylindrical rollers equally spaced about the rod to be threaded, and which, when rotated relative to the rod, will progressively depress small segmental portions of said rod and form screw thread grooves, and at the same time progressively force small portions of the metal of said rod to flow outwardly radially of the rod to form a screw thread raised above the normal diameter of the rod, and whereby with a minimum of applied power a standard thread may be formed on a metal rod, and whereby the finished rod will have substantially the same tensile strength at the screw threaded portion as it has at an unthreaded portion.

A further object is to provide a screw thread roller of this class, in which, as the screw thread is being formed upon a rod, its complete side faces will be formed, initially at relatively slight angles and uniformly and progressively increasing to greater angles until a so-called standard thread is formed, which will thereby retain the full strength of the material.

My invention consists in the construction, arrangement and combination of the various parts of the device, whereby the objects contemplated are attained, as hereinafter more fully set forth, pointed out in my claims, and illustrated in the accompanying drawings, in which:

Figure 1 shows a side elevation of an ordinary machine lathe having my improved screw thread rolling apparatus applied thereto, having a rod to be threaded supported in position to be operated upon.

Figure 2 shows a vertical, transverse, sectional view through my improved roller supporting head, illustrating the means for moving the rollers inwardly and outwardly, and for locking the rollers at their inward limit of movement.

Figure 3 shows a sectional view on the line 3—3 of Figure 2.

Figure 4 shows an enlarged, detail, side elevation of one of my improved rollers, and a portion of a rod having a screw thread formed thereon.

Figure 5 shows an end elevation of same with the rod in section and illustrating by dotted lines the depth of the screw threaded groove formed in the rod, and the height of the screw thread apex raised above the normal diameter of the rod, and also illustrating by dotted lines the relative positions of the several annular thread rolling ribs upon the roller.

Figure 6 shows a detail, longitudinal, sectional view of a portion of a completed screw threaded rod, and illustrating by dotted lines the relative angularity and shape of the screw thread as it is progressively formed by my improved apparatus.

Figure 7 shows a sectional view through the roller supporting head taken on the line 8—8 of Figure 3.

Figure 8 shows a detail sectional view on the line 9—9 of Figure 8; and

Figure 9 shows an outer side view of the roller supporting head.

Referring to the accompanying drawings, I have used the reference nueral 10 to indicate generally an ordinary machine lathe equipped with the usual sliding pipe supporting standard 11, and having my improved screw thread rolling apparatus applied thereto with a rod 12 to be threaded extended through said apparatus. My improved roller head is applied to the lathe in the same manner in which an ordinary tool supporting head is applied thereto.

My improved roller supporting head comprises a cylindrical body 13 having fixed thereto an end member 14. Fixed in position within the cylinder 13 are the roller supporting disks 16, provided with three radially extended grooves in which are slidingly mounted the roller supporting plates 17. These plates 17, as will be seen in Figure 2, are arranged radially and equidistant, and each plate 17 is provided at its outer end with a lug 18 having one side beveled at 19, and the other side provided with a square shoulder 20 and springs 21 are provided for each of the plates 17 for normally holding the plates outwardly. Rotatively mounted upon the circumference of the cylinder 13 is a cylindrical collar 22 having openings 23 therein to receive the lugs 18.

Assuming that the lugs 18 are projecting out through the openings 23, then as the cylindrical collar 22 is moved clockwise, as shown in Figure 2, the inclined surfaces 19 on the lugs 18 will be engaged by the cylindrical collar 22, and the said plates 17 will be forced inwardly to the position shown in Figure 2, and when the cylindrical collar 22 is moved in the opposite direction, the plates 17 will be moved outwardly by the springs 21.

For effecting this adjustment of the plates 17 I have pivoted to one of the roller supporting disks 16 a lever 24, extended through a slot 25 in the cylindrical collar 22, and so arranged that

when this lever is moved by the operator, it will move the cylindrical collar 22 with it, and by this means it is obvious that the roller carrying plates 17 may be moved inwardly against spring pressure and locked at their inward limit of movement, and may also be released and moved outwardly by their springs when the lever 24 is moved in the proper direction.

Mounted in each one of the three pairs of roller supporting plates 17 is a thread forming roller. This thread forming roller is formed of a single piece of material and is provided with centrally arranged bearings 26 in its ends. These bearings are mounted in the roller supporting plates 17.

Formed upon the periphery of the roller is a series of annular thread rolling ribs, with annular thread rolling depressions between them. One of these ribs, which is intended to perform the initial thread rolling process, is arranged at the end of the roller which I have referred to herein as the starting end, and this rib, indicated by the numeral 27, is formed with straight flat side faces arranged with relatively slight degrees of angularity relative to the surface of the cylinder, and the flat side face of said rib 27 on the side opposite from the starting end of the rollers extends to the bottom of the thread forming groove indicated at 28.

The second one of said thread rolling ribs from the starting end of the roller has its apex indicated by the numeral 29, and the next thread groove between the ribs is indicated by the numeral 30. The apex 29 of said rib projects radially outwardly from the center of the roller farther than the apex of the rib 27, and also the bottom of the groove 30 extends deeper into the roller than does the bottom of the groove 27, and in addition thereto the sides of said rib are straight from the apex 29 to the bottom of the groove 30, and are arranged at a greater degree of angularity than that of the corresponding side of the first thread rolling rib at the starting end of the roller.

This same arrangement is carried out in the construction of several of the remaining thread rolling ribs, each one progressively, from the starting end to the finishing end of the roller, has its apex projected farther outwardly from the center of the roller than the preceding one, and has its thread forming groove extended deeper into the roller than the preceding one, and the sides of the ribs are progressively arranged at greater degrees of angularity, and the last rib at the finishing end has its sides of such angularity as will in operation form what is known as a standard thread.

These rollers, preferably three, are mounted in their supporting plates 17 with their axes of rotation parallel radially with the axis of rotation of the roller supporting head, but each of the rollers has its axis inclined slightly in a lateral direction relative to the axis of rotation of the roller head, as clearly shown in Figure 5.

In practice and assuming that it is desired to thread a rod, and assuming that the roller head and rod are supported on a lathe in the manner illustrated and described with the rod supporting standard capable of free longitudinal sliding movement, then the roller head is rotated and the rod fed into it until the apex of the starting rib 27 engages the rod. When the head has been rotated approximately one-third of a revolution, then the apex of the rib 27 on the second roller will enter the groove in the rod formed by said rib on the first roller, because the second roller is spaced slightly in the rear of the first, and this same action will occur with the apex of the rib 27 on the third roller, because it also is spaced slightly in the rear of the second roller.

Since the rollers are locked against outward movement, it is obvious that a rotation of the head must force the annular ribs on the rollers into the material of the rod, and form a screw thread thereon. The apex of the starting rib 27 is relatively blunt, that is to say, its sides are arranged on relatively slight angles. However, this rib, due to the structure and arrangement of the roller, will penetrate the surface of the rod being rolled only for a relatively short segmental portion, as illustrated in Figure 5, where the line 31 indicates the line of the rib apex 27, and the line 32 indicates the normal circumference of the rod being rolled, and then when the said annular ribs on the rollers, near the finishing end of the roller, pass through this same screw thread on the rod, they will penetrate the rod much deeper and through segments of greater length, as shown by the dotted line 33 in Figure 5.

By this arrangement each annular rib on the roller requires about the same amount of pressure to cause it to perform its part of the thread rolling operation, because those ribs which have their sides at slight angles penetrate the rod to a less depth and through shorter arcs, and those ribs toward the finishing ends of the rollers which penetrate the rod deeper have their sides at greater angles and operate on the rod through greater arcs, as shown in Figure 5, and the latter annular ribs have the threads more or less completely formed before they engage and do their work upon the rod.

One of the important results which I attain by the use of my improved apparatus is that while the initial part of the thread is being formed upon the rod, a groove in the rod is formed, which is comparatively shallow, but the sides of the groove are arranged on relatively slight angles, and these sides are straight from the bottom of the groove to the apex of the next thread. This is illustrated by the dotted lines 34 in Figure 6, and when the second thread forming rib 29 is passed through the thread on the rod to form a thread, the bottom of the groove is slightly deeper as shown at 35 in Figure 6 and between these grooves 34 and 35 the pressure upon the rollers will cause the material of the rod to flow outwardly radially of the rod to a point beyond the normal diameter of the rod, thus forming a slightly raised thread portion with the sides between the bottom of the groove and the apex of the thread, and which are smooth and flat, and which are arranged at greater angles relative to the longitudinal axis of the rod, as illustrated by the dotted lines 36 in Figure 6, and then when the finishing rib on the roller is passed through the same thread on the rod, the groove is formed of greater depth into the rod, and the rib is pressed outwardly still farther beyond the normal diameter of the rod, as illustrated by the solid lines 37 in Figure 6.

I have found in practice that by thus progressively deepening the groove, and causing a flow of metal outwardly from the normal diameter of the rod, and that by keeping the sides of the rib substantially straight at all times during this rolling operation, the apex of the screw thread on the rod will not only retain the normal strength of the material of the rod, but will be additionally strengthened by this rolling on the familiar principle of annealing metal by such working.

One of the advantages of my improved apparatus is that a thread may be formed of any desired length upon a rod.

In Figure 4 of the drawings I have used the dotted line 38 to indicate upon said figure the position of the normal or unthreaded surface of the rod being operated upon, and I have used the dotted line 39 to indicate that the annular thread forming ribs on the roller progressively penetrate deeper into the rod during a thread rolling operation, and I have used the dotted line 40 to indicate that the apex of the thread being formed on the rod projects beyond the normal surface of the rod progressively greater as the finishing end of the roller completes its operation.

In practice I have employed one or more additional annular ribs at the finishing end of the roller, all of the same diameter and shape, and these additional annular ribs are useful not for purposes of shaping the thread, but for polishing or smoothing it. I have, however, found in practice that a satisfactory thread may be rolled upon a rod with rollers having three or four annular thread rolling ribs of gradually increasing diameter toward the finishing end of the roller, and with grooves between them of gradually decreasing diameter toward the finishing end of the roller.

In the accompanying claims where I refer to the finishing end portion of the roller, I do not desire to be understood as limiting the claims to the last annular rib on the roller if there are several such ribs of the same size and shape, but desire to be understood as referring to that portion of the roller at which the major operation of shaping the screw thread on the rod is completed.

I claim as my invention:

1. In a thread rolling device of the class described, a roller substantially cylindrical in form and having formed on its periphery a series of annular ribs with grooves between them, the diameters of said ribs being progressively increased from the starting toward the finishing end of the roller, and the diameters of said grooves being progressively decreased from the starting toward the finishing end of the roller.

2. In a thread rolling device of the class described, a roller substantially cylindrical in form and having formed on its periphery a series of annular ribs with grooves between them, the diameters of said ribs being progressively increased from the starting toward the finishing end of the roller, and the diameters of said grooves being progressively decreased from the starting toward the finishing end of the roller, and the angularity of the sides of said thread forming ribs and grooves on the roller being progressively greater from the starting end toward the finishing end of the roller.

3. In a thread rolling device of the class described, a roller substantially cylindrical in form and having formed on its periphery a series of annular ribs with grooves between them, the diameters of a number of said ribs being progressively increased from the starting toward the finishing end of the roller, and the diameters of a number of said ribs at the finishing end of the roller being substantially the same, and the diameters of a number of said grooves at the starting end of the roller being progressively decreased from the starting toward the finishing end of the roller, and a number of grooves at the finishing end of the roller of substantially the same diameter.

CHARLES E. HANDEL.