No. 859,642. PATENTED JULY 9, 1907.

C. L. CUMMINGS.

THREADING TOOL.

APPLICATION FILED SEPT. 11, 1905.

3 SHEETS—SHEET 1.

Fig. 2.

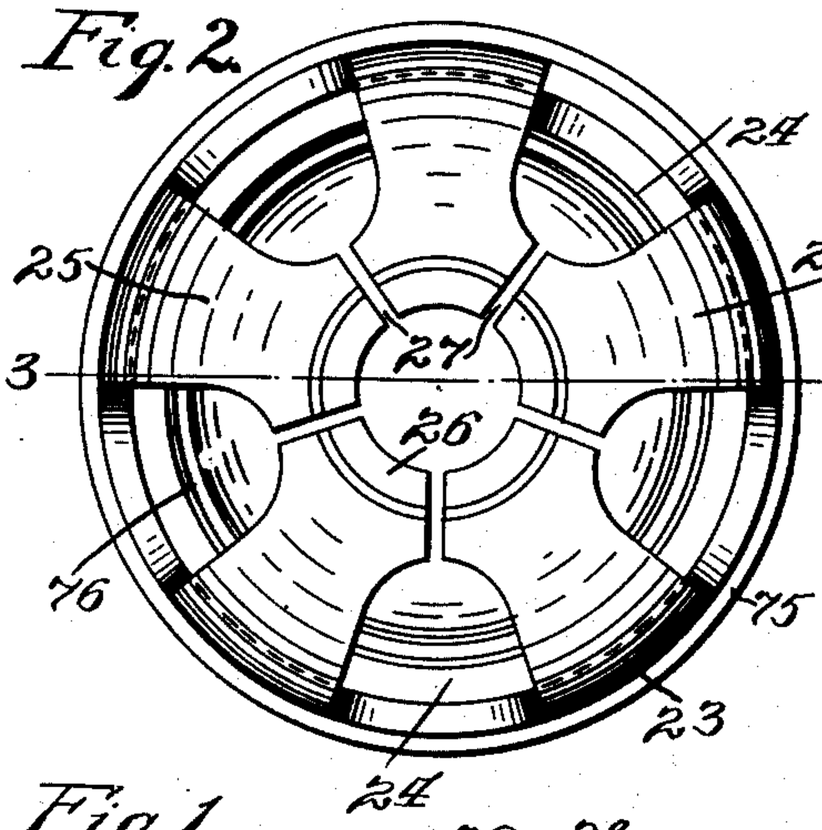


Fig. 4.

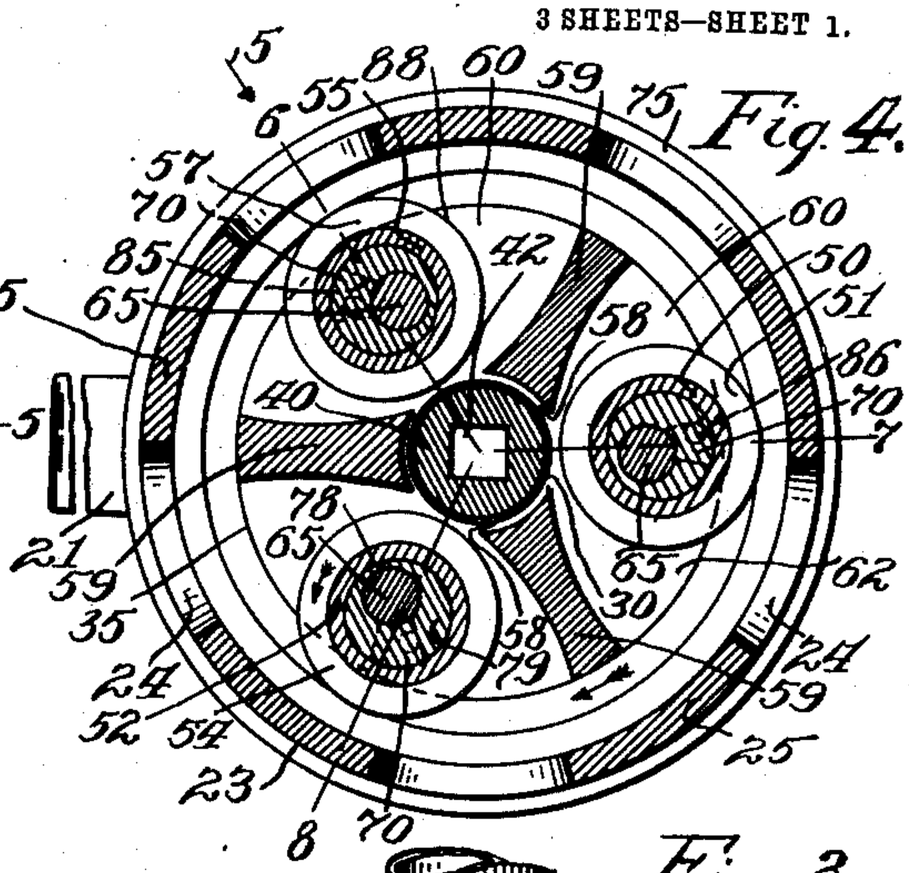


Fig. 1.

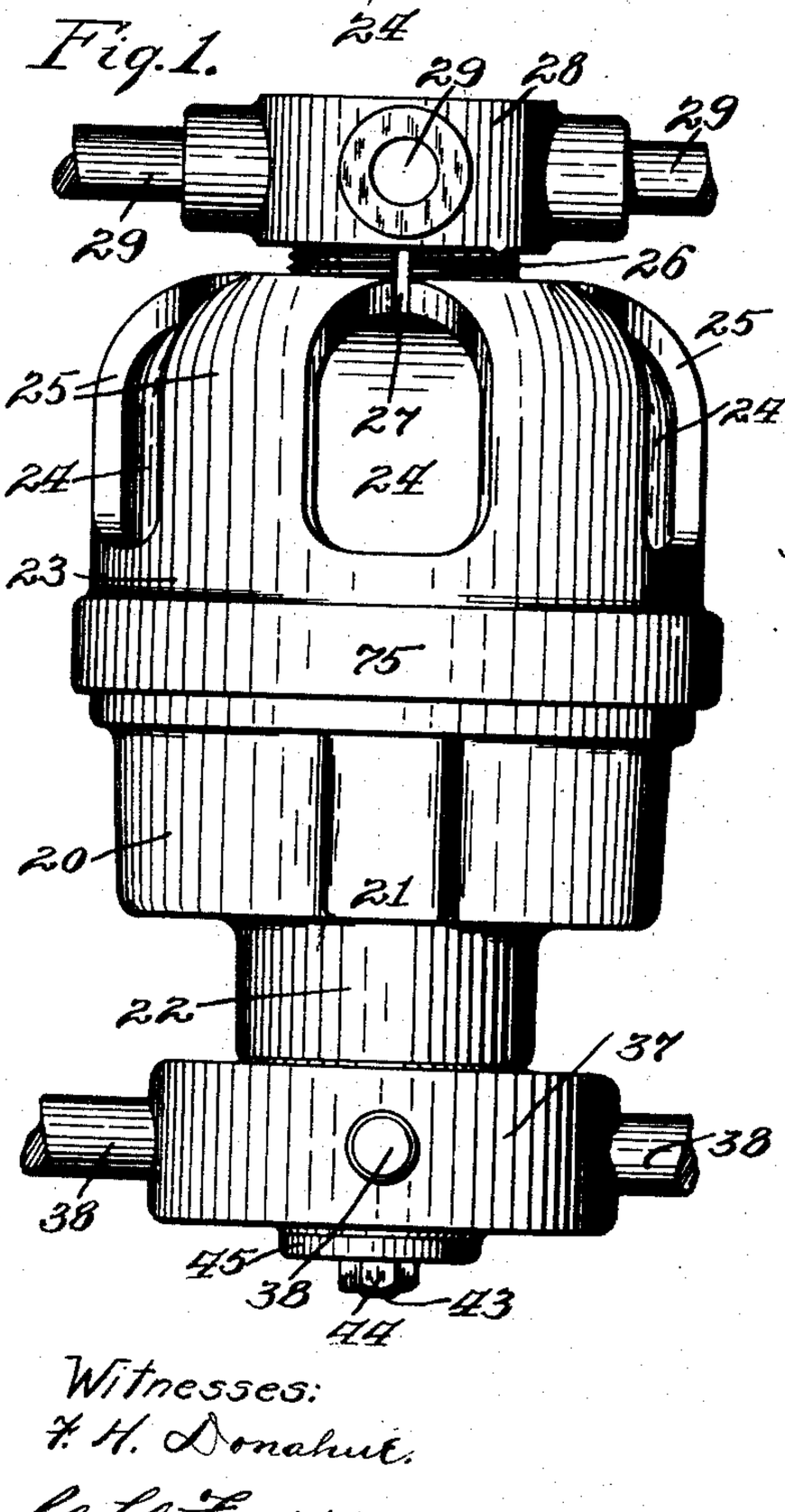
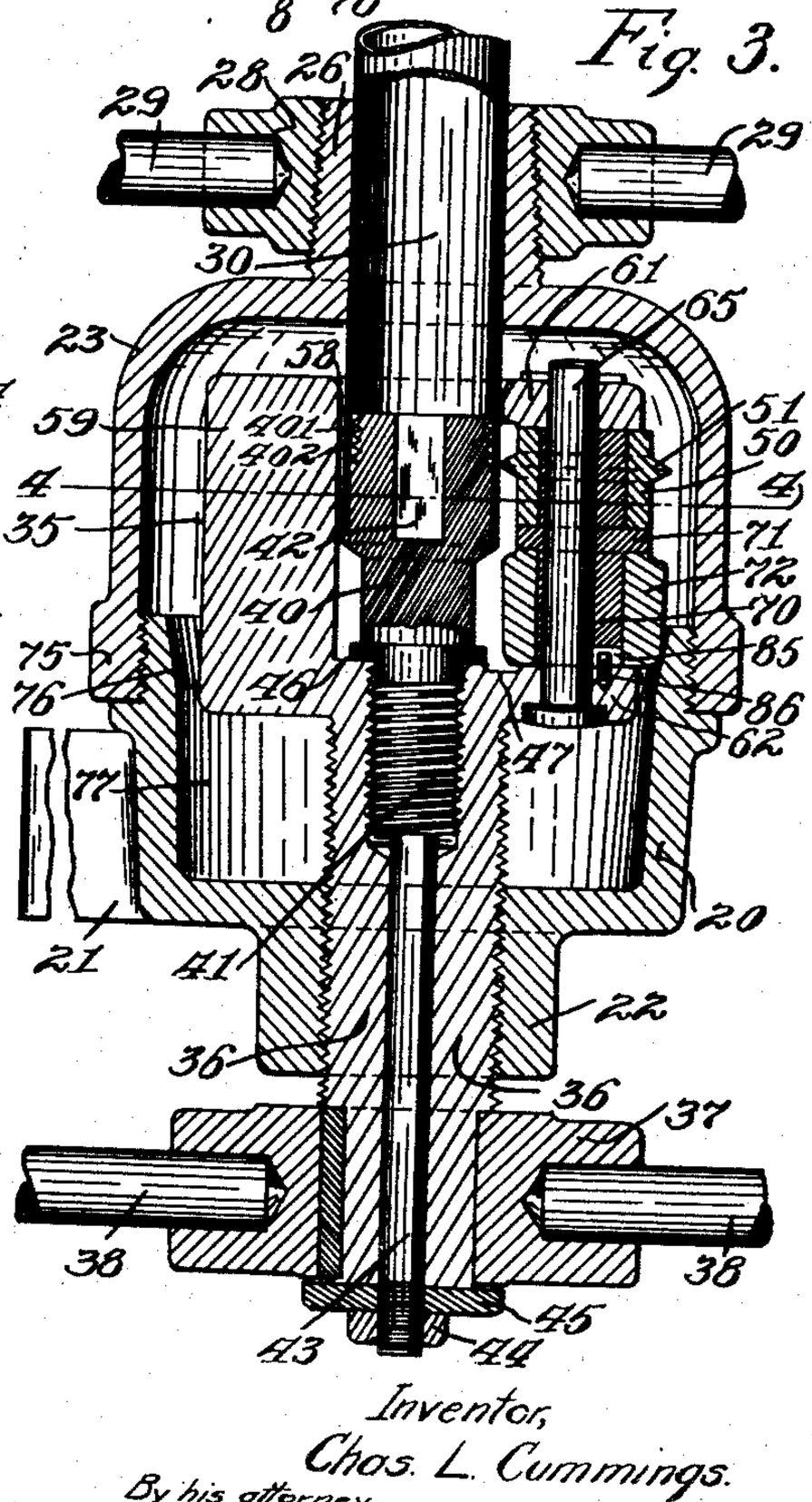


Fig. 3.



Witnesses:
F. H. Donahue.
C. C. Fuss.

Inventor,
Chas. L. Cummings.
By his attorney,
F. H. Richards.

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3 SHEETS—SHEET 2.

Fig. 12.

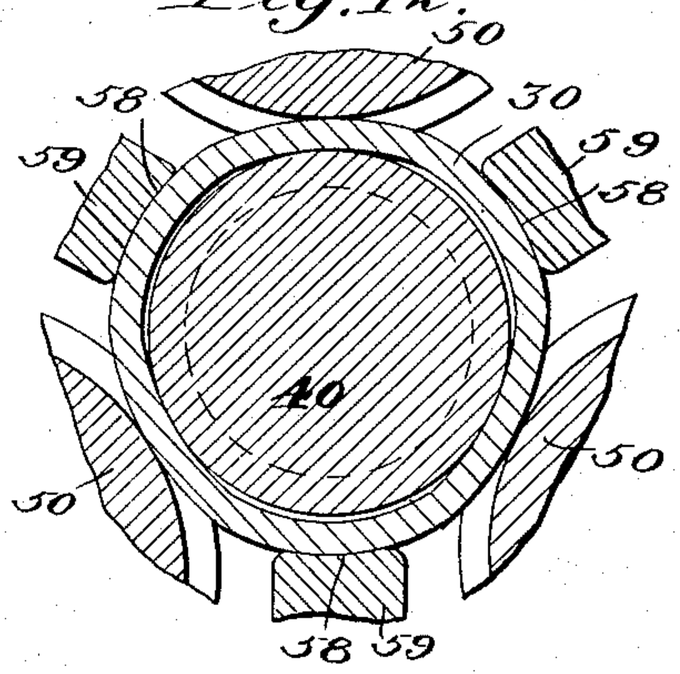
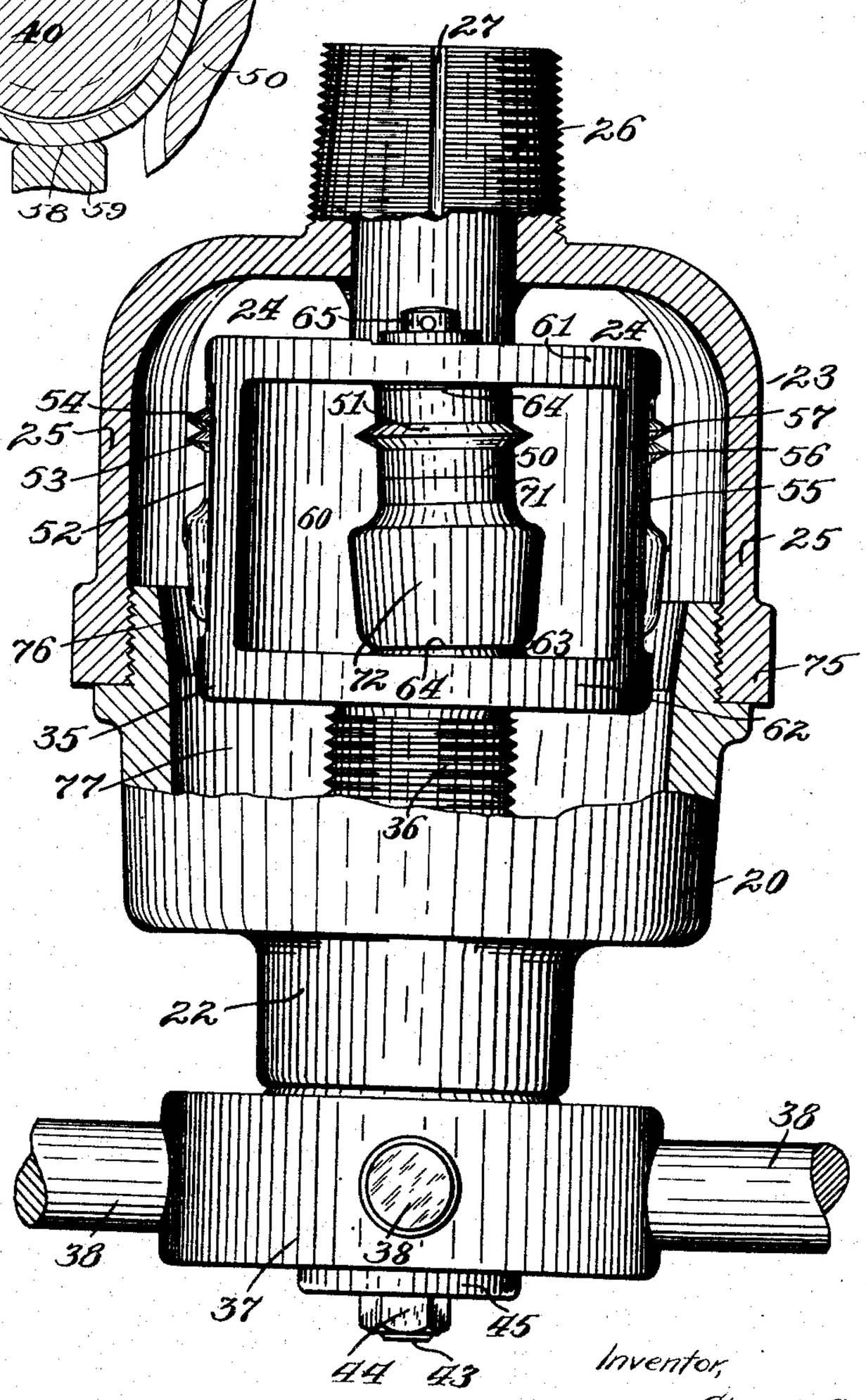


Fig. 5.



Witnesses,
F. H. Donahue
C. C. Tuss.

Inventor,
Chas. L. Cummings.
By his attorney,
F. H. Richards.

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3 SHEETS—SHEET 3.

Fig 6.

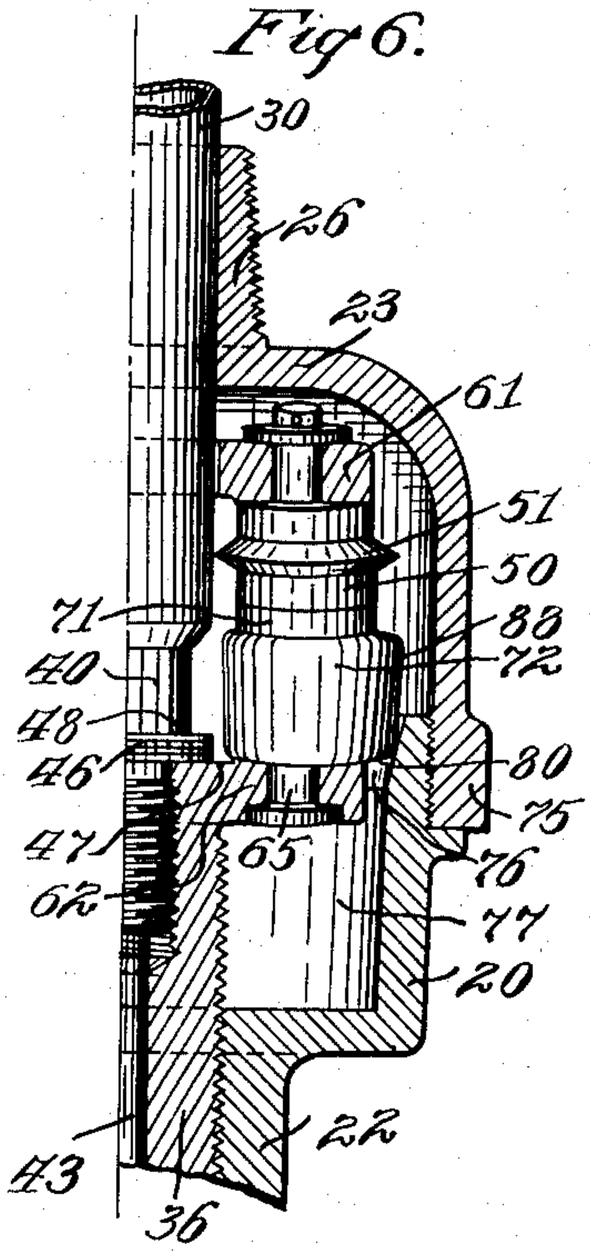


Fig 7.

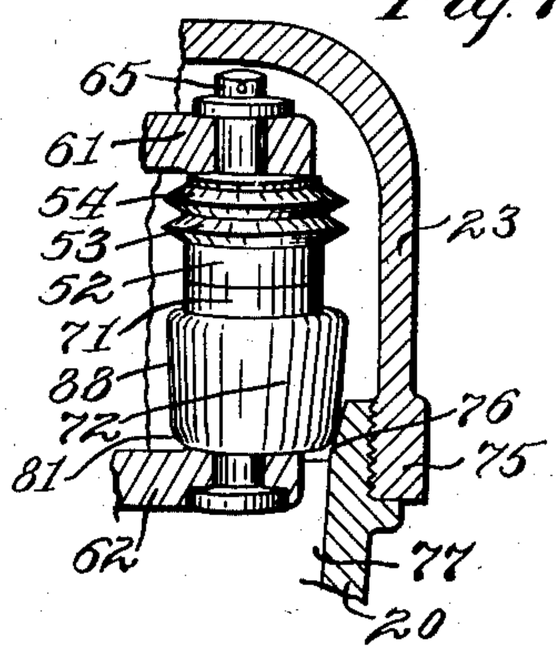


Fig 8.

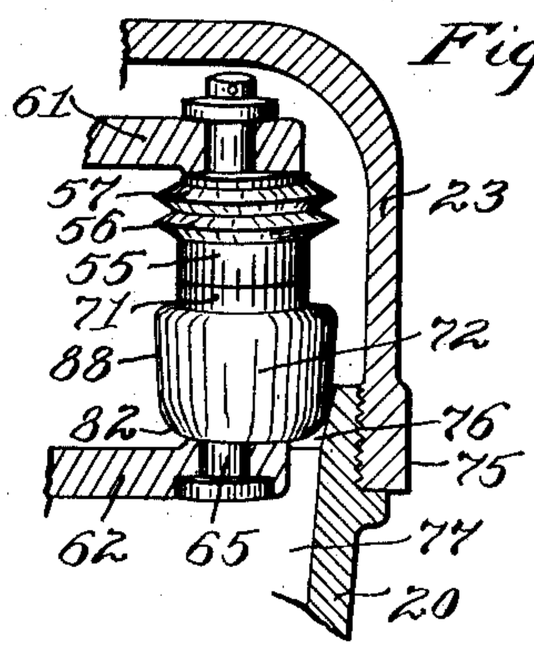


Fig 9.

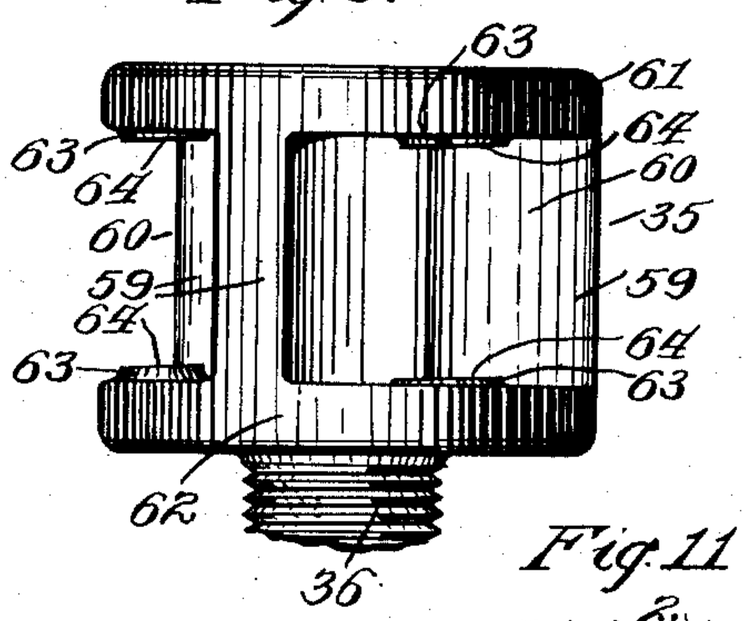


Fig 10.

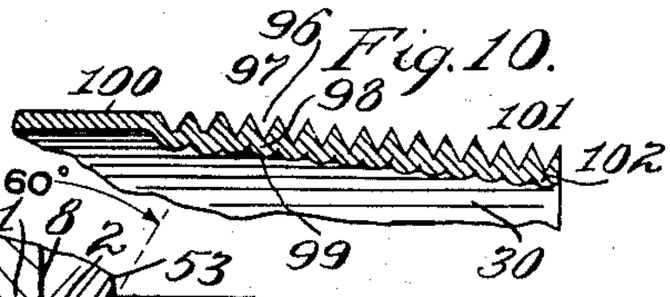
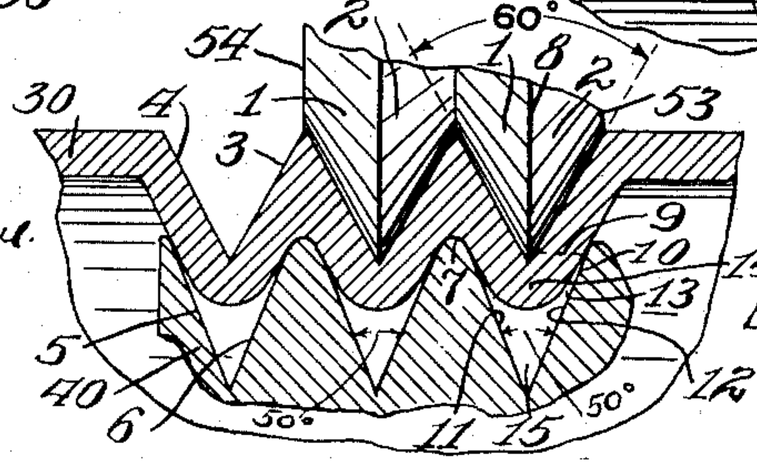


Fig 11



Witnesses,
F. H. Donahue.
C. C. Tuss.

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By his attorney
F. H. Richards.

UNITED STATES PATENT OFFICE.

CHARLES L. CUMMINGS, OF NEW YORK, N. Y., ASSIGNOR TO CUMMINGS MACHINE COMPANY, OF NEW YORK, N. Y., A CORPORATION OF NEW YORK.

THREADING-TOOL.

No. 859,642. Specification of Letters Patent. Patented July 9, 1907.

Application filed September 11, 1905. Serial No. 277,828.

To all whom it may concern:

Be it known that I, CHARLES L. CUMMINGS, a citizen of the United States, residing in New York city, in the county of New York and State of New York, have invented certain new and useful Improvements in Threading-Tools, of which the following is a specification.

This invention relates to means for forming screw threads on metal tubing, and has for its object to provide means for the formation of standard screw threads on the exterior of metal tubing such as approximates in thickness the height of the thread, and producing such thread without the material reduction of the thickness of the tubing at points between the thread bases, and without any appreciable change in the length of the tube, and which means may also in the screw forming operation taper the end of the tube and produce a thread of tapering spiral disposition for producing a standard taper screw thread on thin metal tubing without removal of the metal or the reduction of its radial thickness at the juncture of base-lines, or appreciable change in length of tubing; and wherein the taper of the end of the tube is automatically and positively determined by the apparatus, and embodies one or more forming tools for engaging the exterior of the tube and forcing the metal into screw threads, and a co-operating mandrel for engaging the interior of the tube and controlling and directing the flowage of the metal displaced by the forming tool in the making of such threads.

In threading pipes for pipe fitting purposes the same are generally provided with a thread of a standard pitch and the threaded end is given a taper in many instances at about three-quarters of an inch to the foot. This enables the piping to be used with standard couplings and the taper not only compensates for slight variations in the sizes of the couplings, but also enables the couplings to be re-applied to the pipes after they have been removed for any purpose, and screwed down so tightly that the coupling will occupy a new position upon the tubing and secure a perfectly tight joint.

In certain classes of work, as for instance brass and copper tubing, it has been found that the tubing must be thicker than is really necessary in order to accommodate the screw-threads, and particularly the tapering portion of the screw-threaded end. Since the coupling will not in many instances surround the entire screw-threaded end, the portions which are exposed will therefore reduce the strength of the pipe to the strength of the thickness of the metal between the meeting point of the bases of adjacent portions of the thread and the inside perimeter of the tube. Consequently the tubing must be much heavier than is actually needed throughout its entire length so as to bring enough metal below the screw thread to withstand strains to which the tubing is subjected. Thus, in such tubing as brass or copper there is a large waste of material, which consequently involves unnecessary expense.

By my present improvement I am enabled to employ tubing of about one-half the thickness heretofore required and to put upon such tubing a standard taper screw-thread, and the tubing in some instances may be of a thickness about equal to the height of the thread employed. Were such threads directly cut upon the tubing they would cut through the tubing in places and dangerously weaken it in others. By the proper disposition of the metal during the forming operation, its thickness at the bottom of the groove between the screw-threads will be no less than its thickness throughout the unscrew-threaded body of the tubing, thus producing a screw-threaded end which is no weaker than the tubing by which it is carried.

Before coming to a detailed description of the drawings, it may be stated that broadly the apparatus herein illustrated embodies means for acting upon the inside and outside of a tubing simultaneously in the formation of a screw thread upon it; and that the forming tools acting upon the outside of the tubing will coöperate with an inner forming tool which for convenience will be called a screw-threaded mandrel upon the inside of the tubing, the tools and the mandrel being respectively revolved and rotated about the axis of the tube and commence the screw-threading operation inwardly of the tube and work toward the end of the tube, so that as the screw-thread is completed the forming tool will run off of the end of the tube and immediately thereafter the mandrel will screw out of the recently formed screw-thread. The advance of the tool in an axial direction during each of its revolutions will be equal to one pitch distance of the thread being formed.

Many of the details which coöperate in the efficient working of the tool will be brought out in their proper relations in the detailed description which will follow.

The drawings accompanying and forming a part of this specification illustrate a form of embodiment of the present improvement, in which drawings

Figure 1 is an elevation of the device and considering the same in the position it will assume when in use it will be a bottom view, certain of the interior parts have been omitted from this view since they are clearly shown in other parts of the drawings. Fig. 2 is an end view of the casing and shows the clamping portion or chuck. Fig. 3 is a central longitudinal sectional view in about the line 3—5 of Fig. 2. Fig. 4 is a cross section taken in about the line 4—4 of Fig. 3. Fig. 5 is an enlarged view showing portions of the device in longitudinal section and other portions in elevation; this view in its sectional portions may be assumed to be taken in about the line 3—5 of Fig. 2, and looking at the portions shown in elevation in the direction of the arrow 5 in Fig. 4. Figs. 6, 7 and 8 are longitudinal

sectional views taken in the radial lines 6, 7 and 8 respectively of Fig. 4; Figs. 7 and 8 showing less details than does Fig. 6. Fig. 9 is an elevation of the tool carrier head. Fig. 10 shows a longitudinal section of tubing threaded by a device embodying the present improvement; Fig. 11 is an enlarged detail representing the manner in which the thread forming tool and the mandrel co-operate in the formation of screw threads on metal tubing; and Fig. 12 is a detail showing relation of the mandrel, the outer forming tools, the tube and thrust faces for bearing upon the tube during certain times in the operation upon the tube.

The device is illustrated as supported and partially housed by a framing or casing member 20, which has a flange or wing 21 that may be clamped in a vise for supporting the device, which in its present form is a hand tool intended to be carried about by a workman in his kit of tools. The casing is shown as provided with an interiorly screw-threaded hub 22, and also having screw-threaded connection with a cap portion 23, which two portions together house the operative parts. The cap portion is shown as provided with a number of openings 24, leaving the intermediate arm-like portions 25 substantially resilient when the screw-threaded hub 26 is longitudinally slitted as at 27. The hub 26 is shown as having a tapered thread, so that a nut 28 may be, by means of suitable spanner pins 29, screwed down on the hub to press its portions against a pipe or tube 30 for clamping the same in position for treatment, and constituting a chuck. The forming tools and mandrel are carried by a head 35 having fast with it a screw-threaded shaft 36 engaging with the screw-threads of the hub 22, and which shaft is shown as having keyed upon it a wheel 37 having sockets for receiving suitable spanner pins 38. The mandrel 40 for entering the end of the tube which is to be operated upon is concentrically located in the head and has upon its exterior a working face disposed in a plane at an angle to the axis of the mandrel, and in the form herein illustrated is a spiral groove 401 and a screw-thread 402 corresponding in pitch to the pitch which is to be given the finished thread, and the screw-threads on the hub 22 and shaft 36 also correspond to the pitch to be produced. For instance assuming that a thread is to be made having fourteen threads to the inch, the mandrel will be provided with fourteen threads to the inch, as will also the shaft 36, the mandrel will be made smaller than the interior of the tube and sufficiently small so that as the tube is reduced in diameter in the making of the thread and in the making of the taper on the tube it will screw out readily as the screw-thread is completed. Since the mandrel and the forming tools move in unison about the same center, each forming tool will be working upon the same portion of the mandrel after they have been set in position. This will, owing to the fact that the tube moves between the forming tool and the mandrel, have a tendency to wear away the mandrel below the point of engagement of the forming tool, to which end it may be convenient from time to time in practice to rotate the mandrel slightly relatively to the forming tools and, bring a new working face of a mandrel below the point of engagement of each tool. A rotation without a movement of the mandrel in an axial direction would bring the groove in the mandrel at a wrong position relative to the angular face of the forming tool; consequently the pitch of the thread upon the mandrel must be had in consideration in the movement of the mandrel, and it is shown in the present instance as provided with a shank 41 having a screw-thread engaging the screw-threaded interior of a socket in the shaft 36, the pitch of the screw-threads upon which said socket and shank correspond with the screw-threads on the shaft 36 and upon the mandrel. The mandrel may be provided with a key opening 42 for receiving a suitable key for turning the mandrel, and the shank 41 may be continued into a stem 43 passing out of the end of the shaft 36, where it may be engaged by a nut 44 resting upon a washer 45, which washer may be of larger diameter than the shaft 36 for preventing the wheel 37 from being displaced from the shaft. A number of thin washers 46 may be interposed between the face 47 of the head and a shoulder 48 formed on the shank of the mandrel, and when it is desired to shift the mandrel axially the nut 44 may be removed, the shank 41 screwed out of its socket and one or more of the washers removed, when the parts may be replaced, which will then give a different axial position to the mandrel and bring a new working face opposite the forming tool.

Three forming tools may be used for coöperating with the mandrel in the formation of a screw-thread. These are illustrated herein as comprising a forming tool body 50 having an angularly shaped engaging roller, as it were, 51; a forming tool body 52 having two such rollers 53, 54; and a tool body 55 also having two tools 56 and 57. When the operation is inaugurated the tool 51 will engage the metal, after which the tool 53 will be brought into engagement with the same groove which is being formed, and then after the point at which the tool 51 engaged the work is advanced an angular distance of 120 degrees the tool 56 will be brought in contact with it, and then after the tool has been advanced a complete rotation and the tool 51 is advancing in the second round of the tube, the tool 54 will be entering the groove at the position of inauguration, a further advance of 120 degrees will bring the tool 57 into such poesition. It will readily be seen that one or any desirable number of tools may be employed, but by the employment of three tools the working thrust of one tool will be compensated for by the other two, so that any tendency of the tube to move away from one tool will ordinarily facilitate the working of the others.

The faces 58 of the partitions 59 between the tool chambers 60 also serve to sustain the tubing, particularly against distortion during the threading operation.

The angular faces of the forming tools must be so disposed relatively to the work that not only will they properly form the metal with which they come in contact, but as they leave the groove which they have formed they will do so without marring the walls of the same. One way of accomplishing this is to set the axis of rotation of the forming tools at an angle of 90 degrees to the line of the contemplated thread, which will bring the axis of rotation of such tools at an angle to the axis of their revolution, which is also the axis of the shaft 36. This angular disposition is more clearly seen in Fig. 5. The head 35 for carrying the tools, and which may be called a tool carrier, is illustrated in Fig. 9, to which reference is now made,

and which head may be assumed to be a casting. Suitable recesses 60, heretofore alluded to as tool chambers, are shown in its sides, there being three of such recesses shown, which leave a head plate 61 and a head plate 62, upon which heads are shown bosses 63, the faces 64 of which may be dressed off for giving proper angle and pitch distance to the forming tools, the end face of the body portions of which bear against said faces 64. One way of dressing said faces is to screw the shaft 36 into a suitable "jig" and run a facing grinder between the bosses 63 on the respective heads, the jig being so positioned that the faces 64 will be at the proper angle for the pitch of the screw-thread which is to be made; then the head will be turned 120 degrees in a right-handed direction to bring the second recess 60 opposite the grinding tool, which rotation will shift the head in an axial direction one-third of a pitch distance; then the head will be turned another 120 degrees to bring the third recess 60 opposite the grinding tool, and which rotation will have again moved the head axially one-third of a pitch distance so that the height of the bosses 63 on the plate 62 will gradually increase in height, and the height of the bosses 63 upon the plate 61 will have similarly diminished. Then by placing all the tools 51, 53 and 56 the same distance from the end faces 58 of their body portions, which abut the faces 64, such tools will be placed the proper axial distance apart, so that they will follow a thread forming groove one after the other in a proper manner for producing a spirally disposed thread.

The plates 61 and 62 are bored through the bosses 63 for receiving spindles 65 upon which the forming tools are mounted. Such spindles may be held in position by suitable cotters. Upon each spindle is mounted an eccentric member 70; that is, it is of a general cylindrical formation and has an eccentrically disposed bore forming a working fitting with the spindle and is provided in its central portion with a flange 71, the respective forming tools are mounted on the eccentrics at one side of the flanges with a working fit, and at the other side of which flange a sheave 72 will be mounted on each of the eccentrics. These sheaves and eccentrics are for coöperation with suitable cam faces for bringing the tools to their working position, and after they have been brought to the work gradually pressing them toward the center of the same for producing the desired taper upon the screw-threaded portion.

It will be seen by referring to the various figures of the drawings that the point of juncture between the cap portion 23 and the rest of the casing is in the nature of a reinforce 75, the inner portion of the casing 20 constitutes a cam of conoidal formation, it having an angular face 76 and an angular face 77 at a more acute angle to its axis. The face 76 is for engaging the sheaves 72 as the same are moved axially during their revolution, incident to the axial movement of the head upon rotation of the shaft 36. The engagement of the face 76 with the corners of one of the sheaves will cause it to press upon the eccentric 70, which will squeeze it around so that its thinner portion 78 (see Fig. 4) will be advanced in the direction of the arrow, which is the direction of rotation of the sheave 72 by virtue of its engagement with the face 76, the head moving in the direction of the arrow upon it in said Fig. 4. This will bring the thinner portion 78, before referred to, between the sheave 72 and the spindle 65 toward the other side of the head, and will bring a thicker portion 79 between the spindle and the portion of the sheave toward the center of the head, and which will bring such thicker portion of the eccentric between the body portion of the tool which is in engagement with the work and the spindle and press it into the work.

By referring to Figs. 6, 7 and 8 it will be seen that the sheave for controlling the tool body 50 has a sharper corner 80 than is the corner 81 of the sheave for the tool body 52, and that the sheave for the tool body 55 has a more rounding corner 82 than has the sheave for either of the other tools. These are so proportioned and adjusted that the tool on the body 50 will first be brought into operation and then each of the other tools in succession.

When it is desired to place a piece of work in the device, it is placed in any suitable vise and the vise will be screwed up upon the flange or web 21; then the chuck portion of the casing 23 will be loosened by unscrewing the nut 28. The tube may then be inserted over the mandrel, the end of which tube in entering the tool will engage the angular faces of the forming tools and press them outward from the position they assumed after they completed the last piece of work, in which position a thick portion of the eccentric is located toward the center of the head. The tube will cause the reverse action which caused the bringing of the tools to such position and will throw them outwardly. This does away with any special device for throwing the tool into working position. The lower faces of the eccentrics may be cut away as at 85 to form a stop, in connection with a suitable pin 86, which will prevent overthrow of the eccentrics and prevent the same from coming to dead center.

The threading operation commences at the end of thread farthest from the end of the tube, and after the tube has been placed in the chuck portion and fastened therein, the wheel 37 will be turned in an unscrewing direction, causing the forming tools to run about the outside of the tube and the shaft 36 to unscrew from the hub 22, which will bring the faces 80, 81 and 82 successively into engagement with the face 76, when one or two turns will rapidly draw the forming tools into screw-threading engagement with the tubing, after which continued rotation of the shaft 36 will bring the faces 88 of the sheaves into engagement with the gradually tapering face 77 and the screw-threading will continue producing the desired taper, the tools traversing a tapering helical path. After the tools have completed their work, they will run off the end of the tube and one or two more turns will be sufficient to bring the mandrel from the work, it being, as before stated, of less diameter than the smallest diameter of the tapered end of the tube, so that it will readily run out, after which it is only necessary to release the chuck to remove the threaded tubing.

In making screw-threads on tubing by means of the present improvement, the forming tools give the thread its proper formation by displacing the metal radially inwardly of the tube, and longitudinally of the axis of the tube, and the screw-threaded mandrel receives the displaced metal as it is caused to flow from the forming

tool and controls and directs its flowage, preventing the displacement of the metal between threads at the base line from reducing the thickness at such locality below that of the original thickness of the tube.

The action herein contemplated is an active molecular redistribution throughout the metal being acted upon, and is to be distinguished from bending large areas of the metal, as for instance, in corrugating where there is of course at the summits of the corrugations an amount of flowage and an amount of displacement, yet applicant believes that during the thread formation produced by the present device the entire mass of metal is subjected to flowage and forging action, which takes the form of a redistribution of the molecules of the metal.

In Fig. 10, which represents product of a tool embodying the present improvement, it will be seen that the screw threads are standard height, and are of a height which is greater than the radial thickness of the original metal 100 of the tube, and that the groove 96 at the portion 97 leaves the thickness of metal 98 between the apex or bottom of the groove and the inside surface 99 about as thick as the original metal 100, and that at the region 101 where the screw threads are given a taper the portion of the metal 102 is as thick as it is at the portion 98 or in the unworked part of the tube 100. It will be seen that threads of standard height could not be cut upon such a tube, since it would cut through when it got down to the tapering portion. It has been the practice when it has been desired to cut screw threads upon thin tubing to cut a thread less than standard, which of course produces a weak thread, and also requires that the couplings with which it is intended to use the threaded tubing must be special, since standard threads on these would not match up with the special threads upon the tubing. Or the practice has been in other instances to employ tubing much thicker than that required merely to get sufficient thickness and strength of metal at the roots of the threads. Both of these expedients it will be seen are expensive, since special threads, which are not so strong as standard, require special dies and taps, and if thicker tubing is employed than that needed it means additional expense for metal, which in brass and copper tubing greatly adds to the expense and the unnecessary amount of metal also adds to the weight of the structure, which in certain classes of work is undesirable.

By reference to Fig. 11 it will be seen how the metal is worked and formed and controlled so that the tube is not reduced in thickness or in strength by the formation of the screw-threads upon it. The faces 1 and 2 of the forming tools are disposed at some suitable angle, which is here shown as 60 degrees, which is the angle of the faces of standard screw-threads, and such faces form the screw-thread faces 3 and 4 of the thread. The faces 5 and 6 of the mandrel are shown in this diagram at an angle of 50 degrees and the apex 7 of the thread upon the mandrel as clearing the interior of the tube, for the purposes before referred to. As the apex 8 of the forming tool presses the metal of the tube in a radial direction between the convolutions of the screw-thread upon the mandrel there is also a tendency for the metal to flow in the direction indicated by the dotted line 9, and against the portion at about the region 10 on the faces 11 and 12 of the thread on the mandrel. There being free space at about the region 13, the flowage will be downwardly and in a radial direction, so that the tendency of the apex 8 to cut into the metal will be compensated for by the vent given the metal at 13, and the metal at the point 14 will be thickened and compensate for the displacement above such point by the apex 8, so that in the completed screw-thread the thickness at the region 14 will be equal to the thickness of the original tubing. By having the faces 1 and 2 at an angle of 60 degrees and the angle between the faces 11 and 12 at an angle of 50 degrees, the free space 15 in the channel of the mandrel is much deeper than it would be were the faces of the mandrel at the same angle as are the faces of the forming tools.

It will be seen by reference to Fig. 12 that the thrust faces 58 receive the tube wall between the rolls upon the adjacent sides of said thrust face when the tube is slightly bent from its true circular position. This bending of course will be but slight; but by having the thrust faces for immediately returning any slight tendency to distortion the tube will be kept in its true symmetrical position.

It will be seen that the present improvement acts upon the metal of the tube in forming the screw-threads differently from present methods in the forming of screw-threads by a forging action upon the surface of the stock only, as, for instance, in the formation of the threads upon wood screws wherein the surface metal is forged up into a thread and the thread forged into shape without any change taking place in the core of the metal of the screw body; and it also differs from the formation of so called screw-threads upon thin metal by means of a spinning action, which merely bends the metal, as, for instance, in the formation of caps for jars and similar purposes. In the present case the entire metal of the tube is subjected to forging action; not only bending and spinning the metal into a corrugated form considered in a longitudinal section, but also forging the metal, which is so bent, and causing the metal to flow in desired directions to compensate for displacements taking place adjacent thereto.

Having described my invention, I claim:

1. Means for forming screw-threads on metal tubing and embodying means for holding the tubing, means for displacing by flowage the metal on the exterior of the tube for forming a thread thereon and having a working face disposed at an angle to the radius of the tube, and a mandrel having a co-operating working face disposed in a plane at an angle to the axis of the tube and at a less angle to its radius than the exterior working face for acting upon the interior of the tube for directing and controlling the said flowage.

2. In a tube threading tool the combination with means for holding a tube, of a roller for forming a thread on a tube, and set at an angle to the axis of a tube held by said holding means, a spindle for said roller, an eccentric sleeve interposed between said spindle and roller, a sheave on said sleeve, a conoidal bearing for said sheave, means for revolving said spindle and moving it along its axis of revolution and causing said sheave to traverse said conoidal bearing and shift the eccentric sleeve for gradually advancing the roller toward the axis of its revolution.

3. In a tube threading tool, the combination with means for holding a tube, of an inner forming member, a screw-threading tool, means for moving these longitudinally and rotarily upon the axial line of the tube position in unison, an eccentric associated with said tool and longitudinally movable with the same for advancing the tool

toward said axial line, and a conoidal bearing face cooperative with the eccentric in the longitudinal movement of the tool for automatically advancing the same toward said axial line for imparting taper formation to the threaded tube.

4. The combination with a screw threaded mandrel, of means for pressing external screw threads into tubing on the mandrel, means for helically advancing the pressing means toward the end of the tube, means for acting upon said pressing means for decreasing the diameter of the convolutions of the helix during the said advance, and means mechanically connecting the pressing means and mandrel for moving the mandrel out of the tubing concurrently with the formation of the thread.

5. Means for forming threads on the outside of tubing and embodying a forming tool, means for revolving said tool about the tubing, a complementary mandrel in axial line with the tube position and of smaller diameter than the smallest diameter of the contemplated product and rotatable with the tool, and means for advancing the tool toward the tube for giving it a taper.

6. In means for forming screw-threads on tubing, the combination with means for pressing screw-threads into the exterior of the tubing, of a complementary screw-threaded mandrel for entering the tubing, means for holding the tubing from rotation, means for revolving the pressing means and rotating the mandrel about the axis of the tubing and forming screw-threads and withdrawing the mandrel in the tubing during the formation of the thread and at an equal ratio to the advance of the pressing means.

7. In means for forming screw-threads on tubing, the combination with tools for pressing screw-threads into the tubing, of a complementary mandrel for entering the tubing, means for bringing the tools into working engagement with the tubing, mechanically connected means for revolving the tools and rigidly connected to the mandrel for rotating the same about the axis of the tubing and forming screw-threads and withdrawing the mandrel from the screw threaded portion of the tubing during the formation of the thread and at an equal ratio.

8. A tube threading tool embodying a tool carrier head having a centrally disposed chamber, an exteriorly screw-threaded mandrel located in said chamber, tool chambers in the sides of said head and opening into said central chamber, screw-threading tools mounted in said tool chambers between the top and the bottom thereof for engaging a tube on the mandrel through said openings, the partitions between the tool chambers in their faces forming the walls of the central chamber constituting supporting means for the tube under treatment adjacent to the working point of the tools.

9. In a tube threading tool, the combination with a tool carrier head having a centrally disposed chamber, an exteriorly screw-threaded mandrel located in said chamber for receiving the end of the tube to be threaded, tool chambers in the sides of said head and opening into said central chamber, the walls of the central chamber constituting thrust faces for the tube, and tools in said tool chambers at positions midward of the ends of said thrust faces.

10. In a tube threading tool, the combination with means for holding a tube, of a roller for forming a thread on a tube held thereby, a spindle for said roller, an eccentric sleeve interposed between said spindle and roller, a sheave on said sleeve, a conoidal bearing for said sheave, means for revolving said spindle and moving it along its axis of revolution and causing said sheave to traverse said conoidal bearing and shift the eccentric sleeve for gradually advancing the roller toward the axis of its revolution.

11. In a tube threading tool, the combination with means for holding a tube, of a roller for forming a thread on a tube held thereby, a rotary and axially movable tool carrier, a spindle for said roller mounted on said carrier and having its axis at an angle to the axis of rotation of said carrier, an eccentric sleeve interposed between said spindle and roller, a sheave on said sleeve, and a support having a conoidal bearing for the engagement of said sheave for gradually pressing the roller toward the tube.

12. In a tube threading tool, the combination with a casing having an interior conoidal bearing face, an interiorly screw-threaded hub, and a chuck for holding a tube, of a tool carrier head having a screw-threaded shaft traversing the said hub, tools for engaging the exterior of a tube, eccentric bearings for the tools carried by the head, and sheaves mounted upon said eccentric bearings for engaging said conoidal bearing and turning said eccentric bearings for moving said tools inwardly.

13. In a tube threading tool, the combination with a casing having an interior conoidal bearing face, an interiorly screw-threaded hub, and a chuck for holding the tube, of a tool carrier head having a screw-threaded shaft traversing the said hub, inwardly movable tools carried by said head for engaging the exterior of a tube held by said chuck, and sheaves associated with said tools for engaging said conoidal bearing.

14. In a threading tool, the combination with a casing having an interiorly screw-threaded hub, of a head within said casing and having a screw-threaded shaft traversing said hub, a chuck carried by the casing for holding a tube to be threaded, a mandrel carried by the head and concentric with the shaft thereof for entering the tube and having a screw-threaded exterior of equal pitch with the thread on the shaft, screw-thread forming tools carried by the head for engaging the exterior of the tube and having faces for forcing the metal thereof against the screw-thread of the mandrel, and means for bringing said tools to working position.

15. In a threading tool, the combination with a casing having an interiorly screw-threaded hub, of a head within said casing and having a screw-threaded shaft traversing said hub, a cap member for said casing having a chuck for holding a tube to be threaded, a mandrel carried by the head and concentric with the shaft thereof for entering the tube and having a screw-threaded exterior of equal pitch with the thread on the shaft, and screw-thread forming tools carried by the head for engaging the exterior of the tube and having faces for forcing the metal thereof against the thread of the mandrel.

16. In a tube threading tool, the combination with a tool carrier head having a centrally disposed chamber, a mandrel located in said chamber for receiving the tube to be threaded, an odd number of tool chambers in the sides of said head and in communication with said central chamber, said head having thrust faces for the tube at regions between said chambers, and a tool in each of the respective tool chambers in a plane midward of the ends of said thrust faces and between two of said faces and opposite another of said faces.

17. In a tube threading device, the combination with a mandrel for engaging the inner portion of the tube, said mandrel having a spirally disposed thread and groove, each of the side faces being at an angle of about 50° to the axis of the mandrel, of a tool for engaging the outer perimeter of the tube and pressing the metal of the same into such groove and it having side faces disposed upon an angle of about 60°, the groove between the convolutions of the mandrel thread being relatively deep.

18. In a tube threading device, the combination with a mandrel for engaging the inner portion of the tube, it having a spirally disposed groove, of an inwardly movable tool for engaging the outer perimeter of the tube and pressing the metal of the same into such groove and it having faces disposed upon an angle greater than the angle between the opposed faces of said groove.

19. In a tube threading tool, the combination with a casing having an interior conoidal bearing face a portion of which is at a greater angle to the axis of the device than the remainder, an interiorly screw-threaded hub, and a chuck for holding a tube, of a tool carrier head having a screw-threaded shaft traversing the said hub, inwardly movable tools carried by said head for engaging the exterior of a tube held by said chuck, eccentric means for mounting said tools on the head, and sheaves associated with said eccentric means for engaging said conoidal bearing and when the head is moving toward said bearing face for engaging first the portion thereof of the greater angle for bringing the tools to their working position and then the portion thereof of the lesser angle for tapering the screw-threaded end of the tube.

20. In a tube threading device, the combination with a frame embodying an interiorly screw threaded portion, of a chuck carried thereby, a tool carrier having a screw threaded shaft traversing said screw threaded portion, inwardly movable tools mounted upon said head for engaging the exterior of a tube held by said chuck, sheaves associated with said tools for inwardly moving the same, said frame having an interior conoidal bearing face for the engagement of said sheaves upon the axial movement of said head incident to its shaft screwing through said interiorly screw threaded portion of the frame, the first portion of said face for the engagement of said sheave being at a greater angle to the axis of the shaft than the remainder of said bearing face, whereby the tools will be moved inwardly rapidly to their work and then moved gradually inwardly during the operation thereof for tapering the end of the tube.

21. Tube threading mechanism comprising a lead screw, a tool carrier fast therewith and embodying a pair of head-plates disposed transversely of the axial line of said lead screw, a series of spindles carried by said head plates and axially parallel with a line perpendicular to the pitch line of the lead screw, a series of interchangeable threading rolls carried by said spindles, said plates being provided with bosses surrounding said spindles and having faces forming end bearings for said rolls and disposed transversely to the axis of the surrounded spindle, said bosses progressively varying in height for positioning said rolls in progressive axial advance in accordance with the pitch angle of the thread to be produced.

22. Tube threading mechanism comprising a rotary tool carrier embodying a pair of head-plates disposed transversely of the axis of rotation thereof, a plurality of interchangeable threading rolls carried thereby, said plates having bosses progressively varying in height and forming end bearings for said rolls for positioning the same in progressive axial advance in accordance with the pitch angle of the thread to be produced.

23. In a tube threading tool, the combination with a rotary and axially movable tool carrier, of a bearing having an interior conoidal bearing face, a portion of which is at a greater angle to the axis of rotation of said tool carrier than is the remainder of said bearing face, inwardly movable tools carried by said carrier and sheaves associated with said tools for engaging said bearing face and bringing the tools to their work and causing the same to advance toward their work.

24. In a tube threading tool, the combination with a rotary and axially movable tool carrier, of a bearing having an interior conoidal bearing face, a portion of which is at a greater angle to the axis of rotation of said tool carrier than is the remainder of said bearing face, inwardly movable tools carried by said carrier and sheaves associated with said tools for engaging said bearing face and bringing the tools to their work and causing the same to advance toward their work, said sheaves having their faces of first engagement progressively in advance one of the other for bringing the tools progressively to their work.

25. In a tube threading tool, the combination with a tool head carrying screw thread forming tools, and provided with a screw threaded socket and a shoulder surrounding said socket, of a mandrel having a helically disposed working face co-operative with said screw thread forming tools and having a screw threaded shank for engaging said screw socket and provided with a shoulder surrounding said shank and a series of thin washers interposed between said shoulders.

Signed at Nos. 9–15 Murray street, New York, N. Y., this 7th day of September, 1905.

CHARLES L. CUMMINGS.

Witnesses:
JOHN O. SEIFERT,
CHAS. LYON RUSSELL.