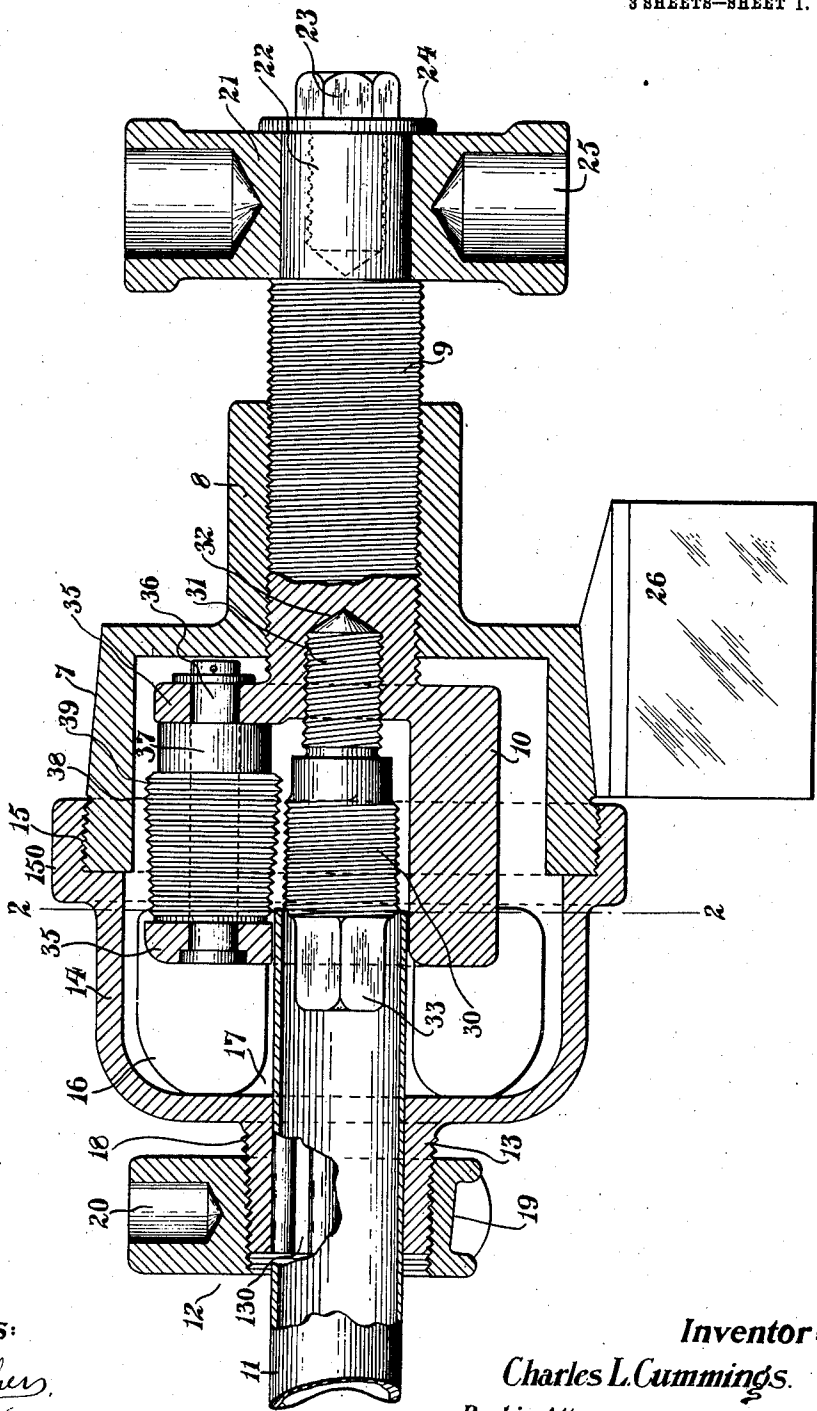


C. L. CUMMINGS.
THREADING TOOL.
APPLICATION FILED MAY 24, 1906.

3 SHEETS—SHEET 1.

FIG. 1.



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PATENTED JULY 9, 1907.

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3 SHEETS—SHEET 2.

Fig. 2.

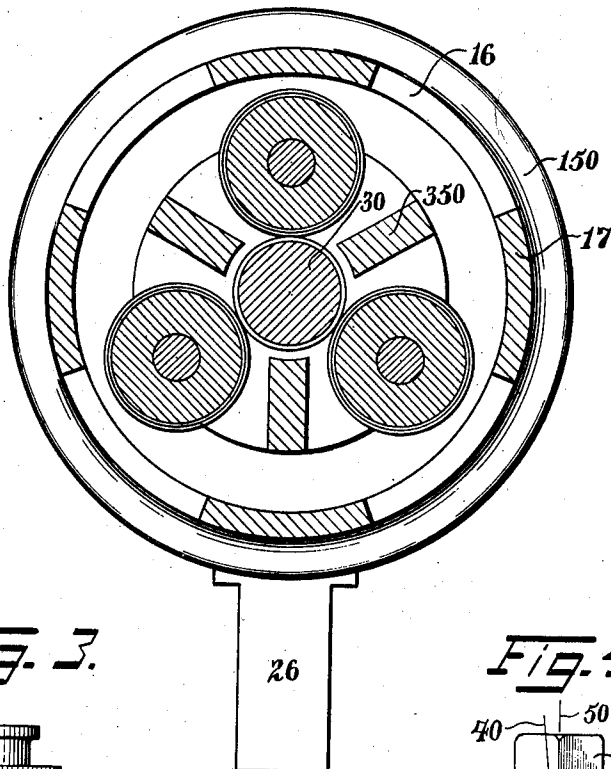


Fig. 3.

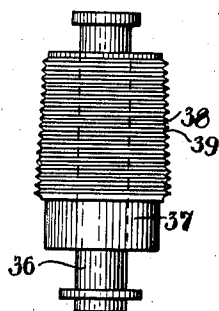


Fig. 4.

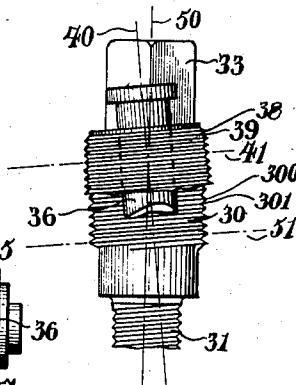
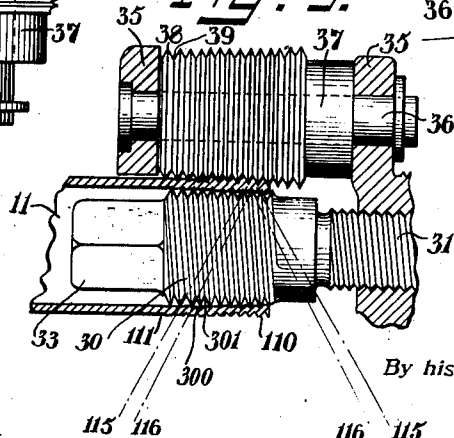


Fig. 5.



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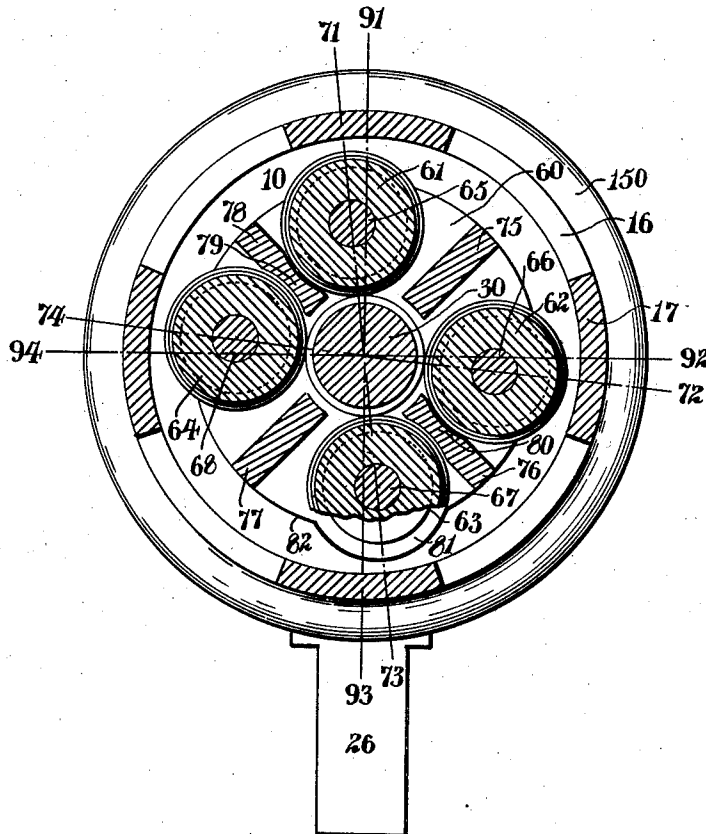
PATENTED JULY 9, 1907.

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THREADING TOOL.

APPLICATION FILED MAY 24, 1906.

3 SHEETS—SHEET 3.

Fig. 5.



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UNITED STATES PATENT OFFICE.

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THREADING-TOOL.

No. 859,644.

Specification of Letters Patent.

Patented July 9, 1907.

Application filed May 24, 1906. Serial No. 318,222

To all whom it may concern:

Be it known that I, CHARLES L. CUMMINGS, a citizen of the United States, residing in the borough of Manhattan, city of New York, 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 mechanism for forming screw threads upon tubing, and in one form thereof may be embodied in a device of such dimensions that it may be regarded as a hand tool to be carried by a workman from place to place.

In my concurrently pending application for threading tool, filed September 11, 1905, Serial No. 277,828, a series of properly formed tools are rotated about the tube axis and moved from a position inward of the end toward and off of the end as the thread is formed and completed. In the present device, however, the tools are presented to the end of the tube and forced onto it. The tools will be so situated that the general line of the working portion of the working face will be at an angle to the tube axis for producing the tapering effect, and the tools are preferably tapering or conical. Each of such tools will have upon it a series of ribs disposed at the proper distance apart for giving to the thread the desired pitch. The tools when conical, will be situated with their smaller ends toward the tube chuck and upon being revolved and forced toward the chuck will engage a tube which may be held by the chuck and swage in the tube wall at its end and concurrently form a screw thread, preferably tapered throughout a portion of its length, by a forging due to a rolling treatment which may be termed a roll-forging action. The swaging or inward translation of the tube wall and thread formation upon such translated wall proceed by a series of rapidly succeeding steps, the tool as a whole only advances once upon the tube, and even then the tool in all its parts does not traverse the entire worked upon end of the tube; but those thread convolutions which are formed adjacent the tube end are each acted upon by all, or nearly all, of the tool elements or working faces of each tool. The first few, say from three to five perhaps, of the thread convolutions, that is those convolutions occurring at the end of the tube which receives the greatest strain when the tube is connected up with some suitable union, receive the most extended tooling or working and the most complete forging, and thus, resulting as it does in raising the tensile strength of the metal of the tube at this region, strengthens rather than weakens the tube at its screw threaded end, and particularly at those few convolutions which, in pipe fittings, bear the burden of the work, presenting a condition directly the reverse of that existing in a tube having

cut threads. The advantage thus gained over cut threads is two-fold, the thickness of the tube wall is not appreciably reduced, and it is compacted, strengthened and toughened by the treatment to which it is subjected.

The working thrust of the thread formative operation is in a direction opposite to that of some of the strains of use. This would appear to place the metal which is acted upon by the threading tool; and in the present instance this is practically all the metal contained within the tube wall at the part of the tube which is given a completely finished screw thread; in such a position that it will resist strain when applied in a direction opposite to the thrust of the tool in its work of forming the thread, the metal assuming certain arch formation against the thrust of the nut or coupling which will engage it when such thrust is in a direction toward the end of the tube.

In the drawings accompanying and forming a part of this specification Figure 1 is a longitudinal section of a practicable embodiment of a form of this present improvement. Fig. 2 is a cross section on a plane in about the line 2-2 of Fig. 1. Fig. 3 is a detail of one of the threading tools removed. Fig. 4 is a detail showing the mandrel and a portion of one of the tools and its shaft to show the relation of the axis of said shaft to the thread upon the mandrel, such axis being disposed at about 90 degrees to the line of the thread. Fig. 5 is a detail illustrating a tube and a portion of the tool at the completion of the thread forming operation; and Fig. 6 is a detail similar to Fig. 2 but showing four instead of three tools and these spaced apart unsymmetrically.

The operative parts of the device are shown mounted in a compact relation, there being a housing as it were, comprising a portion 7 which has an interiorly screw threaded hub 8 for receiving the screw threaded shaft 9 which carries a tool head 10. The pitch of the threaded shaft 9 will bear a definite relation to the pitch of the thread which it is intended the tool shall produce upon the tube, as 11, held in the chuck member designated in a general way by 12, and which comprises a hub 13 carries by the portion 14, of the housing, such portion having a hub 150 shown in screw threaded engagement as at 15 with the portion 7, and having a number of openings 16 which will leave arms, as it were, 17, these being slightly elastic will when the hub 13 is divided as at 130 normally tend to open the same from the tube; it will be closed upon the tube by having upon its outer perimeter a taper screw thread 18 upon which is mounted a jam nut device or collar 19 which is provided with some suitable means for tightening it, as for instance sockets 20 for the reception of a bar or some other suitable device, whereby the collar 19 may be turned up or down upon the screw 18 and thus clamp and release

the tube. In the present instance the definite relation which exists between the pitch of the thread 9 and the pitch of the thread which it is intended shall be produced is that a number of convolutions to a given length of the thread shaft 9 will produce an equal number of convolutions of the thread upon the tube. The shaft and its head 10, which in the present instance is integral with it, will be rotated by some suitable means, in the present instance a handle device 21 is mounted thereon, it being upon a reduced portion 22 of the shaft and held in position by means of some suitable nut as 23 and washer 24, and may be provided with sockets 25 for receiving an actuating device, for instance a bar.

The illustrated form of the device is one which makes it particularly adaptable for transportation with a workman's tools, and it may be provided with a wing or lug 26, in the present instance integral with the frame member 7, which lug may be engaged by a bench vise to hold it in position while the tool is being operated. An inner forming member or mandrel, designated in a general way by 30, is carried by the head 10 and shaft 9 and is located in axial coincidence with such shaft and the chuck. In the present instance the mandrel is shown as having a screw threaded stem 31 which bottoms as at 32 in a screw threaded socket in the shaft, the body portion of the mandrel is provided with a working face spirally disposed, and in the present illustration in the form of a cylindrical spiral, a thread 300 and groove 301 constituting the working faces. This inner forming member or mandrel is for entrance within the tube to be acted upon, and may be provided with suitable key or wrench engaging faces 33 whereby it may be removed from the tool for repairs or for replacement by another.

The tool carrying head 10 may be regarded as having a pair of head plates as it were 35—35 which will afford a bearing for the shafts or spindles 36 of the tools for acting upon the outer side of the tube, the head plates are connected by partitions 350. Each of the tools in the present illustration comprises a body portion 37, having a working fit between the heads 35 and freely rotatable upon its shaft 36; each of such tools has upon it a series of ribs and grooves 38—39 which produce the working faces of the tool, the series of faces being disposed in a conoidal formation presenting a tool having a conical working face, that is, the grooves and ribs from, for instance, the left hand end in Fig. 1 toward the right hand end will increase in radius gradually, such increase of the conically disposed tool face will correspond with the desired taper which is to be given to the thread. In the present illustration such ribs and grooves will correspond in angle to the angle of the desired thread, and the distance apart of the groove bottoms to the distance apart of the apexes of the thread convolutions for producing the desired pitch.

In the mechanism illustrated herein it will be seen that the spindles or shafts 36 are normally fixed in the head relative to the axis of rotation of the head. By this means each of the series of tools mounted upon such spindles will be caused to become a fixed working part of what may be regarded as a single tool, so that uniformity of action is had.

By reference to Fig. 4 it will be seen that the shaft 36 has its axis 40 disposed at an angle to the axis 50 of the mandrel 30, and it will also be seen that the axis

40 is at an angle of 90 degrees to the line 51 which is drawn along the summit of one of the convolutions of the mandrel at the side which co-operates with the outer tool, and it will be seen that the line 41 coincides with a line drawn along the summit of one of the ridges of the outer tool, the lines 51 and 41 are in parallelism. By this organization the convolutions and the various working faces upon the outer tools will clear themselves from the faces of the completed or partially formed threads without marring the same, as might be the case with working faces of certain formation were these placed in a plane at right angles to the axis of the tube.

Fig. 1 shows the device about ready to commence operation upon a tube; as the shaft 9 is rotated the mandrel will be screwed into the tube, when it comes in engagement with the tube wall due to the swaging down of the tube or to the original dimensions of the tube, as the case may be, and the outer forming tools, which between their working faces present a tapered space with the larger portion toward the tube, will be revolved about the axis of the tube and will rotate upon their shafts, the result of their engagement with the tube, which is forced into this tapered space by the advance of the tools, will be to initially break down the end of the tube and swage it in, and as the head 10 is advanced upon the tube and toward the chuck the outer forming tools will gradually advance upon the tube, forming a screw thread corresponding in taper to the angle of the general line of tube engagement of the outer forming tools to the axis of the tube. The first thread convolution on the tube, 110 Fig. 5, will be acted upon by each of the working faces upon each of the outer tools, so that if there are fourteen of the ribs, as in the present illustration, and three of the tools, each portion of such first convolution of the thread will be subjected to forty-two separate and distinct forging actions. Toward the inner end of the tube, of course, the number of forging actions to which each thread convolution is subjected will decrease until at last a place, 111 Fig. 5, is arrived at where one only of the working faces will run over the convolution, and at this point the tools will be brought to rest, see Fig. 5 for the position of the tool upon the completion of the thread. Then when the shaft 9 is rotated in the opposite direction for removing the tools and mandrel from the tube there will be a reversal of action; if the thread has been formed completely in the forward action the backing off will merely have a tendency in most instances to finish or smooth the surface during one or two rotations of the head 10 when the outer tools will be brought out of engagement with the tube at its threaded portion owing to the fact of the taper which it has been given and the angle of the outer forming tools. The working thrust or that rolling forging action by which the thread is produced forces the metal toward the body portion of the tube, and this is directly opposite to the working thrust of the coupling, union, or other nut which may be employed upon the screw threaded end of the tube.

The difference between the lines 115 and 116 shows a difference in angle of the working faces upon the outer forming tools and the inner forming tool. This is made the subject of my copending application hereinbefore referred to, and the art or method of thread

formation in some of its portions described and claimed in my application, Serial No. 306,508, filed March 17, 1906, may be practiced by the device herein, and this device may also form the threaded tube described and claimed in my application Serial No. 308,464, filed March 28, 1906.

In Fig. 2 there are shown three outer engaging tools arranged with their axes at the angles of an equilateral triangle. In working upon some kinds of stock and under certain conditions it is found that this arrangement of tools will have a tendency to distort the tube from a true conoidal formation into one of a hexagonal formation, probably due to a chattering of the tools, due to their triangulation, or to their symmetrical arrangement, and to afford means for overcoming this distortion of the product, an organization such as illustrated in Fig. 6 may be provided wherein the axes of the tools are arranged in an unsymmetrical formation. In this figure the head, designated in a general way by 10, is shown as provided with an end member 60 in the nature of a plate which has mounted upon it, four tools 61, 62, 63 and 64, which may be carried by spindles, 65, 66, 67, and 68 respectively set into the head 60 in some convenient manner. The lines 91, 92, 93 and 94 are set quartering, but in the present unsymmetrical arrangement the lines 71, 72, 73 and 74 will pass through the axes of the respective spindles 65 to 68 inclusive and meet at the axis of the inner forming member 30. By this means it will be seen that the tools 61 and 64 are brought nearer together than these are to the tools 62 and 63 which tools 62 and 63 are also brought closer together than they are to the tools 61 and 64. The partitions connecting the heads and forming the tool compartments are in the present instance indicated by the reference characters 75, 76, 77 and 78. Since the tools 61 and 64 are brought relative close together the partition between these tools will have a narrow or contracted portion as 79 for the clearance of the working faces of the tools and the partition 76 will have a similar contracted portion 80 for like reasons. The plate 60 may have outward extensions 81 beyond the normal line 82 of the plate 60 for the better accommodation of the ends of the tools.

Having described my invention I claim:

1. In a tube threading mechanism, the combination with a frame provided with a lead screw nut, of a chuck carried by the frame for holding a tube, thread forming means for engaging the outer face of the tube wall and arranged with a tapered space between their working faces for swaging the tube wall inwardly and concurrently forming a taper spiral thread on the tube, a lead screw traversing said nut

and carrying said engaging means for advancing the same in a spiral path, presenting the same to and forcing this upon the tube, and means for supporting the inner face of the tube wall and receiving the thrust from the outer engaging means.

2. In tube threading mechanism, the combination with a chuck, of a rotary head, a lead screw for moving said head axially toward and from said chuck, tool spindles carried by said head and normally fixed relatively to the axis of said head, and a series of conical rotary thread-forming tools mounted on said spindles, and each of said tools having a series of ribs disposed about a common axis, the ribs at the end toward the chuck being of smaller radius than those toward the other end.

3. In tube threading mechanism, the combination with a frame provided with a lead screw nut, of a tube chuck carried by said frame in axial coincidence with said nut, a shaft provided with a lead screw and engaging said nut, an inner forming member carried by said shaft, and a series of conoidal outer forming members carried by the shaft and each having its smaller end directed toward said chuck.

4. The combination with a frame, of a tube chuck carried by the frame, an inner forming tool having the convolutions of its working face disposed in a cylindrical spiral, a lead screw connection between the said inner forming tool and the frame in axial alinement with the chuck, a series of rotary outer thread forming tools each having a series of groove and rib convolutions of gradually decreasing radius and disposed about said inner forming tool and mounted with the inner forming tool for movement about the tube in a spiral path, the axis of each tool being disposed at an angle of ninety degrees to the plane of the inner forming member convolutions.

5. In a tube threading mechanism, the combination with a chuck for holding a tube, of means for engaging the outer face of the tube wall and swaging the same inwardly and concurrently forming a spiral thread on the tube and comprising a rotary head, a series of four rotary thread forming tools carried by said head for revolution about a tube held in the chuck, each of said tools having a series of ribs disposed about a common axis, the axes of said tools being unsymmetrically arranged about their orbit of revolution, and means for rotating said head and moving the same toward the chuck for revolving said tools in a spiral path.

6. In tube threading mechanism, the combination with a frame, of a tube chuck carried by the frame, a head, a lead screw connection between the head and the frame in axial alinement with the chuck, a series of four rotary thread swaging tools mounted upon said head for rotation thereon each upon its own axis and for revolution by the head in a common orbit, the axes of said tools being unsymmetrically arranged in their orbit about a common axis whereby the first and second and the third and fourth tools are each farther apart in said orbit than are the fourth and first and the second and third.

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