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APPARATUS FOR FORMING SPIRAL PROJECTIONS IN TUBING

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2 Sheets-Sheet 1

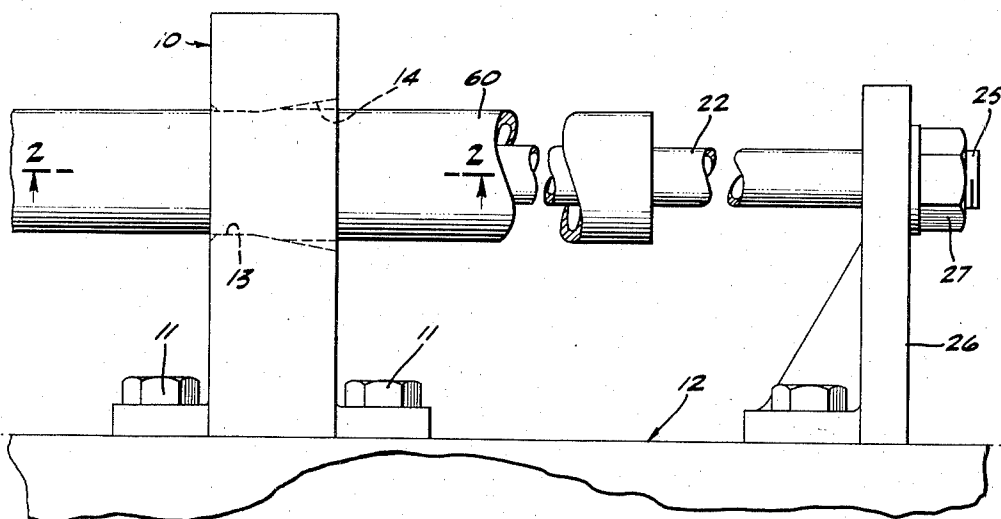


FIG. 1.

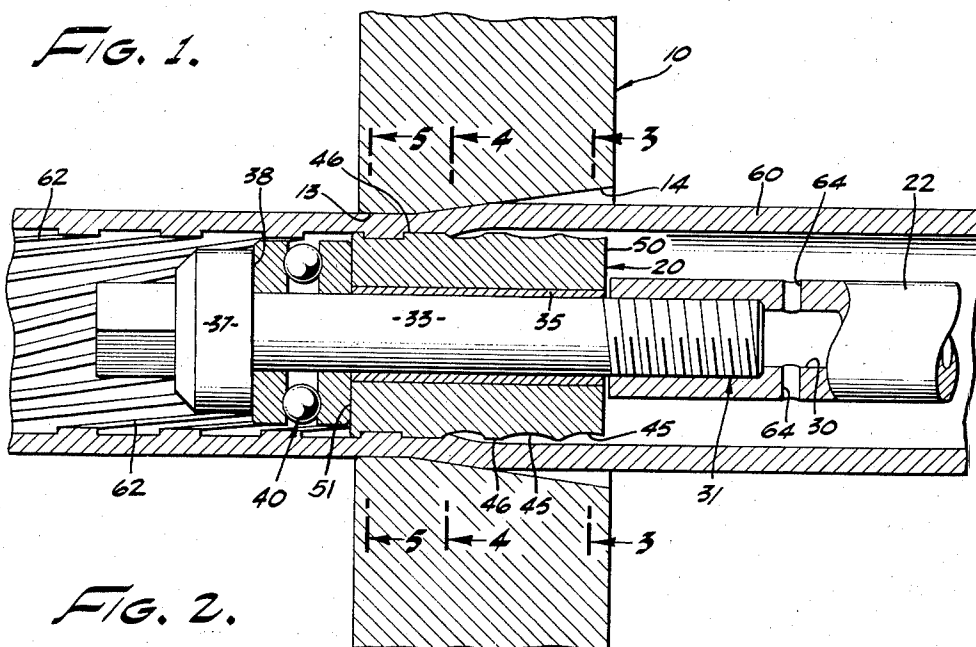


FIG. 2.

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FIG. 3.

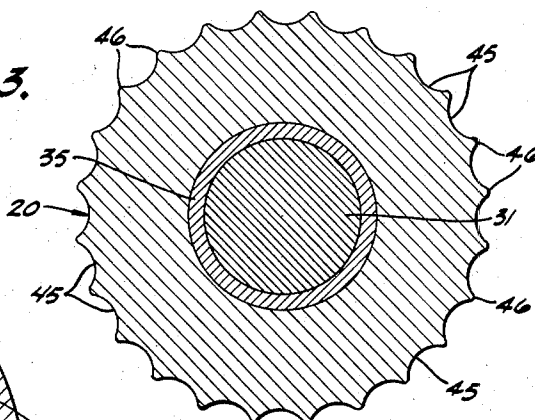
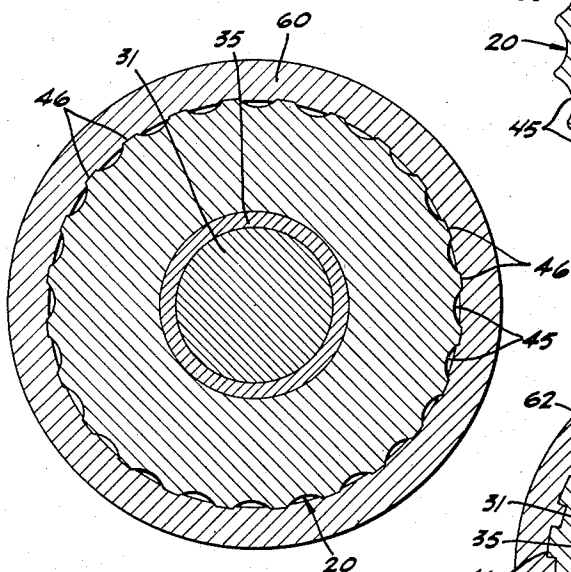


FIG. 4.

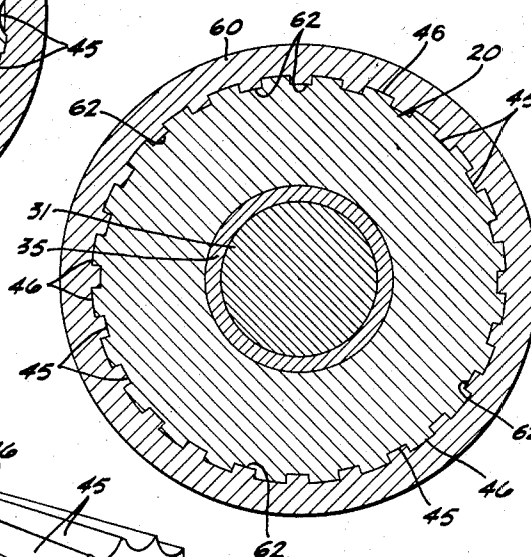


FIG. 5.

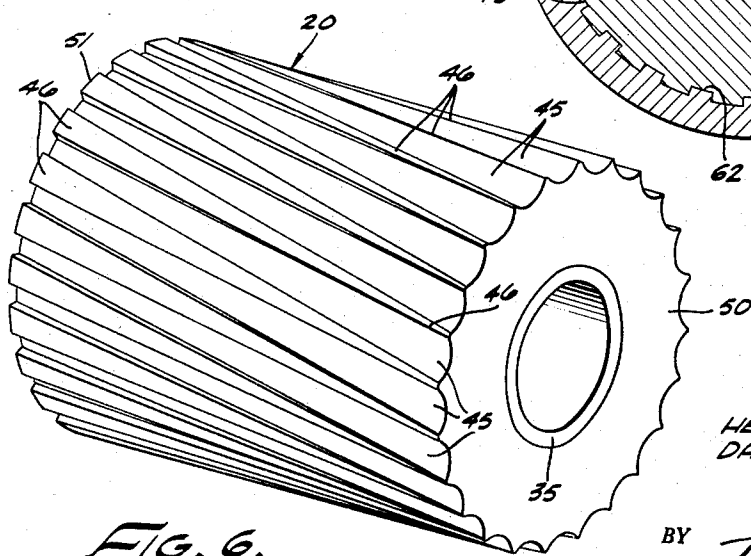


FIG. 6.

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APPARATUS FOR FORMING SPIRAL PROJECTIONS IN TUBING

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1 Claim. (Cl. 29—1.1)

This invention relates to the production of tubing and has particular reference to apparatus for forming spiral projections in tubing.

One of the principal objects of this invention is to provide a novel apparatus for the formation of spiral projections on the internal surface of metallic tubing.

Another object of this invention is to provide apparatus for simultaneously drawing metallic tubing and forming spiral projections therein.

Another object of this invention is to provide apparatus wherein tubing is properly sized as to outside and inside diameter and simultaneously provided with internal spaced projections of accurate helical configuration.

Another object of this invention is to provide a novel apparatus for the production of rifled barrels for use in the firing of projectiles.

More specifically, it is an object of this invention to provide apparatus wherein metallic tubing is drawn through an annulus formed by a stationary cylindrical die and a cooperating rotatable grooved mandrel for simultaneously drawing the tubing to size and forming spiral projections on the interior surface thereof without subjecting the tubing to twisting stresses.

Other objects and advantages of this invention it is believed will be readily apparent to those skilled in the art from the following detailed description of a preferred embodiment thereof when read in connection with the accompanying drawings.

In the drawings:

Figure 1 is a side elevation of an apparatus embodying a preferred form of the invention.

Figure 2 is a sectional elevation taken substantially on the line 2—2 of Figure 1.

Figure 3 is a sectional elevation taken substantially on the line 3—3 of Figure 2.

Figure 4 is a sectional elevation taken substantially on the line 4—4 of Figure 2.

Figure 5 is a sectional elevation taken substantially on the line 5—5 of Figure 2.

Figure 6 is a perspective view of the rifling mandrel.

Referring now to the drawings, the apparatus of this invention includes a die member 10 rigidly secured, as by means of the bolts 11, to a conventional redraw bench 12, or any other suitable base member or structure. The die member 10 is provided with a cylindrical bore 13 of a diameter equal to the desired final outside diameter of the tubing to be formed, and a lead-in portion 14 of tapered or frusto-conical configuration. The taper of the lead-in portion 14 is preferably maintained in the range of 6° to 15° from the axial, but this is not critical and may be varied depending upon particular job conditions, such as the hardness and other physical properties of the tubing being produced.

A grooved rifling mandrel 20 is operably associated with the die member 10, means being provided for rotatably mounting the mandrel within the die opening. As shown in the drawings, these means may include the mandrel rod 22 which is rigidly but adjustably connected

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to the bench 12. The rod is provided with a threaded end 25 engaged in an opening (not shown) in a support bracket 26 and is held against movement in one direction by means of a stop member or nut 27. If desired, an intermediate support bracket (not shown) may be used to assure proper alignment of the mandrel rod.

The mandrel rod 22 is provided with an axial bore 30 suitably threaded at one end of the rod to receive a bolt 31 having an elongated cylindrical portion 33. The rifling mandrel 20 is provided with a radial bearing 35 journaled on the bolt cylindrical portion 33. The bolt is provided with an integral flange 37 forming a shoulder 38, a thrust bearing assembly 40 being interposed between the shoulder and the rifling mandrel. It will be observed that the bolt 31 is an extension of the mandrel rod 22 and forms a part thereof.

The outer surface of the rifling mandrel is provided with a plurality of spaced grooves 45 forming lands 46 therebetween, the grooves and lands defining generally spiral configurations. As is clearly shown in Figures 3—6, the grooves become progressively narrower and less deep in a substantially uniform manner from the forward end 50 of the mandrel to a point adjacent the rear end 51 thereof, for a purpose to be described below.

In operation of the apparatus described, the end (not shown) of a tube 60 to be rifled is swaged and inserted through the annulus between the die 10 and the rifling mandrel 20 so that the end of the tube may be gripped by a suitable drawing mechanism (not shown) for drawing of the tube through the annulus in a direction to the left as seen in Figures 1 and 2. This is in accordance with conventional redrawing practice, as will be readily understood by those skilled in the art. Also, it will be understood that the rifling mandrel 20 and the rod 22 are initially in a retracted position, i. e., moved to the right from the position shown in Figure 1, to permit the initial insertion of the tube 60 between the die opening and the rifling mandrel. Then, as the tube is initially drawn forward it carries the rifling mandrel with it to the position shown in the drawings, the nut 27 acting as a stop member for the rod 22 and the rifling mandrel.

From an inspection of the drawings it will be understood that as the tube is drawn, the lead-in portion 14 of the die will gradually bring the outside of the tube down to the desired size of the bore 13. Simultaneously, spaced portions of the inside of the tube will be forced into the grooves of the rifling mandrel, the forward component of force due to the drawing of the tube causing the mandrel to rotate on its radial bearing 35 and against the thrust bearing 40, it being understood that the mandrel is held against longitudinal movement with respect to the die, but being free to rotate with respect thereto. Continued movement of the tube 60 through the annulus results in the formation of the internal rifling consisting of the spiral projections 62. Radial bores 64 may be provided in the mandrel rod for lubrication of the tubing interior through the axial bore 30, if desired.

While, of course, not inherently so limited, the apparatus of this invention finds specific application in the production of rifled aluminum barrels for use in recoilless rifles, rocket launchers and the like wherein pre-rifled projectiles are utilized. It will therefore be understood to those skilled in the art that the spiral projections or rifling must be formed with a high degree of accuracy, substantially radial groove edges and sharp corners when seen in section being particularly necessary.

The configuration of the mandrel grooves in the manner described above is an extremely important feature of the present invention, at least insofar as the production of suitable rifle or rocket launcher barrels is concerned. It has been found by actual experimentation that where the grooves and lands of the mandrel are of equal width,

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only the middle portion of the projections of the tube to be rifled will contact the middle portion of the mandrel grooves and subsequent or continued drawing will not completely fill out the mandrel grooves, resulting in incomplete or malformed projections in the tube. Additionally, it has been found that where the projections and grooves are of equal dimensions, and are uniform throughout the length of the mandrel, the pull on the mandrel when drawn is too great to permit complete filling of the grooves of the mandrel, resulting in incomplete formations and excessive distortion of the tube after completion of the rifling.

These disadvantages have been completely overcome by forming the mandrel grooves so that they are initially wider and preferably deeper than the dimensions of the tube projections to be formed. The groove dimensions progressively decrease, as described, until they are of the desired dimensions at the rear end 51 of the mandrel, preferably the dimensions being uniform therein for a short distance from that end. This converging groove configuration permits easy entry, by radial pressure of the die lead-in portion, of a substantial amount of tube metal into the mandrel grooves during the initial movement of successive portions of the tube through the annulus. A sufficient amount of metal to completely fill the final dimensions of the groove is thus readily forced into the wider and deeper portions of the groove, whereupon continued drawing of the tube, and the consequent components of force in circumferential directions, causes the formation of projections therein substantially exactly conforming to the final groove configuration and at substantially accurate lead.

By longitudinal adjustment of the mandrel rod, the position of the rifling mandrel with respect to the lead-in portion of the die may be varied, and hence the point at which contact between the tube and mandrel is made may be predetermined to conform with the hardness and other physical properties of the tube.

From the above description it will be understood that tubing may be simultaneously sized and provided with accurate internal spiral projections, without tedious ma-

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chining operations. It will be further understood that a wide range of types and sizes of rifling is possible through variation in mandrel design.

While a specific embodiment of this invention has been shown and described, it is not intended to limit the same to the exact details of the construction set forth, and it embraces such changes, modifications and equivalents of the parts and their formation and arrangement as come within the purview of the appended claim.

We claim:

In apparatus for drawing tubing, the combination of a base member, a die rigidly secured to said base member and having a cylindrical bore, a tapering lead-in portion forming a continuation of said bore, a mandrel rod adjustably mounted on said base member and coaxial with said cylindrical bore, said mandrel rod having a mandrel bearing end extending through said bore, a rifling mandrel rotatably mounted on said mandrel rod adjacent the mandrel bearing end thereof and defining an annulus with said bore, said mandrel being provided with a plurality of spaced, helical grooves forming lands therebetween, the width and depth of said grooves progressively decreasing from one end of said mandrel to the other, means for drawing tubing through said annulus in contact with said die and said mandrel, said tubing initially contacting the narrowest portions of said lands, and thrust bearing means on said mandrel rod interposed between the mandrel bearing end thereof and said mandrel.

References Cited in the file of this patent

UNITED STATES PATENTS

1,328,077	Boyer	Jan. 13, 1920
1,789,308	Hatcher	Jan. 20, 1931
2,392,797	Hackett	Jan. 8, 1946
2,641,822	Sampson	June 16, 1953

FOREIGN PATENTS

118,253	Australia	Mar. 8, 1944
130,336	Great Britain	Jan. 29, 1920
865,585	Germany	Feb. 2, 1953