

L. H. BRINKMAN.
TUBE AND ROD TAPERING.
APPLICATION FILED FEB. 11, 1919.

1,418,697.

Patented June 6, 1922.

2 SHEETS—SHEET 1.

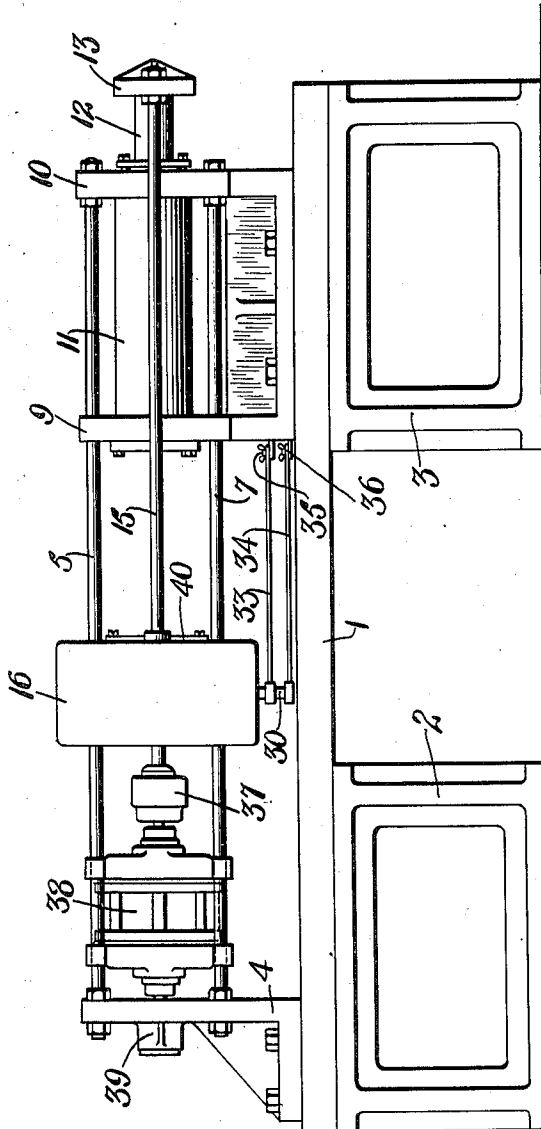


Fig. 1.

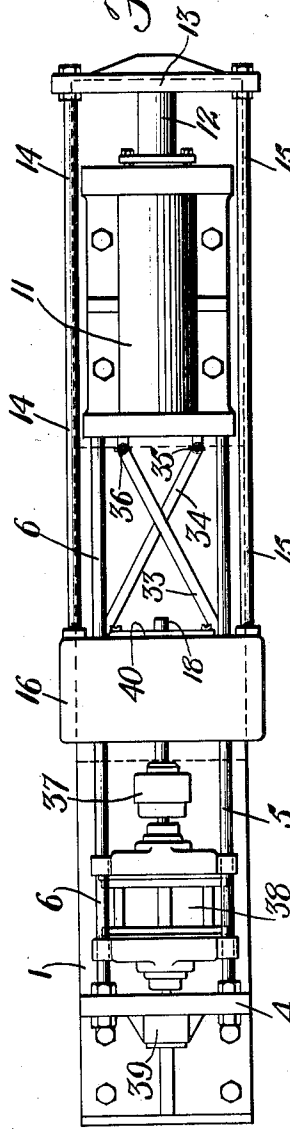


Fig. 2.

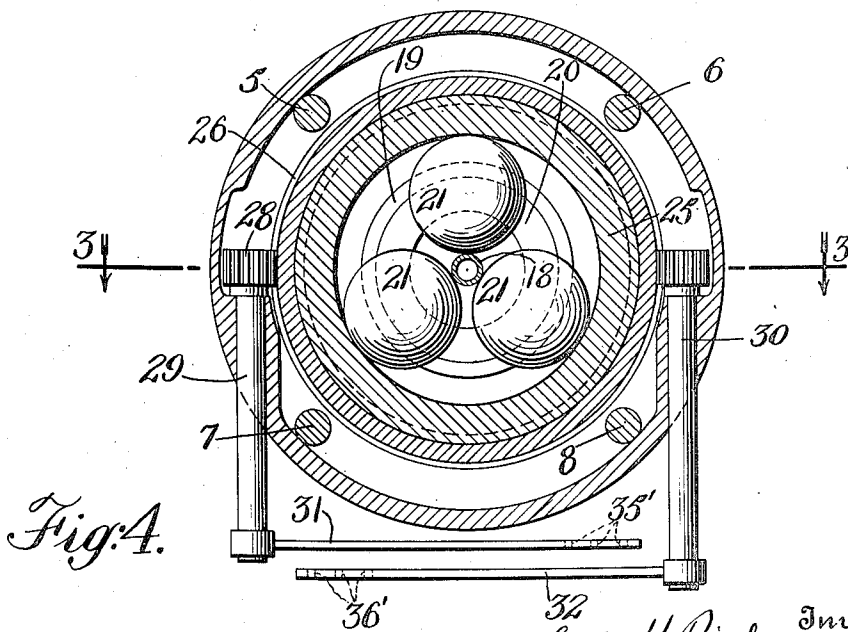
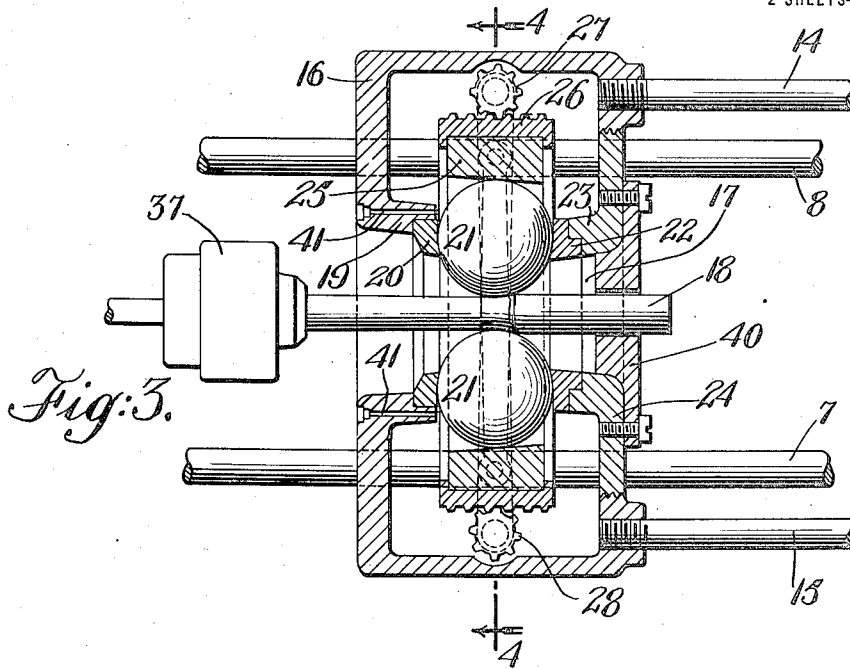
Louis H. Brinkman Inventor
By *Lis* Attorney
Thomas Howe

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By his Attorney
Thomas Howe

UNITED STATES PATENT OFFICE.

LOUIS H. BRINKMAN, OF GLENRIDGE, NEW JERSEY, ASSIGNOR, BY MESNE ASSIGNMENTS, TO GENERAL SEAMLESS TUBE COMPANY, OF BLOOMFIELD, NEW JERSEY, A CORPORATION OF DELAWARE.

TUBE AND ROD TAPERING.

1,418,697.

Specification of Letters Patent.

Patented June 6, 1922.

Application filed February 11, 1919. Serial No. 276,321.

To all whom it may concern:

Be it known that I, LOUIS H. BRINKMAN, a citizen of the United States of America, residing at Glenridge, Essex County, and State of New Jersey, have invented new and useful Improvements in Tube and Rod Tapering, of which the following is a specification.

This invention relates to the drawing of rods or tubes by means of ball dies and especially to such drawing where the radius of the die is varied as the work progresses through it so that the work may be made longitudinally tapering or otherwise to vary in diameter or thickness or both. It is to be understood, however, that the invention is not limited to tapering or forming the work of varying diameters or thickness, nor to ball dies, as it may have other applications.

It is one object of the present invention to provide means whereby the diameter of the pass is varied in a pre-determined ratio to the longitudinal movement of the die and work with relation to each other.

A further object of the invention is to provide means for automatically effecting the variation of the diameter of the pass.

A further object of the invention is automatic means for varying the diameter of the pass, this means being operated by the relative movement of the pass and work.

A further object of the invention is to provide an improved structure of adjustable ball die.

Other and ancillary objects of the invention will appear hereinafter.

In the accompanying drawings which illustrate the invention—

Figure 1 is a side elevation of apparatus embodying the invention;

Fig. 2 is a top plan view of the apparatus of Fig. 1;

Fig. 3 is a central longitudinal section on an enlarged scale of the die and adjacent parts, the remainder of the apparatus being broken away, this section being taken on the line 3—3 of Fig. 4, and

Fig. 4 is a section on the line 4—4 of Fig. 3.

Referring to the drawings, the apparatus comprises a bed 1 suitably supported by blocks or legs 2 and 3. Upstanding from the bed at one end is a bracket or head-piece 4

from which extend rods or bars 5, 6, 7 and 8, these bars extending through other up-rights 9 and 10, which support a hydraulic cylinder 11. The piston rod 12 of the hydraulic cylinder has secured to it a cross head 13 to which are secured bars or rods 14 and 15 which are also secured to the casing 16 of the ball die which is slidably mounted upon the bars 5, 6, 7 and 8 so that the die may be slid longitudinally of the machine by means of the hydraulic cylinder which may be supplied with fluid and controlled in a manner well understood.

The casing 16 of the die has a central opening 17 through which the work 18 may be passed. About this opening is an inturnd flange 19 which has mounted within it a hard steel ring 20 forming a lateral bearing surface for the series of hard steel balls 21 which contact with the work and form the working members of the die. On the opposite side of the series of balls, is a similar hard steel ring 22 mounted in the inturnd flange 23 of the circular head 24 which is screwed into the casing. By turning this head in one direction or the other, adjustment of the distance between the rings 20 and 22 may be made so that they may be adapted to the desired fit of the balls. It will be noted that the inner edges of the rings 20 and 22 project inwardly of the die beneath the centers of the balls so that the balls are prevented from falling out of the die. Encircling the series of balls is a ring 25 having its interior surface which bears upon the balls tapered longitudinally of the work so that by shifting this ring longitudinally, the balls are either forced inwardly so as to decrease the diameter of the pass or are allowed to move outwardly so as to increase its diameter. The ring 25 is provided, upon its outer periphery, with a series of circumferential teeth 26 with which mesh, upon opposite sides of the ring, spur gears 27 and 28 which are respectively fixed upon the shafts 29 and 30 rotatably mounted in the die casing. Each of the gear teeth 26 extends around an entire circumference so that no matter how much the ring 25 can shift circumferentially it will not be disengaged from the gears 27 and 28.

Fixed to the shafts 29 and 30 are arms 31 and 32 which are respectively pivoted to the ends of links 33 and 34 which are

also pivoted to the frame at 35 and 36. The result is that as the die or pass is longitudinally moved, the shafts 29 and 30 are rocked so as to shift the ring 25 longitudinally, it being in one direction or the other according to the direction of movement of the die. The movement of the ring 25 is ordinarily very small in comparison to the movement of the die and the apparatus referred to constitutes a reducing motion whereby this result is effected. It will be seen, however, that the movement of the ring 25 bears a certain pre-determined relation to the movement of the die and this may be made any that is desired by a proper adjustment. A convenient manner of effecting the adjustment is provided in the present instance by providing a plurality of holes 35' and 36' in the arms 31 and 32 respectively whereby the arms 33 and 34 may be pivoted. By suitably selecting the holes the lengths of the arms 31 and 32 may be made any desired which will produce the desired ratio of movement of the ring 25 to that of the die.

The work, such as the tube 18 is tightly gripped in a suitable chuck 37 which secures the work to the shaft of an electric motor 38. This motor may be of any suitable type, either alternating or direct current and is supported by having its frame slidably mounted upon bars 5 and 6. It is held against longitudinal movement during the drawing operation by means of the thrust bearing 39 into which extends the motor shaft.

To steady the work, a plate or collar 40 is removably secured to the head 24, this plate having a central hole adapted to loosely fit the work. Different diameters of work may be accommodated by removing the plate 40 and introducing another one of suitable size whenever the diameter of the work changes.

A series of passages 41 extend through the die casing and afford a means whereby cooling fluid, as water may be introduced upon the advanced side of the balls, that is, the side of the balls after the work has been operated upon by the pass. The water so introduced trickles down and cools the tube immediately after it has been reduced by passing under the balls, thereby causing it to hold its shape and not be crushed by the inward movement of the balls to decrease the succeeding sections in the tapering operation.

The operation of the apparatus may be briefly traced as follows—

The tube to be tapered having been secured in the chuck 37 and the work introduced into the die, the motor 38 may be started in to rotation and the fluid pressure cylinder 11 operated to draw the pass

longitudinally of the work. The tube will thus be reduced as the pass is drawn along it and to a decreasing diameter, because as has been indicated above, the movement of the die along the work causes a shifting of the ring 25 so as to force the balls 21 inwardly. When a length of tube has been operated upon to a desired extent, the work may be removed and the die returned to its left hand position (see Figs. 1 and 2), a new length of tube placed in position and the operation as described repeated indefinitely.

While the invention has been illustrated in what is considered its best embodiment, it may have other embodiments without departing from the spirit and is not, therefore, limited to the structure shown in the drawings.

What I claim is—

1. In metal drawing apparatus, the combination with a frame of a motor thereon, a chuck driven thereby for securing the work in driving relation to the shaft of said motor, said work being co-axial with said shaft, a thrust bearing for resisting longitudinal movement of said shaft and work, a die or pass adapted to act upon the work and comprising a casing, balls encircling the work and ball positioning means comprising a ring encircling the balls and having its ball engaging surface tapered longitudinally of the work, gear teeth upon said ring, a gear engaging with said gear teeth, a shaft mounted in said casing and upon which said gear is mounted, a crank arm extending from the last mentioned shaft, a link from said crank arm to said frame, a fluid pressure cylinder and means connecting said die or pass with said cylinder for moving the said die along said frame.

2. In metal drawing apparatus, the combination with means for supporting the work, of a die or pass through which the work is passed, means for relatively moving said pass and work longitudinally of the latter, means for relatively rotating the work and pass, said pass comprising a series of balls to encircle the work and positioning means for said balls, said positioning means comprising a ring encircling the balls and said ring being adapted to move the balls inwardly as it is moved longitudinally of the work and means for moving the said ring longitudinally of the work in a pre-determined ratio to the relative longitudinal movement of the pass and work.

3. In metal drawing apparatus, the combination with means for supporting the work, of a die or pass through which the work is passed, means for relatively moving said pass and work longitudinally of the latter, means for relatively rotating the work and pass, said pass comprising a series of balls to encircle the work and po-

sitioning means for said balls, said positioning means comprising a ring encircling the balls and said ring being adapted to move the balls inwardly as it is moved longitudinally of the work and means including a reducing motion for moving the said ring longitudinally of the work in a predetermined ratio to the relative longitudinal movement of the pass and work, the said reducing motion producing a less movement of the ring than the corresponding movement of the pass with relation to the work.

4. In metal drawing apparatus, the combination with means for supporting the work, of a die or pass through which the work is passed, means for relatively moving said pass and work longitudinally of the latter, means for relatively rotating the work and pass, said pass comprising a series of balls encircling the work and positioning means for said balls, and means for adjusting the said positioning means in a predetermined ratio to the relative longitudinal movement of the pass and work, to force said balls inwardly.

5. In metal drawing apparatus, the combination with means for supporting the work, of a die or pass through which the work is passed, means for relatively moving said pass and work longitudinally of the latter, means for relatively rotating the work and pass, said pass comprising a series of balls encircling the work and positioning means for said balls, and means for adjusting the said positioning means comprising a connection between said positioning means and the frame of the apparatus whereby the relative longitudinal movement of the die

and work causes movement of said positioning means to vary the diameter of the die. 40

6. The combination with a pass comprising a series of balls adapted to act upon the work and a ball raceway including a tapered ring encircling the balls and longitudinally movable with relation to the remainder of the raceway, a support on which the pass is slidable axially of the pass, means for rotating the work in said pass, means for moving said pass longitudinally and means for moving said tapered ring to vary the diameter of the pass. 45 50

7. The combination with a pass comprising a series of balls adapted to act upon the work and a ball raceway including a tapered ring encircling the balls and longitudinally movable with relation to the remainder of the raceway, a support on which the pass is slidable axially of the pass, means for rotating the work in said pass, means for moving said pass longitudinally and means operated by relative movement of the pass and work for longitudinally moving said tapered ring to vary the diameter of the pass. 55 60

8. A ball die comprising a casing, a series of balls within said casing, a raceway for said balls comprising a ring on said casing at each side of the said series of balls and a longitudinally tapered ring encircling said balls and gearing engaging with the last mentioned ring to adjustably position it longitudinally of the die. 65 70

In testimony whereof I have signed this specification this 31st day of January, 1919.

LOUIS H. BRINKMAN.