

No. 880,563.

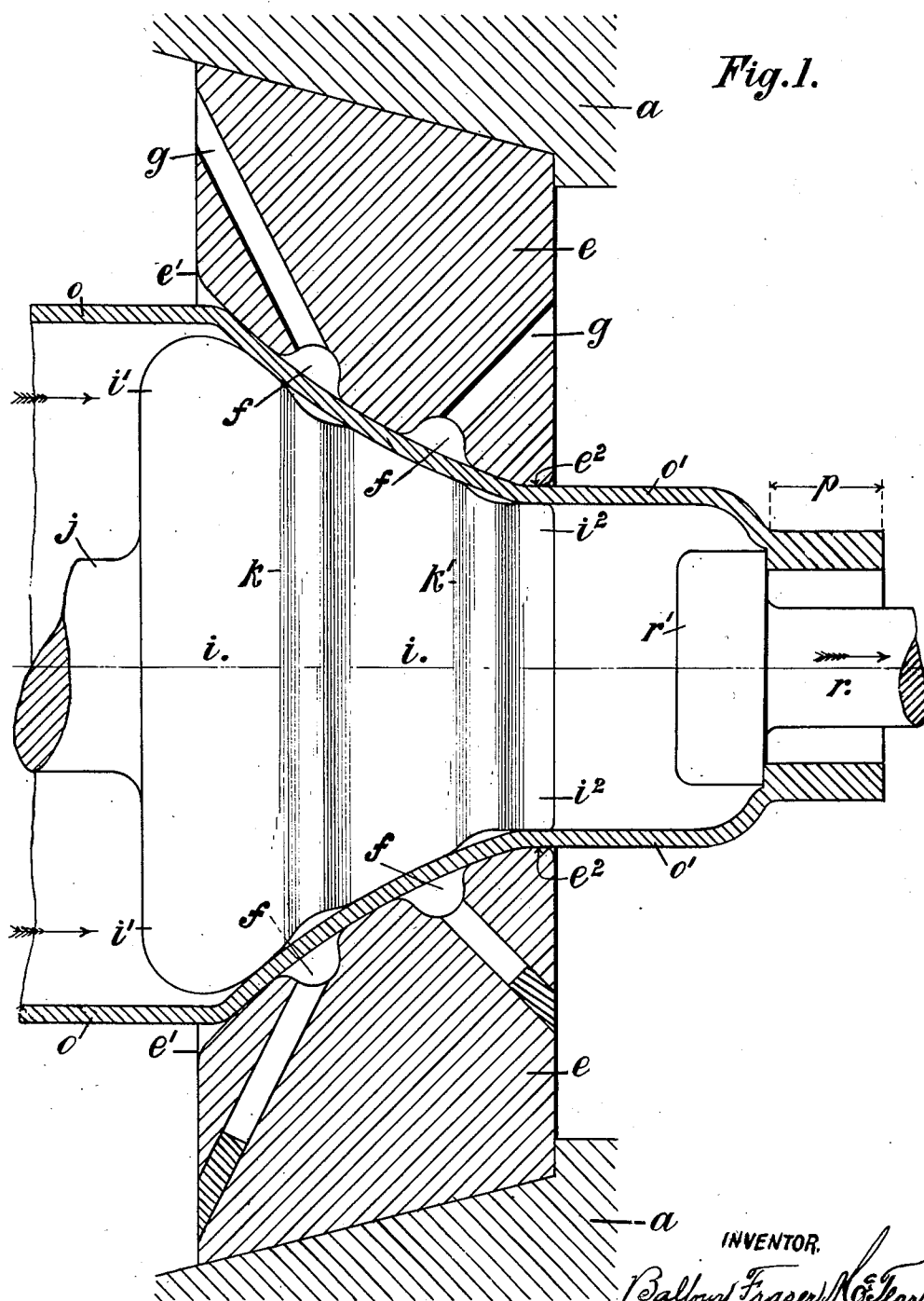
PATENTED MAR. 3, 1908.

B. F. McTEAR.

APPARATUS FOR DRAWING HARD METAL TUBES.

APPLICATION FILED MAR. 7, 1902.

3 SHEETS—SHEET 1.



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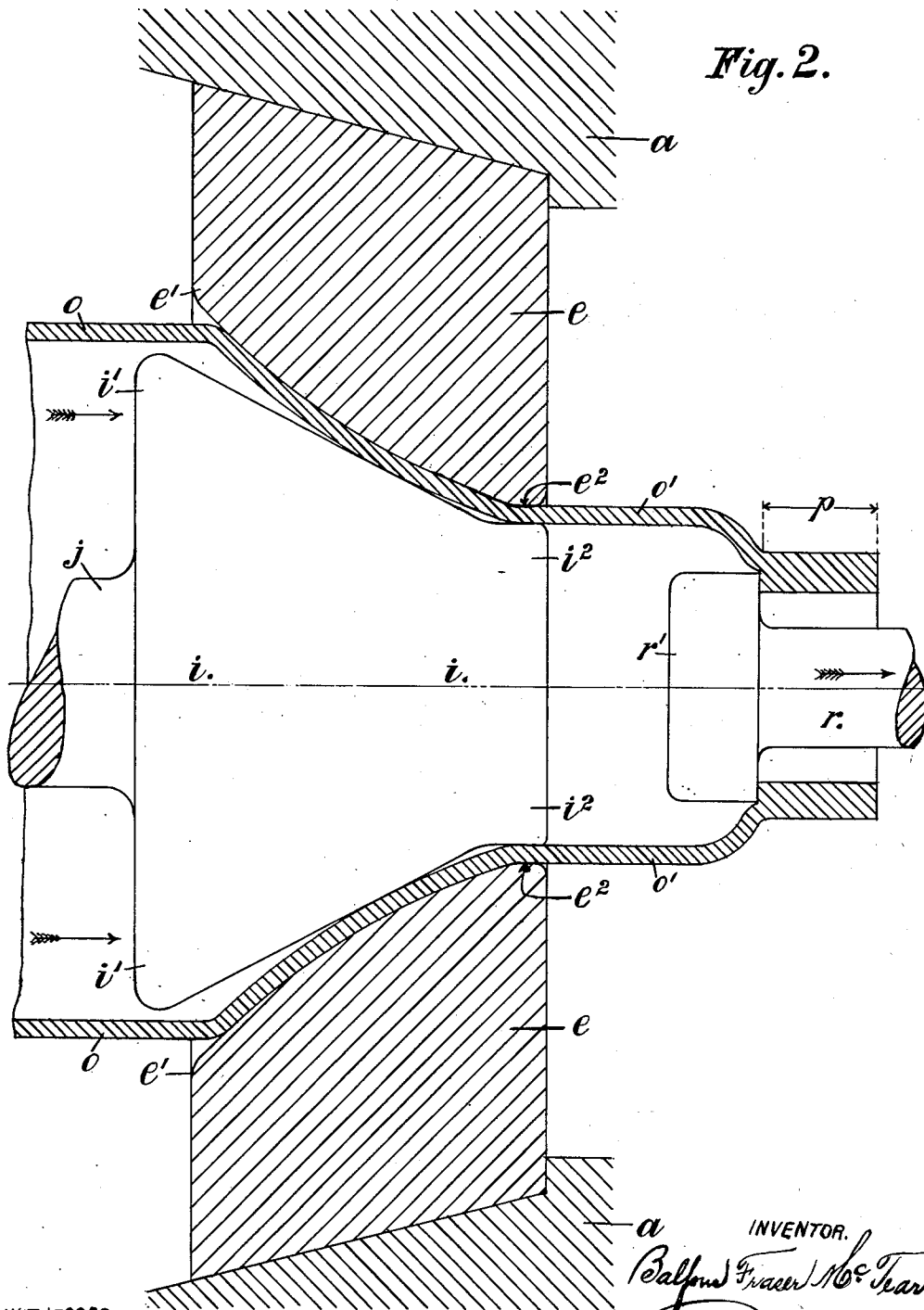
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3 SHEETS—SHEET 2.

Fig. 2.



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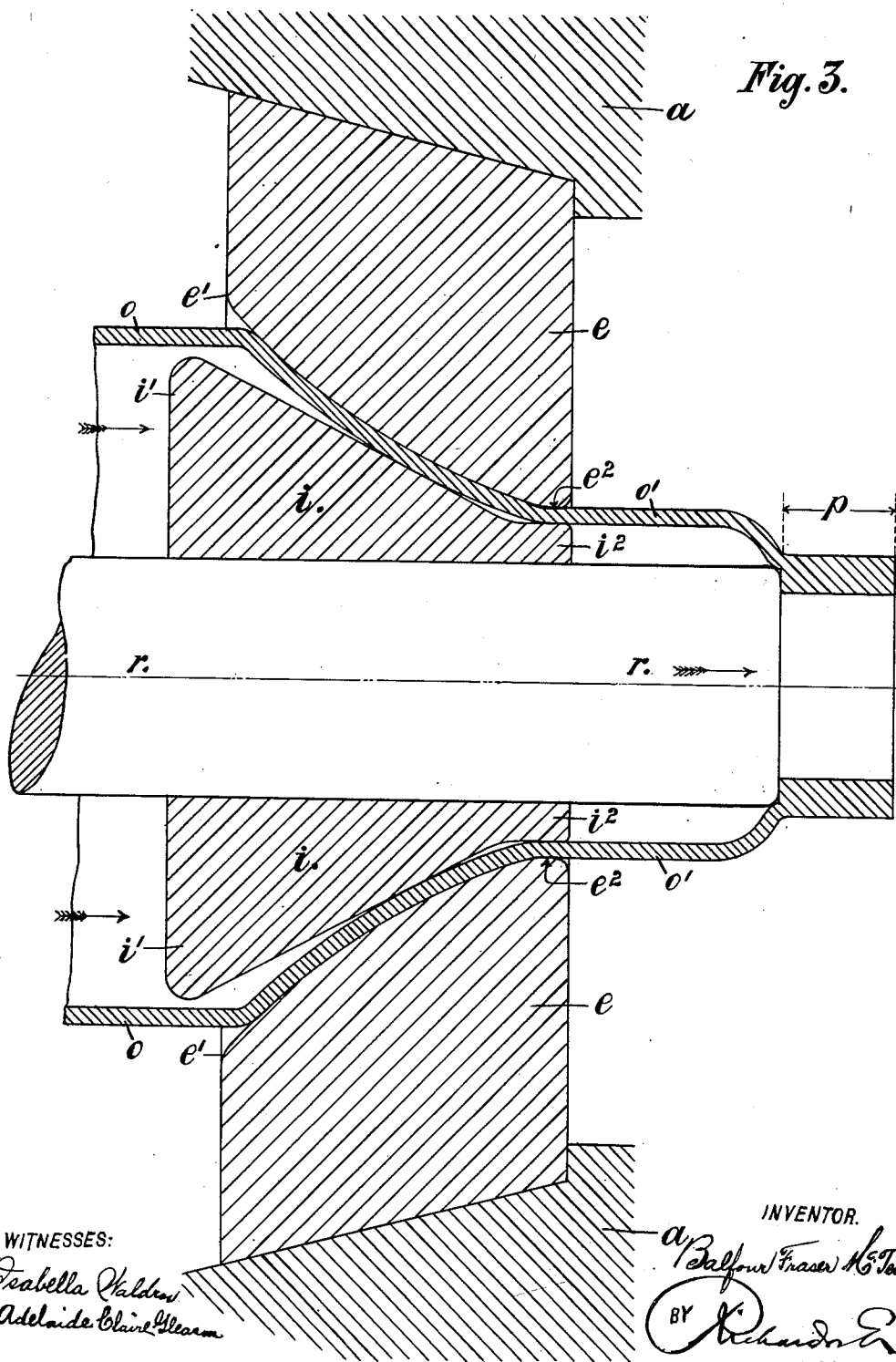
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UNITED STATES PATENT OFFICE.

BALFOUR FRASER McTEAR, OF RAINHILL, ENGLAND.

APPARATUS FOR DRAWING HARD-METAL TUBES.

No. 880,563.

Specification of Letters Patent.

Patented March 3, 1908.

Application filed March 7, 1902. Serial No. 97,130.

To all whom it may concern:

Be it known that I, BALFOUR FRASER McTEAR, a subject of the King of England, and a resident of Brook Cottage, Rainhill, in the county of Lancaster, England, have invented new and useful Improvements in Apparatus for "Drawing" Hard-Metal Tubes, of which the following is a specification.

This invention has reference to the manufacture of hard metal tubes or hollow bodies, such as of steel, iron, copper, and analogous or other hard metals; and more particularly to that part of the process of such manufacture wherein the tubes or tubular bodies are "drawn" through dies, generally, for reducing their diameter. Further, the species of tubes or tubular bodies referred to is that which is without weld or seam.

According to this invention, the aperture of the die through which tubes are drawn, and by which they are reduced, is of a varying diameter at different points along its axis, it being "bell-shaped" or of analogous formation. The contour of the die aperture in its preferred form, is therefore of tapering form, or of an abrupt curved shape.

The thickness of a die, according to this invention, for making tubes of medium or larger sizes is considerable; and the diameter of the aperture at the exit much smaller than the inlet end or mouth; and the effect is, that a large reduction of diameter of tube can be made at each pass of the tube through the die. Furthermore, the power necessary to draw the tube through the die is not excessive; neither are the disruptive tendencies. Nor is the metal strained, or otherwise damaged.

In connection with the die above specified, a plug is employed within the tube, and within the planes of the faces of the die; and this plug has a shape and contour similar to that of the die aperture, or largely so. The plug is held in position within the tube by a bar, from one end, and is immovable therein, being disposed and adjusted to the position required by means of this bar.

The end of the tube blank or tubular body to be drawn is reduced by pressing or forging to somewhat the shape and size of the die aperture; and its smaller end is projected out in the form of a nozzle, the end of which is provided with a strong internal flange. The tube is drawn through the die by a draw rod or bar, having upon it a head, which bears on the inner surface of the internal flange of the

nozzle above referred to; and by the pull on the bar the tube is pulled through the die.

In some cases, the surface of the die round the aperture is grooved or corrugated, thereby forming a plurality of rings or points of support and pressure to the tube in series. In some cases the plug surface is of a similar formation or construction. When these points of contact are in the form of rings or annular corrugations, the construction constitutes a series of dies, performing a series of successive diametrical reducing actions upon the tube as it passes through the apparatus. A further object and effect of this ring or corrugated construction of die, or die and plug, is that it serves a means by which lubricants can be continuously supplied to the surface, or surfaces, of the tube, and the active surfaces of the die, or die and plug. The lubricant may be introduced to the die, through suitable holes or openings from the outside; or the recesses or grooves of the die, or die and plug, may be filled with grease or like lubricant prior to the drawing action.

In the drawings illustrating my invention, Figures 1, 2, and 3 are longitudinal sectional elevations showing three modifications of apparatus or means for cold drawing tubes under this invention.

Referring generally to the drawings, *a* designates the die holder or frame, which may be of any known suitable kind; *e* is the die fitting in the holder *a*; *i* is the plug for supporting the tube internally; and *o* is the tube. The thickness of the die *e*—which is for reducing tubes of medium or large size, say about from 8 to 18 inches—is made of considerable width, say about 6 inches, and the surface of the die aperture which acts upon the tube, is a tapering one, decreasing in diameter from the mouth or entrance face at *e*¹, to the discharge face or end at *e*² said surface being also a convex curve. The plug *i* is made of a corresponding form on its external operative surface, as the die aperture, namely, it is tapering in form and decreases in diameter from the larger end *i*¹ to the smaller end *i*²; and it is disposed within the die aperture.

Referring now to Fig. 1, the die *e* is shown provided with two annular grooves or recesses *f*, by which, in the first place, the die is practically comprised of three successive parts or dies of successively smaller diameter, and in the second place, these grooves are provided as lubricant containers, for lubricating the surface of the tube and dies, as the tube

passes through them. This is of importance in reducing the diameter, or diameter and thickness of tubes of large diameters, as referred to, as it enables large reductions of diameters—or diameter and thickness—in the larger sizes of tubes such as referred to, to be made in a single pass or draw. Furthermore, by it, the metal is not subjected to abnormal or deteriorative stresses; and the power required in drawing is proportionately small; and it generally conduces to good work, and obviates the straining or breaking of the dies and machinery, and keeps the temperature of the parts down.

As an illustration of what may be done by the construction of this apparatus, comprising the form or construction of die and the internal holding up or supporting plug, and by means of lubricating the die and tube internally, and having a succession of diminishing lubricated die portions or dies, as much as 6 inches diminution of diameter in a tube of 12 inch original diameter, can be effected in one pass; and similar proportional reductions can be effected in tubes of other diameters.

When the thickness of tubes as well as the diameter is to be reduced, the difference of diameter between the smaller end i^2 of the plug i , and the internal diameter of the exit end e^2 of the die, would be the same as the internal and external diameters of the tube required. The end portion i^2 of the plug i , is made cylindrical or parallel, as is also the discharge end portion near the face e^2 of the die, and they together assist in guiding the tube out of the die in a right line, and in causing it to be drawn in a smooth and truly cylindrical form of even diameter. That is, while the other parts of the die guide and force the tube inwards in a conical diminishing formation, the latter parallel parts change it from the conical or tapering formation to the truly cylindrical, and guide and direct it.

The lubricant or grease is introduced preferably into the annular recesses f , through holes g , leading from the faces of the die to the back of the grooves; but if desired, they may be filled with grease from within the die aperture, prior to the tube being introduced.

The plug i will be held from the back end of the cold drawing bench or machine by the stem j , in the same way that such plugs are usually held. As shown in Fig. 1, the plug i is provided with an annular recess or groove at k , and another recess k^1 . These grooves make the plug into one containing a plurality of supporting plugs or surfaces of successively smaller diameter, corresponding with the successive diminishing operative surfaces of the die e .

The leading end of the tube o is forged before the drawing, into the form shown in the figure, that is, it is made in the form of a bell to correspond with the die aperture; and at its outer end the tube blank to be drawn, is

provided with a strong elongated neck p , which is of smaller diameter than the inside diameter of the finished tube, (which is shown by the parallel portion o^1); and the inner face of this internally projecting neck p forms a seat to receive the head r^1 of the draw bar r , by means of which the tube is pulled through the die; the inner face of this head r^1 butting against the inner face of the neck p .

In some cases, instead of the successive parts of the die e being in one piece, it may consist of a series of separate pieces or dies arranged in series, the diameters of their various apertures varying, the first being the larger or largest, and the last the smaller or smallest. In the case of the apparatus or means set forth being required for reducing the thickness as well as the diameter of the tube, the size of the mouth of the die e , and the larger portion i^1 of the plug i , would be so made that the annular space between them would be larger at the commencement or mouth, and diminishing inwards, as shown in Fig. 2 and Fig. 3.

With regard to the mode of using the apparatus, and its operation, the tube would be placed in position in the die, as shown, the rod r passed through the opening in the neck p on the tube end, and the plug i placed in position in the tube o in the usual ordinary way; whereupon the tube will then be drawn through the die, and over the plug. By making the die broad, and with an extended operative surface of a gradually decreasing diameter, biggest at the face of the entrance, and smallest at the face where the tube leaves the die; and by providing a plug i of decreasing diameter, adapted to support the tube internally during the greater portion of its passage between itself and the die surface; the tube is gradually reduced, and the crinkling or rucking of it, which would otherwise occur in attempting to make so large reductions as referred to, is prevented, and a smooth and well-finished surface is produced. It also furnishes a means by which the metal is not strained or damaged, notwithstanding the great reduction effected in its diameter in a single pass, and the great pressure necessary to move it through the dies.

Referring to the modification in Fig. 2, the general form of die and parts are the same as those set forth with reference to and shown in Fig. 1; but in this case, the operative surface of the die e is continuous throughout, instead of consisting of a number of annular parts, there being no annular recesses for containing lubricating grease; and the annular space at the entrance or mouth of the die, *i. e.* between the die aperture surface and the larger portion i^1 of the plug i , is larger within, and it tapers and diminishes in size, towards the discharge end.

Referring now to the modification shown

in Fig. 3, this construction of parts, as regards the die *e*, and the formation of the end of the tube *o*, is similar to that shown in Fig. 2, while the external form of the plug *i* is also similar; but in this case the tube is forced through the die by the drawing or forcing rod, which passes through a hole in the plug *i*, and supports the plug, and presses on the inner face of the neck *p*, similarly as the head *r*¹ of the rod *r* does in the construction shown in Fig. 1, the rod *r* being pushed along by any suitable power, instead of being pulled. Otherwise than in these respects, this construction is the same as that shown in Fig. 1.

Having now described my invention, what I claim as new and desire to secure by Letters Patent is:—

1. An apparatus for drawing hard metal tubes, comprising an external die having an aperture therein which decreases in diameter from the mouth or entrance face to the discharge face, the surface of said aperture being a convex curve, said aperture having a short cylindrical portion at its discharge end, an internal plug *i* disposed axially within the aperture of the die, said plug having its operative surface tapering and decreasing in diameter from the entrance end towards the

discharge end and said discharge end portion being cylindrical and parallel with the cylindrical portion of the die and the said tapered operative surface being substantially straight.

2. An apparatus for drawing hard metal tubes, comprising an external die *e* having an aperture therein, the operative surface of which being a convex curve and decreasing in diameter from the entrance end to the discharge end and having a short cylindrical portion at its discharge end, annular chambers *f* in said operative surface, said die having ports therein leading to said chambers, a plug *i* disposed axially within the die aperture, said plug having its operative surface tapering and decreasing in diameter from the entrance end to the discharge end and said discharge end being cylindrical and parallel with the cylindrical portion of the die, said plug having annular recesses therein corresponding to the chambers in the surface of the die.

In witness whereof I have hereunto set my hand in presence of two witnesses.

BALFOUR FRASER McTEAR.

Witnesses:

SAM GOODALL,
GEO. E. GODDING.