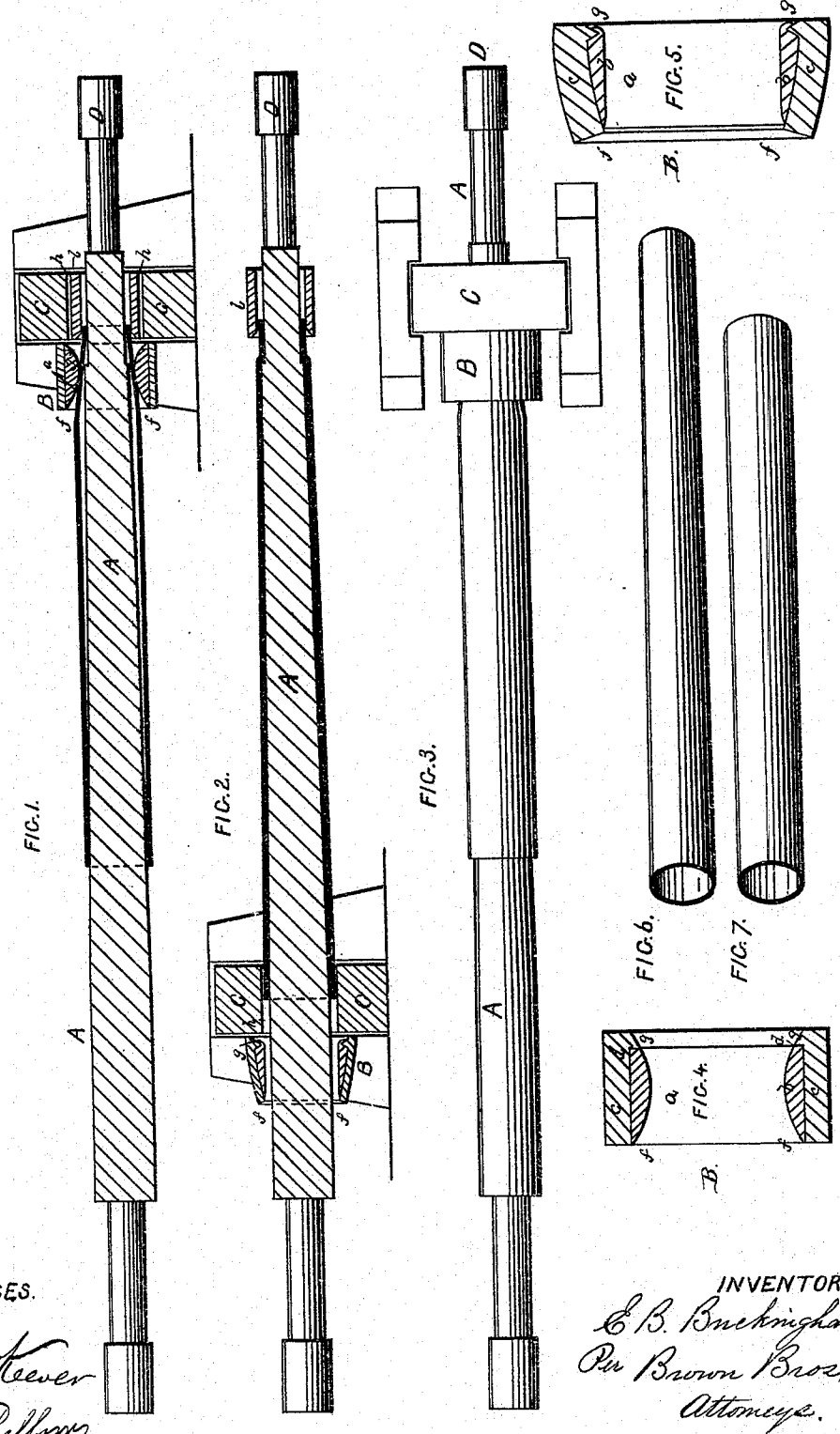
(Model.)

E. B. BUCKINGHAM.

DEVICE FOR DRAWING METAL TUBES.

No. 252,423. Patented Jan. 17, 1882.



WITNESSES.

W. M. Keever

W. S. Pelton

INVENTOR.

E. B. Buckingham

Per Brown Bros.

Attorneys.

N. PETERS. Photo-Lithographer, Washington, D. C.

UNITED STATES PATENT OFFICE.

EDWIN B. BUCKINGHAM, OF BROOKLINE, ASSIGNOR TO THE AMERICAN TUBE WORKS, OF BOSTON, MASSACHUSETTS.

DEVICE FOR DRAWING METAL TUBES.

SPECIFICATION forming part of Letters Patent No. 252,423, dated January 17, 1882.

Application filed January 25, 1877. Renewed July 14, 1881. (Model.)

To all whom it may concern:

Be it known that I, EDWIN B. BUCKINGHAM, of Brookline, county of Norfolk, and State of Massachusetts, have invented certain new and useful Improvements in Devices for Drawing Metal Tubes, of which the following is a specification.

As is well known, drawn metal tubes are manufactured by drawing a metal tube on a mandrel through a stationary die, and as the working-face of the die is rigid the tube made is of uniform diameter exteriorly.

The object of this invention is to draw metal tubes which shall taper exteriorly and which can be used for many purposes—as, for instance, hose-pipes, boiler-flues, candle-molds, &c.; and the invention consists in an expanding die made in parts, each part being constructed of metal capable of expanding and to abut or interlock, and in other details, as hereinafter shown and described.

In the accompanying plate of drawings, Figure 1 is a longitudinal section, showing the improved combination of tapering mandrel and expanding die, and the mandrel as just entering the die to be drawn through it by the ordinary arrangement and operation of a draw-bench; Fig. 2, a similar view to Fig. 1, but showing the mandrel as having been drawn through the die. Fig. 3 is a plan view of Fig. 1. Fig. 4 is a cross-section, on an enlarged scale, of the die before use; Fig. 5, a similar section of it after use. Fig. 6 is a perspective view of a drawn exteriorly tapering metal tube, and Fig. 7 is a perspective view of a metal tube from which the tube shown in Fig. 6 can be produced.

In the drawings, A represents the mandrel, and B the die. The mandrel A tapers in the direction of its length according to the exterior taper of the tube which it is desired to produce; but otherwise it is formed as usual.

a is the die-opening through which the mandrel A and the tube on it are to be drawn. This die opening *a* is shaped to receive the smaller end of the mandrel, and the die is made of such metal as will expand and enlarge or stretch to the increased diameter of the mandrel as the mandrel is drawn through the die, while at the same time it will hug the mandrel with such tightness as to draw and elongate the tube which is on the mandrel and shape it exteriorly to the taper of the mandrel, and otherwise reduce and finish it in all the well-known respects of the common drawn metal tube.

For drawing brass tubes exteriorly of a taper, a die made only of copper or other proper expanding metal or metals is suitable, and for similarly drawing copper tubes I use a die which is made in parts, *b* and *c*, (see Fig. 4,) which compound constructed die is one of the features of this invention. The part *b* makes the working-face of the die-opening *a*, and it is made of an alloy of tin and lead in equal parts; and the part *c* is an outer metal band, which surrounds, strengthens, and holds the inner working part, *b*, against rupture from the strain on it in the operation of drawing a tube through its opening *a*. The outer die part, *c*, preferably is made of copper; but obviously other metals may be used; and, again, preferably it is made of a metal or metals capable of expanding in proper proportion relative to the expansion of the inner part, and to holding such inner part against rupture in the drawing of a tube through its opening *a*. The part *b* is shouldered exteriorly and the part *c* interiorly, and when the two parts are together these shoulders make an abutment and interlock *d* of the parts, by which the inner part, *b*, is held against being forced through the outer part, *c*, when the die is used, as hereinafter described. The two parts *b* and *c* of the die preferably are cast or otherwise made separately and fitted together; but obviously the inner part may be made and then the outer part made or cast directly upon it.

The die-opening *a* is bell-shaped at its front or receiving end, *f*, and countersunk at its rear or delivering end, *g*, and when the die is in its working position its delivering end *g* lies against the upright face of a stationary block, C, with the die-opening about and concentric with a hole, *h*, which extends through said block. This hole *h* is of suitable diameter to receive the larger end of the mandrel, and the countersunk end *g* of the die-opening *a*, which is at the end of the die lying against the block C, is such that the bearing of the die against the block is beyond the boundary of the hole

h, all as plainly shown in Fig. 1 more particularly.

l is a loose collar of a size to fit the smaller end of the taper to the mandrel A and to loosely fit the hole *h* through head-block C. This collar sets over the end of the metal tube to be drawn, which is at the smaller end of the mandrel, and when the mandrel and die are put into position for the drawing of the tube it is set in the hole *h* of the head-block C, and thus the mandrel is centered in said hole *h*.

To draw a metal tube to an exterior taper under this invention, (it being of course understood that tubes and tapering mandrels and expanding dies, all of suitable metal and of suitable relative shape and size, are to be used together in each instance, (I take the tube which is to be drawn to an exterior taper, and having shouldered or slightly tapered one end of it, as is well-known in tube-drawing, I place and bring it to a bearing, as usual, on its mandrel. I now place the die on the smaller end of the mandrel, and then the loose collar, which latter I bring to a bearing over the shouldered end of the tube, which is the end at the smaller end of the mandrel, and then I place the smaller end of the mandrel through the head-block opening *h* and adjust the collar *l* in said opening *h* and the die against the head-block in the position described, and all as plainly shown in Fig. 1. The mandrel and tube, with the die, are now in position for the drawing of the tube, which is accomplished by attaching the mandrel at its end D to the drawing mechanism of an ordinary draw-bench. As the mandrel and tube are thus drawn through the die-opening *a* the die expands and enlarges or stretches to the increasing diameter of the mandrel, and yet at the same time hugs and binds the tube on the mandrel to such extent as to draw and elongate and shape it to the mandrel, giving it an external taper and otherwise finishing it as ordinarily in drawing metal tubes. The bell shape of the die-opening gives greater freedom to the entrance of the mandrel and to the expansion of the metal of the die, and also with a given length of die-opening reduces the frictional bearing at the start of the die on the tube, and withal admits and secures an increased frictional bearing proportionate with the increasing work of the die caused by the increasing diameter of the mandrel as the mandrel travels through the die, and all without in the least degree detracting from the desired action of the die.

The countersinking of the die-opening *a*, with the bearing of the die against the block C, prevents the die from being drawn into the opening of the head-block by the draw of the mandrel through the die, and this is insured to a greater degree if said countersinking be so made that the die will have but a small frictional contact with the head-block compared to the full thickness of the metal of the die, for the reason, in the first case, that the bearing-surface of the die on the tube and mandrel can thereby be so far removed from the opening of the head-block that all the metal of the die, if any, which is drawn toward the opening *h* of the head-block, because of the passage of the mandrel through the die, lies within the die and does not enter the said opening; and for the additional reason, in the second case, that the die is rendered thereby freer to open outwardly than to be drawn by the mandrel toward said opening.

It is obvious that if any of the metal of the die be pulled into the opening *h* such metal proportionately blocks up such opening to the free passage of the mandrel and tube through it, and also would tend to stop the expansion of the die, which shows the importance of the entire countersunk construction herein described without further explanation, and while neither said countersunk construction nor the said bell-shape construction of the die is absolutely essential to the expansive action of the die in the passage of a tapering mandrel to draw exteriorly a tube to a taper, yet with either one or both of the said constructions of the die the quality of the work and the action of the die are measurably improved.

The choice of a metal or metals of which to make a die to expand and operate as described will obviously depend more or less upon the nature of metals themselves, their adaptability, either single or in combinations or alloys, for the work, and their capability for being used, as herein described, with the metal composing the tube to be drawn, and consequently I do not limit myself to any particular metal or metals or alloys of metals for the die.

It may be well to here observe that my improved expansive metal die might be used to draw tubes to a taper or to draw and finish tapering tubes without a mandrel being employed in conjunction with it; but it is preferable, as is obvious, to employ a mandrel, as described.

My invention is applicable to drawing tubes exteriorly to a taper, either in the whole or in a part of their length, and to so drawing tubes whether they be straight or tapering, or straight in part and tapering in part, or seamless, or brazed, or welded, or made of any metals or combinations or alloys of metals.

Having thus described my invention, what I claim, and desire to secure by Letters Patent, is—

1. An expanding die, B, in parts *b* and *c*, each made of metal capable of expanding and to abut or interlock, as at *d*, substantially as and for the purpose described.

2. The combination, with a mandrel, a die, and a head-block for drawing tubes, of a loose collar, *l*, which is on the mandrel and outwardly is adapted to fit the head-block, substantially as and for the purposes described.

E. B. BUCKINGHAM.

Witnesses:
GEO. H. EARL,
EDWIN W. BROWN.