

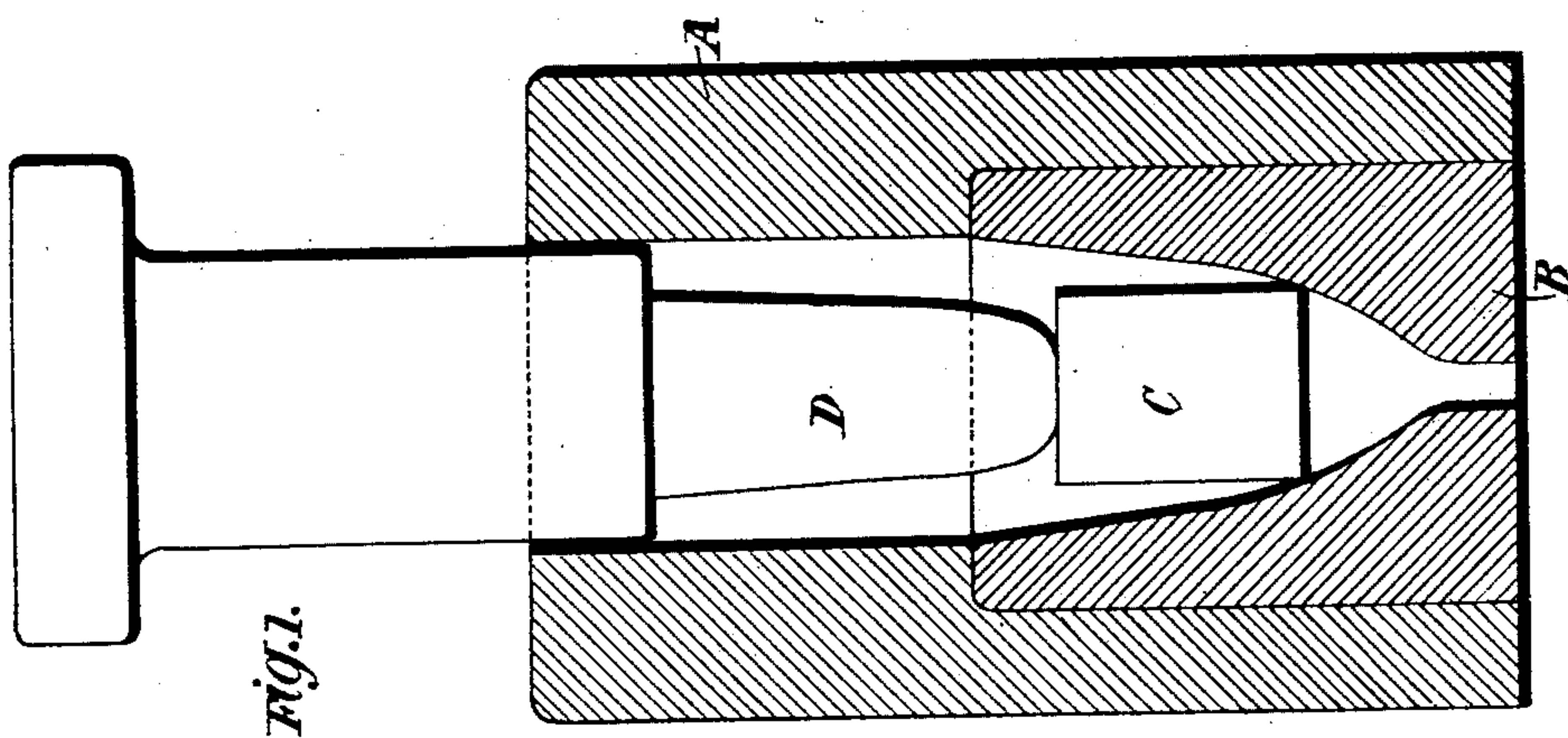
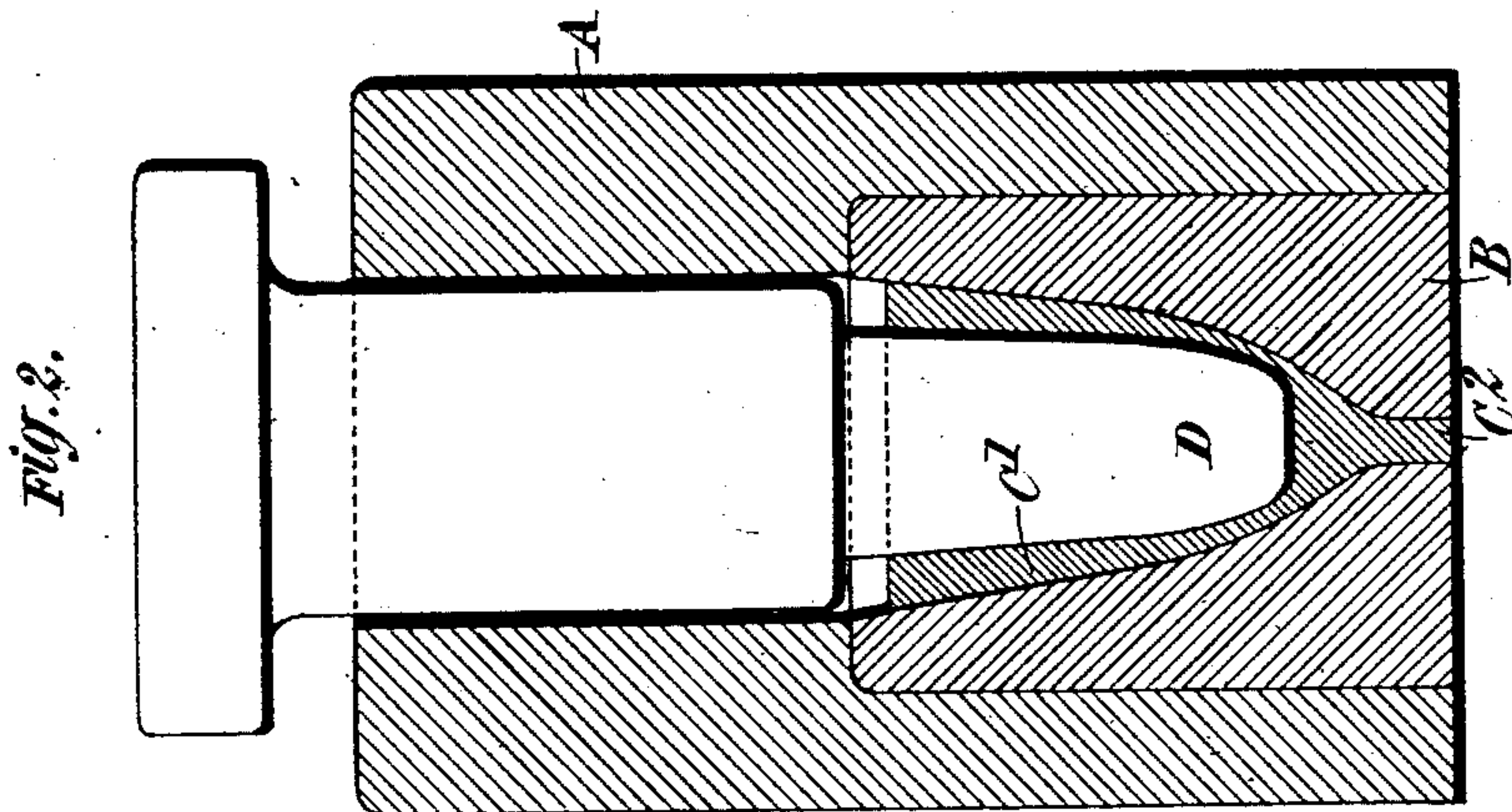
(No Model.)

2 Sheets—Sheet 1.

C. T. CAYLEY.  
MANUFACTURE OF METAL TUBES.

No. 520,296.

Patented May 22, 1894.



Witnesses:

G. W. Rea.

Thos. A. Green

Inventor:

Claud T. Cayley

By

James L. Norris

Atty

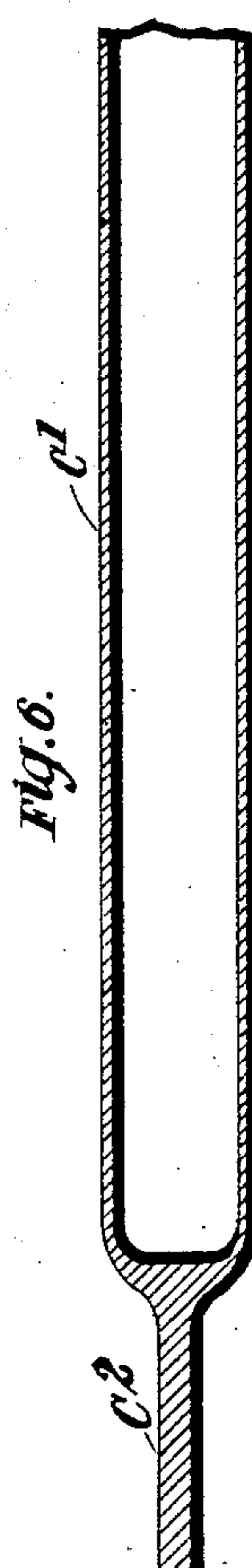
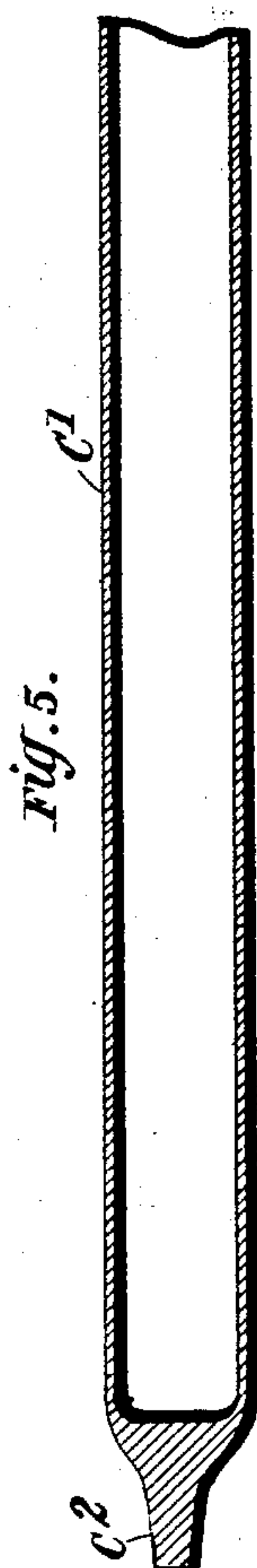
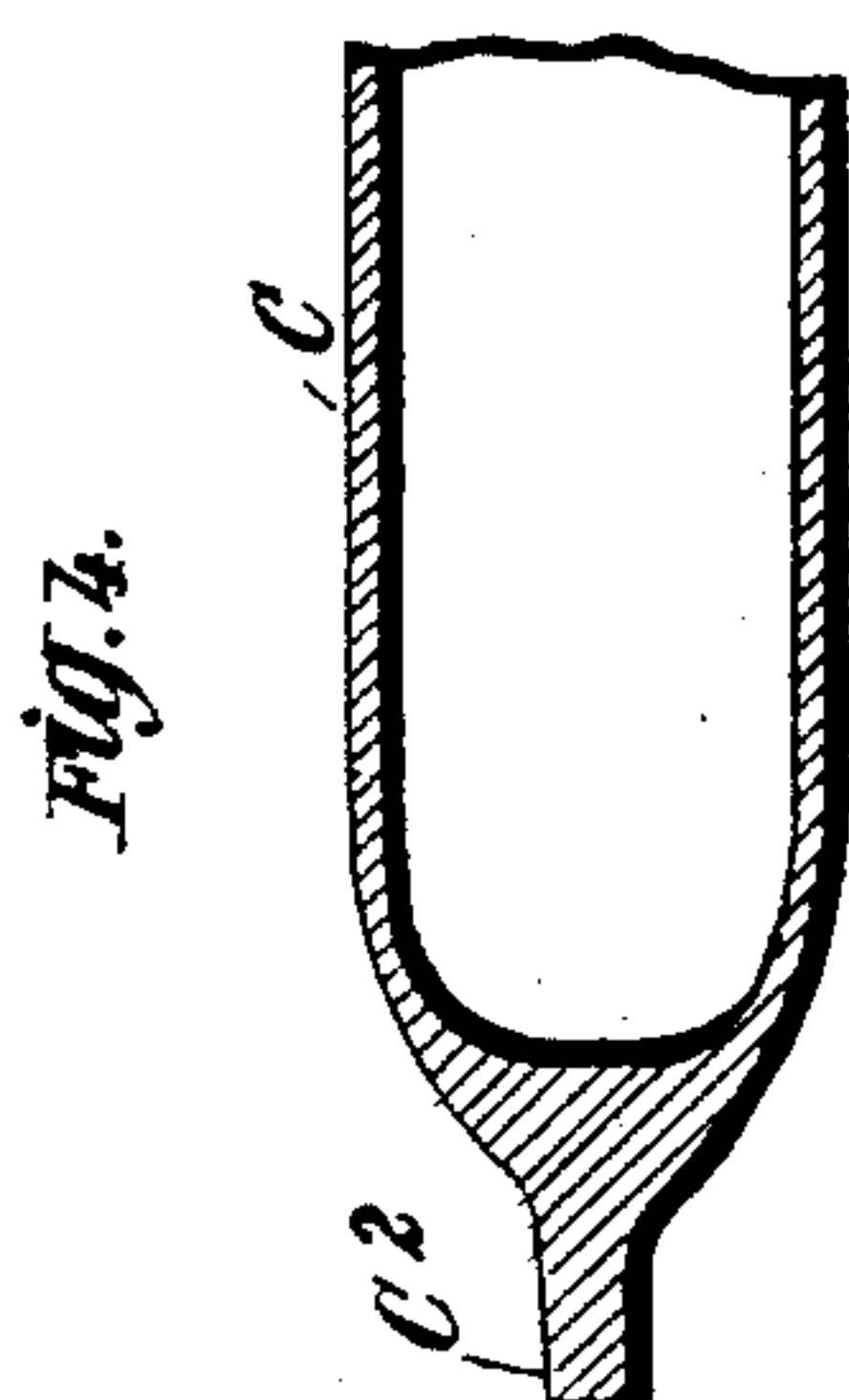
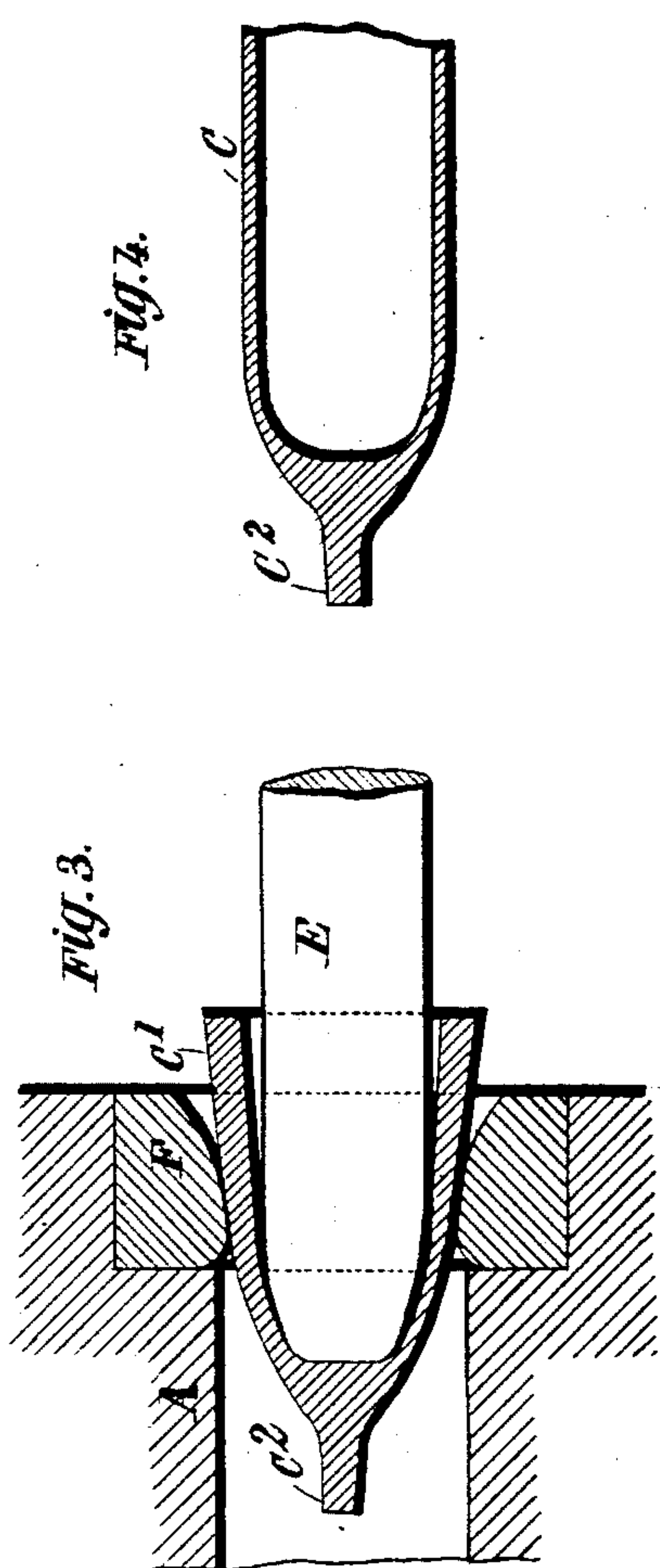
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# UNITED STATES PATENT OFFICE.

CLAUD THORNTON CAYLEY, OF LONDON, ENGLAND.

## MANUFACTURE OF METAL TUBES.

SPECIFICATION forming part of Letters Patent No. 520,296, dated May 22, 1894.

Application filed December 4, 1893. Serial No. 492,713. (No model.)

*To all whom it may concern:*

Be it known that I, CLAUD THORNTON CAYLEY, engineer, a subject of the Queen of Great Britain, and a resident of London, England, have invented an Improvement in the Manufacture of Metal Tubes, the same being new and useful, of which the following is a specification, reference being had to the accompanying drawings.

My invention relates to an improved manufacture of metal tubes.

The object of my invention is to improve the manufacture of solid-drawn weldless tubing by forming it from a solid block of metal in a novel manner, whereby as compared with processes in which such tubes are formed from tubular ingots the manufacture is simplified and facilitated, and waste of metal therein is greatly reduced. The finished product of the improved manufacture is of the highest character, and can be profitably sold at a much lower price than a similar article manufactured according to any of the usual and well-known methods.

The improved manufacture of metal tubing according to this invention is analogous, in certain respects, to the manufacture of projectiles as set forth in the specification of Letters Patent of the United States, No. 374,113, granted to Cayley and Courtman, but, further, comprises certain special features hereinafter particularly described.

Hitherto it has been customary for the manufacturers of metal tubing to obtain expensive tubular ingots, to subject these ingots to suitable rolls, and then to crush and otherwise deform one end of the rolled ingot in order that it may be conveniently held by grippers employed in a subsequent operation of hot or cold drawing. This deformation is very considerable, and is not limited merely to the part of the tube which is to be actually seized in the gripper, but extends for a considerable distance along the tube, beyond that part. It necessitates great waste of material previously worked into tubular form, as the whole of the deformed portion has to be separated from the finished tube. According to my invention I reduce such waste by manufacturing tubes from a solid blank upon which the formation of a small but sufficient "tang" for seizure by the gripper is

initiated simultaneously with the commencement of the formation of the tube. The latter has not thereafter to be deformed on account of the tang. The subsequent treatment of the tang and the formation of the tube proceed as distinct operations which do not interfere in any way with each other, and when the formation of the tube is completed the tang is cut off therefrom. As the quantity of metal in the tang is extremely small the resulting waste is very much reduced, in comparison with that which occurs in the other and earlier processes hereinbefore referred to. Further, the employment of the tang enables the article to be gripped more conveniently than in the said prior processes.

In order that my invention may be clearly understood I will now proceed to describe the same with reference to the accompanying drawings, wherein—

Figure 1 is an elevation partly in vertical central section showing the apparatus, and the solid blank aforesaid, as they appear at the commencement of my improved manufacture. Fig. 2 is an elevation similar to Fig. 1 illustrating the next stage in the manufacture. Fig. 3 is a sectional view illustrating other apparatus and showing the blank as it appears in a further stage of said manufacture, and Figs. 4, 5 and 6 are longitudinal central sections of the blank in the shapes which it assumes in subsequent operations.

Like letters indicate corresponding parts throughout the drawings.

A is a casing in which a die B is received. The die is provided with a central tapered cavity from which extends a small channel through the bottom of the die. This cavity is shaped to correspond with the form to be imparted to a solid cylindrical block of metal C placed centrally therein as shown. The block must previously have been heated.

D is a punch adapted to descend into the die, and to act upon the block C to transform it into a hollow blank C' by displacing the heated metal into the space around and below the said punch so that it assumes in cross-section the form indicated in Fig. 2. By the downward displacement of the metal into the central channel in the bottom of the die B, the formation of a tang C<sup>2</sup> is initiated. After this



is done the blank C' is reheated and subjected to a hot-drawing operation such as is illustrated in Fig. 3, that is to say, a mandrel E is inserted in the central cavity of the hot blank, and is employed to thrust the blank through an annular die F held in a suitable support. This operation is repeated, with smaller mandrels and dies of graduated sizes to diminish the diameter and thickness of the blank which is re-heated as often as is necessary. Thus the blank having been caused to assume an intermediate shape such as is indicated in cross-section in Fig. 4, is finally given such relative diameter and thickness as are shown in Fig. 5. Thus far, the tang C<sup>2</sup> remains as it was in Fig. 2, but in the next operation it is heated and then lengthened by hammering as indicated in Fig. 6. After the tang is thus extended, the whole blank is heated, and the tang is immediately cooled or quenched by any suitable means. After being thus cooled or quenched the tang is inserted in a gripping-device which grips it and draws the blank, the body of which remains hot, through an annular die or a succession of graduated dies of smaller internal diameter than those employed in the preceding drawing-operations, whereby the external diameter of the blank is reduced and the lengths thereof are increased. During this part of the manufacture, in which the tube is reheated as may be necessary, no mandrel is placed within the said tubular portion, consequently the scale upon the interior of the latter will become detached while the internal diameter diminishes. Finally when the blank has cooled after the last-described hot-drawing operation I still further reduce its diameter to that of the desired finished arti-

cle by a process of cold-drawing in which the tang is again useful. Between each cold draw, in which the metal becomes hard, I heat the blank to blood heat, anneal it and pickle it as is customary. The tang, which, owing to the smallness of its diameter presents no obstacle to the aforesaid successive reductions of diameter of the blank, is now cut off, leaving a finished cylindrical tube, which contains all the metal of the original block C save the trifling amount discarded in the said tang.

What I claim is—

For the manufacture of metal tubes a process which consists, first, in subjecting a solid hot blank or block to the action of a punch and hollow die, the cavity of the latter being reduced in dimensions at one end and adapted to act, simultaneously with the hollowing of the blank or block by the punch, to form a tang at the end of the blank or block; second, in drawing down the hollow blank or block thus formed, by thrusting the same, while hot, through annular reducing-dies by means of mandrels placed in the punched cavity of the blank; third, in heating the blank or block and tang and extending the tang by forging; fourth, in cooling the tang; fifth, in pulling the hot blank or block by means of the tang through external finishing-dies without the presence of a mandrel in its interior, substantially as set forth, for the purposes specified.

In witness whereof I have hereunto set my hand this 17th day of November, 1893.

CLAUD THORNTON CAYLEY.

Witnesses:

S. WINLO. HOAR,  
THOMAS LAKE.