

(No Model.)

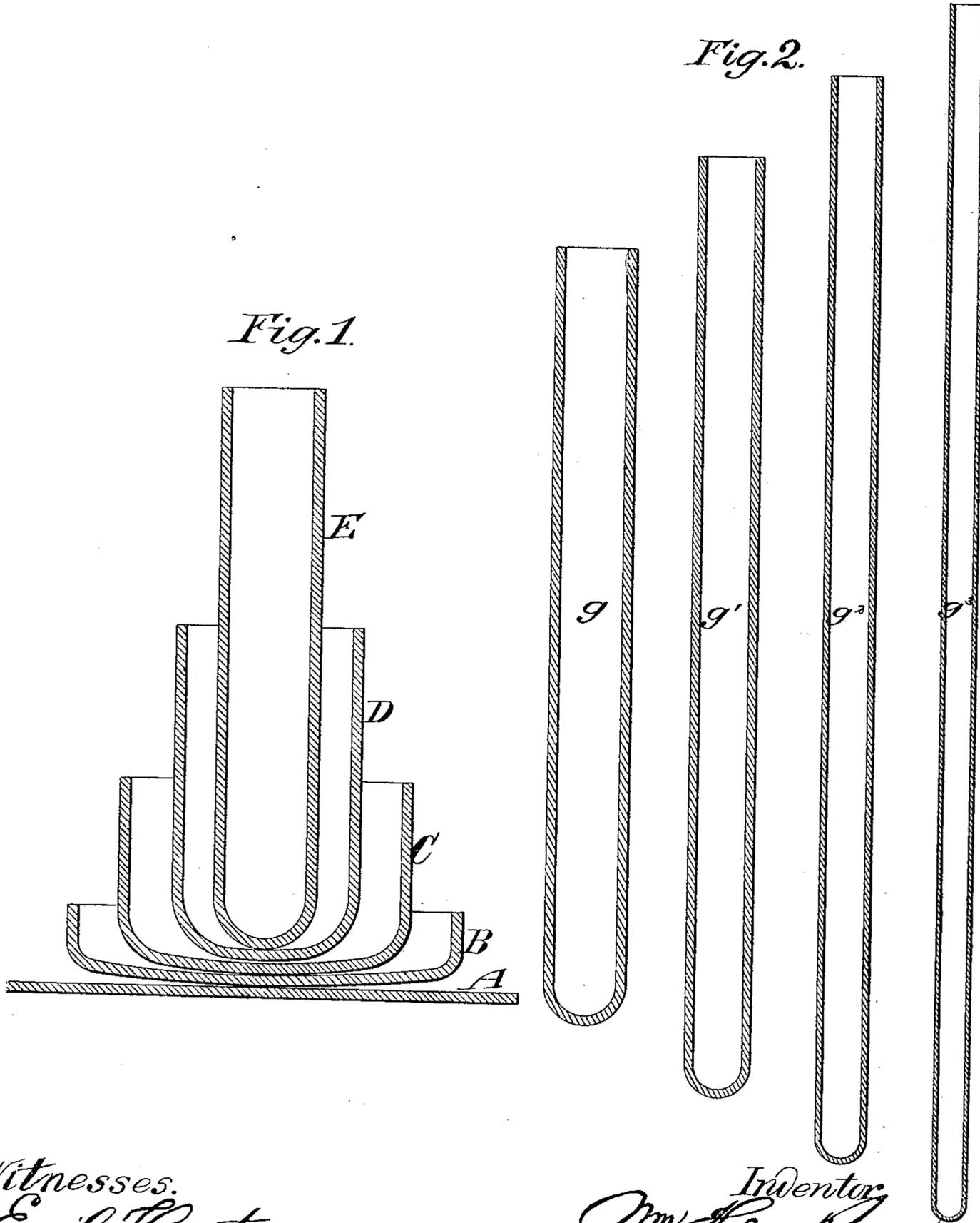
2 Sheets—Sheet 1.

W. H. BROWN.

ART OF MAKING SEAMLESS TUBES.

No. 377,347.

Patented Jan. 31, 1888.



Witnesses.
Emil Ketter.
O. Sundgren.

Inventor
Wm. Henry Brown.
by his Attorneys.
Rowntree & Co.

(No Model.)

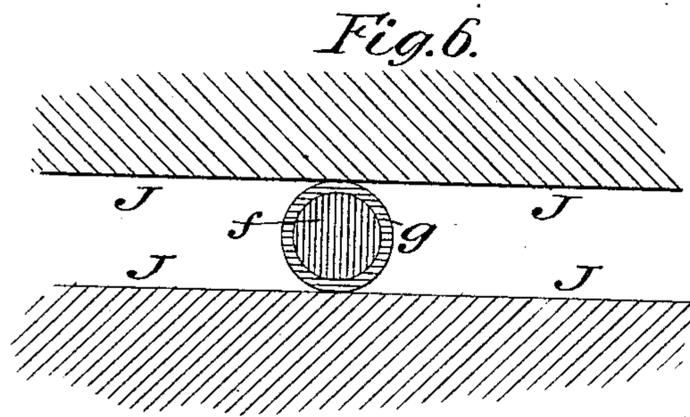
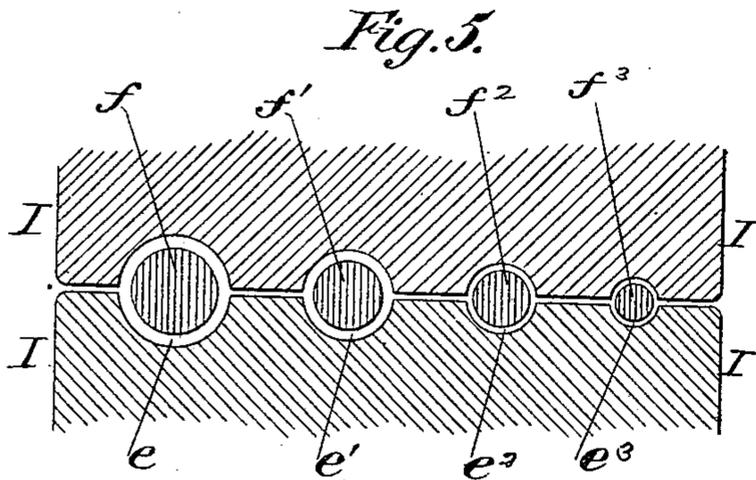
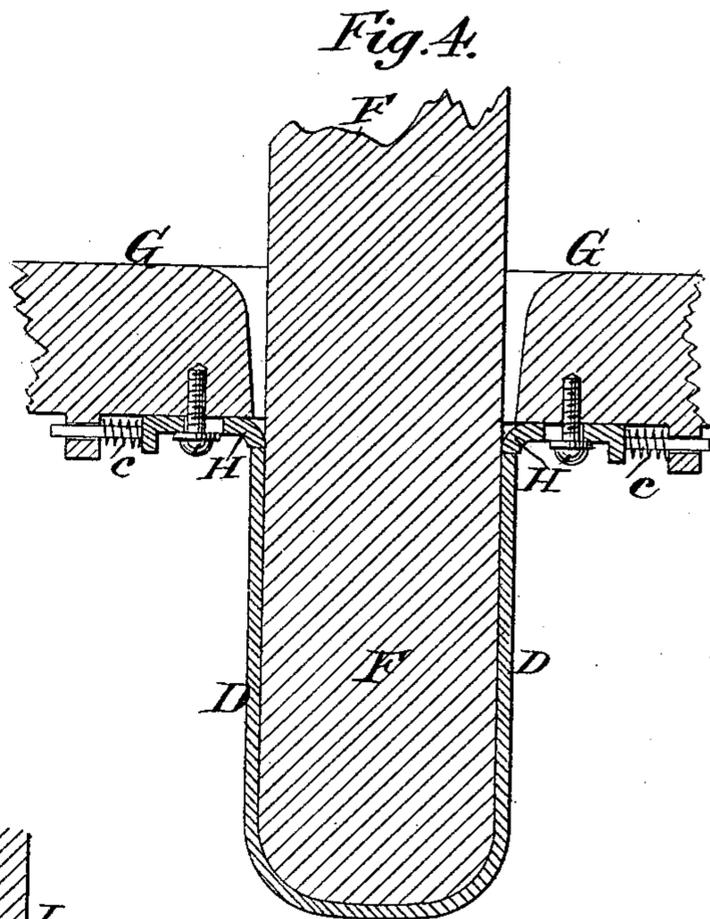
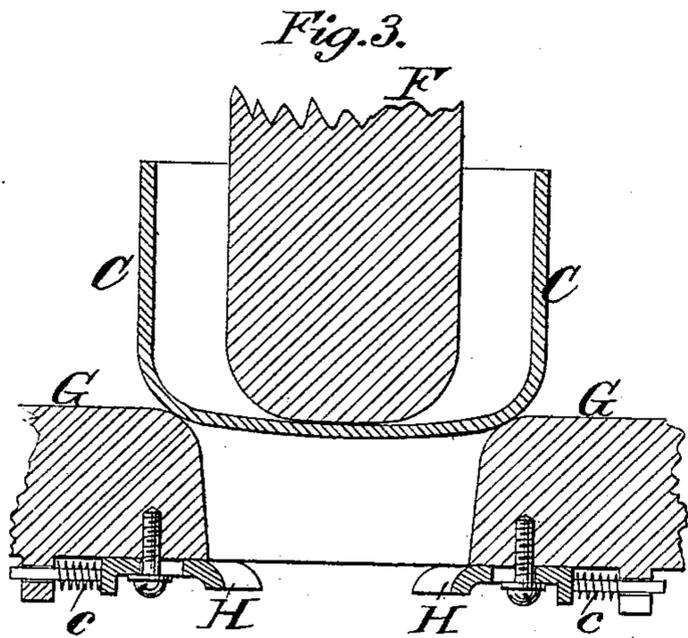
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Emil Carter.
Olundgren

Indenter:
Wm Henry Brown
by his attorneys
Brown & Hall

UNITED STATES PATENT OFFICE.

WILLIAM HENRY BROWN, OF JERSEY CITY, NEW JERSEY, ASSIGNOR TO
THE BROWN'S SEAMLESS METAL COMPANY, OF NEW JERSEY.

ART OF MAKING SEAMLESS TUBES.

SPECIFICATION forming part of Letters Patent No. 377,347, dated January 31, 1888.

Application filed May 27, 1887. Serial No. 239,517. (No model.)

To all whom it may concern:

Be it known that I, WILLIAM HENRY BROWN, a citizen of the United States, residing at Jersey City, in the county of Hudson and State of New Jersey, have invented a new and useful Improvement in the Manufacture of Seamless Metal Cylinders and Tubes, of which the following is a specification, reference being had to the accompanying drawings.

This invention relates to the manufacture of seamless cylinders of steel, iron, or other metal or alloy, either open throughout as tubes or closed at one end to constitute vessels or receptacles or parts thereof; and the object of my improvement is to reduce the cost of such manufacture, and to obtain cylinders or tubes having great tensile strength without the operation of drawing, which can only be performed on the metal while cold, and which, requiring great power and costly machinery, makes the manufacture of drawn cylinders and tubes of any considerable size too expensive for many purposes. According to my invention I operate upon the metal in a heated state during the whole process of manufacture, first bringing the disk or blank with which I commence to a cylindrical or cup form, and from that of a shorter cylinder or shallower cup of larger caliber to that of a longer cylinder of smaller caliber by folding or gathering in without any considerable reduction of thickness, and afterward reducing both the diameter and thickness, and at the same time condensing, hardening, and toughening the metal by successive alternate longitudinal and circumferential rolling operations.

The preliminary shaping operations by which the disk or blank is brought to the cylindrical or cup form, and from that of a shorter cylinder or shallower cup to that of a longer cylinder or shallower cup of smaller caliber without reduction of thickness, may be varied without departing from my invention. For instance, the disk may first have its edges turned in by an ordinary flanging-machine, and the cup thus formed may be afterward brought successively to the forms of longer and longer cylinders of less and less diameter by means of dies and mandrels passing longitudinally through said dies; or it may be done

by means of a machine substantially like that which is the subject of United States Letters Patent to O. W. Minard, No. 14,696, dated April 15, 1856, the metal being heated previous to the working in said machine, and being kept heated by a gas-flame while being so worked. The succeeding operations of longitudinal rolling and circumferential rolling to which the hot cylinders of metal are alternately subjected are performed upon cold mandrels, upon which the longitudinal rolling may be done in an ordinary rolling-mill with grooved rollers, and the circumferential rolling may be done between flat plates, one or both of which has a reciprocating motion by which the cylinder and contained mandrel are rolled on their axis between the said plates.

As I do not now intend to claim any novelty in the machinery by which my invention is performed, but my process can be performed by machinery which is well known to iron and steel workers, it is not necessary to the explanation of my invention to make any full representation of that machinery by drawings; but it will be sufficient to illustrate it by a few simple diagrams, which I will now explain.

Figure 1 illustrates the changes of profile form through which the metal passes in the conversion of the disk or blank into a cylinder of considerable length in proportion to the caliber by folding or gathering it in without material reduction in thickness. Fig. 2 is a diagram showing the successive reductions of both caliber and thickness to which the cylinders are subjected by the alternate longitudinal and circumferential rolling. Figs. 3 and 4 are sectional views of a plunger and die which may be used for the reduction of the metal in cylindrical shape as far as required before the reduction of thickness is to be effected. Fig. 5 is a transverse section of a metal cylinder and the contained mandrel and parts of a pair of rolls between which the cylinder is longitudinally rolled on the mandrel. Fig. 6 is a transverse section of a cylinder and mandrel and parts of two plates between which the cylinder is circumferentially rolled on the mandrel.

Similar letters of reference designate corresponding parts in all the figures.

After turning the edges of the disk by a flanging-machine or other means to bring it to the form B, Fig. 1, the succeeding operations of conversion into cylinders C D E, of successively greater length and smaller caliber, may be performed by a series of cylindrical mandrels or plungers, F, and dies G, of correspondingly-diminishing diameter, a proper proportion being observed between the external caliber of each plunger or mandrel and that of its corresponding die to preserve between all the corresponding plungers or mandrels and dies a uniform width of space, so that the metal between the successive operations in said dies may be simply turned, folded, or gathered in over the mandrel or plunger without being reduced or materially reduced in thickness. This operation is illustrated in Figs. 3 and 4, the former of which figures represents the cylinder C as placed upon the die G, ready for the action of the plunger F, which forces it through the said die and brings it to a smaller caliber and increased length, as illustrated by D in Fig. 4. In the figures last referred to, the dies G are represented as fitted with strippers H, of a well-known kind, controlled by springs *c*, for the purpose of stripping the cylinders from the mandrel as the latter retires from the die.

For the succeeding operations of longitudinal rolling, the semicircular grooves in the rolls I I, (see Fig. 5,) through which the cylinders are to be successively passed, are of successively smaller width and depth, as shown at *e e' e² e³*, and the mandrels *f f' f² f³*, on which the cylinder is to be successively placed to be rolled in the said grooves, are successively of smaller diameter; but the diminution of diameter of the mandrels is not so great as the diminution of width of their corresponding grooves in the rollers, and hence the cylinders in their successive passages through the smaller and smaller grooves of the rolls are not only reduced in caliber but are reduced in thickness at every pass, as illustrated by reference to the cylinders *g g' g² g³* in Fig. 2, with a corresponding increase of length.

Between every two successive passes of the cylinder through the different grooves of the rolls I I for longitudinal rolling the cylinder on the mandrel on which it was last longitudinally rolled is to be rolled between the plates J J of the flat-rolling mill. This is necessary to provide for the loosening of the cylinder on the mandrel, and it also has the effect of condensing and compacting the metal, and by al-

ternate and successive operations of longitudinal and circumferential rolling the metal is made very dense and tough. The final rolling is always performed circumferentially to the cylinder between the plates of the flat-rolling mill, in order to enable it to be removed easily from the mandrel.

Throughout the whole of the process hereinabove described the cylinder should be kept at a red or nearly red heat, and it may require to be reheated several times in a suitable furnace between the successive manipulations; but the mandrels on which the rolling is performed should be kept as cool as possible, and therefore will have to be cooled after every longitudinal and succeeding circumferential rolling.

When tubes are to be produced, the closed end left in the cylinder by forming it from a flat piece or cup must of course be cut off; but this need not be done until after or just before the process of reduction has been completed.

What I claim as my invention, and desire to secure by Letters Patent, is—

1. The improvement in the art of manufacturing metal cylinders and tubes, consisting in submitting the cylinder or tube while hot to successive and alternate longitudinal rollings and cross-rollings on mandrels, whereby it is subjected to successive reductions of caliber and thickness with a corresponding increase of length, and the metal is compacted, condensed, and toughened, substantially as herein described.

2. The improvement in the art of manufacturing metal cylinders and tubes from disks or blanks, consisting in first submitting the metal in a hot state to a series of turning-in or folding operations, whereby its form is changed from the flat to the cylindrical and from that of shorter cylinder of larger caliber to that of a longer cylinder of smaller caliber without material reduction of thickness, and afterward submitting the so-produced cylinder in a hot state to a series of alternate longitudinal rollings and circumferential rollings, whereby it is subjected to successive reductions of caliber and thickness with a corresponding increase of length, and its metal is condensed and toughened, as herein set forth.

WM. HENRY BROWN.

Witnesses:

D. W. McCREA,
R. O. BABBITT.