

(No Model.)

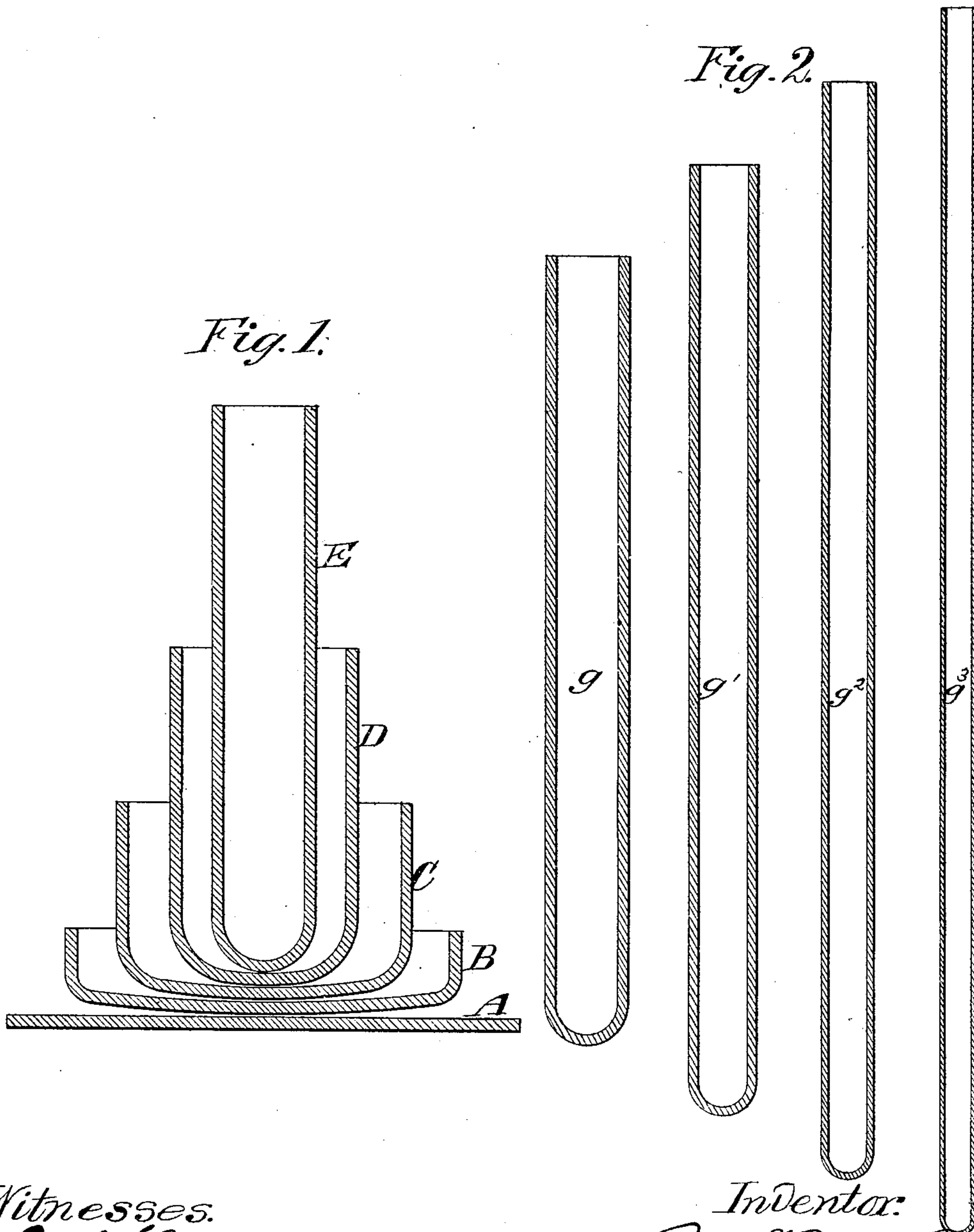
2 Sheets—Sheet 1.

W. H. BROWN.

ART OF MAKING SEAMLESS TUBES.

No. 377,348.

Patented Jan. 31, 1888.



Witnesses.
Emil Heister
O. Sundgren

Inventor:
Wm Henry Brown
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Brown & Hall

(No Model.)

2 Sheets—Sheet 2.

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Fig. 3.

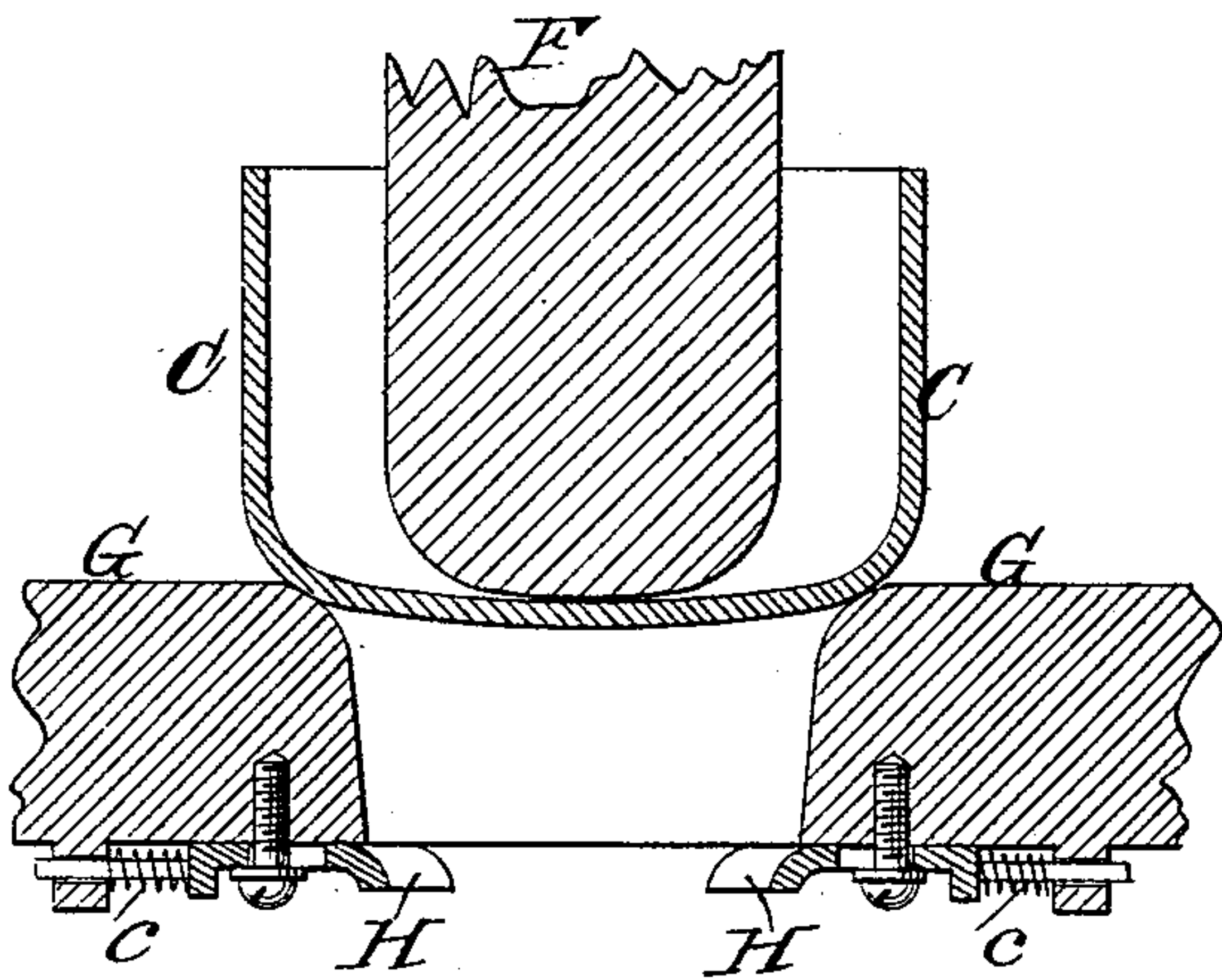


Fig. 4.

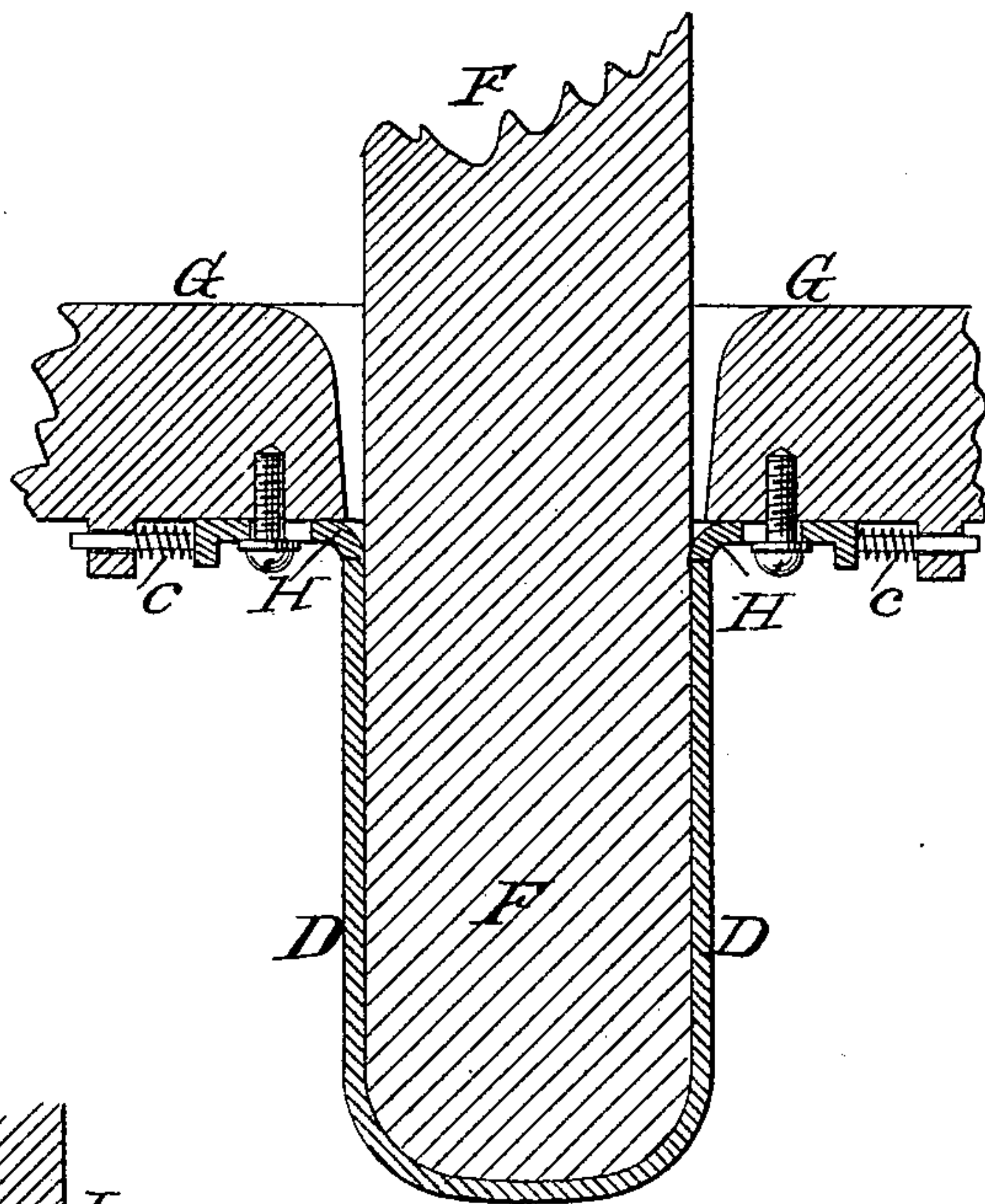


Fig. 5.

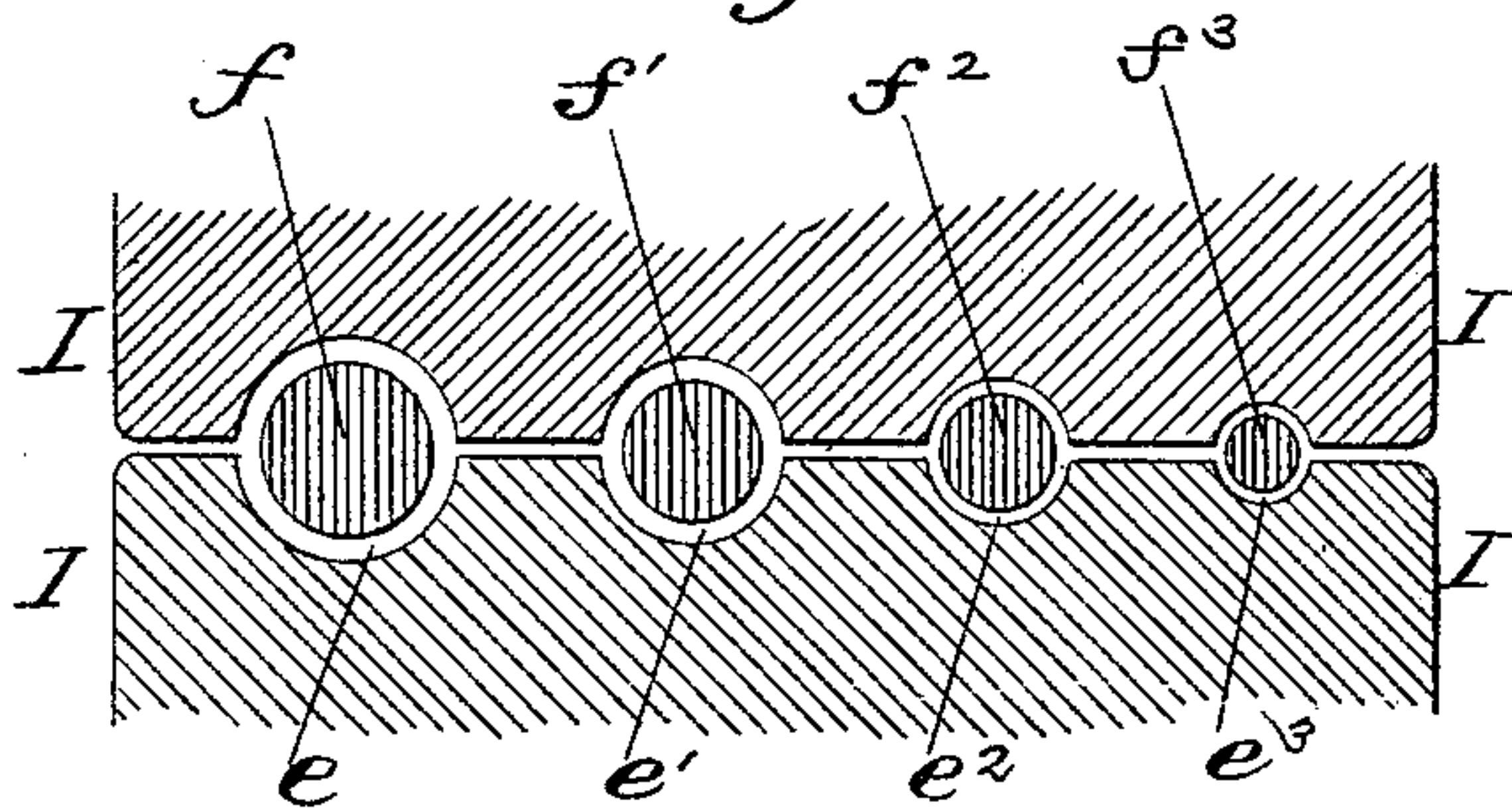
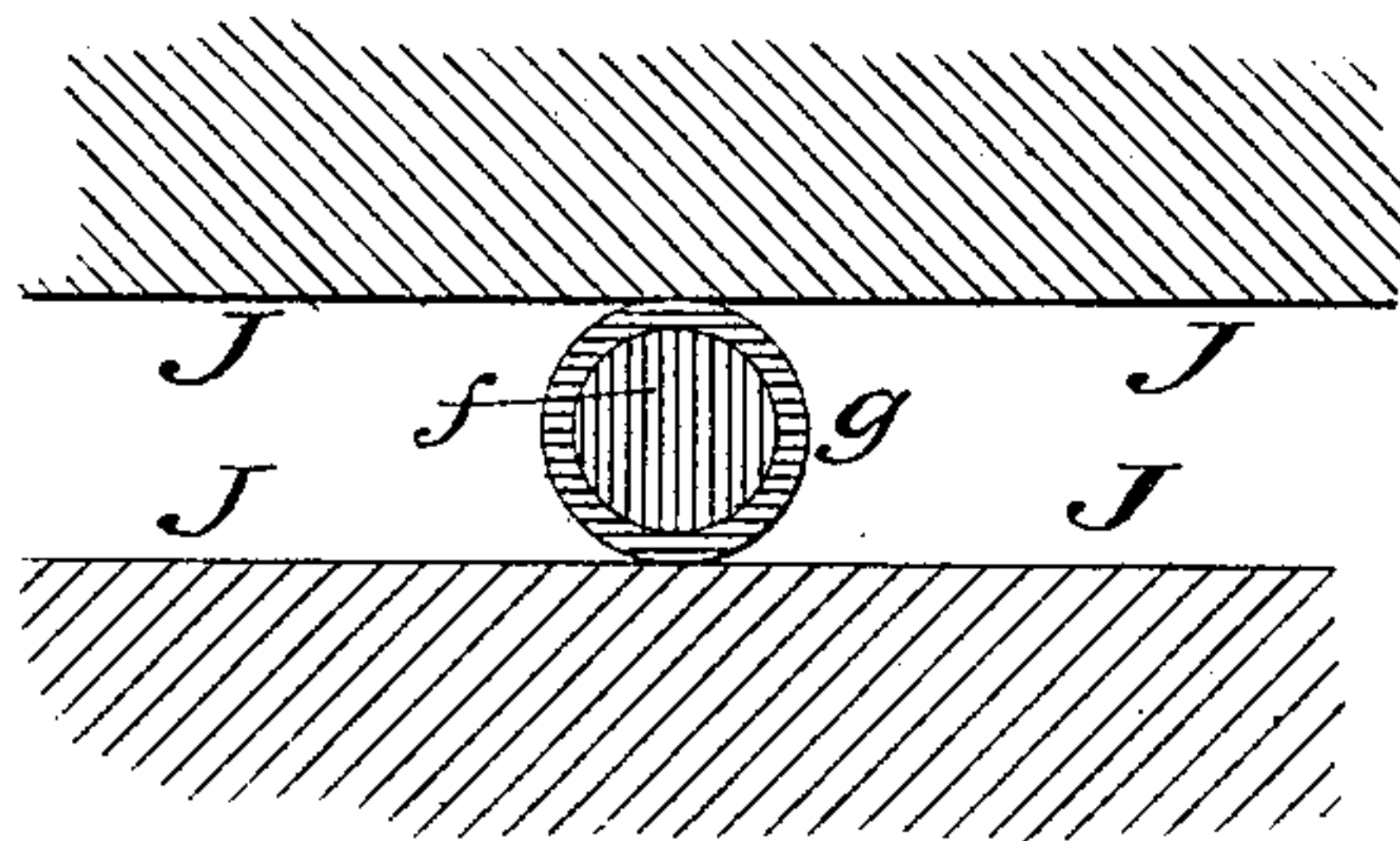


Fig. 6.



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UNITED STATES PATENT OFFICE.

WILLIAM HENRY BROWN, OF JERSEY CITY, NEW JERSEY, ASSIGNOR TO
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ART OF MAKING SEAMLESS TUBES.

SPECIFICATION forming part of Letters Patent No. 377,348, dated January 31, 1888.

Application filed May 28, 1887. Serial No. 239,652. (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.

10 This invention relates to the manufacture of seamless cylinders, of steel 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 purpose of my im-
15 provement is to produce cylinders and tubes having all the good qualities of cylinders and tubes produced entirely by the process known as "drawing" at a very much less cost.

20 According to my Letters Patent No. 316,600, dated April 28, 1885, and No. 348,718, dated September 7, 1886, I manufacture seamless cylinders from disks or blanks of metal by first subjecting the metal in a hot state to a series of folding operations, whereby its form
25 is changed from the flat to the cylindrical, and afterward subjecting it in a cold state to drawing operations, by which the cylinders are condensed, consolidated, tempered, and finished.

30 My present invention may be considered as an improvement upon that process, the object of the improvement being to reduce the number of repetitions of the cold-drawing operation, which is expensive by reason of the great power required for that operation and of the
35 costly machinery necessary for its frequent repetition.

40 According to my present process I submit the metal, between the two stages or operations of hot-folding and cold-drawing, which constitute my patented processes hereinabove mentioned to intermediate operations of alternate longitudinal rolling and circumferential rolling, whereby I condense and compact the metal while it is hot and ductile, leaving less
45 to be accomplished by the cold-drawing process.

50 The preliminary shaping operations by which the disk or blank is brought to the cylindrical form, and from that of a shorter cylinder to that of a longer cylinder 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
55 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
60 which is the subject of United 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 during such working.
65 The succeeding operations of longitudinal rolling and circumferential rolling to which the hot cylinders of metal are alternately subjected are performed on a cold mandrel, upon which the longitudinal rolling may be done in
70 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
75 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
80 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. 85

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 its caliber by folding or gathering it in without ma-
90 terial reduction of 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
95 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
100 metal cylinder and the contained mandrel and parts of a pair of rolls between which the cyl-

inder 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

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

After turning in the edges of the disk by a flanging-machine or other means to bring it to
10 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 correspond-
15 ingly-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
20 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.
25 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 said die and brings it to a smaller caliber and
30 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
35 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 suc-
40 cessively smaller width and depth, as shown at *e' e'' e'''*, and the mandrels *f f' f'' f'''*, 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 diam-
45 eter 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 re-
50 duced in caliber, but are reduced in thickness at every pass, as illustrated by reference to the cylinders *g g' g'' g'''* in Fig. 2, with a corresponding increase of length.

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

densing and compacting the metal, and by these alternate and successive operations of longitudinal and circumferential rolling the metal is made very dense and tough. The
65 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, as far
70 as 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
75 is performed should be kept as cool as possible, and therefore will have to be cooled after every longitudinal and succeeding circumferential rolling. When the cylinder has been thus brought by successive alternate longi-
80 tudinal and circumferential rollings to a caliber and thickness approximating more or less to the caliber and thickness of the drawn tube required, it may be cleaned by any suitable means to remove the scale, and is then sub-
85 jected as many times as desirable to a drawing action between triblets or mandrels and dies of the kind commonly used, and in the manner commonly practiced in cold-drawing metal cylinders and tubes, for the purpose of further
90 reducing its thickness, and also reducing its caliber, if desired, to give it the thickness and caliber required, and also to give it, as described in my hereinabove mentioned Letters
95 Patent, those desirable qualities of density, homogeneity, hardness, tenacity, and smoothness peculiar to cold-drawn metal cylinders and tubes.

If tubes are to be formed, the closed end left in the cylinder in forming from a flat piece or
100 blank may be cut off at any stage of the manufacture after the termination of the folding or turning-in operations, which constitute the first of the three stages of this process.

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

The improvement in the art of manufacturing seamless cylinders and tubes from disks or blanks of metal, consisting in first subject-
110 ing the metal in a hot state to the folding or turning-in operations necessary to change its form from substantially flat to cylindrical, afterward subjecting it in a hot state to alternate longitudinal rollings and circumferential rollings, and, finally, subjecting it in a cold state
115 to drawing operations, substantially as and for the purpose herein set forth.

WM. HENRY BROWN.

Witnesses:

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R. O. BABBITT.