

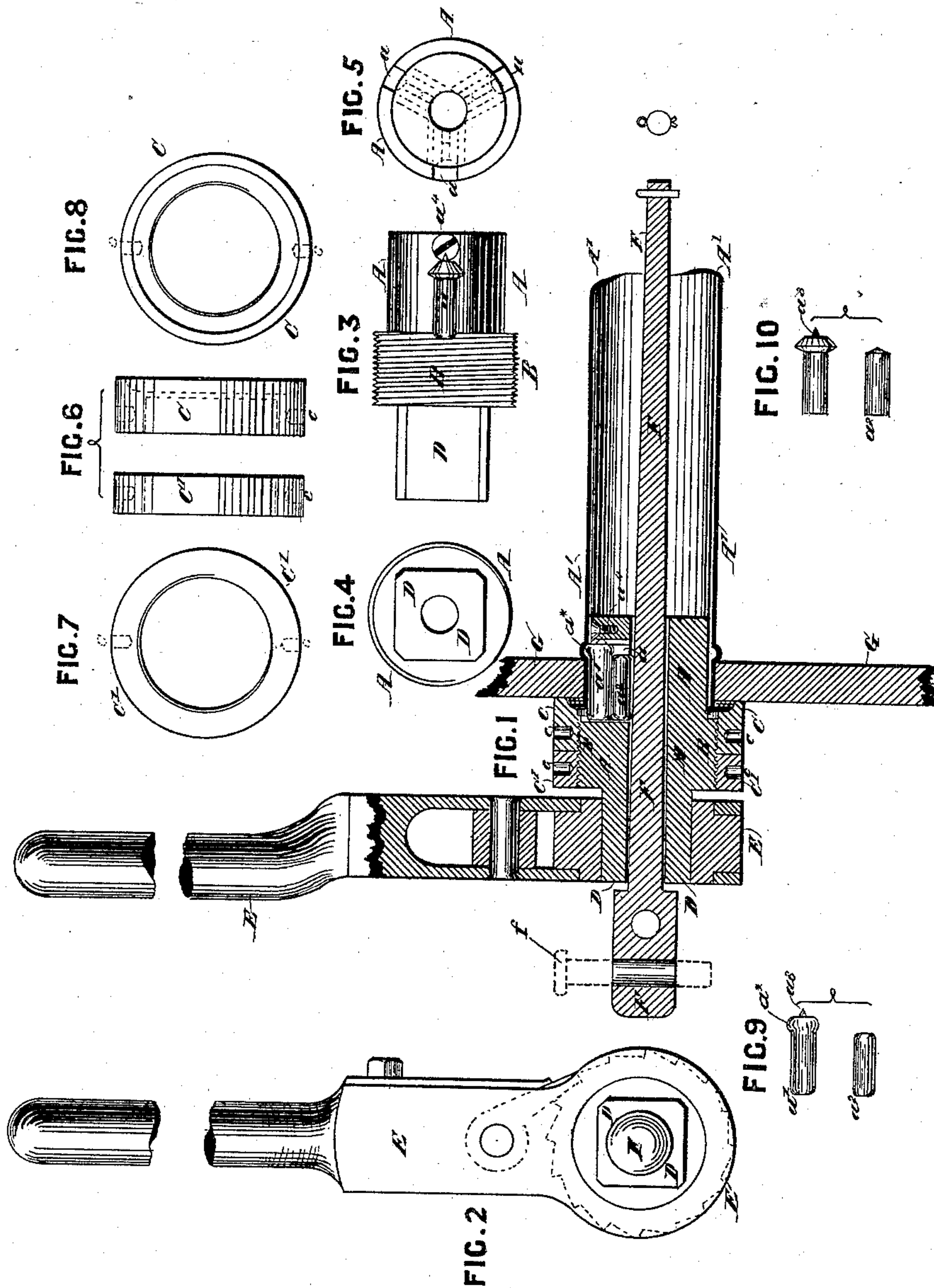
(No Model.)

3 Sheets—Sheet 1.

W. WALKER.  
TUBE EXPANDER.

No. 476,107.

Patented May 31, 1892.



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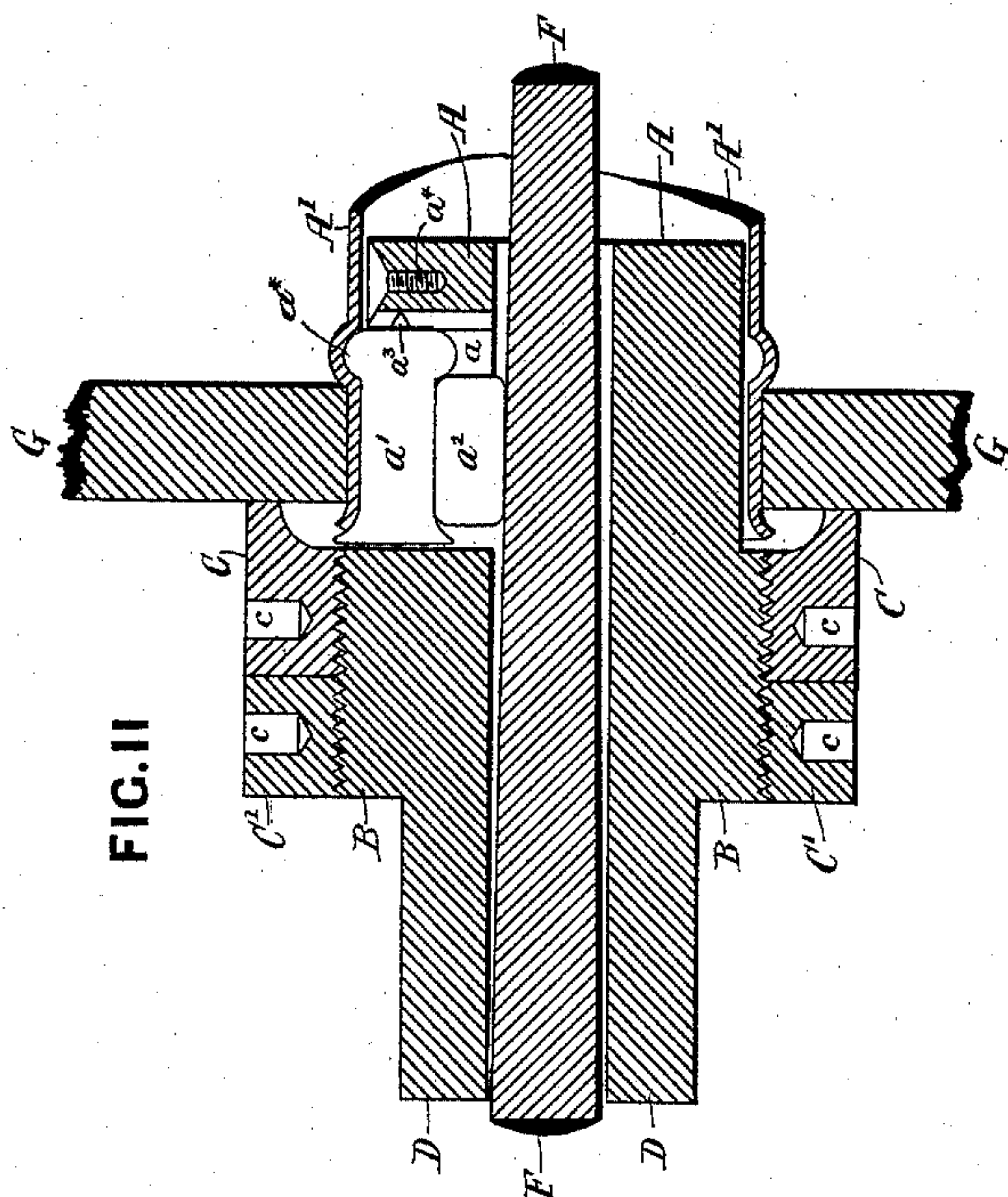
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TUBE EXPANDER.

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Patented May 31, 1892.



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(No Model.)

3 Sheets—Sheet 3.

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FIG. 14.

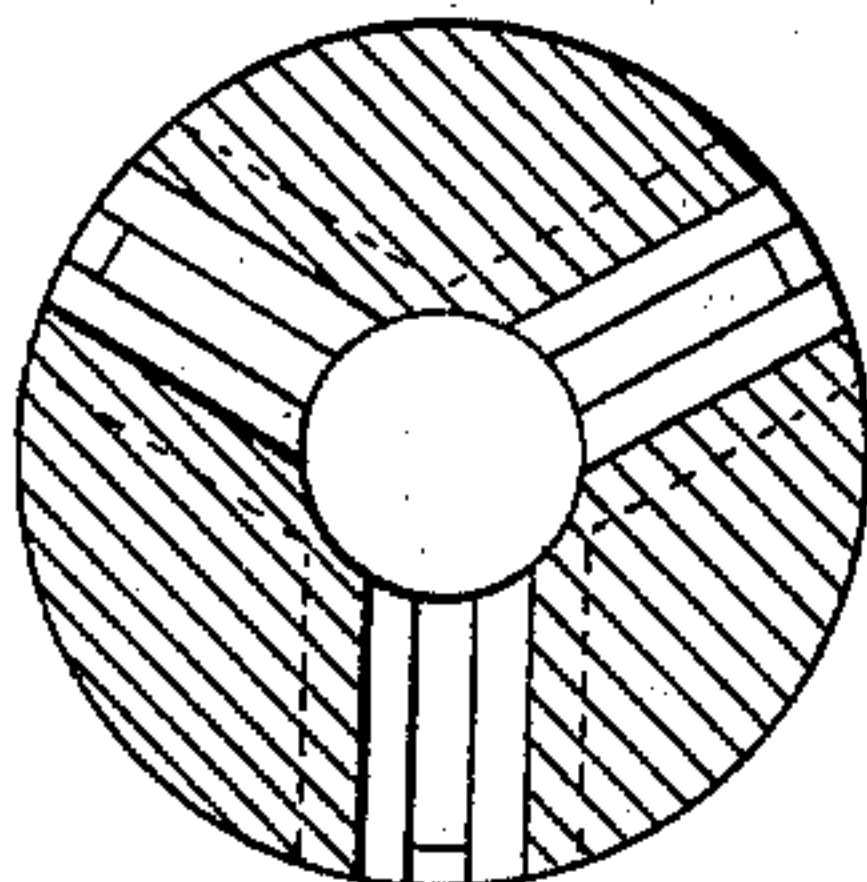


FIG. 13.

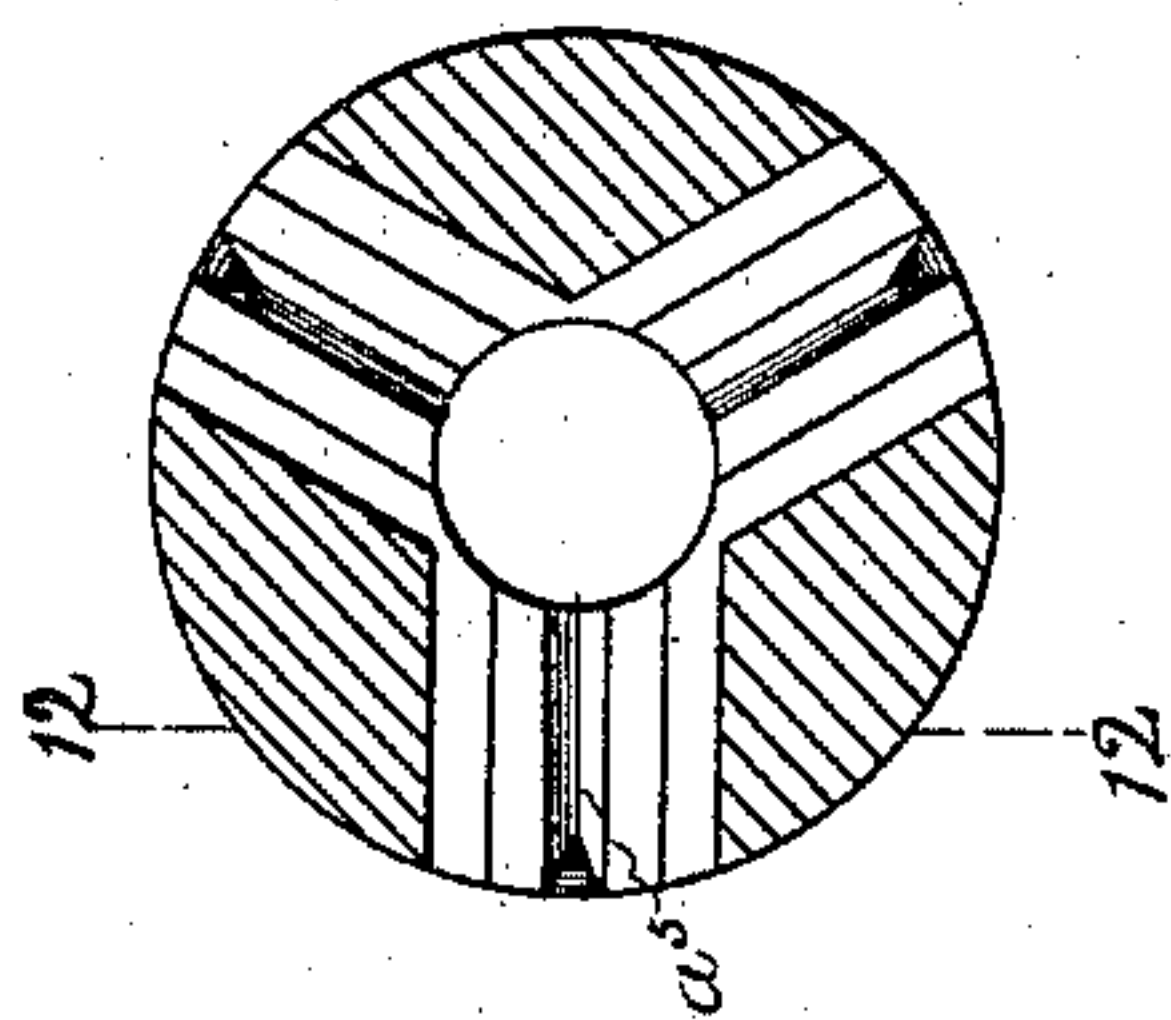
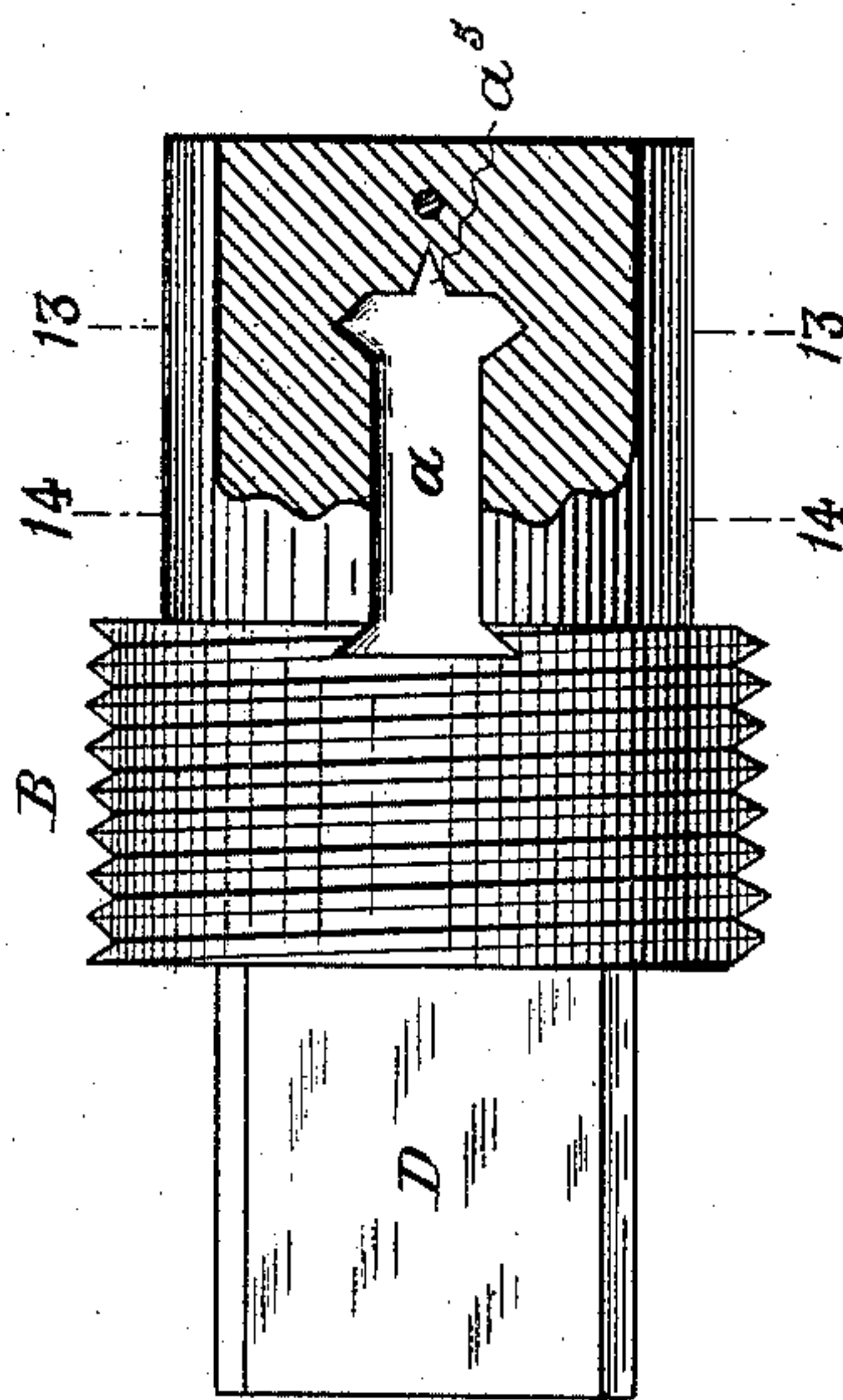


FIG. 12.



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# UNITED STATES PATENT OFFICE.

WILLIAM WALKER, OF SYDNEY, NEW SOUTH WALES.

## TUBE-EXPANDER.

SPECIFICATION forming part of Letters Patent No. 476,107, dated May 31, 1892.

Application filed November 8, 1890. Serial No. 370,742. (No model.)

*To all whom it may concern:*

Be it known that I, WILLIAM WALKER, a subject of the Queen of Great Britain and Ireland, and a resident of Sydney, in the county of Cumberland and Colony of New South Wales, Australia, have invented an Improved Device for Expanding and Beading Boiler-Tubes, of which the following is a specification.

This invention consists of certain improvements in those implements that are employed to expand and bead the ends of the tubes used in tubular boilers and boiler-furnaces, so as to cause such tubes to adhere rigidly to the tube-plates, and thus prevent leakage of either steam or water from the boiler.

The implement is primarily and mainly intended for tightening new tubes in their head-plates, and the following specification will treat chiefly of this use of it; but the implement is also available, by substitution of shearing for expanding rollers, for removal of damaged tubes. The mandrel and rollers hereinafter specified are composed of hard steel.

The implement comprises a rotatable head or holder having an axial bore or orifice for reception of a conical mandrel and several (preferably three) equidistant radial slots or recesses, of which each carries two coacting rollers—namely, a plain cylindrical inner roller, which rests and rolls upon the mandrel, and an outer roller having a cylindrical portion of the same length, which rests upon said inner roller and which serves to expand the tube and (being flanged at one or both ends) serves to impart the desired bead or bead and crest to a newly-inserted tube, or, the flange being suitably sharpened, becomes available for cutting out an old and spent tube. The short auxiliary or inner roller, of plain cylindrical form, serves to hold the flanged outer roller squarely to its work and prevents contact of the flange or flanges with the conical mandrel, which would be destructive of one or both of these members. Without the auxiliary roller the beading-roller would be liable to get out of parallelism and become jammed and have its flange worn into facets, which in turn would cut spiral grooves and scratches in the mandrel, thus rendering it useless. Said auxiliary inner roller is further useful by making all the

contacts in the line of pressure rolling ones. The mandrel being pushed further in by the operator as the implement is revolved, tends to gradually force the rollers outward, so as to distend and at the same time bead the tube.

The apparatus in its most complete form further comprises a cylindrical flanged roller-carrier fitted with an adjustable gage or cap, which is secured in any desired position (according to the thickness of tube-plate) by means of a lock-nut. The outer or rear end of the apparatus is formed into a square head and fitted with a ratchet-brace, by which the whole may be rotated.

Referring to the accompanying drawings, which form a part of this specification, Figure 1 is a longitudinal section of the implement in the act of expanding a tube in the tube-plate. Fig. 2 is an end view chiefly showing the ratchet-brace. Fig. 3 is an elevation of the roller-carrier with the gage or cap and its lock-nut removed. Fig. 4 is an end view of Fig. 3, looking toward the right. Fig. 5 is an end view of Fig. 3, looking toward the left, the recesses for carrying the rollers being shown by dotted lines. Fig. 6 is a side elevation of the lock-nut and gage or cap, while Figs. 7 and 8 are end views of the same, respectively. Fig. 9 shows one of the expanding-rollers with its auxiliary short and flangeless supporting-roller. Fig. 10 is a view of a modified form of roller to be used for cutting out a tube when necessary, and its auxiliary roller. Fig. 11 is a longitudinal section omitting the ratchet-brace and part of the mandrel and showing a double-flanged roller by which the expansion, the beading, and the cresting of the tube are effected at a single operation, thus rendering the joint steam-tight equally against thrusting and contracting forces. Fig. 12 shows the roller-carrier partly by side view and partly by section on line 12 12, Fig. 13. Figs. 13 and 14 are cross-sections on lines 13 13 and 14 14, respectively.

A is the cylindrical head or roller-carrier, constructed of such a size that it will fit loosely into the end of the tube A' to be expanded, while the part that remains outside the tube is formed into a thick flange B. (See Fig. 3.) The periphery of the flange B is threaded, so as to carry an adjustable tapped gage or cap C and a lock-nut C' for securing the gage



or cap C in any desired position, according as the thickness of tube-plate varies. The gage C and the lock-nut C' are each preferably provided with holes *c* for the insertion of the stud of a semicircular spanner to be used in adjusting them. The portion of the roller-carrier A which enters the tube A' is cored out internally, so as to form radial longitudinal recesses or compartments *a*. Each of these radial slots carries two rollers—to wit, an outer roller having a cylindrical portion *a'* for distending the portion of the tube which is within the tube-plate and at one end of said cylindrical portion a rounded flange *a*<sup>3</sup> for spinning or throwing up a head or collar on that part of the tube which is just within the tube-plate. Interposed between the roller *a'* *a*<sup>\*</sup> and the mandrel is a roller *a*<sup>2</sup>, of cylindrical or slightly-tapered cylindrical form, of the same length as the cylindrical portion of roller *a'* *a*<sup>\*</sup>. These rollers will be hereinafter more fully described. The outer end of the roller-carrier A is formed into a square head D and is fitted with a spanner or, more preferably, a ratchet-brace E, by which the tool may be rotated. The central portion of the roller-carrier A is cored out, so that a tapered mandrel F may be inserted.

By referring more particularly to Figs. 1 and 9 the shape of the expanding-rollers *a'* *a*<sup>\*</sup> and the supporting-rollers *a*<sup>2</sup> may be clearly seen. The supporting-roller *a*<sup>2</sup> is a perfectly plain roller of hard steel, while the expanding-roller is bulbed at one end or both ends. This bulbed end is for the purpose of producing a bead upon the tube A', (see Fig. 1,) the bead tending to support and strengthen the tube-plate G, thus obviating the necessity of introducing stay-tubes into the boiler, each tube forming a stay of itself. The supporting-rollers *a*<sup>2</sup> bear upon and revolve round the mandrel F as the tool is rotated, the expanding-roller *a'* *a*<sup>\*</sup> revolving upon the supporting-roller *a*<sup>2</sup>. The rollers are prevented from dropping from their recesses (when the tool is removed from the work) by means of conical studs or projections *a*<sup>3</sup>, formed upon the bulbed ends of the expanding-rollers *a'* *a*<sup>\*</sup>. These projections *a*<sup>3</sup> take into radial grooves *a*<sup>5</sup>, formed in the ends of the recesses *a*, the peripheral openings of the radial slots in the roller-carrier being closed by set-screws *a*<sup>4</sup>. The other ends of the rollers *a'* *a*<sup>\*</sup> abut against the overlapping edge of the gage or cap C, (see Fig. 1,) and are thereby kept within their recesses. A pin or handle (see dotted lines *f*) enables the operator to impart the desired thrust and rotation to the mandrel.

The mode of operating the expander is as follows: The tube being in position in the tube-plate, the gage or cap C is then adjusted to the thickness of the tube-plate G in such a manner that the bulbed end of the expanding-rollers *a'* *a*<sup>\*</sup> shall lie just beyond the inner side of the tube-plate G. (See Fig. 1.) The gage or cap C is then secured in that posi-

tion by means of the lock-nut C'. The mandrel F is withdrawn as far as possible, thus allowing the expanding-rollers *a'* *a*<sup>\*</sup> to lie within the periphery of the roller-carrier A. The roller-carrier is then introduced into the end of the tube until the cap C abuts against the outer surface of the tube-plate G. Upon pushing in the mandrel F the expanding-rollers *a'* *a*<sup>\*</sup> will be forced outward until they "bite" the inner surface of the tube A'. The tool is then rotated by means of the brace or spanner E. The mandrel F being rotated by the operator in an opposite direction will continuously work its way longitudinally into the carrier A until the expanding-rollers *a'* *a*<sup>\*</sup> have reached their expanding limit. This result having been attained, it will be found that the plain surfaces of the rollers *a'* *a*<sup>\*</sup> have caused the tube A' to make a close joint with the tube-plate G, and at the same time the bulbed ends of the rollers *a'* *a*<sup>\*</sup> will have formed a bead upon the tube inside the line of the inner surface of the tube-plate C. The outer end of the tube that projects beyond the tube-plate may then be crested in the usual manner. The tube-plate will thus be stayed both in tension and compression by the tubes themselves.

By referring to Fig. 10 a modification of the expanding-rollers *a'* *a*<sup>\*</sup> and supporting-rollers *a*<sup>2</sup> will be seen. In this modification the bulbed end of the roller *a'* *a*<sup>\*</sup> is formed in the shape of a cutting-disk, and is introduced into the carrier A in place of the expanding-roller *a'* *a*<sup>\*</sup> for the purpose of cutting out a defective tube. The mode of operating is precisely the same as when a tube is being expanded into a tube-plate.

Fig. 11 shows a modification of the form of beading-roller *a'* *a*<sup>\*</sup>, the modification consisting in making the roller with a flange at both ends, the bulb at the rear end tending to turn up and partially "crest" the end of the tube A'. When this form of beading-roller is employed, it will be necessary to form the radial slot in which it moves so as to correspond with the form of the roller. (See Fig. 12.) It will also be seen by referring to Fig. 11 that the supporting-roller must be slightly shortened, so as to lie snugly in the recess in the beading-roller between the two bulbs. When the particular form of beading-roller shown in Fig. 11 is employed, it will not be necessary to have the cap C adjustable, (although it is shown so in the drawings,) as such a beading-roller can only be employed for one thickness of tube-plate.

Having now particularly described and ascertained the nature of my said invention and in what manner the same is to be performed, I declare that what I claim is—

1. In tube-expanders, &c., the combination of a flanged roller and a flangeless supporting-roller, the two rollers working together in sets within radial recesses in an axially-pierced rotary carrier, and a tapered mandrel within said bore, the supporting-roller being



interposed between the flanged roller and the said mandrel, as and with the object explained.

5 2. In tube-expanders, an expanding and beading roller flanged at one or both ends, in combination with a rotary head, a supporting flangeless roller, and a central mandrel, as set forth.

10 3. In a tube-expander, &c., the combination of rotary, axially-bored, and radially-slotted head A, the tapering mandrel F, the provision in each radial slot of flangeless supporting-roller  $a^2$  and flanged expanding and beading roller  $a'$   $a^*$ , having axial stud  $a^3$ , working in  
15 grooves  $a^5$ , and the confining-screw  $a^4$ , substantially as set forth.

4. In tube-expanders, the roller-carrier A, in combination with an adjustable gage or cap C and lock-nut C' for the purpose of rendering the expander capable of adjustment 20 to varying thicknesses of tube-plate and insuring that the bead shall be formed on the tube immediately within the tube-plate, as specified.

In testimony whereof I have signed my 25 name to this specification in the presence of two subscribing witnesses.

WILLIAM WALKER.

Witnesses:

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G. W. GRIFFIN,

*U. S. Consul.*