

No. 796,566.

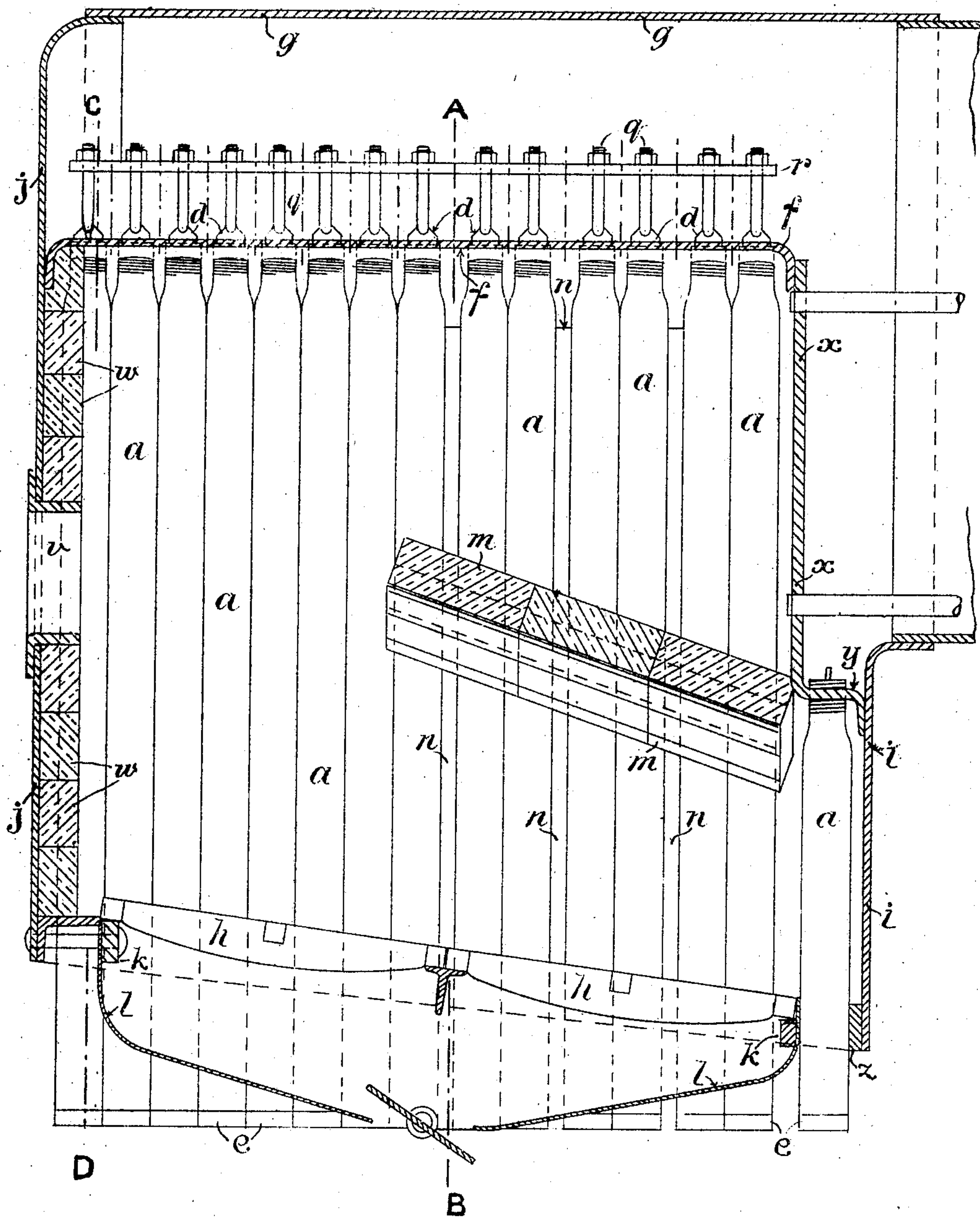
PATENTED AUG. 8. 1905.

D. CROWTHER.
FIRE BOX OF STEAM GENERATORS.

APPLICATION FILED NOV. 1, 1904.

3 SHEETS—SHEET 1.

FIG. 1.



John Jefferson } Witnesses
Ernest Jackson }

David Crowther
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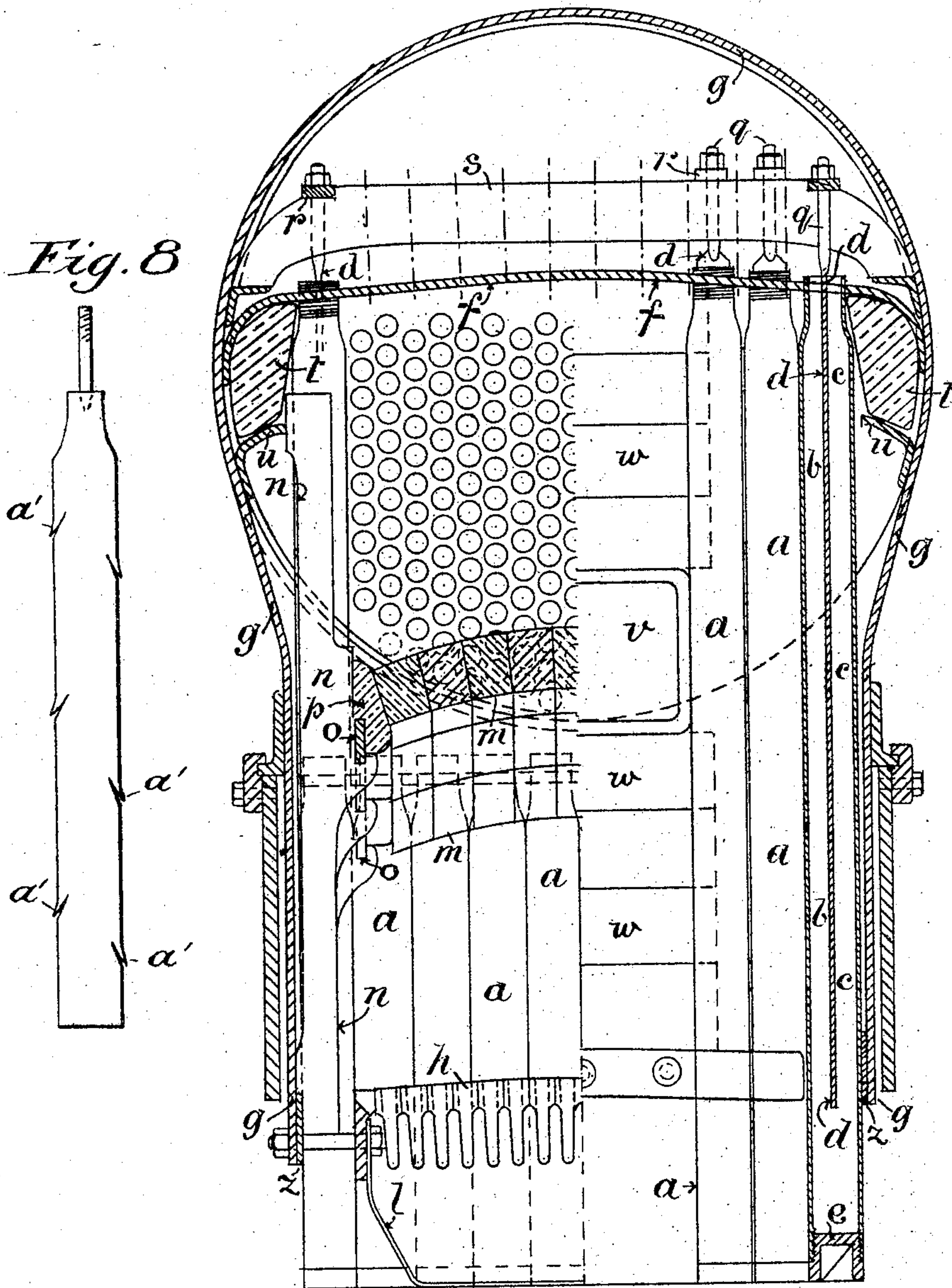
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3 SHEETS—SHEET 2.

FIG. 2.



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3 SHEETS—SHEET 3.

FIG. 3.

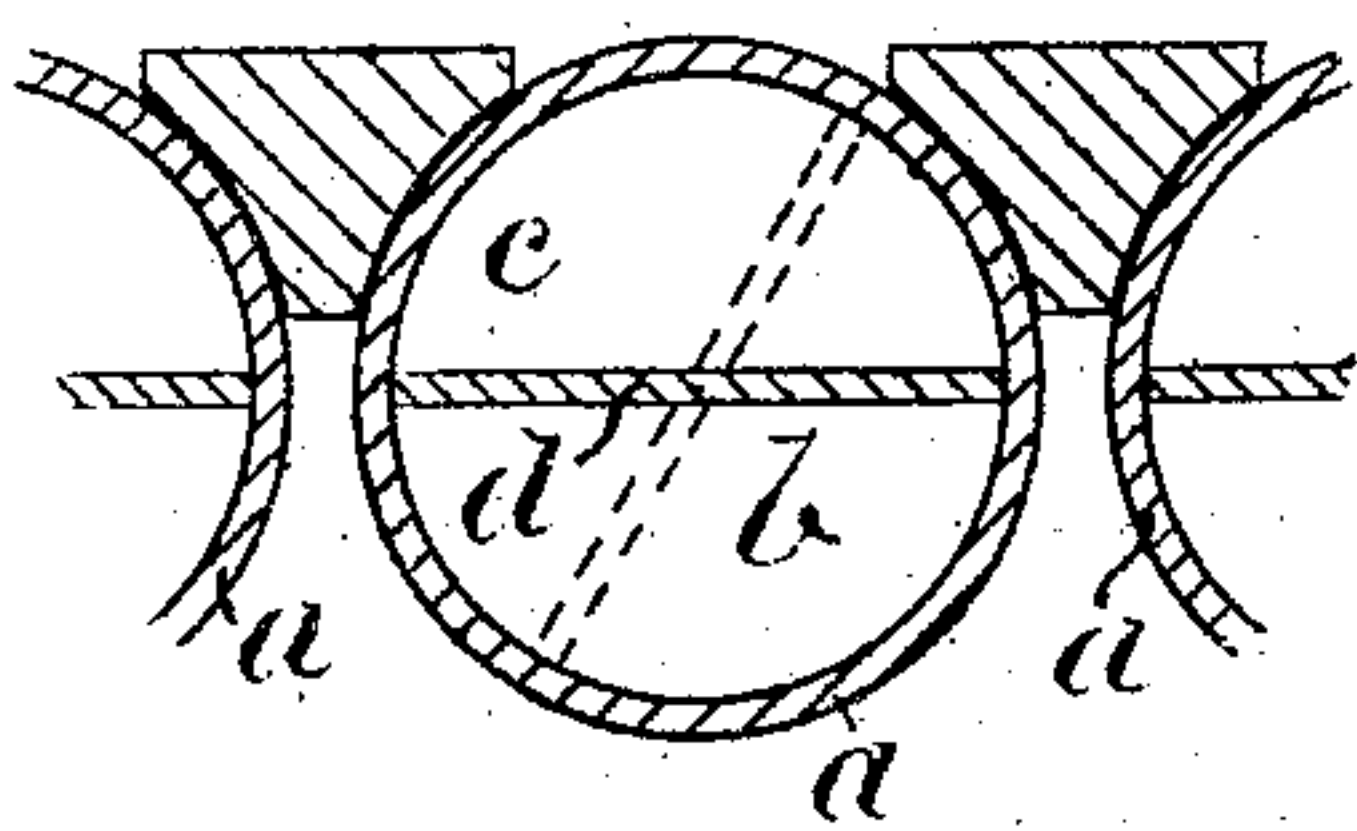


FIG. 4.

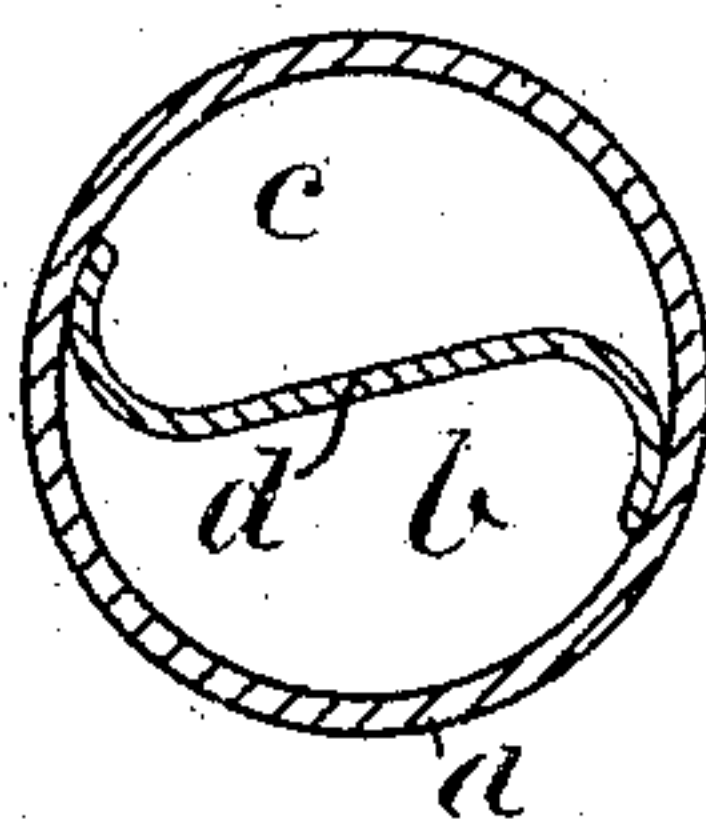


FIG. 5.

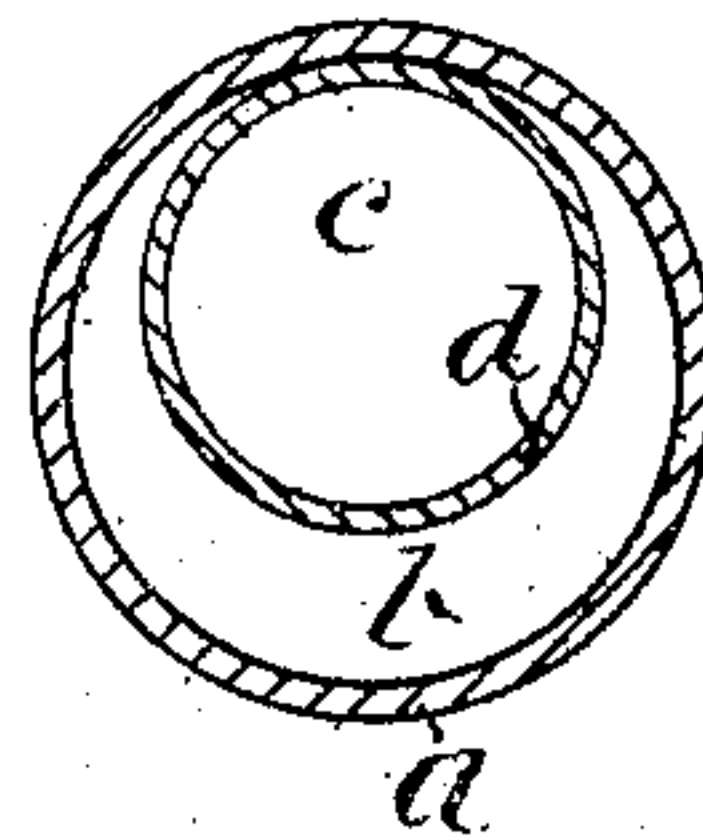


FIG. 7.

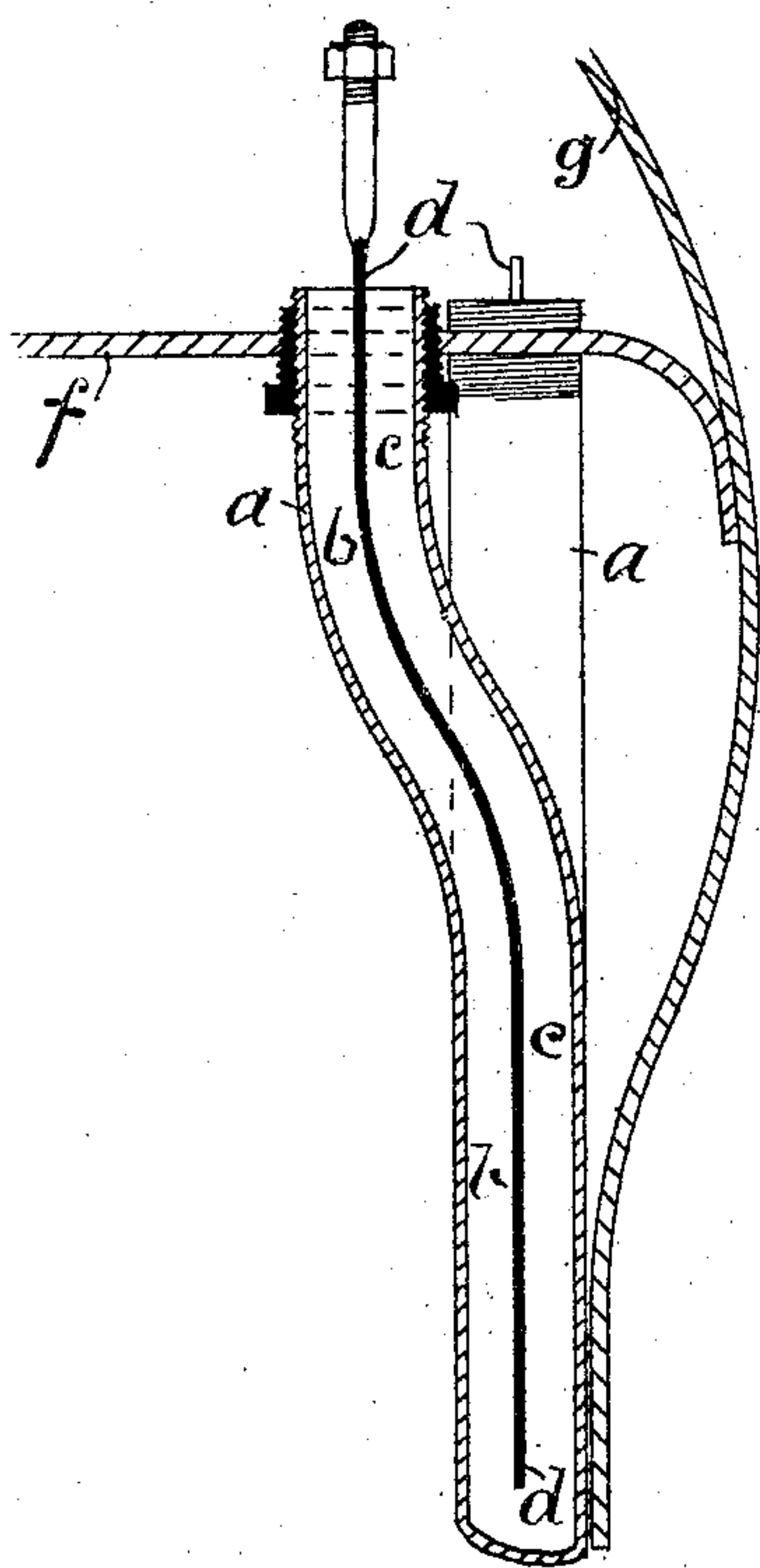
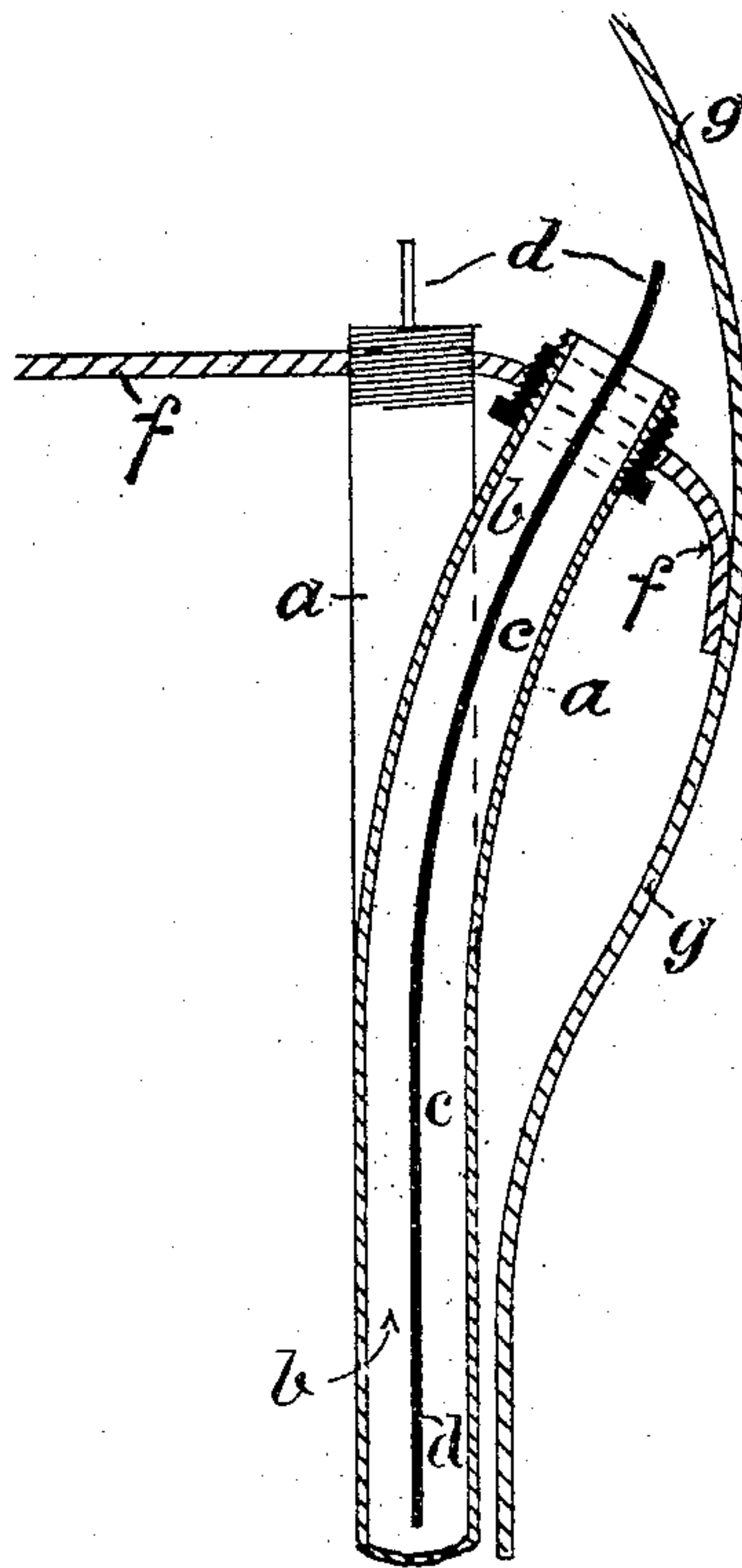


FIG. 6.



J. Clark Jefferson }
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UNITED STATES PATENT OFFICE.

DAVID CROWTHER, OF LEEDS, ENGLAND, ASSIGNOR TO GLOVER'S WATER
TUBE BOILER COMPANY LIMITED, OF LEEDS, ENGLAND.

FIRE-BOX OF STEAM-GENERATORS.

No. 796,566.

Specification of Letters Patent.

Patented Aug. 8, 1905.

Application filed November 1, 1904. Serial No. 230,928.

To all whom it may concern:

Be it known that I, DAVID CROWTHER, a subject of the King of Great Britain and Ireland, and a resident of Leeds, in the county of York, England, have invented a certain new and useful Improvement in Furnaces or Fire-Boxes and Combustion-Chambers of Steam-Generators, of which the following is a specification.

This invention relates to a new construction of the furnaces or fire-boxes and combustion-chambers of steam-generators, more particularly to those of the locomotive type, and has for its objects to increase the efficiency and power or steaming capacity of the steam-generator and the durability of the furnace or fire-box or the combustion-chamber. These objects I effect by forming the sides or two or more of the sides of the same of a row of water-tubes, each tube being divided by a straight or curved internal division-plate into front and back spaces, the water ascending the front or fire side space and descending in the back or rear space, and by fitting the upper ends of the water-tubes into the roof-plate along or near the sides or edges of the same.

This invention is illustrated by the accompanying drawings, showing its application to a locomotive-boiler.

Figure 1 is a longitudinal section, the left side of Fig. 2 a cross-section on line A B of Fig. 1 looking toward the front or tube plate end of the fire-box and the right side of Fig. 2 being a cross-section on line C D of Fig. 1 looking toward the back or firing end of the fire-box. Figs. 3, 4, and 5 are cross-sections of the water-tubes. Figs. 6 and 7 are part cross-sections near the side of the fire-box roof, showing the arrangement of the upper ends of the water-tubes where fitted into the roof; and Fig. 8 represents a view of a division-plate.

In all the figures the same reference-letter indicates the same or corresponding part.

a indicates the water-tubes. As shown in Figs. 2 and 3, these water-tubes are divided into a front or upflow space b and a back or downflow space c by a straight internal division-plate d . In Fig. 4 this division-plate is formed curved or S-shaped to give a slight spring or side elasticity to the plate, so that the plate d can be adjusted to present one of the spaces only and fully to the fire side and the other fully away to the back side. The

desired position is as shown by the full lines in Fig. 3 and not as indicated by the dotted lines, whatever may be the position rotatively in which the tube a itself has been fitted in the roof of the fire-box. To obtain this adjustability of the straight division-plate while retaining sufficient hold against accidental displacement, I make two or more inclined slits a' in the plate near the edges and expand the metal outward. In Fig. 5 the internal division-plate has for cross-section a complete circle—that is, it forms an inner tube which, however, is placed eccentrically within the tube a as far away as possible from the fire side. The division-plate d (see Fig. 2) stops short two or three diameters length from the bottom of the tube, the lower end of which is closed by a valve-fitting or screw-plug e , which can be unscrewed for cleaning or emptying the sediment. If the tubes are reduced in diameter or cranked or bent at their lower ends as hereinafter described for the upper ends, the lower ends may be fitted into a common water-box.

As shown in Figs. 1 and 2, the longitudinal sides of the fire-box, the front end below the flame-tube plate, and the rear end on each side of the firing-door are formed by placing the water-tubes close together side by side, with the exceptions hereinafter referred to, and with the division-plates adjusted in the direction of the line of the wall formed by the row of tubes. The roof-plate f of the fire-box is extended on each side up to the outer or boiler shell-plate g and riveted to the same, while the outer shell-plate g is carried down on each side to somewhat below the level of the fire-grate h and acts as a casing to the tubes a , forming the fire-box. The front and rear outer or shell plates i and j are carried down in a similar manner, a rectangular ring plate z , between the outside of the water-tube fire-box and the shell-casing, providing a space which may be filled with non-conducting material to lessen or prevent loss by radiation. A similar narrow foundation ring or bar k on the inner side of the tubes a provides a support for the fire-grate h and ash-pan l .

In order to carry the fire-arch m , some of the tubes a , forming the longitudinal sides of the fire-box, are spaced slightly apart, so as to allow of the insertion of vertical support-bars n , carried by bolts from the outer shell

or casing plates *g*, and the bars *n* carry inclined side bars *o*, on which the abutments *p*, Fig. 2, of the fire-arch *m* rest.

The upper ends of the water-tubes are inserted in and through the roof of the fire-box and may be carried therefrom either by merely screwing in, as shown in Fig. 2, or by inside or outside ferrules. (See Figs. 6 and 7.) In order to avoid completely cutting through the roof-plate or weakening it too much, the upper ends of the tubes *a* may be reduced in diameter, as shown in Figs. 1 and 2, or alternate tubes may have a single or double bend to right or left, as illustrated in Figs. 6 and 7. Further, where the upper ends of the tubes are reduced in diameter the roof-plate may be supported by welding a short bolt *q*, Figs. 1 and 2, to the upper end of the internal division-plate *d* and securing this by nuts to a bar *r*, carried by the roof-girders *s*, the division-plate being engaged to the top of the tube, which is engaged to the roof-plate.

The lower end of the flame-tube plate *x* is flanged back at *y* and then down and riveted to the front outer or shell plate *i*, Fig. 1, in order to admit of the insertion of the upper ends of the tubes *a*, which serve to produce an upward current of the water close to the tube-plate, and thus facilitate the disengagement of steam.

The open spaces left between the upper ends of the tubes *a* by reducing their diameters or by bending them to the right or left may be covered by fire-brick blocks *t*, resting on the angle or bent plates *u*, riveted to the side shell-plates *g*. The space between the back of the tubes *a* and the side shell-plates *g* also may be filled in by non-conducting material, while the space above and below the fire-hole *v*, unoccupied by water-tubes, is filled in by fire-brick blocks *w*.

In certain cases—as, for example, where it is preferred to place the tubes a slight distance apart in addition to narrowing their upper ends to prevent too great a reduction of the strength of the roof-plate along the line where the upper ends of the tubes are inserted—the open space may be blocked by triangular metal or brick blocks on the outer side, as illustrated in Fig. 3.

In the case of cylindrical vertical boilers the fire-box is formed of double-flow water-tubes of the construction above described placed close together side by side, forming a cylindrical wall, the internal division-plates being placed tangentially with respect to the circle passing through the centers of the tubes. The insertion of the upper ends of the tubes is effected as indicated in Figs. 6 and 7, the roof-plate being connected to the vertical shell-plate of the boiler.

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

1. In fire-boxes of steam-generators, the combination of two side rows and two end rows of water-tubes *a* having internal division-plates *d* and screwed bottom plugs *e*, with a roof-plate *f* into and through which the upper ends of the tubes *a* are fitted, two side shell-plates *g*, rear-end shell-plate *j*, flame-tube plate *x* to which the roof-plate *f* is riveted, horizontal bottom flange *y* to the flame-tube plate and front-end shell-plate *i* riveted together, foundation-bars *z*, vertical support-bars *n*, and fire-arch *m*.

2. In the fire-boxes of steam-generators, the combination of two side rows and two end rows of water-tubes *a* having internal division-plates *d* and screwed bottom plugs *e*, a roof-plate *f* into which the upper ends of the tubes *a* are fitted, two side shell-plates *g*, rear-end shell-plate *j*, flame-tube plate *x* to which the roof-plate *f* is riveted, horizontal bottom flange *y* to the front tube-plate *x* and front-end shell-plate *i* riveted together, and foundation-bars *z*.

3. In the fire-boxes of steam-generators, the combination of two side rows and two end rows of water-tubes *a* having internal division-plates *d* and screwed bottom plugs *e*, a roof-plate *f* into which the upper ends of the tubes *a* are fitted, two side shell-plates *g*, rear-end shell-plate *j*, flame-tube plate *x* to which the roof-plate *f* is riveted, horizontal bottom flange *y* to the tube-plate *x* and front-end shell-plate *i*.

4. In the fire-boxes of steam-generators, the combination of two side rows and one end row of water-tubes *a* having internal division-plates *d* and screwed bottom plugs *e*, a roof-plate *f* into and through which the upper ends of the tubes *a* are fitted, two side plates *g*, a rear-end plate *j*, flame-tube plate *x*, foundation-bar *z*, vertical support-bars *n*, and fire-arch *m*.

5. In the fire-boxes of steam-generators, the combination of two side and one end row of water-tubes *a* having internal division-plates *d* and bottom screwed plugs *e*, a roof-plate *f* into and through which the upper ends of the tubes *a* are fitted, two side shell-plates *g*, a rear-end shell-plate *j*, and flame-tube plate *x*.

6. In the fire-boxes of steam-generators, the combination of two side rows and two end rows of water-tubes *a* having internal division-plates *d* and screwed bottom plugs *e*, a roof-plate *f* into and through which the upper ends of the tubes *a* are fitted, two side shell-plates *g*, and one end shell-plate.

7. In the fire-boxes of steam-generators, the combination of two side rows of water-tubes *a* having internal division-plates *d* screwed bottom plugs *e*, with a roof-plate *f*, flame-tube plate *x*, vertical support-bars *n*, and fire-arch *m*.

8. In the fire-boxes of steam-generators, the combination of two side and one end row

of water-tubes *a* having internal division-plates *d* and screwed bottom plugs *e*, with a roof-plate *f*, outer shell-plates *g*, *i*, and flame-tube plate *x* having bottom flange *y*.

9. The combination of a boiler, with a fire-box having a roof and a wall comprising the shell of said boiler, fire-tubes set in the part of said shell entering into said wall, and water-tubes providing separate passages for the downward and upward flow forming sides for said fire-box and set in the portion of said shell forming the roof of said fire-box.

10. The combination of a fire-box, with a boiler having a shell forming the roof of said fire-box, water-tubes in sides of said fire-box and set in said roof, and bolts connected with said tubes and supported within said shell.

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

DAVID CROWTHER.

Witnesses:

J. CLARK JEFFERSON,
ERNEST JACKSON.