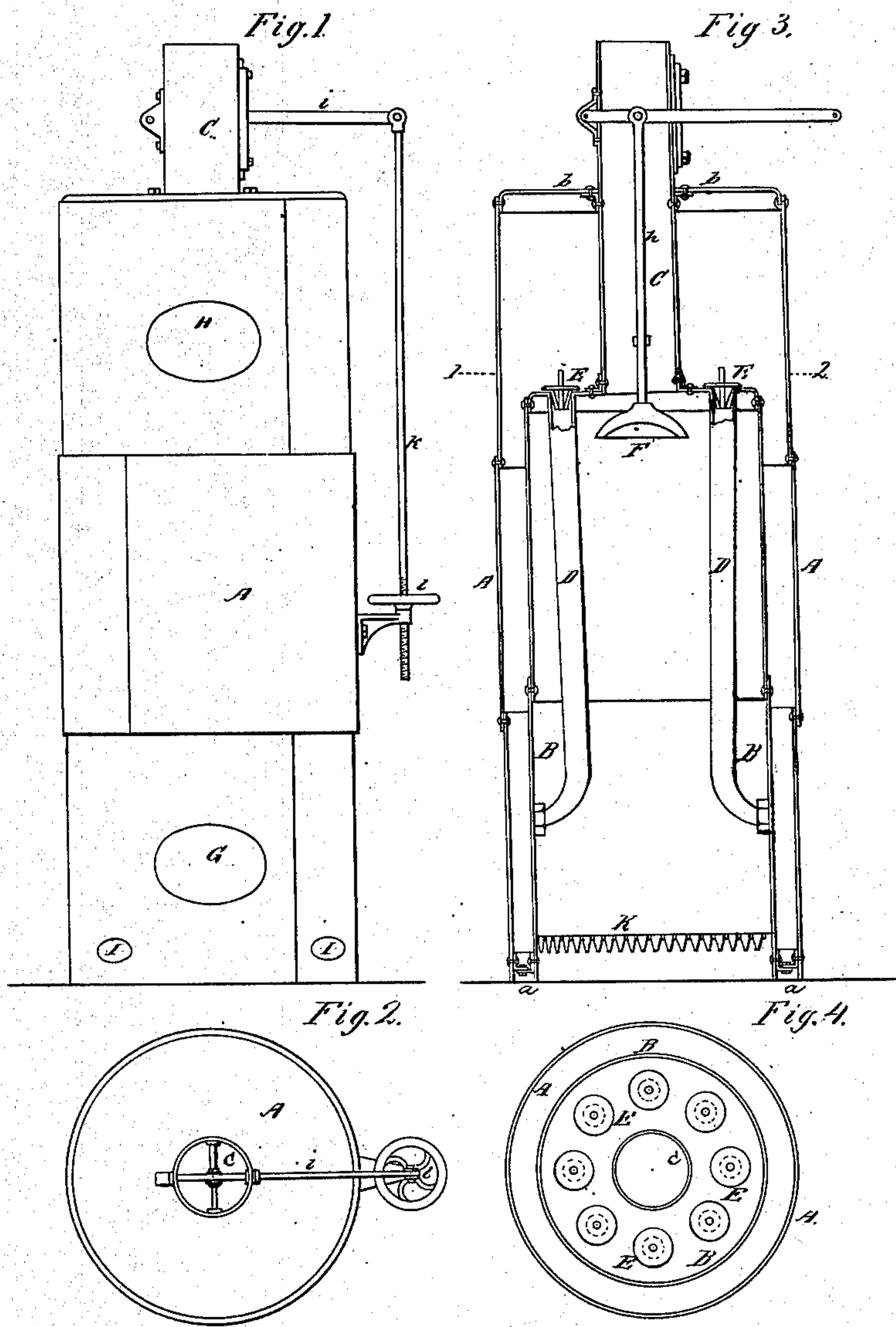


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Improvement in Steam-Boilers.

No. 128,812.

Patented July 9, 1872.



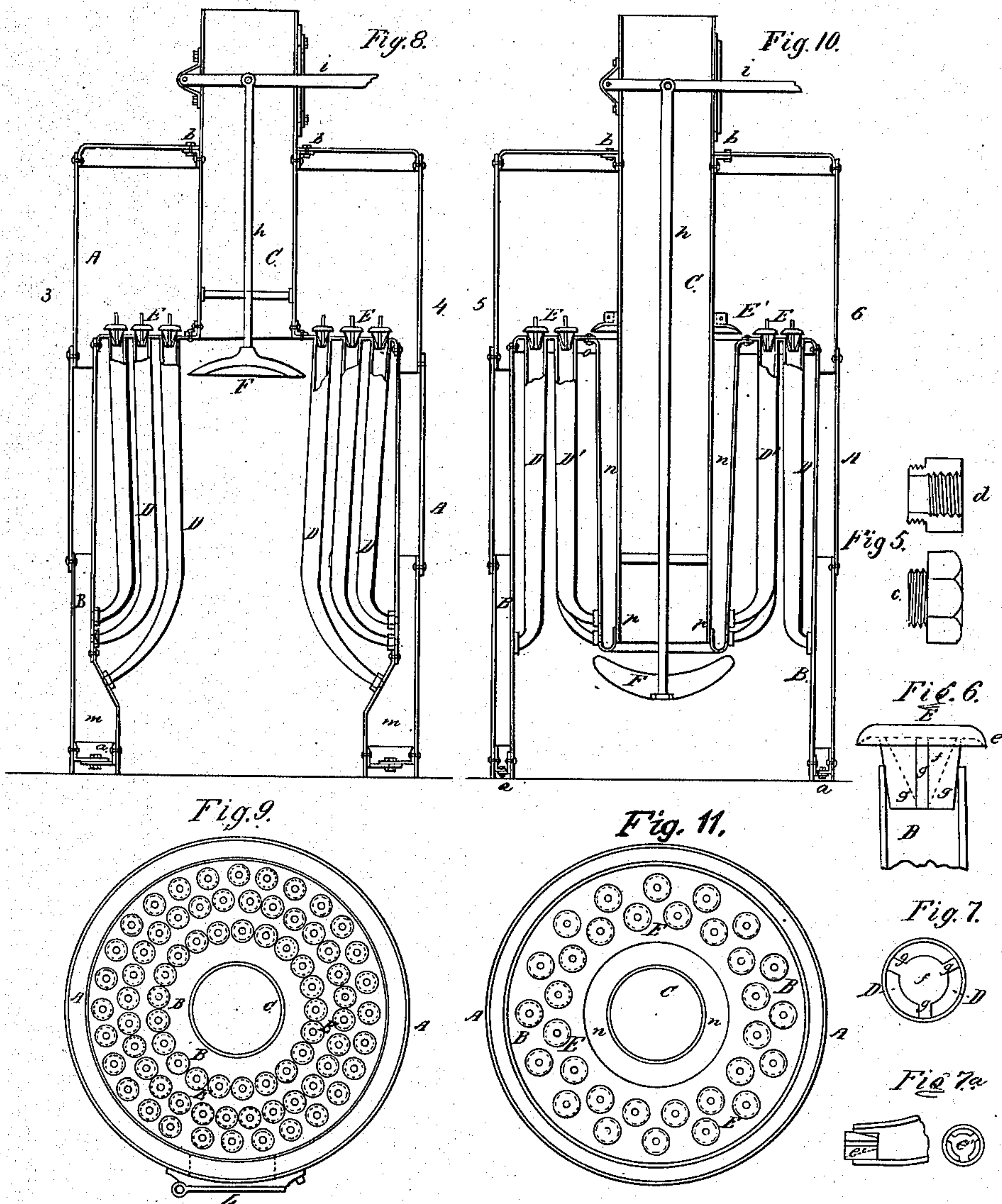
Witnesses:  
T. C. Bricht  
O. E. Duffy

James N. Paxman & Henry M. Davey  
per *[Signature]*  
Attys

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Witnesses.  
J. C. Brecht,  
O. E. Duffy

Inventor:  
James N. Paxman & Henry M. Davey  
per *[Signature]* attys



# UNITED STATES PATENT OFFICE.

JAMES N. PAXMAN AND HENRY M. DAVEY, OF COLCHESTER, ENGLAND.

## IMPROVEMENT IN STEAM-BOILERS.

Specification forming part of Letters Patent No. 128,812, dated July 9, 1872.

Specification describing a new and useful Improvement in Steam-Boilers, invented by JAMES NOAH PAXMAN and HENRY MATTHEWS DAVEY, of Colchester, in the county of Essex, England.

The invention relates to vertical as well as horizontal boilers, and will first be fully described in connection with all that is necessary to a full understanding thereof, and then clearly pointed out in the claims.

Figure 1 of our drawing represents a side or external elevation of one of our improved vertical boilers. Fig. 2 is a corresponding plan of the same, both these views showing the adjusting gear for regulating the position of the baffle-plate or disperser. Fig. 3 is a vertical sectional elevation of the said boiler. Fig. 4 is a horizontal section of the same taken along the line 1 2 in Fig. 3, and showing the crown of the fire-box in plan.

In the figures above enumerated, which are drawn to a scale of one and a half inch to one foot, A represents the outer shell of the boiler, and B the fire-box, which is bolted, as shown at *a a*, Fig. 3, to the outer shell at or near the bottom thereof, while to the center of the crown of the fire-box there is riveted the uptake or flue C, which is fitted with an annular flange at *b*, whereby the said flue is bolted to the crown of the outer shell of the boiler, as shown clearly in Fig. 3. Round the interior of the fire-box there are disposed a number of bent water-tubes, D, (two of which only are shown in Fig. 3.) These tubes are of uniform diameter throughout the greater portion of their length, and are tapered only at their lower bent ends. The upper ends of these tubes are expanded or otherwise secured into the crown-plate of the fire-box, while their lower bent and contracted or tapered ends are secured in any convenient manner to the vertical sides of the fire-box. We prefer to effect this connection by means of the combined screw and nut, shown on an enlarged scale in detail section and elevation at Fig. 5. The projecting portion *c* of the screw-nut has an external screw-thread formed thereon, which screws into a tapped hole made through the side of the fire-box; a second screw-thread (but in the reverse direction to that at *c*) is made inside the nut, as shown in the sectional view at *d*. Into this last-named screw there

is introduced the taper bent end of the tube D, while the screwed part *c* of the connection or coupling is screwed into the side of the fire-box, the act of screwing in such coupling serving at the same time to draw home the screwed taper bent end of the tube D inside the nut, thereby effecting a perfect joint, which can be made and unmade, as may be found requisite, with the greatest ease. To the top of each tube D there is fitted the mushroom-cap or deflector E, one of which is shown in detail elevation on an enlarged scale, inserted into a tube end at Fig. 6, and in cross-section taken through the end of the tube at Fig. 7. *e* represents the expanded portion of the head, and *f* a short tapered stem, provided with projecting ribs *g g*, which stem is fitted into the upper mouth of each tube D, the projecting ribs *g* leaving sufficient space for the upward circulation of the water from the end of the tube, while the expanded or overhanging mushroom head *e* deflects the current downward and laterally. If desired, a plug having ribs thereon, and with or without a perforation therethrough, may be driven into the lower end of the water-tube, as shown at *e* in Fig. 7<sup>a</sup>, in order to insure a scour or rapid circulation through the lower bent end of such tube. F is the baffle-plate or heat-disperser, which is adjustable toward or from the mouth or entrance to the central flue C by means of the rod *h*, lever *i*, screwed spindle *k*, and hand-wheel nut *l*. G is the stoke-hole; H, the man-hole; I, the mud-holes; and K, the fire-bars. Fig. 8 represents a vertical section of a larger size of vertical boiler, provided with three series of tubes, and drawn to a scale of one inch to one foot; and Fig. 9 is a horizontal section of the same taken along the line 3 4 in Fig. 8, showing the top or crown of the fire-box in plan view, with the numerous mushroom-shaped deflectors in their places. Fig. 8 shows the inclination inward of the sides of the fire-box at the lower portion thereof, whereby we obtain an annular chamber, *m*, of increased area, at the bottom of the boiler, for the accumulation of deposit, while, moreover, the water which passes through the tubes D, in connection with such enlarged annular chamber *m*, will be in a more quiescent state, and therefore denser and better adapted for absorbing heat. D D D represent the three series or concentric circles of tubes, which de-



scend to different depths along the fire-box sides. L, Fig. 9, is the fire-door frame. Fig. 10 represents a vertical section of a vertical boiler, drawn to the same scale as the last two figures previously referred to; and Fig. 11 is a horizontal section of the same taken along the line 5 6 in Fig. 10. In Fig. 10 we have represented the central flue or smoke-chamber C as being prolonged or extended downward into the chamber of the fire-box to within a moderate distance—say eighteen inches—from the surface of the fire-grate, and have shown this extended portion of the flue or smoke-chamber as being inclosed in or surrounded by an annular water-space, *n*, the sides of which are secured to the crown of the fire-box at *o*, and to the bottom of the flue at *p*. One or more series of bent tapered tubes, D' D', may be made to communicate with the lower portion of the central annular water-space *n* in addition to the other tubes D which communicate with the vertical sides of the fire-box, and all these tubes are provided with deflectors, E, as shown in our drawing. Above the top of the central annular water-space *n* there is fitted, when found requisite, round the flue C an annular deflector, E', for the purpose of arresting or controlling any undue or over-energetic circulation of the water in the said water-space *n*, the said annular deflector being made so as to be capable of adjustment higher or lower, as required. The baffle-plate or heat-disperser F, which serves to direct the flames and heated gases among the tubes, in lieu of allowing them to pass directly up the chimney, may be composed either of cast-iron, as shown in Figs. 3 and 8, or of fire-brick.

Our improved tubes are made of uniform diameter throughout the greater portion of their length, the taper or contracted portion existing only at their lower bent end, or that end through which the colder water first enters such tube; the essential object of such con-

traction being the imparting of a more effectual and stronger scouring action to the current of water at that part of the tube wherein deposit or incrustation is most likely to take place, thereby preventing the collection or deposit or incrustation in the lower part of the said tube.

Having now described and particularly ascertained the nature of our said invention and the manner in which the same is or may be used or carried into effect, what we claim is—

1. The application and use, to and in steam-generators, of water-tubes made contracted or tapered at their lower bent ends only, in combination or not with deflecting-plates or mushroom-shaped caps, substantially as and for the purpose hereinbefore described.

2. The application of a plug or its equivalent, perforated or not, to the lower end of a water-tube in a steam-generator, so as to partially close the same, for the purpose hereinbefore described.

3. The combination of bent water-tubes, contracted at their lower bent ends only, with deflectors, substantially as and for the purpose hereinbefore described.

4. The combination, with an annular water-space in a steam-generator, of an annular deflector for dispersing the water as it rises from the annular water-space, substantially as hereinbefore described.

The above specification of our invention signed by us this first day of November, 1871.

JAMES NOAH PAXMAN.

HENRY MATTHEWS DAVEY.

Witnesses:

W. S. GOODY,

*Solicitor, Colchester:*

HENRY HOLLAWAY,

*58 Crouch street, Colchester, Solicitor's Clerk.*

HENRY GOODY,

*Notary Public, Colchester.*