(No Model.) 2 Sheets—Sheet 1.

N. H. TENNEY.

STEAM GENERATOR.

No. 424,629. Patented Apr. 1, 1890.

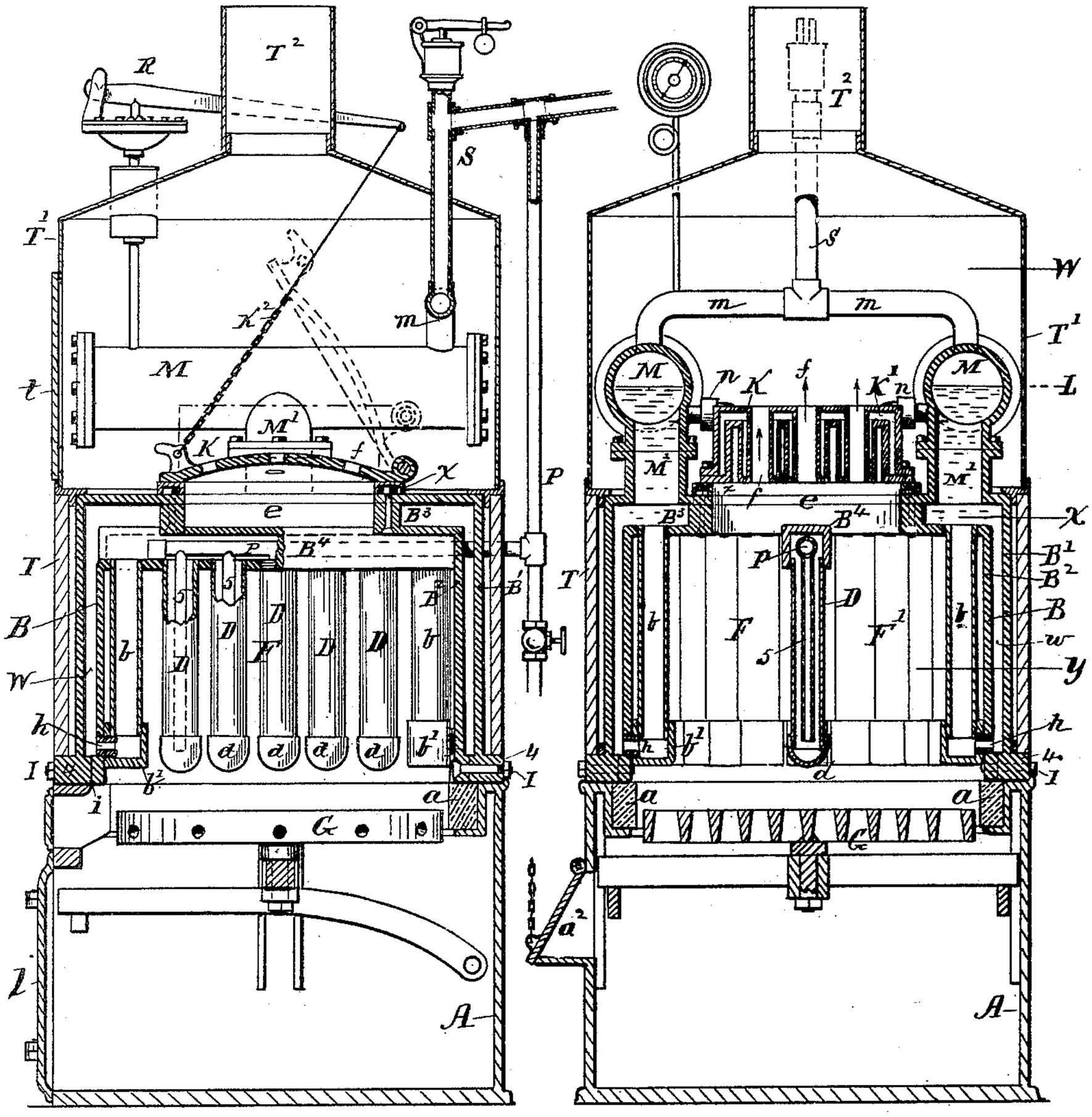

FIG. 1

FIG. 2

Witnesses

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(No Model.) 2 Sheets—Sheet 2.

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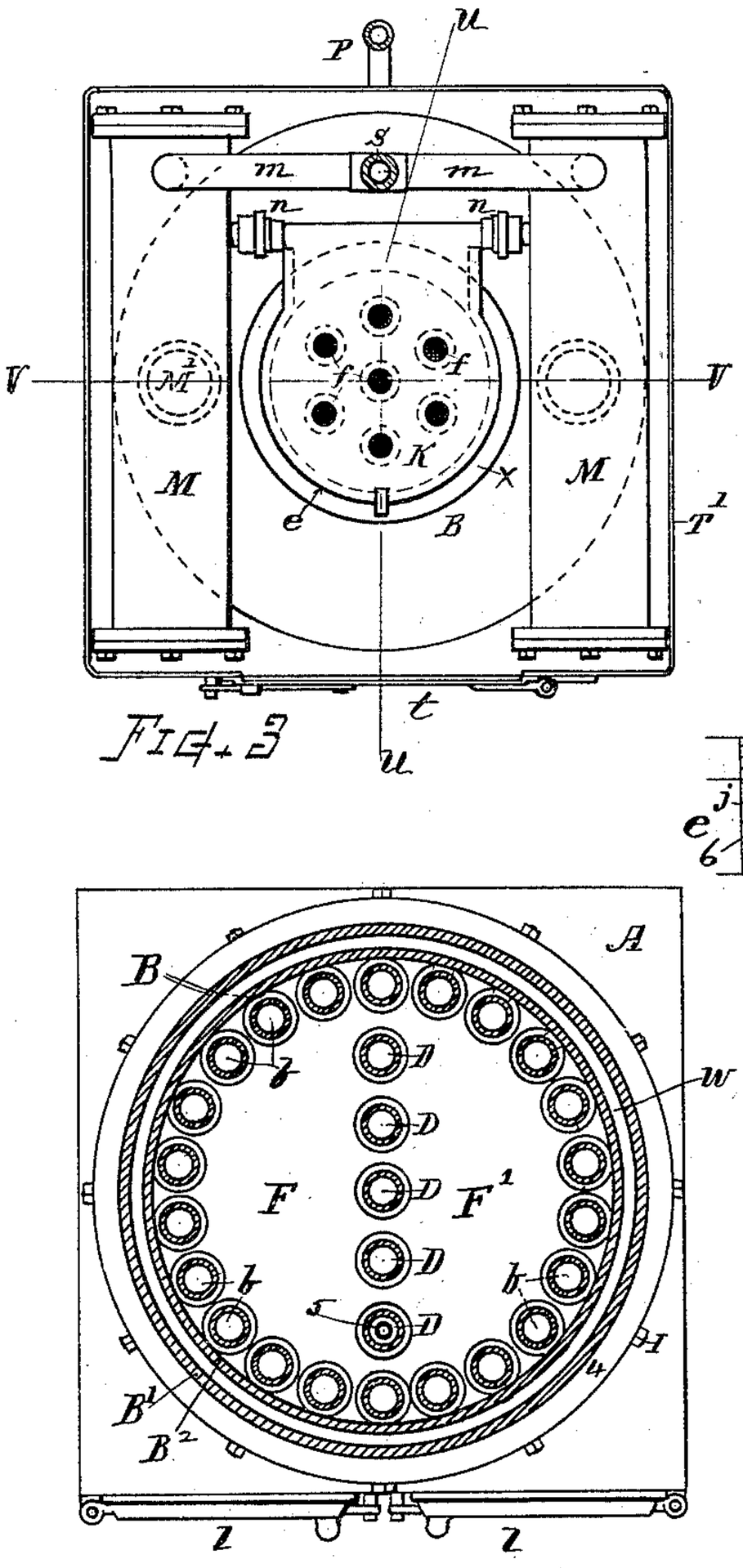

FIG. 3

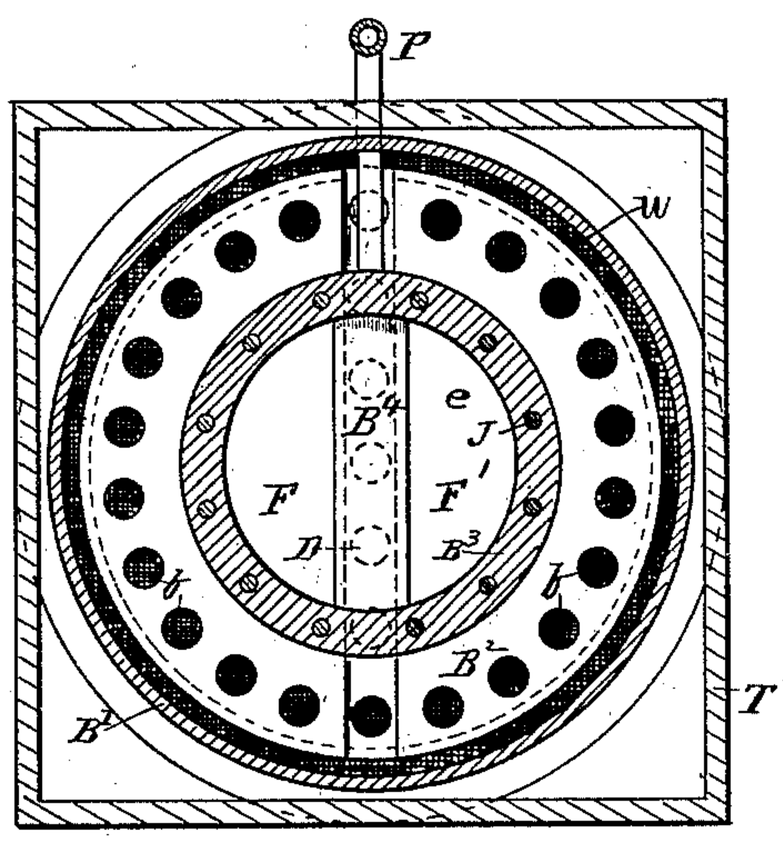

FIG. 4

FIG. 5

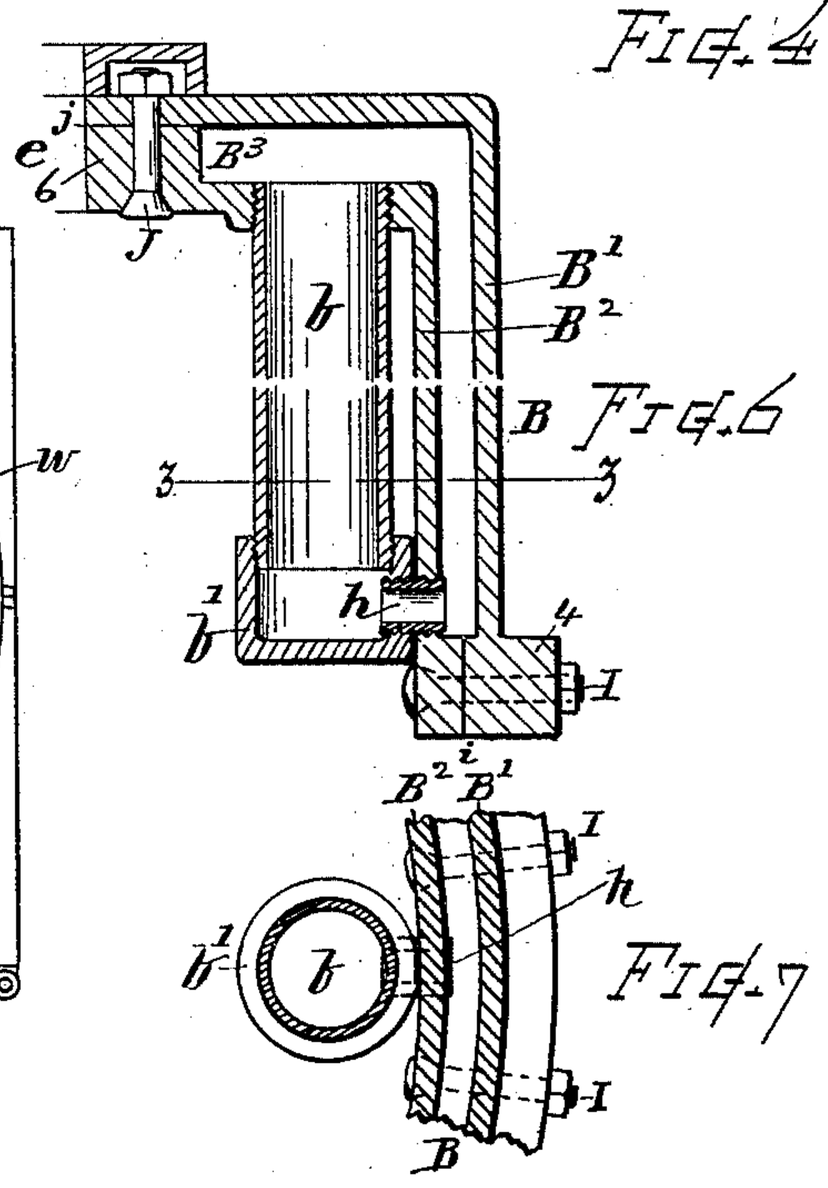

FIG. 6

FIG. 7

Witnesses.

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UNITED STATES PATENT OFFICE.

NELSON H. TENNEY, OF ACTON, MASSACHUSETTS.

STEAM-GENERATOR.

SPECIFICATION forming part of Letters Patent No. 424,629, dated April 1, 1890.

Application filed September 9, 1889. Serial No. 323,428. (No model.)

To all whom it may concern:

Be it known that I, NELSON H. TENNEY, a citizen of the United States, residing at Acton, in the county of Middlesex and State of Massachusetts, have invented certain new and useful Improvements in Steam-Generators, of which the following, together with the accompanying drawings, is a specification sufficiently full, clear, and exact to enable persons skilled in the art to which this invention appertains to make and use the same.

The object of my present invention is to provide a steam-generator more especially for the heating of buildings and similar purposes, which can be operated successfully and the requisite steam be generated by a slow-burning fire; also, to provide an apparatus in which the furnace is divided by tubes, as hereinafter explained, so that the fire can be separated and the apparatus operated with a small fire when desired or with a large fire when necessary.

Another object is to afford details of construction that render the apparatus convenient and economical for manufacture and durable and practical for use.

I attain these objects by the mechanism illustrated and described, the subject-matter claimed being hereinafter definitely specified.

In the drawings, Figure 1 is a vertical sectional view at line *u u*, Fig. 3, showing the structure of my improved steam-generator or heating apparatus. Fig. 2 is a vertical sectional view at line *v v*. Fig. 3 is a horizontal section at line *w*, Fig. 2. Fig. 4 is a horizontal section at line *x*. Fig. 5 is a horizontal section at line *y y*. Fig. 6 is a sectional view showing the details of construction of the joint connecting the tube and water-leg section. Fig. 7 is a horizontal section of the same at line *z z*.

In my improved generator the boiler comprises a main body or water-leg section having an outer and inner shell with inwardly-extended top and embracing a narrow intervening water-space which incloses the fire-chamber above the grate, and a series of upright tubes, communicating at the top and bottom with the water-space, are arranged within the fire-chamber adjacent to the cylinder. Steam-drums are arranged above and communicate with the main body, and a movable perforated cover is arranged over the central opening at the top of the fire-chamber. The boiler rests upon a suitable base, and is provided with an outer casing above the drums for collecting the smoke and with a flue for conveying away the products of combustion, the parts being preferably arranged substantially as illustrated.

In referring to parts, A denotes the base.

B denotes the water-leg section or main body of the boiler, composed of the outer shell B′ and inner shell B^2, preferably of cylindrical shape and together forming a wall that incloses the fire-space or furnace-chamber F, and embraces an intervening water-space of about five-eighths-inch, more or less, dimension. The upper ends of the shells B′ and B^2 extend inward in the manner illustrated at B^3, partially covering the fire-chamber, but leaving a central opening *e* above the fire-space. Upright tubes *b* are arranged in a comparatively close row around the interior of the fire-chamber adjacent to the surface of the inner shell B^2, the upper ends of said tubes being screwed into openings formed in the horizontal inwardly-extended portion B^3 of the shell B^2. The lower ends of these tubes *b* are best provided with caps *b′* and joined to the shell B^2 by means of screw-threaded nipples *h*, passed through the shell and side of the cap, and forming an attachment through which communication is established from the water-leg to the interior of the tube, as indicated.

The boiler-section B has a transom or hollow bar B^4 across its upper portion, and a series of vertically-depending tubes D are arranged in a row across the center of the fire-space, forming a barrier or partition for dividing the same into two chambers F and F′. The top ends of said tubes are secured in the hollow bar and their lower ends closed by caps *d*. The two parts B′ and B^2 of the body or water-leg section are cast separately, the part B′ being made with a circumferential rim 4 at its base, which is fitted to the rim of the part B^2 by a vertical joint at *i* and secured by radial bolts or rivets I, while the upper portion of the part B^2 is provided with a rim 6 and fitted to the part B′ with a horizontal joint, as at *j*, and the parts secured together by vertical bolts J.

In putting the parts together the upper end of the tube *b* is first screwed into the part B^2, the cap *b'* being screwed onto the lower end. The cap *b'* is then held against or adjacent to the inner surface of the shell B^2, and a hole is drilled from the exterior through both the shell and the cap. This hole is then tapped or threaded, and the screw-threaded nipple *h* is screwed firmly into the opening. (See Figs. 6 and 7.) The outer end of the nipple is cut off flush, or substantially so, with the outer surface of the shell B^2. This is done before the outer shell B' is attached. After the tubes *b* have all been confined the outer shell B' is placed over the inner shell B^2, the bolts I and J inserted, and their nuts screwed down, drawing the joints together and making all tight and secure. The nipple *h* is preferably of brass and serves to hold the lower end of the tube permanently in connection with the shell, and also forms a passway for the circulation of water from the lower part of the water-leg section up through the tube.

At either side above the section B are provided horizontal drums M, which communicate with the water-space through upwardly-projecting necks that have suitable coupling-flanges for connecting the castings. The drums are best connected with each other by suitable pipes *m*. The steam-supply pipe S extends therefrom for conducting steam to the place of use or about the building.

A perforated hinged cover K is arranged over the opening *e*. Said cover K may be a plain perforated plate, as in Fig. 1, or it may be constructed with an internal water-space K' and tubes, as indicated in Figs. 2 and 3. In the latter instance it is best connected with the drums M by pipe-joints and provided with stuffing-boxes *n* at the points of hinging, so that the water can freely flow from the drums into the interior space of the movable cover. The normal water-level is preferably about one-half way of the diametric height of the drums M, as indicated at L on Fig. 2.

Beneath the furnace is arranged the grate G, which may be formed as shown, or of any other suitable construction. The grate G is preferably made and supported in such a manner that it can be revolved, its periphery being provided with a series of holes for the insertion of the shaker-bar. A ring of fire-brick or refractory material *a* is preferably disposed beneath the generator and surrounding the grate, as indicated.

P indicates the return-pipe or feed-pipe through which water enters the boiler. Said pipe can be connected directly with the water-leg section or it can be extended, as indicated, into the hollow bar B^4 and provided with branches 5, that depend within the tubes D, for delivering the feed-water at the lower end of said tubes. In some instances or with small-sized apparatus the generator can be made without the hollow transom and center tubes.

The cover K is best connected by a chain or rod K^2 with the lever of an automatic damper-regulator R, whereby the cover can be raised and permitted to drop by change of steam-pressure for regulating the degree of draft. The air-valve a^2 may also be connected with the damper-regulator in the usual manner for controlling admittance of air to the fire.

T indicates a non-radiating lagging or heat-retaining covering of asbestus, felt, or other suitable material, for protecting the water-leg section B from loss of heat, and T' indicates a sheet-iron hood or casing for concentrating the products of combustion above the boiler, to be conducted away through the flue T^2. A door *t* is arranged in the casing, through which to supply fuel, and doors *l* are arranged in the ash-pit for giving access to the grate and for removing ashes.

When supplying fuel to the fire, the plate K is raised, as indicated by dotted lines in Fig. 1, and the fuel is introduced through the door *t* and central opening *e* into the top of the fire-chamber at either side of the barrier.

An annular plate *x*, having a groove or recess in its under side, is best arranged over the ends of the bolts J to form a proper seat for the cover K; or, if preferred, the cover can be seated on the rim inside the row of bolts or rivets.

Among the advantages of the construction herein set forth it may be noted that the generator contains but a comparatively small quantity of water, so that water can be converted into steam in a rapid manner. The fire-chamber being within the section B, the heat is brought into direct contact with the tubes and inner surface of the water-leg section.

Another advantage is that the tubes *b* serve to support the fuel at a slight distance away from the shell, thus tending to afford sufficient draft about the circumference of the fire for keeping the fire alive and in good condition adjacent to the heating-surfaces of the boiler and generating the heat in contact with the water-containing parts of the boiler. This permits of using dust coal, throws the heat on the surface of the tubes and shell, and also by reason of the arrangement of the heating-surfaces accomplishes the heating with a very slow-running fire, which is an advantage in the burning of coal for heating purposes.

Another important advantage is that the fire-surface, being divided by the tubular partition D, affords facility for working successfully with a small fire, as one part of the fire-space F or F' can be allowed to fill up with ashes and cinders in the spring and fall, when but little heat is needed, and the fire run only on one side of the furnace, or when greater fire is needed both parts can be worked.

I claim as my invention to be secured by Letters Patent—

1. The combination, with the annular water-leg section having the inwardly-extended

top rim and the series of upright tubes disposed adjacent to the inner surface thereof, with their top ends secured in the inwardly-extending rim, of the caps fitted on the lower ends of said tubes and screw-threaded nipples inserted through the shell and caps, whereby said caps are connected with the water-leg shell, substantially as set forth.

2. The combination, with the boiler-section having the inner and outer shells, with an intervening water-space surrounding the fire-chamber, of a hollow transom or cross-bar connecting the water-space from opposite sides of the chamber, and a series of tubes fixed in and internally communicating with the hollow of said transom and disposed in a comparatively close-set row or barrier across the fire-chamber, substantially as set forth.

3. The combination of the water-leg section surrounding the fire-chamber and provided with an inwardly-extended top and a diametrically-disposed hollow transom, of a series of upright tubes adjacent to the inner surface of said water-leg section, and a series of tubes having closed lower ends supported by and depending from said hollow transom to form a barrier across the fire-chamber, substantially as set forth.

4. The adjustable perforated cover above the fire-chamber, in combination with the water-leg section having the inwardly-extended top with central opening and provided with upright tubes surrounding the fire-chamber, and an automatic regulator connected with said cover for adjusting it, substantially as and for the purpose set forth.

5. The adjustable cover constructed with internal water-space and draft-tubes and provided with hollow hinges or connections, in combination with the water-leg section surrounding the fire-chamber and provided with a top rim on which said cover is seated, substantially as set forth.

6. The combination, substantially as described, of the annular water-leg section having the inwardly-extended top, the upright tubes disposed about the interior thereof adjacent to the shell, the hinged cover closing over the opening in said top, the fire-grate, the air-valve, and an automatic regulator and connections for raising and lowering said cover under control of said regulator, all arranged and operating as and for the purpose set forth.

7. A steam-generator having the cylindrical water-leg section composed of the outer and inner shells, with an inwardly-extended top portion joined at their upper and lower rims by rivets or bolts and embracing a narrow intervening water-space surrounding the fire-chamber and provided with a row of tubes disposed about the interior adjacent to the shell, and the steam-drums supported above said water-leg section at either side of its central opening and connected therewith through hollow necks, substantially as shown and described.

8. The combination, with the water-leg section having the hollow bar extending across the fire-chamber, with tubes depending therefrom, of the feed-water pipe extending to the interior of said hollow bar and provided with branches that lead downward within said tubes, substantially as and for the purpose set forth.

9. A steam-generator comprising the annular water-leg section having the inwardly-extended top and hollow diametric bar embracing the fire-chamber, the series of tubes disposed about the fire-chamber adjacent to the inner surface of the water-leg and connected with the water-space at their upper and lower ends, as shown, the series of tubes dependent from said diametric bar and forming a barrier across the fire-chamber, the steam-drums attached to the top of the water-leg section, the adjustable cover, the fire-supporting grate, and the inclosing-casing, all arranged substantially as and for the purpose set forth.

Witness my hand this 3d day of September, A. D. 1889.

NELSON H. TENNEY.

Witnesses:

S. A. GUILFORD,

A. F. DURKEE.