

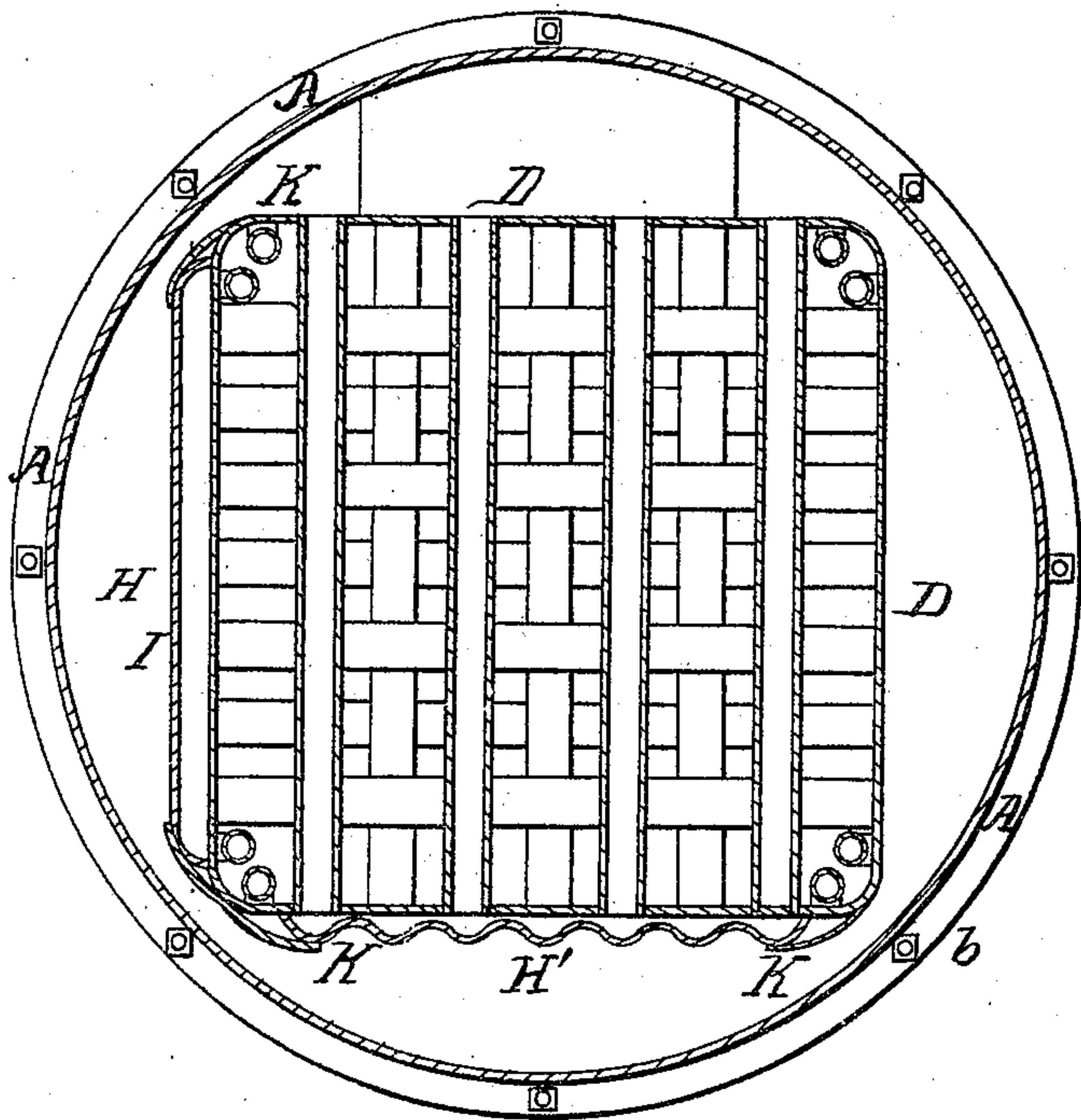
*L. B. Flanders,*

*Steam-Boiler Water-Tube.*

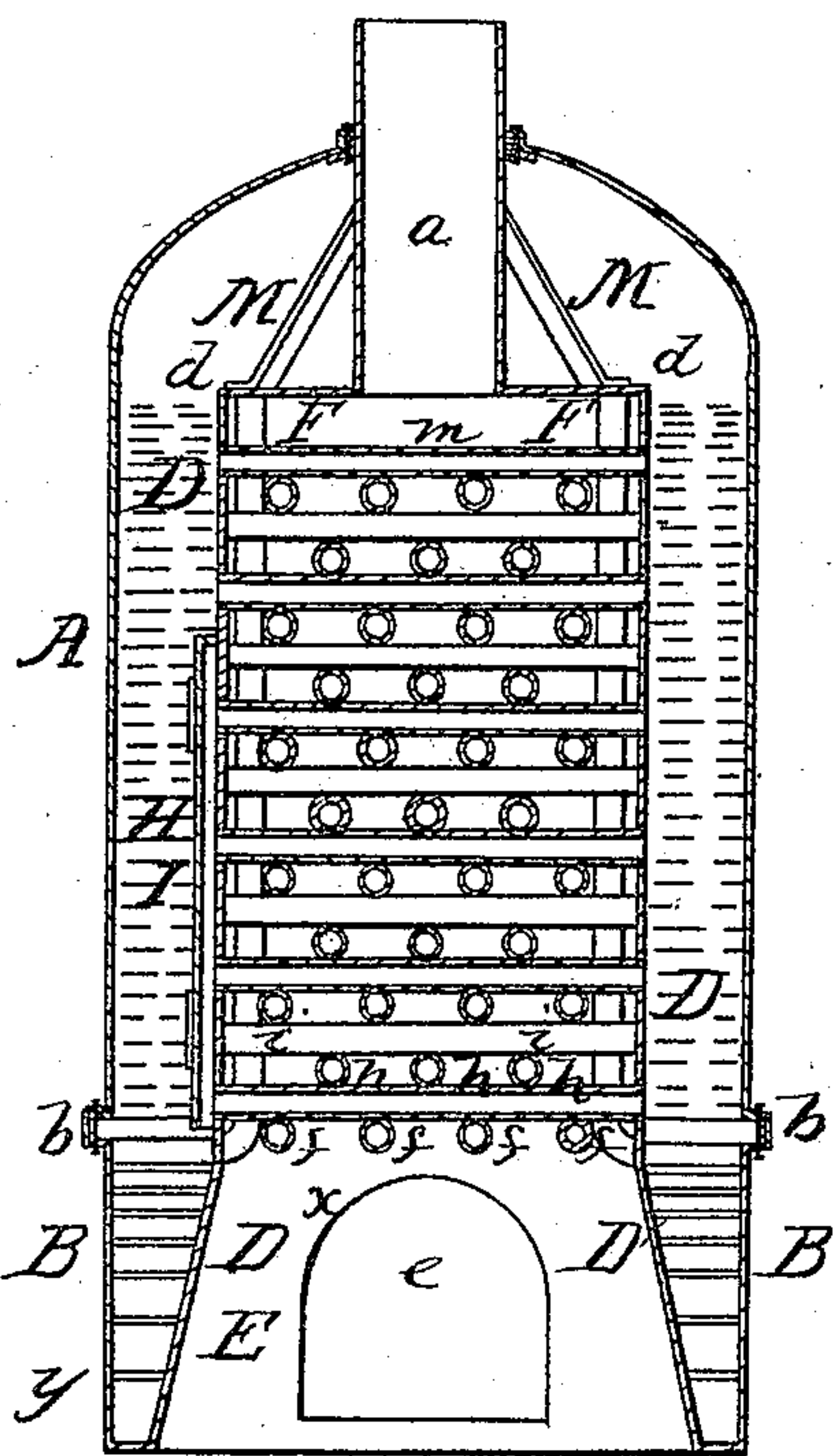
*N<sup>o</sup> 43,577.*

*Patented July 19, 1864*

*Fig. 2.*



*Fig. 1.*



*Witnesses.*

*Charles E. Foster  
H. Albert Steel*

*Inventor.*

*L. B. Flanders  
Henry Howson Atty*



# UNITED STATES PATENT OFFICE.

L. B. FLANDERS, OF PHILADELPHIA, PENNSYLVANIA.

## IMPROVEMENT IN STEAM-BOILERS.

Specification forming part of Letters Patent No. 43,577, dated July 19, 1864; antedated June 17, 1864.

*To all whom it may concern:*

Be it known that I, L. B. FLANDERS, of Philadelphia, Pennsylvania, have invented certain Improvements in Steam-Boilers; and I do hereby declare the following to be a full, clear, and exact description of the same, reference being had to the accompanying drawings, and to the letters of reference marked thereon.

My invention consists of a steam-boiler constructed in the manner fully described hereinafter, with the view of gaining the advantages of an extended heating-surface, a free circulation of water through the boiler, rapid generation of steam, and facility for conducting repairs.

In order to enable others skilled in the art to make and use my invention, I will now proceed to describe its construction and operation.

On reference to the accompanying drawings, which form a part of this specification, Figure 1 is a vertical section of my improved boiler; Fig. 2, a sectional plan of the same, drawn to an enlarged scale.

A is the outer casing of the boiler, and is of cylindrical form, with a dome-shaped top, through which passes the chimney *a*, to be referred to hereinafter. The lower end of the casing A is secured to the cylindrical base B by bolts *b* passing through a flange on the base, as well as through a flange on the casing, both flanges being formed with the view of making a perfectly-packed water-tight joint at the junction of the casing with the base, the joint at the same time being of such a character that the casing can be readily removed from the base under the circumstances described hereinafter.

D is the inner casing of the boiler, and is of the square form, with rounded corners, represented in Fig. 2, the chimney *a*, previously alluded to as passing through the dome-shaped top of the casing A, being secured to the flat top *d* of the interior casing D. The lower end of this interior casing is united to or forms a part of the casing D', which at its junction with the casing D is of the same square form as the latter, but gradually assumes a cylindrical form as it approaches the lower end of the base B, to which it is united. This casing

D' incloses the fire-chamber E, provided with the usual grate-bar, onto which the fuel is thrown through an opening, *e*, the latter being provided with the usual hinged fire doors.

At a point a short distance above the junction of the casing D' with the casing D are arranged the first row of horizontal tubes *f*, and immediately above the latter is a second row of tubes, *h*, which are arranged at right angles to the lower tubes, and immediately above these tubes *h* are another row of tubes, *i*, at right angles to the tubes *h*, and this arrangement of the tubes is continued upward, one row being at right angles to the adjacent row. It will be seen that the center of each tube *h* coincides with a vertical line, *x*, passing midway between two of the tubes *f*—an arrangement continued throughout the entire system of tubes.

Within the casing D, and near each corner of the same, are one, two, or more vertical tubes, F, the upper ends of which are secured to the top plate, *d*, of the casing D, the lower end being bent, and the bent end being secured to the lower end of the said casing D.

On two sides of the square casing D are arranged the shields H, which may be either plain or corrugated, as shown in Fig. 2. Each shield consists of a plate bent at the vertical edges and the top, which bent edges bear against the side of the inner casing, D, a space, I, being thus formed, into which the water can pass freely from below in the direction pointed out by the arrow, Fig. 1, for a purpose explained hereinafter. The shields are not permanently secured to the casing D, but are confined thereto by strips *k*, secured to the corners of the said casing, as best observed on reference to Fig. 2, so that the shields can be readily removed when required.

The advantages of my improved boiler may be described as follows: The system of tubes to which the water has free access from the water-space between the inner and outer casings afford an extended and most available heating-surface, as every portion of each tube is subjected to the direct action of the products of combustion, which, owing to the peculiar arrangement of the tubes, must necessarily take a circuitous or zigzag course prior to escaping at the chimney *a*. At the same time



the tubes form the most efficient stays for resisting the pressure of the steam against the flat sides of the inner casing, D.

It is well known that where horizontal or even inclined water-tubes in steam-boilers are exposed to the direct action of the fire the rapid generation of the steam prevents a free circulation of water through the tubes, and consequently the latter are soon burned and destroyed. This evil effect is obviated in my improved boiler by the shields H in a manner which will be best understood by reference to Fig. 1. As the globules of steam are rapidly generated in the lower tubes of the series, they have a tendency to escape from the latter and rise to the surface of the water in the boiler. If these globules were permitted to escape at both ends of the tubes, the free circulation of water through the same would be prevented, and the evil results mentioned above would ensue; but by the use of the shields H the steam can escape at one end only of each tube, while the water passing in the direction of the arrow into the space I and to the tubes takes the place of the water which has been converted into steam. Thus while the globules of steam are passing out of one end of each tube the water is passing into the other, and such a free circulation of water must necessarily take place through the tubes as must constitute a bar to the destructive action of the fire. It is not necessary to carry the shields upward to the top of the inner casing, D, as the upper tubes are not so liable to be destroyed by the fire as the lower tubes.

A most important feature of my improvement is the manner of connecting the outer casing, A, of the boiler to the base B. After unscrewing the nuts of the bolts *b* and loosening the packed joint at the point where the chimney *a* passes through the dome, the casing A may be elevated clear of the boiler, so as to expose the inner casing, D, every part of which is accessible to the workmen who may desire to make the repairs which all boilers necessarily demand periodically, the shields presenting no permanent obstacle to the conduct of such repairs, as they can be readily

removed and replaced. No stays are required in the square portion D of the boiler other than those presented by the tubes. It will be advisable, however, to connect the base B to the portion D' of the casing by means of suitable stays at the points *y*, (shown by red lines, Fig. 1;) and in order that the top *d* of the inner casing, D, may not be depressed by the steam, I make use of the diagonal stays M, the efficiency of which will be at once understood.

The vertical tubes F perform the important duty of maintaining a free circulation of water between the upper and lower portions of the boiler.

Although I prefer to arrange the tubes horizontally, as forming the most efficient stays when in that position, they may be slightly inclined, and although I have shown the inner casing as being square it will be evident that it may be made six or eight sided without departing from the main feature of the invention.

I claim as my invention and desire to secure by Letters Patent—

1. The inner casing, D, with its arrangement of tubes, the continuation D' of the said casing, the base B, and exterior cylindrical casing A, when the latter is arranged in respect to the base, and constructed for attachment to and detachment from the same, substantially as set forth.

2. In combination with the said casing D, the shields H, constructed and arranged in respect to the tubes of the said casing substantially as and for the purpose specified.

3. The vertical tubes F, arranged within the casing D in respect to the horizontal tubes substantially as set forth, for the purpose described.

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

L. B. FLANDERS.

Witnesses:

JOHN WHITE,  
CHAS. HOWSON.