

(No Model.)

G. CAWLEY.
STEAM-BOILER.

No. 518,443.

Patented Apr. 17, 1894.

FIG. 2.

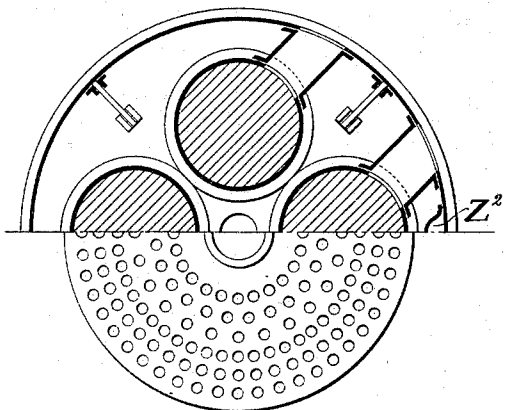
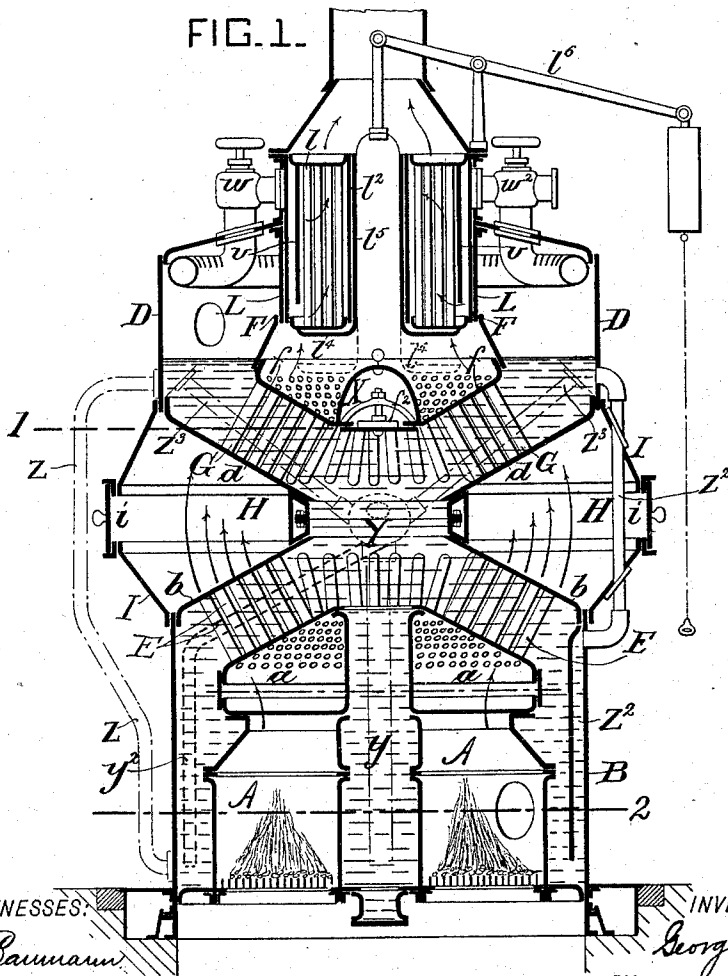


FIG. 1.



WITNESSES:

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UNITED STATES PATENT OFFICE.

GEORGE CAWLEY, OF LONDON, ENGLAND.

STEAM-BOILER.

SPECIFICATION forming part of Letters Patent No. 518,443, dated April 17, 1894.

Application filed March 6, 1893. Serial No. 464,911. (No model.) Patented in England June 29, 1889, No. 10,540.

To all whom it may concern:

Be it known that I, GEORGE CAWLEY, civil and mechanical engineer, a subject of the Queen of Great Britain and Ireland, residing at 358 Strand, in the city of London, England, have invented certain Improvements in Steam-Boilers, (for which I have obtained a patent in Great Britain, No. 10,540, dated June 29, 1889,) of which the following is a specification.

This invention relates to vertical steam boilers, and the improvements which constitute the said invention consist in the construction and arrangement of the constituent parts of the boiler in such a manner as to secure greater strength, greater evaporative efficiency and better circulation of the water and so also as to allow vertical boilers to be constructed and economically worked having a larger size than is at present practicable.

I will describe these improvements with reference to the accompanying drawings, in which—

Figure 1 is a vertical section of a boiler constructed according to my invention. Fig. 2 is a transverse section along the line 1—2 Fig. 1 looking downward.

In constructing a boiler according to my invention I make the upper part *a* of the fire box A or the upper parts of several such fire boxes as shown (the cylindrical portion of which may be corrugated, fitted with Adamson's rings, or be strengthened against collapse by other known or convenient means) of the form of a cone or of the frustum of a cone. I also construct the outer shell of the lower portion B of the boiler so that its upper part *b* is of the form of a frustum of a cone coaxial with the upper part of the fire box or fire boxes and so also that the frustum *b* terminates with a short tube or opening *c* and that an annular space is left between the coned portions *a* and *b* of the fire box or fire boxes and of the shell. Tubes E E are fixed in the said conical portions *a b* and cross the space between them in such a manner that the flame and products of combustion may pass through these tubes E E from the fire box or fire boxes A to the outside of the shell. The upper part of the frustum *b* of the lower outer shell is flanged and may be bolted or riveted to a similar flanged part of the upper

shell D or of a short tube connecting the two parts, or it may be welded thereto.

The upper or steam containing part of the boiler rests upon the portion already described and it consists of two concentric tubes or shells D and F having their lower ends formed by two concentric inverted frusta of cones *d* and *f*. The inner shell F may be strengthened against collapse by similar means to those hereinbefore mentioned as applicable to the fire box. The lower part of the frustum *d* of the outer shell is connected to the frustum *b* by means of a flange or by a short channeled tube and the connection may be made by bolts, by riveting or by welding as is well understood.

The inverted frusta of cones *d* and *f* in the upper part of the boiler are connected by the tubes G G as described for the tubes E E in the lower part, so that the heated gases produced by combustion may pass from the space H into the interior of the inner shell F. The annular space H formed between the two outside frusta *b* and *d* of the upper and lower parts of the boiler, is inclosed by the casing I and forms a smoke box or secondary combustion chamber, and in some cases this inclosure may be surrounded by a casing extended to the bottom of the boiler so as to form a hot air jacket or passage to the upper part of which air is admitted it passing downward to the ash pit or ash pits so becoming itself heated and tending to keep cool the exterior of the parts to which it is applied. When it is not desired to heat the air supply for the furnace or furnaces the casing may be open at top and bottom to allow a current of air to ascend between it and the boiler to keep cool the exterior of the parts to which it is applied. Pipes for heating the air may be used in place of the lower part of this jacket. In this case the doors *i* by which access is gained to the tubes E and G will be double so as to close and open both the casing I and the said air jacket.

The fire box may include a single furnace or it may have two furnaces separated by a fire brick or water space partition, or it may have a greater number of furnaces such for instance as three or four (as shown) each connected with separate combustion chambers or with a common combustion chamber below

the crown of the fire box from whence the products of combustion issue through the tubes E E. In the arrangement shown the furnaces are circular in horizontal section and the furnace doors are preferably arranged in pairs on opposite sides of the boiler. The lower part of the water space K between the fire boxes may have the blow off cock connected thereto.

- 10 To effect a very effective circulation of the water in the boiler I provide a tube, or passage, or tubes or passages, which opens, or open, at one end into the water space, of the boiler a little below the lowest working level of water therein, and, at the other end, near to the lowermost portion, or portions, of the water space. The aforesaid tubes, or passages, may be arranged in various ways; for instance they may take the form of tubes which are completely external to the boiler as shown at Z, or they may be tubes which pass into the water spaces through the skin of the boiler inclosed within or above and below the casing I, which surrounds the annular space H between the upper and lower parts of the boiler, the tubes being joined together by length of tubing situated in the said space. This is shown at Z². Or tubes may be led as shown at Z³ from the upper water space below the lowest working water level and between the upper small tubes G into a small central globe or junction chamber Y, from which a tube or tubes descends or descend into the lower part of the central water spaces as at y, or of the side water space as at y² or both. The upper ends of the said tubes or passages should have their openings situated in as quiescent a part of the water as is practicable. Where the tubes or passages are inside the water space they may be complete tubes or be formed by bent strips riveted to the inside of the skin of the boiler so that one side is formed by the said skin as shown at the lower part of Z².
- 45 When it is desired to provide means for heating the feed water before it enters the boiler, a closed vessel L (preferably cylindrical) may be inserted into the interior of the upper part of the boiler. This vessel L is furnished with tubes l, as shown through which the products of combustion may pass on their way to the chimney and so heat the feed water contained in the vessel which is provided with inlets and outlets therefor.
- 55 I provide an arrangement which will allow the hot gases to be passed not only entirely through the small tubes or partly through them and partly through the large central tube, but also entirely through the large central tube if so desired. With this object I make the valve l⁴ of an annular form corresponding to the lower side of the plate through which the said small tubes t pass, so that when this valve is moved up close to this plate (as shown in full lines) it closes the openings of the small tubes l and the hot gases pass

through the large central tube l² by a central opening in the plate corresponding therewith. A convenient arrangement is to secure the annular plate l⁴ to an inner tube l⁵ sliding in the large central tube l² and to connect the said inner tube to a lever l⁶ by which the valve is operated. When the valve l⁴ and its tube l⁵ are lowered its central opening will be closed by coming against a surface beneath which may be a dome-shaped piece X resting on the boiler plate beneath and covering the man-hole door if there be one at this part as at f². The said tubular arrangement (L l) I may convert into a super-heater for the steam by making a communication therewith as at w, from the steam space so that the steam passes therethrough around the tubes l and therefrom by the steam outlet pipe w², and in order to direct the steam so that it comes in contact with all the tubes l throughout their length I may arrange a baffle plate or baffle plates so that the steam passes backward and forward or downward and upward of the space between the tubes before it leaves by the steam outlet pipe such baffle plates will be arranged so that they leave an opening at opposite places alternately for the steam, so that it is compelled to pass in an upward and downward, or backward and forward, or zig-zag manner through the super-heater. I have shown two baffle plates at v with openings below, and there will be baffle plates extending from either side of the central tube l² to the inside of the vessel L, with an opening above the said baffle plates so that the steam passes under the first baffle plate over the next ones (not seen in the drawings as they are behind and before the tube l²) and under the last baffle plate.

The inner tube or shell F when the feed water heater is not employed may be furnished with a cast iron liner, which will prevent the flames or hot gases from coming into contact with the boiler plates above the water level. This liner may be made in quadrants or in smaller sections to enable it to be fitted within the tube or shell F and there may be rings or struts between it and the boiler plate to resist tendency to collapse.

The casing I of the secondary combustion chamber is furnished with the smoke doors i to enable the soot and flue dust to be removed therefrom and from the tubes E and G when required and to give access to the joint between the upper and the lower parts of the boiler. A man-hole f² may be constructed in the larger boilers at the bottom of the inverted frustum f to give access to the interior of the boiler; other man-holes may be constructed in any desired parts of the boiler shell and be secured in the usual manner.

When the boiler is in operation the hot gases and flame pass from the fire box or fire boxes through the tubes E into the smoke box or secondary combustion chamber H and thence through the tubes G to the interior of

the tube or shell F whence they escape to the chimney first passing through the feed water heater or steam super-heater if such be used.

When desired the fire box or fire boxes may contain a suitable form of revolving grate for the better distribution of the fuel.

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 a vertical steam boiler the combination of a fire-box or of fire-boxes having its or their upper part or parts of conical shape; a lower shell surrounding the fire box or boxes, and having its upper part formed to the frustum of a cone, and terminating in a tube or opening, tubes connecting the coned top of the fire box or boxes, with the frustum of the lower shell, an upper outer shell terminated below by an inverted frustum of a cone, and a short tube or opening connected to the tube, or opening of the frustum of the lower shell, an inner tube or shell in the upper part of the boiler having its lower end formed to the inverted frustum of a cone, tubes connecting the frusta of the upper shell and of the inner tube or shell of the upper part of the boiler, the several frusta being of the same angle, a crown plate connecting the inner tube or shell and the shell of the upper part of the boiler so as to close in the steam space, and a casing connecting the upper and lower shells, so as to inclose a space constituting a supplementary combustion chamber, substantially as hereinbefore described.

2. In a vertical steam boiler, the combination of cylindrical fire boxes having their upper parts of conical shape, and water spaces between the fire boxes, a lower shell surrounding the fire boxes and having its upper part formed to the frustum of a cone, and terminating in a tube, or opening, tubes connecting the coned top of the fire boxes with the frustum of the lower shell, an upper outer shell terminated below by an inverted frustum of a cone, and a short tube or opening connected to the tube, or opening of the frustum of the lower shell, an inner tube or shell in the upper part of the boiler having its lower end formed to the inverted frustum of a cone, tubes connecting the frusta of the upper shell and of the inner tube or shell of the upper part of the boiler, a crown plate connecting the inner tube or shell and the shell of the upper part of the boiler so as to close in the steam space, and a casing connecting the upper and lower shells so as to inclose a space constituting a supplementary combustion chamber, substantially as hereinbefore described.

3. In a vertical steam boiler, the combination of a fire-box, a lower shell surrounding the fire-box and having its upper part formed to the frustum of a cone and terminating in an opening, tubes connecting the top of the firebox with the frustum of the lower shell, an upper outer shell terminated below by an inverted frustum of a cone and an opening connected to the opening in the frustum of the lower shell, an inner shell in the upper part of the boiler, tubes connecting the frusta of the upper outer shell and the lower part of the inner shell, a crown plate to close in the steam space, a casing connecting the upper and lower outer shells to inclose a space constituting a supplementary combustion chamber, and tubes or passages opening at their upper end into the water space a little below the lowest working water level and at their other end opening into the lower part of the water space, substantially as and for the purposes set forth.

4. In a vertical steam boiler, the combination of a fire-box in the lower part, an inner shell in the upper part, a water space between the fire-box and the inner shell, and passages leading from the top of the fire-box to the lower part of the said shell, with a tubular steam superheater at the upper part of the shell, and an annular valve which can close all the tubes so that the products of combustion can be caused to pass only through the central space or partly through the said space and partly through the tubes, substantially as hereinbefore described.

5. In a vertical steam boiler, the combination of a fire-box in the lower part, an inner shell in the upper part, a water space between the fire box and the inner shell, and passages leading from the top of the fire-box to the lower part of the said shell, with a tubular steam superheater at the upper part of the shell, and an annular valve attached to a tube sliding in the central space and a bearing surface beneath so that the products of combustion can be caused to pass only through the central space or only through the tubes or partly through the said space and partly through the said tubes, substantially as hereinbefore described.

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

GEO. CAWLEY.

Witnesses:

RUDOLPH CHAS. NICKOL,

S. CRANSAR,

Clerks to Messrs. I. Newton & Sons, Notaries, 31 Lombard Street, London, E. C.