No. 859,155. PATENTED JULY 2, 1907.

H. C. VOGT.

STEAM BOILER.

APPLICATION FILED APR. 2, 1906.

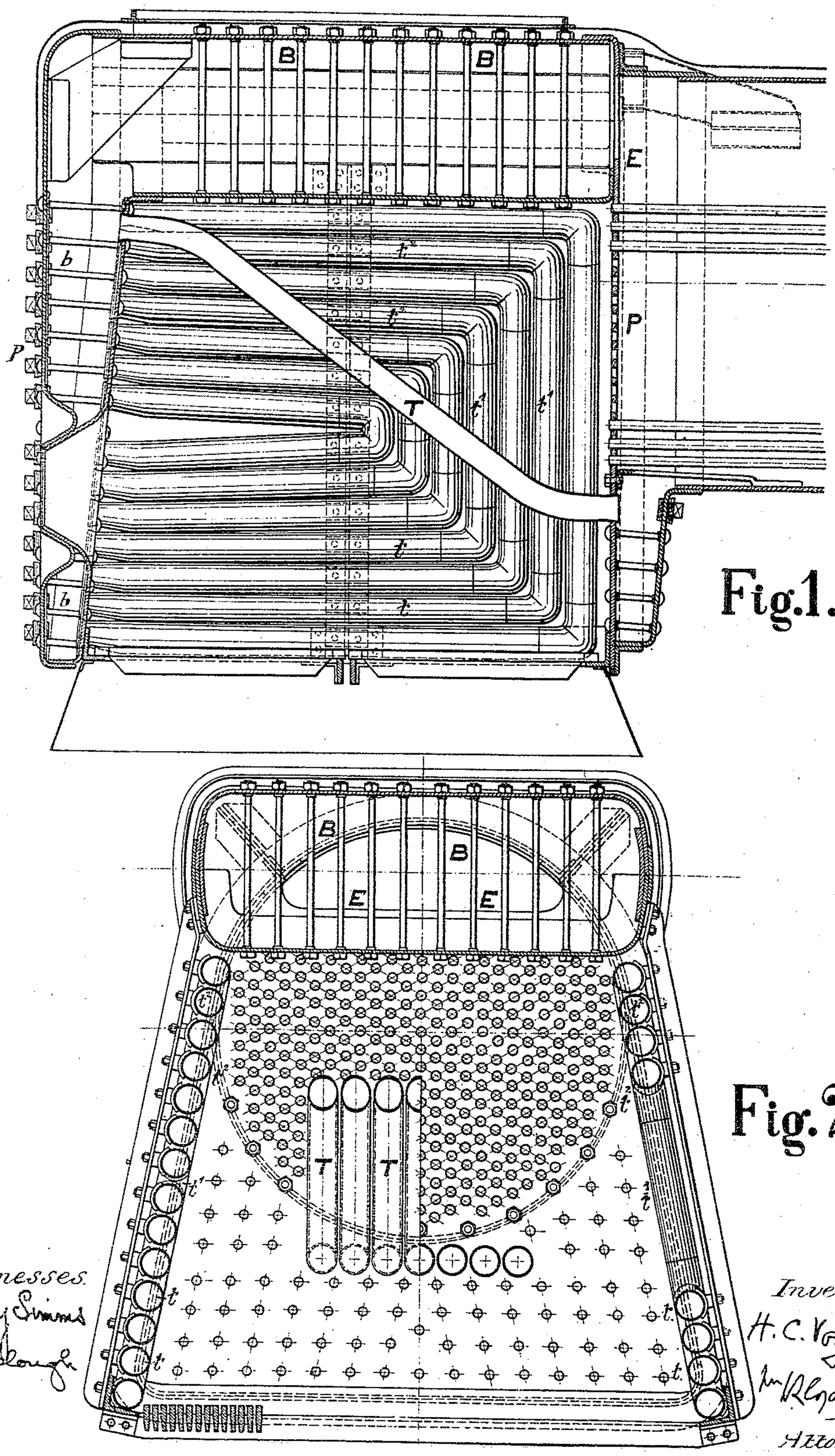

Fig. 1.

Fig. 2.

Witnesses.
W. Hay Simms
E. Clough

Inventor
H. C. Vogt
by R. Lydston
Attorney

UNITED STATES PATENT OFFICE.

HENRIK CHRISTIAN VOGT, OF COPENHAGEN, DENMARK.

STEAM-BOILER.

No. 859,155. Specification of Letters Patent. Patented July 2, 1907.

Application filed April 2, 1906. Serial No. 309,542.

To all whom it may concern:

Be it known that I, HENRIK CHRISTIAN VOGT, a subject of the King of Denmark, residing at Copenhagen, Denmark, have invented Improvements in Steam-Boilers, of which the following is a specification.

In ordinary locomotive boilers the firebox and tubes become heated to a higher temperature than the outer shell, whereby serious strains are set up which cause difficulties both with the tubes in the tube plate and with the stay bolts.

A further drawback in ordinary locomotive boilers is that the water over the top of the firebox is insufficient, whereas over the fire tubes it is too deep and thus reduces the steam space.

Figures 1 and 2 of the accompanying drawings illustrate vertical sections at right angles to each other of the firebox and of a locomotive boiler constructed in accordance with this invention with the object of obviating these disadvantages.

The top of the firebox is formed by a box B fastened to the tube plate P, the cylindrical barrel of the boiler extending from the other side of the tube plate P. A box *b* stayed in the usual manner and extending down from the box B forms the front of the firebox, and the sides of same are formed by means of water tubes *t*, t^1, t^2 issuing from and returning to the box *b*. These tubes are of ⊐ or > shape, and the ends of their lower and upper nearly or more or less horizontal branches *t* and t^2 are expanded in the box *b;* and the more or less vertical parts t^1 of the tubes join the branches *t* and t^2. The water enters the lower tubes *t* and is lifted in the nearly vertical tubes t^1 on account of the reduced specific gravity of the mixture of steam and water created in these, tubes through which a strong circulation is consequently set up when they are heated, the steam bubbles rising and drawing the water after them. The plate is stouter where the tubes *t* and t^2 are expanded into it, and outside these tubes are plugs *p* which can be removed to enable the tubes to be expanded, and partially cleaned. The weight of the tubes *t*, t^1, t^2 is carried partly by an angle iron between the box *b* and the tube plate, as seen on Fig. 2.

The tubes *t*, t^1 t^2 are kept in place and also partly carried by a bar, shown in dotted lines on Fig. 1 and in full lines on Fig. 2.

In ordinary locomotive boilers, furthermore, it is especially the hot flat stayed inner sides of the firebox that connect the tube plate with the front of the firebox which cause troublesome strains, which strains are in present construction eliminated as in place of these sides there are provided the tubes *t*, t^1, t^2 which have no connection with the tube plate. Besides those shown, other > shaped tubes (or out and return tubes) may issue from the box *b* to increase the heating surface. The described arrangements do not either, as in ordinary constructions, detract from or curtail the area of the tube-plate destined for holding the fire tubes of the barrel. The same number of fire-tubes, therefore, can be placed further apart with greater water space between them.

In order to provide sufficient depth of water above the firebox and at the same time obviate excessive depth of water above the fire tubes in the barrel, water tubes T are introduced between the lower part of the water space of the barrel of the boiler and the box *b b* or B, the water lifting power of the tubes T due to the reduced specific gravity of the water and steam in them when heated being sufficient to lift the water say about two feet. These tubes T may be given a sufficient curvature to provide elasticity for taking up the strains caused by the heat. A weir or flange E prevents the water from returning to the cylindrical boiler until the water over the bottom of the box B reaches the height of this weir or flange E, which, as seen on the drawing, is formed by bending up the bottom of the box B and is riveted to the tube plate P. When desired, the said weir or flange E can be raised by an additional thin plate. In case of a double set of tubes T, the height of the water line over the bottom of the box B depends on those tubes T which are least heated. If the weir or flange E be very high and outer and inner rows of tubes T be provided, the outer tubes being more strongly heated than the inner the water may ascend in the outer strongly heated tubes and descend through the inner. As will be seen, when no firing takes place the water level in the box B and in the cylindrical boiler will be the same.

In ordinary locomotive boilers, the weir or flange E must be carried right round the top, or the top be made cup shaped in other suitable manner. By this arrangement, when the feed water is introduced in the coldest part of the cylindrical boiler, then the coldest gases will act on the coldest water and the flame on the hottest water over the firebox top. It will be seen that the water level over the bottom of the box B is kept automatically to the height of the weir or flange E as long as firing takes place (and ought to be say from four to five inches above the water line in the barrel of the boiler); only the water line in the barrel of the boiler need be noticed. The boiler is therefore practically free from explosion, because if the water level in the barrel of the boiler sinks below the tubes, these will be exposed and leak and the fires be extinguished.

What I claim is:—

1. In a steam boiler of the locomotive type, a chamber above the firebox, a weir or flange dividing said chamber from the barrel of the boiler, and a chamber depending from said first mentioned chamber and forming the front of the firebox.

2. In a steam boiler of the locomotive type, a chamber above the firebox, a weir or flange dividing said chamber from the barrel of the boiler, a chamber depending from

said first mentioned chamber and forming the front of the firebox, and water lifting tubes connecting the water space of the chamber above the firebox with the lower part of the water space of the boiler barrel.

3. In a steam boiler of the locomotive type, a chamber above the firebox divided from the barrel of the boiler, a chamber depending from said chamber and forming the front of the firebox, tubes forming the sides of the firebox and each connected to said depending chamber at different levels, and water tubes connecting the water space of the chamber above the firebox with the lower part of the water space of the boiler barrel.

4. A firebox for a steam boiler of the locomotive type comprising a crown sheet above which a chamber is formed, a back tube plate carrying the boiler tubes, a water chamber depending from the chamber above the firebox and forming the front of the firebox, and rearwardly extending bent water tubes forming the sides of the firebox, the two ends of each of the said tubes being connected to the said water chamber at the front of the firebox at different levels, as set forth.

5. In a steam boiler of the locomotive type a chamber above the fire box having steam and water communication with the boiler barrel, a weir or flange dividing the water space of said chamber from the water space of the barrel of the boiler, a water chamber depending from said first mentioned chamber and forming the front of the firebox, and water lifting tubes passing through the firebox connecting the water space of the chamber above the firebox and the water space of the depending chamber with the lower part of the water space of the boiler barrel, an upward water current through the said tubes being created causing the water in the chamber above the firebox to flow over the said weir and back to the lower level of the water in the barrel.

6. In a steam boiler of the locomotive type a chamber above the firebox divided from the barrel of the boiler, a chamber depending from chamber and forming the front of the firebox, and out and return water tubes forming the sides of the firebox and each proceeding from and connected to said depending chamber at different levels.

7. A firebox for a steam boiler of the locomotive type comprising a crown sheet above which a chamber is formed, a back tube plate carrying the boiler tubes, a water chamber depending from the chamber above the firebox and forming the front of the firebox, and rearwardly extending bent, water tubes proceeding from said depending water chamber and forming the sides of the firebox, the two ends of each of the said water tubes being connected to the said depending water chamber at the front of the firebox at different levels, and tubes through the firebox, which tubes when heated cause the water in the upper chamber to rise until it flows over a weir and back to the lower water level in the barrel of the boiler.

Signed at Copenhagen, Denmark this seventeenth day of March 1906.

HENRIK CHRISTIAN VOGT.

Witnesses:

A. RUPERWIN,

H. G. V. PETERSEN.