

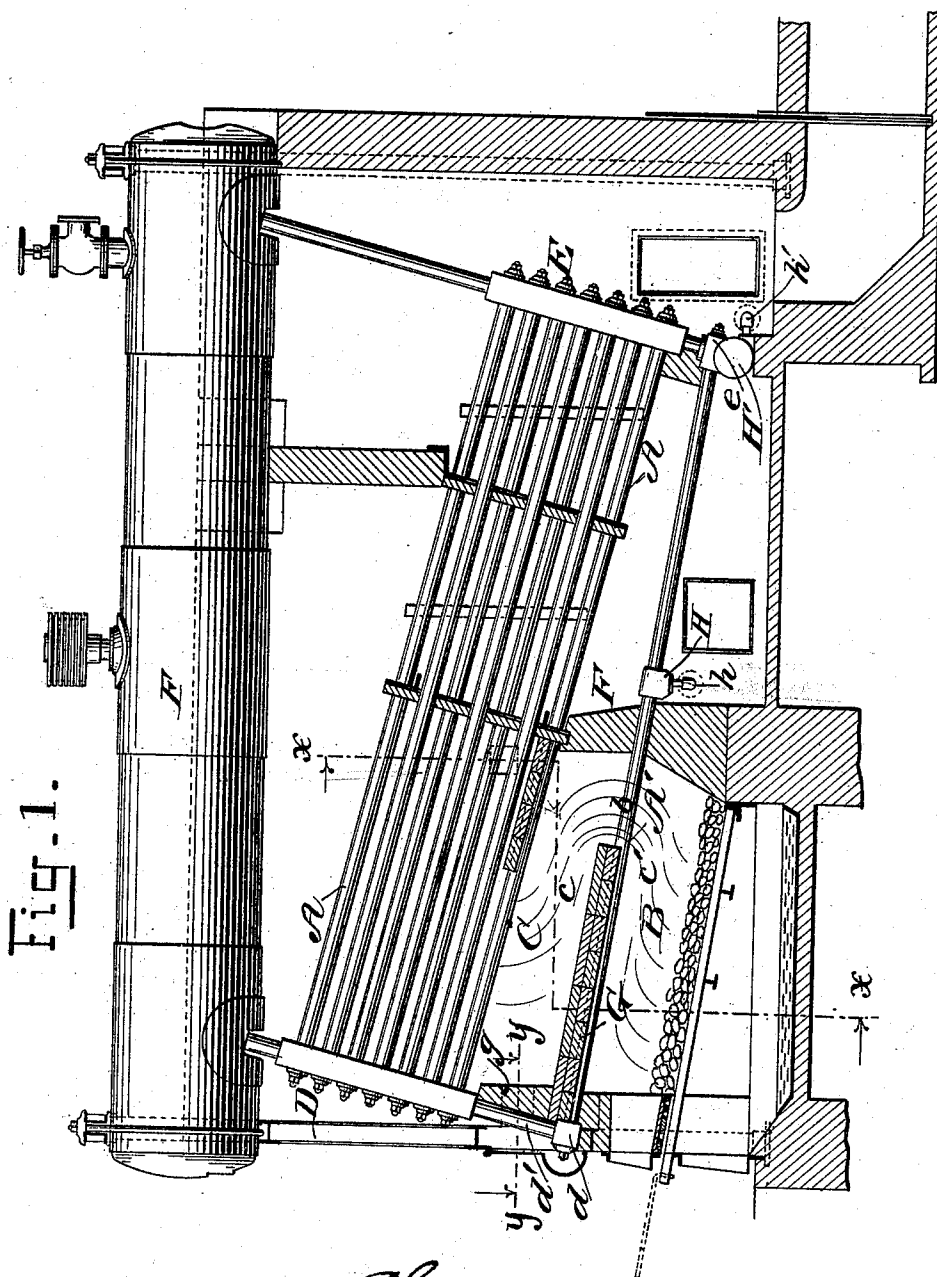
(No Model.)

2 Sheets—Sheet 1.

C. A. KNIGHT & G. W. THODE.
STEAM GENERATOR.

No. 546,119.

Patented Sept. 10, 1895.



Witnesses
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(No Model.)

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Fig. 2.

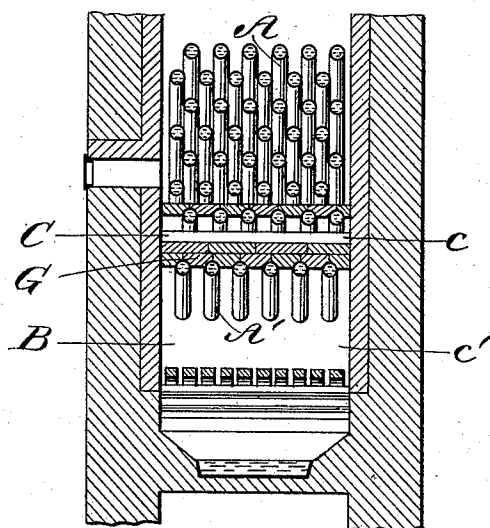
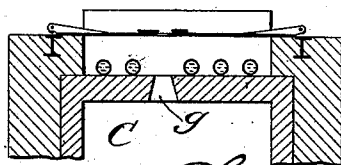


Fig. 3.



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UNITED STATES PATENT OFFICE.

CHARLES ALBERT KNIGHT AND GEORGE WILLIAM THODE, OF GLASGOW,
SCOTLAND.

STEAM-GENERATOR.

SPECIFICATION forming part of Letters Patent No. 546,119, dated September 10, 1895.

Application filed August 3, 1894. Serial No. 519,330. (No model.) Patented in England February 16, 1893, No. 3,456; in Belgium October 25, 1893, No. 106,913, and in France October 29, 1893, No. 233,632.

To all whom it may concern:

Be it known that we, CHARLES ALBERT KNIGHT, a citizen of the United States, and GEORGE WILLIAM THODE, a subject of the Emperor of Germany, residing in Glasgow, county of Lanark, Scotland, have jointly invented a new and useful Improvement in Steam-Generators, (for which we have received patents in Great Britain, No. 3,456, dated February 16, 1893; in Belgium, No. 106,913, dated October 25, 1893, and in France, No. 233,632, dated October 29, 1893,) of which the following is a specification.

This invention has for its objects, by the division of the combustion-chamber or furnace of the boiler into compartments and the special arrangement of certain boiler-tubes, to insure more complete combustion of the fuel used in the furnace and the better utilization of the heat generated, as well as to secure the absence of smoke, which objects are attained by the organization and arrangements herein-after described and claimed.

Referring to the accompanying drawings, Figure 1 shows a vertical longitudinal section of the furnace and walls of the boiler-setting with a sectional tubular boiler in side elevation. Fig. 2 represents a vertical transverse section on line *x x* of Fig. 1. Fig. 3 shows a horizontal section of the boiler front on line *y y* of Fig. 1.

The main series or stack of inclined water-tubes *A* are situated over the furnace *B* or within the combustion-chamber *C* and are connected at each end to headers *D E*, respectively, which are in turn connected to a steam and water drum or reservoir *F* in the usual manner. To this main stack of tubes are added one or more rows of tubes *A'*, (one row being shown in the drawings,) which additional tubes are placed in a lower plane than the stack, separated therefrom by a considerable space and preferably inclined at a less angle of elevation. At the front the tubes *A'* are connected to a header *d*, nipped and connected by straight or bent tubes *d'* to the main headers *D*, and at the rear are connected to a header or drum *e*, nipped to the main rear headers *E*; but, if desired, the tubes may be connected at the front and rear ends di-

rectly with the headers *D E* by suitable pipes or extensions, as will be readily understood. Intermediate of their length—say directly in the rear of the bridge *F*—the tubes *A'* may be connected to a mud-collecting or sludge-intercepting drum *H*, if desired, and said drum be furnished with a blow-off pipe *h*, through which the collected sediment can be discharged, in addition to the function of the mud-drum *H'* and blow-off pipe *h*.

Over or upon the row or series of tubes *A'* there is built or formed of bricks, tiles, or other suitable material a roof *G*, which extends nearly the whole length of the furnace *B* and preferably rests upon the tubes *A'*, so as to be partially supported thereby. This roof divides the combustion-chamber into two parts—an upper *c* and a lower *c'*—and causes the heat from the fire to be first utilized to convert into steam the water circulating through the tubes *A'*. The direct heat impinges upon the tubes *A'* and under side of the roof *G*, by which latter it is deflected, so as to travel nearly the whole length of such portions of the tubes as are in the lower chamber when it passes around the roof through the opening *b* and into the upper chamber, where it acts upon the main stack of tubes *A*. In this upper chamber *c* the volatile gases become thoroughly mixed with air admitted through the fuel or through an opening *g*, Figs. 1 and 3, in the front wall of the setting, or both, and such gases being consumed part with their heat to the water circulating in the stack of tubes *A*. If desired, an additional roof-section *k* may be placed upon the lower row of the stack of tubes *A*, extending forward from the bridge-wall a sufficient distance to direct the gases to the forward end of the stack, and the roof *G* may extend from the bridge *F* toward the front, and the opening or passage *b* between the lower and upper combustion-chambers *c c'* be at the front, or the roof may extend from both the front wall and the bridge toward the center and such opening or passage be centrally located, or the roof may be situated intermediately, leaving openings adjacent to the front wall and the bridge, as will be readily understood without special illustration in the drawings.

The arrangements hereinbefore described not only secure a greater utilization of the heat generated by the fire, but insure more perfect combustion, thereby reducing the amount of smoke, all reducing to a minimum the quantity of soot that desposits upon the main boiler or stack of tubes.

What we claim, and desire to secure by Letters Patent, is—

10 1. In a steam-generator, a main boiler or stack of tubes; a series of auxiliary tubes in circulatory connection therewith located beneath the same and in direct contact with the flames in the furnace; and a roof partially
15 overlying those portions of said auxiliary tubes that are within the furnace and divid-

ing the furnace into two vertically-connected parts, substantially as set forth.

2. In a steam-generator, a main boiler or stack of tubes; a series of auxiliary tubes in circulatory connection therewith, located within the furnace; and a roof partially overlying and partially supported by those portions of said auxiliary tubes that are within the furnace, and dividing the furnace into two vertically-connected parts, substantially as set forth.

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Witnesses:

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