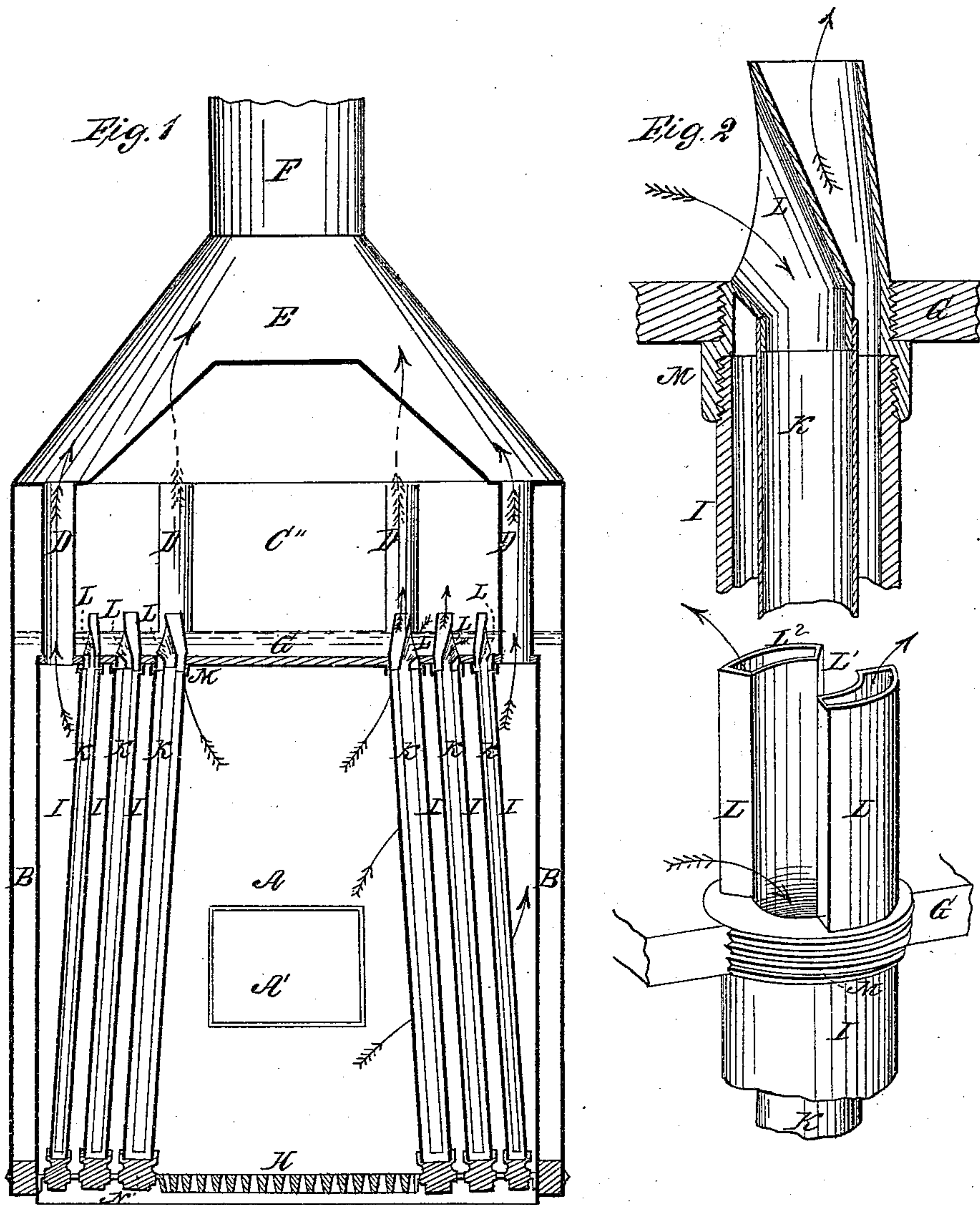


*C. H. James,*  
*Steam-Boiler Water-Tube*  
*N<sup>o</sup> 64,424.                      Patented May 7, 1867.*



*Witnesses*  
*H. C. Webber*  
*Samuel Knight*

*Inventor;*  
*Charles H. James*  
*By Knight Bros*  
*attys.*



# United States Patent Office.

CHARLES H. JAMES, OF CINCINNATI, OHIO, ASSIGNOR TO HIMSELF AND  
FRANK MILLWARD, OF THE SAME PLACE.

*Letters Patent No. 64,424, dated May 7, 1867.*

## IMPROVEMENT IN TUBES FOR STEAM GENERATORS.

*The Schedule referred to in these Letters Patent and making part of the same.*

### TO WHOM IT MAY CONCERN:

Be it known that I, CHARLES H. JAMES, of Cincinnati, Hamilton county, Ohio, have invented a certain new and useful improvement in Steam Generators; and I do hereby declare the following to be a full, clear, and exact description thereof, reference being had to the accompanying drawings, making part of this specification.

My invention relates to that class of boilers having double or circulating tubes, (tubes within tubes,) connected with and descending from the crown-sheet of the fire-box of the boiler, and consists in a device for separating the current of water constantly rising in the outer or "fire tube" from the current of colder water descending through the inner or "water tube," thus securing a more rapid, regular, and an absolutely certain circulation of water under varying conditions and temperatures. A marked peculiarity in this device is that the water in the boiler can, without interfering with the circulation, be carried at a point near the level of the crown-sheet, the tubes of course being full, thus rendering it capable of the generation of a working pressure of steam in the shortest possible time, and making it eminently adapted for steam fire-engines, or wherever a quick generation of steam is desirable. In the accompanying drawings—

Figure 1 is a vertical section of a circulating tube boiler embodying my invention.

Figure 2 is an enlarged view of the tubes and device for separating the currents of water.

Figure 3 is a modification of the separating device.

A is the fire-box, and A' the fire-door of the boiler, B the water-jacket, C the steam-chamber, D the smoke-flues, E the smoke-jacket, F the chimney, G the crown-sheet, H the fire-grate, and I K the circulating tubes. Each of the fire-tubes I is attached to a cap, M, which is secured in any preferred way in the crown sheet, and the water tube K is rigidly secured to the side or inlet duct L, provided in the cap M. The tube K can be short of the length of the fire-tube, to allow of the passage of the water from the inner to the outer tube at the bottom N, or can be of the full length, and scalloped or slotted, to admit of a free circulation.

In the operation of the boiler the heated water and steam rise in the annular space between the tubes I K, and are ejected through the open summit of the cap M, and simultaneously with this action the tube K for the descending current receives its supply direct from the water on the crown-sheet by means of the side duct or inlet L. By this device the upward and downward currents are separated and flow freely and unobstructedly, giving an uninterrupted circulation at all temperatures. In cases when a quick generation of steam is required at the start, as, for instance, in a steam fire-engine, the fire can be lit when the water in the boiler is scarcely even with the level of the crown-sheet, (the tubes being full of water,) as the water will flow over the top of cap M, splash over the crown-sheet, and run down the duct L to keep up the circulation. In this way steam can be raised in an incredibly short space of time, and circulation regularly maintained. It will be seen that the tubes end at the bottom at a point above the fire-grate, and are fitted with caps N extending below it. In the modification, fig. 3, the ascending current passes through pipes L'', and the downward current through the ducts L'. In previous devices, where both tubes end at the same level, and especially on a level with the crown-sheet G, the currents of water upward and downward necessarily conflict, and circulation is interrupted under some conditions, and in other conditions wholly suspended; as, for example, whenever the surface level of the water is near or below the level of the crown-sheet.

In the construction of the boiler I prefer to make the circulating tubes farthest from the fire of smaller diameter than those more immediately exposed to it, as shown in fig. 1, in order to secure the greatest possible area of heating surface in the least possible dimensions of boiler shell.

I claim herein as new, and of my invention—

The stationary or rigidly confined tube K, provided with one or more enclosed ducts or passages L, communicating (through the outer or fire-tube I) with the water space on the crown-sheet of the boiler, the outer tube I extending and discharging its contents above the water line, or above the passage L communicating with the inside tube K.

In testimony of which invention I hereunto set my hand.

CHARLES H. JAMES.

Witnesses:

GEO. H. KNIGHT,

JAMES H. LAYMAN.