(No Model.)

L. P. PERKINS.

STEAM OR OTHER FLUID BOILER.

No. 529,304. Patented Nov. 13. 1894.

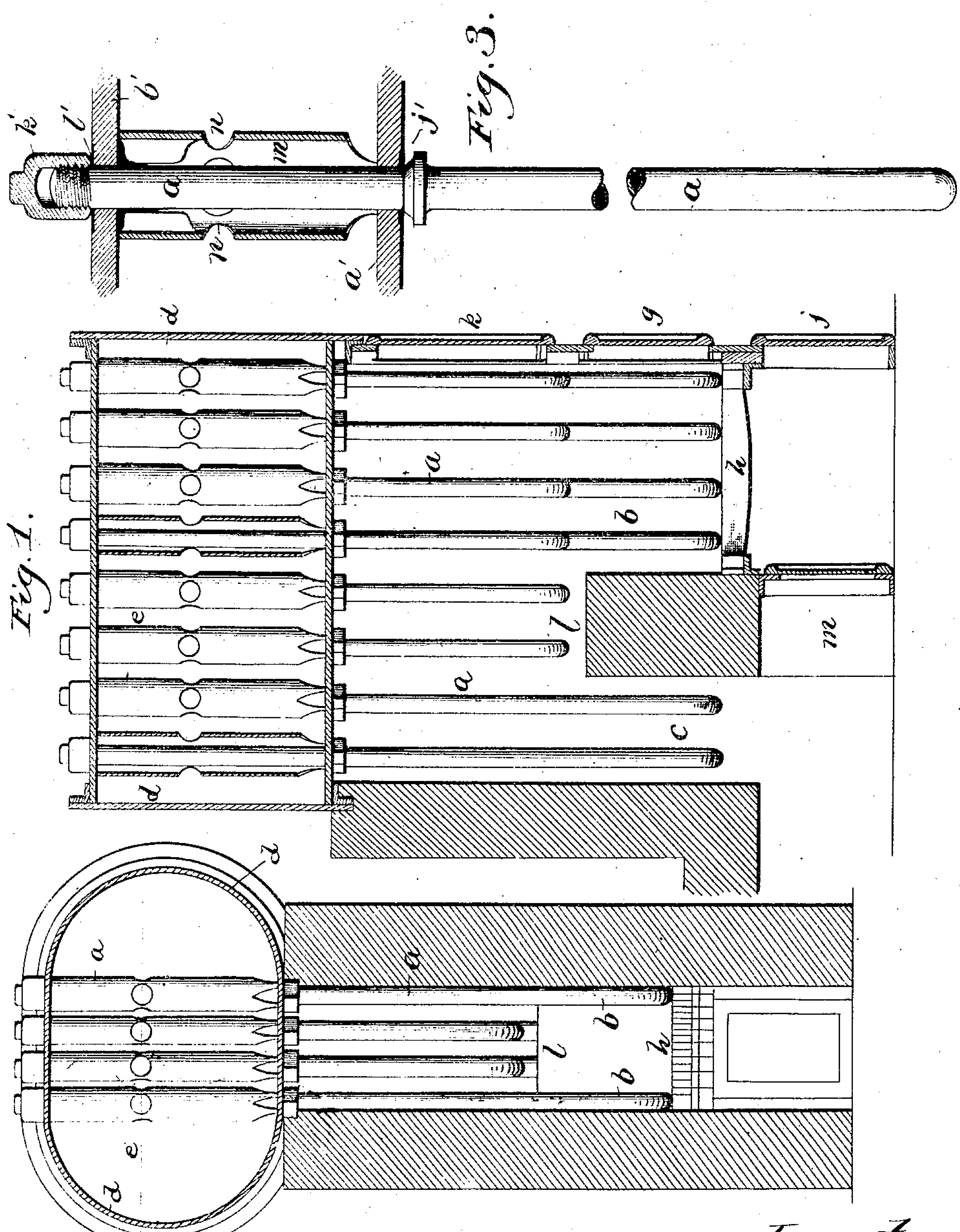

Fig. 2.

Witnesses:
J. W. McGinn.
Antoinette [illegible]

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UNITED STATES PATENT OFFICE.

LUDLOW PATTON PERKINS, OF MANCHESTER, ENGLAND.

STEAM OR OTHER FLUID BOILER.

SPECIFICATION forming part of Letters Patent No. 529,304, dated November 13, 1894.

Application filed February 20, 1894. Serial No. 500,919. (No model.) Patented in England July 24, 1893, No. 14,294.

To all whom it may concern:

Be it known that I, LUDLOW PATTON PERKINS, engineer, a subject of the Queen of Great Britain and Ireland, residing at 113 Acomb Street, Moss Lane, Manchester, in the county of Lancaster, England, have invented certain new and useful Improvements in Steam or other Fluid Boilers; and I do hereby declare the following to be a full, clear, and exact description of the invention, which will enable others skilled in the art to which it appertains to make and use the same.

Said invention was patented in Great Britain July 24, 1893, No. 14,294.

My invention relates to improvements in the construction of apparatus for the generation of steam or pressure vapor and has for its object to increase the efficiency of such apparatus and to remedy existing defects therein. I employ a number of separate hermetically sealed tubes, each partially filled with liquid, in combination with a vessel or chamber or a series of connected vessels or chambers containing the liquid to be evaporated.

The accompanying drawings illustrate the manner in which I propose to carry my invention into effect.

In the drawings: Figure 1 is a longitudinal section of a steam boiler. Fig. 2 is a cross section through the fire grate of the same; and Fig. 3, an enlarged elevation, partly in section, of one of the tubes.

Referring to Figs. 1 and 2, a number of tubes *a*, *a*, each containing a quantity of liquid and hermetically sealed are vertically disposed in the furnace *b* and flue *c*. The upper ends of the tubes pass through the sholl of the vessel *d*, and are made tight where so passing through, in the manner hereinafter described and illustrated in Fig. 3.

The vessel *d*, contains the liquid to be evaporated and the line *e*, *e*, indicates the normal liquid level. The fuel is introduced through the fire door *g*, onto the fire-bars *h*, the necessary air for combustion being admitted through the door *j*. The door *k*, provides means for sweeping the outer surfaces of the tubes and for admitting cold air if it is desired to check the generation of steam. At *l*, is an ordinary bridge and at *m*, a door providing access to the flue *c*. The tubes immediately above the hottest part of the fire are shorter and consequently have less exposed surface than those on either side or in the flue.

To enable the indicated form of shell to withstand internal pressure the tubes are made to act as stays and the portions of the tubes above the level of the liquid serve to dry the steam and to superheat it to some extent. The ends of the boiler may be stayed or strengthened in any ordinary manner.

The shell may be of any suitable form other than the form illustrated and the tubes may be disposed at any angle or angles which will allow the liquid contained to gravitate to the lower ends, or the tubes may be bent in such a manner as to act as fire-bars, or to constitute the sides or end of a fire-box.

The heated gases may be made to pass around the shell, or in any other direction but it is preferable that the hottest gases shall come into contact with the tubes before such gases come into contact with the ordinary heating surface of the boiler.

The quantity of liquid put into the tubes should be such as that all the liquid contained in the tubes cannot be entirely converted into vapor which would lessen the efficiency of the tubes as conductors and permit the tubes to become overheated owing to the fact that a comparatively slow circulation of superheated vapor would be set up instead of a series of rapid conversions, first of a liquid into a vapor accompanied by a large absorption of heat from the fire, and then from a vapor into a liquid with an equivalent surrender of heat to the water contained in the boiler.

When it would be desired to generate steam of such pressures as are generally now in use, say one hundred to one hundred and fifty pounds per square inch and when the combustion of the fire would be under the condition of natural drafts, I should prefer that about one-fourth of the internal volume of the tube shall be filled with liquid, and that if one foot in length of the tube be immersed in the liquid in the boiler or vessel, three feet shall be exposed to the action of the furnace or source of heat. I have found that it is not advisable in any case that the quantity of liquid within the tube shall be less than about one-sixth or more than about three quarters of the capacity of the tube.

The liquid which I prefer to use is water but I do not confine myself to this liquid as it might be advantageous to employ spirits, hydro-carbons or other liquids which have higher or lower boiling points or which better resist the effects of frost. I have found it advantageous in certain cases, particularly when tubes are working at low pressures and temperatures, to exhaust them of air as far as practicable.

The action of the apparatus is as follows: The heat applied to the lower portions of the tubes is rapidly transmitted through them to the liquid contained in the boiler by the agency of the liquid contained in the tubes, which becoming partially evaporated, ascends, giving out its sensible heat and in condensing, its latent heat, to the liquid in the boiler, the condensed liquid contained within the tubes descending to be again evaporated. By suitably proportioning the tubes, the internal pressure may be so regulated as to always insure that the contained liquid shall be kept in contact with the interior of the length of the tube exposed to the furnace even with higher temperatures than are generally employed.

In Fig. 3 the method of fixing the tubes in place and of increasing the circulation is shown. The tube A is provided with a cone *j'* immediately beneath the plate *a'* of the vessel *d* which forms a tight joint therewith and is provided at its upper end with a nut *k'* which engages with the plate *b'* of the vessel, the lower edge of said nut being sharpened as shown, so as to make a narrow metallic joint at *l'*. A circulating tube *m*, provided with suitable apertures *n*, *n*, therein for the passage of the liquid surrounds the tubes within the vessel and serves to materially increase the circulation of water around the tubes. Said circulating pipes also act as a distance piece between the plates *a'* and *b'* of the vessel *d*.

By constructing steam generators in accordance with my invention, the following principal advantages are obtained: I have found that these tubes evaporate more liquid than an equal amount of any ordinary heating surface. The failure of one or any number of these tubes cannot empty the boiler, whether the failure occurs within or without the shell, and need not therefore necessitate the stoppage of the boilers. Liquids containing large quantities of sedimentary matter may be used in the generation of steam because any deposit of scale forming upon the tubes will be only upon their external surfaces and will, by increasing in thickness, allow their temperatures to rise and thereby to crack and detach the scale or sediment which will fall to the bottom of the water space whence it can be readily removed.

I would have it understood that I am aware that it has been proposed to use hermetically sealed tubes charged with minute quantities of liquid in the generation of steam, but on the application of heat to tubes so charged it has been found that they become red hot, thereby proving that the superheated or supercharged steam entirely filling such tubes has not constituted a sufficiently rapid medium for the transference of heat. I am also aware that with a view of obviating this fatal defect, apparatus known as "Perkins' high pressure hot water heating apparatus" has been used in connection with steam boilers, but in such apparatus water has been caused to circulate through closed tubes outwardly exposed to the water to be evaporated and to the heating furnace.

I do not therefore claim the use of the sealed tubes excepting when charged and applied in the manner substantially as hereinbefore set forth.

What I claim is—

A steam generator, consisting of a vessel *d*, tubes *a*, partially filled with liquid and hermetically sealed, said tubes extending diametrically across and engaging opposite walls of the vessel so as to strengthen the same, a portion of said tubes being above the line of liquid therein, whereby the generated steam will be superheated a circulating tube *m*, extending entirely across and engaging with opposite walls of the vessel so as to strengthen the same, and having apertures *n*, surrounding the portion of each tube *a*, within the vessel *d*: and a furnace *b*, for heating the portions of the tubes *a*, outside of said vessel, substantially as set forth.

This specification signed and witnessed the 2d day of February, 1894.

LUDLOW PATTON PERKINS.

Witnesses:
J. ENTWISLE,
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