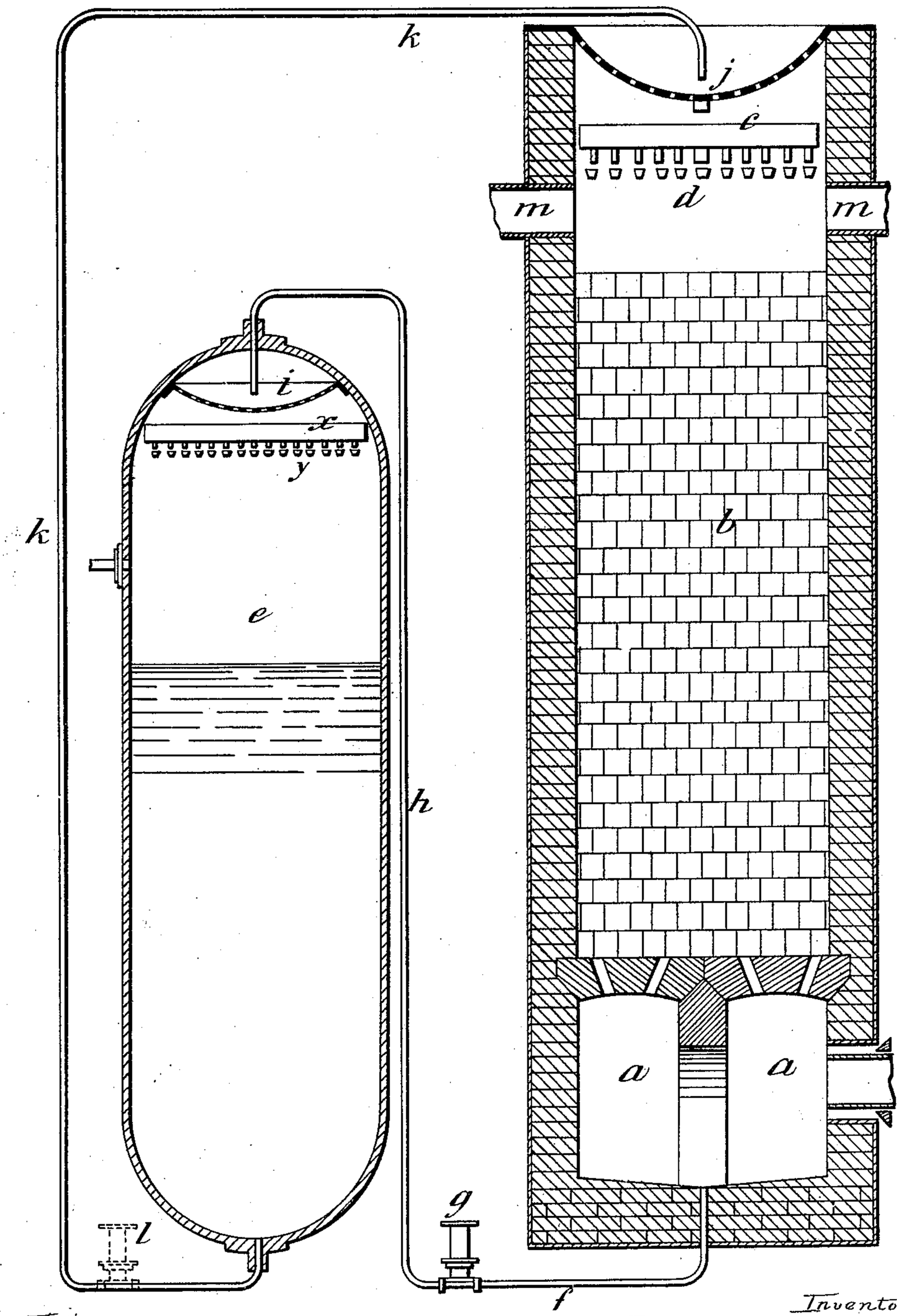
No. 629,520. Patented July 25, 1899.

R. L. MOND.

METHOD OF HEATING LIQUIDS.

(Application filed Dec. 10, 1898.)

(No Model.)



Witnesses
J. B. Taylor
Dennis Sumby

Inventor
Robert L. Mond
by James L. Norris
atty

UNITED STATES PATENT OFFICE.

ROBERT LUDWIG MOND, OF LONDON, ENGLAND.

METHOD OF HEATING LIQUIDS.

SPECIFICATION forming part of Letters Patent No. 629,520, dated July 25, 1899.

Application filed December 10, 1898. Serial No. 698,889. (No specimens.)

To all whom it may concern:

Be it known that I, ROBERT LUDWIG MOND, a citizen of England, residing at No. 20 Avenue road, Regents Park, London, England, have invented a certain new and useful Improved Method of Heating Liquids, (for which I have applied for patents in Austria, dated September 28, 1898, No. 48/4,793; in France, dated July 5, 1898, No. 279,511; in Germany, dated June 10, 1898; in Great Britain, dated May 14, 1898, No. 11,062; in Hungary, dated June 23, 1898, and in Russia, dated June 15, 1898,) of which the following is a specification.

In heating liquids for the purpose of generating steam or vapor for distilling or concentrating the heat is usually applied to the walls of the vessels containing the liquid or to the interior of tubes or conduits immersed in the liquid and is communicated by conduction through the walls of the vessels or conduits. My invention relates to means of imparting heat to liquids in a more direct manner by passing through the liquid to be heated finely-divided molten metal or alloy which has been heated by direct action of flame and hot combustion-gases upon the metal or alloy.

In the accompanying drawing the figure is a vertical sectional view of an apparatus suitable for practicing my improved method or process.

In carrying out my invention I select a metal or alloy which has a melting-point below the temperature to which the liquid has to be heated and a boiling-point considerably higher than the temperature to which this metal or alloy has to be heated, so that after passing through the heated liquid the metal or alloy still remains in a liquid condition.

Referring to the accompanying drawing, it will be seen that above a combustion-chamber *a* bricks *b* or other refractory bodies are built up with interstices between them, as in the chamber of a regenerative furnace, and above these there is a shallow trough *c*, with a number of nozzles and deflectors *d*. A boiler *e* has in its upper part a similar trough *x* and deflectors *y*. From the bottom of the combustion-chamber *a* a pipe *f* leads to a pump *g*, and from the pump a pipe *h* leads into the upper part of the boiler *e* over a curved receiving-dish *i*. From the bottom of the boiler *e* a pipe *k* leads to a receiving-dish *j* at the upper part of the structure containing the bricks *b*. In the course of the pipe *k* in certain cases a pump *l* may be arranged. The apparatus operates as follows: The combustion-chamber *a* being supplied with combustible gaseous mixture which is ignited, the flame and products of combustion ascend through the interstices of the bricks *b*, heating them to a high temperature, and escape by openings *m*, which may lead to a chimney. Molten metal or alloy is forced by the pressure in the boiler *e*, aided, if necessary, by pump *l*, up the pipe *k*, where it is discharged into the dish *j*. It flows into the tray *c* and through the nozzles at its bottom in streams that are broken up by the deflectors *d* into drops which descend through the interstices of the bricks *b*, becoming highly heated, these drops collecting at the bottom of the combustion-chamber *a*. Thence the heated molten metal is pumped into the boiler *e*, where it descends in drops through the liquid to the bottom, whence it again ascends by the pipe *k* to be again heated, and so on continuously. The pump *l* is necessary in starting the apparatus when there is not sufficient pressure in the boiler.

When the heated liquid is under pressure, as in the case of a steam-boiler, the molten metal or alloy is forced or admitted by automatic feeders or other suitable appliances into the boiler, and after passing through the water it is discharged at the bottom under pressure, so that it rises or can be raised by pumping or otherwise to the heating-chamber to be heated again and to be again forced or admitted into the boiler. As such a boiler is not heated from the outside, the walls of it can be made of any desired thickness, and steam of very high pressure can be obtained with perfect safety and very economically.

In cases where the heated liquid is in open vessels—as, for instance, when it is to be concentrated by evaporation—the heated molten metal or alloy descends through the liquid by gravity, and after being discharged at the bottom of the vessel it is raised by pumping or otherwise, so as to be again heated and to pass again through the liquid.

The metal or alloy selected for heating liq-

uids, as above described, must be such that it has a boiling-point above the temperature to which it is heated and that it does not chemically act or is not acted on by the liquid through which it is passed.

As it is necessaay to maintain the metal or alloy in a fluid condition, the heating-chamber and the liquid to be acted on and the vessel containing it are preferably heated in the first place by any convenient means to a temperature somewhat above the fusing-point of the metal or alloy, which must itself be melted in the first instance.

For heating the fused metal or alloy it should be distributed as completely as possible over the material in the heating-chamber, and in applying it to heat liquid it should also be thoroughly distributed, so as to pass in numerous small streams or drops through the liquid.

The apparatus illustrated by the accompanying drawing is only typical of many that could be employed in carrying my invention into effect, and therefore I do not wish to be understood as confining myself to any particular apparatus.

It has heretofore been proposed to vaporize liquids and heat air by placing a bath of metal or alloy in a vessel heated by a fire and forcing water or air through a perforated pipe into the lower part of the fused metal or alloy; but such method does not constitute my invention and is not claimed by me. According to my invention the metal already melted is heated with exposure of great surface in direct contact with hot gases from a furnace and the heated metal in finely-divided streams or drops descends through the water or liquid to be heated, after which the metal is carried back, reheated, and again forced in finely-divided streams or drops through the water or liquid.

Having thus described the nature of this invention and the best means I know of carrying the same into practical effect, I claim—

1. The method herein described of heating liquids, which consists in reducing metal or alloy to a molten mass, heating the melted metal, forcing the same in finely-divided condition through the liquid to be heated, removing the melted metal from the liquid and reheating the metal for subsequent passage through the liquid, substantially as set forth.

2. The method herein described of heating liquids, which consists of melting metal or alloy, heating the melted metal or alloy in direct contact with hot gases, passing the heated metal through the liquid to be heated, separating the melted metal from the liquid, and reheating said metal for subsequent passage through the liquid, substantially as set forth.

In testimony whereof I have hereunto set my hand in presence of two subscribing witnesses.

ROBERT LUDWIG MOND.

Witnesses:

CHAS. ROCHE,

B. PHILLIPS.