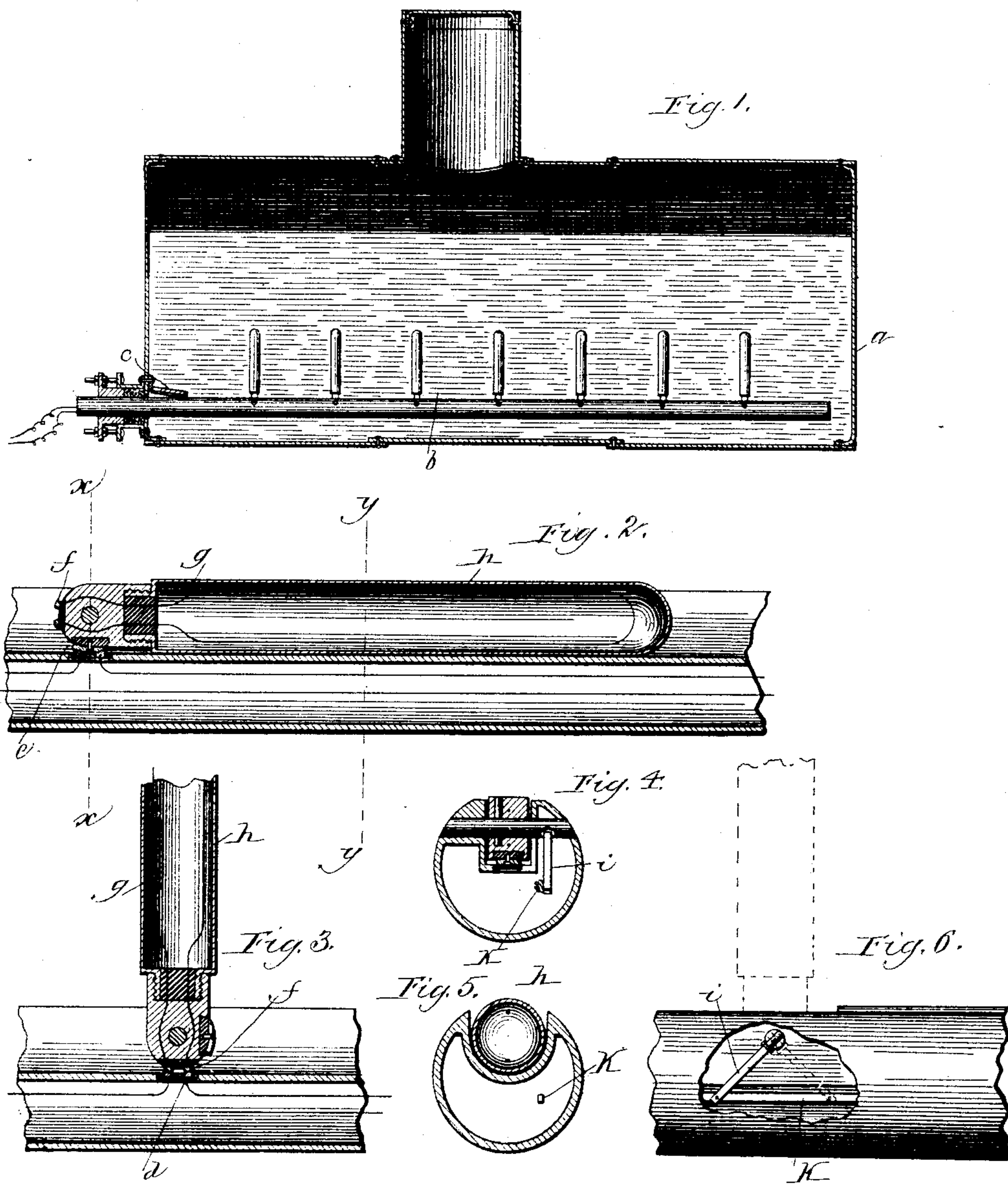


(No Model.)

T. J. DONOVAN.
ELECTRIC HEATER.

No. 446,831.

Patented Feb. 17, 1891.



Witnesses
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UNITED STATES PATENT OFFICE.

THOMAS J. DONOVAN, OF CHICAGO, ILLINOIS, ASSIGNOR TO WALTER G. GOODRICH, OF SAME PLACE.

ELECTRIC HEATER.

SPECIFICATION forming part of Letters Patent No. 446,831, dated February 17, 1891.

Application filed January 20, 1890. Serial No. 337,453. (No model.)

To all whom it may concern:

Be it known that I, THOMAS J. DONOVAN, a citizen of the United States, residing at Chicago, in the county of Cook and State of Illinois, have invented a new and useful Improvement in Electric Heaters, of which the following is a specification.

My invention relates to the heating of fluids and generation of steam by electricity, and will be described, and then more particularly pointed out in the claims.

In the drawings like letters refer to the same parts in the several figures.

Figure 1 is a vertical longitudinal section of a boiler with one form of my invention applied thereto. Fig. 2 is a similar section of a tube containing the wires and one of the heaters in a recumbent position. Fig. 3 is a section of a portion of the tube and one of the heaters in its operative position. Fig. 4 is a cross-section through the line *xx*, Fig. 2. Fig. 5 is a similar view on the line *yy*, Fig. 2; and Fig. 6 is a detail showing the rod connected with an arm for turning the heater.

In carrying out my invention I first produce heat electrically by any of the well-known methods, but preferably by rendering incandescent any suitable filament, such as platinum, carbon, &c., and then inclose the heat-emitting substance in an air-tight envelope from which the atmosphere has been exhausted. This envelope is not of glass, but of some material—such as metal—which will readily become heated by radiation from the incandescent filament or other heat-emitting substance. The envelope should of course not touch the filament or other heat-emitting substance, but should be at such a distance as will effectively insulate it electrically, and at the same time enable it to absorb the radiated heat.

In Fig. 1 I have shown a manner of applying one form of my invention to an ordinary boiler *a*. According to this method of construction I provide the boiler with a stuffing-box upon its exterior and upon its interior with an inwardly-opening flap-valve *c*, which latter is usually held closed by the pressure of the steam. A tube *b* is provided on one side with a concave depression extending

along its entire length, in which a series of heaters lie horizontally when not in use. This tube, with the heaters, is passed into the boiler through an aperture therein which the stuffing-box surrounds, and in its passage lifts the flap-valve *c* out of the way. Of course there may be a number of tubes *b*, and one or all may be withdrawn or replaced at pleasure. The wires from the generator extend along the interior of the tube, and at suitable intervals one of the wires is broken and its severed ends passed through a block of vulcanite or other insulating material, in which are separately embedded two conducting-terminals *d d*.

The heater is provided on one side with a conducting-bridge *e*, which connects the terminals *d d* when the heater is in a recumbent position. The filament *g* of the heater is properly insulated where it passes through the metal parts thereof and connects with two conducting-terminals *f f*, which in the vertical and operative condition of the heater abut against the corresponding terminals *d d* of the tube, and so make a circuit through the heater. Thus when the heater is recumbent the circuit is made through the bridge, and when the heater is in operative position the circuit is made through the terminals and the filament.

The pivot of the heater is mounted in the tube, and near one end of such pivot, within the tube, is an arm *i*. A rod *k* lies within the tube and extends to the outer end thereof. This rod is secured to the arms of the several heaters, so that they can be manipulated from the outside.

Surrounding the filament or other heat-emitting substance is an envelope *h* of heat-radiating material—such as metal—which is air and water tight and has its atmosphere exhausted therefrom. The inner walls of this envelope are at such a distance from the filament as to be insulated electrically, and at the same time to absorb the heat radiating therefrom and communicate the same to the surrounding fluid medium, so as to heat such fluid and manufacture steam.

I have shown and described one way of carrying my invention into effect; but I do not mean to limit myself thereto, for it is obvious that instead of a filament an arc light may be

used, and the details of the invention may be modified in various particulars without departing from the spirit thereof.

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

1. The combination of a boiler or other fluid-reservoir, an electrically-heated substance inclosed in an envelope from which the air has been exhausted, and a removable carrier for such envelope normally inserted in the boiler or reservoir, substantially as shown and described.

2. The combination of a boiler or other fluid-reservoir, and one or more detachable carriers for electric heaters, which are designed to be placed in such reservoir, substantially as shown and described.

3. The combination of a fluid-reservoir and one or more carriers having depressions or

compartments for containing electric heaters, substantially as shown and described.

4. The combination of a fluid-reservoir with one or more carriers and electric heaters pivoted therein, substantially as shown and described.

5. The combination of a fluid-reservoir with one or more carriers having separate compartments for electric heaters and the circuit-wires, substantially as shown and described.

6. The combination of a fluid-reservoir with one or more carriers, electric heaters pivoted thereon, and operating mechanism for manipulating such pivoted heaters, substantially as shown and described.

THOMAS J. DONOVAN.

Witnesses:

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