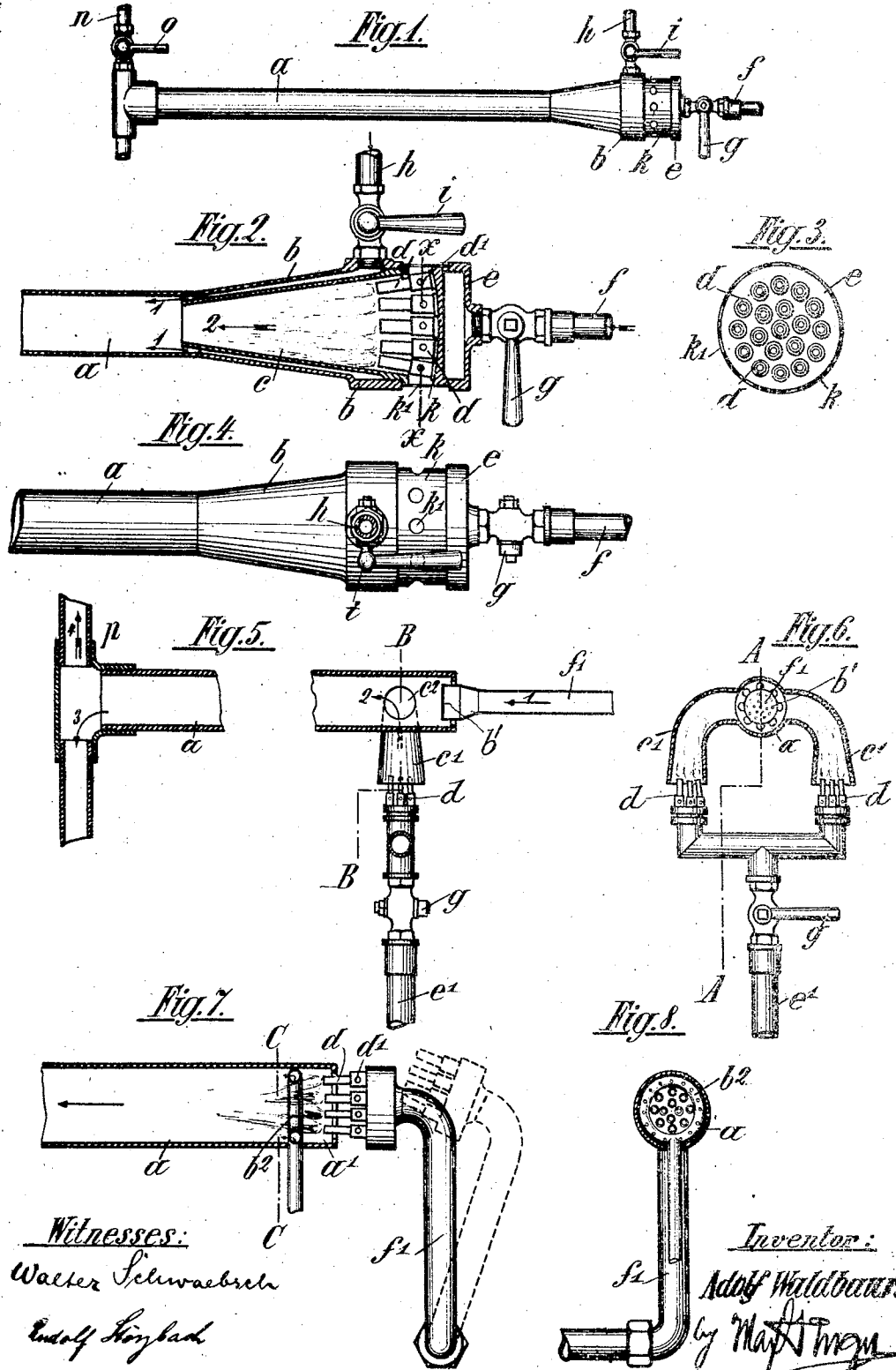


A. WALDBAUR.  
LIQUID HEATER.

APPLICATION FILED AUG. 10, 1901.



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# UNITED STATES PATENT OFFICE.

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## LIQUID-HEATER.

SPECIFICATION forming part of Letters Patent No. 782,632, dated February 14, 1905.

Application filed August 10, 1901. Serial No. 71,585.

*To all whom it may concern:*

Be it known that I, ADOLF WALDBAUR, a citizen of the German Empire, residing at Stuttgart, Kingdom of Württemberg, Germany, have invented certain new and useful Improvements in Liquid-Heaters; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

The present invention relates to heating apparatus for liquids, and especially devices for heating water, the object of the same being to provide a simple and cheap heating device for this purpose which will occupy a very small space and in which the caloric of the heating medium will be given off to the water or other liquid in the completest manner possible.

With these objects in view an apparatus embodying my invention combines with a heating pipe or chamber one or more sources of flame, such as Bunsen burners, which are in direct communication with said heating pipe or chamber and means for injecting into the same water in a spray or fine jets in such a way as to create sufficient suction or draft to draw the flames into the body of the water or other liquid to be heated, and thereby into intimate contact with the same. By this means a strong air-draft is created, whereby the combustion of the Bunsen burners takes place in so complete and thorough a manner as to eliminate all odor of the gas, and, moreover, the products of combustion and the liquid are so completely mixed that the heating effect of the former is fully transmitted to the latter.

Other features of my invention will be hereinafter described, and particularly pointed out in the claims.

I will now describe my invention in detail with reference to the accompanying drawings, in which—

Figure 1 represents a side elevation of a water-heating apparatus embodying my invention; Fig. 2, a vertical longitudinal central section of the same on an enlarged scale; Fig. 3, a transverse section on line *xx*, Fig. 2; Fig. 4, a top plan view of the same; Fig. 5, a vertical section on line A A, Fig. 6, of a somewhat-modified form of apparatus em-

bodying my invention; Fig. 6, a similar section of the same on line B B, Fig. 5; Fig. 7, a partial vertical section of another modification under the same invention; and Fig. 8, a transverse section on line C C, Fig. 7.

Referring first to Figs. 1 to 4, it will be observed that the heating apparatus represented therein in embodiment of my invention consists of a liquid-heating pipe *a*, having a conical or flaring enlargement *b*, constituting an approach thereto, to which is joined a water-pipe *h*, provided with any suitable cock or regulating device *z*. Into this conical enlargement *b* is fitted in any suitable way—for example, by a screw-joint, as shown—a similarly conical flue *c*, the enlargement *b* and deflector *c* being so shaped and arranged that only a very thin annular space for the passage of the water to the heating-pipe *a* is left. A Bunsen gas-burner consisting of one or a number of gas-jets *d* extends into the rear end of the flue *c*, these burners in the present instance being secured to and deriving their gas-supply from a common gas-chamber *e*, which gas-chamber in turn communicates with the gas-pipe *f*, controlled by any usual or convenient gas cock or valve *g*. The forward end of the pipe *a* may be connected at *d'* with a further cold-water pipe *n*, having a cock *o*, whereby the heated water may be mixed and tempered with cold water according to need or desire. As shown, the gas-chamber *e* is removably connected to the enlargement *b* by means of a metal sleeve *k*, having a number of air-openings *h'* for furnishing the air-supply to the Bunsen burner. Each individual jet *d* of the gas-burner is, as shown, made in the usual form of a Bunsen burner, having the usual air-openings *d'*.

For convenience of illustration the heating apparatus is shown in a horizontal position in the various figures of the drawings, but in the practical application of the device it is usually arranged vertically instead of horizontally, the water and products of combustion being introduced downwardly.

In operation, the gas-burner being lighted in the usual manner and the cock *z* being operated to the desired extent, the water proceeds to flow through the narrow annular

space into the heating-pipe *a* in the direction of the arrow 1, thereby creating a draft or suction in the manner well known in injectors. Thereby the air of combustion is drawn with such force and speed through the air-openings *k* and *d'* as to create a flame or flames of great intensity and heat, which flames and the heated products of combustion therefrom are forcibly injected, in the direction of the arrow 2, into the water as it passes through the heating-pipe *a*, thereby quickly heating the same and giving off practically all of their heat to the water. Since under these conditions the combustion is complete, no gas-odor or taste is imparted to the water, the carbon dioxid generated in combustion being practically dissipated. By this operation water may be heated for drinking, cooking, bathing, and other purposes in an exceedingly short time and, as noted from the above, the means for effecting the result are of such very simple nature that an exceedingly light and inexpensive and, if desired, portable apparatus may be made under my invention for heating water for various purposes. The amount of water to be heated in a certain time and the temperature to be imparted to the same may be nicely regulated by properly turning the gas-cock *g* or the water-cock *i*, or both. A further regulating means for this purpose is embodied in the water-cock *u*, arranged in the subsidiary water-pipe *n*.

In Figs. 5 and 6 I have represented a modified form of water-heater under my invention which differs from that just described in the following particulars: The water-heater *a* is under this construction provided with one or more flues *c'*—in the present instance two—communicating with its interior at its rear end at *c''*. Below the flues *c'* are arranged Bunsen gas-burners *d*, as in the first example, sufficient space being left between the burners and the lower openings of the flues to admit a sufficient draft of air for rapid combustion, the flues being preferably flaring at their bottom, so as to intensify the draft, as will be understood. The burners are fed from the gas-pipe *e'*, controlled by the gas-cock *g*, as in the first example. The water is in the present case injected into the heater-pipe *a* in the form of a spray behind the flame-inlets *c''*, through the spray nozzle or rose *b'*. At its forward end the heating-pipe *a* may be provided with a flue *p*, through which the heated water passes downward, as indicated by arrow 3. The direction of the flow of water and of the flames and products of combustion are here again indicated by the arrows 1 and 2, respectively. In this example, it will be noted, the flames pass in advance of the water-inlet, while the reverse arrangement is disclosed in the first example.

Still another form of apparatus embodying my invention is represented in Figs. 7 and 8. In this case the water is injected into the

heater-pipe *a* in an annular spray by the annular sprayer *b''*, while the heating-flames are injected into the same at its open rear end *d'* from a battery of Bunsen burners *d*, which may be swung into and out of position for lighting and for other purposes by being mounted on a swiveled gas-supply pipe *f'*, as shown.

From all of the above exemplifications of the manner in which my invention may be carried into effect it will be seen that one part of said invention consists, essentially, in a liquid-heating pipe or chamber in combination with a source of flame directly communicating therewith; so that the flames or products of combustion will directly enter the liquid to be heated.

Another important feature is the fact that a strong draft or suction is created which carries a current of air through and around the flame-generators, whereby an intense heat and a perfect combustion are produced, the degree of heat supplied by the burners being directly and automatically regulated by the supply of the liquid to be heated.

Still another important distinguishing feature of my invention lies in the fact that the water-injector in the shape of a spraying or contracted nozzle for feeding the water to be heated to the heating pipe or receptacle serves to create said strong draft or suction through the air-supply for the burners, whereby, as stated, an intense and perfect combustion is attained.

What I claim, and desire to secure by Letters Patent of the United States, is—

1. In a liquid-heater, the combination, with a heating-receptacle open to the atmosphere, of a burner arranged to throw its heat into said receptacle, means for introducing the liquid into the vessel under pressure and means whereby the flow of the liquid controls the draft of the burner.

2. In a liquid-heater, the combination, with a heating-receptacle open to the atmosphere, of a Bunsen burner arranged to throw its heat into said receptacle, air-inlets at the rear of said burner, means for introducing the liquid to the vessel under pressure adjacent to the burner, and means whereby the flow of the liquid controls the draft of the burner.

3. In a liquid-heater, the combination, with a heating-pipe open to the atmosphere, and means for forcing the liquid to be heated into the pipe under pressure, of a burner arranged to throw its flames into the heating-pipe substantially in the same direction as the moving liquid, and air-inlets communicating from the atmosphere with the burner, whereby the injector action of the liquid will supply air to the burner in quantities varying with the flow of the liquid.

4. In a liquid-heater, the combination, with a burner and air-inlets, and a passage arranged about said burner, of means for discharging

the liquid to be heated into the receptacle through said passage, whereby the draft upon the burner is automatically regulated by the supply of the liquid to be heated.

5 5. In a liquid-heater, the combination, with a heating-pipe open to the atmosphere, an annular inlet, and means for forcing the liquid to be heated into said pipe through the inlet, of a burner arranged to throw its flames into the heating-pipe centrally of the liquid-inlet, and air-inlets communicating from the outer air with the burner, whereby the moving liquid will supply air to the burner in quantities varying with the flow of the liquid.

15 6. In a liquid-heater, the combination, with a heating-receptacle open to the atmosphere, an approach to said receptacle, a pipe disposed within the approach in such manner as to leave an annular space between the pipe and the approach, and means for discharging the liquid to be heated into the receptacle by way of the annular space, of a burner disposed within the pipe in such relation as to project the heated products of combustion therethrough, and an air-inlet, whereby the flow of the liquid will by an injector action create a draft acting upon the air from the inlet to the products of combustion from the burner.

25 7. In a liquid-heater, the combination, with a heating-receptacle, a conical approach to said receptacle, a pipe disposed within but out of contact with the conical approach, and means for discharging the liquid to be heated under pressure into the annular space between the pipe and the approach, of a burner disposed within the pipe in such relation as to project its incandescent gases therethrough, and an air-inlet to the burner whereby the flow of the liquid from the annular space into the heating-receptacle will by an injector action create a

draft acting upon the air from the inlet and the products of combustion from the burner.

8. In a liquid-heater, the combination, with a heating-receptacle open to the atmosphere, a conical approach to said receptacle, a pipe disposed within, but out of contact with the conical approach, and means for discharging the liquid to be heated under pressure into the annular space between the pipe and the approach, of a burner disposed within the pipe in such relation as to project its incandescent gases therethrough, and an air-inlet to the burner whereby the flow of the liquid from the annular space into the heating-receptacle will by an injector action create a draft acting upon the air from the inlet and the products of combustion from the burner, said draft being substantially proportionate to the supply of the liquid to be heated.

9. In a liquid-heater, the combination, with a heating-receptacle, a conical approach to said receptacle, a conical pipe disposed within but out of contact with the conical approach, and means for discharging the liquid to be heated into the annular space between the pipe and the approach, of a fuel-burner disposed within the conical pipe in such relation as to project its incandescent gases therethrough, and an air-inlet to the burner, whereby the flow of the liquid from the annular space in the heating-receptacle will by an injector action create a draft acting upon the air from the inlet and the products of combustion from the burner.

In testimony whereof I affix my signature in presence of two witnesses.

ADOLF WALDBAUR.

Witnesses:

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JULIUS HEIM.