L. D. LOVEKIN.

WATER HEATER.

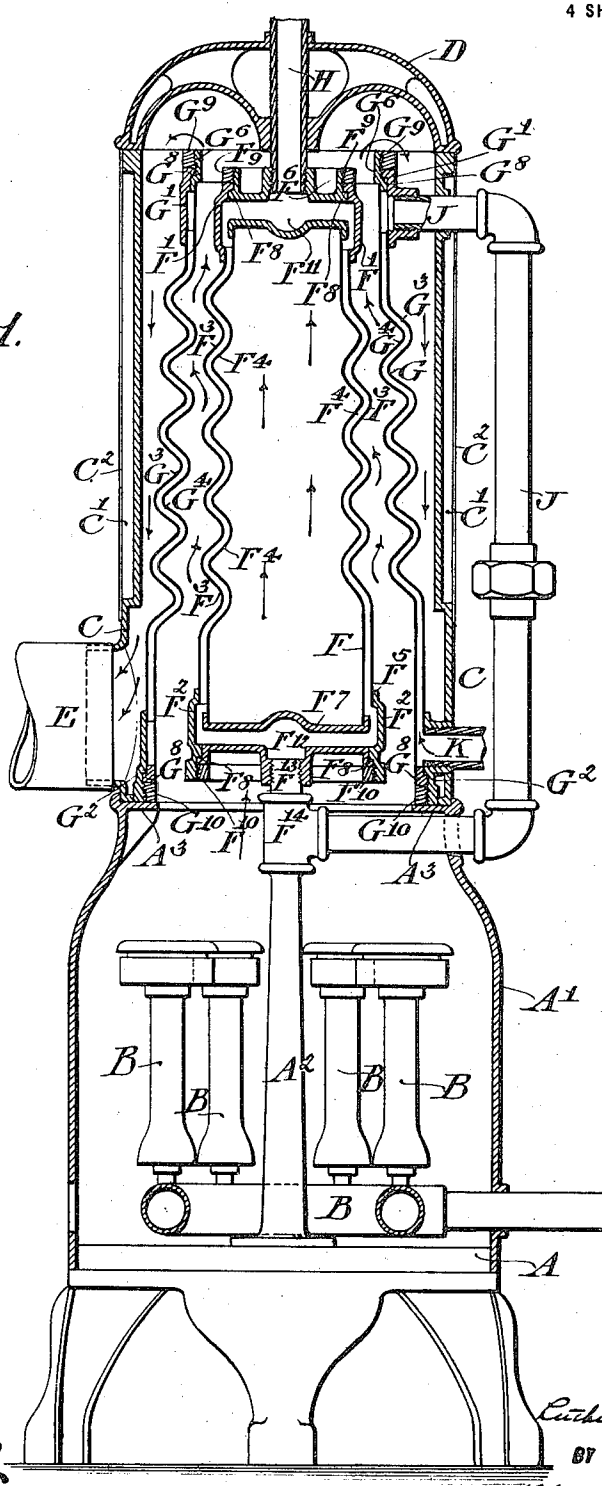
APPLICATION FILED NOV. 15, 1909.

1,143,291.

Patented June 15, 1915.

4 SHEETS—SHEET 1.

Fig. 1.



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L. D. LOVEKIN.

WATER HEATER.

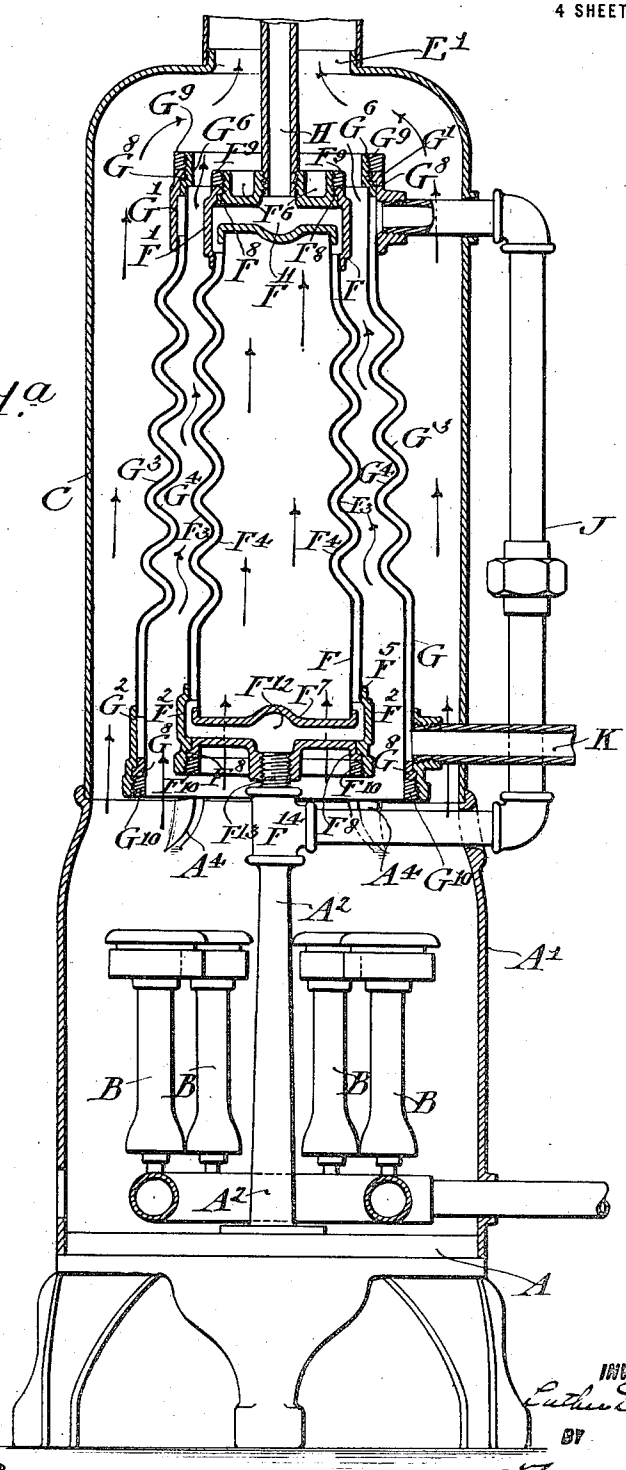
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4 SHEETS—SHEET 2.

Fig. 1a



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4 SHEETS—SHEET 3.

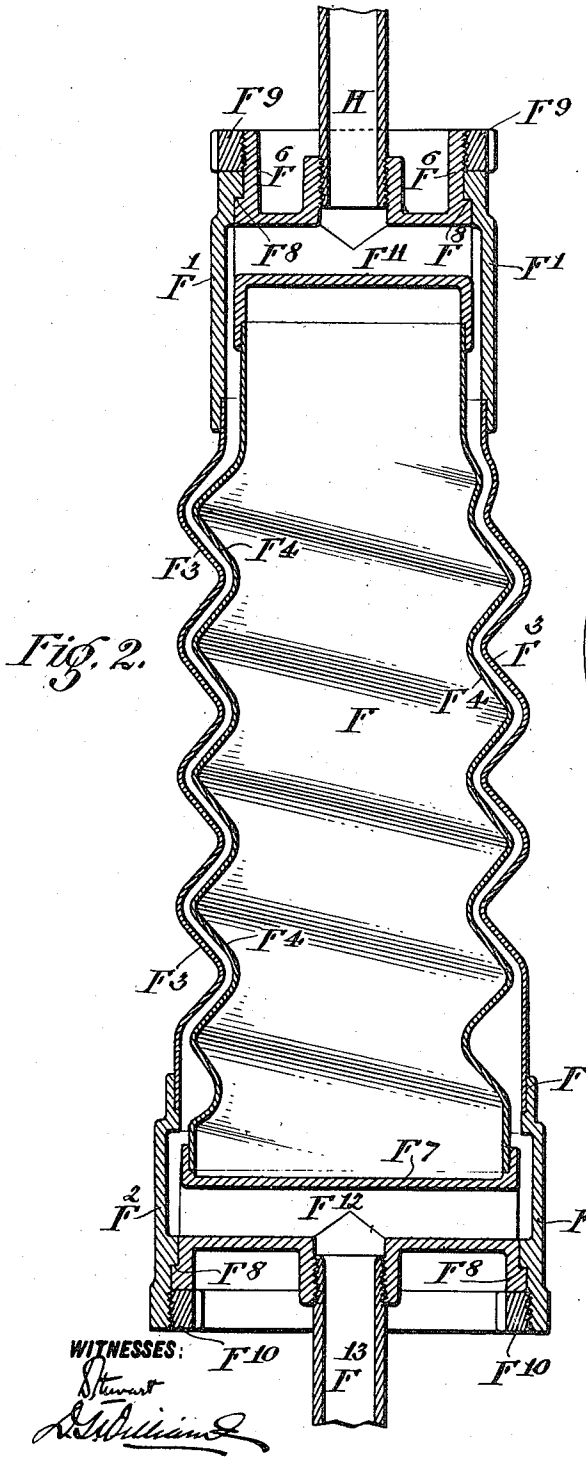
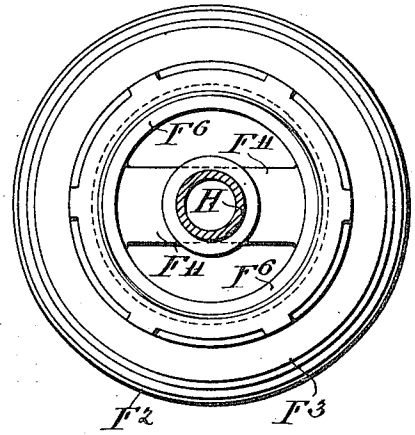


Fig. 2.

Fig. 3.



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WATER HEATER.

APPLICATION FILED NOV. 15, 1909.

1,143,291.

Patented June 15, 1915.

4 SHEETS—SHEET 4.

Fig. 4.

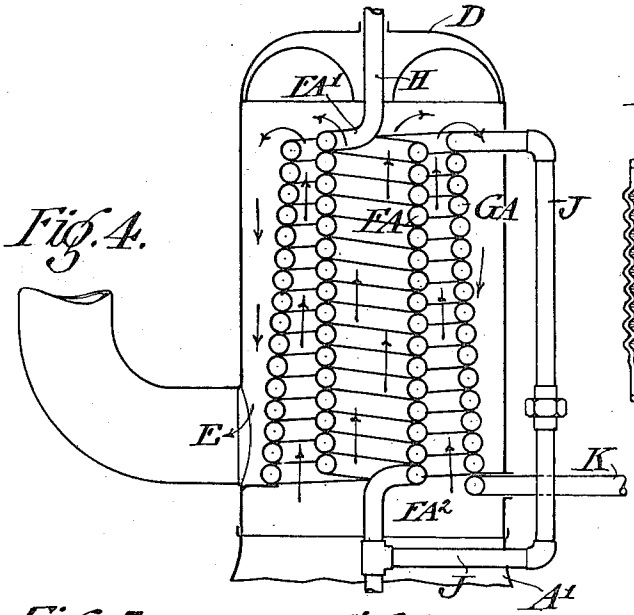


Fig. 10.

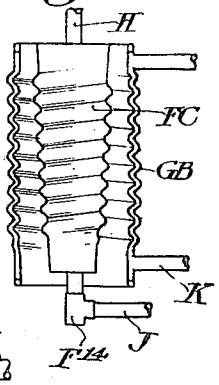


Fig. 5.

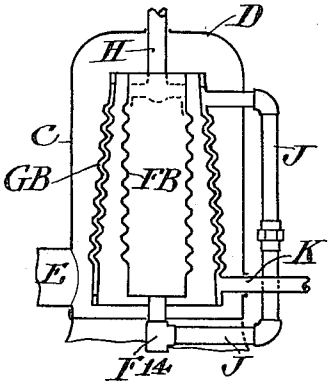


Fig. 6.

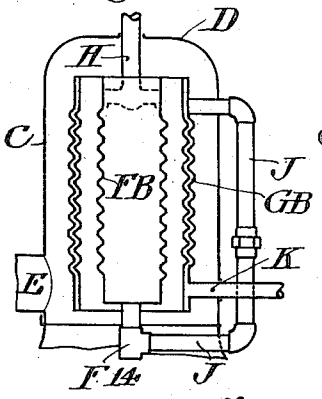


Fig. 7.

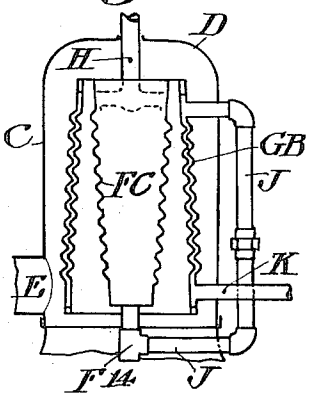


Fig. 8.

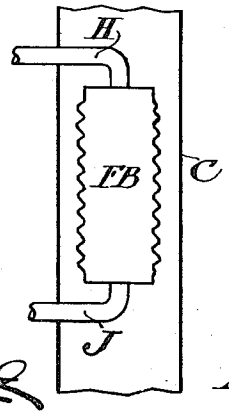
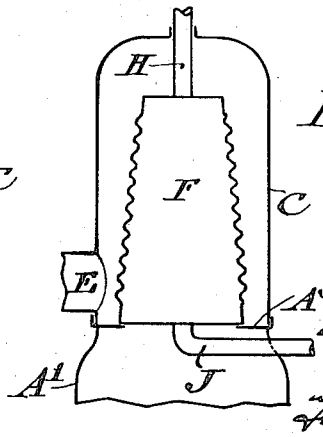


Fig. 9.



WITNESSES:

INVENTOR

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UNITED STATES PATENT OFFICE.

LUTHER D. LOVEKIN, OF PHILADELPHIA, PENNSYLVANIA.

WATER-HEATER.

1,143,291. Specification of Letters Patent. Patented June 15, 1915.

Application filed November 15, 1909. Serial No. 527,936.

To all whom it may concern:

Be it known that I, LUTHER D. LOVEKIN, a resident of Philadelphia, in the county of Philadelphia and State of Pennsylvania, have invented a certain new and useful Improvement in Water-Heaters, of which the following is an exact and true description, reference being had to the accompanying drawings, which form a part thereof.

The present invention relates to apparatus of the kind in which provisions are made for the flow of two separate fluids in proximity to each other and under such conditions that heat is transferred from one fluid to the other, and more particularly to apparatus of this kind designed for heating water by hot gases as the products of combustion from gas burners.

The general objects of the invention are to provide apparatus of the character specified with improvements tending to the production of compact and efficient apparatus characterized by its durability, simplicity of construction, low cost of manufacture, and the ease with which it may be assembled and taken apart for cleaning and repairs.

More specifically, one main object of the invention is to provide a device possessing the advantages just specified and which is especially adapted for use in the rapid heating of water by the heat derived from gas burners.

A further object of the invention is the provision, in a fluid container, the body of which is formed by two tubes arranged one within the other with a space between their walls, of a novel end connection by means of which the two tubes are connected together and the space between the tubes is connected to a pipe axially disposed with respect to the tubes without interfering with the passage of a fluid through the internal tube or along the outer tube.

The various features of novelty which characterize my invention are pointed out with particularity in the claims annexed to and forming a part of this specification.

For a better understanding of the invention, however, and the advantages possessed by it, reference should be had to the accompanying drawings and descriptive matter in which I have illustrated and described several of the forms in which the invention may be embodied.

Of the drawings, Figure 1 is a sectional elevation of a water heater in which the water is heated by gas burners. Fig. 1[A] is a view similar to Fig. 1 showing a modification. Fig. 2 is a sectional elevation, on a larger scale than Fig. 1, of the inner container employed in Fig. 1. Fig. 3 is a plan view of the apparatus shown in Fig. 2. Fig. 4 is a sectional elevation of a heater generally like that shown in Fig. 1, but having containers of different construction from those employed in Fig. 1. Figs. 5, 6, 7 and 10 are diagrammatic views of heaters generally like those shown in Figs. 1 and 4, but showing the use of water containers of different form from those shown in Figs. 1 and 4. Fig. 8 is a sectional elevation illustrating the use of a container generally like that shown in Fig. 2, in a smoke pipe or other tubular casing through which the heating gases flow continuously in one direction, and Fig. 9 is a sectional elevation of a heater in which, with a single container generally like that shown in Fig. 2, in a casing generally like that of Fig. 1, provisions are made for an up and down flow of the heating gases.

In the drawings, and referring first to the construction shown in Figs. 1, 2 and 3, A represents the base which is provided at its upper end with an integral or preferably separable casing A′ forming the wall of the burner chamber in which are located the gas burners B which may be of any suitable form.

At the upper end of the casing the base portion A′ is provided with an internal flange A^3 on which is mounted a tubular casing C. The latter may be formed of metal, usually cast metal, and is provided with a heat insulating jacket C′ which may be inclosed by an outer casing wall C^2 of sheet metal.

Within the casing C and extending from the lower end of the casing to points adjacent the upper end of the casing are located two hollow containers F and G for the water to be heated.

The inner container F comprises a body portion formed of two spaced apart tubular elements F^5 and F^4 and upper and lower end connections. In the form shown, the ends of the outer tube F^5 are brazed or otherwise suitably connected at F^6 to two annular members F′ and F^2 of cast metal. Similarly, the inner tube F^4 is connected at its ends to cast metal end portions F^6 and F^7. The end portions F^6 and F^7 are provided with shoul-

ders F^8 which abut against the corresponding internal shoulders provided on the elements F′ and F^2, respectively. The members F′ and F^6 are connected together to form a rigid end connection with a tight joint between their abutting shoulders by means of a collar F^9 which is threaded on the upper end of the member F^6 and abuts against the upper end of the member F′. Similarly, the members F^2 and F^7 are connected together to make a tight joint between their abutting shoulders by means of an externally threaded ring F^{10} which abuts against the lower end of the member F^7 and is screwed into the lower end of the member F^2.

Preferably, as shown, the two tubular elements F^3 and F^4 are spirally corrugated and are assembled and disassembled by threading the two elements together and apart in accordance with the invention claimed in my prior patent 904,627, granted November 24, 1908. By preference also, as shown, the external diameter of the member F^6 is less than the minimum internal diameter of the outer tubular element F^3 and the internal diameter of the lower end connection F^2. In consequence, by simply removing the threaded members or nuts F^9 and F^{10}, the inner and outer tubular elements may be disassembled for cleaning or repairs and reassembled with ease.

The arrangement just described, while novel with me, is not claimed herein, but is claimed in my prior application Serial No. 463962 filed November 23, 1908.

The member F^6 is formed with a diametrically extending tubular portion F^{11} provided with an axially extending outlet port at its upper side into which is secured the pipe connection H, forming as hereinafter explained, the hot water outlet of the heater. Similarly, the member F^7 is provided with a diametrically extending tubular portion F^{12} provided at its under side with an axially extending port threaded to receive a pipe connection. As shown, a short pipe F^{13} is threaded into the port in the portion F^{12} and the lower end of the pipe section F^{13} is screwed into a T F^{14} which is connected at its side with the lower end of a lateral pipe J and is closed at its lower end and rests upon a column A^2 projecting up from the floor of the burner chamber. The pipe J passes laterally through the wall of the burner chamber. The lower end of the T F^{14} may advantageously be closed and at the same time connected to the column A^2 by threading the upper end of the column into the lower end of the T.

The outer container G comprises parts G′ to G^{10}, inclusive, which may be, and are shown as being, substantially identical with the parts F′ to F^{10} inclusive. In the element G, however, there are no tubular end connection portions corresponding with the portions F^{11} and F^{12}, and the inlet pipe K passing through the casing C and leading to the lower end of the space in the container G is threaded into a lateral boss projecting from the member G^2, while the upper end of the pipe J passes through the casing and is threaded into a lateral boss on the member G′. The element G is supported by the burner casing flange A^3 on which the member G^2 rests.

The upper end of the casing C is closed by an end member D which is provided with a central aperture receiving the pipe H and bears at its periphery on the upper end of the casing C. The member D normally closes the upper end of the casing C but is not secured thereto and is free to rise whenever the pressure in the casing C acting on the underside of the member D is sufficient to lift the weight of the latter. The member D thus acts as a safety valve to relieve the pressure in the casing C when, as may occur from time to time, gas explosions take place in the casing due to the fact that the casing is allowed to fill up with gas before ignition occurs in starting the apparatus, or to other causes. The normal outlet for the used gaseous products of combustion is the pipe E leading from the lower end of the casing.

In operation, cold water is supplied to the lower end of the space in the container G through the pipe K. Water thus admitted flows up through the container G out through the pipe J and into the lower end of the container F through the pipe section F^{13} and tubular portion F^{12}. From the lower end of the container F the water flows up through the container and eventually passes out of the heater through the tubular portion F^{11} and the outlet pipe H. The hot products of combustion from the burners B pass up through the space between the two containers F and G and also through the hollow interior of the container F, and it will be observed that the tubular portions F^{11} and F^{12} and the pipe connections to the same are so arranged as to afford but a slight barrier to the passage of hot gases through the container F. The hot gases passing out of the containers F and G at their upper ends pass down through the space between the container G and the casing C, and are discharged through the outlet pipe E. Preferably, suitable provisions are made, as by connecting the pipe E to a chimney, for insuring a good draft through the heater.

It will be apparent to those skilled in the art that the apparatus hereinbefore described is not only simple, durable, and relatively inexpensive to construct, but that it insures a very effective and rapid abstraction of heat by the water from the hot gases from the gas burners. The apparatus gives

a relatively long path of travel for the heating gases and large heat surface area while at the same time the apparatus is very compact. The hottest gases act directly on both the inner and outer surfaces of the container F from which the water passes out of the heater, while the partially cooled gases passing down through the space between the casing C and the outer container G have much of their remaining heat abstracted by colder water passing up through the container G. By putting the descending current of partially cooled gas outside of the outer container, heat losses by radiation to the external atmosphere are minimized. The construction of the containers disclosed permit the use of thin tubes F^3, F^4, G^3, G^4, with a consequent ready transfer of heat through their walls. The spiral corrugations in these tubes not only strengthen the internal tubes against danger of collapsing under the water pressure, but permit expansion and contraction, due to temperature changes, to take place without subjecting the tubes or the end connections to strains liable to injure the apparatus and in particular to make loose joints.

Preferably, as shown in Figs. 1, 2 and 3, the elements F and G are both conical. This insures that the cross section of the space within the element F, and the cross sectional area of the space between the elements F and G, increase uniformly from the top to the bottom of the elements while the space between the outer surface of the element G and the inner surface of the casing C, which is cylindrical, decreases in area from the top to the bottom of the apparatus. This results in producing a slower flow of the heating gases along the lower portion of the element F where the ascending gases are the hottest, and a slower flow of the descending gases along the outer surface of the upper end of the element F where these gases are most effective owing to their higher temperature than along the lower portion of the element G. In consequence, a more effective abstraction of heat from the gases is obtained with a given average rate of flow of the gases through the heater than if the rate of flow were uniform throughout its path through the heater.

Instead of making both elements conical, as shown in Fig. 1 the outer element G only may be made conical as shown in Fig. 5 where the container F is cylindrical. With the arrangement shown in Fig. 5 there is the same retardation to the upward flow of gases through the space between the containers GB and FB and through the space between the container G and the casing C as in the construction shown in Fig. 1, but in this case the rate of flow through the interior of the container FB is uniform and of course many of the advantages of the invention are obtained where both the inner element FB and the outer element GB are not conical but cylindrical as shown in Fig. 6, or where the outer element GB is in the form of a corrugated conical member while the inner element FC is similar to the element F turned upside down, as shown in Fig. 7, or where, as in Fig. 10, the outer element GB is cylindrical and the inner element FC the same as shown in Fig. 7.

While, in the preferred form of the invention, the containers are each formed of a pair of spaced apart spirally corrugated tubes threaded one into another, as herein- before described, either or both of the containers may be made in different form, and in Fig. 4 I have shown a heater like that shown in Fig. 1, except that the inner container FA and the outer container GA are each formed by a coil of pipes, the convolutions of each coil uniting to form a hollow container having a water space in its wall and generally similar in shape and disposition to the containers F and G of Fig. 1; FA′ and FA^2, respectively, indicating the parts which are equivalent to the members F′ and F^2 shown in Figs. 1 and 2. Of course the containers FA and GB may be given any of the forms illustrated in Figs. 5, 6 and 7.

A container having end connections like the container F of Figs. 1, 2 and 3, may be advantageously employed in heaters different in form from those heretofore described. For instance, the container may be mounted in a stove pipe or stack as shown in Fig. 8. In this form the container FB is preferably in the form of a hollow cylinder. Instead of employing two containers in the casing C, as shown in Fig. 1, a single container like the container F may sometimes be employed with advantage as illustrated in Fig. 9. In this construction the base of the container F rests on the burner casing flange A^3 and performs the functions performed in Fig. 1 by the container G of dividing the lower portion of the space in the casing C into two chambers connected at their upper ends and separately open at their lower ends, one to the burner chamber and the other to the outlet pipe E.

Instead of providing for an up and down circulation of the heating gases as in Fig. 1, the hot gases may be permitted to escape at the top of casing C through outlet pipe E′ as shown in Fig. 1^A. In this case the outer container G is separated at its lower end from the casings A′ and C to permit the hot gases from the burners to pass up along the outer surface of the container G. The outer container G may be supported on ears A^4 projecting inward from the member A′.

While in accordance with the provisions of the statutes I have herein described and

illustrated the best forms of the invention now known to me, it will be apparent to those skilled in the art that many changes may be made in the form of the apparatus disclosed without departing from the spirit of my invention, and that some features of the invention may advantageously be used under some circumstances without a corresponding use of other features, and I do not wish the claims hereinafter made to be limited to the particular forms of apparatus disclosed more than is made necessary by the state of the art.

Having now described my invention, what I claim as new, and desire to secure by Letters Patent, is

1. In a water heater, a casing, a water container in the form of a hollow body having a water space in its wall, said container dividing the space in said casing into two chambers connected at their upper ends, a gas burner or burners located adjacent the lower end of said chambers, an outlet for used gases leading from the lower end of the other of said chambers, and a head normally closing the upper end of said casing but movable to open the upper end of the casing upon a predetermined rise of pressure within the casing whereby said head serves as a safety valve to relieve the pressure within the casing in case of gas explosions.

2. In a water heater, a casing, a water container located therein, a gas burner or burners located at the lower end of said casing, a vertical pipe connection to said container extending above the casing, and a head for the upper end of the casing slidingly mounted on said vertical pipe connection and normally engaging and closing the upper end of the casing whereby said head serves as a safety valve to relieve the pressure within the casing when the pressure rises unduly.

3. In a device of the kind specified, the combination of a container comprising a body portion formed of a pair of spaced apart tubes arranged one within the other, an end connection for said tubes comprising an outer annular member secured to the end of the outer tube, an inner annular member secured to the end of the inner tube, and means for detachably connecting said members together to thereby close the end of the space between the tubes, one of said annular members having a diametrically extending tubular portion communicating with the space between the tubes and provided between its ends with a port for a pipe connection.

4. In a device of the kind specified, a container comprising a pair of spaced apart tubes arranged one within the other and an end connection to which one end of each tube is connected, said end connection being formed with a space communicating with the space between the tubes and with a diametrically extending tubular portion open at its ends to the first mentioned space in the end connection and having a port for an axial pipe extension, a pipe connection secured in said port, a support for the container to which the other end of the pipe connection is secured, and a lateral pipe connection to the first mentioned pipe connection.

LUTHER D. LOVEKIN.

Witnesses:
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D. STEWART.