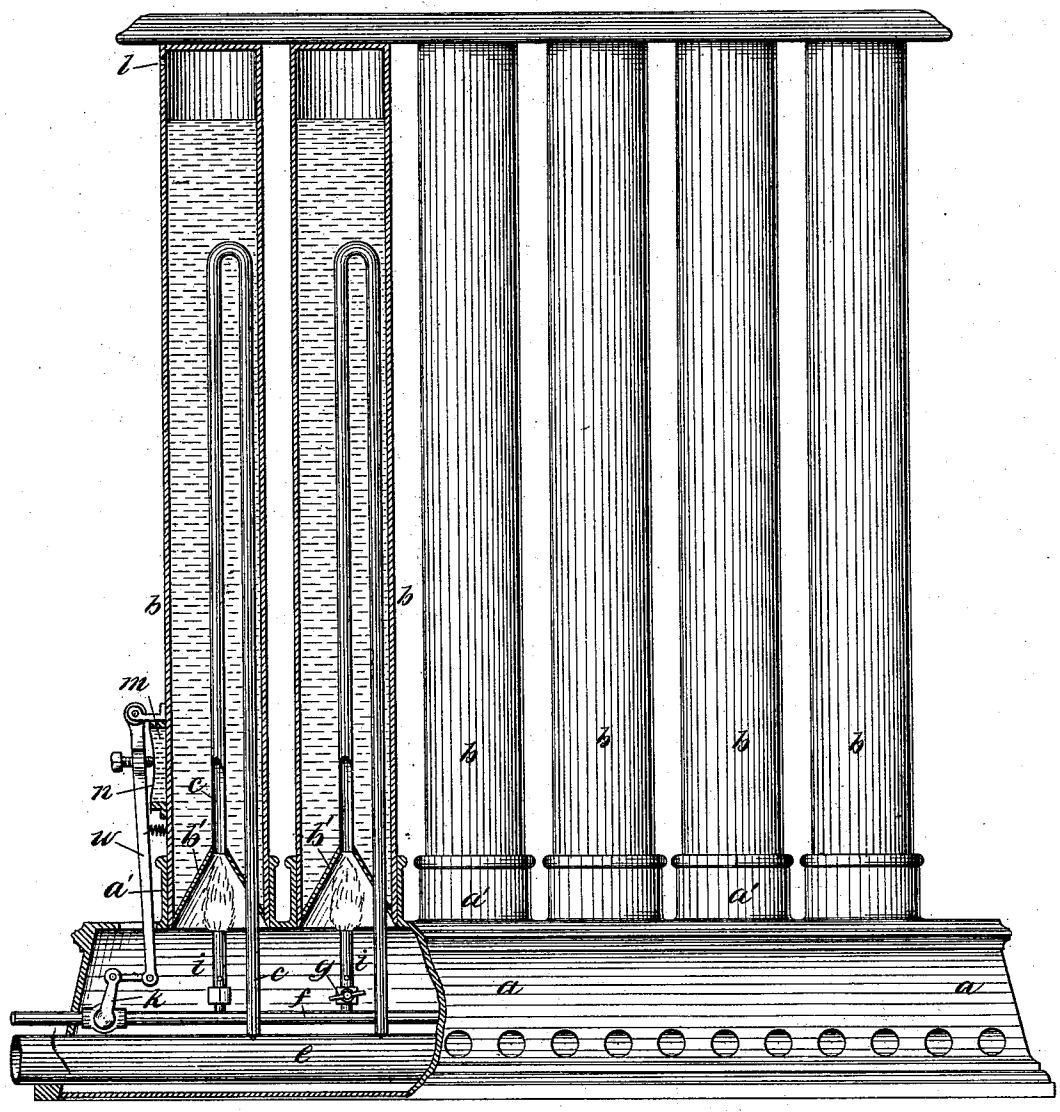
(No Model.) 2 Sheets—Sheet 1.

E. E. GOLD.

GAS STOVE.

No. 281,685. Patented July 24, 1883.

Fig. 1.



Witnesses;
C. C. Perkins
M. J. Leonard

Inventor;
Edward E. Gold
by Chas. R. Higgins
Attorney.

(No Model.) 2 Sheets—Sheet 2.

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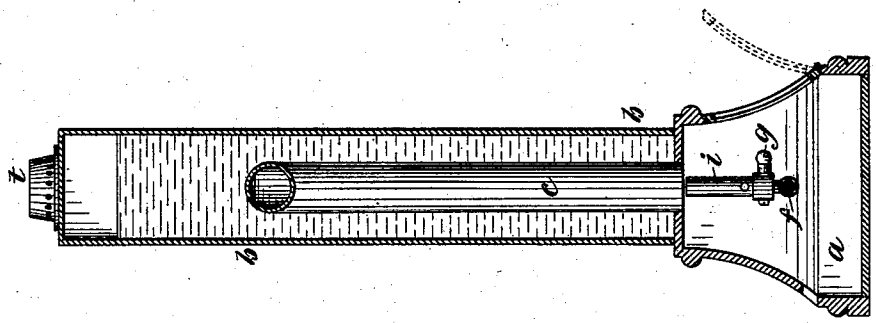

Fig. 3.

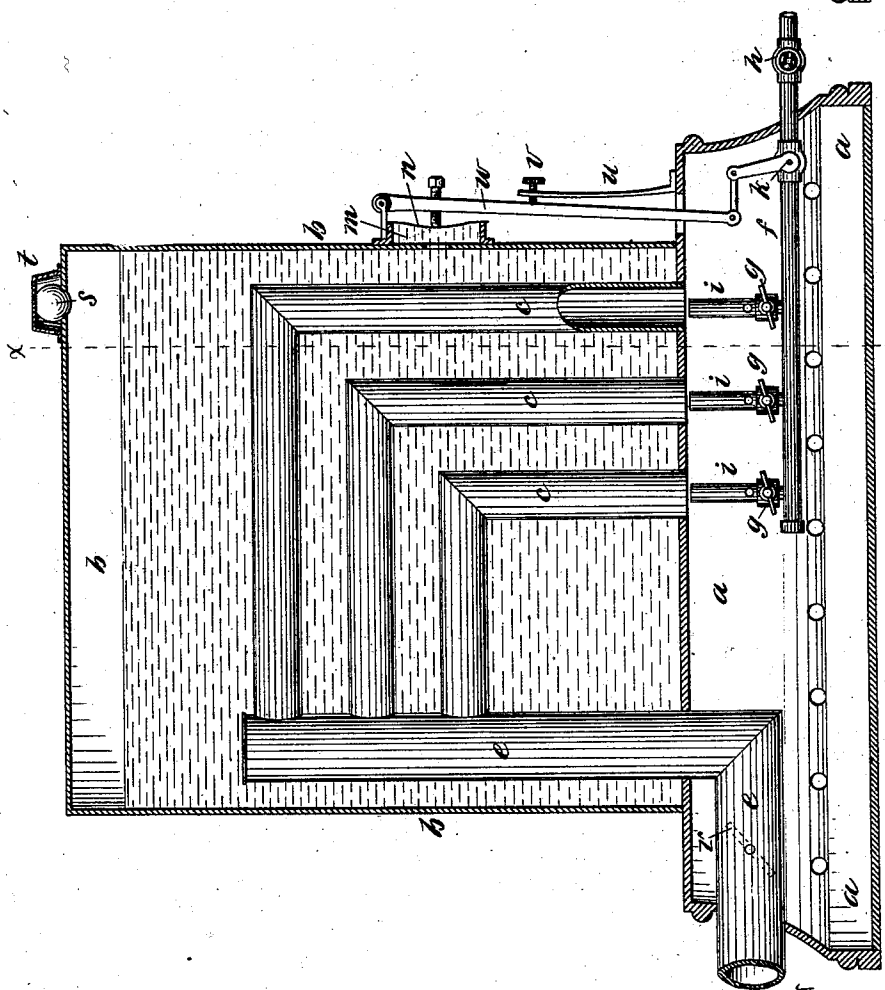

Fig. 2.

Witnesses;
E. C. Perkins.
M. J. Leonard

Inventor;
Edward E. Gold
by Chas. M. Higgins
Attorney.

UNITED STATES PATENT OFFICE.

EDWARD E. GOLD, OF NEW YORK, N. Y.

GAS-STOVE.

SPECIFICATION forming part of Letters Patent No. 281,685, dated July 24, 1883.

Application filed May 13, 1882. (No model.)

To all whom it may concern:

Be it known that I, EDWARD E. GOLD, formerly of Brooklyn, Kings county, New York, but now residing in New York city, have invented certain new and useful Improvements in Gas-Stoves, of which the following is a specification.

In the ordinary types of gas-stoves, as is well known, the burners are inclosed in a simple metal casing, which forms both the air-chamber and casing of the stove; and the heat of the burning gas is absorbed directly by the metal of the stove, and part of this heat is thence convected by the air of the apartment and part radiated into the apartment. In addition to this, the air within the stove-casing is highly heated by the burning gas, and this, together with the hot gases of combustion, is discharged directly into the apartment. This system of heating cannot certainly be charged with waste of heat, for all the heat is produced and dissipated in the apartment; but in all other respects, and except in cleanliness and convenience which pertains generally to gas-heaters, it is probably the worst system of heating that could be devised; and it is doubtless due to this that gas-stoves have heretofore met with much objection in actual use, and have been adopted to but a small extent. Economy of heat, while an important quality of a heating apparatus, is obviously not the most essential, for apparatus which would seriously vitiate the air in the act of applying the heat, produce no ventilation of the apartment, and subject the air to a high temperature should be considered as entirely intolerable, as they in fact are, without reference to the question of economy. Now, in the system of gas-stoves, which we are here criticising, it will be observed that metal and air are the vehicles, so to speak, of the heat, and both of these materials are capable of being heated to very high temperatures; hence where these materials form the vehicles of the heat, the air of the apartment is always subjected to a very high temperature, which is always injurious to its healthful qualities; and this is in fact the improper way to apply heat, for the direct heating of the air should always be avoided as far as practicable, and the heat applied by radiation as much as possible. Now, it is of course hardly practicable to heat entirely by radiation, and it is difficult to avoid the direct heating of the air; but if this be so, then the apparatus should be so organized as to subject the air only to a low temperature; or, in other words, while a good quantity of heat is desired, it should always be diffused at a low intensity, and with this a change of air or ventilation must be provided. Now, these essential requirements for a correct heating apparatus are entirely absent in the present system of gas-stoves, for in them we see that the vehicles of heat are capable of being heated to high and even unlimited temperatures, and that this heat is given out at a high intensity, and is chiefly applied by connection or by direct heating of the air, and not only this, but the air is vitiated by the combustion of the gas, and this vitiated air and products of combustion are voided into the apartment, thus further poisoning the air, instead of tending to purify it. Of course this vitiation of the air could be prevented by leading off the gases of combustion through a flue, same as in a coal stove, and the apparatus would then tend to ventilate the apartment; but if this were done it will be observed that the chief heating effect of the stove would be lost, for as the air and gases are in this case the chief vehicle of the heat, this heat would be conducted off in accelerated force and volume by the flue, producing good ventilation but ineffective heating. That this would be the result can be readily understood for the reason that both the air and the metal of the stove would be always heated to nearly the same temperature; hence the air-current in passing through the pipes and chambers of the stove on its way to the flue would give out little of its heat to the stove, for obviously little or no transfer of heat can take place between two bodies heated to the same temperature.

These principles have controlled me in devising my present improvement, which may be briefly stated to consist in a gas-stove having its casing charged with a large mass or body of liquid, to the base of which the heat of the gas-burners is applied, and through which the heat and gases are preferably conducted by flues which rise through the fluid-chamber and connect with a chimney, the mass of

liquid being fixed in the casing, while the exterior of the casing is freely exposed in the apartment; hence in this case the fluid or water forms the vehicle of the heat, and this possesses great absorbent power for the heat, and much greater capacity, therefore, than any other known material. Consequently the heat of the burning gas is absorbed rapidly and in great quantity by the fluid, and as the fluid cannot possibly be raised to a high temperature, the result is that the heat is diffused rapidly by the fluid into the apartment, both by radiation and connection, and at a low intensity, but in a large quantity, and as the hot air and gases flowing from the burner through the flues have always a much higher temperature than the water-surrounded flues, most all the heat thereof is hence given out to the fluid before the gases enter the chimney, retaining, however, always enough to maintain a draft. By this means it is therefore believed that a valuable improvement in gas-stoves is produced, for not only are the products of combustion carried off and the apartment ventilated without appreciable waste of heat, but the air of the apartment is never subjected to a high temperature, and all the available heat is extracted from the combustion of the gas and distributed in a diffuse manner in the apartment without injuring the healthful quality of the air in any way, thus avoiding all the serious defects of former gas-stoves, while retaining the advantages of safety, economy, cleanliness, and convenience.

My invention also embodies a number of minor features of construction, as hereinafter fully set forth.

In the annexed drawings, Figure 1 presents a side elevation, partly in section, of my improved gas-stove. Fig. 2 is a vertical section of another form of the same, and Fig. 3 is a vertical cross-section on line *x x* of Fig. 2.

On reference to Fig. 1 it will be observed that my improved gas-stove presents the appearance of an ordinary tubular or sectional steam-radiator—that is, it is formed with a long and narrow hollow base, *a*, from which a number of tubes or cylinders, *b b*, arise, which tubes are surmounted by a marble slab or other suitable top. The top of the base is formed with a number of projecting tubular necks, *a'*, in which the lower ends of the tubes *b b* are socketed, which tubes, as illustrated, are closed at both ends and filled or nearly filled with a charge of water or other liquid, which is permanent or fixed in the tubes when the stove is in action. I prefer water in which a large percentage either of glycerine or some crystalline substance is dissolved, to raise the boiling and freezing points of the liquid, as will be understood. Each of the tubes *b* has an indented conical bottom, *b'*, which opens out of the top of the hollow base *a*, and from the apex of each cone a small flue-pipe, *c*, opens and rises up through the liquid in the tubes, thence curves back upon itself, and returns down through the base of the cone in the form of an inverted **U**, and opens into a large flue-pipe, *e*, which pipe *e* extends horizontally through the bottom of the base, and projects out at one end thereof, as illustrated, and is adapted to connect in the manner of an ordinary stove with the chimney of the apartment in which the apparatus is placed.

Extending longitudinally through the base is a gas-pipe, *f*, which is preferably placed over the flue-pipe *e* and centrally under the conical bottoms of the water-tubes. One end of this gas-pipe projects externally from one end of the base, and is adapted to connect with the gas-pipes of the house by rubber or metal tubing, and this end of the pipe is provided with a cock, *h*, by which the gas may be let into or shut off from the pipe. The opposite end of the gas-pipe, which is not seen in Fig. 1, terminates within the opposite end of the hollow base and is closed, while from the upper side of the pipe a number of gas-burners, *i i*, branch, each corresponding to one of the water-tubes *b* and arranged centrally under the same, so as to impinge its flame and hot gas against the cones *b' b'*, and thence up through the flue-pipes *e e*, as illustrated in Fig. 1. The burners *i* are preferably some form of the Bunsen type of burner; but any other suitable kind of burner may be adopted, and in the drawings I have represented one of the simplest forms of Bunsen burners. Each burner is fitted with a stop-cock, *g*, whereby it may be individually shut off or adjusted for any desired size of flame, and the gas-pipe *f* has a regulating-valve at *k*, controlled by an automatic regulator, as will be hereinafter described. One side of the base is provided with a suitable door, whereby access may be had to the burners to adjust the same or light the gas, as will be understood. It will now be understood that when the gas is turned on and lighted, the flames will play against the conical bases of the water-tubes, and the hot air and gases arising from the flames will rise in the ascending bend of the flue-pipes *c*, and thence descend in the return-bend, and, flowing into the main flue-pipe *e*, will thence escape into the chimney, and by this action the vitiated air and products of combustion will be disposed of, while the heat will be readily absorbed by the metal and water of the water-tubes, and thence diffused by radiation and connection into the apartment. It will be readily seen that as the fluid in the tubes cannot possibly become heated much over 200°, or not above its boiling-point, and as the capacity of the fluid for heat is greater than any other substance, the intense heat of the gas-flames will be absorbed rapidly by the fluid and diffused in great quantities through it, but at a low intensity or low temperature; hence this heat will thence be dissipated in the apartment by free and rapid radiation, and partly by convection to the air, and in a diffuse or quantitative manner at a comparatively low

temperature, thus giving an effectual healthful heating effect without overheating or in any way injuring the healthful qualities of the air, and besides this action the vitiated air will be drawn out of the apartment from near the floor and through the base and flues of the apparatus, thus presenting the important hygienic and efficient advantages before noted. It can now be readily appreciated that the conditions presented in my improved gas-stove for the absorption and diffusion of the heat of the gas-flames, and for the disposition of the air and gases arising from the flames, are entirely distinct from what exists in gas-stoves as heretofore made. Thus in the former stoves the heat is applied to metallic parts which are surrounded by air, and as the temperature of the flame is very high, or much over 1,000°, hence the metal becomes very highly heated, and may be heated to as high a temperature as the flame itself, for the surrounding air has of course little capacity for heat and is itself a non-conductor. The air in contact with the flames and the hot metal therefore becomes necesarily raised to a very high temperature, and in this condition is discharged with the products of combustion into the apartment; hence in addition to the external radiation from the exterior of the stove-casing, the chief vehicle of heat, as before noted, is the air which continues to flow in increasing volume through and over the heated chambers and metal parts of the stove, and is finally discharged in a heavily-vitiated and intensely-heated state into the apartment, which, as before noted, is a most pernicious mode of heating. Now, in contradistinction from this, in my improved stove the heat of the flames is applied at first to metal also; but this metal is surrounded by water or liquid which has the greatest known capacity for heat; but as it is incapable of being raised to a high temperature it hence absorbs the heat with the greatest rapidity from the metal and stores it up in large quantities, but at low intensity, and thence diffuses it in this condition into the apartments, as before stated, with the greatest hygienic and economic advantage. Now, another important point to be considered is that in order to insure a rapid transfer of heat from one body to another it is of course necessary that the receiving-body should be at a lower temperature than the imparting body, for obviously no transfer of sensible heat can take place between two bodies at the same temperature. This important condition, as may be readily seen, is forcibly present in my improved gas-stove, for as the vehicle or diffuser of heat in my stove is water or liquid, which can never be raised much over 200°, while the temperature of the flame or source of heat is much over 1,000°, it follows that the direct heat of the flame must be absorbed rapidly and completely. Furthermore, for the same reason, the convected heat contained in the hot air and gases which arise from the flames and flow through the flues is most all extracted before it reaches the chimney, for these fluid-surrounded flues are of course always cool compared with the intensely-heated gases, and therefore have great absorbing-power for the heat contained in the gases; hence these gases will enter the chimney at little or no higher tempearture than that of the fluid in the tubes, having given out all the remainder of their heat to the fluid; and it may be stated that the flues *c c* are designed to be of a sufficient length to effect this full extraction of the heat; but they may be shorter. This small amount of heat thus retained by the waste gases will be quite sufficient in this stove for maintaining an effective draft, for it will be understood that in a gas-stove a positive or forcible draft is not required for the purpose of combustion, as is the case in a coal-stove, for the gas will burn perfectly without draft; but only sufficient current is necessary as will carry off the vitiated air and products of combustion and produce a fair degree of ventilation, which is here practically accomplished, thus presenting great advantages, both economical and hygienic, and thereby obviating all the objections heretofore existing with gas-stoves, while retaining the desirable advantages which pertain to gas-heating.

In the stove shown in Fig. 1 each water-tube is preferably vented at the top, as shown at *l l*, but is otherwise closed; and in this case it is designed that the water shall never be raised above the boiling-point, or not over, say, 200°, and when this point is reached an automatic regulating device tends to partly close the reguating-valve *k* and turn down the gas, and, *per contra*, acts to again raise the gas when the water cools much below this maximum point. This regulator consists of a small cell or chamber, *m*, soldered onto the side of one of the water-tubes, having a flexible or diaphragm cover, *n*, and charged with a sealed quantity of some volatile fluid. A pivotal lever, *w*, overlies the diaphragm and depends into the base, being connected at its extremity by a link with the lever-arm of the plug of the regulating-valve *k*, while a set-screw near the pivoted end of the lever bears upon the center of the diaphragm *n*. When the water in the tubes is cool or heated only to its minimum the diaphragm *n* will recede into its cells by the contraction of the volatile fluid, and a spring, *o*, will move the lever inward, and thus open the valve *k* to its maximum point, so as to raise the flames in the burners to their maximum. As soon as the fluid in the tubes becomes heated to its maximum, the diaphragm *n* is forced out by the expansion of the volatile fluid, the lever *w* moved thereby, and the regulating-valve closed, so as to turn down the flames to their minimum without, of course, entirely shutting off the gas, thus maintaining the heat of the apparatus constant and uniform without attention.

If it is desired to have only a portion of the

stove in action, this may be done by extinguishing the burners, where desired, by turning the burner-cocks *g g*, leaving the others lighted; but the burner at the first tube, having the regulator thereon, must not be so extinguished, and for this reason it is not provided with a cock.

If desired, the several water-tubes in Fig. 1 may be connected, so that the fluid may circulate through all; but it is not desirable.

In Figs. 2 and 3 the parts corresponding to those in Fig. 1 are lettered similarly; but the construction is somewhat different. Thus the water-casing *b* is made in one large cell or chamber of rectangular form, broad or square on the side and narrow in cross-section, as illustrated. The flue-tubes *c c* rise through this chamber in elbow form and concentric series, as seen in Fig. 2, and connect with the main flue *e*, which is also inclosed by the water-chamber and descends therefrom into the base, where an elbow thereon projects from the end to connect with the chimney with the same effect as in Fig. 1. A damper, *r*, is preferably arranged in the lower end of this flue *e*, as indicated. In the apparatus shown in Fig. 1 it is designed not to heat the water above its boiling-point, so as not to generate any steam-pressure or obtain a higher temperature than the boiling-point, while the apparatus shown in Figs. 2 and 3 is adapted to be run under some pressure, so as to obtain a much higher temperature, if desired; hence in this case the water-chamber *b* is closed tight, and is provided with a simple form of safety-valve, which consists of a hollow rubber ball, *s*, sprung into an opening or valve-seat in the top of the water-chamber, and held to its seat by a perforated cap, *t*, fixed over it, so that when the water is heated sufficiently to generate a steam-pressure, say, of a few pounds to the square inch, or to any other limit desired, the rubber ball *s* will be pressed from its seat, allowing the steam to escape, and thus prevent the formation of any pressure in the water-chamber beyond this limit. The regulator of the heat in this case is similar to that already described, except that the cell *m* communicates directly with the fluid-chamber, as shown in Fig. 2, so as to allow the direct pressure of the water to bear upon the diaphragm *n*, which pressure tends to force out the diaphragm and the lever *w*, and thus close the valve *k*, while a strong spring, *u*, bearing on the lever through an adjusting-screw, *v*, tends to constantly press in the lever and open the valve. By adjusting this screw in or out any desired pressure may be put on the lever, corresponding, as will be understood, to the pressure and temperature which it is desired to maintain in the water-chamber; and when the temperature and pressure in the water-chamber just exceed this point, the diaphragm will be distended, the lever moved, and the gas turned down; and, on the other hand, when this pressure and temperature fall the gas will be again raised, so as to keep the desired temperature uniform, or nearly so, as will be understood.

In Fig. 1 the base *a*, with the necks *a'*, is preferably made of cast-iron, the tubes *b b* of brass or sheet metal, the cones *b'* preferably of cast brass or iron, and the flue-pipes *c* of brass or copper, and the main flue-pipe *e* of sheet-iron. In Figs. 2 and 3 all the parts mentioned may be made of cast-iron; but I prefer to make only the base of cast-iron, and the water-chamber *b* and flue-tubes *b' b'* of sheet metal, all soldered to the base. The water tubes or chambers in Figs. 1 and 2 may have any desired corrugated form to increase their radiating surfaces, instead of being smooth, as illustrated; or they may be studded with a number of projecting metal points or flanges, to present greater radiating surface to the air, and the external surface thereof is preferably stained or painted black, in order to insure more effective radiation, as will be understood. It may therefore be finally noted that not only does this form of gas-stove possess many important advantages, as before set forth, but, in addition to these, its construction is very light, simple, and inexpensive, and its management very easy and almost entirely automatic, for it not only furnishes a most efficient and healthful form of heat and keeps the apartment ventilated, but also enables the heat to be kept practically uniform at any desired degree without care or attention.

I am aware of the heater shown in the Patents No. 150,750, of May 12, 1874, and No. 255,912, of April 4, 1882, which are distinct from my invention. The former device consists of an upright tubular steam-boiler heated by a central coal-fire, the hot gases from which rise through the vertical flues of the boiler and pass down around the sides of the boiler through a smoke-jacket, in which it is inclosed. The latter patent shows a form of gas-stove in which gas-burners are inclosed in a hollow base or casing, and play against the ends of a series of partially-vacuous tubes which rise from the casing and are exposed for radiation in the apartment. This latter stove is, however, quite distinct from my invention, in that the tubes are not actually charged with water, but contain a small quantity at the bottom, designed to be vaporized into steam to fill the vacuum-space above, and by the condensation of this steam on the sides of the tube the heat of the gas is diffused into the apartment, whereas in my device the casing is filled with water, and flues extend from the gas-burners up through said casing, which flues are constantly surrounded by water, whereby the heat of the spent gases is completely absorbed by the flues and the surrounding water before the gases escape, and is thence radiated from this body of water through the external walls of the casing, thereby forming a new and valuable type of gas-stove, as before described.

What I claim is—

1. A gas-stove constructed with a casing or chamber charged with a fixed mass of water or liquid, and having its walls freely exposed to radiate heat into the apartment, with a gas burner or burners arranged to apply their heat thereto, and with a flue or flues extending from the burners through the said water-chamber, and connecting with a chimney or conductor to the external atmosphere, substantially as and for the purpose herein set forth.

2. A gas-stove embodying the following elements: a hollow base having openings to admit air from the apartment, a casing or chamber mounted upon said base and charged with a fixed mass of water or liquid, a gas burner or burners placed in said base and arranged to apply their heat to the said water-chamber, and a flue or flues extending through said water-chamber over the burners, and conveying the air and gases from said burners to a chimney or external conduit, substantially as herein shown and described.

3. A gas-stove formed with a casing or chamber charged with a fixed mass of liquid, and a gas burner or burners arranged to heat the same, and a flue-pipe rising into said chamber over the gas-burners, and thence returning or descending through the same and connecting with a chimney or external conduit, substantially as herein shown and described.

EDWARD E. GOLD.

Witnesses:
JAS. G. COOPER,
CHAS. M. HIGGINS.