L. A. HALL.

Hydrogen Gas Apparatus.

No. 3,121. Patented June 1, 1843.

Fig: 2.

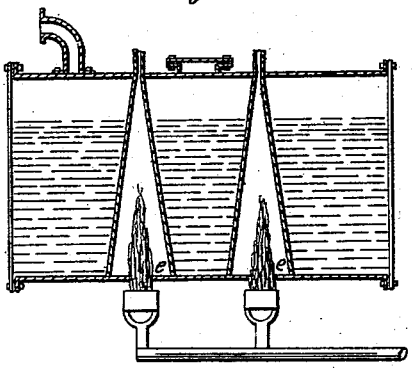
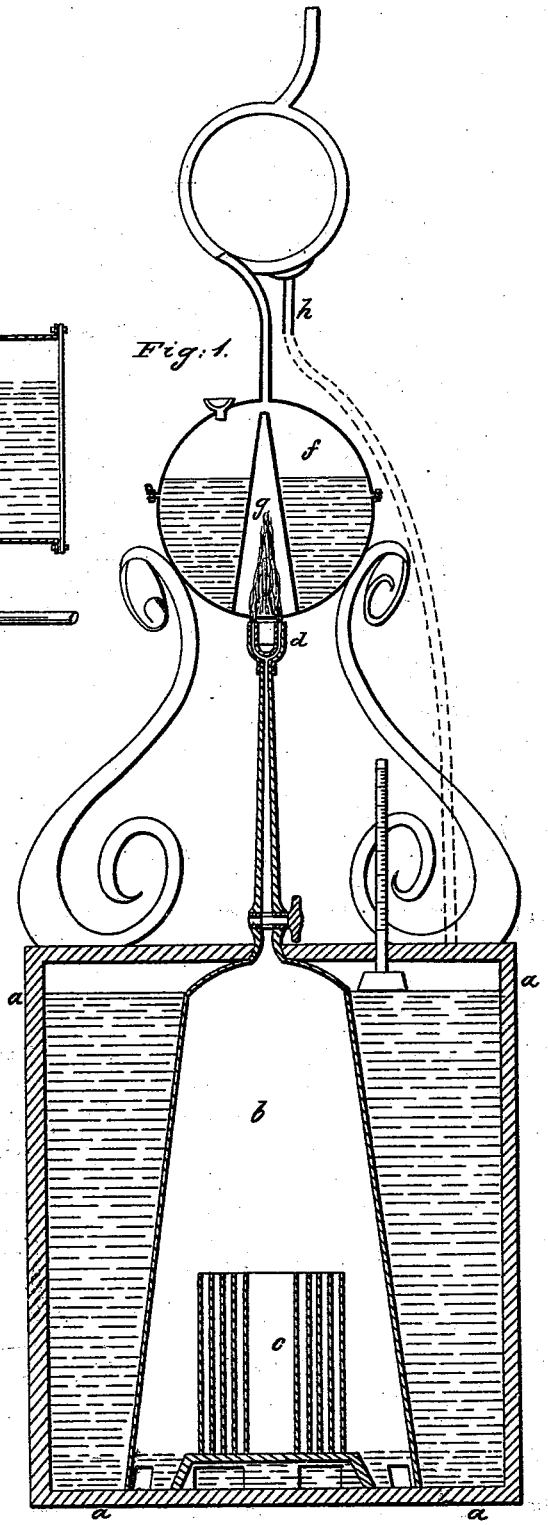


Fig: 1.



UNITED STATES PATENT OFFICE.

LEWIS A. HALL, OF NEWARK, NEW JERSEY.

GENERATING HEAT BY HYDROGEN GAS.

Specification of Letters Patent No. 3,121, dated June 3, 1843; Antedated June 1, 1843.

To all whom it may concern:

Be it known that I, LEWIS A. HALL, of Newark, in the county of Essex and State of New Jersey, physician, have invented a new and useful Improvement in the Method of Applying Hydrogen Gas for the Generation and Diffusion of Heat, of which the following is a full and exact description.

First let there be constructed a reservoir of any size commensurate in capacity for the generation in amount of all the heat required for the purpose to which it is intended to be applied. This reservoir which may be of any form must be lined with or constructed of lead or any other metal or article which forms the negative pole of an electro galvanic battery. Next let there be constructed a receiver say of one fourth the size of the reservoir, to be made of or lined with lead or any other metal or article which forms the negative pole of an electro galvanic battery. This reservoir is to be inserted in an inverted position, that is, the open part down into the reservoir. Into the top of this receiver a pipe or pipes or tubes are to be introduced of sufficient size to convey off the hydrogen gas which is to be generated within it, as fast as it is necessary to turn it. The reservoir is to contain the prepared fluid hereinafter mentioned, and is marked in the diagram herewith submitted *a*, Figure 1. The receiver is to contain the hydrogen gas to be generated as herein after described and is marked *b*, Fig. 1. Within the receiver let there be suspended or placed a basket or table to be made of lead or any other metal in or upon which basket or table is to be placed any metal which is a positive pole in reference to the composition the reservoir is lined with and the receiver is made of or lined with in quantity sufficient to decompose the fluid with which it comes in contact.

Letter *c*, Fig. 1 of the diagram represents this metal supported on a table. Iron or zinc may be used for the generation of the hydrogen gas. Zinc is the preferable metal more especially for apparatus designed for domestic uses and for the heating of dwelling houses and other buildings and apartments on board steamboats and vessels, because it emits no offensive smell. The zinc should be in sheets placed on their edges slightly apart from each other, so as to allow a free circulation of the fluid between the sheets and to allow the gas as it is evolved to rise without any obstruction. The zinc or iron, may also be used in folds or rolled up, and when so used should be placed on end edges down. The receiver is to descend to near the bottom of the reservoir leaving a sufficient space however for the free ingress and egress of the fluid or it may be made to rest on the bottom of the reservoir and be fastened to it, in which case however it must have holes or apertures in its lower rim or base of a size sufficient for the free ingress and egress of the fluid. The bottom of the receiver—and the top of the holes or apertures in case it rest on the reservoir must be below the bottom of the zinc or iron constituting the positive pole so that when the receiver is full none of the gas may escape from under it. Both the reservoir and receiver must be so constructed with reference to each other whatever their size may be that when combined for use the top of the internal portion of the latter may be on a line with the surface of the fluid or near it in the reservoir at the time when the latter contains its maximum of fluid and the receiver its maximum of hydrogen gas. The reservoir must in all cases be of such dimensions as not to overflow when by the generation of the hydrogen gas in the receiver the fluid is expelled from the latter into the former.

In place of using one reservoir and receiver two or indeed any number may be used for the production of hydrogen gas in the same manner. To the pipe or tube or pipes and tubes at the top of the receiver are to be attached pipes or tubes with valves and stop cocks to lead the hydrogen gas wherever heat is desired to be applied.

For the purpose of generating hydrogen gas the reservoir is to be filled three fourths full, with water. Salt water will answer as well as fresh. To this is to be added as much of any mineral acid as is required by its specific action to overcome the elective chemical affinity of the hydrogen and oxygen constituting water. In most of my experiments I have used one twentieth part of acidum sulfuricum by weight to nineteen twentieths of water and this proportion I have found sufficient. The decomposition of the water commences as soon as the zinc or other metal within the receiver comes in contact with the prepared fluid; an electro chemical action takes place between the non-

electric constituents of water and the metal constituting the positive pole. The non-electric of the water combines with a portion of the metal forming an oxid which is the same instant combined with the sulfur of the acid and is precipitated to the bottom of the reservoir in the form of a sulfate of whatever metal may be used. When zinc is used white vitriol or sulfate of zinc is produced.

The electric portion of the water being thus deprived of its non electric is set free and instantly ascends into the receiver and by its accumulation depresses the fluid until it is driven below the zinc or other metal within it, when the electro chemical action of the non electric for the metal ceases. By turning the valve of the stop cock of the pipes leading from the receiver, the hydrogen gas is let off into the atmosphere *a*, a constant current or stream and by applying any ignited body to the burner through which it escapes combustion instantly commences giving out the most intense heat that can be produced by the consumption of any equal weight of matter that can be produced in nature or compounded by art. The hydrogen gas may also be ignited by causing the current as it escapes from the tube or burner to impinge or strike against spongy platinum. The hydrogen gas is forced from the receiver and through the pipe or pipes or tube or tubes by a force proportioned to the weight of the column of water displaced in its formation. The moment the hydrogen gas is consumed or let off so as to admit the water to come in contact with the zinc or metal constituting the positive pole the same play of electro chemical action takes place and continues until the water is again displaced by the generation of the hydrogen gas and so on ad infinitum or until all the combustible portion of the water in the reservoir is consumed.

At the end of each pipe or pipes and tube or tubes is to be secured a burner or burners of the construction hereinafter described.

They may be made of any size or form, circular square or oblong or any other shape or may asume any possible position with respect to the horizon according to the extent position and locality of the body or object to be heated or the surface on which the heat is to operate. Letter *d*, Fig. 1, of the diagram represents a circular burner which may be used for the purpose of heating dwelling houses and other buildings. It consists of a hollow shank in which a thread is cut inside which screws down on the hydrogen gas tube or tubes outside having the shoulders so constructed as to screw down air tight upon the end of the hydrogen gas tube or tubes and pipe or pipes having two arms joined to its one on each side rising above the shank in the form of a staple upon which the burner which is to be made of steel covered with copper rests the burner is open in the center to allow a full current of atmospheric air to flow in on all sides of the hydrogen gas when it is undergoing combustion. Through each of the arms or branches of this staple passes a hole or tube which extends from the top of the cavity of the hydrogen gas tube to within one line of the top of the burner and is thence carried around the top or within a line of the top of the circle; this circular cavity is perforated with few or more holes as the case may require, eight holes of the one five hundredth parts of an inch in diameter I have found to furnish a sufficient supply of heat to an ordinary sized room on a cold day, and can be consumed within a few inches of the base of the flame.

When the heat is to operate on an extended surface such as a boiler burners of a single or double line of holes may be used and run under the boiler horizontally as represented in the diagram letter *e* Fig. 2, to be set apart so as to allow the free ingress of a current of atmospheric air to the several currents of consuming hydrogen gas as it escapes for the purpose through the holes in the burner or burners. A series of circular burners may be used for the heating of extended surfaces.

For the purpose of heating dwelling houses and buildings of every description as well as ships steamboats and other vessels let a line of pipe from the main pipe to be terminated in a burner be brought into the place where the heat is required. Over this burner is to be placed the copper globe letter *f*, Fig. 1, of the diagram and which I call the heating chamber. This globe has an internal portion of a conical shape open at both ends the bottom opening being for the ingress of heat as it is evolved by the burning of the hydrogen gas between the burner and the chamber and one at the top for the egress of the nitrogen gas after the oxygen has been taken from the air by the combustion of the hydrogen gas escaping from the burner. This cone is represented by the letter *g* Fig. 1 in the diagram. The large hole at the bottom admits a free passage while the conical shaped portion of the chamber being attached to the globe all around its edge with rivets making it completely water tight at its attachment forming a base and from thence tapering to a point, mounting up to within a few inches of the internal top of the chamber where it terminates in a hole in its summit corresponding in size with the hole in the end of the nitrogen gas tube which commences and is to be attached to the superior part of the chamber immediately over it hereinafter mentioned.

The chamber may be of any form, and

of any metal or material capable of heat for radiation. In place of leaving any space between the top of the internal cone and the nitrogen tube should it be preferred the latter may be united with the former in which case however another tube will have to be inserted in the chamber for the purpose of carrying off the steam. The nitrogen gas tube represented in the diagram is joined to the top of the heating chamber and may be carried into the open air through a window or a wall or into a flue or chimney. The heating chamber may be used without water as well as water in it. If used with water according to the figure represented in the diagram the steam produced will ascend into the nitrogen gas tube where it will be condensed at that point where the temperature is sufficiently low for condensation and the water formed by this condensation will descend through the reverse water tube letter *h*, Fig. 1 and be conducted into the reservoir or in any other way disposed of.

The principle on which the heating chamber is made is applicable to boilers for the generation of steam, and they may be made with as many conical shaped internal portions for the application of heat as may be desired. In all cases however this internal part through which the heat passes will have to be united with the nitrogen tube. By a steam pipe leading from the chamber or boiler where the steam is generated it can be connected with any apparatus through which it is to be applied. An example is given in Fig. 2 of the drawing.

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

The above method of applying hydrogen gas for the generation and diffusion of heat; that is to say, the heating chamber, or boiler as above described and in combination therewith, the nitrogen tube and the burner connected with the hydrogen tube.

LEWIS A. HALL.

Witnesses:
J. J. GREENOUGH,
HENRY C. FLAGG.