

J. M. HIRSH.
PROCESS AND APPARATUS FOR MANUFACTURING
HYDROGEN GAS.

No. 179,018.

Patented June 20, 1876.

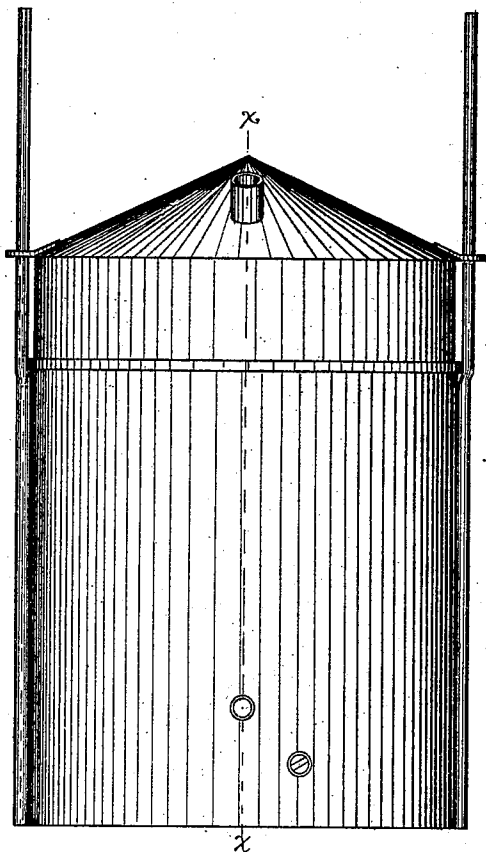


Fig. 1

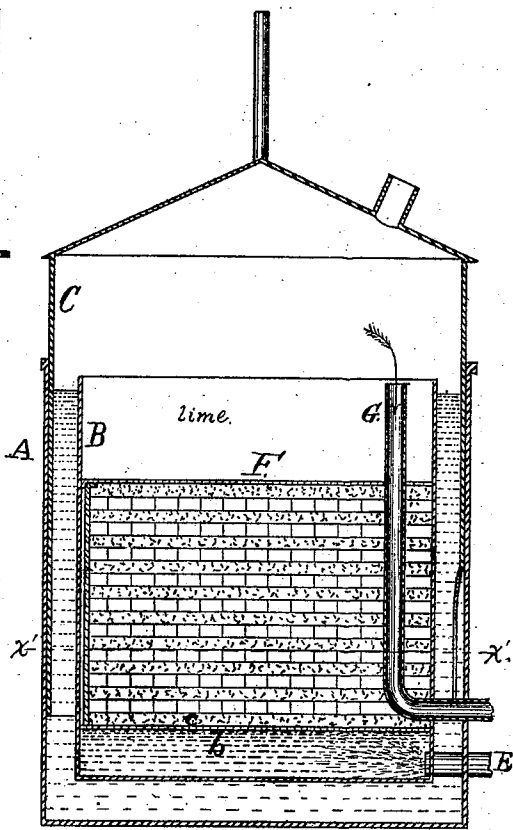


Fig. 2

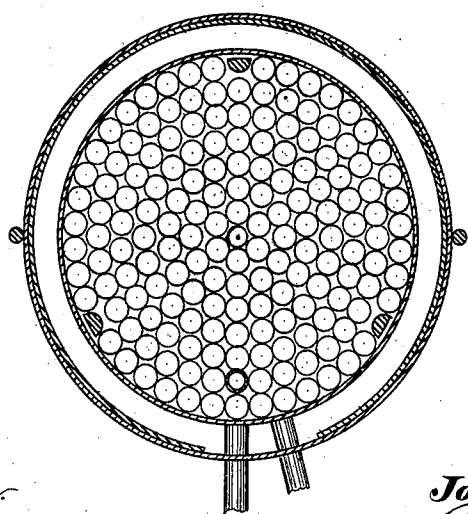


Fig. 3

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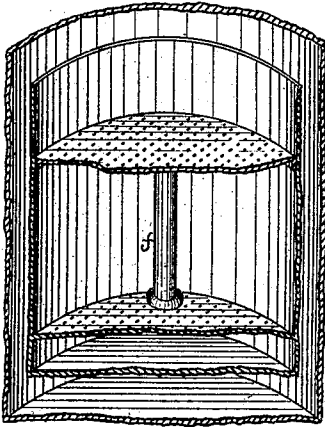


Fig. 5

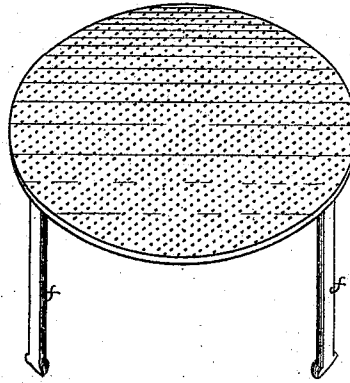


Fig. 4

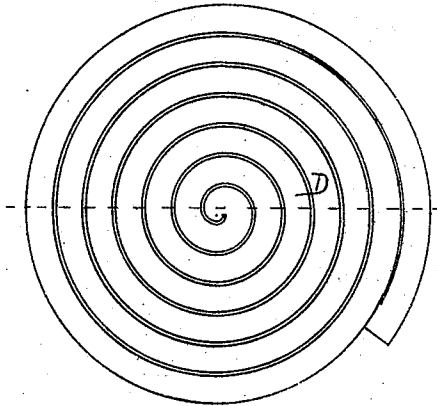


Fig. 6

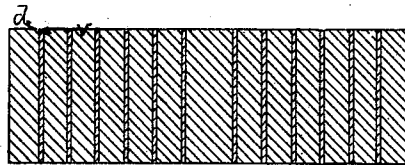


Fig. 7

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UNITED STATES PATENT OFFICE.

JOSEPH M. HIRSH, OF CHICAGO, ILLINOIS.

IMPROVEMENT IN PROCESSES AND APPARATUS FOR MANUFACTURING HYDROGEN GAS.

Specification forming part of Letters Patent No. **179,018**, dated June 20, 1876; application filed April 12, 1876.

To all whom it may concern:

Be it known that I, JOSEPH M. HIRSH, of Chicago, county of Cook and State of Illinois, have invented a new and useful Improvement in the Manufacture of Illuminating-Gas, which is fully described in the following specification, reference being had to the accompanying drawings, in which—

Figure 1 represents an elevation of an apparatus used by me; Fig. 2, a sectional view of the same, taken on the line *x x*, Fig. 1; Fig. 3, a cross-section of the same, taken on the line *x' x'*, Fig. 2; Figs. 4 and 5, detailed views of the interior of the apparatus; Fig. 6, a plan view of one of the batteries, and Fig. 7 a section of the same, taken on the line *y y*, Fig. 6.

My invention consists, first, in the manufacture of hydrogen gas in the manner and under conditions hereafter described and claimed; secondly, in the method of accelerating and enhancing the action of the battery; thirdly, in the process of regenerating the battery used for electrolyzing water, and utilizing the residual hydrocarbon; fourthly, in certain apparatus for carrying out my process.

In the drawings, A represents an outer vessel or casing, closed except at the top. Within the vessel A is placed a second vessel, B, which is a little smaller than the first, and is supported within the latter, so that there will be an annular space between the sides and bottoms of the two. The bottom space is filled with water, and between the sides of the two vessels is placed a gasometer, C, of the usual construction. Within the vessel B, near the bottom, is placed a false bottom, *b*, of perforated metal, upon which I build up my battery, as follows: A layer of charcoal, O, is first placed upon the false bottom, and upon the charcoal are placed a large number of scraps of metal, to constitute the electro-positive elements of the battery. This metal may be either iron or zinc, or, preferably, tin scrap, coiled up, as shown in Fig. 6 of drawings, curled-beech shavings being interposed to prevent contact of the coils. The interstices between the batteries are filled up with coarsely-ground charcoal, which serves as the negative element, and so on, until the battery is completed, the layers of charcoal and batteries alternating,

as shown in Fig. 2. A pipe, E, enters the vessel B between its false bottoms. The batteries are saturated with an acid metallic solution, or with a mixture of acid metallic salts—preferably a solution of a salt of the electro-positive metal—to which solution is added its own weight of chloride of calcium and glycerine, when used for the production of gas on a small scale.

The batteries being built up, as above described, the exciting-solution is added. The amount and composition of the same can be varied, but I have found, in practice, that the best results flow from the use of a solution of a salt of the electro-positive element. When this element is iron I use any salt of iron, such as sulphate; when zinc, the chloride or sulphate; when tin, the chloride; these solutions being of a degree of concentration approximating from 1.2 to 1.6 specific gravity. An excess of acid may be added, especially when the salt in solution—such as copperas—is likely to deposit some of its metal—as oxide. To these solutions may also be added an equal bulk of a dilute solution of glycerine and chloride of calcium. Neither need be pure, as they are only employed on account of their hygroscopic properties, and to prevent freezing in cold weather. These solutions are added in amounts necessary to thoroughly saturate the battery or cells. Just above the charge of batteries is placed a diaphragm of perforated metal, F, upon which may be placed a quantity of quicklime, for the absorption of any carbonic acid which may be present as in solution in water.

The operation of my device is as follows: Steam is introduced through the pipe E, which condenses in the batteries, and the so-formed water is electrolyzed by the vast number of local currents of electricity which are set up, the hydrogen being liberated, and oxygen combining with the electro-positive metal, whether zinc, tin scrap, or iron. If the nascent hydrogen combines, in small part, with the carbon present, and small quantities of hydrocarbons are formed, they pass off with the hydrogen through the pipe G to a carbureter, where they are carbureted. From the carbureter the gas is supplied to the burners.

When the gas is to be made on a large scale

ordinary gas-retorts are charged with a series of batteries in the manner above described, and the process is conducted in the same way. In this case the retorts may be heated, and the resulting thermo-electric currents will supplement the ordinary electric currents, and enhance the production of gas. The internal temperature should not be as high as the fusing-point of the most fusible metal present, and when the battery-case is heated no glycerine is used in the exciting-liquid. Should the beech shavings become charred during a cessation of the steam current they still serve to keep the coils of scrap-tin from coming in contact, and act as absorbents. Such a temperature as would char the shavings would also evaporate to dryness the metallic salts; but the free supply of incoming steam will sufficiently moisten the salts to render them active. The hydrogen gas produced may be carbureted in a carbureter of ordinary construction, external to the battery-case; or oil vapor may be introduced into the case itself.

When using gas retorts as the battery-case oil vapors may be introduced into the case itself. When using gas-retorts as the battery-case under the influence of heat another and desirable result is attained: The oxidized positive metal is reduced, by the hydrogen of the introduced hydrocarbon, to the metallic state, and the battery is thus revived, the light hydrocarbon introduced being at the same time converted into a heavier by the abstraction of a part of its hydrogen. The introduction of the steam directly into the batteries, whether they are hot or cold, subserves also another desirable end, besides furnishing the water for electrolysis: The mechanical action of the steam serves to free, by attrition, the

deposit upon the positive elements, and keeps them bright and ready to be acted upon; and it also serves to carry away the liberated hydrogen from the negative or carbon poles. The same effect may be produced by aqueous vapor, conveyed by any vehicle, such as air; or it may be produced by the mechanical action of air alone, if there be sufficient water in the apparatus.

Having thus described my invention, what I claim is—

1. In producing hydrogen gas by electrolysis of water by a large number of minute galvanic cells, the process of accelerating and enhancing the action of the battery and the evolution of gas, the same consisting in forcing through the battery a current of steam, or aqueous vapor, or air, substantially as described.

2. The process of regenerating the battery by reducing the decomposed metal to the metallic state, the same consisting in passing through or over its particles, while heated, a current of hydrocarbon vapor, substantially as described.

3. The process of utilizing the heavy hydrocarbon left after regenerating the battery, as described, which consists in passing hydrogen through the battery while the same is still heated, whereby the hydrogen will be carbureted, substantially as set forth.

4. The combination of the tank B, steam-pipe E, and battery of contiguous elements, substantially as described.

JOSEPH M. HIRSH.

Witnesses:

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ALBERT HEYMAN.