

(No Model.)

2 Sheets—Sheet 1.

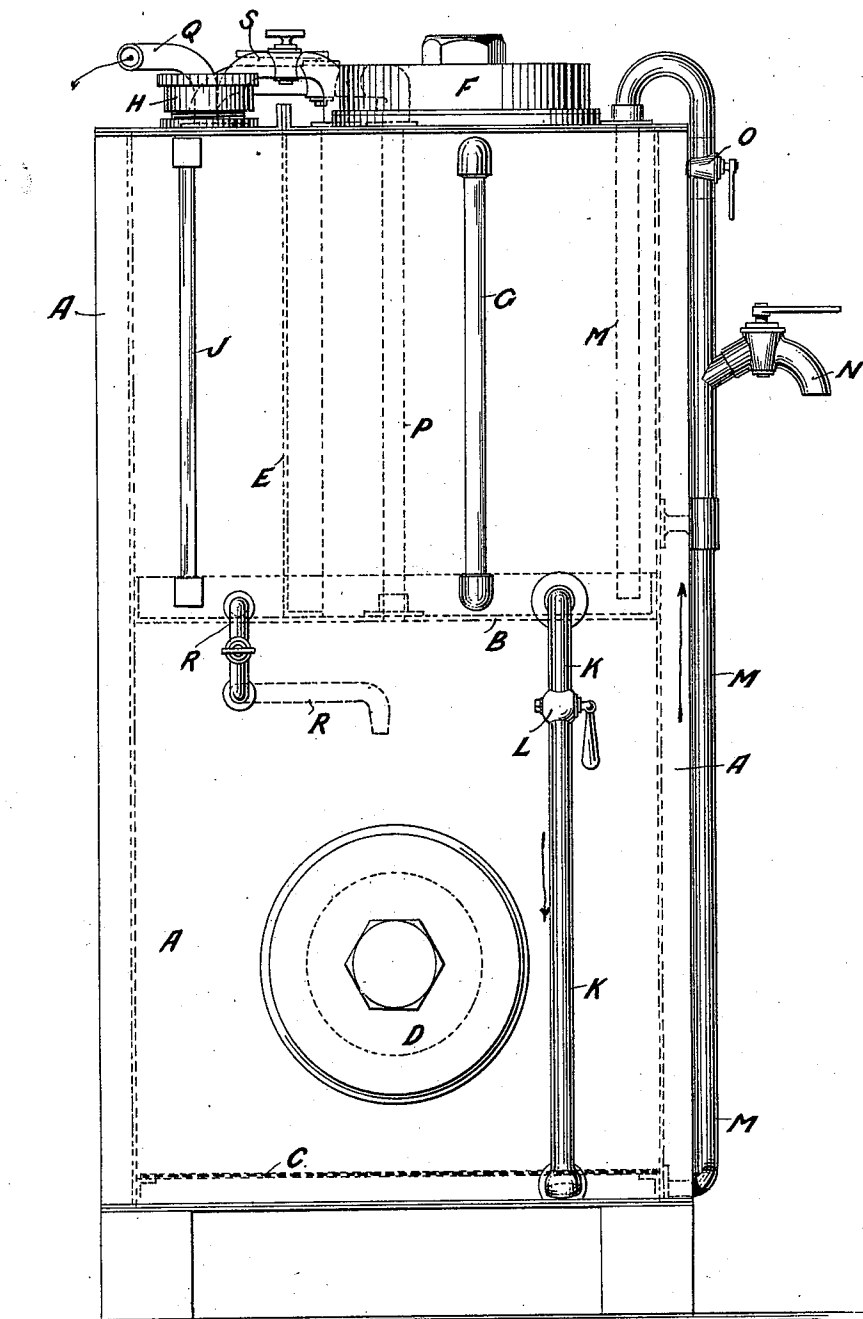
S. H. & H. HAWKINS.

APPARATUS FOR PRODUCING CARBURETED HYDROGEN.

No. 560,582.

Patented May 19, 1896.

FIG. 1.



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(No Model.)

2 Sheets—Sheet 2.

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FIG: 2.

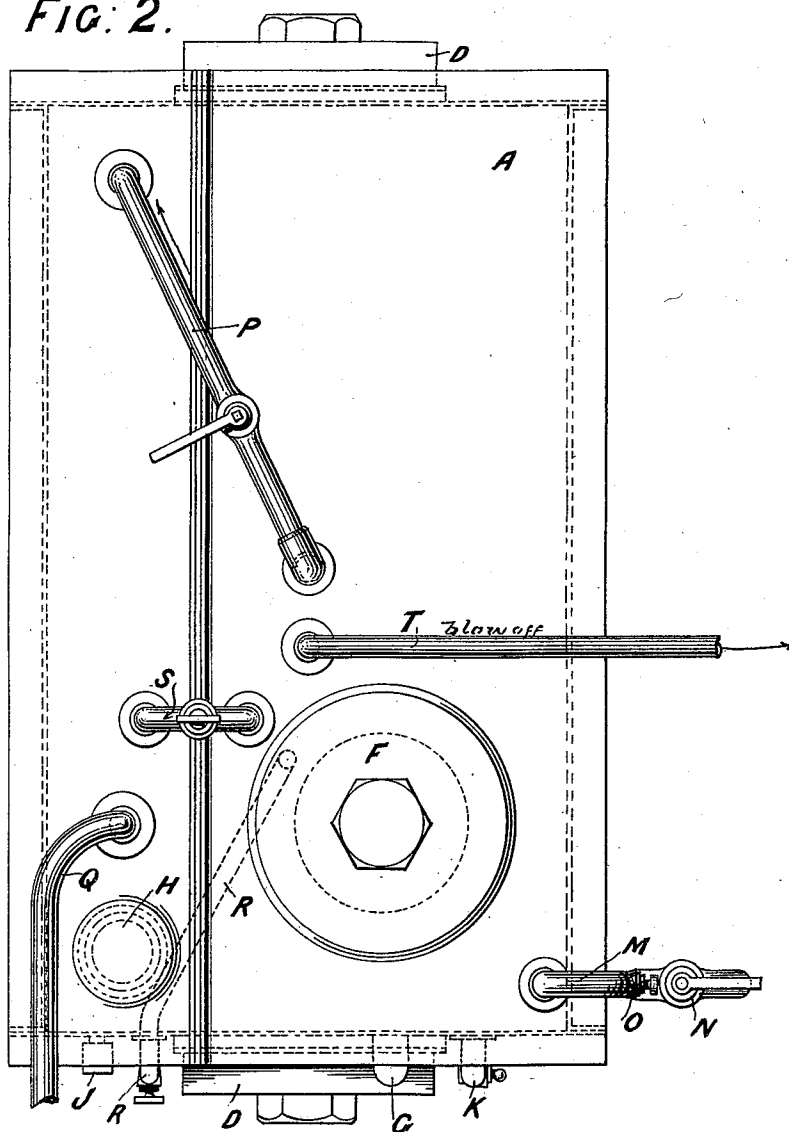
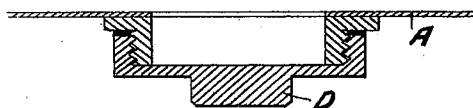


Fig: 3.



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UNITED STATES PATENT OFFICE.

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APPARATUS FOR PRODUCING CARBURETED HYDROGEN.

SPECIFICATION forming part of Letters Patent No. 560,582, dated May 19, 1896.

Application filed November 22, 1894. Serial No. 529,605. (No model.)

To all whom it may concern:

Be it known that we, SAMUEL HENRY HAWKINS and HENRY HAWKINS, subjects of the Queen of Great Britain, residing at London, England, have invented certain new and useful Improvements in Apparatus for the Production of Carbureted Hydrogen Gas and Metal Sulfates; and we 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.

An apparatus according to this invention presents several novel features, being capable of producing a carbureted hydrogen gas of great purity and illuminating power, which is also capable of being advantageously used in gas-engines, the production of the gas leaving a valuable residue—namely, sulfate of iron or zinc, according to whichever metal is used. When desired to produce pure hydrogen and metal sulfates, the carbureting arrangement is not used, or the apparatus can be limited to the production of either hydrogen or sulfates.

To enable this invention to be properly understood, we will proceed to describe the same with the aid of the accompanying drawings.

Figure 1 is a front elevation; Fig. 2, a plan, and Fig. 3 a section of hand-hole and mode of securing same.

The apparatus consists of a tank or chest A, preferably made of sheet-copper, though other metal may be employed that will withstand the action of sulfuric acid and water. The tank is divided across the middle with a partition B, thereby forming an upper and a lower chamber. The lower chamber has a false bottom C, made of a perforated copper plate. At the front and back of tank A is a hand-hole, closed by screwed-on cap D, to enable iron-metal shavings or zinc to be introduced into the lower chamber. These metal shavings rest upon the perforated false bottom C. This false bottom may be hinged in the middle or other part to enable a portion to be turned up to wash out the lower chamber. The upper chamber is divided by a partition E into two chambers, a large and

small one. The larger one is intended to hold sulfuric acid and water, which is put in through a hand-hole on top, which is closed by screwed-on cap F. The outside of this chamber is fitted with a gage-glass G to enable the height of the liquid within to be shown. The smaller chamber is intended to hold a carbureting material, such as benzin spirit, which is introduced through a hole in top, closed by screwed-on cap H. In the front of this chamber is also a gage-glass J to show the height of the spirit within. Connected to the outside of the acid and water chamber on a level with the partition is a pipe K, which passes down to bottom and is connected to an inlet below the false bottom, so that the acid and water passing down from the top chamber will enter the bottom one under the false bottom C and rise up in the bottom through the metal shavings. This pipe K is fitted with a tap L to control the outflow of acid and water. A second pipe M is connected to an outlet at bottom of tank and passes up the outside, being turned round at top and passes through the top of tank and is carried down the inside of the acid and water chamber to near the partition B. This pipe may be termed the "safety-valve" arrangement of the apparatus. When acid and water run into the lower chamber and rising through the metal, it will at once act upon the metal, decomposing the same and producing hydrogen gas in the usual known way. If the gas is not at once drawn off to keep down the pressure, the latter will force the liquid back to the upper chamber through the pipes K and M, when the generation of hydrogen ceases until the liquid comes down again. It will thus be understood that if the tap L is turned off when the acid and water have run down into the lower chamber the pressure of gas will then be limited to the height of the column of liquid in the pipe M, and by carrying the end of the pipe within the acid and water chamber down to near the bottom of it the outlet of this pipe is sealed until the chamber is emptied of its contents. By this means a uniform pressure of gas is secured within the bottom chamber. To enable the acid and

water to be withdrawn while working, the pipe M is fitted with taps N and O. In working the tap N is always closed and the other always open, being only closed when the other tap is opened to draw off. The partition B has an opening in the center, over which is attached one end of a pipe P to carry off the hydrogen gas. This pipe passes vertically through the acid and water chamber and is bent over the top of the carbureting-chamber to which it is fixed over a suitable opening for the purpose of enabling the hydrogen gas to pass into the carbureting-chamber, and so become carbureted by passing over the spirit. The gas is then drawn off by the pipe Q for use, as may be required. When it is desired to give an additional amount of carbureting to the hydrogen gas, the carbureting material is introduced in small quantities to drip upon the iron by means of the pipe R, fitted with the tap. A spout of the pipe extends some distance within the bottom chamber to enable the carbureting material to be carried toward the center. A gas-pipe S, fitted with tap on top, connects the carbureting-chamber with the acid and water chamber to enable any gas in same to be let into the acid and water chamber. The top of the latter is fitted with an outlet or blow-off pipe T to enable any gas that may find its way into the top chamber to blow off.

The invention has so far been described for the production of carbureted hydrogen gas, and we will now describe how metal sulfates are formed as a by-product in the production of this gas. In the production of metal sulfates by the action of sulfuric acid and water upon metal it is necessary to keep the liquid and metal continuously agitated to assist the liberation of the hydrogen, and we have found that by inclosing the hydrogen-chamber to obtain a pressure of hydrogen and arranging the acid and water chamber over the same the continual variations in the pressure by the drawing off of the gas causes the liquid to continually wash up and down through the metal, thereby automatically carrying out the agitation in the most perfect manner. When the acid and water have been entirely worked out by the metal, no more hydrogen gas is produced, and the whole of the acid and water remains in the lower chamber. When this is ascertained, the liquid is then drawn off into suitable receptacles, and in the course of a few hours crystallizes into sulfates of iron or zinc, according to which metal has been used, without any evaporation being required; but this crystallization will not take place unless the whole of the acid and water in the upper chamber has become thoroughly worked out by the action of the metal. For this reason the pipe K must be so connected to the acid and water chamber that the whole of the contents can run down into the lower chamber. Unless this takes place the liquid when drawn off will not crystallize.

From the above it will be readily understood that the invention can be employed to produce carbureted hydrogen and metal sulfates as by-products or metal sulfates alone. The proportions of acid, water, and iron that have been found to give good results are one pound and a half of acid to four pounds of water and one pound of iron.

Having now described our invention, what we desire to secure by Letters Patent of the United States is—

1. An apparatus of the character described, comprising a case divided into an upper acid-chamber, a lower chamber for the metal to be acted upon, and a carbureting-chamber, the latter being in the upper portion of the case, a pipe connecting said metal-chamber with said carbureting-chamber to conduct the hydrogen gas from the lower chamber into the carbureting-chamber, a pipe for carrying off the gas from the carbureting-chamber, a pipe and a cock regulating the same to drain the acid from the acid-chamber into the metal-chamber, a pipe connecting the top of the carbureting-chamber with the top of the upper acid-chamber, and a blow-off pipe leading from the top of said acid-chamber, substantially as described.

2. An apparatus of the character described, comprising a case divided into an upper acid-chamber, a lower chamber for the metal to be acted upon, and a carbureting-chamber, the latter being in the upper portion of the case, a pipe connecting said metal-chamber with said carbureting-chamber to conduct the hydrogen gas from the lower chamber into the carbureting-chamber, a pipe for carrying off the gas from the carbureting-chamber, a pipe and a cock regulating the same to drain the acid from the acid-chamber into the metal-chamber, a pipe connecting the top of the carbureting-chamber with the top of the upper acid-chamber, and a blow-off pipe leading from the top of said acid-chamber, and a siphon M connecting the lower metal-chamber with the upper acid-chamber and adapted to siphon the acid back into the upper chamber when the pressure of the hydrogen in the lower chamber becomes excessive, substantially as described.

3. An apparatus of the character described, comprising a case divided into an upper acid-chamber, a lower chamber for the metal to be acted upon, and a carbureting-chamber, the latter being in the upper portion of the case, a pipe connecting said metal-chamber with said carbureting-chamber to conduct the hydrogen gas from the lower chamber into the carbureting-chamber, a pipe for carrying off the gas from the carbureting-chamber, a pipe and cock regulating the same to drain the acid from the said chamber into the metal-chamber, a pipe connecting the top of the carbureting-chamber with the top of the upper acid-chamber, and a blow-off pipe leading from the top of said acid-chamber, and a

siphon M connecting the lower metal-chamber with the upper acid-chamber and adapted to siphon the acid back into the upper chamber when the pressure of the hydrogen in the
5 lower chamber becomes excessive, a cock O in said pipe M to regulate the flow of liquid therethrough, and a draw-off cock N to allow the liquid and gas forced into said pipe M

from said metal-chamber to be drawn off when desired, substantially as described.

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