(No Model.)

M. TRAUBE.

MANUFACTURE OF HYDROGEN DIOXIDE.

No. 302,800. Patented July 29, 1884.

Fig. 1.

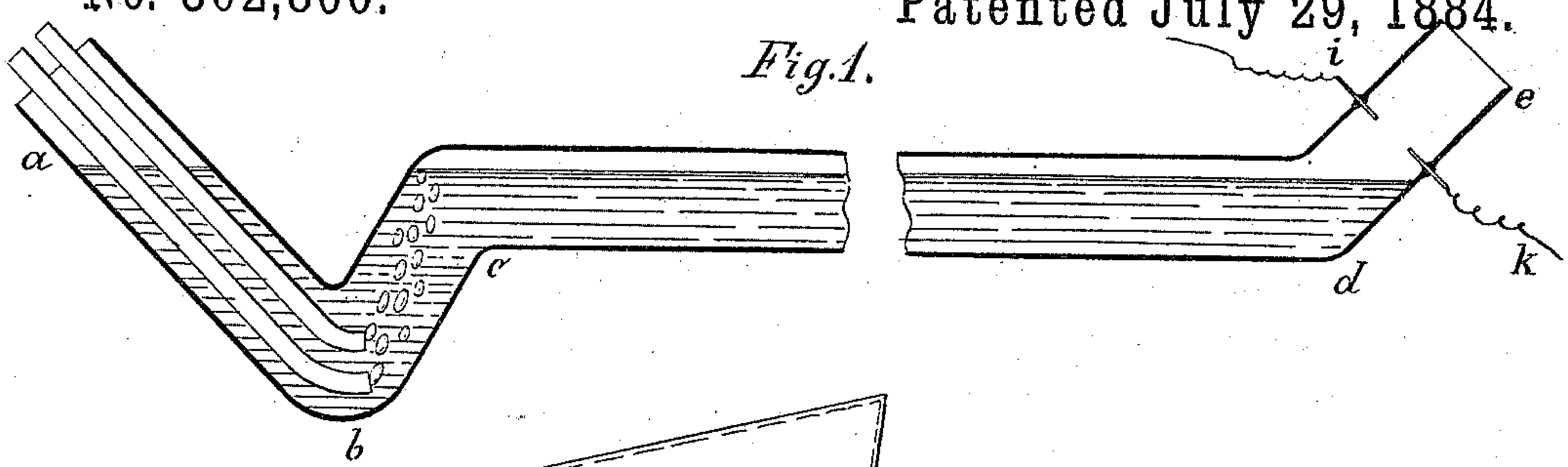


Fig. 2.

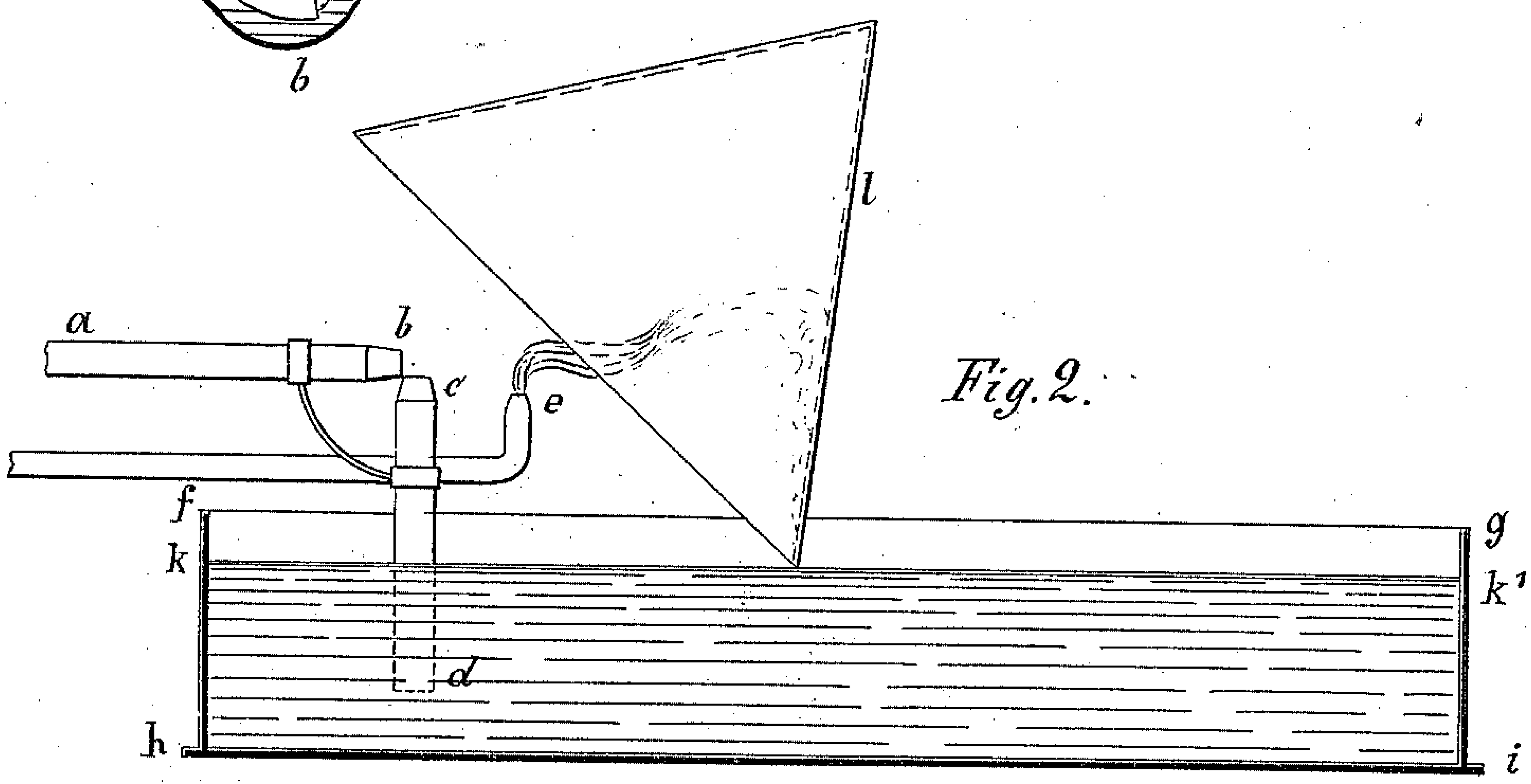


Fig. 3

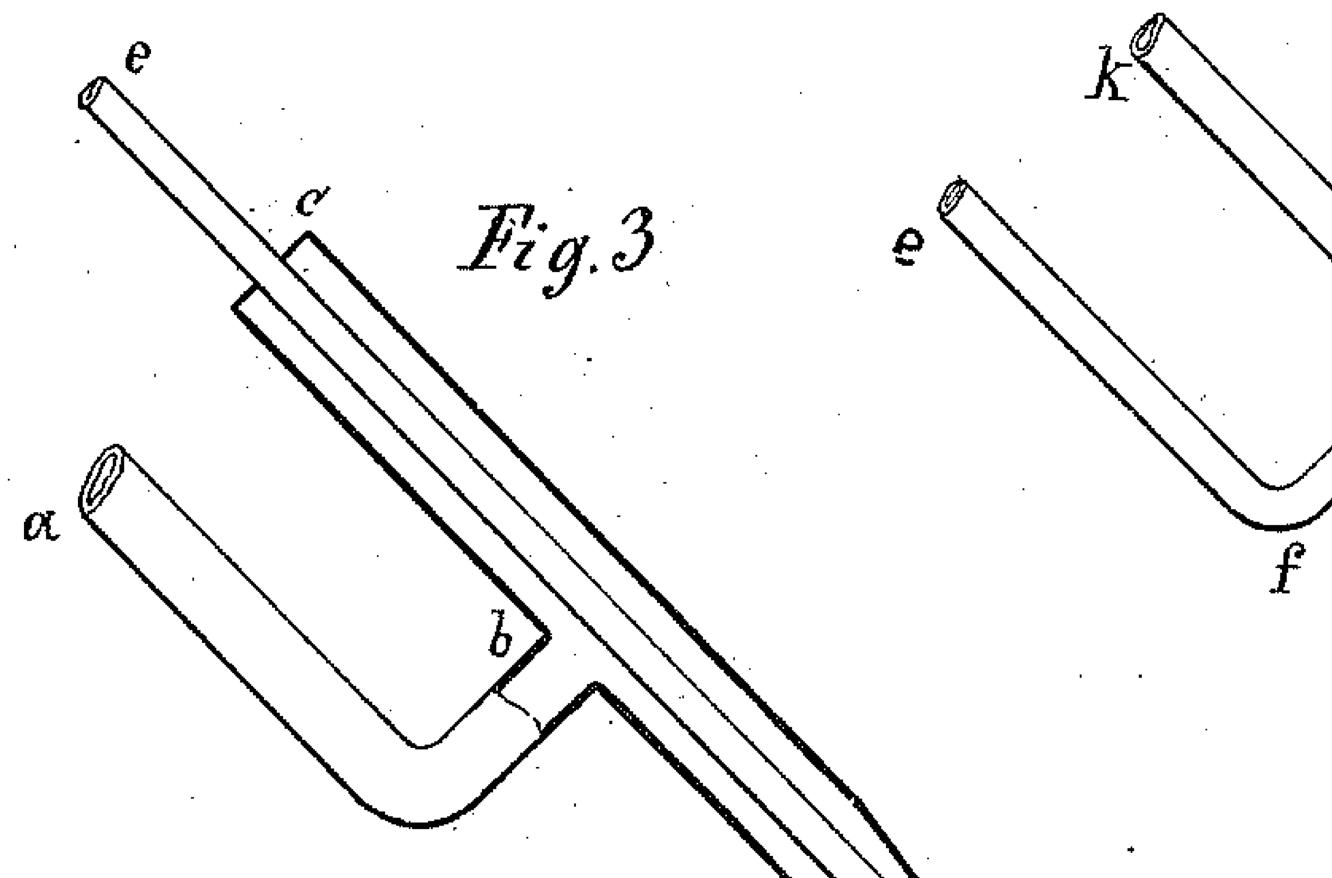
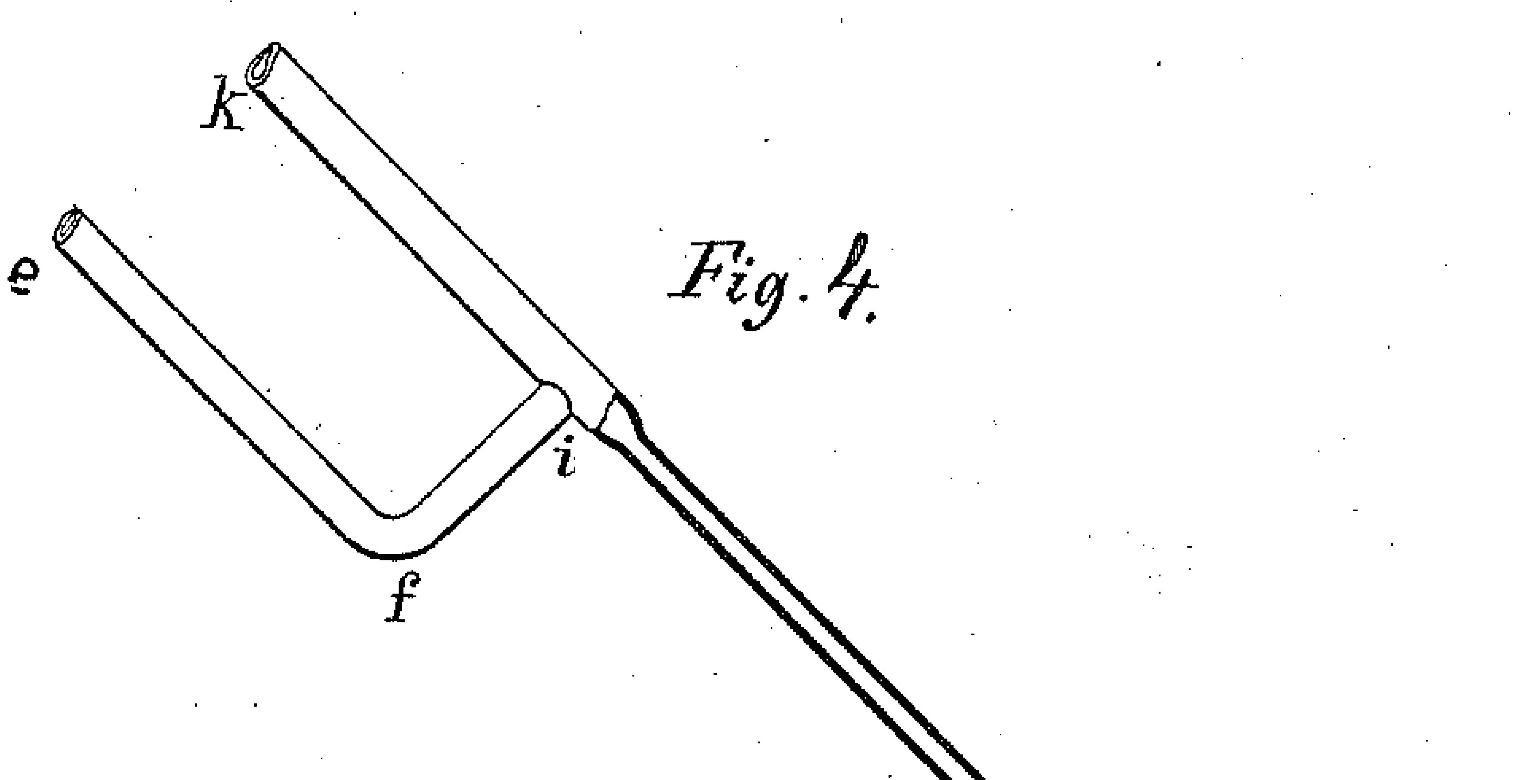


Fig. 4.



Witnesses
William Miller
Otto Hufeland

Inventor
Moritz Traube
by Van Santvoord & Hauff
his att'y's

N. PETERS. Photo-Lithographer. Washington, D. C.

UNITED STATES PATENT OFFICE.

MORITZ TRAUBE, OF BRESLAU, PRUSSIA, GERMANY.

MANUFACTURE OF HYDROGEN DIOXIDE.

SPECIFICATION forming part of Letters Patent No. 302,800, dated July 29, 1884.

Application filed November 22, 1883. (No model.)

To all whom it may concern:

Be it known that I, MORITZ TRAUBE, of Breslau, in the Kingdom of Prussia, German Empire, have invented certain new and useful Improvements in Devices for the Manufacture of Dioxide of Hydrogen, of which the following is a specification.

My invention has for its object a cheap and rapid production of hydrogen dioxide; and it consists in subjecting a gas-flame to the action of water, as hereinafter more fully set forth.

I have observed that a flame of carbonic oxide led into a bottle containing dry air generates no trace of hydrogen dioxide, but that such a flame generates large quantities of hydrogen dioxide when it is led onto water and burned in immediate contact with water. Hydrogen gas behaves in a similar manner. The immediate and most extended contact of the flame with water is absolutely essential for the production of large quanties of hydrogen dioxide, as the water has for its object not only to take up the hydrogen dioxide, but by its immediate contact with the flame the water affects the chemical process, in a manner specified herein. The hydrogen dioxide, as I have observed, is not generated for the first time upon the contact of the flame with water, but it exists already in the flame in considerable quantities. Under ordinary circumstances the hydrogen dioxide as soon as generated is almost totally destroyed by the great heat of the flame, while, when the flame is in contact with water, in consequence of the cooling action of the water the hydrogen dioxide escapes decomposition, at least in part. The yield of hydrogen dioxide is considerably increased when air is forced through the flame burning in contact with water. The beneficial effect of supplying oxygen is easily explained. If the burning gases do not contain oxygen, but a slight combustion takes place at those parts where the flame touches the water, in consequence of a limited supply of air; but if the gases are mixed with air a thorough combustion takes place also at those parts of the flame which are not so accessible to the surrounding atmosphere as other parts. If a powerful current of air is forced through the flame, it furthers the yield of hydrogen dioxide in so far as the flame plows or forces its way deeper into the water, thus increasing the contact-surface between the flame and the water. It is yet better if the combustible gases, mingled with air, are forced out of tubes into water, being first ignited at the mouths of the tubes. Favorable results are obtained especially with small flames, as these touch the water along a comparatively larger surface in proportion to their volume than larger flames. If the gases employed (carbonic oxide or hydrogen or a mixture of the two) are pure, and particularly if they contain no sulphureted or arseneted hydrogen, the hydrogen dioxide produced therefrom is chemically pure.

Illuminating-gas acts in a similar manner, as above set forth, as regards the formation of hydrogen dioxide, only the hydrogen dioxide in this case is not pure, but contaminated with burned products.

The material best employed for the flame generating the hydrogen dioxide is the cheap mixture of hydrogen, carbonic oxide, and carbonic acid known by the designation of "water-gas," and which is obtained by the action of steam upon well-charred charcoal or coke heated to an incandescent heat. Any contents of sulphureted hydrogen may be removed in any well-known method. The object now is to bring the flame of this gas into the most thorough possible contact with water in such a manner that the access of air (oxygen) to the contact-surface of the flame with the water is not hindered. This result may be attained as follows: The gas, mingled with air, is caused to pass into a horizontal tube filled with water to such an extent that above the water there remains a small air-space for the reception of the gas-mixture. The explosion of this gas-mixture is effected by electric sparks or by a flame. At one end the tube is bent, as at *a b c*, Fig. 1, and filled with water. In the branch *a b* are two tubes—one for combustible gas, the other for air. The rising bubbles pass through the branch *b c* to the air-space in the tube above the water, and when they reach the branch *d e* they are ignited or exploded by an electric spark passing from one of the terminals *i k* to the other, which terminals may be fused into the tube or otherwise attached therein; or a flame may be employed for the electric spark and applied at the mouth *e* of the tube. The useless gas remaining after the explosion is forced out by the continually-entering explosive mixture, which is again ignited as soon as it has advanced to the end of the horizontal tube. The explosions thus follow one upon the other the more rapidly in proportion as the explosive mixture flows in more rapidly. Another mode is to throw a water-spray by means of an atomizer or other suitable means through the flame, and catching the water thus charged with hydrogen dioxide by means of a screen.

In Fig. 2 the letters *f g h i* represent a receptacle in which water reaches up to the level *k k'*. In this water rests the tube *d c*, open above and below, and having its mouth provided with an aperture smaller than the channel in the tube. A powerful current of air is forced out of the tube *a b*, above the mouth *c* of the tube *c d*, which current of air causes water to rise in the tube *c d* and forces or throws it in the form of a spray and mingled with air through the flame at the mouth of the tube *e*, whence it is caught by the screen or funnel *l*, at the walls of which it condenses and flows back into the receptacle *f g h i*, to be again taken into the tube *c d* and forced into the flame at the mouth *e*, and to receive fresh quantities of hydrogen dioxide. Another mode to accomplish the desired result is to force a central current of air through a flame burning above water in a similar manner as is done in blow-pipes. Fig. 3 shows an apparatus to accomplish this end. The compressed air is forced into the tube *e f*, which may be narrowed at its lower end, *f*. The tube *e f* passes centrally through the tube *c d*, into which the combustible gas enters from the tube *a b*. At *c* the central tube is connected air-tight with the tube *c d*, so that the combustible gas can only flow out at the mouth *d*. If the gas is ignited at the mouth *d*, the current of air flowing out of the tube *e f* forces the flame deep into the water, (shown at *g h*,) the blow-pipe being advantageously placed at an angle of about from thirty to forty-five degrees with the level of the water. Another mode is to force, by pressure, small flames of the gas mingled with air into water. An apparatus serving for this purpose may be constructed for each single flame in the manner shown in Fig. 4. The combustible gas enters through the tube *e f i*, the air through the tube *k i*. At *i* the gas and air mingle, and then flow through the capillary-tube or fine tube *i l* to its mouth, where the mixture is ignited. If the capillary-tube is placed at an angle of about from thirty to forty-five degrees against the surface *g h* of the water, the gases being under pressure, the flame will be forced into the water. From fine capillaries a mixture of equal parts by volume of water-gas and air under pressure will not burn. This disadvantage may be overcome, as I have found by employing capillaries which are considerably enlarged at their lower ends. From such capillaries water-gas will burn even when containing a greater proportion of air, and even when under pressure up to one-quarter of an atmosphere.

It is advantageous to render the air which is supplied to the flame in these proceedings free from dust, which may be accomplished by means of flocculent glass; also, the water subjected to the action of the flame must be continually cooled, so that the hydrogen dioxide which is taken up is not decomposed.

It will be seen that all the above-described modes of operation are in reality modifications of one another, all accomplishing the same result—namely, a contact of the flame with water.

It should also be remarked that in all these methods of operation a thorough contact of the flame, with water extending over the largest possible surface, is to be attained.

I am aware that Schuller has found (see Wiedemann's Annalen, 1882, volume XV, page 289) that when hydrogen flowing out at a slow rate is burned in oxygen, the water which is precipitated contains only traces of hydrogen dioxide, while, when the hydrogen flows out rapidly, appreciable but still very small quantities of hydrogen dioxide are generated. This process I consequently do not claim.

It is also to be noted that if a carbonic oxide or hydrogen flame is burned in a bottle containing air, in which is also contained water, but not in direct contact with the flame, there are only generated small quantities of hydrogen dioxide. Consequently my object is to attain a thorough contact of the flame with water.

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

The process of producing hydrogen dioxide consisting in bringing water and a flame of carbonic oxide or other gas into contact with each other, all substantially as described.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

MORITZ TRAUBE.

Witnesses:
LOUIS MERTH,
B. ROI.