C. DELCAMPE.

ACETYLENE GENERATOR.

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1,038,489.

Patented Sept. 10, 1912

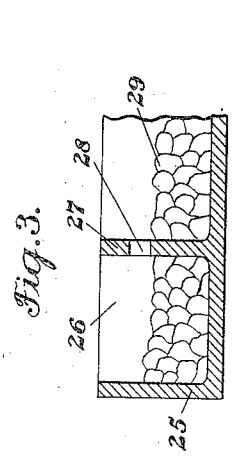

Fig. 3.

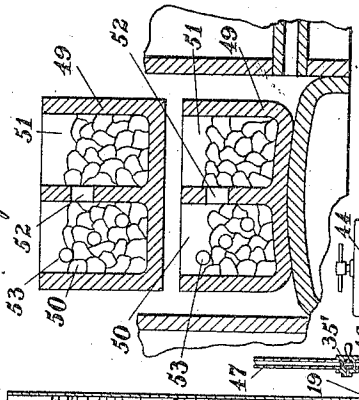

Fig. 4.

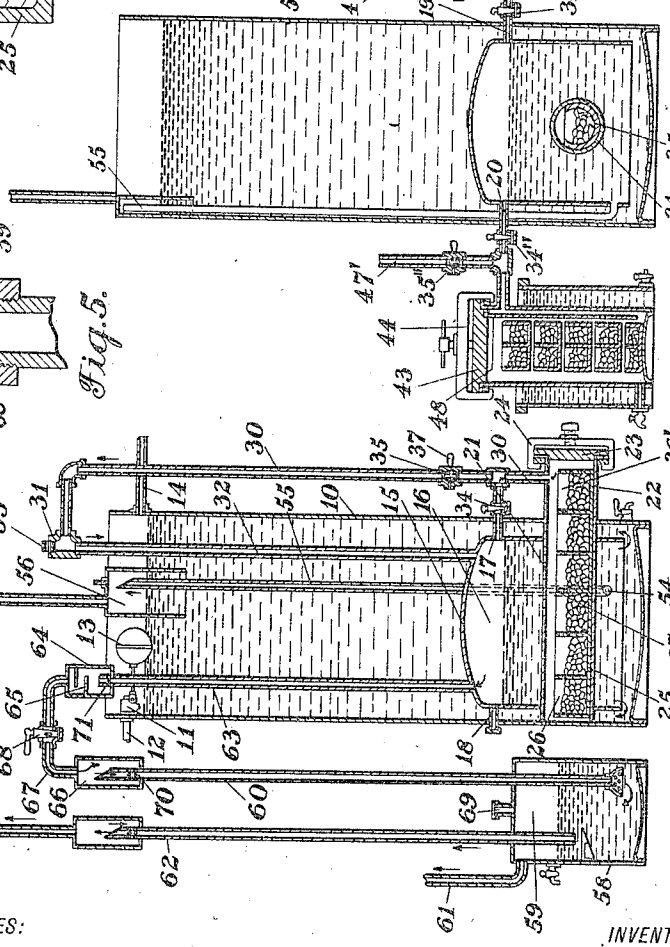

Fig. 2.

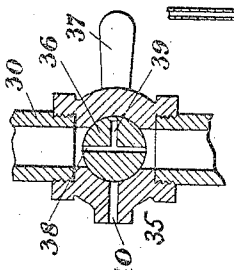

Fig. 5.

Fig. 1.

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ACETYLENE-GENERATOR.

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To all whom it may concern:

Be it known that I, CYRILLE DELCAMPE, a subject of the King of Belgium, residing in the city of Bridgeport, county of Fairfield, and State of Connecticut, have invented certain new and useful Improvements in Acetylene-Generators, of which the following is a full, clear, and exact description, reference being had to the accompanying drawings, forming part of this specification.

This invention relates to gas generators and particularly to apparatuses for generating acetylene gas from carbid of calcium; and its primary object is to provide an apparatus for generating and storing gas which shall operate automatically, the supply of water to the carbid being regulated by the consumption of the gas contained in the gas holder and the supply of cooling water being also controlled by the same.

A further object of this invention is to provide an improved construction of gas generating and storing apparatus in which the gas holder is entirely submerged in the water tank and completely surrounded by water on all sides; the effect of this arrangement being to keep the gas at a low temperature and to provide an effective water seal for the holder containing the same.

It is advantageous to employ in connection with the present acetylene gas generating and storing apparatus, an improved water seal valve inserted between the delivery pipe of the apparatus and the pipe leading to gas consuming appliances, preventing foreign gases at a higher pressure from reaching said gas chamber. This water seal valve is especially useful where the acetylene gas is used in welding plants in connection with oxygen; if the blow pipes should for any reason become plugged, oxygen being usually at a higher pressure will form a back pressure in the acetylene gas piping, and unless prevented from doing so by some suitable appliance, will reach the acetylene gas chamber forming with the acetylene gas contained therein a powerful explosive mixture.

A still further object of this invention is to provide an improved construction of acetylene gas generating and storing apparatus of a simple and efficient design combining various valuable features for insuring the automatic feeding of water to the water tank, the gradual consumption of carbid in the retorts, etc.

With these and other objects in view such as will more fully appear as the description proceeds, this invention consists in certain constructions and arrangements of parts as will be hereinafter fully described and claimed in the appended claims.

It is well known that acetylene gas is an endo-thermic compound, and in order to improve its stability, it is highly desirable that the same be kept at a low temperature, both while being evolved and while being stored for consumption purposes. The reaction of water and carbid of calcium takes place with the production of considerable heat, which is absorbed by the water usually surrounding the generating chambers within which said reaction takes place.

In the current types of acetylene generators, the gas holder usually consists of a bell which is caused to rise or to lower within the water tank, forming a water seal for the same, according to the quantity of gas contained therein. The displacement of water taking place on account of these movements of the bell or gasometer are only thus due to the difference in the volume of the part of the bell submerged in the different positions, and in comparison with the total quantity of water contained in the tank, said displacements can be said to be very small. The water of the water tank is not always renewed, and where devices have been applied to keep the same at a constant level, the same only have to supply to the tank such water as may be lost through evaporation, leakages, and possibly overflowing due to said up and down movements of the gas holding bell.

Where a considerable quantity of gas is produced and used, and where the production of such gas is automatic and continuous, I have found that in order to keep the temperature of the cooling tank at a low point, it is desirable that the water in the same be renewed with a certain frequency; therefore I have provided an apparatus in which the volume of the gas produced does not force up the bell in which the same is contained, but forces a certain volume of water out of the bell and a corresponding volume out of the water tank. As the consumption of gas takes place, the water thus forced out of the water tank will be replaced by water fed from the mains by means of an automatic valve controlled by a float or by any other suitable means. The volume of water thus

renewed at each time that the production of gas takes place is much more considerable than in the usual type of generator and effectively satisfies the requirements of a continuously working plant.

Referring to the drawings, Figure 1 is a vertical sectional view of my improved acetylene generator, showing a water seal relief valve which may be employed for example in connection with a welding plant (not shown); Fig. 2 is a sectional view of the same at right angles to Fig. 1, showing a way of connecting the gas holding bell to additional independent generators; Fig. 3 is a detail sectional view showing the operation of my improved form of carbid holders to be used in connection with the horizontal generating chamber provided in my generator; Fig. 4 is a detail sectional view showing the operation of my improved carbid holders to be used in connection with auxiliary generators, provided in the supplementary generators which may be used in connection with my apparatus; and Fig. 5 is a detail sectional view of a three way valve which may be used for controlling the opening and closing of the gas conveying pipe.

My apparatus is composed of a tank 10, provided at its upper part with a feeding valve 11 connected to the water main 12, and controlled by a float 13 which automatically keeps the water at the level shown in the drawing. Said tank is also provided with an overflow 14, through which a portion of the water contained in tank 10 escapes every time that the production of gas takes place, as will be hereinafter set forth. Internally to said tank 10 and at the lower part of the same is mounted a gas holder 15 having the shape of an inverted bell open at the lower part, having a diameter smaller than the diameter of the tank so as to be entirely surrounded by water, and having its lower edge a few inches away from the bottom of tank 10 so as to leave free communication between the outside and the inside of the bell. The upper part of bell 15 forms a gas holding chamber 16, in which gas is held under the pressure due to the difference in level between the water contained in the tank and the water inside of the bell; in normal conditions, the level reached by the water within said bell is equal to that of overflow outlets or water feed pipes 17, 18, 19, 20, arranged around said bell at an even height. 21 designates a hermetically sealed generating chamber provided within said tank and bell and extending diametrically thereacross, having an outer projecting portion 22 constituting the charging end of the same and closed by means of a cover 23 and a clamp 24, or in any other suitable manner. Within said generating chamber is inserted a carbid holder 25, which is preferably composed of a series of compartments 26, divided by partitions 27, as illustrated in detail in Fig. 3. Each compartment communicates with the adjoining ones by means of an overflow 28 near its upper edge, and the carbid 29 is arranged in said compartments so as to reach about the level of said overflow. Said carbid holder is adapted to fit longitudinally within the generating chamber so as to have its outer compartment 26′, directly underneath the pipe 30 attached to the upper side of projecting part 22 of said generating chamber. Said pipe 30 extends upwardly alongside of tank 10 and is bent above the edge of the same to be connected by means of a joint 31 to a pipe 32 upwardly extending from the top of bell 15. Said joint 31 has also an additional opening shown in the drawing Fig. 1, fitted with a plug 33 for connecting the same with additional generating chambers when desirable. Pipe 30 is connected to overflow or water feeding pipe 17, the flow of water through said pipe 17 being controlled by means of a stop cock 34, inserted between bell 15 and pipe 30. Above the point of connection between pipe 17 and pipe 30, I provide a three-way valve 35, shown in detail in Fig. 5, in its opened position. The plug 36 of said valve is provided with an operating handle 37, and has a diametrical opening 38 adapted to establish communication between the lower and the upper part of pipe 30, and an opening 39 radially extended on one side of said opening 38. The body of the valve 35 is provided with a blow-off opening 40 on the side, and it can be seen that by turning handle 37, 90 degrees downward, plug 36 will close the upper part of pipe 30 and connection will be established between the lower part of said pipe 30 and said blow-off opening 40.

Coming now to examine the operation of the different parts heretofore mentioned, gas is automatically and continuously supplied in the following manner. Assuming the level of the water in the bell to be at or above that of the overflow feed outlets, valve 35 is first set to the position shown in the drawing, establishing communication between the lower and the upper parts of pipe 30. Stop cock 34 is then opened so that some water will flow from the inside of the bell through pipe 17 and down through the lower part of pipe 30 and will drip in first compartment 26′ of carbid holder 25. A certain quantity of acetylene gas will be immediately produced nd will be conveyed through pipes 30 and 32 to the gas chamber 16. The action of this gas will be to force the water out of the bell, reducing the level of the same inside of the bell and therefore stopping the supply of water through pipe 17. The production of gas due to the water first supplied will continue for sometime until the reaction is completed and all the

said water exhausted, and while the gas is thus gradually produced, the level of the water within bell 15 becomes lower and lower, and the water thus forced out goes to swell the quantity of water contained in the water tank outside of the bell, which will thus flow through overflow 14 until the original level is reached. As the gas contained in chamber 16 is being used by the consuming appliances, the water within the bell will gradually rise until it reaches the level of the overflow feed outlet or outlets, while in the meantime, the level in the water tank accordingly tends to become lower thus causing float 13 to operate valve 11 letting in a new supply of water to replace the water which has been lost through overflow 14. As soon as the water in the bell reaches the level of the feed pipes, some water will again flow through pipe 17 and down pipe 30, immediately causing a new quantity of gas to be produced and causing the same cycle of operations to take place. When the carbid contained in compartment 26′ is all used up, the water flowing in the same will have no effect, and no production of gas will take place until the water in compartment 26′ will reach the level of its overflow 28, when said water will pass into the next compartment, causing the production of a fresh supply of gas. In a similar manner the carbid contained in said next section will all be used up before the water can reach the carbid contained in the next compartment, and so on until the entire series of compartments are used up, when a new charge will be made. While inserting a new charge of carbid it is obvious that stop cock 34 and valve 35 should be closed. When the apparatus is out of use, stop cock 34 is normally closed and plug 36 is set at the position where the inside of the generating chamber 21 communicates with vent outlet 40, so as to permit any gas which may be produced in the generating chamber on account of moisture remaining therein to escape freely to the air.

As it has been previously stated, bell 15 is fitted with several outflows or water feeding pipes; and the same can be closed with a plug or cap if not used, as seen for instance in Fig. 1, in connection with pipe 18, or else can be connected to independent generators when a considerable quantity of gas is to be produced.

In Fig. 2, I show an arrangement in which the connection of my improved machine with two additional generators is illustrated. Said additional generators can be of any suitable description and consist preferably, as shown in the drawing, of a cooling tank 41, in which is provided a vertical generating chamber 42 hermetically sealed by means of a cover 43 and a clamp 44. Each generating chamber is fitted with an outlet 45 connected by means of a joint 46, to a pipe 47, which may be connected to pipe 32 in a manner similar to pipe 30. To said connections 46 are also connected pipes 19, 20, in which are located stop cocks 34′, 34″, respectively, between said connections 46 and bell 15. Pipes 47, 47′, are also provided with three-way valves 35′, 35″, said stop cocks 34′, 34″ and three-way valves 35′, 35″, being exactly similar in scope and operation to stop cock 34 and three-way valve 35, hereinbefore described. As in the previous case, outlet 45 for the gas is also utilized as a feed inlet for water. A separating wall 48 is provided opposite to outlet 45 to compel the water to flow to the bottom of the generating chamber before reaching the carbid containers. The carbid is charged into the generating chamber by means of carbid holders 49, serially arranged one above the other within the same. This arrangement also insures the gradual consumption of the carbid, the carbid in each holder being attacked as the level of the water rises within the generating chamber. Each carbid container, as illustrated in Fig. 4, is preferably composed of two compartments 50, 51, in inter-communicating relation to each other by means of an overflow 52. Water is admitted to chamber 50 through perforations 53, provided in one of its sides, and when the carbid contained in compartment 50 is completely used up, said compartment will fill with water until the level of the same reaches the height of the overflow 52, when it begins to be fed to compartment 51, generating gas from the carbid contained therein. This process takes place until the carbid in all the containers is exhausted. The arrangement described, in which a single gas holder is independently connected to several generators, renders it possible to generate a considerable quantity of gas at the same time, such as may be needed in a plant connected to a large number of consuming appliances; at the same time in the arrangement shown, the production of said large quantity of gas is just as uniformly and accurately regulated as the smaller production which can be obtained through one single generator. This arrangement has the additional advantage of insuring the continuity of the operation, inasmuch as each generator can be independently connected to and disconnected from the gas holder; when the supply of carbid in one generator is exhausted, the same can be disconnected and recharged while the operation of the apparatus goes on with the remaining generators. In case of an over supply of gas or when the pressure in the gas holding bell suddenly increases on account of the simultaneous shutting off of all the gas consuming appliances, the water

level in said bell will descend to a point 54 when the gas will be allowed to escape through the relief pipe 55, leading from the inside of the gas holding bell to a point above the water level in the water tank, within a chamber 56 communicating with the outside. Said chamber 56 is formed in the shape of an inverted bell with the lower edge, inserted into the water so as to form a water seal for the space 56, and said space 56 communicates with the outside by means of a pipe 57 out of alinement with pipe 55. Any foreign matter that should enter pipe 57 from the outside will thus fall into the water and will not have a chance to reach the inside of bell 15 through pipe 55.

The delivery of gas from the gas holder to the consuming appliances may be made in any well known manner; when the apparatus is to be used however, in connection with an oxy-acetylene welding plant, it is necessary to prevent the formation of a mixture of oxygen and acetylene in the gas holding chamber in order to insure safety in operation of the plant. In welding plants of this kind, oxygen gas is usually delivered to the blow pipes at a pressure higher than that of the acetylene, and if for any cause the blow pipes should become plugged there is danger of the oxygen pushing back the acetylene through the piping on account of its higher pressure and forming highly explosive mixtures therewith within the apparatus. In order to prevent occurrences of this kind and the dangers ensuing therefrom, I provide a novel water seal relief device composed of a tank 58 filled with water up to a certain height, forming a chamber 59 at its upper portion. The gas coming from the gas holding bell is delivered to said water seal relief device by means of a pipe 60, the lower end of which is immersed in the water contained in said tank 58 down to a level a little above the bottom of said tank.

61 is a pipe delivering the gas to the blow pipes, having its inlet at the upper part of chamber 59 in tank 58.

62 is a blow-off pipe communicating with the outside, and having its lower end immersed in the water contained in tank 58 a little below the level of the same but at a point considerably higher than the lower end of pipe 60.

The gas coming from pipe 60 will pass through the water contained in tank 58, by which it will be washed and freed of any foreign matter which the same may contain; the same will then pass through chamber 59 and pipe 61 and be delivered to the blow pipes. If for any cause a back fire should occur, or in other words, if for any cause oxygen should form a back pressure in pipe 61, and enter chamber 59, the pressure of the same being higher than that of the acetylene gas contained in chamber 61, the water contained in tank 58 will be forced out of the same through pipe 60. As soon as the level of the water in tank 58 has been lowered sufficiently to uncover the end of pipe 62, however, the gas will freely escape through the same to the outside, and the end of pipe 60 being still immersed in the water, no gas will have a chance to enter into the same.

63 designates a pipe extending from the top of bell 15 for delivering the gas to pipe 60 and to water seal relief device 58; at the upper end of the same is provided a chamber 64 having horizontal separating surfaces 65, forcing the gas to follow an irregular course, retarding the motion of the same and retaining any liquid or foreign matter which might be carried therewith. The upper end of pipe 60 terminates within a larger chamber 66 and a pipe 67 between the upper part of chamber 66 and the upper part of chamber 64, completes the connection between pipe 63 and pipe 60. Said pipe 67 is provided with a stop cock 68 by means of which connection can be opened or closed at will. Water will be put into tank 58 by means of a filling plug 69 in the top of the same and during this operation it will be necessary to close stop cock 68.

It will be noted that the end of pipe 63 projects above bottom of chamber 64, and that the end of pipe 60 projects above the bottom of chamber 66, both pipe ends being provided with perforations 70, 71, near the bottom of their respective chambers. The object of this is to allow any liquid matter carried with the gas or resulting from condensation of the heaviest volatile matters contained in the same to drip down through the respective pipes to the under-lying water.

In generating and supplying acetylene for use with oxy-acetylene blowpipes and the like, the proper regulation of the pressure of the acetylene is of the utmost importance. For such purposes acetylene must be furnished at pressures rather higher than are usual with fuel gases, and for a given class of work the pressure should vary only within comparatively narrow limits. An acetylene pressure equivalent to about 8 feet of water is suitable in many connections where oxy-acetylene blowpipes are used in welding and cutting operations for example, and in order to maintain the proper shape and quality of the flame for some classes of work, the acetylene pressure must not vary far from this amount. This result is difficult to attain in practical work, especially where there are a number of blowpipes taking acetylene intermittently from a single generating apparatus, thus rendering it necessary to furnish gas at practically constant pressure in extremely

fluctuating quantity. In the present apparatus, the relatively great depth of the water tank as compared to height of the gas storage bell arranged in the tank near its base, taken with the overflow outlet and automatic water feed located near the top of the tank, makes readily possible the maintenance of a relatively high and reasonably constant pressure of acetylene no matter how variable the demand may be. Speaking approximately, the maximum variation in pressure possible in the present apparatus is that due to the difference between the possible upper and lower limits of water level in the submerged bell; and this difference, as can be seen at once, is only a minor fraction of the substantially fixed height of the water column which is above and around the bell and which forms a substantially constant positive component of the net water pressure on the imprisoned gas.

From the foregoing it will be seen that I provide an apparatus simple in construction and in operation, fulfilling all the essential requirements which an apparatus running for a considerable time is expected to satisfy, namely, continuous generation of gas, automatic regulation of the same, frequent renewing of the cooling water during the operation, gradual consumption of the carbid contained in the generators, means for keeping the gas at a low temperature, and embodying various safety appliances in order to prevent over-production of gas, and in order to prevent foreign gases at a higher pressure from entering the gas holding chamber.

It is to be understood that many of the constructive details of my apparatus can be changed to a certain extent without substantially departing from the spirit of my invention; and I reserve the right of bringing to the same all those various changes and modifications which may be required to satisfy the individual requirements of various plants and which fairly enter into the scope of the appended claims.

I claim:

1. Apparatus for generating acetylene gas comprising a water tank provided with water supply means and an overflow outlet, a stationary gas storage bell arranged within said tank and wholly below the level of the overflow outlet, a generating chamber arranged within said bell and sealed from direct communication therewith, valved conduit means connecting said bell and generating chamber and means for conducting gas from said bell to a place of use.

2. Apparatus for generating acetylene gas comprising a water tank provided with water supply means and an overflow outlet, a stationary gas storage bell arranged within said tank below the level of the overflow outlet, a generating chamber extending transversely through said bell and tank and sealed from direct communication therewith, valved piping connecting one end of said generating chamber with the upper part of said bell, overflow water supply means connecting said bell with said generating chamber, and piping leading from said bell to a place of gas consumption.

3. Apparatus for generating acetylene gas comprising a water tank, automatic feed means for maintaining water in said tank at a substantially constant normal level, a stationary gas storage bell arranged to be wholly submerged within said tank, a gas generating chamber, means for feeding water from the interior of said bell to said generating chamber when the water reaches a predetermined level in said bell, the height of such water feeding means above the lower edges of said bell being a minor fraction of the height of the normal water level in said tank above such edges, means for conveying gas from said generating chamber to said bell at a point above such water feeding means, and means for conveying gas from said bell to a place of use.

4. Apparatus for generating acetylene gas, comprising a relatively tall water tank having an overflow outlet arranged in its upper portion, means controlled by the liquid level in the tank for supplying water to said tank, a gas storage bell located within and near the base of said tank, the height of said bell being small as compared to that of said tank, a gas generating chamber connected to said storage bell, and means for conveying gas under pressure from said bell to a place of use.

5. Apparatus for generating acetylene gas, comprising a water tank having an overflow outlet adjacent its upper edge, means controlled by a float valve for supplying water to said tank, a gas storage bell arranged in said tank with its lower edges adjacent the tank bottom, the height of said bell being a minor fraction of the height of said tank, a gas generating chamber, an overflow feed for supplying water from the interior of said bell to said generating chamber, a conduit connecting said generating chamber with the upper part of said bell, and a conduit for conveying gas under pressure from said bell to a place of use.

6. Apparatus for generating acetylene gas, comprising a water tank having an overflow outlet, means controlled by a float valve for supplying water to said tank, a gas storage bell arranged within said tank below said overflow and having its lower edges in proximity to the tank bottom, a gas generating chamber, an overflow feed for supplying water from the interior of said bell to said generating chamber, the height of said overflow feed above the lower edges of

said bell being a minor fraction of the height of said tank overflow above such edges, and suitable piping means for conveying gas from said generating chamber to said bell and from said bell to a place of use.

7. Apparatus for generating acetylene gas comprising a water tank provided with an overflow outlet and float-controlled water supply means for maintaining the water level in the tank substantially at that of said overflow outlet, a stationary gas storage bell arranged within said tank and wholly below the level of said overflow outlet, a gas generating chamber, means for conducting generated gas from said chamber to said bell, and means for conducting gas from the bell to a place of use.

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