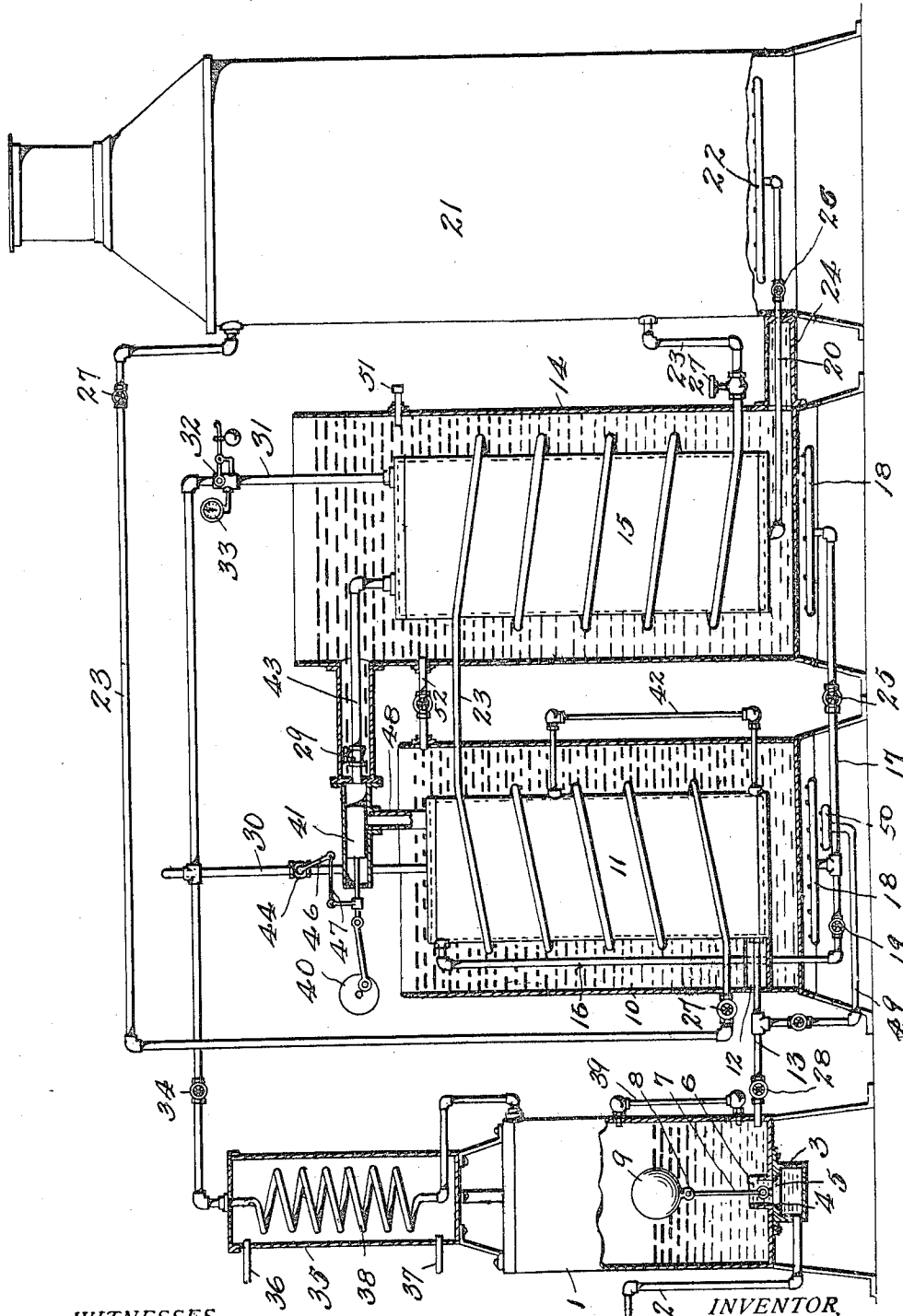


G. M. ECKELS.
GAS GENERATOR.
APPLICATION FILED JULY 24, 1909.

Patented June 6, 1911.

994,135.



WITNESSES

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GAS-GENERATOR.

994,135.

Specification of Letters Patent.

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To all whom it may concern:

Be it known that I, GEORGE M. ECKELS, a citizen of the United States, residing at Mechanicsburg, in the county of Cumberland and State of Pennsylvania, have invented certain new and useful Improvements in Gas-Generators, of which the following is a specification.

The object of my invention is the provision of means for the vaporization, or changing to the form of gas, of alcohol or any similar volatile liquid which is capable of being vaporized by means of heat not greater than 212° F., and which will condense or assume the liquid form again at a temperature of 170° F. or less.

It further consists in the provision of means for maintaining in a gaseous form until used the fugitive or unstable gas, obtained from alcohol or similar liquids by means of heat.

It further consists in appliances for conducting the gas generated to one or more condensing tubes which condensing tubes or receptacles act as a safety valve or pressure reducer to the apparatus and thus eliminate all possibility of explosion in the same.

A further object is the provision of means for taking care of the condensed liquid and the proper storage of the same. The means being adapted to insure that under no circumstances shall there be any waste of the alcohol and that it must either be consumed or saved by condensation.

Finally, the invention consists in certain novelties of construction and combinations of parts as herein set forth and pointed out in the claims.

The accompanying drawing illustrates an example of the physical embodiment of the invention constructed according to the best of the several modes I have so far devised for the practical application of the principle.

The single figure shows the entire apparatus in elevation, parts thereof being in section.

Referring to the figure, the numeral 1 designates a feed tank preferably consisting of any suitable inclosed receptacle; 2, a pipe leading from said tank to a reservoir, not shown; 3, a valve casing in connection with pipe 2 and the tank; 4, a conical valve seat in the casing; 5, a valve adapted to fit the seat; 6, an opening in the valve casing; 7, the valve stem loosely fitting the opening in the valve casing; 8, a double eye connection at one end to the valve stem and the external surface of a hollow float ball 9 which is freely movable within the tank the operation of the same being well known; 10, a hot water boiler of any suitable construction preferably insulated to prevent the radiation of heat and open to the atmosphere, forming practically a hot water bath surrounding the vaporizing tank shown in elevation; 11, the vaporizing tank; 12, a circular opening in that side of the boiler 10 nearest to alcohol tank 1 for the entrance of alcohol feed pipe 13 into the vaporizing tank; 14, a second hot water boiler; 15, a gas holder or tank located inside of the second boiler or water bath, which latter is similar in all respects to tank 10; 16, a pipe leading from the top of the receptacle 11 downwardly within the boiler; 17, a branch extending from said pipe 16 to positions beneath both water boilers 10 and 14, as shown; 18, hydrocarbon burners of any suitable type beneath both water boilers; 19, a hand operated valve in branch 16; 20, a pipe leading from the gas tank or holder to the place where the vapor or gas is to be used, as for generating steam in a boiler 21, in which case the pipe 20 connects with a burner 22 and said boiler 21 may be provided with a water or steam circulating pipe 23 for the purpose of heating the water in both water boilers 10 and 14, used in 10 for the purpose of obtaining sufficient heat to vaporize the alcohol and in 14 for the purpose of retaining the gas in gaseous form; 24, a hot water jacket surrounding pipe 20, as shown; 25, a hand valve in branch pipe 17, as shown; 26, a hand valve in pipe 20, as shown; 27, hand valves in the heat circulating pipe; 28, a hand valve in pipe 13, as shown; 29, a one way check or swing valve to prevent the gas returning from gas holder 15 to the vaporizer receptacle; 30, a relief or pressure reducing pipe leading from the top of the receptacle 11 through any kind of a condenser and returning preferably to the feed tank 1, though it may connect with any

other suitable receptacle; 31, a pipe from the gas holder 15 to the relief pipe; 32, a pressure valve for the gas tank 15 located in pipe 31; 33, a pressure gage in connection with pipe 31; 34, a hand valve in the relief pipe; 35, a condenser consisting of a cylinder through which water can circulate by way of pipes 36, 37; 38, a coil of pipe within the cylinder and surrounded by water, if desired, said coil constituting a part of said relief pipe, as is obvious; 39, a gage showing the height of alcohol in the feed tank; 40, an eccentric for operating a force pump; 41, the piston operated by the eccentric and so set and operated that it will force the gas or vapor from vaporizer 11 into gas holder 15; 42, a gage showing the height of alcohol in vaporizer 11; 43, a pipe through which gas is pumped into the gas tank or holder 15; 44, a rotary valve in pipe 30, said valve being operated by a handle 46 and said handle connected to a rod 47 in combination with the eccentric 40 through the medium of a rod so that one movement of the rod will open valve 44 for releasing surplus gas from the vaporizer 11, and the opposite movement will close the valve; 48, a pipe leading from vaporizer 11 to the pump; 49, a pipe leading from the supply pipe 13 to a burner; 50, an alcohol burner at the end of pipe 49; 51, a pipe for introducing water to the bath for boilers 10 and 14; and 52 is a water pipe between the two water baths or boilers.

The method of converting the alcohol or similar volatile liquid into vapor or gas is as follows: The alcohol is first conducted by pipe 13 from tank 1 to the vaporizing tank 11 located in water bath 10. By means of heat, however applied, as by burner 50, the temperature of the water bath is raised to 172° F. or more. At this temperature the alcohol boils and is converted into vapor or gas. This vapor or gas is now conducted by way of pipe 43 to the gas tank or holder 15 which is located within the water bath 14 and the temperature of the same is maintained by means of heat, however applied, at 172° F. or more. This temperature will maintain the gas as a stable gas at atmospheric pressure. At a less temperature the gas is a fugitive or unstable gas and will be condensed again to the form of a liquid. The pressure of the generated gas or vapor in the vaporizing tank 11 and the gas tank or holder 15 is regulated and controlled by means of the pipes leading from both said tanks and connecting with the condensing outfit which will permit the return of the condensed liquid to the feed tank as shown by pipes 30 and 31 or any other receptacle for collecting and saving this condensed liquid. In this way the condenser 35 acts in a double capacity with the balance of the apparatus. First, the condenser acts as a

safety valve to the entire apparatus in caring for and controlling any surplus of gas or vapor formed beyond the needs of consumption for fuel purposes, thereby rendering the entire apparatus immune and free from the danger of explosion. Second, the condenser cares for and reclaims any surplus of gas or vapor formed and returns the same in the form of condensed liquid to that part of the apparatus where it can be again used without loss of original fuel or alcohol.

Obviously, any suitable power may be employed to operate the pump which forces the gas from the vaporizing tank to the gas holder 15. When the piston 41 is in a position which allows the gas to pass to the pump the rotary valve 44 is closed. When the piston moves to force the gas by the check valve into the holder 15 the valve 44 is opened so gas can pass to the pipe connected with the condenser. The pressure regulator is an important feature of the apparatus and, as herein explained, serves both to prevent an explosion and also to save the excess of gas when condensed to liquid form. It is clear that in some instances the gas holder 15 may be omitted and the gas led directly from the vaporizer 11 to the place of use. The operation of the float valve in the feed tank is well known and need not be described.

The device in general insures that every drop of alcohol must be consumed as a fuel in the form of gas and which is the most economical way that alcohol can be used as a fuel.

From the foregoing description taken in connection with the drawing it becomes clear that I have provided means for vaporizing alcohol or other hydrocarbon liquid and converting the same into gas, and likewise means for regulating the pressure thereof without waste.

While I have illustrated only one example of the physical embodiment of the invention, I do not hereby intend to restrict the scope of the claims to the details shown. Other types of means can be used in place of the vaporizer 11 and gas tank or holder 15 and other means employed to vaporize the alcohol, but the principle involved means simply that the conversion of alcohol into the form of a gas must be done by means of heat in whatever way applied. The hot water or water bath is one suitable means, and as the liquid therein is open to the atmosphere explosion is impossible from confining the steam, and vaporization is attained, inasmuch as the boiling points of alcohol and some other hydrocarbon liquids are lower than the boiling point of water. However, the boiling point can be raised by adding to the water any well known substance or substances (see *Smithsonian Physical Tables*, 1908, page 196). The regulating means

shown can be used in whole or in part, and in some cases a single pipe leading from the receptacle 11 to the feed tank 1 will be sufficient with the manipulation of the hand valve 34 in the relief pipe.

Obviously, the vapor or gas when generated may be used for any suitable purpose—for converting water into steam to be used in connection with a heating system, for heating water to the required point for a hot water heating system, for illumination, or as fuel for explosive engines, and in each use thereof the degree of pressure may be regulated accordingly.

15 What I claim is:

1. In a gas generator, the combination with a still, a condenser, a conduit leading from the still to the condenser, and a pressure regulating valve in such conduit, of a boiler, a conduit for conveying the gas from the still, a burner connected to said conduit beneath the boiler, and means for heating the still.

2. In a gas generator, the combination with a still, a condenser, a conduit leading from the still to the condenser, and a pressure regulating valve in such conduit, of a boiler, a conduit for conveying the gas from the still, a burner connected to said conduit beneath the boiler, and a closed circuit connection between the boiler and still for heating the same.

3. The combination with a hot water boiler open to the atmosphere, of a vaporizing tank located within said boiler, means for delivering liquid to said tank, a second hot water boiler, a pipe leading from the tank to said second boiler, a burner in connection with said pipe, and hot water circulating pipes connecting said second boiler with the said boiler containing the vaporizing tank.

4. The combination in a vaporizer, of a vaporizing tank, means for delivering liquid to the interior of the tank, means for heating the liquid within the tank, a gas-holder in communication with the tank, a hot water bath surrounding the gas-holder, means for heating the hot water bath, and a pipe leading from the gas-holder to the place of use.

5. The combination in a vaporizer, of a vaporizing tank, means for delivering liquid to the interior of the tank, means for heating the liquid within the tank, a gas-holder in communication with the tank, a hot water bath surrounding the gas-holder, means for heating the hot water bath, a relief pipe leading from the gas-holder, and

a pipe leading from the gas-holder to the place of use.

6. The combination in a vaporizer, of a vaporizing tank, means for delivering liquid to the interior of the tank, means for heating the liquid within the tank, a gas-holder in communication with the tank, a hot water bath surrounding the gas-holder, means for heating the hot water bath, a relief-pipe provided with a safety valve leading from the gas-holder, and a pipe leading from the gas-holder to the place of use.

7. The combination in a vaporizer, of a vaporizing tank, means for delivering liquid to the interior of the tank, means for heating the liquid within the tank, a gas-holder in communication with the tank, means for forcing the gas into the gas-holder, a hot water bath surrounding the gas-holder, means for heating the hot water bath, and a pipe leading from the gas-holder to the place of use.

8. The combination in a vaporizer, of a vaporizing tank, means for delivering liquid to the interior of the tank, means for heating the liquid within the tank, a gas-holder in communication with the tank, a pump for forcing the gas into the gas-holder, a hot water bath surrounding the gas-holder, means for heating the hot water bath, and a pipe leading from the gas-holder to the place of use.

9. The combination in a vaporizer, of a vaporizing tank, means for delivering liquid to the interior of the tank, means for heating the liquid within the tank, a gas-holder in communication with the tank, a pump for forcing the gas into the gas-holder, a check valve for retaining the gas in the holder, a relief-pipe leading from the tank, a valve in said pipe, means connecting the valve with the pump for opening and closing the valve, a hot water bath surrounding the gas-holder, means for heating the hot water bath, and a pipe leading from the gas-holder to the place of use.

10. In a gas generator, the combination with a still, a condenser, a conduit leading from the still to the condenser, and a pressure regulating valve in such conduit, of a conduit for conveying the gas from the still, a burner connected to said conduit, and means for heating the still.

In testimony whereof I affix my signature in presence of two witnesses.

GEORGE M. ECKELS.

Witnesses:

E. E. CAMPBELL,
A. S. JACOBSEN.