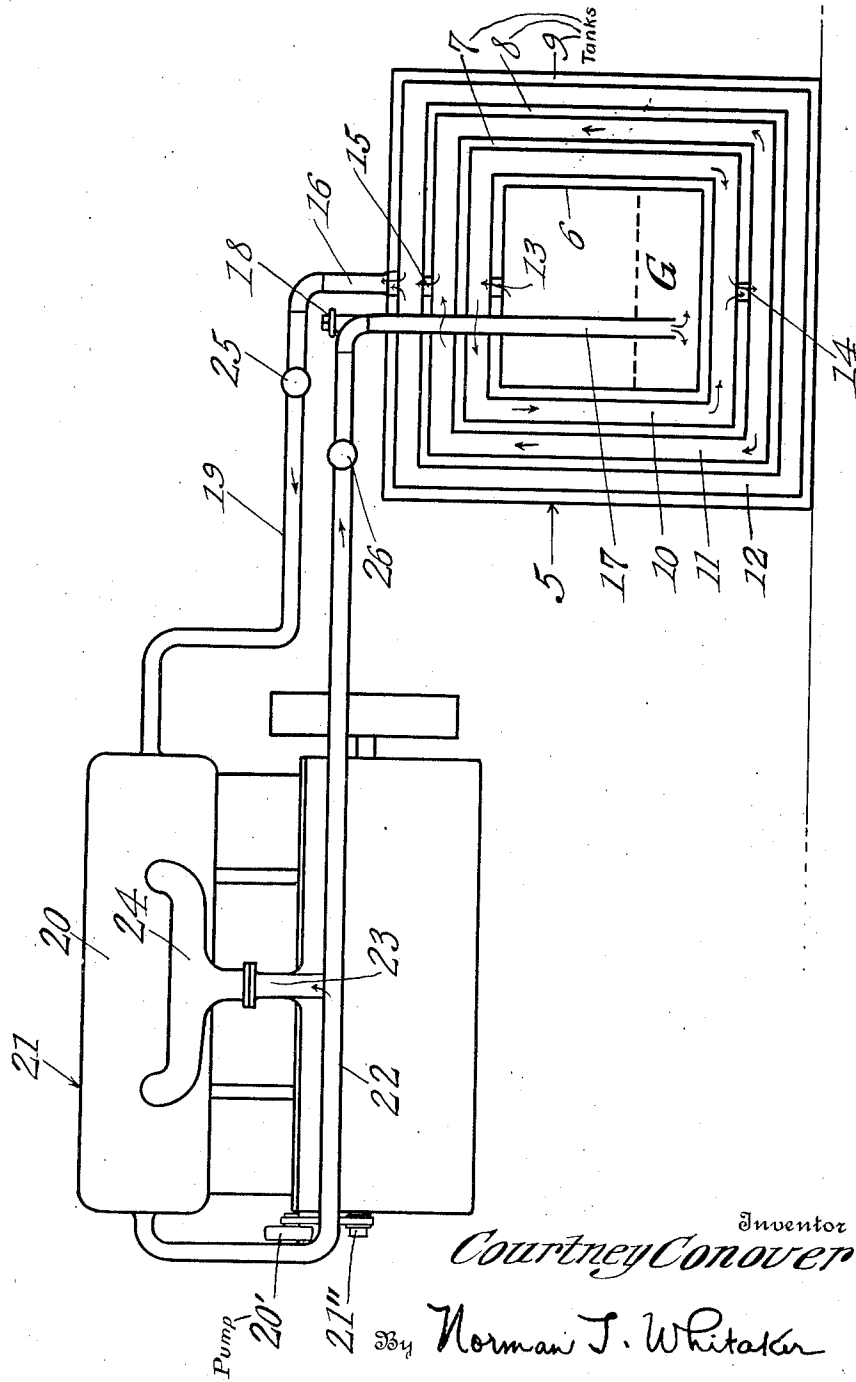


C. CONOVER.
METHOD OF HANDLING AND UTILIZING COMBUSTIBLE GASES.
APPLICATION FILED SEPT. 12, 1918.

1,368,313.

Patented Dec. 28, 1920.



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METHOD OF HANDLING AND UTILIZING COMBUSTIBLE GASES.

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Application filed September 12, 1918. Serial No. 253,839.

To all whom it may concern:

Be it known that I, COURTNEY CONOVER, a citizen of the United States, and a resident of Philadelphia, in the county of Philadelphia and State of Pennsylvania, have invented new and useful Improvements in Methods of Handling and Utilizing Combustible Gases, of which the following is a specification.

10 The object of my invention is to provide a means of generating power, heat and light which shall be an improvement over other methods in that a fuel is used which can be cheaply produced, which can be transported or stored in the liquid state and yet can be gasified more easily than most liquid fuel, and which, in the generation of power can be used for cooling the engine in which it is used.

20 My invention consists in substance in the production of power, heat, or light by liquefying inflammable substances which are gaseous at ordinary temperature, storing or transporting the liquid fuel so produced in a form of container which does not allow the rapid penetration of heat to the contained liquid and which hence will prevent rapid evaporation, converting the liquid fuel into gas with the aid of the heat of its own combustion, and burning the gas for the production of heat or light, or using it both as a cooling agent and as a fuel in the generation of power.

30 To illustrate the practical operation of my invention I shall describe in detail one of the many ways in which the process may be applied. One preferred procedure is as follows: Inflammable gaseous material, preferably natural gas, is subjected to conditions which will convert some of its constituents, boiling below 10° centigrade, into the liquid state. For the production of heat, whether by burning with air, or in a special torch with oxygen, ethylene and the hydrocarbons with boiling point above 45 -100° centigrade would be most desirable, while for the purpose of taking advantage of abundant raw material it might be desirable to liquefy and utilize gases (as for example certain constituents of natural gas) with boiling point below -150° centigrade.

50 The accompanying drawing is a diagrammatic view of an apparatus which may be used for carrying out the objects of my invention.

The liquid product obtained is placed for

storage or transportation in containers which will protect it from heat and hence will prevent rapid evaporation. The preferred container for this purpose is one in which the tank holding the liquid is surrounded by other tanks, each tank except the outside one being so supported and having openings so situated that it is surrounded by the cold vapor coming from its interior and is partially protected by this vapor from heat from the outside. A container utilizing this principle is shown in the figure forming a part of this specification and indicated as a whole by the numeral 5. I have shown this container diagrammatically as comprising a plurality of tanks 6, 7, 8 and 9. The tanks 6, 7 and 8 are inclosed within tanks 7, 8 and 9 respectively which are so positioned with respect to their respective inclosed tanks as to provide insulating spaces 10, 11 and 12. Within the top of the tank there is provided an opening 13 which communicates the insulating space 10 with the interior of the tank 6. The insulating spaces 10 and 11 are communicated through an opening 14 provided in the bottom of the tank 7 and an opening 15 provided in the top of tank 8 serves to communicate the insulating spaces 11 and 12. To the top of the tank 9 there is connected a pipe 16 designed to carry the gases, evolved from the liquefied gas G, contained within the tank 6, to a desired and remote location for the purpose of utilizing the latent energy contained therein. A tube 17 is secured to the upper wall of each of the tanks 6, 7, 8 and 9 and projected a substantial distance within the tank 6. The upper end of the tube 17 is provided with a screw-plug 18 which when removed permits desired liquefied gas to be deposited into the tank 6.

The preferred method of converting the volatile liquid G into gas consists in withdrawing from the container a portion of the gas accumulated there (through the gradual absorption of heat from outside), dividing this gas into two streams, one of which is heated and forced back into the container where it is brought into close contact with the liquid and serves to evaporate it. The preferred means of heating this stream of gas is by circulating it where it will absorb the heat evolved by the second stream of gas when this is used for the production of power, heat or light.

I have shown diagrammatically in the

drawings a means for utilizing the gas, evolved by the above named method, for the generation of power. To this end I transmit through a pipe 19 a portion of the gas, accumulated within the tank 6 (through the gradual absorption of heat from the outside), to the jacket 20 of an internal combustion engine, indicated as a whole by the numeral 21. To the pipe 17 there is connected a pipe 22 which in turn is connected to the jacket 20, the two pipes 17 and 22 serving as a means for transmitting a portion of the gas from the engine jacket back into the tank 6. As a means for drawing the gases from the tank 6 into and through the engine jacket 20 there is provided preferably a rotary pump 20' having suitable driving connection with a desired rotating element of the internal combustion engine 21 as shown at 21''. This pump serves not only as a means for drawing the gases into and out of the jacket 20 but also as a means for forcing a portion of the gases back into the tank 6 through the pipes 17 and 22. By means of a pipe 23 a portion of the gas from the jacket 20 is directed into the manifold 24 from which it is passed into the explosion chamber of the engine and therein exploded.

The gas which is exploded within the cylinders of the engine necessarily liberates a quantity of energy in the form of heat, which heat is utilized to heat the gas transmitted to the jacket 20 through the pipe 19. The gas thus heated is rendered not only capable of being more readily exploded when transmitted into the cylinders through the pipe 23 connected to the manifold 24 but also serves as a means when directed back into the tank 6 to volatilize the liquefied gas G contained therein. Should it be desired to regulate or discontinue the flow of the gas from the tank 6 a suitable valve 25 may be provided for this purpose, and on the other hand should it be desired to regulate or discontinue the flow of gas from the jacket 20 back into the tank 6 a valve 26 similar to that indicated by the numeral 25 may be provided for this purpose.

The process as above described may be varied in many ways and yet will be practicable. Thus inflammable gases other than natural gas, such as coal gas, water gas, or producer gas may be used. The process of liquefaction may be varied so as to produce liquids having different properties. The container, instead of being as described may be one in which partial or complete dependence is placed for insulation upon a vacuum or upon solid insulating material such as cork, felt, magnesia, or others. The liquid may be gasified in many ways such as by heating electrically with resistance wire immersed in the liquid, by circulating a warm gas through a tube passing through the container and by other well known means and

methods of volatilizing hydrocarbons and other liquids.

Having thus described my invention, what I claim as new and desire to secure and protect by Letters Patent of the United States, 70 is:

1. A method of handling and utilizing combustible gases which consists in liquefying inflammable materials which are gaseous at ordinary temperature, placing the liquid in a container constructed to prevent rapid volatilization, gasifying the liquid when needed for use, ejecting the evolved gases from said container in a single stream, dividing the stream into a plurality of flows, igniting one flow, directing another flow around the point of ignition, heat being absorbed by the second named flow by the ignition of the first named flow directing the gases of the second named flow together with the heat absorbed thereby into contact with said liquid whereby rapid evaporation of the same is facilitated. 75 80 85

2. A method of handling and utilizing combustible gases which consists in liquefying inflammable materials which are gaseous at ordinary temperatures, placing the liquid in a container constructed to prevent rapid volatilization, gasifying the liquid when needed for use, burning a portion of the evolved gases, heating the unburned portion of the evolved gases, and utilizing the heated unburned gases to facilitate rapid volatilization of the liquid within said container. 90 95 100

3. A method of handling and utilizing combustible gases which consists in liquefying inflammable materials which are gaseous at ordinary temperature, placing the liquid in a container which will prevent rapid volatilization, gasifying the liquid when needed for use, igniting a portion of the evolved gases and directing the heat generated by the ignition of said gases back into said container to facilitate rapid volatilization of said liquid, the heat being transmitted through the unburned portion of said evolved gases as a medium. 105 110 115

4. A method of handling and utilizing combustible gases which consists in liquefying inflammable materials which are gaseous at ordinary temperature, placing the liquid in a container which will prevent rapid volatilization, gasifying the liquid when needed for use, igniting a portion of the evolved gases, heating the unburned portion of the evolved gases, and directing the heated unburned gases back into said container to facilitate rapid volatilization of said liquid. 120 125

5. A method of handling and utilizing combustible gases which consists in liquefying inflammable materials which are gaseous at ordinary temperature, placing the liquid in a container which will prevent rapid 130

volatilization, gasifying the liquid when needed for use, igniting a portion of the evolved gases, heating the unburned portion of the evolved gases by the heat created by the
 5 ignited portion of said gases, and directing the heated unburned gases back into said container to facilitate rapid volatilization of said liquid.

6. A method of handling and utilizing
 10 combustible gases which consists in liquefying inflammable materials which are gaseous at ordinary temperature, placing the liquid in a container which will prevent rapid volatilization, gasifying the liquid when
 15 needed for use, igniting a portion of the evolved gases, heating the unburned portion of the evolved gases, and directing the heated unburned gases back into direct contact with the liquid within said container
 20 to facilitate rapid volatilization of the liquid.

7. A method of handling and utilizing combustible gases which consists in liquefying inflammable materials which are gaseous
 25 at ordinary temperatures, maintaining the materials in a liquefied condition, gasifying the liquid when needed for use, burning a portion of the evolved gases, heating the unburned portion of the evolved gases, and
 30 utilizing the heated unburned gases to facilitate rapid volatilization of the liquid.

8. A method of handling and utilizing combustible gases which consists in liquefying inflammable materials which are gaseous
 35 at ordinary temperatures, placing the liquid in a container constructed to prevent rapid volatilization, gasifying the liquid when needed for use, burning a portion of the evolved gases, heating the unburned portion
 40 of the evolved gases by the heat created by the burned portion of said gases, and utilizing the heated unburned gases to facilitate volatilization of said liquid.

9. A method of handling and utilizing
 45 combustible gases which consists in liquefying inflammable materials which are gaseous at ordinary temperatures, maintaining the materials when liquefied normally in a liquefied condition, gasifying the liquid when
 50 needed for use, burning a portion of the evolved gases, heating the unburned portions of the evolved gases by the heat created by the burned portion of the gases, and utilizing the heated unburned gases to fa-
 55 cilitate volatilization of said liquid.

10. A method of handling and utilizing combustible gases which consists in liquefying inflammable materials which are gaseous at ordinary temperatures, maintain-
 60 ing the materials when liquefied normally in a liquefied condition, gasifying the liquid when needed for use, directing a portion of the evolved gases into the cylinder of an internal combustion engine, burning within
 65 the cylinder the gases directed therein,

utilizing the unburned portion of said evolved gases as a heat absorbent medium to cool the engine, and utilizing the heat absorbed by the unburned portion of gases to facilitate volatilization of said liquid. 70

11. A method of handling and utilizing combustible gases which consists in liquefying inflammable materials which are gaseous at ordinary temperatures, maintaining the materials when liquefied normally in a
 75 liquefied condition, gasifying the liquid when needed for use, directing a portion of the evolved gases into the cylinder of an internal combustion engine, burning within the cylinder the gases directed therein, 80
 utilizing the unburned portion of said evolved gases as a heat absorbent medium to cool the engine, and directing the heated unburned gases back into contact with said liquid to facilitate volatilization of said 85 liquid.

12. A method of handling and utilizing combustible gases which consists in liquefying inflammable materials which are gaseous at ordinary temperatures, maintaining the
 90 materials when liquefied normally in a liquefied condition, gasifying the liquid when needed for use, directing a portion of the evolved gases into the cylinder of an internal combustion engine, burning within 95
 the cylinder the gases directed therein, utilizing the unburned portion of said evolved gases as a heat absorbent medium to cool the engine, and transmitting the heat absorbed by the unburned gases to said 100 liquid to facilitate volatilization of said liquid, the heat being transmitted through the unburned portion of said gases as a medium.

13. A method of handling and utilizing 105 combustible gases which consists in liquefying inflammable material boiling below -150° centigrade, maintaining the material when liquefied normally in a liquid condition by means of a container in which the 110 liquefied material is protected from heat by layers of its own vapor, gasifying the liquid when needed for use, utilizing the evolved gases for cooling the cylinders of an internal combustion engine, the heat from the engine 115 being absorbed by the evolved gases, and utilizing the heat absorbed by said evolved gases to facilitate volatilization of said liquid, the heat absorbed by said evolved gases being transmitted to said liquid. 120

14. A method of handling and utilizing combustible gases which consists in liquefying inflammable material having a boiling point of less than -150° centigrade, surrounding said liquefied material by layers 125 of its own gas to maintain the material in a liquefied condition, applying heat to the liquefied material to gasify the same when it is to be utilized, and burning the evolved gases. 130

15. A method of handling and utilizing combustible gases which consists in liquefying inflammable material having a boiling point of less than -150° centigrade, surrounding said liquefied material by layers of its own gas to maintain the material in a liquefied condition, applying heat to the liquefied material to gasify the same when it is to be utilized, injecting the evolved gases into an internal combustion engine, and igniting said gases within the engine to transform the latent energy of said gases into power.

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