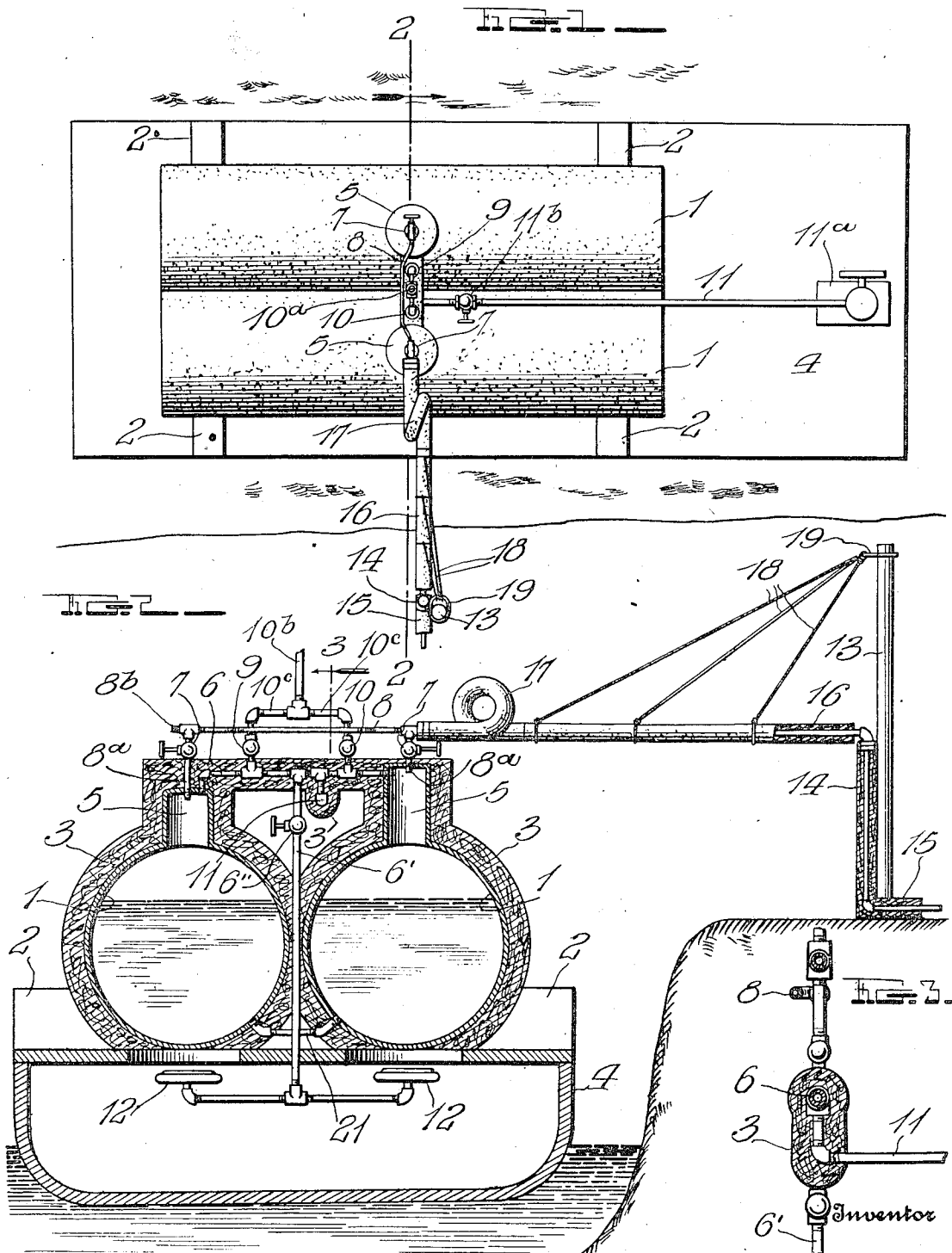


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 MEANS FOR HANDLING AND TRANSPORTING LIQUID GAS.
 APPLICATION FILED OCT. 12, 1914.

1,140,250.

Patented May 18, 1915.



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MEANS FOR HANDLING AND TRANSPORTING LIQUID GAS.

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Specification of Letters Patent.

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To all whom it may concern:

Be it known that I, GODFREY L. CABOT, a citizen of the United States, residing at Boston, in the county of Suffolk and State of Massachusetts, have invented certain new and useful Improvements in Means for Handling and Transporting Liquid Gas; and I do 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.

This invention relates to new and useful improvements in means for handling and transporting liquid gas and the primary object of the invention is to provide an apparatus for delivering the liquid gas to receptacles and transporting the receptacles containing the same which will positively retain the gas at the temperature necessary for liquefaction.

Another object of the invention resides in providing a tank or the like insulated against heat radiation and a further object resides in providing means in connection with the tank to permit the evaporated gas therein to be conveniently utilized for providing the energy necessary for the transportation of said tanks.

A still further object resides in providing means in connection with the tanks for causing a gas evaporation such as desired when such gas is necessary for lighting, heating or propulsion purposes.

Still another object resides in providing an apparatus which is simple and durable in construction, inexpensive to manufacture and one which will be very efficient in use.

With these and other objects in view the invention consists in the novel features of construction, combination and arrangement of parts as will be hereinafter referred to and more particularly pointed out in the specification and claims.

In the accompanying drawing forming a part of this application: Figure 1 is a top plan view of the device constructed in accordance with my invention and applied to use; Fig. 2 is a vertical transverse section therethrough as seen on line 2—2 of Fig. 1; Fig. 3 is a vertical section as seen on line 3—3 of Fig. 2, looking in the direction of the arrow.

It is a well known fact that gas can only exist in a liquid state when under action of intense cold, great pressure or a combination

of both. There are certain gases which have not been and cannot be commercially transported in a liquid state at ordinary temperatures and this is true for the reason that such gases in a liquid state exert at ordinary temperatures a pressure so great that a sufficiently strong receptacle for containing the same would necessarily be enormously heavy in proportion to the weight of the gas contained therein. Such gases for instance are oxygen, nitrogen and pure methane. There are other gases which can be liquefied and transported commercially as for instance, carbonic acid gas, and fuel gas composed of the higher homologues of methane and having the nature of extremely light and fugitive gasoline. Such gases are transported in steel cylinders tested at an internal pressure of something like 150 to 200 atmospheres, which obviously requires the weight of the containing receptacle to greatly exceed the weight of the gas contained therein. Natural gas containing a very large amount of methane and a variable but lesser amount of its higher homologues, something like 70% by volume of natural gas, has been successfully compressed and shipped in such cylinders, without accident. The liquid therein contained consists in the first instance of the higher homologues of methane, containing, however, a very large amount of methane in solution, probably up to 40%. It is obvious that under such conditions of manufacture in the first place, at least 30% of the natural gas would not be available for sale in this manner and it would probably often be a much larger percentage for the natural gas of which 70% would be obtained in the liquid form, would be especially carbonaceous, and of higher specific gravity than the average. While this business of manufacturing, liquefying and shipping in steel cylinders a fuel hydro-carbon gas has been more or less successfully carried on in certain countries it is a well known fact that in view of the strong containers which must be provided therefor, the same must necessarily be of great weight. Thus the expense connected with the shipping thereof, first with the containers filled and then the return thereof empty, would be such as to make it impracticable from a commercial standpoint.

My invention primarily contemplates a means for handling and transporting a lique-

5 fied gas in a cheaper and more expeditious manner than heretofore known, the same involving the control of the temperature and the pressure. There is no reason to suppose that the vessels that would naturally be used for such transportation would suffer any injury by reason of the lowering of the temperature, although their tensile strength and toughness to resist shock and other physical wear and tear might be seriously affected and therefore necessitate extraordinary precaution in the handling thereof. The chief difficulty in such transportation will lie in the absorption of heat during transportation, the consequent evaporation of a portion of the goods transported, and the expense and danger thereby implied. To overcome these difficulties and reduce the commercial loss within feasible limits, it will be necessary in the first place to transport the liquid gas in very large quantities, for instance, in tanks of considerable size. Second, it will be necessary to insulate these tanks against heat radiation so far as it is possible to do so; third, to provide a vent so that the gases evaporating may be either conveniently utilized for providing energy necessary in the transportation of the commodity or be allowed to escape harmlessly in the open air without danger of explosion or accidental fire which latter provision also eliminates the internal pressure caused by volatilization. Fourth, to provide appliances for the necessary trans-shipment of this unusual commodity for safety and convenience and without appreciable loss by leakage and other means.

40 Leading to the dome 5 in each of the tanks is a short pipe section 6 which places the domes in communication with each other for a purpose hereinafter to be specified. To simultaneously fill the tanks 1 I provide a transversely extending pipe 8 which latter is provided with downwardly projecting extensions 8^a whose lower extremities open into the domes 5. As at times it may be desirable to fill only one of the tanks 1, I include in the aforesaid extensions 8^a the valves 7 for controlling the supply as will be readily understood. Furthermore to prevent the emission of the liquefied gas from the unused extremity of pipe 8, I provide a threaded plug 8' which may be transferred from one extremity of said pipe 8 to the other dependent on which of said extremities is attached to the supply pipe. Inasmuch as these tanks are intended to be conveyed from place to place, as heretofore stated, in so doing a certain amount of the liquefied gas will volatilize and in order to provide an escape for the products of volatilization and consequently maintain a constant pressure within the tanks 1, I provide an outlet pipe 10^b having the two branch sections 10^c whose lower extremities

communicate with the short pipe sections 6 leading from the two domes 5. Included within the branch sections 10^c are the two blow-off valves 9 and 10 which enables the pressure by the volatilized gas in the tanks to be relieved and the latter conveyed to some distant point on the float through the pipe 10^b. Also arranged in connection with the pipe section 6 is an additional pipe 11 leading to a gas engine 11^a which may be used in the operation of the conveying member as will be readily understood. While every precaution is provided to prevent absorption of the heat in the handling and transportation of this liquefied gas, a certain amount nevertheless will be volatilized, and this I propose to utilize as far as possible for the operation of the gas engine 11^a. It will be appreciated, however, that at certain times there will be a greater amount of escaping gas than will be necessary for operation of the engine, and when this occurs, the blow-off valves 9 and 10 are then brought into operation, inasmuch as by the use of these valves the surplus gas may be conveyed to some distant point on the float by means of the pipe 10^b as hereinbefore stated. It may be possible that when it is desired to utilize certain of the escaping gases from the tanks, none will be available and consequently it has been deemed advisable to provide means for quickly volatilizing the liquefied gas, and to this end there are the two burners 12 disposed upon the member 4 just below the tanks 1, these burners being connected by the pipe 6' with the short section pipe 6. For controlling the flow of gas to burners 12, I also provide a valve 6'' as clearly shown in Fig. 2. From this it will be seen that by heating the tanks to a certain extent the evaporation process will be effected, and the volatilized gas formed thereby can be utilized for any purpose desirable.

In transporting a commodity of the character specified, it has been found necessary to equalize the amount of liquid on each side of the float so that the same will be properly balanced, consequently I provide the pipe 21 connecting the bottoms of the two tanks so that the level of the liquid therein will remain the same at all times.

It may be here stated that this invention is particularly well adapted for use in connection with the apparatus covered by my companion application filed October 26, 1914, Serial No. 868,680, on an apparatus for condensing gas under high pressure. However, it will be understood that this apparatus may be used in connection with any apparatus known for the purpose of forming liquefied gas. In supplying the tanks 1 which are preferably supported on a float, with this liquefied gas I desire to provide a mast 13 which is mounted on the ground at

a point adjacent to the member 4. Mounted for oscillation on this mast 13 is a pipe section 14 extending longitudinally of the latter and having connection at its lower end with a gas supply pipe section 15. Connected with the upper end of the pipe section 14 is a laterally extending pipe section 16 which leads outwardly to a point adjacent to the tanks. The pipe sections 14, 15 and 16 are also covered with non-conducting material 3 as are the tanks 1, so that the liquefied gas passing therethrough will be substantially retained at a permanent temperature. Connected with the outer end of the pipe section 16 is a flexible tubular section 17 which is also covered with non-conducting material and adapted to be connected directly with the inlet pipe 8 of the tanks 1. The pipe section 16 is supported on the mast 13 by means of the guy wires 18 which in turn connect with a ring or the like 19 rotatably mounted on the upper end of said mast. Through the medium of this construction, it will be seen that the arm 16 may be directed to various positions, according to the position of the tank with respect to the mast and in view of the flexible connection 17, engagement with the inlet pipes of the tanks will be readily had.

From the foregoing it will be seen that I have provided a simple, inexpensive and efficient means for carrying out the objects of the invention and while I have particularly described the elements best adapted to perform the functions set forth, it is obvious that various changes in form, proportion and in the minor details of construction may be resorted to, within the scope of the appended claims, without departing from the spirit or sacrificing any of the principles of the invention.

Having thus described my invention, what I claim is:

1. In an apparatus of the class described, a supporting member, a pair of intercommunicating tanks mounted thereon, heat insulation completely incasing said tanks to retain the contents thereof at predetermined temperatures, means for simultaneously filling the tanks on either side thereof, an insulated pipe connection between said tanks, and expansion valves mounted in the length of said pipe connection for the escape of volatilized contents of said tanks, for maintaining said other contents at a continuing low pressure.

2. The combination with an insulated vertically disposed supply pipe having a swivelly mounted right angularly projecting extension, the latter being provided at its outer extremity with a flexible attaching member, and means for supporting said right angular extension member; of a supporting member, a pair of tanks mounted thereon, each having a dome, heat insula-

tion completely incasing said tanks to retain the contents thereof at predetermined temperatures, means for simultaneously filling said tanks, the latter being adapted to receive said flexible attaching member, a pipe connection between the domes of said tanks, said pipe connection being also insulated, and a pair of safety valves arranged in the length of said pipe connection for escape of the volatilized contents of said tanks:

3. An apparatus for transporting liquefied gas in bulk at a predetermined temperature and continuing low pressure consisting of a transporting member, a tank thereon, a dome disposed upon said tank and communicating with the interior of the latter, heat insulation completely enveloping said tank and dome, means for filling said tank, an outlet pipe communication with the upper portion of said dome, and an expansion valve included in said outlet pipe whereby the products of volatilization may be conveyed from said tank to a distant point for maintaining a continuing low pressure within the latter substantially as and for the purpose set forth.

4. An apparatus for transporting liquefied gas in bulk at a predetermined temperature and continuing low pressure consisting of a transporting member, a tank thereon, a dome disposed upon said tank and communicating with the interior of the latter, heat insulation completely enveloping said tank and dome, an outlet pipe communicating with the upper portion of said dome, means connected with said outlet pipe for conveying the contents of said pipe to a distant point for utilization, and a blow-off pipe connected with said outlet pipe and including in the length thereof a safety valve whereby when the pressure within said tank exceeds a predetermined amount the latter may escape through said valve substantially as and for the purpose set forth.

5. An apparatus for transporting liquefied gas in bulk at a predetermined temperature, a pair of tanks contiguously disposed thereon, a dome disposed upon the upper portion of each of said tanks, heat insulation partially enveloping said tanks, means for simultaneously filling both of said tanks, a short section pipe interposed between said tanks having its extremities communicating with the domes of the latter, heat insulation disposed around said pipe, means connected with said short section pipe for conveying the volatilized contents of said tanks to a distant point for utilization, a blow-off pipe also connected with said short section pipe and including safety valves in the length thereof whereby to automatically control the pressures in said tanks, a burner disposed beneath each of said tanks, and means connecting said burners with said out-

let pipe whereby to supply the former with the products of volatilization issuing from the contents of said tanks substantially as and for the purpose set forth.

- 5 6. In an apparatus of the character described, a supporting member, a pair of tanks mounted thereon and capable of containing a large quantity of liquefied gas, a
10 hollow cylindrical member arising from the upper surface of each of said tanks, said members having their upper ends closed and the lower ends thereof communicating with the interior of said tanks, heat insulation completely enveloping said tanks, and hol-
15 low members arising therefrom, a supply pipe spaced from and extending transversely across said heat insulation, branch pipes depending from the extremities of said supply pipe and having their lower ends com-
20 municating with the upper ends of said hol-

low cylindrical members, valves in connection with said branch pipes, an outlet pipe embedded in said heat insulation and having its extremities also communicating with the interior of said cylindrical members, and 25 a blow-off pipe connected with said outlet pipe and including in the length thereof a safety valve whereby when the pressure within said tank exceeds a predetermined amount the latter may escape through the 30 valve substantially as and for the purpose set forth.

In testimony whereof I have hereunto set my hand in presence of two subscribing witnesses.

GODFREY L. CABOT.

Witnesses:

L. O. HILTON,
M. H. STUARD.