Oct. 15, 1963 E. M. SCHLUMBERGER 3,106,827

APPARATUS FOR PUMPING BOILING LIQUID

Filed Nov. 24, 1961

FIG.I.

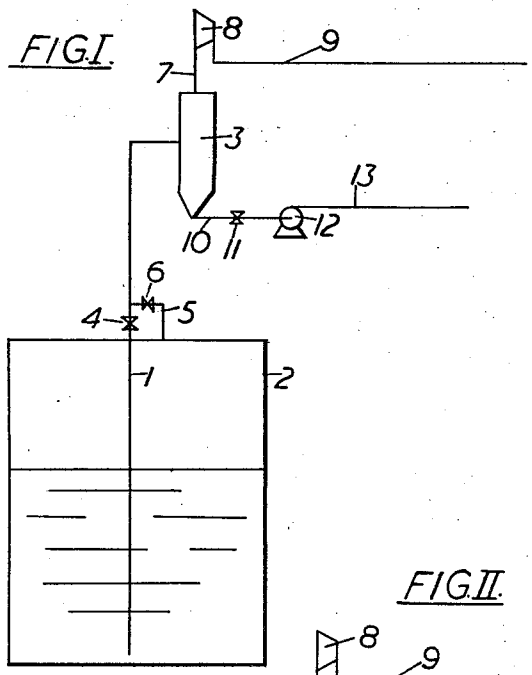
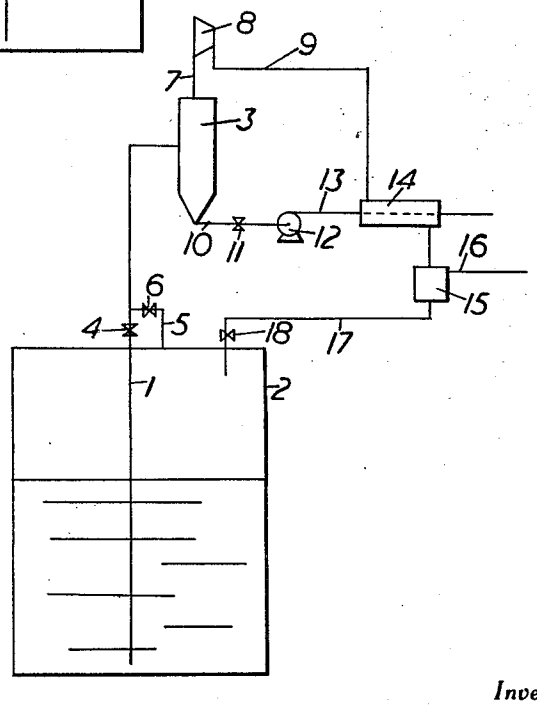


FIG.II.



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United States Patent Office 3,106,827 Patented Oct. 15, 1963

3,106,827

APPARATUS FOR PUMPING BOILING LIQUID

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Filed Nov. 24, 1961, Ser. No. 154,407
Claims priority, application Great Britain Feb. 28, 1961
4 Claims. (Cl. 62—51)

In the transport of liquefied hydrocarbon gases such as methane or propane by tanker, it is economic to use part of the liquefied gas cargo as fuel for the tanker's boilers or engines. This invention relates to an economical apparatus whereby the pumping equipment used for discharging the liquefied gas cargo from the tanker's storage tanks can also be used for feeding fuel gas to the boilers or engines.

Accordingly, the invention provides apparatus for pumpa boiling liquid from a container and also for pumping gas from said container when required, which comprises:

(1) A riser extending from a point near the bottom of the container,

(2) A branch on said riser communicating with the vapour space at the top of the container,

(3) Valve means in said riser and in said branch to control flow of fluids from either the bottom of the riser or the said vapour space,

(4) A separator, to the inlet of which said riser is connected,

(5) A vapour outlet from said separator connected to a compressor,

(6) A liquid outlet from said separator connected to a pump, and

(7) Valve means for controlling flow of fluid from said liquid outlet.

In a preferred arrangement, there is also a heat exchanger downstream of the pump on the liquid outlet so that vapour from the compressor may be passed in heat exchange with the cold liquid and a further separator in the vapour line downstream of the heat exchanger. From this further separator, a liquid line fitted with valve means runs back to the container, and a vapour line runs to the boilers or engines or other desired destination.

The apparatus of this invention and a method of using the same will now be described with reference to the accompanying drawings, in which:

FIGURE I shows a simple form of the invention, and FIGURE II a more elaborate form.

Referring to FIGURE I, a riser **1** communicates from near the bottom of the container **2** to the cyclone separator **3**. The riser **1** is fitted with a control valve **4** and downstream of this control valve joins a branch line **5** fitted with control valve **6**. The branch line **5** communicates with the vapour space in container **2**. A vapour discharge line **7** connects the top of the cyclone with a compressor **8**, and a line **9** communicates the discharge from the compressor to the tanker's boilers or engines and, when required, to any other destination. The liquid discharge line **10** from the bottom of the cyclone is fitted with control valve **11** and communicates with pump **12** which pumps the liquid to its destination through line **13**.

During the voyage, valves **4** and **11** are closed, and valve **6** is open, and the compressor **8** pumps vapour from the vapour space of the container **2** through conduit **5** and the upper part of riser **1** and through separator **3** and line **7** into line **9** which feeds it to the tanker's boilers or engines. When the tanker reaches its destination, valve **6** is closed and valves **4** and **11** are opened and now compressor **8** will cause liquid from the foot

of riser **1** to flow up into separator **3** in which the vapour is separated from the liquid, and the liquid is pumped via line **10**, pump **12** and line **13** to its destination on land. The separated vapour from separator **3** will pass via line **7**, compressor **8** and line **9** to auxiliary engines or to a reliquefaction plant or to the land installation or back to the container or to waste.

Referring to FIGURE II, numerals **1**, **2**, **3**, **4**, **5**, **6**, **7**, **8**, **9**, **10**, **11**, **12** and **13** have the same significance as in FIGURE I. However, in FIGURE II the discharge line **9** from the compressor **8** passes through heat exchanger **14** and then through a further separator **15**, from which vapour is taken via line **16** and liquid is returned to the container **2** via line **17** and control valve **18**.

In this case, when it is desired to pump vapour to the tanker's engines or boilers during the voyage, valves **4**, **18** and **11** are closed and valve **6** is open, and then compressor **8** pumps vapour from the vapour space of container **2** via line **5**, the upper part of riser **1**, separator **3** and lines **7**, **9** and **16** to the engines or boilers. When it is desired to pump liquid from the container, valves **4**, **11** and **18** are opened, and valve **6** is closed. The compressor then causes liquid to rise up riser **1** from the bottom of container **2** into separator **3**, from which the liquid is pumped away by pump **12** and lines **10** and **13**. The vapour separated in the separator **3** passes via line **7**, compressor **8** and line **9** through heat exchanger **14** in which it is cooled against the cold liquid being pumped to storage. Some of the vapour is condensed and the condensate is separated out in separator **15** and returned to the container via line **17**. The remainder of the vapour passes out through line **16**.

We claim:

1. Apparatus for selectively pumping a boiling liquid from a container in which it is stored at substantially atmospheric pressure and also for pumping gas from said container when required, which comprises a riser extending from a point near the bottom of the container, a branch on said riser communicating with the vapour space at the top of the container, valve means in said riser and in said branch to selectively control flow of fluids from either the bottom of the riser or the said vapour space, a separator, having an inlet to which said riser is connected, a vapour outlet from said separator connected to a compressor, a liquid outlet from said separator connected to a pump, and valve means for selectively controlling flow of fluid from said liquid outlet, said valve means in the riser and in the liquid outlet being closed when the valve means in the branch is open, to withdraw only vapor from said container.

2. Apparatus for pumping a boiling liquid from a container and also for pumping gas from said container when required, which comprises a riser extending from a point near the bottom of the container, a branch on said riser communicating with the vapour space at the top of the container, valve means in said riser and in said branch to control flow of fluids from either the bottom of the riser or the said vapour space, a separator, to the inlet of which said riser is connected, a vapour outlet from said separator connected to a compressor, a liquid outlet from said separator connected to a pump, valve means for controlling flow of fluid from said liquid outlet, and additionally a heat exchanger downstream of the pump on the liquid outlet from the separator, a line communicating the compressor exit with said heat exchanger and a further separator in said line downstream of the heat exchanger.

3. Apparatus as claimed in claim 2 which includes a liquid discharge line from said further separator fitted with valve means and communicating said further separator with the container.

4. Apparatus for selectively pumping a boiling liquid from a container in which it is stored at substantially atmospheric pressure and also for pumping gas from said container when required, comprising

(*a*) a riser extending from a point near the bottom of the container,

(*b*) a branch on said riser communicating with a vapor space at the top of the container,

(*c*) first valve means in said riser ahead of said branch,

(*d*) second valve means in said branch,

(*e*) a separator having an inlet to which said riser is connected beyond said branch,

(*f*) a vapor outlet from said separator,

(*g*) a compressor connected to said vapor outlet,

(*h*) a liquid outlet from said separator,

(*i*) a liquid pump connected to said liquid outlet,

(*j*) third valve means in said liquid outlet for selectively controlling flow of fluid from said liquid outlet,

(*k*) said first and third valve means being closed when said second valve means is open to selectively deliver only vapor from said container,

(*l*) said second valve means being closed and said first and third valve means being open to deliver liquid from said container.

References Cited in the file of this patent

UNITED STATES PATENTS

Re. 18,646	Heylandt	Nov. 1, 1932
1,505,095	Heylandt	Aug. 19, 1924
2,365,423	MacSporran	Dec. 19, 1944
2,757,516	Buttolph	Aug. 7, 1956
2,871,668	Reed	Feb. 3, 1959
2,895,305	Reed	July 21, 1959