May 20, 1930. J. S. HAUG 1,759,453

GAS CONDENSER

Filed May 6, 1929 2 Sheets-Sheet 1

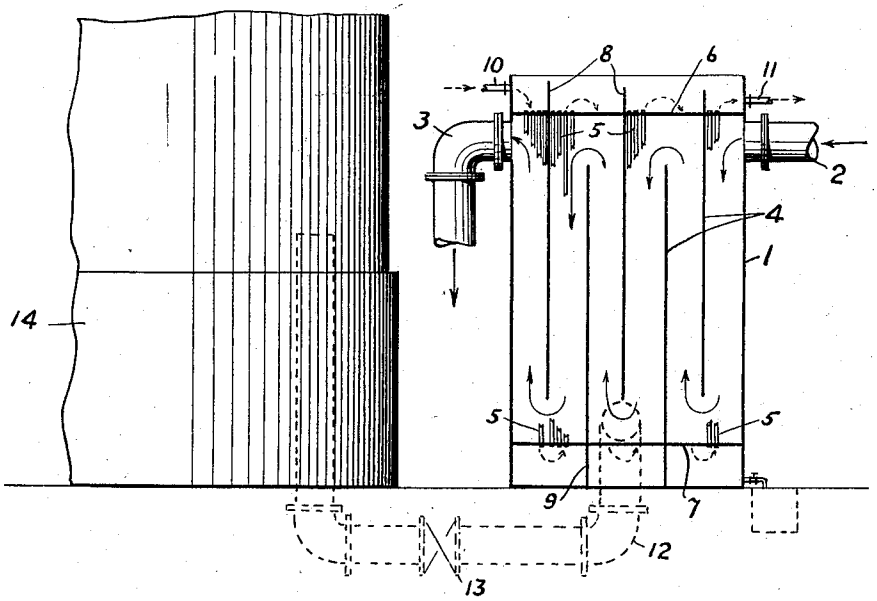


FIG. 1.

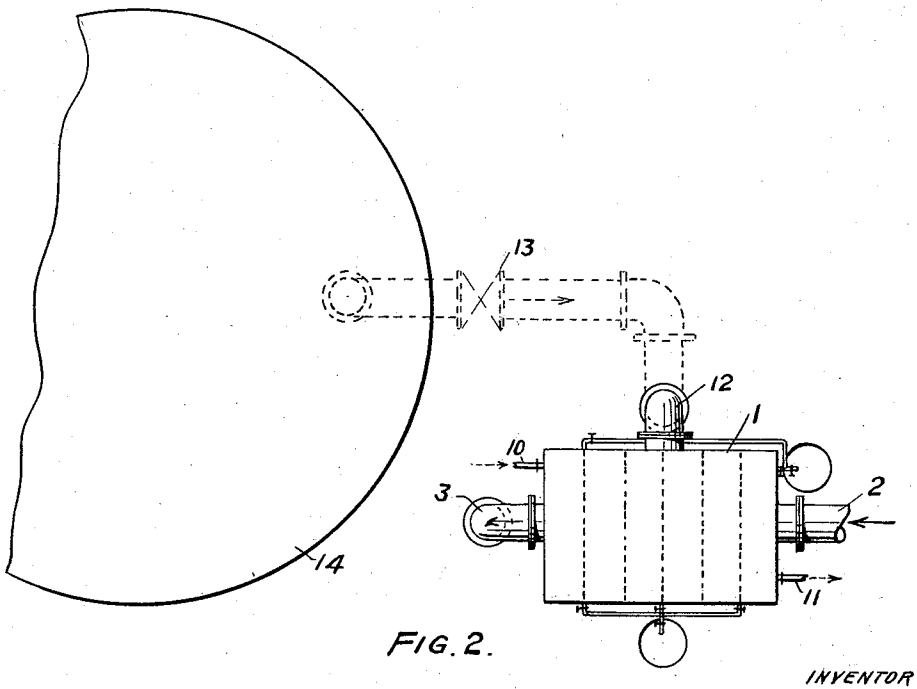


FIG. 2.

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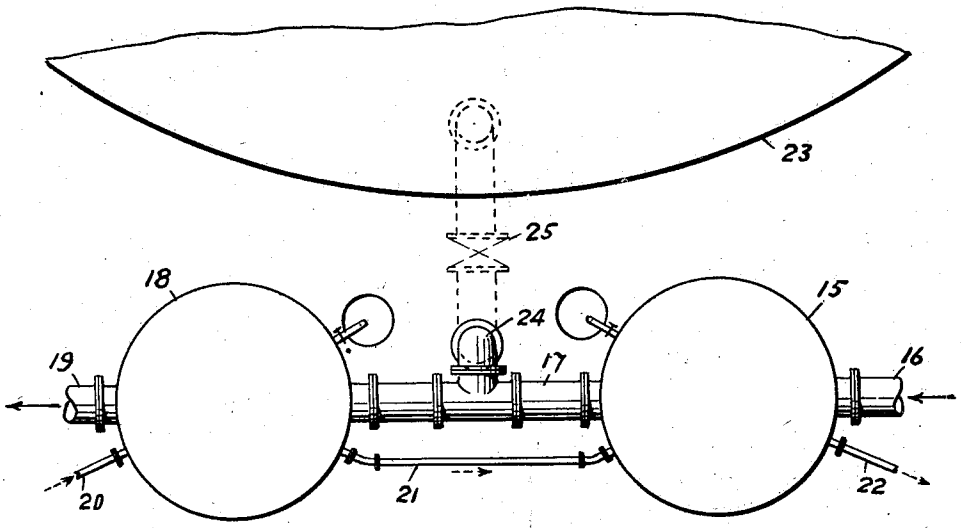


FIG. 3.

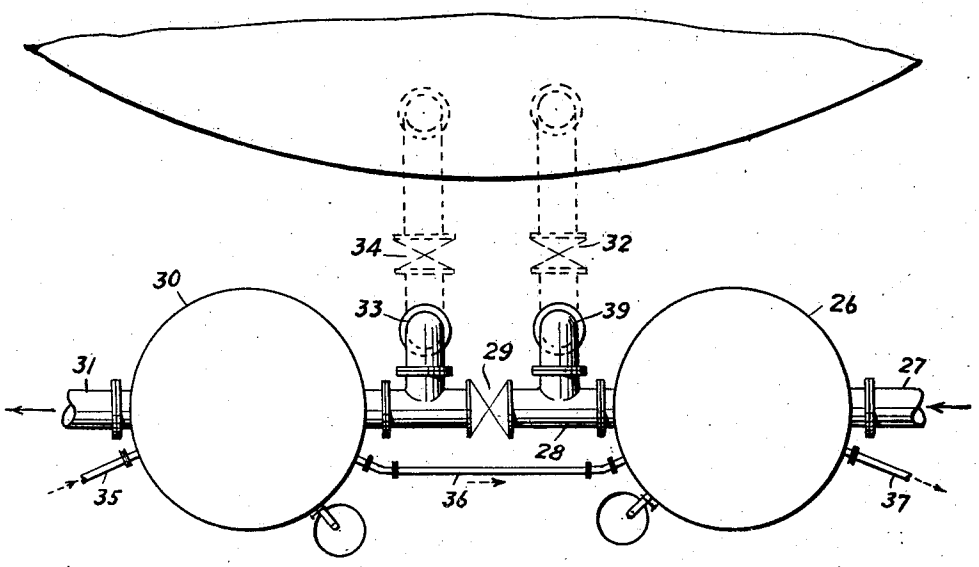


FIG. 4.

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UNITED STATES PATENT OFFICE

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GAS CONDENSER

Application filed May 6, 1929. Serial No. 360,801.

The present invention relates to the cooling of gas for the removal of its condensible vapors.

In the manufacture of combustible gas for industrial or domestic consumption, it is customary to employ a relief holder at the outlet of the generating apparatus. The holder may serve several purposes, for example, to receive a fluctuating supply of gas from the generating apparatus and to deliver a supply more uniform in quantity and quality to the auxiliary apparatus such as purifiers and also to relieve the generating apparatus of the back pressure produced by the auxiliary apparatus.

For instance, in the manufacture of carburetted water gas, the gas is produced intermittently by the individual water gas sets, and although when there is a plurality of sets in operation, the gas making periods overlap and tend to produce a more steady out-put, the flow from the generating apparatus as a whole fluctuates considerably. The relief holder receives this supply which fluctuates both in quantity and quality and functions to deliver a steady supply of gas of more uniform quality through the exhausters to the purifying apparatus.

If the condenser is placed on the inlet of the relief holder, undue back pressure may be thrown on the generating apparatus. If the condenser is placed on the outlet of the relief holder, the generating apparatus is relieved of this back pressure, but the exhausters are subjected to undue suction, and gas is delivered hot to the relief holder, containing large quantities of steam, occupying a large volume and requiring an undue relief holder investment.

The present invention is directed to the provision of a condenser and a relief holder arrangement which does not throw undue back pressure on the generating apparatus or create undue suction in the exhauster inlet and does not require undue relief holder investment. At the same time it provides for desirable counterflow relation between the gas and the condenser cooling water, discharging all of the water but slightly below the temperature of the uncooled gas, and passing the coolest water in heat transfer relation only with the cooled gas about to be discharged, to the exhausters.

The invention will be more particularly described in connection with the attached drawings which form a part of this specification and in which,—

Fig. 1 shows the apparatus of the invention in partial elevation and partial vertical cross section.

Fig. 2 shows a plan view of the apparatus of Fig. 1.

Fig. 3 shows a plan view of a modification of the apparatus of Figs. 1 and 2.

Fig. 4 shows a plan view of another modification of the apparatus of Figs. 1 and 2.

Referring to Figs. 1 and 2,

1 generally indicates the condenser which is provided with the gas inlet 2 and the gas outlet 3. The gas space within the condenser illustrated is divided into a number of passes by the partitions 4, and is traversed by the tubes 5 which terminate in the upper and lower tube sheets 6 and 7 respectively. The partitions 8 and 9 in the upper and lower water spaces serve to provide passes for the water from the water inlet 10 to the water outlet 11, in counterflow relation to the passage of the gas.

Intermediate of the gas inlet and outlet is provided the connection 12, furnished with the valve 13 leading from the condenser to the relief holder.

In operation, for instance, when employed with carburetted water gas apparatus, the hot gas passes from the water gas set or sets to the gas inlet 2 and traverses the passes of the condenser as shown by the solid arrows being progressively cooled by the cooling water which passes through the tubes in the opposite direction as shown by the dotted arrows. If the supply of gas to the inlet 2 is greater than that being drawn by the exhausters (not shown) from the outlet 3 plus the decrease in volume due to cooling, the excess gas passes through the connection 12 to the holder 14. The remainder of the gas passes through the following passes of the condenser to the outlet 3.

When the supply of gas to the inlet 2 is in-

sufficient to supply the steady demand of the exhausters, the gas which has passed to the holder is returned through the connection 12 and is passed through the passes of the condenser between the connection 12 and the gas outlet 3, being reduced thereby to the proper temperature.

Condensing water passes from the water inlet 10 through the tubes in the successive passes to the water outlet 11, cooling first the gas about to leave the condenser through the outlet 3 and finally the hot gas from the generating set.

The gas flow through the passes between the gas inlet 2 and the connection 12 fluctuates with variation in gas generation, while the flow through the passes between the connection 12 and the gas outlet 3 is steady as governed by the exhausters. The gas in passing through the first passes is cooled and reduced in volume, reducing the relief holder investment. The water used in cooling the gas passing through the latter passes, including the gas returned from the holder, is further utilized for cooling the hotter gas flowing through the first passes.

Referring to Fig. 3,

This figure shows a modification of the apparatus of Figs. 1 and 2 in that the connection to the relief holder leads from a connection between two of a battery of condensers instead of intermediate of the gas inlet and outlet of one condenser.

15 indicates one condenser provided with the gas inlet 16 leading from the generating apparatus, and the gas outlet 17 leading to condenser 18 which is also provided with the gas outlet 19 leading to the exhauster. The cooling water enters condenser 18 through inlet 20, flows through it in counterflow relation to the gas and thence by connection 21 to the condenser 15, and through it in counterflow relation to the gas to the water outlet 22 as shown by the dotted arrows. 23 is the relief holder. The connection 24, provided with the valve 25, leads from connection 17 to the relief holder.

The operation is as in Figs. 1 and 2. The condenser 15, Fig. 3, performs the same function as the first passes of condenser 1 in Fig. 1 and the condenser 18, Fig. 3, the same functions as the latter passes of condenser 1 in Fig. 1, and the connection 24 the same function as 13 in Fig. 1.

The water used in cooling the gas flowing through condenser 18 including the gas returned from the relief holder is further utilized in cooling the hotter gas flowing through condenser 15.

Referring to Fig. 4,

In this modification of the apparatus there are two connections leading to the relief holder from a connection between two condensers of a battery of condensers.

26 indicates one condenser of the battery provided with the hot gas inlet 27 and further provided with the gas outlet 28 furnished with valve 29 and leading to the condenser 30 which is further provided with the gas outlet 31 leading to the exhauster. The connection 39, provided with valve 32, leads from the connection 28 (intermediate of the condenser 26 and the valve 29) to the relief holder. The connection 33, provided with the valve 34, leads from connection 28 (intermediate of the condenser 30 and the valve 29) to the relief holder.

The cooling water means are arranged as in Fig. 3. The cool water enters the battery at the water inlet 35 of condenser 30, flows through that condenser in counterflow relation to the gas and thence through connection 36 to condenser 26 and through that condenser in counterflow relation to the gas to the water outlet 37.

In operation, if valve 29, and one or both of valves 32 and 34 open, the apparatus functions as in Fig. 3. In periods of greater production, the excess of gas over the demand by the exhauster goes to the relief holder after passing through condenser 26, the remainder passing through condenser 30 to the exhauster. During periods of lesser production, gas is returned from the relief holder and passed through condenser 30, together with the gas passing from condenser 26. If the valve 29 is closed, with valves 32 and 34 open, all of the gas passing through condenser 26 passes through connection 31 to the relief holder and is passed from the relief holder as demanded by the exhauster, through connection 33 and condenser 30 to the exhauster.

The cooling water used in cooling the gas passing through condenser 30 is utilized in cooling the hotter gas passing through condenser 26.

In Figs. 3 and 4, a battery of two condensers is shown for illustration. The battery may consist of any number of condensers connected for series gas and water flow. Two or more such batteries may be connected in parallel or two or more condensers arranged as in Figs. 1 and 2 may be connected in parallel.

I claim:

1. Apparatus for cooling and storing gas including a relief holder, a condensing chamber on the inlet side of the holder, a second condensing chamber on the outlet side of the holder, means for connecting said condensing chambers together, and means for passing a stream of a cooling agent progressively through both condensing chambers in counter current relation to the flow of gas therethrough.

2. Apparatus for cooling and storing gas including a relief holder, a condensing chamber forming part of the inlet conduit for gas thereto, a conduit between the condensing chamber and the relief holder, a second con-

densing chamber connected to said conduit and forming part of the outlet conduit for gas from the relief holder, and means for passing a stream of a cooling agent progressively in series in operative relation to both condensing chambers in counterflow relation to the flow of gas therethrough.

3. Apparatus for cooling and storing gas including a relief holder, a condensing chamber forming part of the inlet conduit for gas thereto, a conduit between the condensing chamber and the relief holder, a valve in said conduit, a second condensing chamber connected to said conduit and forming part of the outlet conduit for gas from the relief holder, and means for passing a stream of a cooling agent progressively in series in operative relation to both condensing chambers in counterflow relation to the flow of gas therethrough.

4. Apparatus for cooling and storing gas including a relief holder, a condensing chamber forming part of the inlet conduit for gas thereto, a second condensing chamber forming part of the outlet conduit for gas from the relief holder, a conduit connecting said chambers, a valve in said conduit, two conduits between the relief holder and the said connecting conduit one on either side of the valve therein, valves in said two conduits, and means for passing a stream of a cooling agent progressively in series in operative relation to both condensing chambers in counterflow relation to the flow of gas therethrough.

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