W. O. FELT.

PROCESS OF PURIFYING GAS.

APPLICATION FILED SEPT. 6, 1912. RENEWED NOV. 1, 1916.

1,237,767. Patented Aug. 21, 1917.

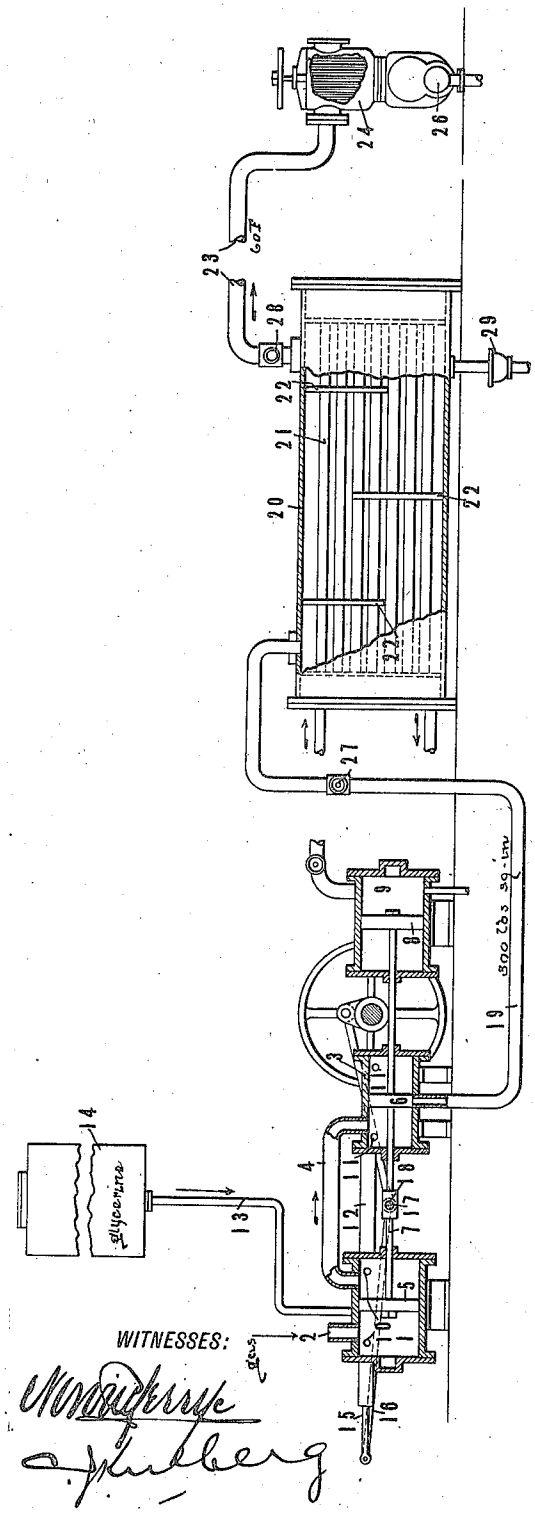


Fig. 1.

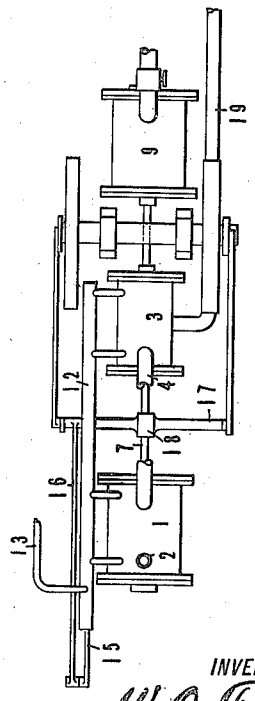


Fig. 2.

WITNESSES:

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PROCESS OF PURIFYING GAS.

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To all whom it may concern:

Be it known that I, WILLARD O. FELT, a citizen of the United States, residing at Brooklyn, in the county of Kings and State of New York, have invented certain new and useful Improvements in Processes of Purifying Gas, of which the following is a full, clear, and exact description, such as will enable others skilled in the art to which it appertains to make and use the same.

This invention relates to the treatment of fluids for the removal of certain constituents therefrom, and with respect to certain more specific features thereof, to a process for the purification of illuminating and other gases.

One of the objects of the invention is to provide a practical and efficient process of the kind described which may be carried out with a minimum operating expense.

Another object is to provide a simple process of the kind described adapted to remove impurities in the gas with a maximum rapidity.

Another object is to provide a process of the kind described which may be carried out with a simple and inexpensive plant adapted to occupy a relatively small space.

Other objects will be in part obvious and in part pointed out hereinafter.

The invention accordingly consists in the several steps and the relation and order of one or more of such steps with relation to each of the others thereof, which will be exemplified in the hereinafter disclosed process, and the scope of the application of which will be indicated in the claims that follow.

In the drawing, wherein is shown one of the various possible embodiments of the invention—

Figure 1 represents a diagrammatic side elevation of a preferred form of apparatus in which the process may be carried out;

Fig. 2 represents a partial plan view thereof.

Similar reference numerals refer to similar parts in both views of the drawing.

In connection with the herein described process it is to be noted that one of the most important features of gas manufacture is that of purification of the gas coming from the retorts in the case of coal gas manufacture, or from the generator sets in that of water gas manufacture.

The ordinary gas of commerce, whether it be water or coal gas, or a mixture of the two, or oil gas or the like, contains quantities of sulfur and sulfur compounds in various proportions along with certain amounts of ammonia and carbon dioxid, all of which are considered as deleterious ingredients or impurities. Before the gas can be sent out for consumption, these impurities should be removed or else reduced to such a negligible percentage that their presence offers substantially no disadvantage.

In order that the purification may be effective and that the results secured may be as profitable to the manufacturer as possible, it is recognized that the apparatus employed should be simple; should not be apt to become obstructed in use; should be capable of rapid repairs. Further, the process carried out should be simple, inexpensive, free from steps apt to cause non-uniformity in the resulting gas, and capable of continuous performance. That the herein described process completely fulfils these desired features will be realized by a more specific reference to the various steps thereof.

Referring more specifically now to the drawing, 1 designates the low pressure cylinder of a two-stage compressor and 2 an inlet pipe leading thereinto. 3 designates the high pressure cylinder of the compressor, the cylinders 1 and 3 being connected by a pipe 4. Pistons 5 and 6 are mounted, respectively, in the cylinders 1 and 3, being joined together by a common rod 7 connected thereto. A third piston 8 operates within a steam cylinder 9, being also mounted upon the rod 7.

Within the cylinder 1 are apertures 10 and within the cylinder 3 are apertures 11. The apertures 10 and 11 are connected by means of a valve casing 12 and pipe 13 with a tank 14 adapted to supply glycerin thereto. A valve spindle 15, upon which are mounted a series of valves, placed in a position to correspond with the apertures 10 and 11, is adapted to be driven by a rod 16 from a cross-rod 17 attached to the cross-head 18 mounted upon the shaft 7.

Leading from the central portion of the cylinder 3 is a pipe 19 leading to a horizontal condenser 20 comprising a series of tubes 21, through which water or other fluid medium is adapted to pass. The condenser is provided on the interior thereof with a series of baffle plates 22. The outlet end of the condenser pipe 23 passes to the inlet end of an extractor 24, which may be of any desired type, and in this instance is provided with a series of baffle plates in the upper portion thereof and in the lower portion thereof with a pressure operated valve 26.

The pipe 19 is provided with a valve 27 preferably disposed therein adjacent the inlet end of the condenser 20. The pipe 23 is similarly provided with a valve 28 adjacent the outlet end of the condenser. The condenser is further provided, in the lower portion thereof, approximately opposite the point of entrance of the pipe 23, with a trap 29. It will be understood that the apparatus is provided with suitable devices, such as check valves, for the purpose of insuring the flow of the glycerin and the gases toward the condenser. Such devices being of well known construction and application, it is thought unnecessary to illustrate the same.

In carrying out the process by means of the above described apparatus, illuminating gas from which the tar has been preferably extracted by a tar extractor of any desired type, or gas of any desired constitution containing one or all of the impurities ordinarily found in gas, such as carbon dioxid, sulfur, carbon disulfid and other sulfur compounds, ammonia and ammonia compounds, and other liquid gaseous and solid substances, is fed into the inlet pipe 2 of the cylinder 1, and the piston 5, upon moving to the right from its extreme left position, compresses this gas and forces it through the pipe 4 into the cylinder 3. During this compression a suitable quantity of glycerin passes from the tank 14 through the pipe 13 to the valve casing 12 and is injected into the cylinder 1 and there commingled with the gas. Upon passing into the cylinder 3 the gas is further compressed and during this second compression an additional quantity of glycerin is injected thereinto. After this second compression the gas passes into the pipe 19, flows past the valve 27 and enters the intake end of the condenser 20. The glycerin added to the gas in the two-compression cylinders is capable of preventing a material rise in the temperature of the gas over the temperature obtained at the inlet end of the low pressure cylinder; that is, the gas coming from the tar extractor as the process is preferably conducted with certain kinds of illuminating gas. The pressure employed may be varied, according to the operative conditions, being preferably maintained at or about 300 pounds per square inch.

The gas and glycerin mixture constituting the resulting product passes into the condenser and is there cooled to a temperature of at least 60° F. A portion of the mixture of gas and glycerin may be condensed by this contact and any condensate may be tapped through the trap 29. A majority of the gas and glycerin mixture will, however, pass along through the pipe 23 into the extractor 24. The glycerin, after passing through the condenser, appears as a fog which is held in suspension by the gas. Upon contacting with the baffle plates in the extractor, the glycerin, together with the impurities which are present in the gas, fall to the bottom of the extractor 24 and ultimately may be tapped out through the valve 26. The gas freed from the glycerin, and other impurities, passes in a purified state from the extractor and is ready for distribution and consumption.

The glycerin thus injected into the pressure cylinders acts as an absorbent agent and removes from the gas the ammonia, ammonia compounds, sulfur, sulfur compounds, carbon dioxid, etc., hereinbefore mentioned as impurities, and when the fog, comprising the glycerin and impurities, falls to the bottom of the extractor and is tapped off, the gas is left substantially free from these contaminating substances. The gaseous impurities in the glycerin, such as ammonia, carbon dioxid and hydrogen sulfid, are liberated and fly off when the pressure upon the glycerin is removed; that is, when the glycerin and impurities are tapped from the extractor. Such fixed salts as ammonium carbonate, ammonium sulfate and the like, which enter with a certain amount of water and remain in solution in the glycerin, may be gotten rid of by concentrating the glycerin and precipitating them thereby from the solution. The glycerin may be used over and over again, being preferably pumped back to the tank 14 and from there introduced into the cylinders 1 and 3, as heretofore indicated. It has been found necessary only to remove the fixed salts at certain intervals as the quantity of these salts is not large and consequently their interference does not become noticeable except after a rather long continuous use of the glycerin.

The process herein described is extremely simple, requires only simple apparatus, is easily controllable, and withal purifies the gas at a very low cost. Only a small number of men is required to operate a plant capable of handling a large quantity of gas. The gas purified by this process is exceptionally free from sulfur compounds, sulfur, ammonia, ammonia compounds, carbon dioxid, and the like, and is capable of readily passing the most stringent tests.

It will thus be seen that this invention fully accomplishes, among others, the objects hereinbefore enumerated.

Having described my invention, what I claim as new and desire to secure by Letters Patent is:

1. A process of the nature disclosed, which comprises compressing to a pressure of approximately 300 pounds per square inch a fluid mixture comprising a gas, mixing said mixture with glycerin while under compression, and reducing the temperature of the resultant mixture to approximately 60° F. while under compression, thereby separating glycerin and contained impurities and liberating the gas in a relatively purified condition.

2. A process of the nature disclosed, which comprises compressing to a pressure of approximately 300 pounds per square inch a fluid mixture comprising a gas, mixing said mixture with glycerin while under compression, reducing the temperature of the resultant mixture to approximately 60° F. while under compression, thereby separating glycerin and contained impurities and liberating the gas in a relatively purified condition, and passing the relatively pure gas into a separator under compression, thereby further eliminating glycerin and contained impurities and liberating a practically pure gas.

3. A process of the nature disclosed, which comprises, first, mixing a hydrocarbon gas with glycerin, then cooling said mixture to approximately 60° F., then separating the resultant gaseous product of the cooling operation from the glycerin and contained impurities, the mixture of gas and glycerin being at a pressure of approximately 300 pounds per square inch, and said pressure being maintained until separation of said gaseous product.

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

WILLARD O. FELT.

Witnesses:

J. W. ANDERSON,

L. A. WATSON.