PROCEEDINGS

OF THE

International Gas Congress

HELD AT

San Francisco, California
September 27 - October 2
1915

Edited by the Secretary

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Guild of Gas Managers of New England
Illinois Gas Association
Illuminating Engineering Society
Indiana Gas Association
International Acetylene Association
Iowa District Gas Association
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National Commercial Gas Association
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L. V. Lowe. Paul Doty.

COMMITTEE ON AWARDS. COLLECTIVE GAS EXHIBIT,
PANAMA-PACIFIC EXPOSITION.

4. The fixing surface was small for a given volume of apparatus.

5. Experiments by Hempel, and also by the writer, upon the effect of vaporizing oil in the presence of blue gas, prove that chemical action takes place between the hydrogen of the blue gas and the hydrocarbons of the oil, and show clearly the advantage of vaporizing and fixing the oil in the presence of blue gas. It is possible that in the Tessie du Motay type, in which the oil is not subjected to high temperature until mixed with blue gas, no evil effects would result. It is evident, however, that in those processes in which the finished oil gas is mixed finally with the blue gas, such as the Hanlon-Johnson and the Edgerton, this objection would apply. The processes which possessed the advantages of mixing blue gas and oil vapor before fixing seem to have been restricted to the use of naphtha. This in itself, on account of the high cost of naphtha compared with gas oil, would prohibit their use to-day.

Lowe System.

The basis of the modern forms of water gas apparatus was invented by Prof. T. S. C. Lowe, of Norristown, Pa. During the Civil War, Prof. Lowe was Chief Aeronaut of the Army of the Potomac, and as such he engaged in the manufacture of gas for balloons. In 1875 he took out a patent covering a separate fixing chamber heated by internal combustion, thus laying the foundation for the only types of apparatus now in use.

The original Lowe apparatus is shown in Fig. 2. The fire was blown by forced draft, and the superheater heated by secondary combustion in what is now the usual way. During the run, oil was sprayed on top of the fire. In the patent, provision was made for passing the illuminating gas through a boiler which furnished steam to the generator; the products of combustion leaving the stack were discharged through an air heater which preheated both the primary and secondary air.

At least one works of large size has until recently followed the practice of admitting some of the oil on top of the fire, thereby obtaining an increase in candles per gallon. The reason for discontinuing this method was due to the extreme care

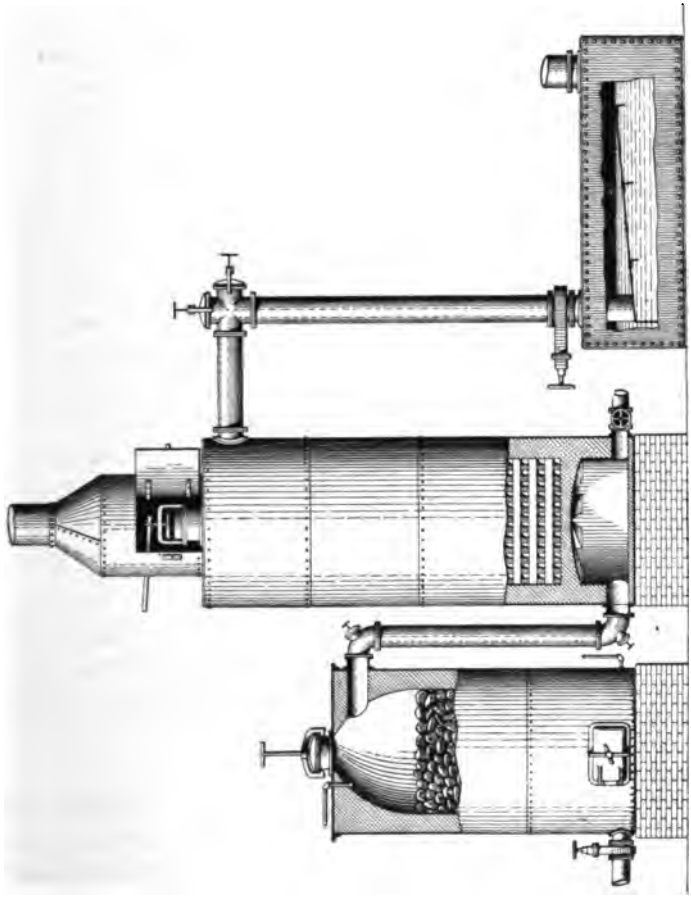

Fig. 2.—Original Lowe Apparatus.

required to obtain results; while under the most efficient operation it gave excellent results, it was nevertheless very sensitive. Increase in efficiency in this case was sacrificed for ease in operation.

In view of the development of the waste heat boiler of the present day, it is interesting to note that Prof. Lowe showed separate devices for recovering heat from the illuminating and from the blast gases. The use of a single boiler for the extraction of the heat of the blast and the illuminating gases has in some cases been found objectionable on account of the stopping up of the tubes by tar and lampblack. The tar which condenses out of the illuminating gases is normally sufficiently fluid to run out of the tubes without causing any great stoppage; if, however, the tar produced from some grades of oil is subjected to the drying action of the blast gases, it may stiffen and stop up the tubes. For this reason the double type of boiler is now generally used.

Prof. Lowe's patent application also provides for the use of superheated steam. Although no records are available showing that superheated steam was used in those days to any extent, it is again of interest to state that its use at the present time is being looked upon with favor.

Prof. Lowe laid particular stress upon the importance of vaporizing the oil in the presence of hydrogen. While the precise chemical reactions taking place may not have been known at that time, still he specifies clearly that a beneficial effect is obtained.

The great advances in the art made by Prof. Lowe seem, therefore, to be:

1. The reduction of the fuel consumption by the utilization of previously wasted gases from the generator for the internal heating of a fixing vessel.

2. The statement of the advantages to be derived by the vaporization of oil in the presence of hydrogen.

3. The design of an apparatus which could be used either with an easily volatile oil such as naphtha, or with the less volatile gas oil of the present day.

The introduction of the Lowe apparatus in 1874 at Phoenixville, Pa. was followed by numerous designs bearing other names, but all based upon the Lowe principle.

In the Granger-Collins type, the long goose-neck connection between the generator and the superheater was eliminated by locating the generator in the cellar and having the shells slightly lapping, thus giving a short, straight horizontal connection from the top of the generator to the base of the superheater. This design decreased the heat lost by radiation and convection, brought all the valves in a convenient location for easy operation, reduced the ground area required, and allowed of fairly free access to the fire for cleaning.

In the Hanlon-Leadley there were provided three generators connected to two steam and two gas superheaters. The generators were blown in parallel, which made possible the use of a shallow bed for blasting, with consequent decrease in resistance. During the run, the steam was superheated by the steam superheaters and was then passed through the generators in series, thereby getting the effect of a deep fuel bed for the decomposition of the steam. The mixture of oil vapor and water gas was fixed by passing it through the two gas superheaters in parallel. The germ of the idea is still found in the double generator of the present day. The chief objection to the early machines was the difficulty of keeping both gas superheaters at the same temperature.

In the Springer set the superheater was placed above the generator, thereby reducing the ground area but correspondingly increasing the height of the apparatus. The chief objection to this type is in the difficulty of access to the fire for purposes of cleaning.

One of the first improvements in the original Lowe design was brought about by the increasing necessity to use the heavier oils. It consisted in enlarging the goose-neck connection between the generator and superheater so as to form another superheater known as the "first" superheater (in contradistinction to the second). Later, the second superheater was made higher for the purpose of increasing the fixing surface, and also of acting as a short stack for the production of a natural draft, thus carrying away the heated gases which

otherwise might issue from the generator fuel-charging-door during coaling. The placing of the stack valve well above the operating floor line also removed the possibility of injury to the gas maker from horizontal flames issuing from it. The entire height of the apparatus was increased in order to allow of a deeper fuel bed.

In 1891 the up-and-down run feature was added; since that time the changes in design have been less radical, although each improvement has played its part in increasing the efficiency, the capacity, the flexibility, or the safety of the apparatus. One modern form of setting, equipped with the double waste heat boiler, is shown in Fig. 3.

Systems for Using Bituminous Coal.

Due to the difference in cost between anthracite coal, or coke, and bituminous coal, particularly in the West, many attempts have been made to use soft coal directly in water gas generators.

Although the successful use of soft coal for producers is common, the requirements of a fuel for water gas production are so much more exacting than those for producer work, that its use in water gas generators cannot yet be said to be entirely successful.

Some of the differences in requirements between the two methods of gas generation may be indicated as follows:

1. While the fuel consumption in a producer amounts to about 12 pounds per square foot per hour, in our modern water gas sets it may be as much as 80 pounds.

2. On account of the very deleterious effect of impurities, such as CO_2, upon candle-power, the water gas reaction must be more perfect in water gas generators than in producers. In consequence of this, the temperatures carried must be higher.

3. The action in a producer is continuous, the mass of coal gradually increases in temperature in its descent in the fuel bed, and it is not subjected to the full steam until it reaches the base of the fire. In water gas sets, on account of the

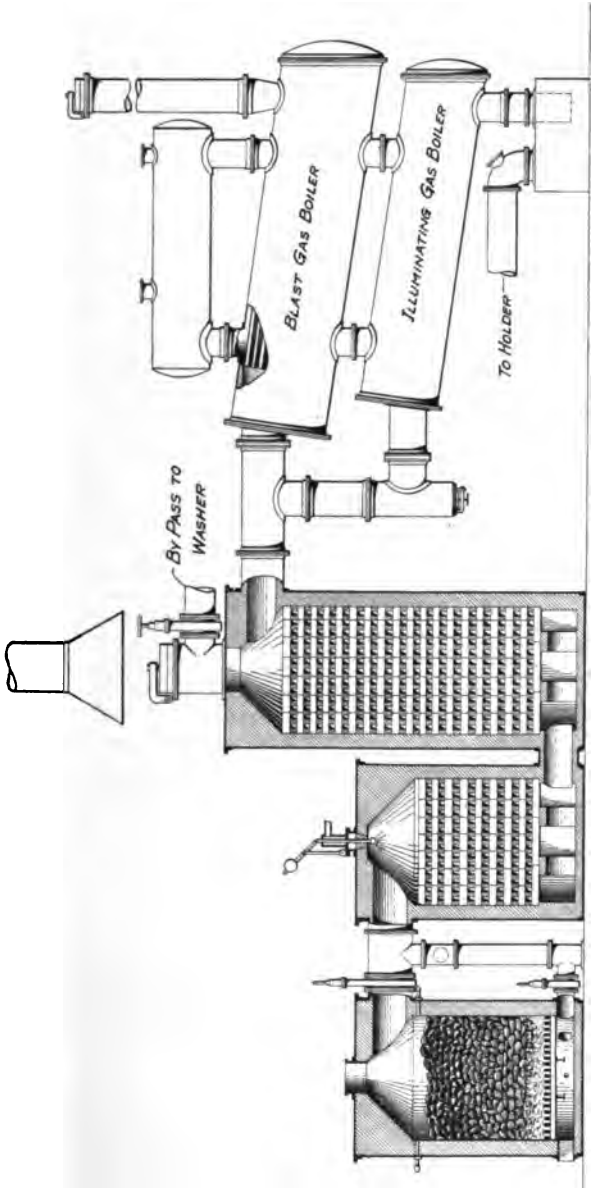

Fig. 3.—Modern Lowe Apparatus