H. A. CARPENTER.
APPARATUS FOR TREATING COAL GAS.
APPLICATION FILED AUG. 6, 1914.

1,167,150. Patented Jan. 4, 1916.

2 SHEETS—SHEET 1.

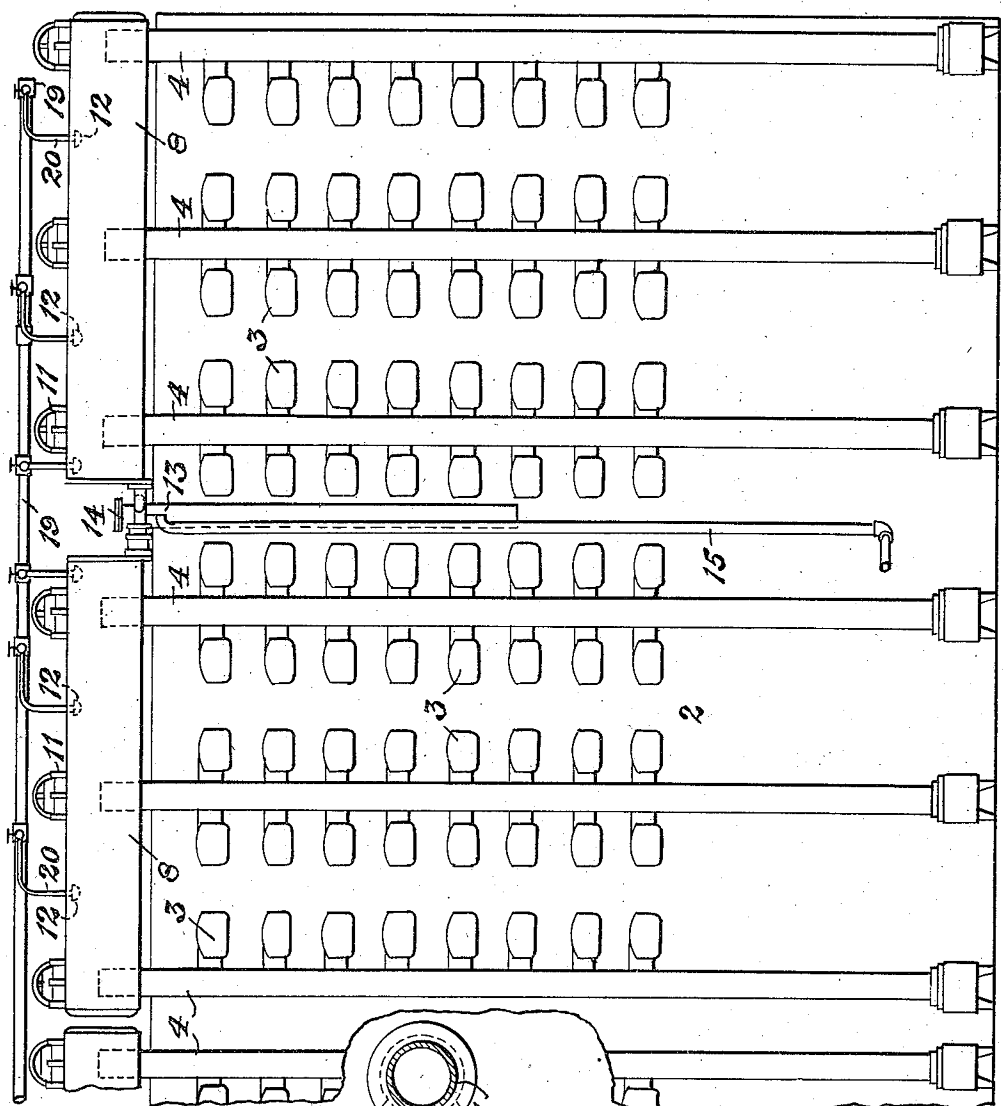

FIG. 1.

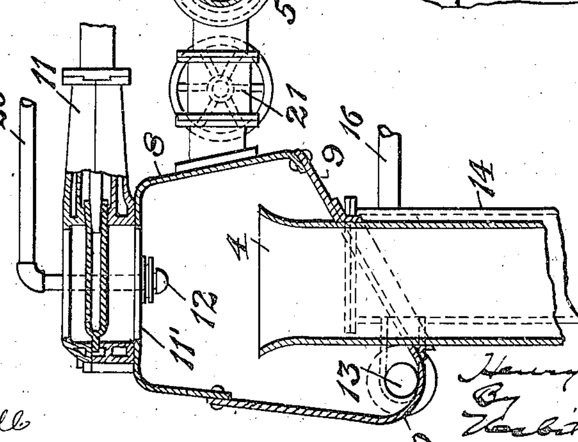

FIG. 4.

WITNESSES

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2 SHEETS—SHEET 2.

FIG. 2.

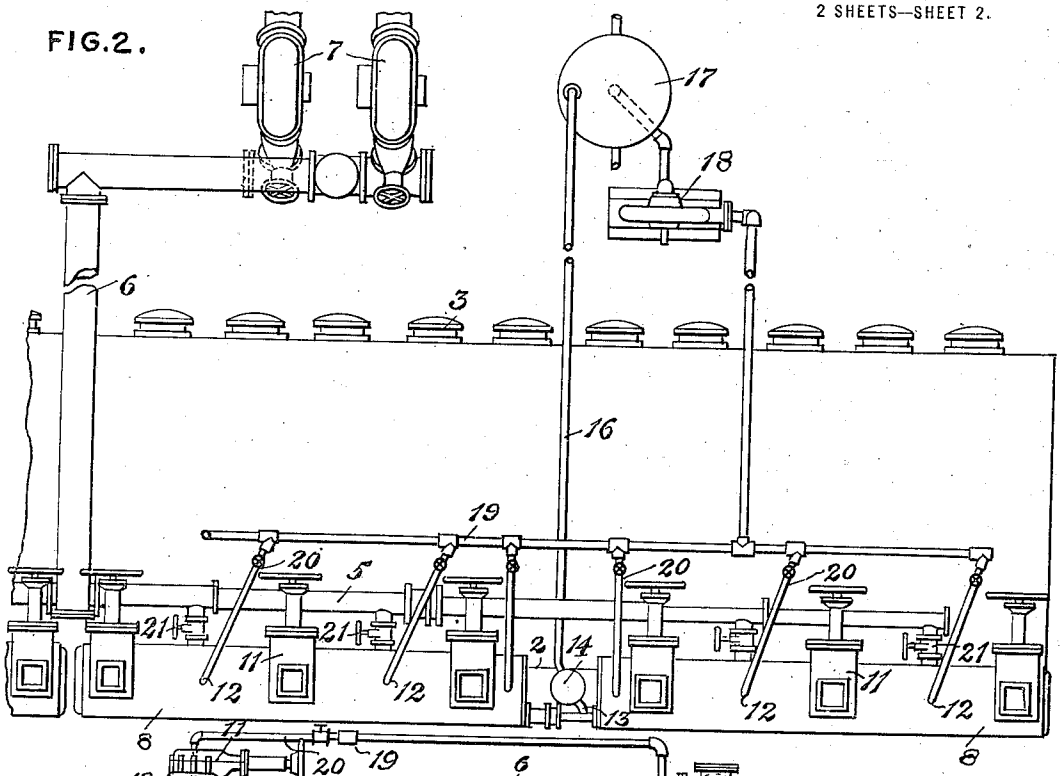
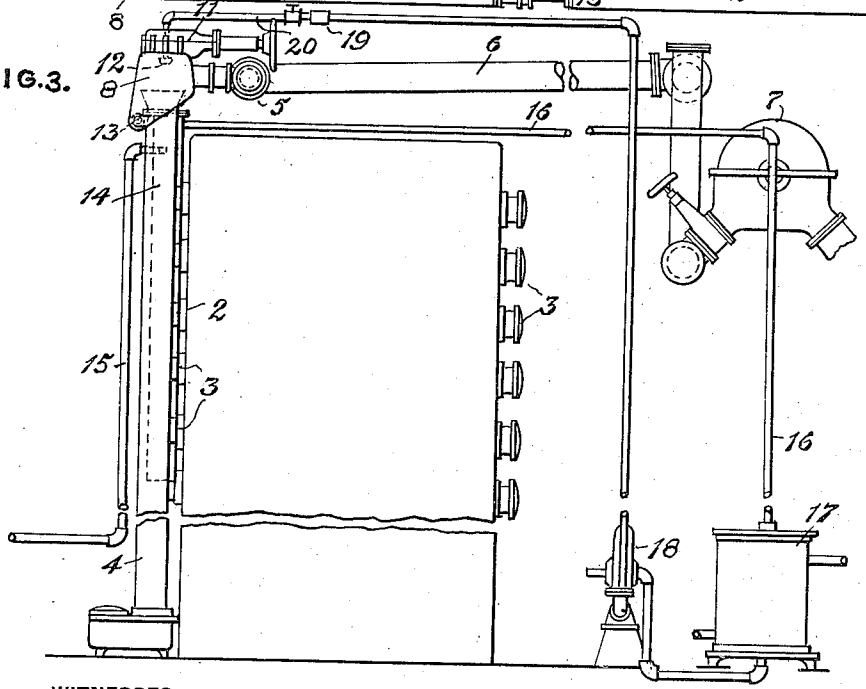


FIG. 3.



WITNESSES

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UNITED STATES PATENT OFFICE.

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APPARATUS FOR TREATING COAL-GAS.

1,167,150. Specification of Letters Patent. Patented Jan. 4, 1916.

Original application filed May 6, 1914, Serial No. 836,677. Divided and this application filed August 6, 1914. Serial No. 855,415.

To all whom it may concern:

Be it known that I, HENRY A. CARPENTER, a citizen of the United States, residing at Sewickley, in the county of Allegheny and State of Pennsylvania, have invented certain new and useful Improvements in Apparatus for Treating Coal-Gas, of which the following is a specification.

One object of this invention is to provide for the removal of the heavier hydrocarbons, such as tar and naphthalene, from coal gas immediately upon discharging the product of gas generating retorts from the stand-pipes and before these substances have had opportunity to pass to the take-off main and to the apparatus beyond, thereby eliminating most of the stoppages heretofore experienced and at the same time decreasing the work of those portions of the apparatus or system to which the gas is delivered from the main.

A further feature and object is to accomplish this separation after the gaseous fluid has attained such temperature as results in fixing some of the lighter and enriching hydrocarbons into a permanent gaseous state which in the absence of such temperature would condense and be carried away with the tar. Approximately 1000° F. is an efficient temperature for fixing the lighter hydrocarbons into a permanent gaseous state, although it may be higher, and even lower temperatures may suffice.

In order that the quality of the gas delivered to the take-off main may be substantially uniform, the gaseous fluid discharging from the stand-pipe should be maintained at a relatively constant temperature, and this is accomplished by allotting a proper number of retorts to each stand-pipe and by so alternating or arranging the retort charging periods that the resultant of the low temperature of the product of freshly charged retorts and the maximum temperature of the product of other retorts will be an efficient fixing temperature.

The requisite high temperature having been attained and the lighter hydrocarbons thereby fixed into permanent gaseous state before discharging from the stand-pipe, reduction of the temperature of the gaseous fluid immediately upon issuing from the stand-pipe is of prime importance to avoid the accumulation of solid deposits in the take-off means. The temperature should be reduced to from 110° to 125° F. for the best results, and it therefore becomes a further object of the invention to interpose means between the stand-pipes and the take-off main for accomplishing this immediate temperature reduction. The apparatus is constructed to provide ready access to the stand-pipes for clearing them of stoppages, and provision is also had for disposing of the precipitated tar and other hydrocarbons, keeping the latter clear of the stand-pipes and of course preventing them from gaining access to the take-off. The net result is that enriched and relatively clean gas passes to the apparatus beyond, thereby minimizing such apparatus, and otherwise reducing the expense incident to the treatment of foul gas which, under present practices, is delivered to the system through the hydraulic main. While the present invention does not accomplish the removal of all naphthalene, only a small percentage is carried forward. This is due to the fact that full saturation of the gas at 110° F. is accomplished by a small amount of naphthalene, whereas at higher temperatures, the absorption is proportionately greater. Heretofore, due to the relatively high temperature at which the gas enters the system, much naphthalene is carried forward and is subsequently thrown down at points where no tar is present to absorb it, causing serious stoppages.

A further advantageous result is that a relatively large number of retorts may be connected to one stand-pipe, as here shown the benches being eight-high, so that a single pipe handles the product of sixteen retorts. This results in economy in space and in the cost of constructing the benches. It may be possible to increase the number of retorts for each stand-pipe, but even an eight-high construction is a substantial advance over present practice.

In the accompanying drawings, which are largely diagrammatic, Figure 1 is a front elevation of apparatus embodying the invention. Fig. 2 is a view in top plan of the same. Fig. 3 is an end view, and Fig. 4 is a view in cross-section of one of the cooling chambers or receivers interposed between

the off-take main and the stand-pipes, and showing one of the latter discharging thereinto.

Referring to the drawings, 2 designates the front of a bench, and 3 are retorts of usual construction arranged one above the other, in the present adaptation, the retorts being arranged in tiers of eight-high and with a stand-pipe 4 connected to the retorts of two adjacent tiers, and thereby taking care of the product of sixteen retorts. 5 designates the take-off main which is connected at 6 to the twin exhausters 7 which may be utilized alternately, in accordance with present practice, for delivering the gas to scrubbers or other portions of the apparatus beyond, not shown.

Interposed between the take-off main 5 and the stand-pipes 4 are the cooling chambers or receivers 8 into which the stand-pipes discharge, as clearly shown in Fig. 4. In the preferred construction, the bottom 9 of each chamber is inclined to form the trough or valley 10, with the stand-pipes 4 projecting through and above the inclined bottom to exclude the liquid accumulation in the trough. At the top of chamber 8 are valves 11 for closing openings 11′, the latter being in line vertically with the stand-pipes for the introduction of pipe cleaning devices or for gaining access to the stand-pipes for any other purpose.

The cooling means for each chamber 8 consists of a suitable number of liquid sprayers 12 depending thereinto from the chamber top and arranged out of vertical line with the stand-pipes to minimize the amount of liquid entering the latter. A closed circulating system is preferably employed, for which no novelty *per se* is claimed herein, as thereby much ammonia is saved as compared with a fresh water circulation for the reason that after the cooling medium has become saturated, no additional ammonia is extracted from the gaseous fluid being treated. The circulation system includes a drain 13 for conducting the tar and cooling liquor from trough 10 to a conventional form of tar separator 14, the tar discharging from the latter through pipe 15 and the liquor through pipe 16 to a cooler 17, and from the latter is forced by a pump 18 into manifold 19 from which extend pipes 20 to the several spray devices 12.

In operation, the charging and recharging of the several retorts of each bench are so arranged and timed that some are in a comparatively freshly charged state with the product entering the stand-pipe at comparatively low temperatures, while the generation in other retorts is approaching completion with the product thereof at maximum temperature. And the manipulation is preferably such that the gaseous product discharges from the stand-pipe at approximately 1000° F., and as heretofore explained, this temperature results in fixing into permanent gaseous state the lighter hydrocarbons, thereby materially enriching the ultimate cleansed gas, retaining in the latter valuable products which, due to the absence of a sufficiently high fixing temperature, have heretofore been dissociated from the main body of gas and virtually lost.

Immediate cooling of the stand-pipe output is necessary to prevent accumulation of solids in the take-off main and apparatus beyond, and this is accomplished by the liquid sprays which the gaseous fluid encounters immediately upon emerging from the stand-pipes, the operation being preferably such that its temperature is reduced to from 110° to 125° F. This temperature reduction results in precipitating the major portion of the tar and also nearly all of the naphthalene, the latter combining with the tar and the condensates and the cooling liquid draining into trough 10 and discharging to separator 14 through outlet 13, as above explained.

Chambers 8 are designed with special reference to accomplishing the described cooling operation with maximum efficiency, and also for the purpose of obtaining a proper withdrawal therefrom of the cleansed and cooled gas. With these considerations in view, relatively short chambers are employed, as thereby the cooling and withdrawing of the gas may be more effectually controlled and greater uniformity attained than though a single continuous chamber for all the benches were provided. In practice, each chamber is preferably arranged to accommodate three stand-pipes, and with such arrangement, no difficulty has been experienced in maintaining the desired highly efficient conditions above described. And this arrangement provides for more accurately controlling the withdrawal of the cleansed and cooled gas through the valved outlets 21 to take-off main 5, the valves of these connections being so adjusted as to subject all of the cooled and cleansed gas to uniform exit force with the result that no portion of the gas is retained within the chamber for an appreciably longer period than any other portion thereof.

This application is a division of my application Serial No. 836,677, filed May 6, 1914.

I claim:—

1. The combination of a stand-pipe in communication with coal gas generating apparatus and adapted to conduct the gas upwardly therefrom, a take-off main, a cooling and condensing chamber at the upper end of the stand-pipe and into which the latter discharges, means for maintaining controlled communication between said chamber

and main, and means operative within said chamber for cooling the gas immediately upon its discharge from the stand-pipe and thereby precipitating tar and other impurities therefrom before it passes to the main.

2. The combination of a cooling chamber, a stand-pipe beneath and adapted to discharge upwardly into the chamber with the stand-pipe outlet above the chamber bottom, means within the upper portion of the chamber for directing a spray of liquid on the gas discharging upwardly from the stand-pipe, and a take-off main in communication with the upper portion of the chamber.

3. The combination of a cooling chamber, a stand-pipe extending upwardly into the chamber through the bottom of the latter with the upper end of the pipe open for discharging gas into the upper portion of the chamber, means within the chamber for subjecting the gas discharged thereinto to a liquid spray, a liquid outlet for the chamber located beneath the plane of the upper end of the stand-pipe, and a take-off main in communication with the upper portion of said chamber.

4. The combination of a plurality of stand-pipes, a cooling chamber above and common to the stand-pipes and into which the latter are adapted to discharge above the chamber bottom, a liquid outlet for the chamber located in a plane lower than the stand-pipe outlets, means within the upper portion of the chamber for subjecting the gas discharging from the several stand-pipes to a liquid spray, and a take-off main in communication with the upper portion of said chamber.

5. The combination with a plurality of gas-bench stand-pipes, of a cooling chamber into which the pipes discharge, means for cooling the discharged gas within the chamber and thereby precipitating the heavier hydrocarbons, and an off-take main in controlled communication with the chamber at a plurality of points for subjecting all of the cooled and cleansed gas within the chamber to uniform exit force.

6. The combination with a plurality of gas-bench stand-pipes, and a take-off main, of a cooling chamber interposed between the main and the stand-pipes and into which the latter discharges, means within the chamber for cooling the gaseous fluid discharging from the stand-pipes and thereby separating the heavier hydrocarbons from such fluid, and controlled communications between the main and different portions of the cooling chamber for withdrawing the cooled and cleansed gas uniformly for all portions of the cooling chamber.

7. The combination of a gas-cooling chamber, a retort-bench stand-pipe adapted to discharge thereinto, a closed liquid circulation system adapted to discharge cooling liquid into the chamber and withdraw the liquid therefrom, and a pump for maintaining such circulation.

8. The combination of a gas-cooling chamber, a retort-bench stand-pipe in communication with and adapted to discharge directly into the chamber, the chamber having an outlet for the cooled gas, cooling liquid inlet means for the upper portion of the chamber and a liquid outlet for the lower portion thereof, a conduit for the liquid connecting the chamber inlet and outlet, and a pump interposed in the conduit for maintaining circulation of the liquid.

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

HENRY A. CARPENTER.

Witnesses:
J. M. NESBIT,
F. E. GAITHER.