No. 885,857. PATENTED APR. 28, 1908.

J. S. McILHENNY.

METHOD OF TREATING GAS.

APPLICATION FILED APR. 11, 1907.

2 SHEETS—SHEET 1.

Fig. 1.

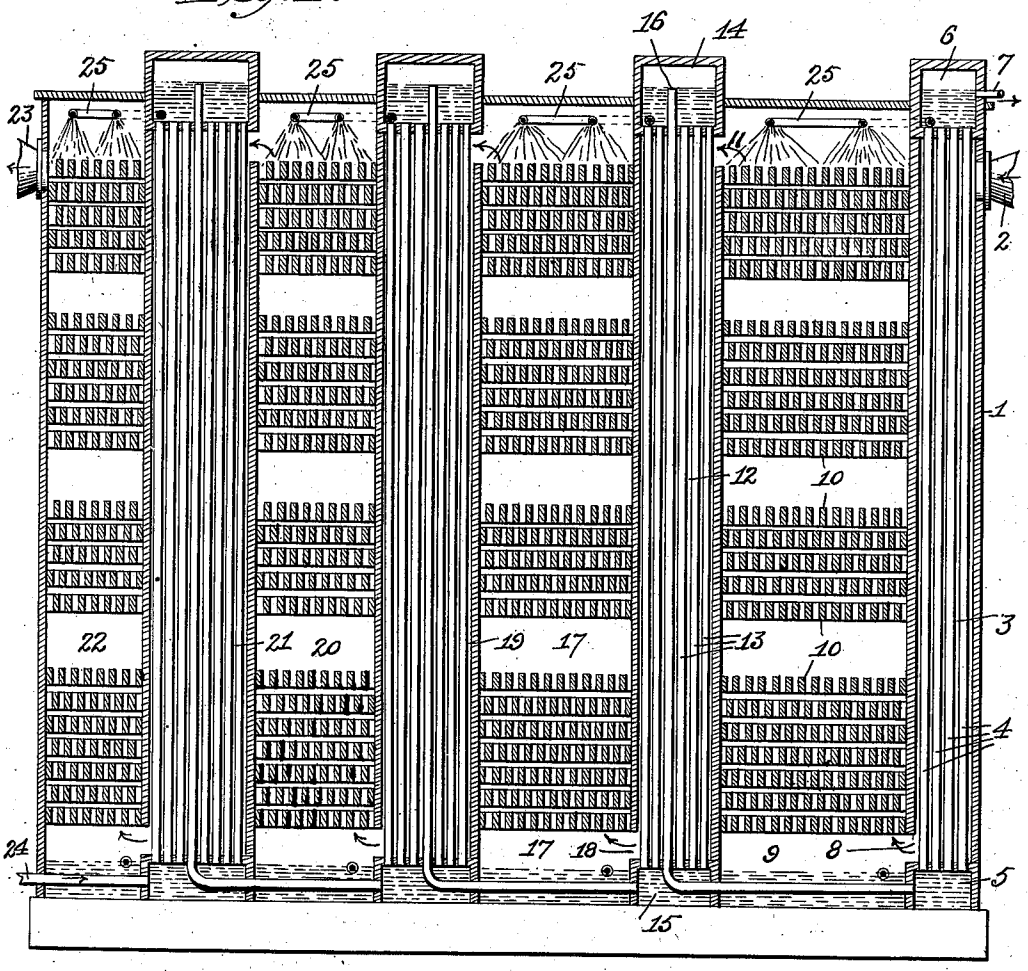
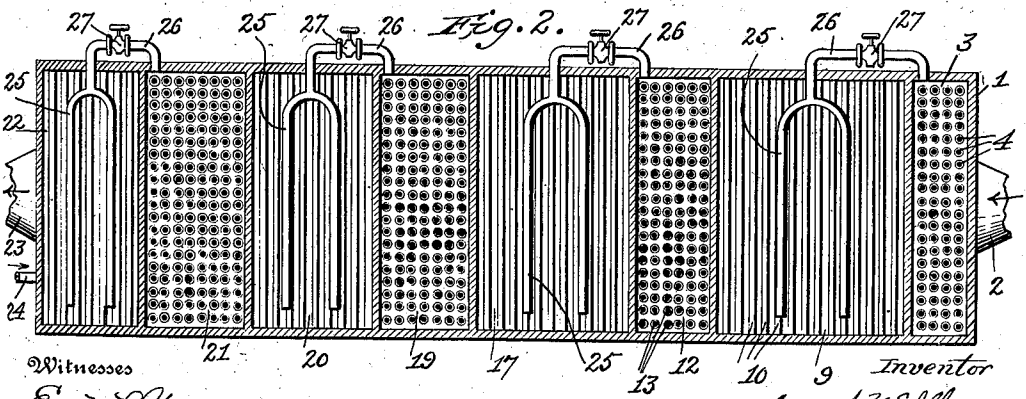


Fig. 2.



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2 SHEETS—SHEET 2.

Fig. 3.

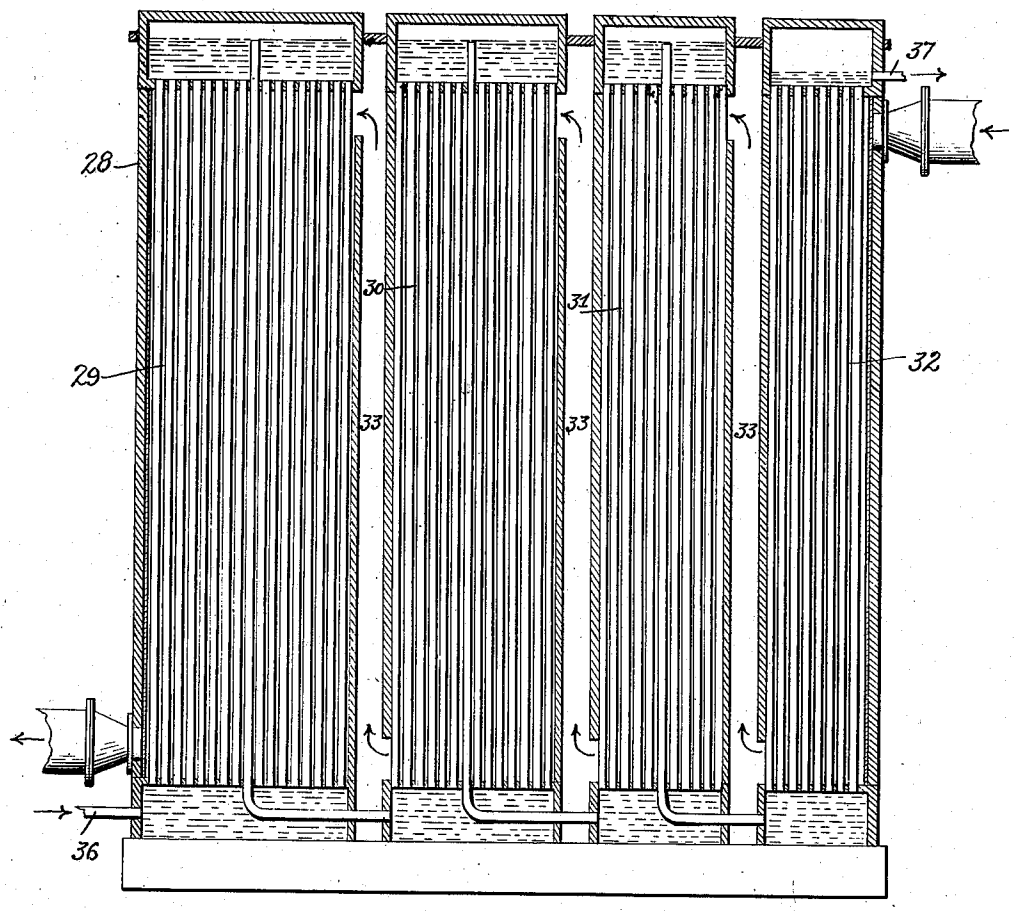
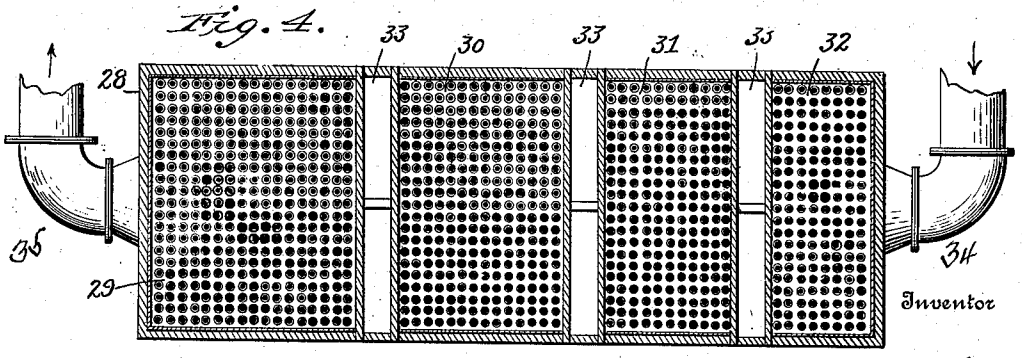


Fig. 4.



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UNITED STATES PATENT OFFICE.

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METHOD OF TREATING GAS.

No. 885,857. Specification of Letters Patent. Patented April 28, 1908.

Application filed April 11, 1907. Serial No. 367,551.

To all whom it may concern:

Be it known that I, JAMES S. McILHENNY, a citizen of the United States, residing at Washington, in the District of Columbia, have invented new and useful Improvements in Methods of Treating Gas, of which the following is a specification.

My invention relates to the method of treating of coal or water gas intermediate the generator and the distributing system, and has for its object, first, to more efficiently remove therefrom the tar and heavy hydrocarbon oils that are precipitated by a reduction in temperature of the gas after it leaves the generator; secondly, to provide for a gradual cooling of the gas; thirdly, to provide an alternate cooling and scrubbing whereby the gas will be successively subjected to said steps in a series of stages, each stage of cooling being immediately followed by a stage of frictional scrubbing, and, fourthly, to provide, if desired, for successive washings of the gas with water at substantially the temperature of said gas at each washing step.

In the accompanying drawings, illustrating a convenient apparatus for carrying out my improved processes: Figure 1 is a vertical longitudinal sectional view of a combined condenser or cooler, scrubber and washer. Fig. 2 is a horizontal sectional view of the same. Fig. 3 is a view similar to Fig. 1, illustrating a condenser or cooler alone. Fig. 4 is a view similar to Fig. 2, of the construction shown in Fig. 3.

In the said drawings, referring to Figs. 1 and 2, the reference numeral 1 denotes the casing of the structure, into one end of which near its top is tapped a gas main 2 leading from the hydraulic main of a coal gas apparatus, or the seal box of a water gas apparatus. Said pipe leads into a chamber 3 containing a series of vertically disposed pipes 4 for conveying a suitable cooling medium, such as water. Said chamber 3 is provided at its bottom with a cooling medium receiving compartment 5, into which the pipes 4 are tapped, and at its top with a similar compartment 6 receiving the upper ends of said pipes 4, as shown, and having connected therewith a discharge pipe 7 for the water. The chamber 3 is sealed gas-tight except at its lower end where there is an opening 8 leading into the adjoining chamber 9. This chamber is filled in the usual manner with any suitable scrubbing apparatus, such as slats 10, and is closed gas-tight except at its upper end, where an opening 11 is provided communicating with the next adjoining chamber 12. Said chamber 12 is substantially similar to chamber 3, being provided with the water circulating pipes 13 and upper and lower compartments 14 and 15. Nested within said pipes 13, however, is a series of overflow pipes 16, whose upper ends terminate some distance above the bottom of chamber 14 and within the same, and which at their lower ends are turned horizontally and lead through the lower end of chamber 9 into the lower compartment 5 of chamber 3. Next adjoining chamber 12 is a scrubbing chamber 17 similar in construction to chamber 9, and which communicates with chamber 12 at the bottom through opening 18. Similarly there are provided to the left of chamber 17, alternately, cooling chambers 19 and 21, and scrubbing chambers 20 and 22 the chambers 19 and 21 being provided with upper and lower compartments similar to the compartments 5 and 6 of chamber 3, and with similar vertical piping, the upper compartments thereof communicating with the lower compartments of the next cooling chambers in a manner, identical with said communication between chambers 12 and 3 through pipes 16.

The chambers 20 and 22 are provided with suitable apparatus similar to chambers 9 and 17 and the points of communication between all these chambers 19, 20, 21 and 22 is such that the gas passes up through the scrubbing chambers 20 and 22 and down through cooling chambers 19 and 21. The chamber 22 has communicating therewith at its upper end a gas main 23 leading to the distributing system, while a pipe 24 leads from the exterior into the lower compartment of cooling chamber 21 to supply the cooling medium to the apparatus.

From the above description the operation of my improved apparatus will be understood as follows: It will be observed that the cooling chambers 3, 12, 19 and 21 gradually increase in size from the entrance side of the gas towards its exit side, and that reversely the scrubbing chambers 9, 17, 20 and 22 gradually decrease in size, the chambers 9 and 21 being, respectively, about twice the size of their corresponding chambers 22 and 3. It results, therefore, that the gas enters

chamber 3 from main 1 at a temperature of from 120° to 200° F. and, owing to the comparatively small area of said chamber 3, must pass therethrough at a comparatively rapid rate, and is discharged therefrom through opening 8 into the lower end of scrubbing chamber 9. The cooling medium in the pipes 4 of chamber 3, having by its passage through chambers 21, 19 and 12 absorbed heat from the preceding gas, has reached pipes 4 at a temperature not much below that of the gas in chamber 3, so that the cooling action on said gas in chamber 3 is comparatively slight; due not only to this fact, but also to the fact of rapid passage of the gas through chamber 3 on account of the small area of the latter. The gas entering at the bottom of scrubbing chamber 9 filters slowly up through the slats in same, due to the much larger area of said chamber as compared with chamber 3, and is deprived of much of the heavy tars and water contained therein, the temperature of the gas being but little lowered. The gas then passes from the top of chamber 9 into cooling chamber 12, where, owing to the somewhat larger area of said chamber as compared with chamber 3, it passes downward more slowly than through chamber 3, and yet faster than through scrubbing chamber 9. The cooling medium in the pipes of chamber 12, being necessarily somewhat cooler than that in the pipes 4 of chamber 3, further reduces the temperature of the gas, and this reduction is greater by comparison than in chamber 3, owing to the larger area of exposure in chamber 12 and the consequent slower movement of the gas therethrough. The gas passing from the bottom of chamber 12 into scrubbing chamber 17 is subject to a scrubbing action similar to that in chamber 9 except that, as chamber 17 is somewhat smaller than chamber 9, its passage therethrough is faster than through chamber 9. Successively the gas passes through chambers 19, 20, 21 and 22, its speed through the scrubbers increasing, and its speed through the cooling chambers decreasing, and out to the distributing system through main 23. In a similar manner the cooling medium, such as water, is supplied to the device through supply pipe 24, either at the water system pressure or through a force pump, and passes successively through the piping in chambers 21, 19, 12 and 3, it being observed that the size of said chambers successively decreases from chamber 21 to chamber 3, so that the cooling medium must necessarily proportionately increase its speed in its passage through the device. Said cooling medium by its successive contacts with the cooling gas becomes proportionately heated, the result being that the gas temperature is gradually reduced by successive and increasing exposures to the cooling medium, the latter being in each of the cooling chambers at a temperature but little below that of the gas. The result of this combined scrubbing and gradual cooling is that the removal of tar or ammonia and other deleterious substance is effectually accomplished, and without the re-absorption of any of the illuminants, thus providing a rich, clean gas for the distributing system.

It is frequently very desirable that in addition to the frictional scrubbing, the gas be subjected to a washing action in the scrubbers, and this I accomplish in an improved manner by locating at the top of the scrubbing chambers 9, 17, 20 and 22 spraying pipes 25, the pipes of each chamber being supplied through pipes 26 with water from the preceding cooling chamber, suitable cut-offs 27 being provided to regulate or cut off the flow. By preceding cooling chamber I mean when considered with respect to the direction of flow of the gas. Thus, the spraying pipes of chamber 20 are supplied from the compartment at the top of chamber 19, the result being that said water is sprayed into chamber 20 at a temperature approximating that of the gas which it acts upon, and this is true from end to end of the apparatus, this feature being important, as it does not subject the gas at any time to excessive cooling action.

I have illustrated in Figs. 3 and 4 a modified construction in which the scrubbing chambers are dispensed with, the casing 28 containing a series of cooling chambers 29, 30, 31 and 32 alone with small intervening spaces 33 providing upward passages for the gas between said chambers, as shown by the arrows, the gas being admitted from main 34 and discharged through main 35. As in the construction shown in Figs. 1 and 2, the cooling medium is admitted through supply pipe 36 and taken off through discharge pipe 37, the interior construction with respect to the cooling medium circulation being the same as in Figs. 1 and 2, it being observed that the size of the cooling chambers successively decreases from the cooling medium inlet towards its exit. This apparatus is designed for use in plants where other means are employed to scrub the gas, and is intended solely for the gradual cooling of the gas in the manner hereinbefore described.

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

1. The method of treating gas, which consists in passing said gas through a condenser in one direction, passing a separate cooling medium through said condenser in the opposite direction in such manner as to exert its cooling action on said gas, and successively decreasing the speed of said gas in its passage through said condenser while subjected to the action of said cooling medium.

2. The method of treating gas, which con-

sists in passing said gas through a condenser in one direction, passing a cooling medium through said condenser in the opposite direction in such manner as to exert its cooling action on said gas, and successively increasing the speed of said cooling medium in its passage through said condenser.

3. The method of treating gas, which consists in passing said gas through a condenser in one direction, successively decreasing the speed of said gas in its passage through said condenser while subjected to the action of said cooling medium, passing a cooling medium through said condenser in the opposite direction in such manner as to exert its cooling action on said gas, and successively increasing the speed of said cooling medium in its passage through said condenser.

4. The method of treating gas, which consists in passing the same through a condenser, subjecting it to successive scrubbing actions in its passage through said condenser, and successively increasing the speed of the gas through the scrubbers in its passage through said condenser.

5. The method of treating gas, which consists in subjecting said gas alternately to cooling and scrubbing actions, and increasing the speed of travel of said gas while subjected to said scrubbing actions.

6. The method of treating gas, which consists in subjecting said gas alternately to cooling and scrubbing actions, increasing the speed of travel of said gas while subjected to said scrubbing actions, and decreasing the speed of travel of said gas while subjected to said cooling actions.

7. The method of treating gas, which consists in passing said gas through a condenser in one direction, passing water through said condenser in the opposite direction and subjecting said gas thereby to successive cooling actions, and said water to successive heating actions, and subjecting said gas to successive washing actions with a part of said water after its cooling contact with that portion of the gas about to be washed thereby.

8. The method of treating gas, which consists in subjecting said gas to successive cooling actions, and simultaneously subjecting it to successive washing actions with water at temperatures approximating that of the gas in its different stages of transit.

9. The method of treating gas, which consists in passing said gas through a condenser and there subjecting it to successive scrubbing actions, passing water as a cooling medium through said condenser in the opposite direction, and subjecting said gas to successive washing actions in said scrubbers with water taken from said cooling water after its cooling contact with the gas about to be washed thereby.

In testimony whereof, I have hereunto set my hand in the presence of two subscribing witnesses.

JAMES S. McILHENNY.

Witnesses:
PERCY B. HILLS,
G. M. COPENHAVER.