No. 855,448. PATENTED JUNE 4, 1907.

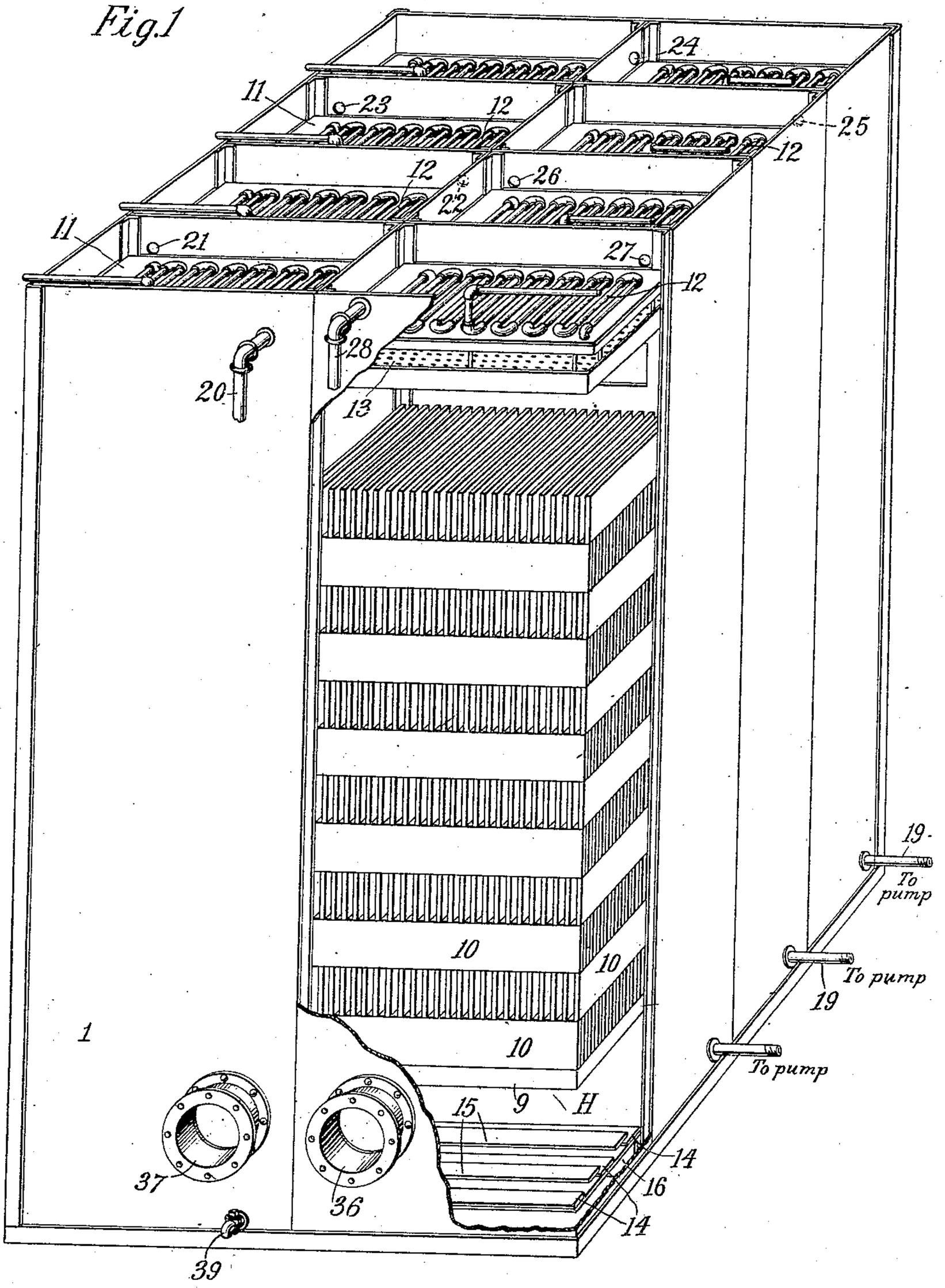
H. L. DOHERTY.

APPARATUS FOR WASHING AND COOLING GAS.

APPLICATION FILED JUNE 29, 1905.

3 SHEETS—SHEET 1.

Fig. 1



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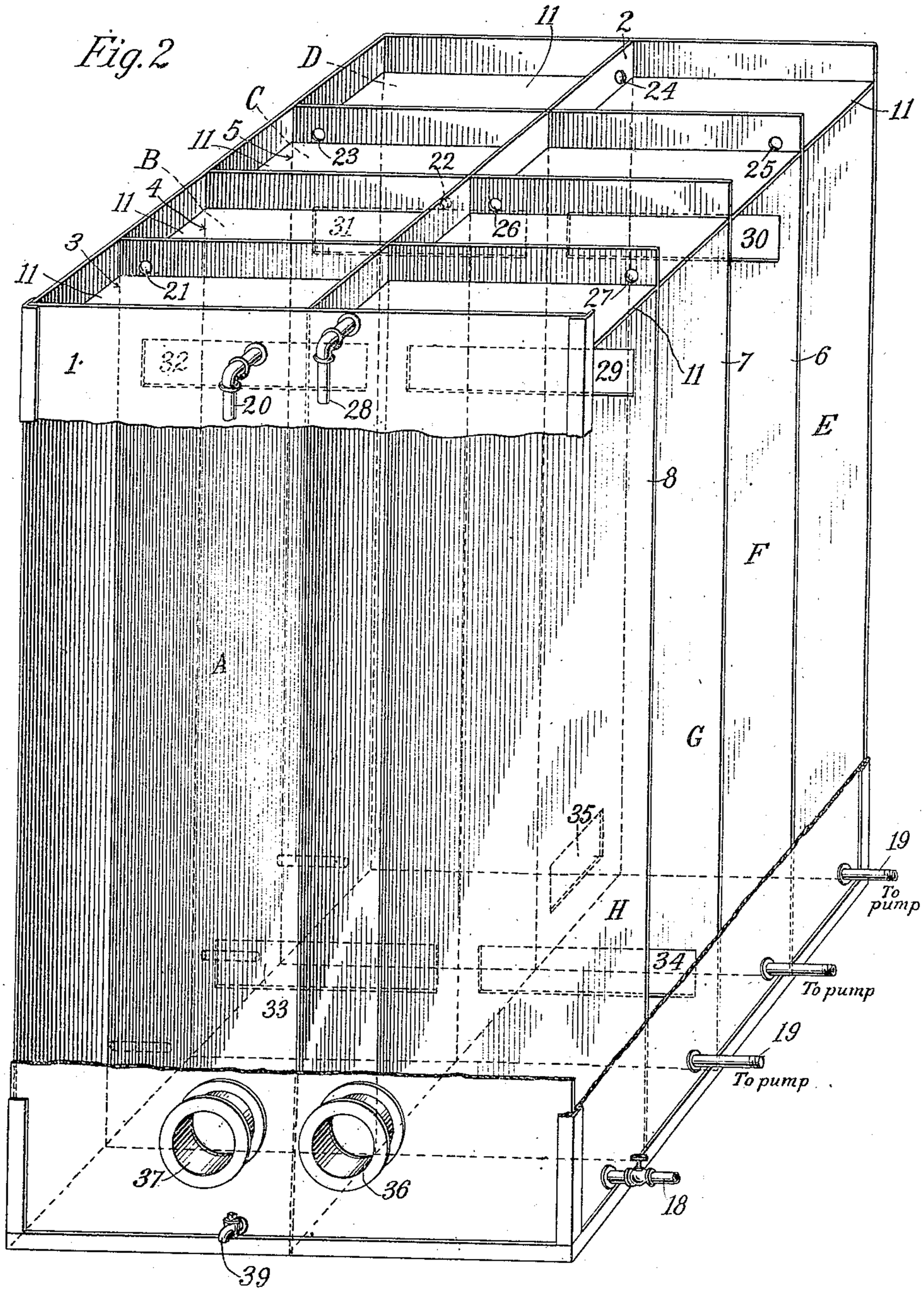
3 SHEETS—SHEET 2.

Fig. 2



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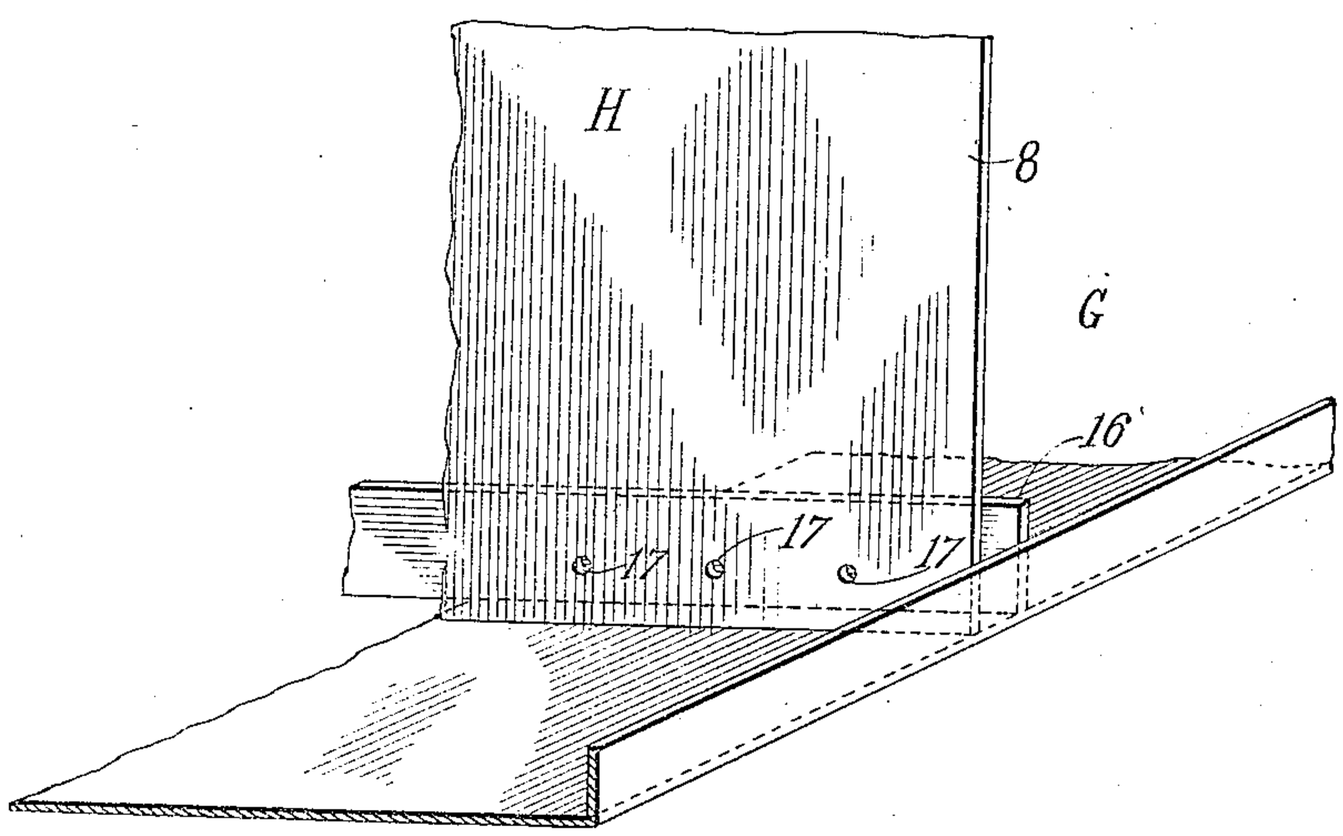
3 SHEETS—SHEET 3.

Fig. 3



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UNITED STATES PATENT OFFICE.

HENRY L. DOHERTY, OF MADISON, WISCONSIN.

APPARATUS FOR WASHING AND COOLING GAS.

No. 855,448. Specification of Letters Patent. Patented June 4, 1907.

Application filed June 29, 1905. Serial No. 267,504.

To all whom it may concern:

Be it known that I, HENRY L. DOHERTY, a citizen of the United States, and a resident of Madison, in the county of Dane and State of Wisconsin, have invented certain new and useful Improvements in Apparatus for Washing and Cooling Gas, of which the following is a specification, reference being had to the drawing accompanying and forming part of the same.

My invention relates to apparatus for washing and cooling gas, and has for its object to provide an apparatus for this purpose which shall perform its functions rapidly and effectively, with minimum loss of the enriching constituents of the gas by condensation.

The invention, which consists of the novel features, arrangements of parts, and combinations of elements hereinafter described, and more particularly pointed out in the claims, is shown in its preferred embodiment in the accompanying drawings, in which

Figure 1 is a perspective view of the apparatus, with a portion of the walls broken away to show the interior construction and arrangement. Fig. 2 is a perspective view of the casing, with portions of the side walls broken away, showing the arrangement of the compartments and chambers therein and their communication with each other. Fig. 3 is a detail view.

The outer casing of the apparatus may be of any convenient form, though preferably rectangular in plan. In the drawing the casing is designated by 1. It is divided into any desired number of chambers by longitudinal or transverse partitions, or both. In the present embodiment there are eight chambers, A, B, C, D, etc., formed by a longitudinal wall or partition 2 and transverse partitions 3 to 8 inclusive. Each chamber contains a mass of material of any suitable character having numerous interstices or passages therein, so as to cause a liquid discharged thereon to be spread over a large surface in flowing down through the mass. I prefer, however, to employ a number of layers or tiers of flat plates arranged as follows, it being understood that each chamber is similarly provided.

A short distance above the bottom is a shelf formed by angle-irons 9 with inwardly projecting flanges (not shown) extending around the inside of the chamber or across opposite sides thereof. Resting on their edges on the flanges of those angle-irons is a series of plates, 10, of wood, iron, earthenware, or other suitable material. On these plates, extending at right angles thereto as shown and also standing on edge, is another series of plates, and above the latter is a third series, parallel with the first. This arrangement of alternating longitudinal and transverse plates is continued until the chamber is nearly full, thus providing a large number of passages therethrough, so that liquid delivered on top of the pile will in descending to the bottom of the chamber be divided into numerous streams spread over a very large total area, and will thus be brought into contact with all parts of a stream of gas passing through the chamber.

Near the top the chambers are hermetically closed by horizontal partitions 11, providing an upper compartment above each chamber. In the compartment are cooling pipes 12, coiled or otherwise disposed to provide a maximum length of pipe in each. In the apparatus illustrated the pipes in parallel lengths connected in pairs by bends as shown, and the liquid, entering at the middle, flows back and forth across the compartment toward the sides of the same. At diagonally opposite corners the pipes pass through the horizontal partitions and discharge upon perforated trays 13, by which the liquid is delivered evenly upon the edgewise plates, which as before stated, constitute means for dividing the liquid into numerous streams and distributing it over a large area.

In the bottom of each chamber is arranged a series of baffle plates, as shown in chamber H, consisting of three horizontal plates 14, spaced apart, and two horizontal plates 15 located above the spaces between those below. The liquid falling from the distributer strikes the baffle plates and flows gently off of the latter to the bottom of the chamber, thereby avoiding any violent agitation of the liquid collected therein.

The liquid in the bottom of chamber H can flow into chamber G by an arrangement as follows, shown clearly in Fig. 3. 16′ is dam spaced slightly from the partition 8, which latter is pierced by one or more apertures 17. The liquid rising in chamber G will finally

erflow the dam 16 and rise in the space between the latter and the wall 8 until it escapes through the openings 17. The total area of the latter is preferably such that they are submerged, with the result that they are sealed by the liquid and so do not allow the gas to pass from one chamber to another. By similar arrangements chamber A is in communication with B, B with C, C with D, D with E, E with F, and F with G. Hence liquid introduced into A will flow through all the chambers successively, and finally leaves the apparatus through an escape pipe 18 from chamber H.

Extending from chambers B, C, D, E, F, G, near the bottom, are pipes, 19, connected with pumps (not shown), which are connected with the cooling pipes 12 above the same so that liquid may be pumped from the bottom of each chamber mentioned, delivered to the cooling pipe, and again discharged upon the distributer. The excess, over what is re-delivered to the distributer, flows out of the chamber to the one following, escaping finally from chamber H through pipe 18 as already explained.

The liquid in the pipes 12 may be cooled by radiation into the air, or the pipes may be immersed in a cooling liquid, as water. For this purpose the compartment above chamber A is provided with an inlet 20, by which the water may be introduced. From this compartment the water flows into the next through an opening 21, thence to the next through an opening 22, and so on through openings 23, 24, 25, 26, 27, and finally out of the last compartment through the outlet 28. The openings 20 to 28 are located preferably at diagonally opposite corners of the respective compartments, so as to better distribute the water and give it a longer flow over the cooling pipes.

A short distance below the closure 11 the partition 8 is provided with an opening, 29, similar openings, 30, 31, 32, are provided in, partitions 6, 5, and 3. Near the bottoms of partitions 4, 7, and in the longitudinal partition 2 between chambers D and E are openings 33, 34, 35. In addition, chambers H and A are provided with an inlet 36 and outlet 37, respectively, for the ingress and egress of the gas to be washed and cooled.

From the foregoing the operation of the apparatus will be readily understood. The liquid, such as cold water, or ammoniacal liquor, etc., with which the gas is to be washed and cooled, is delivered through the cooling pipe in the compartment above chamber A, and being discharged on the perforated tray below the chamber closure it is delivered evenly upon the distributer and thence to the bottom of the chamber. Accumulating therein it overflows the dam, similar to that shown at 16, Fig. 3, into chamber B. From the latter it is pumped through the outlet pipe (19) and delivered to the cooling pipe (12) in the compartment above chamber B. There it is cooled by the water which is introduced into the first compartment and which is, as previously explained, flowing through the successive compartments. Collecting in the bottom of chamber B, a part of the liquid overflows into C, whence a part of it is pumped to the cooling pipe in the compartment above and finally delivered upon the distributer in the chamber. This process is repeated in each of the chambers, except the last, and from that the liquid escapes through the pipe 18. At the same time, the gas to be scrubbed and cooled is admitted to chamber H through the inlet 36. Rising in the chamber it passes through the distributer, where it is brought into contact with the scrubbing and cooling liquid over a large surface, and finally escapes into chamber G through the opening 29. Flowing downward in chamber G it passes through another distributer and receives another washing and loses still more of its heat. This process is kept up, the gas flowing alternately up and down until, reaching chamber A, it flows out through the pipe 37.

It will be evident that the washing and cooling liquid has the highest temperature in compartment H, where the hot gas enters the apparatus; and that, the gas having lost some of its heat in the chamber just mentioned, the liquid in chamber G is at a lower temperature. For the same reason the temperature of the liquid in F is still lower, and so on through chambers E, D, C, B, and A, in which latter it is coldest, being delivered thereto fresh. In this way the gas, after the apparatus has been in operation for a few minutes, at no time is subjected to a liquid at a temperature greatly below its own, and it therefore never suffers a sudden and violent fall in temperature. The consequence is that condensation of the volatile hydrocarbon in the gas is reduced to a minimum. Moreover, the gas on entering, containing as it does then the most impurities to be washed out, encounters the hottest liquid to do the scrubbing, and the coolest and cleanest gas comes in contact with the coldest and fresh liquor. This gradual washing and cooling is of the greatest importance, since it preserves the maximum illuminating value of the gas as well as producing ammoniacal liquor of the greatest strength.

The baffle plates in the bottoms of the chambers prevent agitation of the liquor therein, and the tar is thereby allowed to settle and the light oily matter to rise to the surface. The tar may be drawn off from time

to time by means of cocks 39 located near the bottom of the apparatus.

The pipes 19 are preferably arranged to take the liquor from between the upper layer of light oily matter and the lower layer of tar, so that the liquor delivered to the cooling pipes is free as possible from such materials. If desired, fresh water or other washing liquid may be supplied to compartment B, and others as well, instead of pumping liquor from the bottoms thereof. Furthermore, the gas can be cooled to any desired degree in any chamber by regulating the temperature of the cooling liquid which is circulated through the compartments above the washing chambers, and which cools the liquor flowing through the pipes 12.

It will thus be seen that by means of my invention the gas can be cooled very gradually to any desired temperature, with minimum loss by condensation of its hydrocarbons, and at the same time is thoroughly scrubbed and thus freed from its impurities.

The apparatus herein described is merely the preferred form of the invention, which may be embodied in a great variety of concrete forms without departure from its proper scope.

What I claim is:

1. In a gas washing and cooling apparatus, in combination, a plurality of chambers in communication with each other whereby the gas may be passed through all the chambers in succession, means for discharging a washing and cooling liquor into the chambers, means in the chambers to receive the liquor, provided with numerous interstices over the surfaces of which the liquor is distributed and through which the gas passes, and means for subjecting the liquor to a cooling medium before discharging it into the chambers, as set forth.

2. In a gas washing and cooling apparatus, in combination, a series of chambers each in communication with the one succeeding it, a gas inlet in the first chamber and an outlet in the last of the series, means in each chamber for delivering a washing and cooling liquor into the same, distributing means in each chamber to receive the liquor and distribute it over a large surface, and means in conjunction with the chambers intermediate to the first and last of the series for withdrawing the liquor collected in the bottoms of the chambers and returning it to the said delivering means, and means for subjecting the liquor to a cooling medium before it is delivered to a chamber, as set forth.

3. In a gas washing and cooling apparatus, in combination, a chamber having an inlet and an outlet for the gas, a distributer in the chamber for dividing the gas into streams, means for delivering washing and cooling liquor upon the distributer, and means for subjecting the liquor to a cooling medium before delivery upon the distributer, as set forth.

4. In a gas washing and cooling apparatus, in combination, a chamber having an inlet and an outlet for the gas, a cooling pipe coiled at the top of the chamber for conveying washing and cooling liquor thereto, means for subjecting the coiled portion of said pipe to a cooling medium, and means for returning to the cooling pipe the liquor collected in the chamber, as set forth.

5. In a gas washing and cooling apparatus, in combination, a chamber having an inlet and an outlet for the gas, means for delivering washing and cooling liquor to the chamber near the top thereof, a baffling device at the bottom of the chamber to receive the liquor and protect from agitation the liquor collected below the baffling device, and means for withdrawing the settlings from the lower level of the liquor collected below the baffling device, as set forth.

6. In a gas washing and cooling apparatus, in combination, a series of communicating chambers, a cooling compartment above each of the chambers, the compartments being in communication with each other, a cooling pipe arranged in each compartment, means in connection with each chamber for delivering cooling and washing liquor from the cooling pipe above to the chamber below, means for admitting a cooling medium to the first compartment, and means for withdrawing the said medium from the last compartment after it has flowed through the intermediate compartments in succession, as set forth.

7. In a gas washing and cooling apparatus, in combination, a cooling chamber having gas inlet and outlet openings, a horizontal partition across the top of the chamber forming a compartment, the walls of said compartment being provided with openings for the inflow and outflow of a cooling medium, a pipe disposed in the compartment for the circulation of washing and cooling liquor therein and discharging the said medium into the chamber below the compartment, a perforated tray in the chamber and immediately below the partition, to receive the liquor discharged by the cooling pipe, and means for withdrawing the liquor collecting in the bottom of the chamber, as set forth.

8. In a gas washing and cooling apparatus, in combination, a chamber having gas inlet and outlet openings, means for discharging washing and cooling liquor into the chamber at its upper end, a plurality of spaced and staggered plates arranged horizontally in the chamber adjacent to the bottom thereof and constituting a baffle to protect from agitation the liquor collected below the plates,

and means for withdrawing the settlings from the lower level of the said liquor, as set forth.

9. In a gas washing and cooling apparatus, a casing having longitudinal and transverse partitions dividing the casing into chambers, and having horizontal partitions near the tops of the chambers, extending entirely across the same and forming a closed compartment at the top of each chamber, as set forth.

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Witnesses:
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