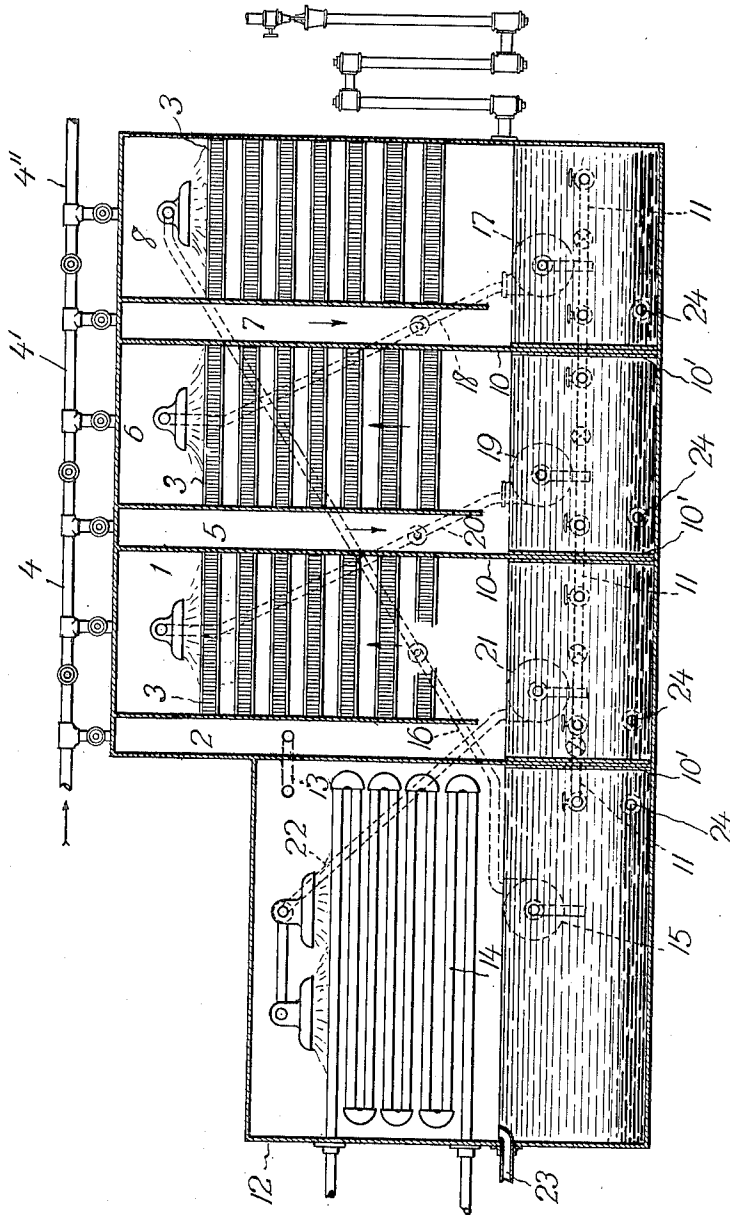


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GAS WASHING AND COOLING APPARATUS.
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UNITED STATES PATENT OFFICE.

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Specification of Letters Patent.

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To all whom it may concern:

Be it known that I, ERNEST F. LLOYD, a citizen of the United States of America, residing at Detroit, in the county of Wayne and State of Michigan, have invented certain new and useful Improvements in Gas Washing and Cooling Apparatus, of which the following is a specification, reference being had therein to the accompanying drawings.

In the manufacture of gas for illuminating and heating purposes during which the gas is freed of tars and other undesirable substances by washing the gas, and in which the gas is thereby also reduced in temperature to a determined point, it is found that the quantity of washing liquor required to serve as a cooling medium is not always coincident with the quantity required to clear or wash it of the substances referred to, so that the same amount of liquor which may reduce it in temperature may not effectively clean it.

This invention relates to a gas washing and cooling apparatus in which the washing liquor is circulated within the series of chambers in such a manner that it lowers the temperature of the gas properly while at the same time at certain points in the circulatory system the liquor in contact with the gas may be increased or decreased in quantities sufficient to both effectually reduce the temperature and remove the foreign constituents, tars, etc. The apparatus is also arranged so that the temperature at which the gas escapes may be regulated accurately while not being at any point subject to arbitrary drops or reductions. It also provides for the removal of any surplus of washing liquor as may be produced from the condensation of aqueous vapors contained in the gas, or as may be introduced for the washing purposes, at the lowest temperature reached in the system, thereby removing from the system the greatest quantity of ammonia per unit of washing liquor removed.

Another feature of the invention relates to certain means whereby certain portions of the apparatus may be cut out for cleansing or repair without necessarily stopping the operation of the apparatus as a whole. The invention consists in the matters hereinafter set forth and pointed out in the appended claims.

The drawing is a view that is largely diagrammatic, partially in elevation and par-

tially in section, of one form of apparatus that embodies features of the invention.

Referring to the drawing, a plurality of chambers are arranged in series so that gas entering the upper portion of a chamber 1 is led down a passage 2 along one wall, and rising through a series of baffles or grids 3 if preferred of any preferred type, escapes through a valved connection 4 or a suitable fitting into a passage 5 of a second chamber 6 from whence it passes upwardly through a second set of grids 3 thence through the valved connection 4' into a down passage 7 of another chamber 8 from whence it escapes through an outlet 4'', the chamber 8 also having grids or baffles 3. Obviously the series may be extended to have any number of chambers desired and the chambers may be proportioned to vary the necessary grid or baffling surface. Each chamber is separated from the adjacent one by walls 10, the lower portion preferably provided with insulating material 10', and forms a reservoir which contains washing liquor, a common level being established in the chambers by means of by-passes 11 inserted in any desired manner but preferably passing outside the casings so that regulating valves for both regulating as may be desired, the flow of liquor to each chamber, and for by-passing it as for cleaning etc., may be placed therein in accessible positions.

If the cutting out of any one chamber of the series be not desired, it is obvious that the external controllable connections between the several chambers may be substituted by the forms described in my Patent No. 973,120 of October 18, 1910.

Preferably adjacent the inlet, or first gas chamber of the series, there is a cooling chamber 12 whose lower or liquor containing portion is in communication with the corresponding parts of the gas washing chambers by the by-pass 11 and a pressure equalizing connection 13 so that the washing liquor stands at the same level as in the other chambers. Cooling means, preferably in the form of coils 14 through which a cooling medium is forced, are secured in the upper portion of the cooling chamber 12.

The washing liquor in the bases of the cooling and washing chambers is forced around and around in its cycles through the apparatus in the following manner; a pump indicated at 15 is arranged to force the

liquor from the base of the cooling chamber 12 along a suitable pipe line indicated diagrammatically at 16 to the top of the last or finishing chamber 8, where it is
 5 showered over the grids and falls against the uprising current of gas to the base of the chamber; it is then forced by a pump 17 from the base of the chamber 8 through suitable piping indicated at 18 to the top of
 10 the intermediate chamber 6 of the series, whence it is showered over the grids and falls into the base of the chamber 6 (and similarly for any number of intermediate chambers); another pump 19 then lifts the
 15 liquor from the base of the chamber 6 to the top of the first gas chamber 1 through suitable piping indicated at 20 so that it falls over the grids 3 to the base of chamber 1; it is then forced by a pump 21 from
 20 the base of chamber 1 through a pipe 22 and is caused to fall over and in intimate contact with the cooling means 14 to the base of the cooling chamber 12, whence it is withdrawn by the pump 15 to repeat the
 25 above described cycle.

An overflow 23 is provided for the removal of any surplus of liquor from the base of the cooler. Outlets 24 with suitable
 30 valves and controlling connections are provided for drawing off at intervals the accumulations of condensed tars decanted from the washing liquor in the several chambers.

In operation the washing liquor is kept in continuous circulation through the system
 35 in opposition to the gas current and rises in temperature because of its advancing contact with the gas so that when warmest it encounters gas at initial temperature the commingling currents being thus respectively
 40 gradually increased and reduced in temperature so that as the gas leaves the apparatus it has just passed out through liquor fresh from the refrigerating coils. This avoids any abrupt transitions in temperature in the gas which tend to break up and
 45 throw down certain constituents which are of value for illuminating and heating purposes. As, however, the quantity of liquor required to effect the cooling may not be coincident with the quantity required to
 50 wash out all the impurities, and as varying quantities of gas may make it desirable to vary the zones within the apparatus wherein the principal temperature reduction and
 55 principal washing is performed, it is provided that the pumps that force the water from each chamber of the series to the next one are regulatable as to their several capacities or discharges and thereby may de-
 60 liver a different volume of liquor into one or more of the chambers than is delivered into another, or from the refrigerating chamber into the last chamber of the series. This is possible because of the intercon-
 65 necting by the by-passes or other suitable means

of the bases of the washing chambers so that the pumps always have sufficient supply.

The by-passing of the gas over any one chamber which may be readily accomplished
 70 by this apparatus, permits the examination and cleansing of any one chamber without stoppage of the entire apparatus. The apparatus is compact as it is not necessary to extend the series of chambers sufficiently to have the cooling and washing effected by an
 75 even circulation of the washing liquid through the system; its local acceleration in the main circulatory system accomplishes the removal of the tars and the like without affecting the gradual cooling or without
 80 necessitating the extension of the gradual cooling through a long series of chambers as would otherwise be necessary to make it coincident with the washing of the gas.

Obviously changes in the details of construction may be made without departing
 85 from the spirit of my invention and I do not care to limit myself to any particular form or arrangement of parts.

What I claim is:—

1. In a gas washing and cooling apparatus, a series of chambers in communication
 90 whereby gas may be passed therethrough in succession, a washing liquor cooling chamber, means for circulating liquor from the
 95 cooling chamber through the chambers and returning it to the cooling chamber, whereby it comes into intimate contact with gas passing in opposite direction through the
 100 chambers, and means for locally varying the volume of spray flow of the liquor injected into any washing chamber without changing the rate of circulation through the apparatus as a whole.

2. In a gas washing and cooling apparatus, a series of chambers in communication
 105 whereby gas may be passed through the chambers in succession, means for circulating washing and cooling liquor through the chambers in the opposite direction to a current of gas regulatable to vary the spray flow
 110 from any one chamber to the next without varying the rate of flow through the system as a whole, and regulatable means for cooling the liquor during the return thereof
 115 from contact with the gas to its initial point of contact therewith.

3. In a gas washing and cooling apparatus, a series of chambers in communication
 120 whereby gas may be passed therethrough in succession, a washing liquor cooling chamber, means for forcing liquor from the cooling chamber through the washing chamber in succession in opposite direction to the
 125 gas flow, regulatable to vary the volume of spray flow from any one chamber into the next without varying the rate of flow from and to the liquor cooling chamber, and means in the cooling chamber for cooling the washing liquor to a predetermined point. 130

4. In a gas washing and cooling apparatus, a series of chambers having intake passages leading from the upper to the lower portions thereof whereby gas may be passed upwardly through each chamber in succession, gas baffling means in each chamber, a washing liquid cooling chamber, means for forcing liquor from the latter cooling chamber through the series of chambers in opposite direction to the passage of the gas, regulatable to vary the volume of spray flow from one chamber to the next, and regulatable means in the washing liquor cooling chamber for lowering the temperature of the returned liquid to a desired point.

5. In a gas washing and cooling apparatus, a series of chambers whose upper portions are in communication for the passage of gas therethrough in succession, and whose lower portions are in communication for maintaining a substantially common level in washing liquor trapped therein, a washing liquor cooling chamber whose lower portion is also in communication with the lower portions of the other chambers for maintaining a body of washing liquor therein at substantially the level of that in the other chambers, a pump for forcing liquor from the base of the washing liquor cooling chamber into the upper portion of the last chamber in the series, pumps each arranged to force spraying liquid from the base of one chamber to the top of the preceding chamber and from the bottom of the initial chamber of the series to the upper portion of the washing liquid cooling chamber, and means for lowering the temperature of the return liquid in the washing liquor cooling chamber before it is retrapped in the base thereof.

6. In a gas washing and cooling apparatus, a series of chambers in communication whereby gas may be passed through the chambers in succession, means for circulating washing and cooling liquor through the chambers in the opposite direction to a current of gas regulatable to vary the spray flow from any one washing chamber to the next, and means for cooling the liquor during the return thereof from final contact with the gas to its initial point of contact therewith.

7. In a gas washing and cooling apparatus, a series of chambers each having an intake passage leading from the upper to the lower portion thereof whereby gas may be passed upwardly through the chambers in succession, grids for baffling the gas as it passes upwardly through the chambers, a liquor washing and cooling chamber, means for forcing washing liquor from the cooling chamber into the upper portion of the outlet chamber of the series to fall over the grids against uprising gas, means for forcing washing liquor from the bottom portion of each chamber to the upper portion of the

preceding chamber of the series, regulatable to vary the volume of flow of such washing liquor, means for returning washing liquor from the inlet chamber of the series to the cooling chamber, and means for maintaining a substantially common level in the washing liquor in the several chambers.

8. In a gas washing and cooling apparatus, a series of chambers arranged side by side with an inlet gas passage extending from the upper portion of each downwardly therein, the chambers being in communication whereby gas may be passed there-through in succession, the lower portions of the chambers forming receptacles for washing liquor that are in communication for maintaining a substantially common level of liquor in the chambers, a washing liquor cooling chamber whose lower portion is in such communication with the other chambers as to maintain a level of washing liquor corresponding to that in the other chambers, a pump for forcing liquor from the cooling chamber to the upper portion of the outlet chamber, pumps adapted to force washing liquor from the base of one chamber to the upper portion of the preceding chamber and from the base of the inlet chamber to the upper portion of the cooling chamber, and regulating means for cooling liquor returned to the cooling chamber.

9. A gas washer and cooling system consisting of a series of washing chambers secured side by side in communication whereby gas may be passed upwardly through the chambers in succession, a washing liquor cooling chamber, the lower portions of the several chambers having restricted communication whereby washing liquor circulated through the chambers is maintained at substantially a common level in the several chambers, means for forcing cooled liquor from the cooling chamber into the upper portion of the outlet washing chamber and returning it therefrom through the other chambers in succession, means in the chambers for baffling the oppositely moving gas and water to thoroughly commingle, and regulatable means for cooling the liquor as it is returned.

10. A series of chambers through which gas passes in succession; means regulatable as to each chamber, for passing a washing and cooling liquor therethrough in a cycle and spraying a portion thereof in each chamber, and means at a point in the system for cooling the washing liquor from the highest to the lowest temperature required in the system.

11. A series of chambers through which gas passes in succession, means for passing a cooling and washing liquor therethrough in a cycle oppositely to the flow of the gas and regulatable as to the liquor sprayed into each chamber, means at a point in the

liquor circulation for collecting the cooled
liquors employed in the circulation and
means for withdrawing any surplus of liq-
uor after it has been subjected to the cool-
5 ing medium.

12. A series of chambers through which
gas passes in succession, means for passing
a cooling and washing liquor therethrough,
means for trapping liquor in the bases of

said chambers and means for insulating the 10
temperature in the several chambers.

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

ERNEST F. LLOYD.

Witnesses:

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