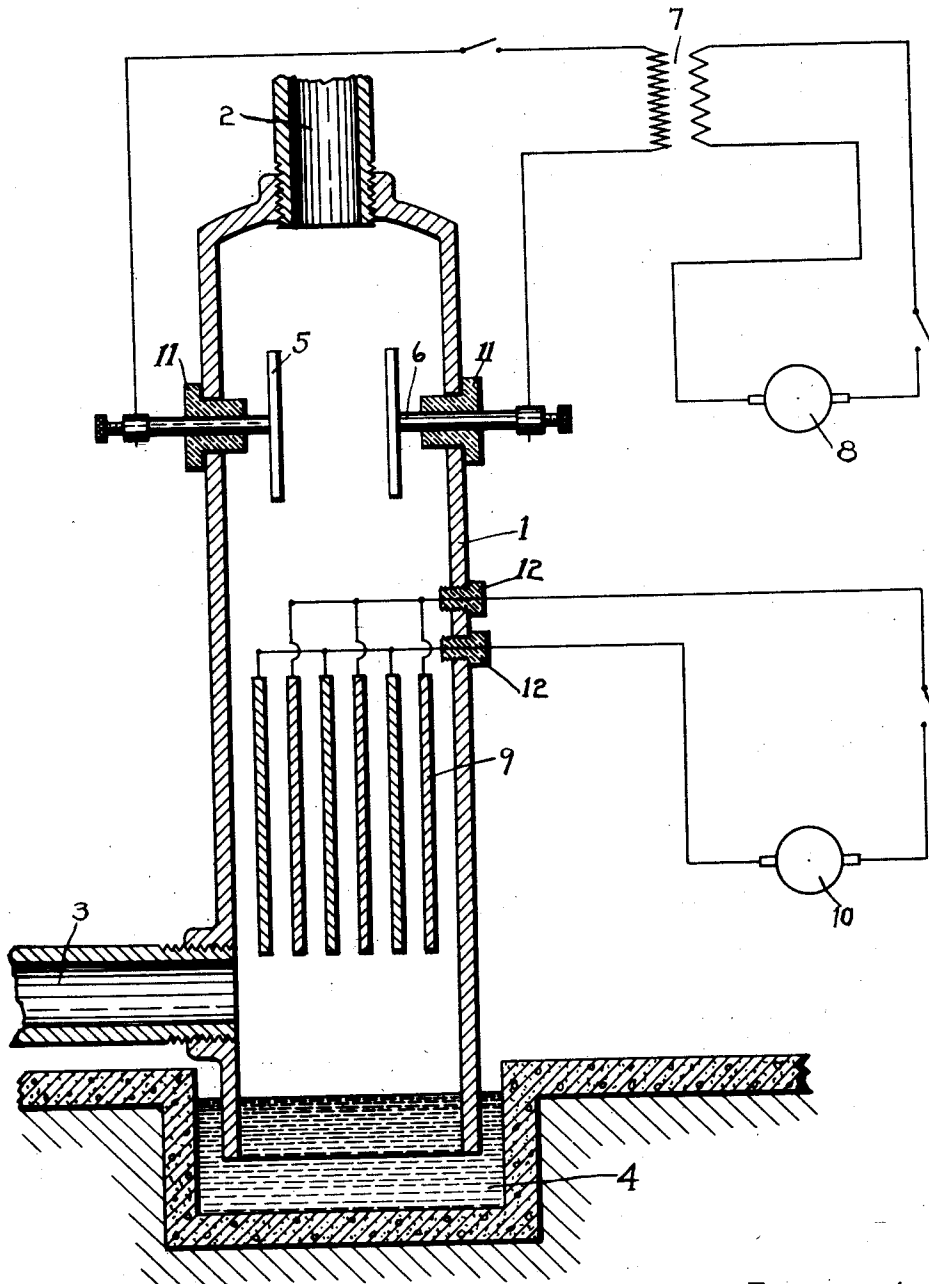


H. F. SMITH.
GAS PURIFICATION.

APPLICATION FILED AUG. 4, 1917. RENEWED AUG. 4, 1920.

1,358,032.

Patented Nov. 9, 1920.



Witnesses
Edwin James.

Inventor
Harry F. Smith
By Kern, Page, Cooper & Hayward
Attorneys

UNITED STATES PATENT OFFICE.

HARRY F. SMITH, OF LEXINGTON, OHIO, ASSIGNOR TO THE SMITH GAS ENGINEERING COMPANY, A CORPORATION OF OHIO.

GAS PURIFICATION.

1,353,032.

Specification of Letters Patent.

Patented Nov. 9, 1920.

Application filed August 4, 1917, Serial No. 184,457. Renewed August 4, 1920. Serial No. 401,279.

To all whom it may concern:

Be it known that I, HARRY F. SMITH, a citizen of the United States of America, residing at Lexington, Richland county, Ohio, have invented certain new and useful Improvements in Gas Purification, of which the following is a full, clear, and exact description.

This invention relates to gas purification, and more particularly to the use of electrical means for securing the removal of vapors and like impurities from gases, such, for instance, as the tar vapor which is found in producer gas. The object of the invention is to provide an effective apparatus making use of electrical energy for removing such impurities from gas, which is sufficiently simple and easy of operation to permit of its practical use. The apparatus forming the subject of this invention is especially designed for carrying into practice the method of gas purification, described in my co-pending application, bearing Serial Number 184,456 and filed Aug. 4, 1917.

The method described in the above referred to application consists broadly in subjecting the impurity containing gas to a brush discharge to produce prolific ionization of such impurities, and then passing the gas with its electrified particles, through a direct current field of sufficient intensity to cause the migration of those particles to the electrodes, with a consequent precipitation of the particles upon the electrodes. In this invention, precisely the same method is carried out, but the apparatus described herein for carrying out that method differs in certain essential features from the apparatus described in the above referred to application.

The apparatus forming the subject matter of this invention is fully illustrated in the drawing herewith, in which 1 is a treating chamber having an inlet 2 in one end and an outlet 3 in the other end thereof. The bottom or outlet end of this treating chamber is open and extends into a tank 4 containing any desired liquid, water being found very desirable when producer gas is being purified, which acts as a seal therefor.

Extending through the sides of the treating chamber, near the upper or inlet end thereof, are two electrodes 5 and 6, which are insulated in any desired manner from

the walls through which they pass, the insulation being shown conventionally at 11. Each of these electrodes is connected, by suitable connecting means, with one end of the secondary coil of a transformer 7, the connections being such that any current passing through the transformer 7 will impress charges of opposite polarity upon these two electrodes. Connected to the primary coil of the transformer 7 is a source of alternating current 8. This arrangement is obviously such that any alternating current generated at 8 will induce in the secondary coil of the transformer 7 a corresponding alternating potential of the same frequency, but of a considerably higher potential, the potential depending upon the ratio between the primary and secondary coils of the transformer. The coils of the transformer 7 are so proportioned that the difference of potential between the electrodes 5 and 6 will be sufficient to readily cause a brush discharge therebetween.

Located in that part of the treating chamber adjacent the outlet 3 is a series of plates 9, which plates are connected to any desired source 10 of direct current, the connections between these plates and the source of direct current being insulated in any suitable manner from the walls of the treating chamber through which they pass the insulation being shown conventionally at 12. The electrodes 9 must also be insulated from the treating chamber 1, and such insulation may be of any preferred form. The direct current generated by the source 10 should not be of sufficient intensity to produce sparking between the electrodes 9, even though these electrodes be placed quite close together, but should be of sufficient intensity to produce a pronounced electrical field therebetween, and of sufficient intensity to cause a migration to the electrodes thereof of any ions or electrified particles of impurity passing therebetween. It is to be understood that my invention is not limited to the use of a direct current precipitating field as, although I prefer such a field, a unidirectional current field would function about as well.

In operating the above described purifying apparatus, the impure gas is passed into the treating chamber through the inlet 2. At the same time an alternating current is generated at 8, which passes through the primary coil of the transformer 7 and

induces in the secondary coil thereof an alternating current of very high potential. This high potential impresses on the electrodes 5 and 6 a correspondingly high potential of opposite polarity, the alternating character of the current insuring, of course, an extremely rapid reversal of polarity on each electrode. The difference of potential between the electrodes 5 and 6 should be sufficient to cause a brush discharge therebetween, the potential necessary for causing such discharge depending upon the distance between these two electrodes. These electrodes are so placed that gas introduced through the inlet 2 will be subjected to the brush discharge therebetween, the effect of such brush discharges being to ionize the impurities contained in the gas; in other words, to impress on such impurities an electrical charge, which electrical charges will be in part positive and in part negative because of the alternating character of the discharge. The gas containing these electrified particles then passes through the direct current field surrounding the electrodes 9. At such time the charged particles in the gas acting under the influence of this direct current field will move toward and contact with the electrodes where they will be retained. The impurities if liquid will run down into the tank 4 from which they may be easily withdrawn. If not liquid, they will still be precipitated upon the electrodes 9 and, because of the low potential existent upon such electrodes, may be readily withdrawn therefrom in any desired manner. The gas, thus relieved of its impurities, then passes out of the treating chamber through the outlet 3, and is led to any desired point of use or storage.

The apparatus described above lends itself to a satisfactory and safe cleaning of impurity bearing gases. The high potential electrodes used are of small size, when compared to the high potential electrodes used in the usual types of electric precipitators now on the market, and in addition they are not adapted to act as precipitators. As a consequence it is much easier to maintain these electrodes properly insulated. And, too, because they are not used as precipitating electrodes, the danger attendant upon operation of the device is considerably decreased. Further the precipitating electrodes, because of the low potential field surrounding them may be readily maintained properly insulated, and in addition because of the low potential existing thereon cleaning of the electrodes is a comparatively simple and safe matter.

It is easily possible to substitute for the source of alternating current of high potential used herein, either a unidirectional alternating current or a direct current of high potential; but, if either of these types

of current is used, care must be taken to so time the exposure of the impurity containing gas to the brush discharge produced thereby that no deposition of impurities will take place upon the electrodes. With an alternating current as the source of high potential it is very easy to avoid any such deposition since the reversals of direction of flow are sufficiently rapid to prevent any substantial translation of the particles of impurities toward the electrodes.

From the above, it is thought evident that I have invented an apparatus for eliminating impurities from gases, which is extremely simple in construction and operation, and which is a decided improvement over any form of electrical purifying apparatus heretofore known.

This apparatus is especially designed for the removal of tar particles from producer gas, but it is quite evident that its applicability is by no means limited to the removal of tar alone, and that it can be utilized as readily in removing from gases any contained impurities, regardless of their character.

What I claim as new and desire to secure by Letters Patent is—

1. In a gas purifying apparatus, the combination with a treating chamber having an inlet and an outlet, of an electrode therein intermediate the inlet and outlet; means connected to said electrode and adapted to cause an electrical discharge within the treating chamber adjacent said electrode; a second electrode within said chamber and intermediate the first-named electrode and the outlet; and means connected to said second electrode, adapted to set up an electrostatic field of constant polarity within the treating chamber.

2. In a gas purifying apparatus, the combination with a treating chamber having an inlet and an outlet; of a plurality of electrodes therein intermediate the inlet and the outlet; means connected to said electrode for causing an ionizing discharge therebetween; a plurality of other electrodes within the treating chamber and intermediate the first-named electrodes and the outlet of said chamber; and means connected to said last-named electrodes and adapted to set up a low potential precipitating field within said treating chamber.

3. An electrical purifying apparatus comprising a treating chamber having an inlet and an outlet therein, means for producing a brush discharge therein adjacent the inlet, and means for producing an electrostatic field of constant polarity therein adjacent the outlet.

4. In an electrical gas purifying apparatus, a treating chamber having an inlet and an outlet in opposite ends thereof, means connected with the inlet end thereof and in-

cluding a source of alternating current for producing an ionizing brush discharge, and means connected with the outlet end and including a source of unidirectional potential for producing an electrostatic field capable of causing precipitation of electrified particles passing therethrough.

5 5. In a gas purifying apparatus, the combination with a treating chamber having an inlet and an outlet, of a plurality of electrodes within said chamber and intermediate the inlet and outlet thereof; a source of electrical potential connected to said electrodes and adapted during operation to cause
10 a flow of electricity from said source of potential between said electrodes, said flow of electricity being in the nature of an ionizing discharge; a plurality of electrodes within the treating chamber and intermediate the
15 first named electrodes and the outlet; and
20

means connected to said second electrodes adapted to set up an electrostatic field of constant polarity within the chamber.

6. An electrical purifying apparatus comprising a treating chamber having an inlet 25 and an outlet; an electrode therein intermediate the inlet and outlet; means connected to said electrode and adapted to cause an ionizing discharge within the chamber and adjacent thereto; a second electrode 30 within the treating chamber and intermediate the first named electrode and the outlet, said electrode being separate from the first named electrode; and a source of electrical potential associated with said last 35 named electrode, for setting up a low potential electrical field adjacent said electrode.

In testimony whereof I affix my signature.
HARRY F. SMITH.