W. O. SNELLING.

APPARATUS FOR SEPARATING GASES.

APPLICATION FILED SEPT. 17, 1914.

1,174,631. Patented Mar. 7, 1916.

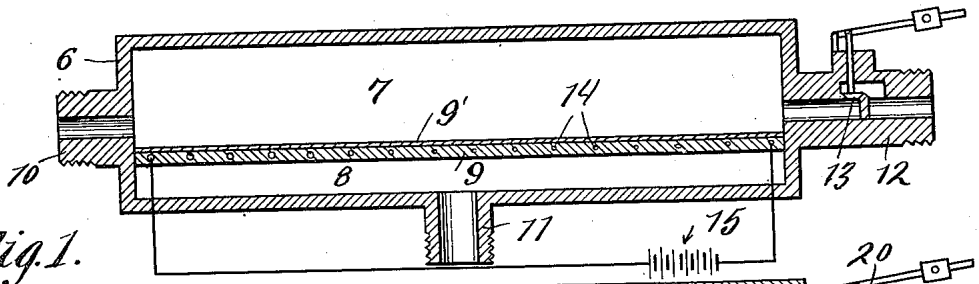

Fig. 1.

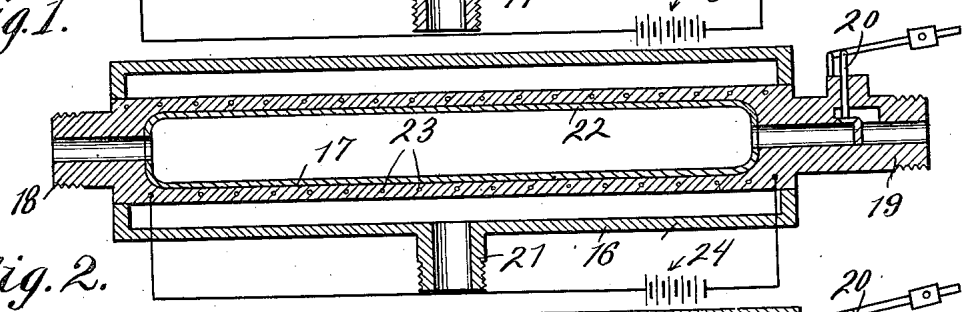

Fig. 2.

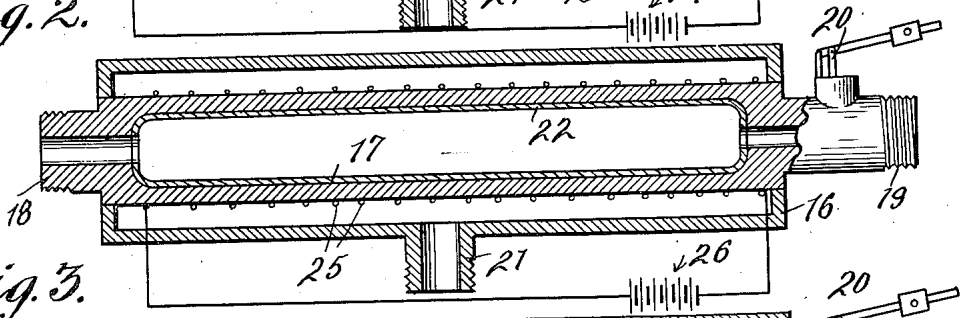

Fig. 3.

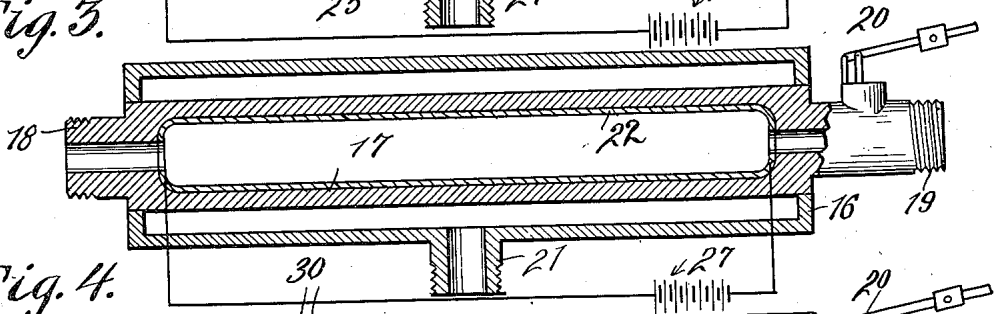

Fig. 4.

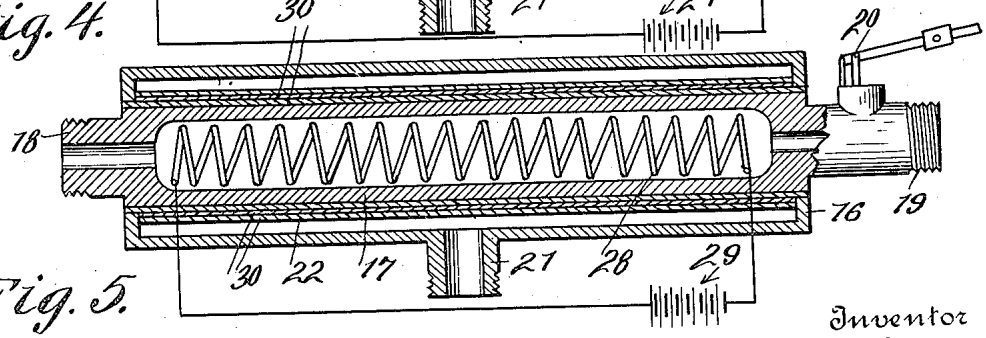

Fig. 5.

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APPARATUS FOR SEPARATING GASES.

1,174,631. Specification of Letters Patent. Patented Mar. 7, 1916.

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To all whom it may concern:

Be it known that I, WALTER O. SNELLING, a citizen of the United States, residing at Pittsburgh, in the county of Allegheny and State of Pennsylvania, have invented certain new and useful Improvements in Apparatus for Separating Gases, of which the following is a specification.

This invention relates to apparatus for the separation of gases and particularly the separation of hydrogen from a gaseous mixture containing the same, such for example, as producer gas or the like.

If certain gases, notably hydrogen, are brought into contact with a very thin sheet or film of platinum or palladium, maintained at an elevated temperature and preferably at a bright red heat, such gases will be taken up or absorbed by the platinum or palladium and will be released from the other side of the sheet or film if the degree of concentration of hydrogen in the gas in contact therewith is less than the degree of concentration of hydrogen in the gaseous mixture to be separated. If the gaseous mixture, such as producer gas, contains, for example, 20 per cent. of hydrogen and the gas, such as air, on the opposite side of the heated film or sheet contains no hydrogen the hydrogen will pass from the gaseous mixture into the space on the opposite side of such film or sheet until the degree of concentration of hydrogen in such space will approach or substantially equal the degree of concentration of hydrogen in the gaseous mixture. If the hydrogen released from the film or sheet be conducted away the removal of hydrogen from the gaseous mixture may be effected in a continuous, practical and highly economical manner. The gaseous mixture under treatment is rendered practically free from hydrogen and such removed hydrogen may be used to effect chemical reaction such as those resulting from the action of hydrogen at elevated temperatures or for other purposes.

In the preferred practice of the invention, I provide a porous support, such as porous earthen ware or alundum, upon which is mounted or to which is applied, a thin sheet, film or coating of platinum or palladium. The function of the porous support is solely to support, reinforce or stiffen the metal sheet or film to prevent the same from being bent, distorted, broken, or otherwise injured by the pressure of the gas against it. Means are provided to supply the gas, which may advantageously be a hydrogen carrying gas, as producer gas, to one side of the sheet or film. Means preferably electrical, are also provided to heat the sheet or film to the temperature most favorable to the described action.

In the accompanying drawings forming a part of this specification and in which like numerals are employed to designate like parts throughout the same, Figure 1 is a central longitudinal sectional view through one form of the apparatus. Fig. 2 is a similar view through a different form of the apparatus, Fig. 3 is a similar view through a different form of the apparatus, Fig. 4 is a similar view through a different form of the apparatus, and, Fig. 5 is a similar view through a still different form of the apparatus.

In Fig. 1, the numeral 6 designates a main shell or casing, divided into two compartments 7 and 8 by a longitudinally extending strip or partition 9, which is preferably formed of porous earthen ware or alundum. Disposed upon one side of the partition 9, preferably upon the upper side thereof, is a thin imperforate sheet or film of platinum or palladium 9′. This sheet or film is very thin, preferably not materially exceeding one thousandth of an inch in thickness, and is advantageously produced by electrolytically depositing the platinum or palladium upon a sheet of copper or the like, which latter metal is subsequently removed by dissolving the same in a suitable solvent. The gaseous mixture to be separated, such as producer gas, is introduced into one end of the chamber 7 through an inlet pipe 10, the hydrogen content of the mixture being absorbed by the sheet or film 9′ and released or given off into the chamber 8, the same passing outwardly therefrom through a pipe 11. The gas which remains after the removal of the hydrogen, is discharged through a pipe 12, the passage of such gas being controlled by a pressure relief valve 13 or any other suitable means. Extending within and through the material of the porous partition or support 9 is a heat generating or resistance coil 14, having connection with a suitable source of electric current 15.

Each form of the apparatus shown in

Figs. 2 to 5 inclusive comprises a main outer shell or casing 16, receiving an inner tube 17, which is much smaller in diameter and is preferably concentrically arranged therein in spaced relation thereto. The tube 17 is preferably formed of porous earthen ware or alundum. The tube 17 is provided at one end with an inlet pipe 18 and at its opposite end with an outlet pipe 19, the passage of the gas therethrough being controlled by a pressure relief valve 20 or any other suitable means. The outer shell 16 is provided between its ends with an outlet pipe 21. In each form of the apparatus shown in Figs. 2 to 4 inclusive, a very thin tube or cylinder 22 of platinum or palladium is disposed within the tube 17. This tube of platinum or palladium is advantageously formed by electrolytic deposition, as explained in connection with the form of my apparatus shown in Fig. 1. In Fig. 5, I have shown this tube or cylinder 22 arranged upon the exterior surface of the tube 17.

In Fig. 2, heating means are provided including a heating or resistance coil 23 which

[redacted]

or films of platinum or palladium but any material permeable to hydrogen at an elevated temperature may be employed. Some measure of success can be obtained by using various other catalytic metals or metals recognized as having catalytic activity, such as nickel, cobalt, and iron, and while I prefer to employ platinum it is to be understood that catalytic metals, notably palladium, nickel, cobalt, and iron are contemplated as equivalents of platinum for use in my process.

While I have described the preferred forms of my apparatus and the preferred practice in making use of the same, it is to be understood that equivalents may be employed and details of construction and procedure widely varied and that my invention is not restricted to such preferred forms of apparatus and preferred practice, except as particularly set forth in the subjoined claims.

Having thus described my invention, I claim:—

[redacted]

face of such film and means to receive and conduct away hydrogen given off from the opposite surface of such film.

5. The herein described means for the separation of hydrogen from a gaseous mixture containing the same, comprising a very thin imperforate film of metal permeable to [redacted] temperature, a po-

throughout substantially its entire area, means to heat the metal tube, means to bring a gaseous mixture into contact with one surface of said tube and means to receive and conduct away hydrogen given off from the opposite surface of such tube.

9. The herein described means for the separation of hydrogen from a gaseous mix-