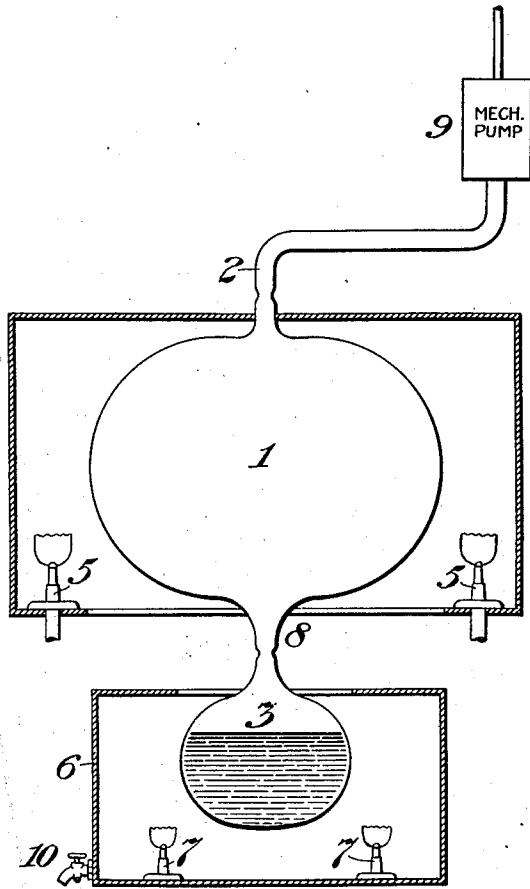


No. 845,670.

PATENTED FEB. 26, 1907.

P. H. THOMAS.  
VACUUM APPARATUS.  
APPLICATION FILED JAN. 23, 1904.



Witnesses  
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# UNITED STATES PATENT OFFICE.

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## VACUUM APPARATUS.

No. 845,670.

Specification of Letters Patent.

Patented Feb. 26, 1907.

Application filed January 23, 1904. Serial No. 190,285.

*To all whom it may concern:*

Be it known that I, PERCY H. THOMAS, a citizen of the United States, and a resident of East Orange, county of Essex, State of New Jersey, have invented certain new and useful Improvements in Vacuum Apparatus, of which the following is a specification.

When it is desired to remove injurious gases from a containing vessel or chamber, it is sometimes desirable to assist the operation by creating a vapor inside the chamber and causing the expulsion or removal of the said vapor either wholly by the same means as those employed for creating it or partially by the use of supplemental means, such as a mechanical pump, which would not in itself provide sufficient means for accomplishing the removal. Such a vapor may be exemplified by mercury vapor, and the vapor may be produced by heating mercury inside the chamber and expelling the gases either entirely by the influence of the heat or with the aid of a mechanical pump. This process has been found useful in connection with the pumping of mercury-vapor apparatus wherein the mercury may serve the purpose of forming an electrode or more than one electrode inside the container after the chamber has been sealed off and the apparatus is ready for use. It should be understood that the sealing off in all cases takes place while the operation of expelling or withdrawing the vapors is in progress.

The present invention is designed to utilize to some extent the same general principles as those above set forth; but it is more particularly applicable to apparatus in which the material used for creating the vapor is not essential to the operation of the completed apparatus.

For convenience I shall show mercury as the source of vapor and a jet, flame, or torch as a source of heat for generating vapor from the mercury. Instead, however, of placing the mercury in the vessel which is to be exhausted of air and other gases I locate the mercury in a separate receptacle below the chamber and connect this receptacle to the chamber by a neck which can readily be sealed off when the operation is complete.

During the process of removing injurious

gases from the chamber the chamber itself and the receptacle containing mercury will both be subjected to heat, thereby causing the passage of a portion of the mercury vapor generated to pass through the chamber and out at a suitable exit-tube. With the said exit-tube may or may not be connected a mechanical pump for assisting in the withdrawal of the vapors and gases. When the operation has been continued long enough, so that the products issuing through the exit-tube are substantially pure mercury vapor, the said exit-tube is sealed off, heat is withdrawn from the mercury-containing receptacle, the latter is subjected to the influence of special cooling means, thereby promoting the condensation of the mercury and its return to the receptacle, after which the neck connecting the receptacle to the chamber is sealed off and the operation is complete. When this process is carried out in the manner described, it is found that a very high degree of vacuum is produced in the chamber, such production being assisted by the means which are provided for condensing the mercury through a cooling process.

The invention is illustrated in the accompanying drawing, which is an elevation of an apparatus adapted to secure the carrying out of my invention.

In the drawing, 1 is the chamber to be exhausted, 2 is the exit-pipe therefrom, and 3 is the receptacle for containing mercury. Around the chamber 1 I may arrange a heat-retaining shield 4, adapted to receive jets 5 5, which may be ignited for producing heat. I may also surround the receptacle 3 with a heat-retaining shield 6 and may place in the bottom thereof one or more jets 7 7 for heating the mercury-receptacle 3 and the mercury contained therein. The receptacle 3 is joined to the chamber 1 by means of a neck 8. The exit-tube 2 may have connected to its remote end a mechanical pump, as shown at 9, and in general I prefer this arrangement, although the pump may be dispensed with, if preferred.

To operate the apparatus, the jets 5 5 and 7 7 may be ignited and the pump 9 set in action. Through the operation of the jets 7 7 mercury vapor is formed, and this passes

into the chamber 1, where it is still further heated by means of the jets 5 5. This causes a tendency for the vapor to pass out through the exit-tube 2, and in some instances no other source of power for withdrawing the vapor is required. Should the pump 9 be used, it will assist the withdrawal of the vapors. The gases originally contained in the chamber 1 will naturally diffuse themselves in the vapor of mercury created by the process above described, and as the said vapor passes out from the chamber the original gases will be carried along with it, and the process may be continued until practically nothing but pure mercury vapor passes out through the exit-tube. At this time the tube 2 should be sealed off, and the jets 7 7 should be removed or the flames put out. The jets 5 5, however, will remain in operation. The part 6, which has been up to this point used as a heat-retaining chamber, may now be filled with a cooling liquid, such as water, which may be caused to pass continuously through the part mentioned, thereby causing a rapid cooling of the receptacle 3. Owing to the comparatively low temperature of this receptacle, the mercury vapor in the chamber 1 will be condensed and fall by gravity into the receptacle. Accordingly an excellent vacuum will be produced in the chamber 1, and when the operation has been continued long enough the neck 8 may be sealed off, leaving the chamber as a distinct structure provided with a high vacuum.

The cooling fluid may be poured into the part 6 from any suitable source and may pass out through a cock 10, as shown near the bottom of the figure:

Instead of causing the vaporization of a liquid by heat and the expulsion of a portion of the vapor by the same means I may employ any other suitable means for producing a vapor and expelling a portion thereof.

I may employ similar means for absorbing the vapor to produce the vacuum after the sealing off of the neck 2.

Under some circumstances it will be found convenient instead of retaining the source of heat 5 during the operation of condensation or removal of the vapor to allow the chamber 1 to cool, thus condensing the vapor, if only means be provided for removing the condensed vapor in the chamber 1 before sealing off the neck 8.

It is convenient to locate the receptacle 3 below the chamber 1. It is, however, quite possible to locate said receptacle at any convenient point, the cooling of the said receptacle as described being adequate to withdraw the vapors from the chamber 1 by condensing them in the receptacle.

In a divisional application filed on the

16th day of June, 1905, Serial No. 265,503, claims are made upon certain features of construction disclosed herein.

I claim as my invention—

1. The method of removing injurious gases from a chamber, which consists in causing a vapor to pass through the said chamber thereby removing a portion of the original gases or vapors, continuing this process to any desired limit, and sealing off both the inlet and outlet of the said chamber.

2. The method of, removing injurious gases from a chamber, which consists in providing a suitable inlet and outlet therefor, passing a vapor into the chamber through the inlet and out through the outlet, thereby continuously removing a portion of the original gases or vapors, continuing the process to any desired limit, and sealing off the inlet and the outlet.

3. The method of producing a vacuum within a chamber, having below it a receptacle containing a volatilizable fluid, which consists in vaporizing a portion of the said fluid, causing a portion of the vapor to pass through the chamber, sealing off the outlet from the chamber while the described operation is in progress, afterward cooling the receptacle and thereby condensing the vapors and permitting the products of condensation to fall by gravity into the receptacle, and sealing off the connection between the receptacle and the chamber.

4. The method of producing a vacuum within a chamber having below it a receptacle containing a volatilizable fluid, which consists in vaporizing a portion of the said fluid by heat, causing a portion of the generated vapors to pass into and out of the chamber, sealing off the outlet from the chamber while the described operation is in progress, removing the source of heat, afterward cooling the receptacle and thereby condensing the vapors and permitting the products of condensation to fall into the receptacle by gravity, and sealing off the connection between the receptacle and the chamber.

5. The method of producing a vacuum within a chamber having below it a receptacle containing a volatilizable fluid, which consists in applying heat to the said receptacle, thereby vaporizing a portion of the fluid, simultaneously applying heat to the chamber, causing a portion of the generated vapors to pass into and out of the chamber, sealing off the outlet from the chamber while the described operation is in progress, removing the source of heat from the receptacle, applying cooling means to the said receptacle, and sealing off the connection between the receptacle and the chamber.

6. The method of exhausting a chamber, which consists in passing a condensable gas into and out of the chamber, sealing off the

outlet, condensing the gas outside the chamber and sealing off the inlet.

5 7. The method of exhausting a chamber, which consists in passing a gas or vapor into and out of the chamber through suitable inlet and outlet passages, sealing off the outlet of the chamber, removing the gas from the chamber, and sealing off the inlet.

Signed at New York, in the county of New York and State of New York, this 11th day 10 of January, A. D. 1904.

PERCY H. THOMAS.

Witnesses:

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GEORGE H. STOCKBRIDGE.