Dec. 7, 1948. R. NEIRYNCK 2,455,602

MERCURY VAPOR ELECTRIC CONVERTER

Filed Feb. 24, 1948

Fig. 1

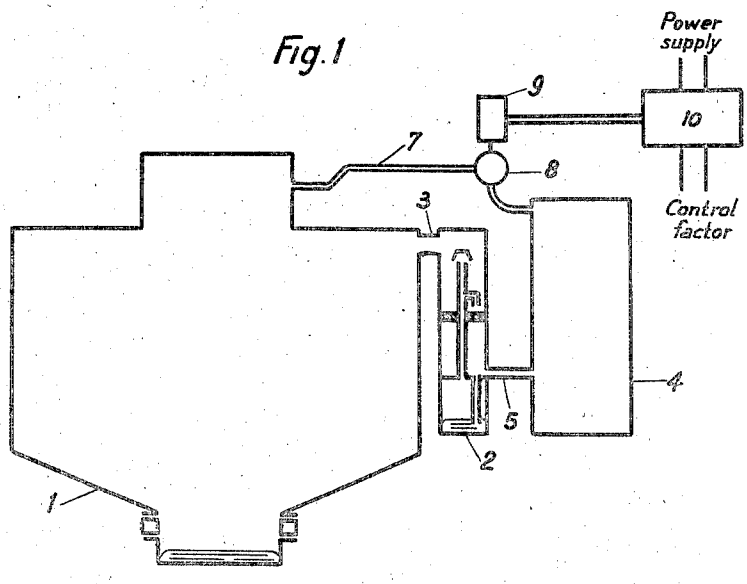
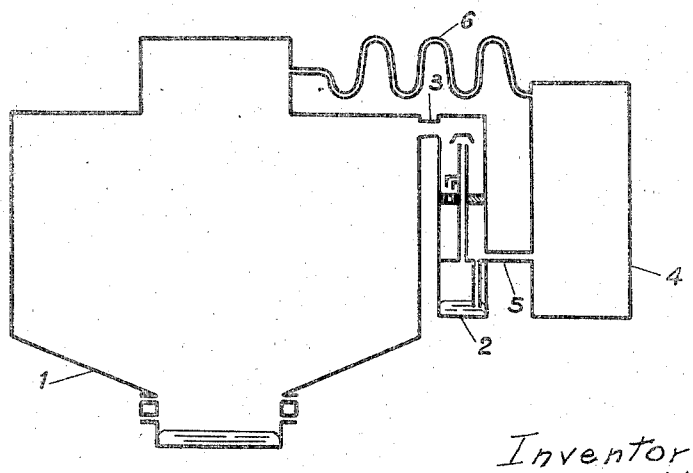


Fig. 2



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MERCURY-VAPOR ELECTRIC CONVERTER

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5 Claims. (Cl. 250—27.5)

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The present invention relates to improvements in mercury vapor electric converters particularly in the means and method for removing excess vapor pressure from the converter.

When mercury vapor converters are operated without a pump it has been observed that such converters have the property of reabsorbing the gases disengaged during operation. However when the apparatus operates temporarily at a higher charge than that for which it has been designed the gas disengaged during such operation will exceed the gas reabsorbed. In such case the density of the gas in the converter increases and as a result thereof operational troubles such as back-fires or relating difficulties will arise in a short time. This excess of gas produced during the period of overcharging also is quite disadvantageous in that the reaction will be present for a considerable period. This is because during overcharge the recombination processes of the gases with certain internal elements of the converters, such as mercury vapor is accelerated. The increased production of these recombination products is disadvantageous for the operation of the converter.

For the above reasons it is highly desirable to withdraw the excess gas from the tank during the period of overcharging.

An object of the invention is to remove from the rectifier an excess accumulation of gas during certain periods of operation and then restore such gas to the rectifier during periods of normal pressure, so that such gas may be reabsorbed.

A further object of the invention is to provide a separate reservoir into which excess gas may be pumped from the rectifier and then returned gradually from such reservoir to the rectifier when conditions have become normal.

A still further object of the invention is to provide means in such separate reservoir whereby the gases pumped therein may be wholly or partially fixed.

A still further object of the invention is to provide means whereby the return of the excess gases from the reservoir to the rectifier may be controlled by a value which in turn, is controlled either by the internal pressure existing within the converter or by the charging rate or by raising the temperature from a determined point of the converter.

A still further object of the invention is to provide means whereby the return of excess gases from the reservoir to the rectifier is controlled by suitable length and cross-sectional area of the

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conduit leading such gases to the rectifier, in accordance with the molecular flowing laws of gases at very low pressures.

With the above and other objects in view which will become apparent from the detailed description below, the invention is set forth in the following description, claimed in the claims and shown in the drawings, in which:

Fig. 1 illustrates schematically one form of the invention and,

Fig. 2 illustrates schematically a modified form of the invention.

Referring to the drawings in which like parts are designated by similar reference characters, the tank of the mercury vapor converter is shown at 1. A high vacuum mercury vapor pump is connected at its suction side to the tank 1 by the conduit 3 and at its pressure side to a reservoir 4 by a conduit 5. A conduit 7 provided with a valve 8 connects the reservoir 4 to the tank 1 of the converter.

In accordance with the invention the gas products in excess during overcharge operation of the converter are suctioned by the high vacuum pump 2 and stored in the reservoir 4. Since no point of the pumping circuit is at atmospheric pressure it is not necessary to provide a preliminary vacuum pump of the paddle type and the pump 2 may be formed as a mercury vapor pump with two stages.

The valve 8 positioned in the circuit of the conduit 7 connecting the reservoir 4 to the tank 1 of the converter is controlled in such a way that the return of the suctioned gases can not take place before the converter returns to normal operation.

The valve 8 may be controlled by a motor 9 through a control arrangement 10 subjected to the influence of a calculable size which varies closely with the pressure of the gases liberated in the converter enclosure.

For example this control factor may be:

a. The interior pressure of the tank of the converter wherein the pressure is measured by a vacuum meter of the Wheatstone bridge type, or a Pirani gauge.

b. The intensity of the rectified current traversing the converter, which may be measured either by a shunt placed in the circuit for the continuous current or by an intensity transformer located in a phase of the alternating current circuit.

c. The elevation of the temperature reached in service by a determined point on the metallic tank and this elevation in temperature may be meas-

ured by a thermocouple and the point chosen on the tank may be located in a zone adjacent the arc, for example in the bottom of the tank.

These factors may be used indifferently either the one or the other considering their interdependence.

A modified form of the invention is shown in Fig. 2 of the drawing in which the conduit 7 and the valve 8 are replaced by a conduit 6 which is of such length and cross-sectional area that the resistance offered to the flow of the gas will automatically only permit the return of the gas under normal conditions of converter operation.

The flow of gas along this conduit may be calculated from the molecular flowing laws which give the relation:

$$Q=\frac{P1-P_2}{W}$$

Q is the estimated flow by multiplying the pressure in a given section by the volume of gas traversing such section in one second.

P1 and P_2 are the pressures at the two ends of the conduit.

W is the flow resistance obtained from the Knudsen formula:

$$W=\frac{3}{4}\frac{\sqrt{\rho}}{\sqrt{2\pi}}\cdot\frac{L}{R^3}$$

Wherein ρ is the density of the gas at the temperature of the conduit and at the pressure there existent,

L is the length of the conduit, and

R is its radius (in the case of a cylindrical conduit).

Therefore, in accordance with the various forms of the invention set forth above when the density of the gases in the converter reaches a normal value at the termination of the overcharging period and because of the action of the pump 2 the gases stored in the reservoir 4 temporarily may return without any inconvenience to the converter.

Furthermore if desired certain products may be placed in the intermediary reservoir 4 which will fix the gases either wholly or partly. Products of this type may be: bases for acid gases, sulphuric acid, or phosphorous pentoxide for water vapor. Also for this purpose the reaction products of alkaline metals with harmful gases under the action of an electric discharge may be used.

I claim:

1. A mercury vapor converter comprising a rectifier, a reservoir for excess gas, a high vacuum pump interposed between said rectifier and said reservoir for withdrawing excess gas from said rectifier and forcing said gas into said reservoir and means for returning said gas from said reservoir to said rectifier operable during periods of normal operation of said rectifier.

2. A mercury vapor converter comprising a rectifier, a reservoir for excess gas, a high vacuum pump interposed between said rectifier and said reservoir for withdrawing excess gas from said rectifier and forcing said gas into said reservoir, a conduit connecting said reservoir and said rectifier and a valve in said conduit controlling the return of gas from said reservoir to said rectifier.

3. A mercury vapor converter comprising a rectifier, a reservoir for excess gas, a high vacuum pump interposed between said rectifier and said reservoir for withdrawing excess gas from said rectifier and forcing said gas into said reservoir, a conduit connecting said reservoir and said rectifier to return excess gas from said reservoir to said rectifier, said conduit being of such length and such cross-sectional area that the return of gas to said rectifier takes place only during operation of said rectifier.

4. A method of operating a mercury vapor electric converter comprising removing excess gas pressure from said converter during overcharging periods and returning said gas to said converter during normal operation periods.

5. A method of operating a mercury vapor electric converter comprising reducing the vapor density of the mercury vapor during overcharging periods by withdrawing excess gas from the converter and storing said excess gas in an auxiliary reservoir fixing a portion of said excess gas within said reservoir and then returning said excess gas from said reservoir to said converter during normal periods of operation of said converter.

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No references cited.