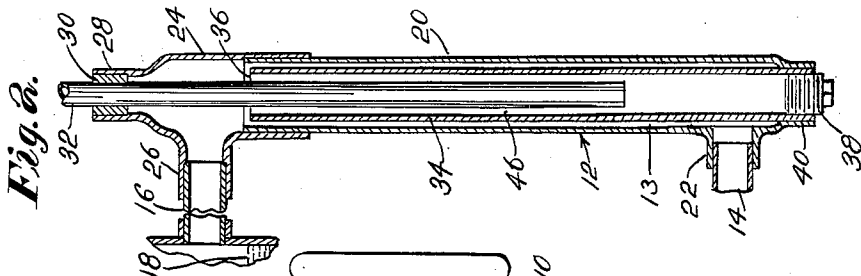
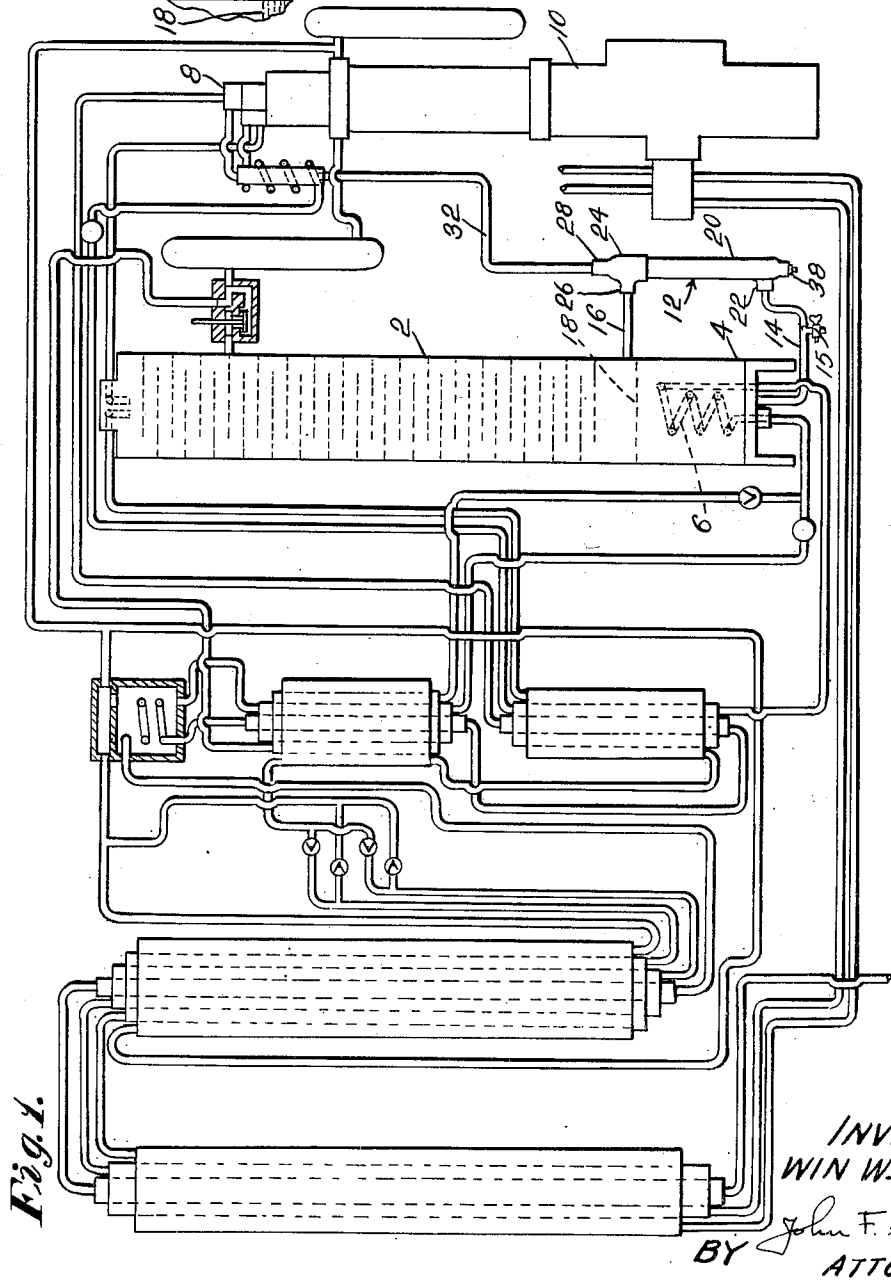


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RECTIFICATION APPARATUS
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RECTIFICATION APPARATUS

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9 Claims. (Cl. 62-122)

1 This invention relates to apparatus for the separation of a gaseous mixture into its constituents, more particularly to apparatus for the separation of air.

In the separation of air into its constituents, especially where the objective is the generation of relatively pure oxygen, there is almost always a possibility, albeit remote, of impurities accumulating in the liquid oxygen receiver. If one such impurity should happen to be acetylene or some similar substance, there is a possibility that a highly explosive mixture might form. It is therefore desirable, where oxygen is withdrawn from the column in the liquid form, to withdraw the oxygen from the bottom of the liquid receiver in order to prevent the accumulation of appreciable quantities of any impurities. At the same time, however, it is usually desirable to maintain a predetermined liquid level in the liquid receiver, because the liquid receiver usually also serves as an evaporator-condenser and it becomes desirable to have the condenser constantly submerged in liquid. These considerations apply whether the apparatus employs a single column or a double column.

It is, accordingly, an object of this invention to provide apparatus for the separation of a gaseous mixture into its constituents in which a liquid rich in one of the constituents is withdrawn from the bottom of a receiver in which the liquid accumulates while at the same time maintaining the liquid level in the receiver at a predetermined height. More specifically, it is an object of this invention to provide apparatus for the separation of air into its constituents in order to produce substantially pure oxygen, in which oxygen can be withdrawn in the liquid form from the evaporator condenser in which it accumulates in such a manner as to prevent the accumulation of impurities in the liquid while also keeping the liquid oxygen level high enough to keep the condenser submerged.

This and other objects are accomplished in apparatus which takes oxygen from the bottom of the liquid receiver and which includes a cup into which liquid oxygen overflows to maintain a desired liquid oxygen level in the liquid receiver, the liquid outlet from the cup constituting a conduit which reaches into the cup to remove liquid therefrom as it overflows into the cup. The cup is so designed that the liquid volume in the cup is greater than the displacement of a positive displacement pump used to withdraw liquid from the cup.

In the drawings:

Fig. 1 is a schematic view of apparatus embodying the invention, and

Fig. 2 is an enlarged detail view, with parts broken away and in section, to show the internal structure of the overflow device.

Except for the means whereby liquid oxygen is withdrawn from the column, the apparatus shown in Fig. 1 is substantially the same as Fig.

2 1 of the application of Samuel C. Collins, Serial Number 122,077 filed October 18, 1949, and assigned to the assignee of this invention. The aforesaid application of Samuel C. Collins also discloses, in Figures 2 and 3, a double-column system to which attention is invited, because the invention described and claimed herein is not limited to a single rectification column such as is shown, but may be used in a double column as well. In view of the similarity of the apparatus set forth in the above identified application of Samuel C. Collins to the apparatus of this invention, the apparatus will not be described in detail herein, except for the changes accomplished by this invention.

The drawings show a single-column rectifier 2 having an evaporator-condenser 4 at the lower end thereof which serves as a receiver in which substantially pure oxygen accumulates. In the receiver 4 there is provided a coil 6 through which cold purified air passes and in which the purified air condenses while boiling off the lower boiling point constituents present in the liquid in receiver 4.

A positive displacement liquid oxygen pump 8 is connected to be driven by an expansion engine 10, as will be well understood by those skilled in the art. The pump 8 withdraws liquid oxygen from receiver 4 through an overflow or chamber device indicated generally at 12, the structure of which is shown in detail in Fig. 2. The overflow or chamber device 12 is an elongated, substantially vertical device having an interior chamber 13 and, as is best seen in Fig. 1, is positioned at substantially the same level as receiver 4. Means are provided to connect one end of the chamber with the bottom of the receiver, and other means are provided to connect the other end of the chamber with the receiver at a point above the normal liquid level in the receiver.

The means to connect one end of the chamber with the bottom of the receiver constitutes a conduit 14 opening into the bottom of receiver 4. Conduit 14 is connected to the lower end of the overflow or chamber device 12 and is provided with a liquid drain cock 15. The means to connect the other end of the device with the receiver constitutes a conduit 16 opening into the column 2 above the normal liquid level 18 in the liquid oxygen receiver 4. In order to assure a maximum effectiveness of the condenser 6, the liquid level 18 is maintained (by means described below) at a point well above the top of coil 6, to insure that coil 6 is always submerged in oxygen-rich liquid.

The overflow or chamber device 12 will now be described in detail. As is best seen in Fig. 2, a substantially cylindrical member 20 is necked down at its lower end, and near its lower end is provided with a connection 22 which receives the end of conduit 14. At its upper end, member 20 is provided with a fitting 24 having two connec-

tions other than the connection with the member 20. A connection 26 secures the conduit 16 to the fitting 24 and serves to connect the upper end of chamber 13 with the interior of the column at some point above the liquid level 18. A second connection 28 is preferably provided with a sleeve or bushing 30 through which passes a conduit 32 which serves as the liquid outlet from chamber 13 and conducts liquid to the pump 8. A liquid collector cup 34 is positioned in chamber 13 and outlet 32 withdraws liquid from the cup 34.

As will be well understood by those skilled in the art, the liquid outlet 32 is secured as by soldering, brazing or other satisfactory means to the fitting 24. To this end the bushing 30 is secured directly to the fitting 24 in the connection 28, and the liquid outlet 32 is secured to the bushing 30.

Cup 34 is preferably a cylinder, open at its upper end to provide an edge 36 over which liquid overflows into the cup, and closed at its lower end, preferably by means of a plug 38. The lower end of cup 34 is secured, as by soldering or brazing, to the necked-down end of member 20 at 40.

The securing of cup 34 by the necked-down end of member 20 at 40 constitutes the sole support of the cup. With this construction, it is possible to adjust the height of the edge 36 of cup 34 to the height desired for the liquid level 18. The adjustment is, of course, accomplished before the joint at 40 is soldered, or otherwise secured; when the desired adjustment has been accomplished, then the member 20 and cup 34 are securely fastened together as shown at 40.

The annular space 46 provided in cup 34 between the inside of the cup and the outside of outlet 32 is preferably such that the liquid volume provided thereby is greater than the displacement of positive displacement pump 8, in order that the pump will not withdraw a charge which consists partially of liquid and partially of gas.

Operation

In the operation of apparatus made according to this invention, liquid is continuously withdrawn from the bottom of liquid receiver 4, thus constantly withdrawing heavy impurities which may settle to the bottom of the receiver and would otherwise accumulate there. Inasmuch as the liquid receiver 4, conduit 14, and member 20 constitute a U-tube, liquid will have the same level in both legs of the tube. Liquid will therefore accumulate in receiver 4 and in member 20 until the level rises to the edge 36 of cup 24. Additional liquid falling into receiver 4 will thereupon cause liquid to overflow the edge 36 into cup 34, from which it is withdrawn by the liquid outlet 32.

It will be evident from the foregoing that this invention provides apparatus having the advantages that liquid may be maintained at a given desired level in a liquid receiver and yet may be withdrawn in such a manner as to prevent the accumulation of heavy impurities in the bottom of the receiver.

While there is in this application specifically described one form which the invention may assume in practice, it will be understood that this form of the same is shown for purposes of illustration, and that the invention may be modified and embodied in various other forms without departing from its spirit or the scope of the appended claims.

I claim:

1. In apparatus for the separation of a gas-

eous mixture into its constituents, a rectification column, a receiver positioned to accumulate a liquid rich in one constituent, an elongated substantially vertical chamber device positioned at substantially the same level as the receiver, means to connect one end of the chamber device with the bottom of the receiver to withdraw liquid from the receiver bottom, means to connect the other end of the chamber device with the receiver at a point above the normal liquid level in the receiver, a liquid collector cup disposed in the chamber of the chamber device with its edge at the level desired for the liquid in the receiver, and a liquid outlet opening into said cup.

2. Apparatus as set forth in claim 1, in which the liquid outlet extends into the cup through its open end defined by said edge to a point near the bottom.

3. Apparatus according to claim 2, in which the liquid outlet is connected with a positive displacement liquid pump, the volume of the annular space formed by the cup and the outlet being greater than the pump displacement.

4. Apparatus according to claim 1, in which the receiver is integral with the column and is disposed at the lower end of a rectifier section thereof.

5. In apparatus for the separation of air into its constituents, a rectifier column, a receiver in the column adapted to accumulate a liquid rich in one of the constituents, a condenser associated with the receiver, an elongated substantially vertical chamber device positioned at substantially the same level as the receiver, means to connect one end of the chamber device with the bottom of the receiver to withdraw liquid from the receiver bottom, means to connect the other end of the chamber device with the receiver at a point above the normal liquid level in the receiver, a liquid collector cup disposed in the chamber of the chamber device with its edge at the level desired for the liquid in the receiver, and a liquid outlet opening into said cup.

6. Apparatus as set forth in claim 5, in which the normal liquid level is such as to completely submerge said associated condenser in liquid.

7. Apparatus according to claim 6, in which the liquid outlet is connected with a positive displacement liquid pump, the volume of the annular space formed by the cup and the outlet being greater than the pump displacement.

8. Apparatus according to claim 5, in which the liquid outlet is connected with a positive displacement liquid pump, the volume of the annular space formed by the cup and the outlet being greater than the pump displacement.

9. Apparatus according to claim 5, in which the sole support for said cup is provided at the lower end of said device.

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