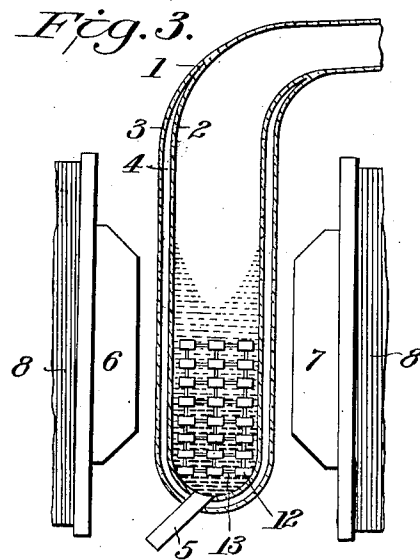
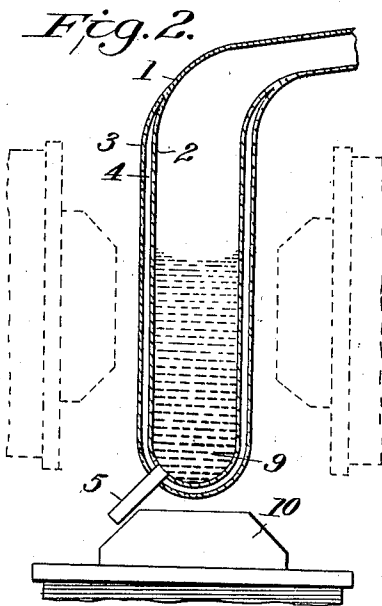
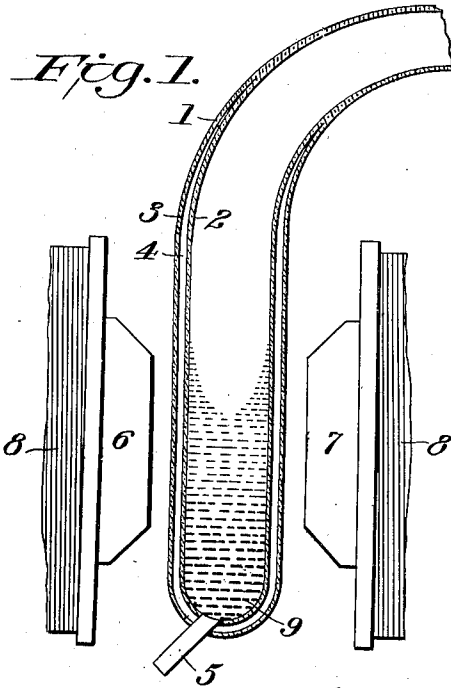


A. C. MORRISON.
 PROCESS OF SEPARATING MIXED LIQUEFIED GASES.
 APPLICATION FILED MAY 17, 1912.

1,056,043.

Patented Mar. 18, 1913.



WITNESSES

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ABRAHAM CRESSY MORRISON, OF CHICAGO, ILLINOIS.

PROCESS OF SEPARATING MIXED LIQUEFIED GASES.

1,056,043.

Specification of Letters Patent.

Patented Mar. 18, 1913.

Application filed May 17, 1912. Serial No. 698,001.

To all whom it may concern:

Be it known that I, ABRAHAM CRESSY MORRISON, a citizen of the United States, residing at Chicago, in the county of Cook and State of Illinois, have invented certain new and useful Improvements in Processes of Separating Mixed Liquefied Gases, of which the following is a specification.

This process is especially designed for the production of gaseous oxygen and nitrogen from liquid air, and is based on the facts that oxygen is a paramagnetic element and that its magnetic susceptibility is higher than that of nitrogen.

The process comprises the steps of placing the liquid air or other mixture of liquefied gases within a strong magnetic field, and then allowing the liquid to become heated to a temperature slightly above the boiling-point of the nitrogen, or other more volatile and less magnetic component, whereupon the nitrogen distils off, the oxygen, or other component, remaining by reason both of its relative involatility and of the tractive effect of the magnetic field.

Suitable apparatus for carrying out the process is shown in the accompanying drawing, in which the several figures are diagrammatic side elevations, showing a double-walled vacuum vessel containing the liquefied gas, and the poles of electromagnets in proximity thereto.

Figure 1 illustrates a vessel 1 having inner and outer concentric walls 2, 3, with an intermediate space 4 from which the air has been exhausted. A tap 5 extends from the lower end of the vessel. The vessel is placed between the opposed pole-pieces 6, 7 of a powerful electromagnet 8. The liquid air or other liquefied gas 9 in the vessel is shown in the position which it assumes in the magnetic field, and is indicated as having a gradually-increasing density toward the bottom, by reason of the partial evaporation of the nitrogen and of the pull of the magnetic field.

The apparatus illustrated in Fig. 2 employs a pole-piece 10 of an electromagnet 11, placed directly beneath the base of the vessel. Means for creating a magnetic field at the sides of or around the tube may also

be used, such as the pole-pieces indicated by dotted lines.

The apparatus of Fig. 3 is identical with that of Fig. 1, as to the vessel and electromagnet. In the lower end of the vessel and within the body of liquid air is placed means for carrying and diffusing the lines of magnetic flux passing between the pole-pieces 6, 7. This means consists of a large number of small pieces of iron 12, supported and spaced apart in regular manner by intermediate pieces 13 of non-magnetic material, such as short copper wires.

In using either type of apparatus illustrated, the liquid air is placed in the vessel and the electromagnet or magnets are energized. The oxygen is strongly attracted by the magnet poles, and the surface of the liquid assumes about the contour shown. As the liquid air becomes heated, the nitrogen, having the lower boiling-point and being less strongly attracted by the pole-pieces, distils off, while the less volatile and more magnetic oxygen remains behind and is drawn off through the tap 5. While for the purpose of distinctness the portion evaporating has been termed "nitrogen" and the portion remaining "oxygen", in practice more or less of the oxygen will escape with the nitrogen and more or less of the nitrogen will remain with the oxygen, the process serving, however, to produce two fractions, one of which has a lower and the other a higher content of oxygen than air.

I claim:—

1. The process of separating or fractionating mixed liquefied gases, which consists in subjecting the liquid to a magnetic field while heated to a temperature above the boiling-point of the more volatile and less magnetic component.

2. The process of separating liquefied air into portions of high and lower oxygen-content than air, which consists in subjecting the liquid to a magnetic field while heated to a temperature above the boiling-point of nitrogen.

3. The process of separating or fractionating mixed liquefied gases, which consists in placing in the liquid a number of separate pieces of paramagnetic metal, and then

subjecting the liquid to a magnetic field while heated to a temperature above the boiling-point of the more volatile and less magnetic component.

- 5 4. The process of separating liquefied air into portions of higher and lower oxygen-content than air, which consists in placing in the liquid a number of separate pieces of paramagnetic metal, and then subjecting

the liquid to a magnetic field while heated 10 to a temperature above the boiling-point of nitrogen.

In testimony whereof I affix my signature in presence of two witnesses.

ABRAHAM CRESSY MORRISON.

Witnesses:

EUGENE A. BYRNES,

N. P. LEONARD.