

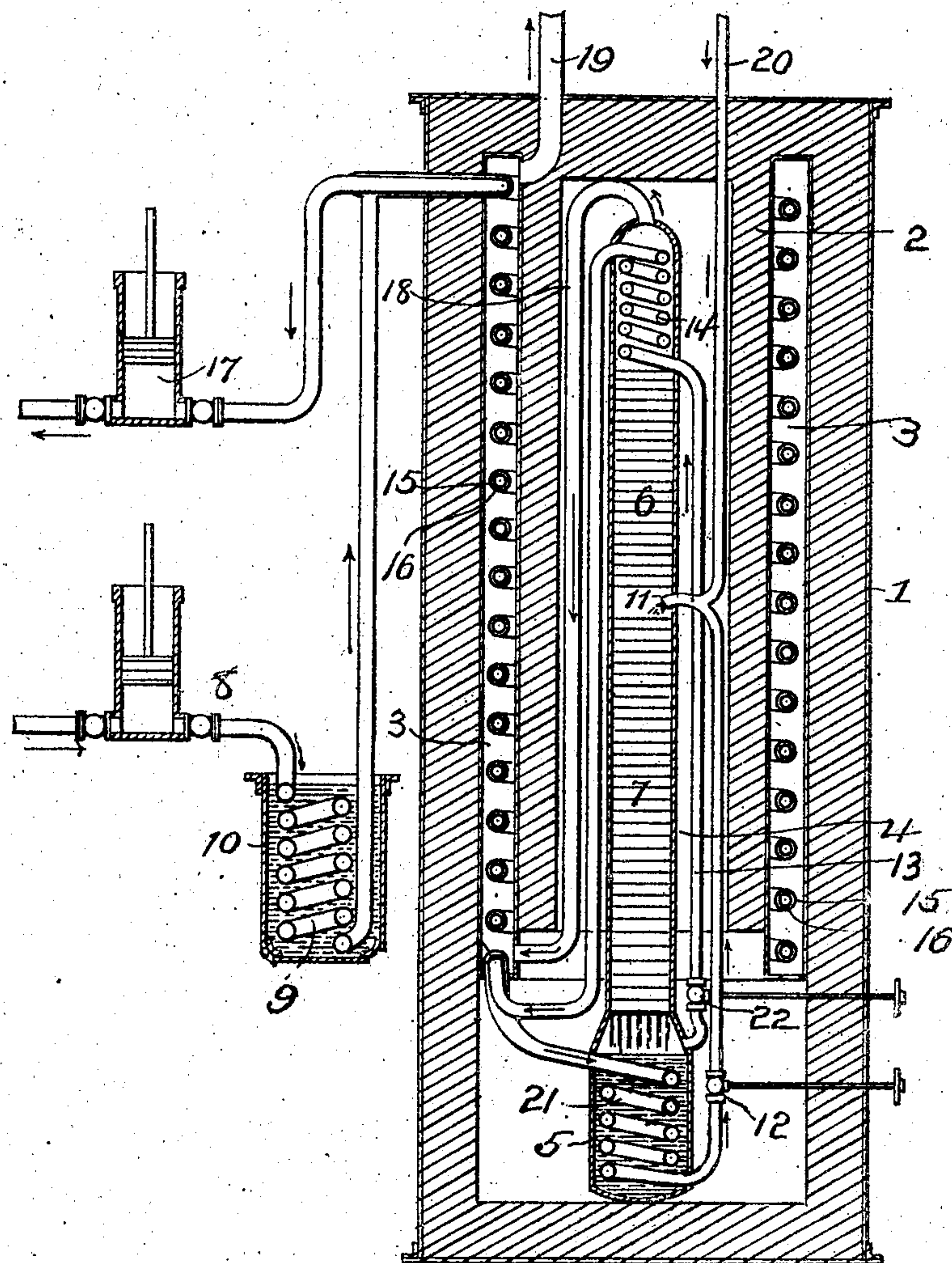
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C. LINDE.

# APPARATUS FOR PRODUCING PURE NITROGEN.

APPLICATION FILED OCT. 22, 1903.



**WITNESSES**

WITNESSES  
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**INVENTOR**

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# UNITED STATES PATENT OFFICE.

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## APPARATUS FOR PRODUCING PURE NITROGEN.

No. 815,601.

Specification of Letters Patent.

Patented March 20, 1906.

Application filed October 22, 1903. Serial No. 178,163.

*To all whom it may concern:*

Be it known that I, CARL LINDE, of Munich, in the Kingdom of Bavaria, Germany, have invented certain new and useful Improvements in Apparatus for Producing Pure Nitrogen; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

My invention relates to an improved apparatus for producing pure nitrogen, the object of the invention being to produce pure nitrogen by fractional distillation and rectification of liquefied atmospheric air; and with this object in view the invention consists in certain novel features of construction and combinations and arrangements of parts, as will be more fully hereinafter described, and pointed out in the claims.

The accompanying drawing is a view in longitudinal section, illustrating my improvements.

1 represents a casing or receptacle suitably lined or walled to provide insulation against heat and made with a cylindrical inner partition-wall 2 to provide a counter-current chamber 3 around the same.

Located in the casing 1 and extending practically throughout the length thereof is my improved rectifying-column 4, which is enlarged at its lower end, forming a chamber 5, and is provided throughout its length with superposed trays to overflow one into the next lower, or other form of obstruction or retarding means may be provided in said column, and for convenience in explanation of my invention I have designated the upper half of the column 6 and the lower half 7.

8 represents an air-compressor to force air through a coil 9 in a cooling-bath 10, from which the pipe passes through the counter-current chamber 3 in the form of a continuous coil 15 of many convolutions and then enters chamber 5 and is coiled therein, as shown at 21. The pipe leaves the lower end of chamber 5 and passes up to about the middle of column 4, where it is provided with a nozzle 11, projecting into column and discharging downward therein, and a throttle-valve 12 is located in said pipe adjacent to chamber 5 to regulate the passage of liquid air to the column, as will more fully hereinafter appear.

A pipe 13 communicates with the upper portion of chamber 5, has a throttle-valve 22 therein, and extends up to near the top of column 4. It enters said column and coils therein, as shown at 14, and then passes out of the column and is coiled within the pipe 15, as shown at 16, and out at the top and communicates with a suitable suction-pump 17.

A pipe 18 connects the top of column 4 with the bottom of counter-current chamber 3, and an outlet-pipe 19 communicates with the upper end of said chamber 3. A pipe 20 communicates with nozzle 11 to supply liquid air thereto in starting the apparatus and to compensate for losses in work.

The operation of my improvements is as follows: Air is compressed by compressor 8 and cooled in the coil 9 in bath 10 and enters the coil 15 in counter-current chamber 3, exchanging its temperature with the escaping currents and liquefies in coil 21 in chamber 5. The air so liquefied flows past valve 12 to nozzle 11 and is directed thereby down into the lower portion 7 of column 4 and passes down the same into chamber 5. The liquefying of the air in coil 21 causes a corresponding quantity of liquid in chamber 5 to evaporate, the vapor passing up through the lower half of column 4 in counter-current to the liquid air descending, rectification sets in, so that while the vapor leaving the chamber 5 contains about sixty per cent. oxygen it will escape through the top of column 4 with but seven per cent. oxygen. Pipe 18 conveys this vapor to the counter-current chamber 3, from which it escapes through the outlet 19. The excess of liquid in chamber 5 is drawn up past valve 22 to coil 14 by means of suction-pump 17, thus maintaining the liquid *in vacuo*. The rising vapors with seven per cent. oxygen exchange their heat with the liquid in coil 14, liquefying said vapors and compelling them to fall down the upper half 6 of column 4 when the self-intensified rectification takes place, so that the vapor escaping from the top of column 4 will contain but about two and one-half per cent. oxygen, and by continued operation of the apparatus finally pure nitrogen only escapes out of column 4 through counter-current chamber 3 and outlet 19. The liquid vaporized *in vacuo* in coil 14 is drawn through the inner pipe-coil 16 in chamber 3 and escapes or may be used again, if desired.



A great many slight changes might be made in the general form and arrangement of the parts described without departing from my invention, and hence I would have it understood that I do not confine myself to the precise details set forth, but consider myself at liberty to make such slight changes and alterations as fairly fall within the spirit and scope of my invention.

10 Having fully described my invention, what I claim as new, and desire to secure by Letters Patent, is—

1. In an apparatus for producing pure nitrogen, the combination of a rectifying-column, a liquefied gas-chamber at the bottom thereof, a nozzle discharging liquefied gas into said column between its ends, means for carrying off the nitrogen at the top of said column, a pipe communicating with the liquid-chamber at the bottom of the column, and coiling in the upper portion of said column and means for drawing a quantity of said liquid through the coil, whereby it is vaporized therein *in vacuo* and a corresponding quantity of the gas in said column liquefied by its contact with the metal walls of said coil.

2. In an apparatus for producing pure nitrogen, the combination with a gas-com-

pressor, a coil through which the gas is forced, means for cooling the coil and a counter-current chamber into which the cooled gas is conveyed, of a rectifying-column, a chamber for liquefied gas at the lower end of said column, a coil therein in which the gas from the counter-current chamber is liquefied and evaporates a corresponding quantity of liquid in the liquid-chamber the vapor from which ascends through the column, a pipe connecting the last-mentioned coil with the column to direct the liquid into the column between the ends of the latter, a pipe-coil in the upper end of the column connected with the liquid-chamber, a suction-pump to draw the liquid from the liquid-chamber to the coil in the column to be vaporized therein and liquefy ascending vapor or gas in the column, and means for conveying the gas escaping from the top of the column through the counter-current chamber.

In testimony whereof I have signed this specification in the presence of two subscribing witnesses.

CARL LINDE.

Witnesses:

ABRAHAM SCHLESINGER,  
ANNI LUTHER.