

E. G. HELANDER.

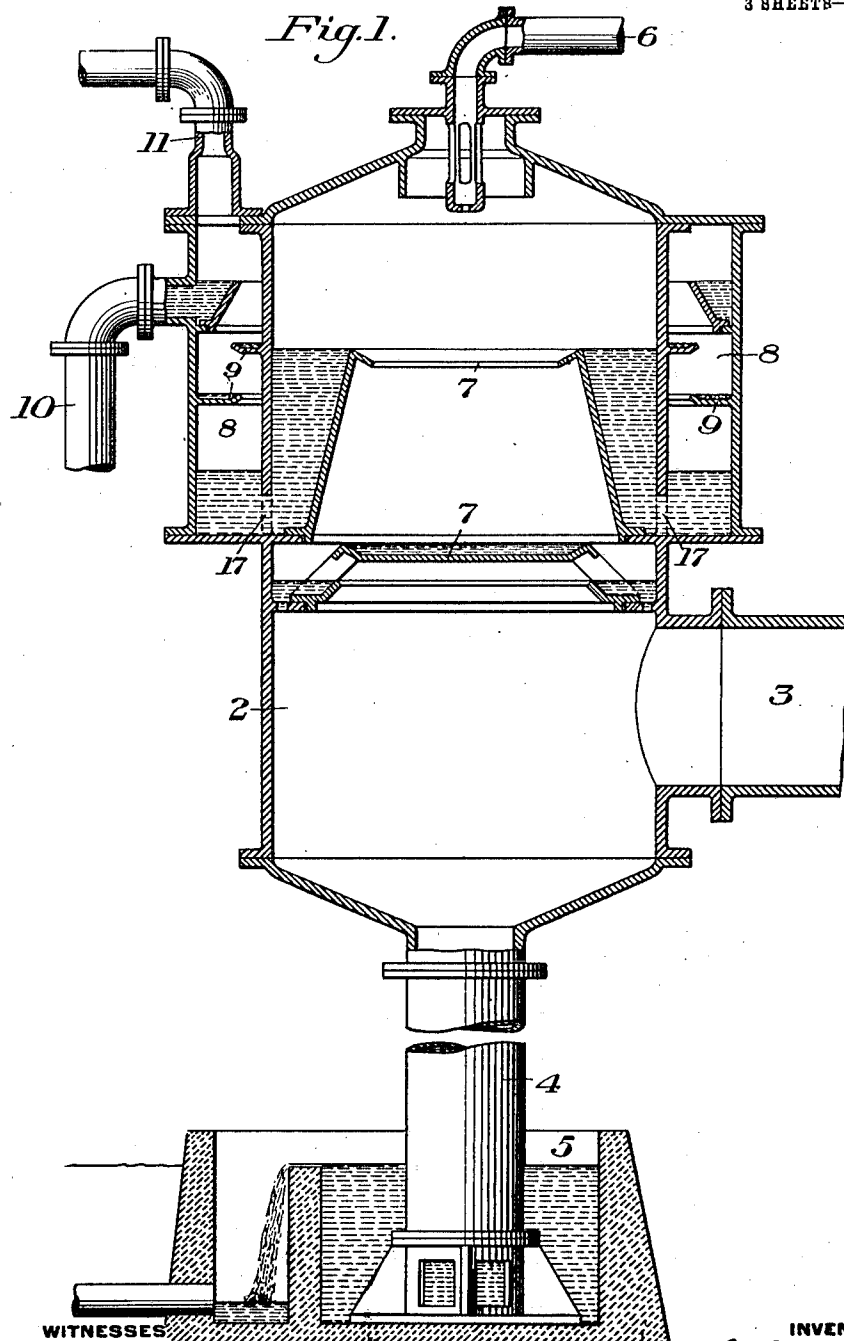
CONDENSER.

APPLICATION FILED OCT. 19, 1910.

1,048,532.

Patented Dec. 31, 1912.

3 SHEETS-SHEET 1.



R. A. Balderson
W. F. Amarish

INVENTOR
E. G. Helander,
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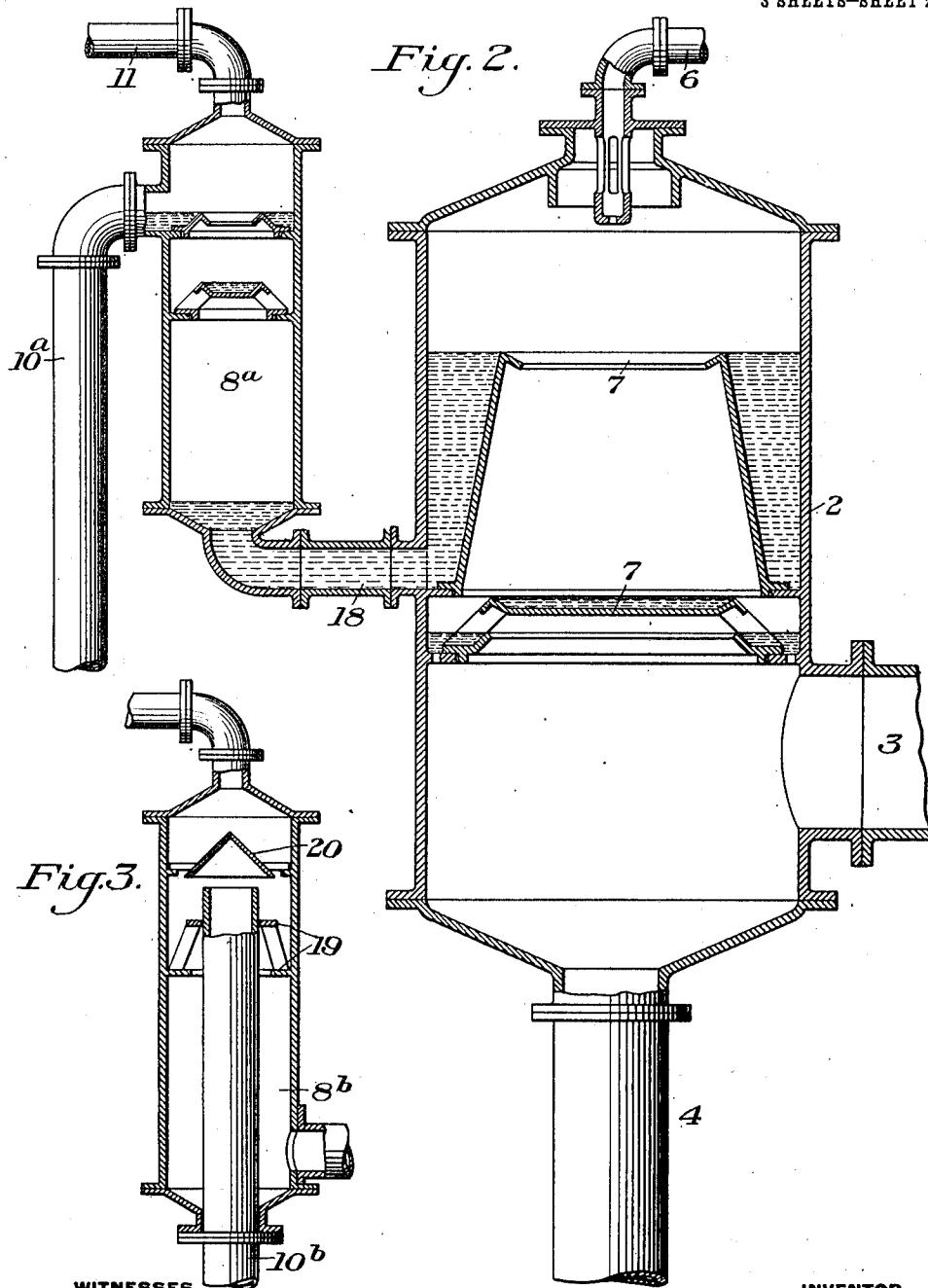
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3 SHEETS-SHEET 2.



WITNESSES

R. A. Balderson
W. J. Farniss

INVENTOR

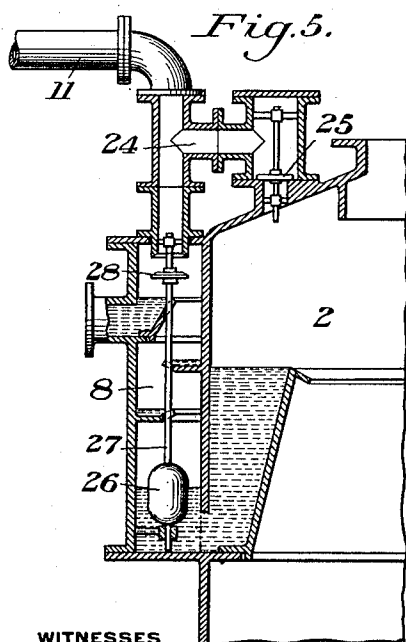
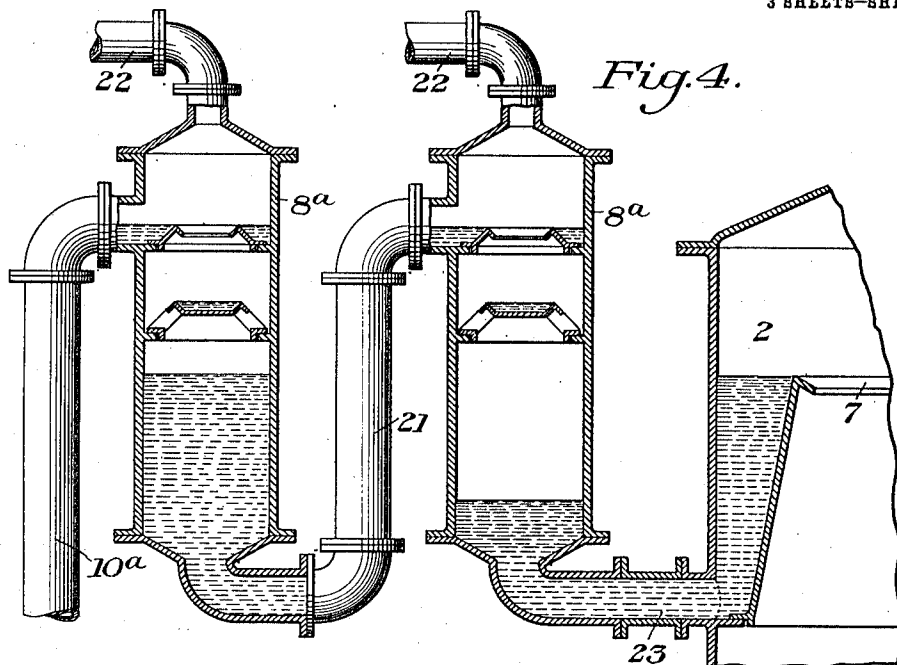
E. G. Helander
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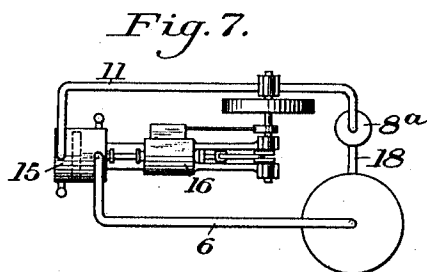
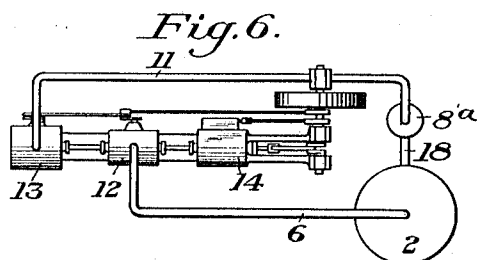
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3 SHEETS—SHEET 3.



WITNESSES

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UNITED STATES PATENT OFFICE.

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CONDENSER.

1,048,532.

Specification of Letters Patent.

Patented Dec. 31, 1912.

Application filed October 19, 1910. Serial No. 587,951.

To all whom it may concern:

Be it known that I, ERNST G. HELANDER, a resident of Pittsburgh, in the county of Allegheny and State of Pennsylvania, have invented a new and useful Improvement in Condensers, of which the following is a full, clear, and exact description, reference being had to the accompanying drawings, forming part of this specification, in which—

Figure 1 is a sectional elevation showing one form of condenser embodying my invention; Fig. 2 is a similar view showing a modification; Fig. 3 is a detail showing another way of connecting the water supply; Fig. 4 is a detail sectional view showing still another modification; Fig. 5 is a detail sectional view showing still another modification; Fig. 6 is a diagrammatic view showing one way in which the air pumps may be connected; and Fig. 7 is a similar view showing another way of connecting the air pumps.

My invention has relation to condensers and the method of operating the same, and is applicable to barometric condensers, jet condensers and barometric jet condensers.

It is well known that a large part of the work expended in maintaining the proper degree of vacuum in the condensing chamber of a condenser is that which is required to exhaust the air which is carried into the condenser with the cooling water. This air expands in proportion to the vacuum, so that the higher the degree of vacuum, the larger will be the volume of air which must be extracted by the air pump. Thus, the higher the vacuum, the larger the capacity of the air pump which is required. For example, when the air which is mixed with the cooling water and which is under atmospheric pressure when outside of the condenser, enters a condenser which has twenty-six inches of vacuum, equal to two pounds absolute pressure, the air will expand substantially in the ratio of $\frac{1}{2}$ or $7\frac{1}{2}$. If the same air is taken into the condenser when the vacuum is twenty-eight inches, the air will expand in the ratio of $\frac{1}{2}$ or 15. It therefore requires an air pump of twice the capacity to maintain a vacuum of twenty-eight inches, as compared with that required to maintain a vacuum of twenty-six inches. The figures given are, of course, only approximate, but are sufficiently accurate for the purpose.

The object of my invention is to diminish the size of the air pump, especially where higher vacuums are required, and at the same time to obtain the highest possible vacuum. I attain this object by a preliminary exhaustion of the air from the cooling water before the latter enters the condensing chamber. A large portion of the air can in this way be extracted at a lower vacuum than that which is maintained in the condenser chamber, preferably leaving but a comparatively small quantity of air to be extracted from such chamber. This not only enables me to maintain a higher vacuum in the condenser chamber, but it also enables me to employ smaller pumps and driving engines therefor.

My invention is susceptible of various modifications, some of which will now be described.

Referring first to that form of my invention shown in Fig. 1, the numeral 2 designates the condensing chamber of a barometric condenser. 3 is the steam inlet pipe, and 4 the usual tail pipe which extends downwardly into the well or sink 5. 6 is the usual connection with the air pump for exhausting the chamber, and 7 designates internal baffles over which the cooling fluid flows and is brought into contact with the steam discharged into the chamber, the condenser being of the well known counter current type.

Surrounding the upper portion of the chamber 2 is an annular chamber 8, which is provided with any suitable arrangement of interior baffles 9, and to which is connected a water supply pipe 10. Connected with this chamber, preferably at the upper portion thereof, is an exhaust connection 11, which leads to an air pump or exhauster.

In Fig. 6, I have shown the pipe connection 6 as leading from a pump 12, and the pipe 11 as leading from a second pump 13, the two pumps being arranged in tandem and driven by an engine 14. In Fig. 7, I have shown the two pipes 6 and 11 as connected to opposite sides of a double-acting pump 15, driven by an engine 16. In the arrangement shown in Fig. 6, the two pumps 12 and 13 may be of any desired relative capacity, and in the form shown in Fig. 7, any suitable regulating means may be provided for maintaining the difference of vacuum between the two con-

nections 6 and 11. Comparatively little regulation will, however, be required, since owing to the preliminary exhaustion of the air from the chamber 8, the same pump
5 will be able to maintain a higher degree of vacuum in the chamber 2 than in the chamber 8.

The lower portion of the chamber 8 is connected with the chamber 2 through the
10 opening or openings 17, and the greater degree of vacuum in the chamber 2 will maintain a difference of water level in the two chambers substantially as indicated in Fig. 1, so that the water maintains an efficient
15 seal.

The operation will be readily understood. By means of the exhaust connection 11, a large part of the air contained in the entering water will be exhausted at relatively
20 low degree of vacuum, as compared with the vacuum which is maintained in the chamber 2. If the pump is arranged to maintain a vacuum of twenty-six inches in the chamber 8, the expansion of air in the chamber
25 8 is only one-half that in the chamber 2, and therefore, the same quantity of air can be exhausted from the chamber 8 with one-half the volume which would be present if it were exhausted from the chamber 2.

In the modification of my invention shown in Fig. 2, the preliminary exhaust chamber 8^a, corresponding to the chamber 8 of the
30 form first described, instead of surrounding the chamber 2, is a separate chamber connected with the chamber 2 by a connection 18.

Fig. 3 shows a form of the invention similar to that shown in Fig. 2, except that the water instead of entering the upper portion
35 of the chamber by a pipe connection 10^a, as shown in Fig. 2, enters by a pipe 10^b, which extends upwardly through the bottom wall of the chamber 8^b. 19 designates suitable baffles in the chamber 8^b, and 20 is a hood placed above the upper end of the
40 pipe 10^b.

Fig. 4 shows a form of my invention which has a two-stage preliminary exhaustion. In this form, two of the chambers 8^a, such as
45 shown in Fig. 2, are connected in series with each other by a pipe 21, and each chamber is provided with an exhaust connection 22. The water flows from the second chamber 8^a into the condenser chamber proper 2, through the connection 23. This arrangement gives a very high degree of preliminary
50 exhausting of the air, although this form will not ordinarily be required.

Fig. 5 illustrates a safety attachment which may or may not be used. In this
55 figure, which shows the general construction shown in Fig. 1, and to which the same reference characters are applied to corresponding parts as in that figure, I have shown a by-pass 24, connecting the chamber 2 with the exhaust connection 11. This

by-pass is provided with a check valve 25, which is normally held closed by the higher vacuum maintained in the chamber 2. The chamber 8 is also provided with a float 26,
60 whose upwardly extending stem 27 is provided with a valve 28, arranged to close the entrance to the connection 11.

If the pump operating the exhaust connection to the main chamber 2 fails for any reason to operate properly, a higher degree
65 of vacuum will be created in the chamber 8 than in the chamber 2. The water will therefore rise in the chamber 8, operating the float 26, to close the valve 28. At the same time, the valve 25 will be opened by
70 the decrease of vacuum in the chamber 2, and the pump 11 will therefore exhaust from the chamber 2, and will operate to temporarily maintain the vacuum therein.

The advantages of my invention will be readily understood by those skilled in the art, since as above stated, it provides for the maintenance of a higher degree of vacuum in a condenser chamber by the use of
75 pumps of relatively small capacity or displacement. The advantage of being able to use pumps or exhausters of smaller capacity is well understood in the art. The condensing chamber can be readily applied to existing condensers, and will largely increase
80 their efficiency and decrease the operating expense.

It will be obvious that the invention is susceptible of various modifications other than those which I have illustrated and described, since the preliminary exhaustion or rarefying chamber or chambers can be arranged in various ways relatively to the
85 main condenser chamber; it may be used in connection with other styles of condensers; any suitable arrangement of pumps or exhausters may be employed; and various changes may be made in the details of construction and arrangement, all without departing from the spirit and scope of my invention, as defined in the appended claims.
90 95

I claim:

1. Condensing apparatus, comprising a main condensing chamber, a preliminary chamber for the cooling water, separate air
95 exhausting means connected to the said chambers and adapted to maintain a higher degree of vacuum in the main than in the preliminary chamber, means for causing the cooling water to fall by gravity through the
100 preliminary chamber, and a water passage connecting the two chambers and having water sealing legs which maintain a constant water seal under variations which may occur in the degrees of vacuum in the two
105 chambers; substantially as described.

2. Condensing apparatus, comprising a main condensing chamber, a preliminary chamber for the condensing water, the two chambers having a water sealed water pas-
110 115 120 125 130

sage connection, separate pumping means
for exhausting the two chambers to main-
tain a higher degree of vacuum in the main
than in the preliminary chamber, a by-pass
5 connecting the exhaust outlets from the two
chambers, and valve means operated by
change in the water level in the preliminary
chamber for connecting the main chamber

with the exhaust pump of the preliminary
chamber; substantially as described. 10

In testimony whereof, I have hereunto set
my hand.

ERNST G. HELANDER.

Witnesses:

H. A. HELANDER,

E. A. LOWNGES