

Feb. 27, 1923.

1,447,014

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EJECTING APPARATUS FOR EXHAUSTING AIR OR OTHER FLUIDS

Filed May 10, 1919

Fig. 1.

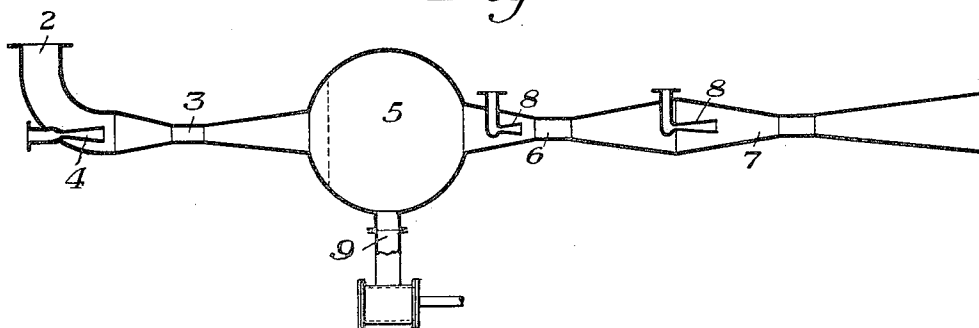
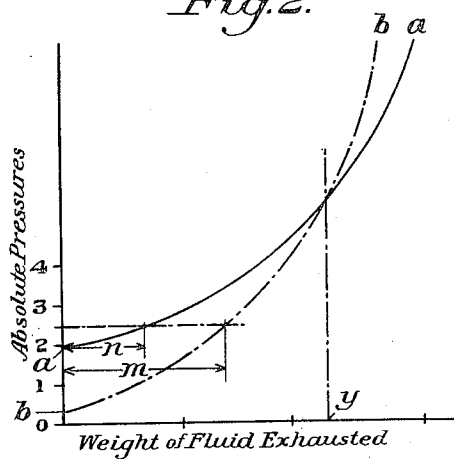


Fig. 2.



WITNESS

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EJECTING APPARATUS FOR EXHAUSTING AIR OR OTHER FLUIDS.

Application filed May 10, 1919. Serial No. 296,236.

To all whom it may concern:

Be it known that I, RAYMOND N. EHRHART, a citizen of the United States, residing at Pittsburgh, Allegheny County, Pennsylvania, have invented a new and useful Improvement in Ejecting Apparatus for Exhausting Air or Other Fluids, of which the following is a full, clear, and exact description, reference being had to the accompanying drawing, forming part of this specification, in which—

Figure 1 is a diagrammatic section of apparatus embodying my invention, and

Figure 2 is a diagram illustrating the relative efficiency of my invention.

My invention has relation to ejecting apparatus for exhausting air or other fluids from condensers and the like; and is designed to provide for the more efficient operation of such apparatus. The invention relates more particularly to that class of ejectors wherein the steam or other fluid is condensed between the various ejector stages. In this class of ejectors, a condenser is employed between the first and second stages of the ejector for the purpose of condensing out the vapor, so that the second stage of the ejector has to handle the air only. Such arrangements are particularly adaptable to very large plants where a high degree of efficiency is required, but are not as applicable to many modern plants where simplicity and direct results are of more importance than the highest degree of efficiency.

Referring to the accompanying drawing in which I have illustrated an embodiment of my invention in a diagrammatic manner, the numeral 2 designates the exhaust connection leading to the condenser or other vessel to be exhausted, 3 indicates the first stage ejector comprising a nozzle or nozzles 4 discharging into the usual converging-diverging diffuser structure; 5 is the intermediate condenser, 6 the first ejector of the second stage which exhausts the air or other fluid from the condenser 5, and 7 a second ejector in series with the ejector 6. Each of the ejectors 6 and 7 is provided with a nozzle or nozzles 8 and with a converging-diverging diffusing structure such as shown for the condenser 3. It will thus be seen that I provide two ejectors arranged in series in a separate stage. Although these two ejectors are shown as arranged in a straight line, they may of course be at an angle to

each other. The condenser 5 is provided with any suitable means such as indicated at 9 whereby the condensate may be discharged therefrom.

In Figure 2 I have shown a diagram which illustrates the action of my improved apparatus as compared with apparatus wherein a single ejector is used for exhausting air from the condenser 5. In this diagram the ordinates represent absolute pressures of mercury while the abscissæ represent weights of fluid exhausted from the condenser 5. The curve *a, a* illustrates the action of an apparatus having a single ejector in the second stage; while the curve *b, b* illustrates the operation of my improved apparatus. This diagram is based upon substantially the same steam consumption for both forms of apparatus. It will be evident from this diagram that if the system is so designed that the second ejector 7 operates within the limits of the points *o* and *y*, it is considerably more efficient than the old apparatus, and that superior economy in steam result. For example, if the suction pressure of the second ejector is $2\frac{1}{2}$ inches of mercury, it can exhaust from the intermediate condenser an amount of air represented by the line *m* where my improved apparatus is used; whereas the single-stage ejector could only exhaust the amount represented by the line *n*. In other words, for the same steam consumption a two-stage ejector will be more efficient in removing the same amount of fluid from the intermediate condenser, and a lesser amount of steam is required. For handling a small amount of air at high vacua or states of rarefaction, the two-stage ejector beyond the condenser will require much less steam than will a single-stage ejector. However, if the amount of fluid flowing to the ejector from the discharge of the condenser 5 is very large (that is, beyond the point *y*) then a single-stage ejector attached to the discharge of the condenser 5 will be more efficient. For condenser service, however, small amounts of air are handled and extremely high vacua are required; and my improved apparatus can be proportioned so that the amounts will fall within the limits of the points *o-y*.

The determination which I have made show that for pressures less than two inches of mercury, air can be exhausted from the main condenser with an expenditure of at

least 25% less steam by the use of my invention than with the arrangements previously used.

These determinations also indicate that if the pressure is materially more than 3" of mercury, my invention is equal to or somewhat less efficient than the old arrangements; but as the pressures required for condensers which serve steam turbines are generally less than 3", my invention provides an apparatus of materially greater efficiency than any previous apparatus with which I am familiar.

I claim:

1. Ejecting apparatus for exhausting air or other fluids, comprising a single-stage steam ejector, a condenser into which the ejector discharges, and a multi-stage ejector for exhausting the condenser, the different stages of the multi-stage ejector being directly connected to each other, substantially as described.

2. Ejecting apparatus for exhausting air or other fluids, comprising a single-stage steam ejector designed to be connected to the vessel to be exhausted, a condenser into which the said ejector discharges, and a

multi-stage ejector connected to the gas off-take of the condenser, the different stages of the multi-stage ejector being directly connected to each other, substantially as described.

3. Ejecting apparatus for exhausting air or other fluids, comprising a single-stage ejector, a condenser into which the ejector discharges, and a two-stage ejector connected to the offtake of the condenser, said two-stage ejector being constructed and arranged to compress over a greater range than the single-stage ejector, substantially as described.

4. Ejecting apparatus for exhausting air or other fluids, comprising a single-stage ejector, a condenser into which the ejector discharges, and a two-stage ejector connected to the offtake of the condenser, said two-stage ejector being constructed and arranged to compress over a greater range than the single-stage ejector, together with means for withdrawing the condensate from said condenser, substantially as described.

In testimony whereof, I have hereunto set my hand.

RAYMOND N. EHRHART.