R. N. EHRHART.

JET CONDENSER.

APPLICATION FILED DEC. 10, 1908.

1,009,657.

Patented Nov. 21, 1911.

4 SHEETS—SHEET 1.

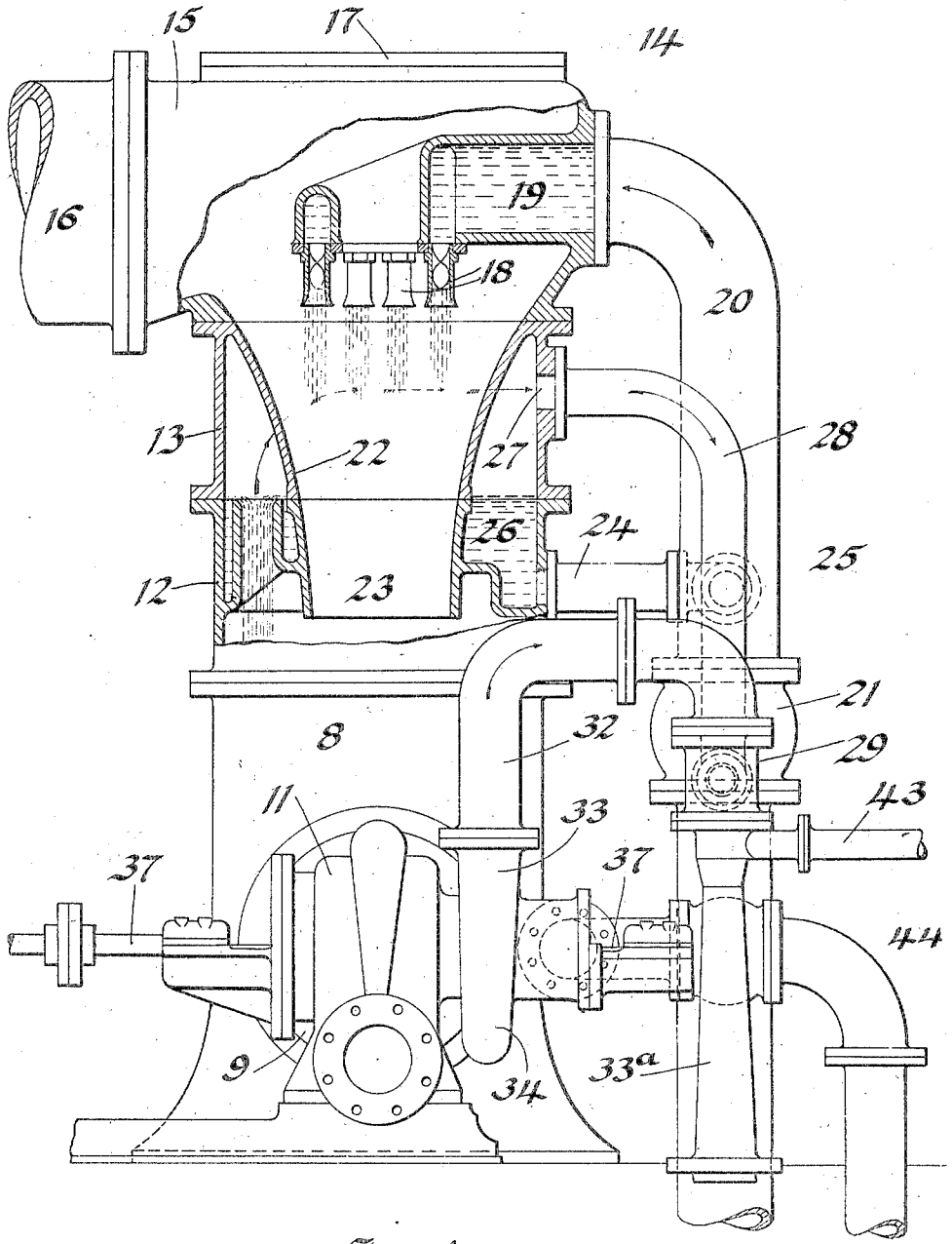

Fig. 1.

WITNESSES:

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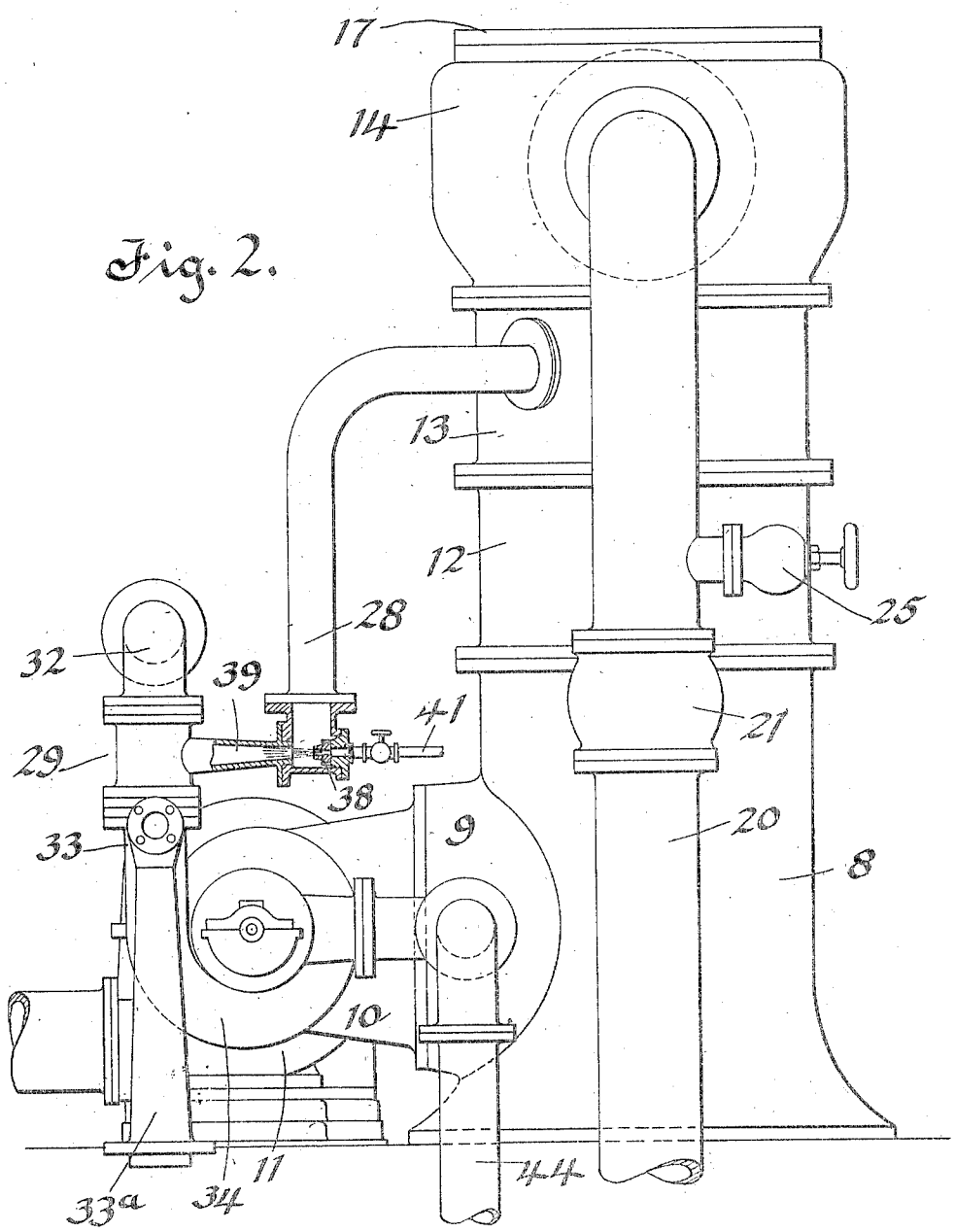
4 SHEETS—SHEET 2.

Fig. 2.



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4 SHEETS—SHEET 3.

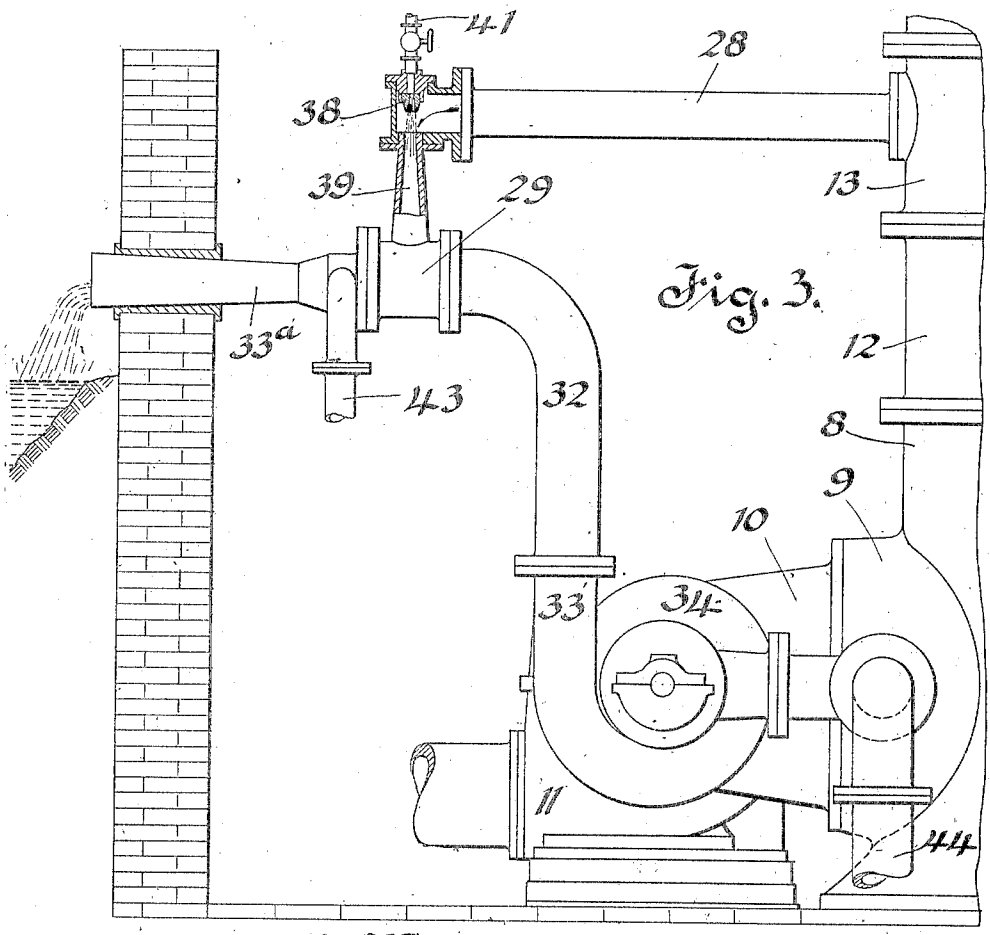

Fig. 3.

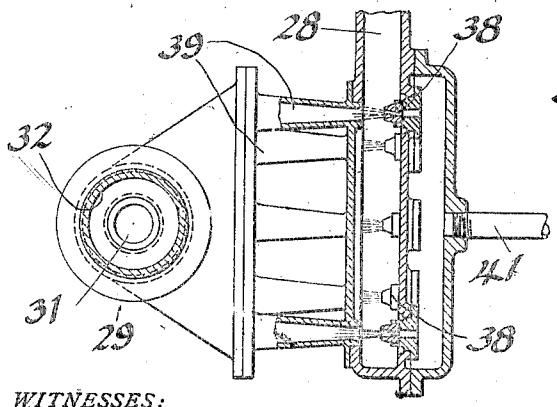

Fig. 6.

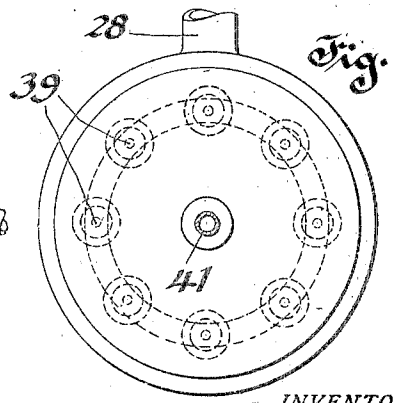

Fig. 7.

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4 SHEETS—SHEET 4.

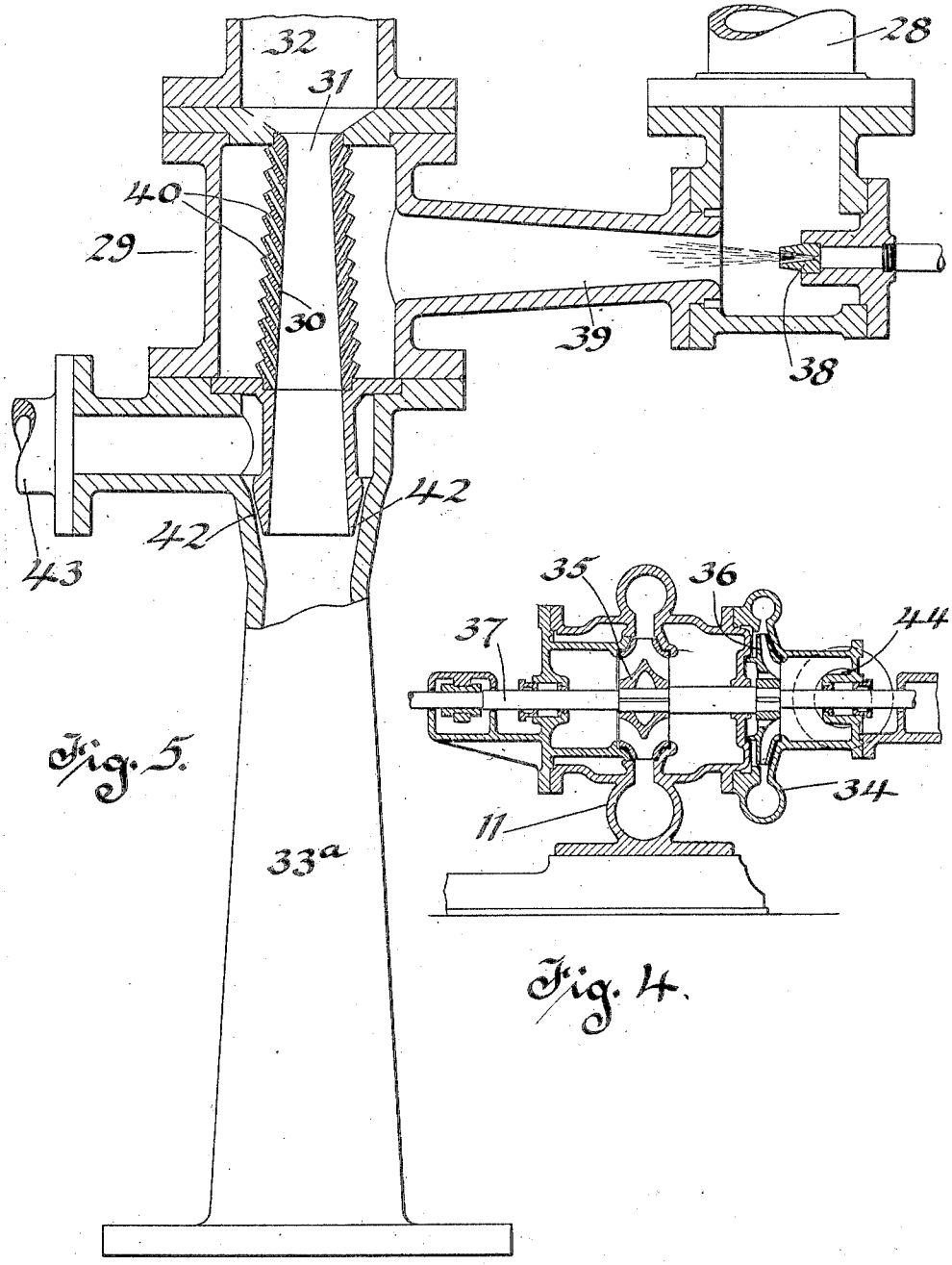

Fig. 5.

Fig. 4.

WITNESSES:

Geo. L. Walker

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BY Raymond N. Ehrhart.

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UNITED STATES PATENT OFFICE.

RAYMOND N. EHRHART, OF PITTSBURGH, PENNSYLVANIA, ASSIGNOR, BY MESNE ASSIGNMENTS, TO THE COLONIAL TRUST COMPANY, TRUSTEE, OF PITTSBURGH, PENNSYLVANIA, A CORPORATION OF PENNSYLVANIA.

JET-CONDENSER.

1,009,657. Specification of Letters Patent. **Patented Nov. 21, 1911.**

Application filed December 10, 1908. Serial No. 466,875.

To all whom it may concern:

Be it known that I, RAYMOND N. EHRHART, a citizen of the United States, and a resident of Pittsburgh, in the county of Allegheny and State of Pennsylvania, have made a new and useful Invention in Jet-Condensers, of which the following is a specification.

This invention relates to condensers of the jet type and an object has been to produce an organized condensing apparatus employing nothing but rotary pumps, and in which the elevation of the discharge from the air-ejecting pump is independent from the elevation of the base of the condenser.

A further object is the production in an organized jet condenser apparatus in which the water and air may be handled by devices driven by a common turbine or other prime mover operating at a relatively high speed.

These and other objects, which will readily appear to one skilled in the art, I attain by means of the apparatus described in the specification and illustrated in the accompanying drawings, throughout which like parts are designated by like numerals.

In the drawings, Figure 1 is a view in elevation, a portion of the same being in section, illustrating this invention; Fig. 2 is a view in elevation of the apparatus embodying this invention; Fig. 3 is a somewhat diagrammatic view of the apparatus showing the outlet for the air pump at a considerable elevation above the base of the condenser; Fig. 4 is a longitudinal section of the air and water pumps; Fig. 5 is a sectional view of the ejector employed with this apparatus; and, Figs. 6 and 7 are detail views of a modified form of a portion of the ejector apparatus illustrated in Fig. 5.

The condenser proper, which may be of any desired form, as illustrated in the drawings consists of a base portion 8 which forms a collecting chamber for the condensed steam and the condensing water and which is provided with an outlet passage 9 for conducting the water to the inlet 10 of a centrifugal pump 11.

For the purpose of manufacture the section resting on and supported by section 8 is formed of two castings 12 and 13. The upper portion 14 of the condenser proper is provided with a steam inlet 15, which connects with the exhaust steam line 16. This portion is covered by a plate 17 and interiorly carries an annularly arranged series of spray nozzles 18. These spray nozzles are provided with water through passage 19 and pipe 20, which connects with a suitable source of condensing water supply. Pipe 20 is preferably provided with a valve 21, by means of which the condensing apparatus may be cut off from the source of water supply when desired. The spray nozzles 18 are formed and arranged to deliver a shower of drops of condensing water into a combining tube 22 located therebeneath and formed partially in casting 13 and partially in casting 12. The contracted throat 23 of this combining tube terminates at a slight distance above the top casting 8 and preferably above the level of the water within the condenser. A by-pass 24, provided with a valve 25 connects water pipe 20 with an overflow tank 26 formed in casting 12. Casting 13 is provided with an air outlet 27 located a considerable distance above the throat 23 of the combining tube. A pipe 28 leads the air to an ejector 29. The ejector may be of any well-known type, but preferably consists of a multiported nozzle 30 provided with ejecting water through the throat 31 by means of a pipe 32 connected to the outlet 33 of a centrifugal pump 34 mounted on the same shaft as pump 11. The air which passes to the ejector through the pipe 28 enters the ports of nozzle 30 and is ejected through the diffuser 33^a by the water which passes through the nozzle.

In Figs. 1 and 2, the outlet to the diffuser 33^a is shown on a level with the base of the condenser while in Fig. 3 the outlet is shown at a considerable elevation above the base of the condenser. Either position may be employed and, in fact, the position of the diffuser does not depend upon the position of the base of the condenser.

The runners 35 and 36 of the centrifugal pumps 11 and 34 are mounted on a common shaft 37. The castings of the two pumps are bolted together and the shaft may be driven by any suitable prime mover, but preferably by a relatively high speed turbine.

Since the ejector 30 is supplied with water at constant pressure, the velocity of the water therein is approximately constant, so that it will entrain a constant volume of air, since at any cross-section of the ejector

we have a fixed space taken up by the water, thereby leaving a fixed space to be taken up by the entrained air and, hence, with any condition of air density, any cross-section of the ejector has a given area taken up by air and water, moving at approximately the velocity produced by the existing water pressure. Therefore, the ejector has the characteristic of always entraining a constant volume of air no matter from what vacuum it is exhausting the air; that is, if it is drawing air from 28-inch vacuum, it will handle the same volume of air as when drawing from a 26-inch vacuum; a greater weight of air, however, is handled when drawing from a 26-inch vacuum. The power absorbed by the centrifugal pump furnishing the water is approximately the same no matter what the vacuum.

In order to increase the capacity of the condensing apparatus, a steam jet 38 discharging into a diffuser 39, which communicates with the inlet 40 to the multiported nozzle 30, is employed. In case the condensing apparatus is of large capacity, a number of these steam jets, arranged preferably in annular series as illustrated in Figs. 6 and 7, may be employed. The device consists either of a single jet or a series of jets, which may be supplied either with live or exhaust steam from any suitable source through pipe 41, and is arranged to compress the air upon which it acts, say, from 28-inch vacuum to 26-inch vacuum, thereby increasing the capacity of the ejector 29. In order to preliminarily start ejector 29, a steam ejector, as illustrated at 42, Fig. 5, is employed which may be supplied with steam from any suitable source through pipe 43. This pipe will be provided with a valve which, after the device is in operation, may be closed.

In operation, the inlet 15 of the condensing apparatus will be connected to the line to be exhausted and the exhaust steam passing down through the combining tube 22 intimately mingles with the shower of water drops discharged by nozzles 18. The steam is thus condensed within the combining tube and flows into the receiving chamber within the casting 8. The air which comes over with the steam and with the water passes up through the sheets of water overflowing from the tank 26 and out of the condenser through pipe 28. Any steam which passes throat 23 of the combining tube is prevented from passing out with the air by means of these falling sheets of water from the tank 26.

The inlet 44 to the centrifugal pump which furnishes water to the ejector 29 will connect with the cold well or any other suitable source of relatively cold water supply and, of course, if desired, the ejector 29 may discharge the water passing through it back to the cold well or other source of supply.

In accordance with the provisions of the patent statutes, I have described the principle of operation of my invention, together with the apparatus which I now consider to represent the best embodiment thereof, but I desire to have it understood that the apparatus shown is only illustrative and that the invention can be carried out by other means.

What I claim is:

1. In a condensing apparatus, a water jet device, a centrifugal pump adapted to supply said device with an approximately constant volume of water, means connecting said device with the source of air to be removed, and a steam jet device adapted to raise the pressure of the air from said source prior to its entrance to said water jet device.

2. In a condensing apparatus, a condensing chamber, a water jet device, a centrifugal pump adapted to supply said device with water, an air conduit connecting said chamber with said device, and a steam jet device adapted to raise the pressure of the air from said conduit prior to its entrance to said water jet device.

3. In a condensing apparatus, a water jet device, a centrifugal pump adapted to supply said device with water, conduit means connecting said device with the source of air to be removed, and a steam jet device adapted to raise the pressure of the air from said source prior to its entrance to said water jet device.

In testimony whereof, I have hereunto subscribed my name this 9th day of December, 1908.

RAYMOND N. EHRHART.

Witnesses:
CHARLES W. MCGHEE,
GEO. C. WALKER.