W. B. POTTER.

JET CONDENSER.

APPLICATION FILED JUNE 19, 1907.

912,167.

Patented Feb. 9, 1909.

2 SHEETS—SHEET 1.

Fig. 1.

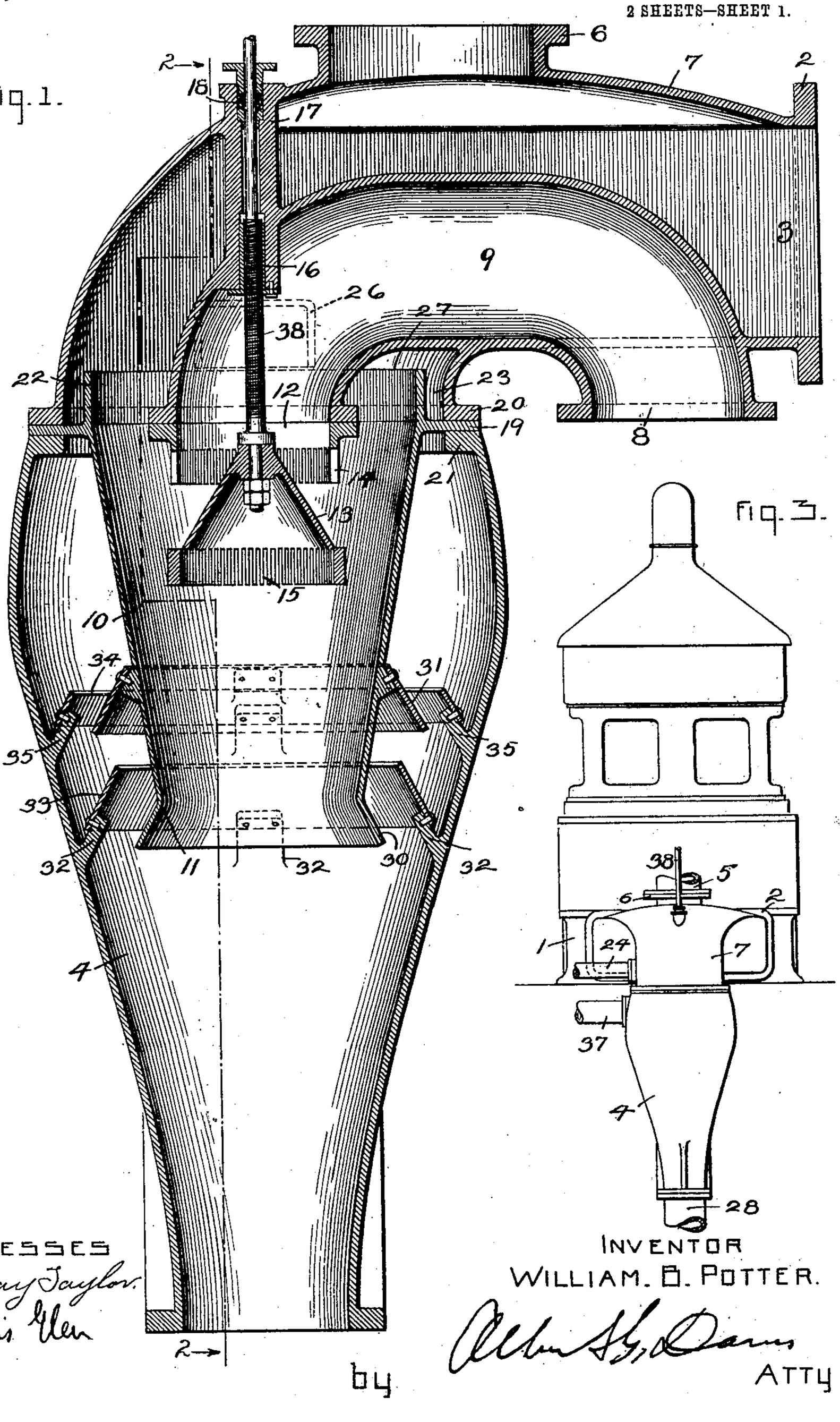

Fig. 3.

WITNESSES

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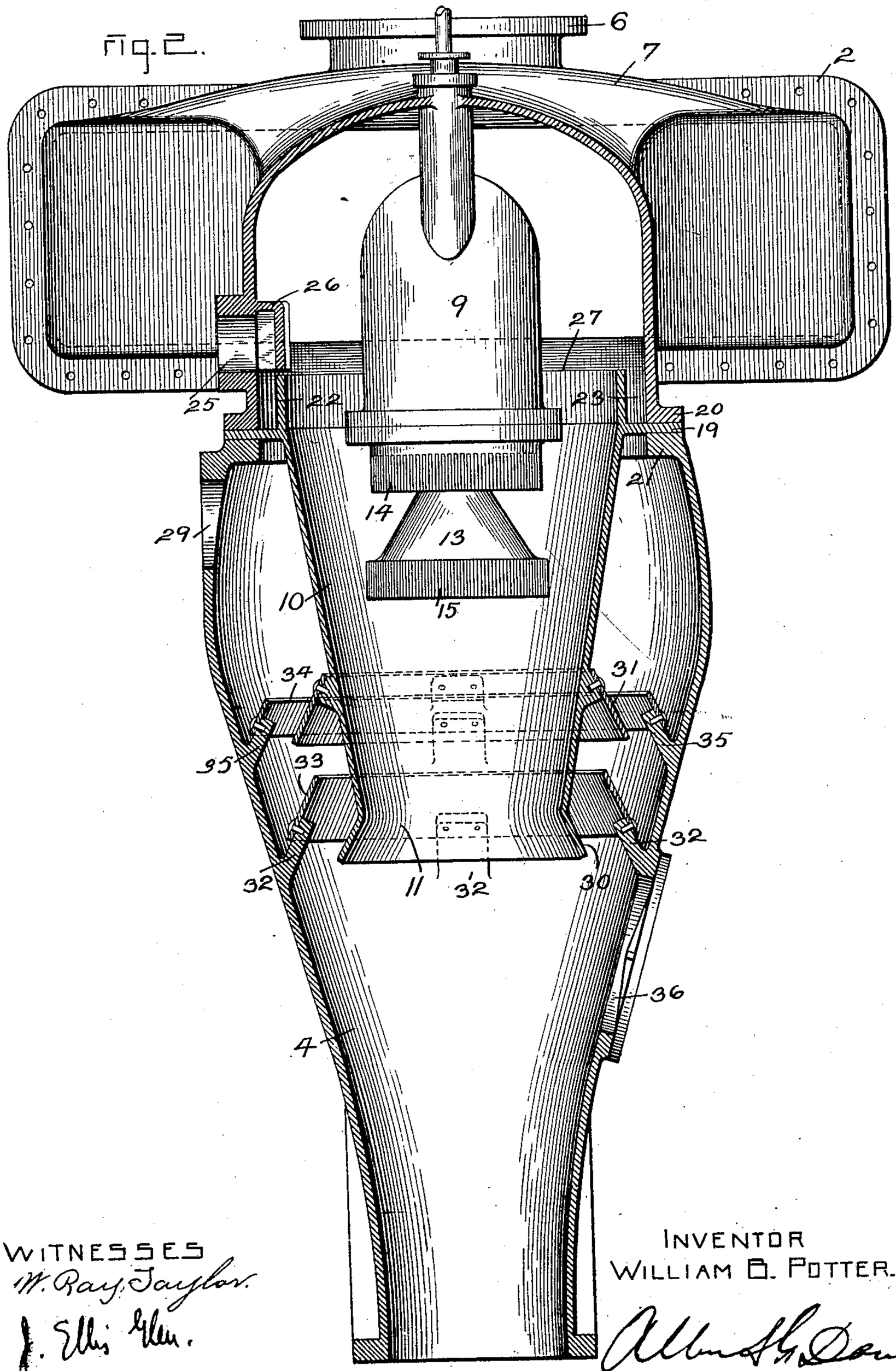
2 SHEETS—SHEET 2.

Fig. 2.



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UNITED STATES PATENT OFFICE.

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JET-CONDENSER.

No. 912,167. Specification of Letters Patent. Patented Feb. 9, 1909.

Application filed June 19, 1907. Serial No. 379,705.

To all whom it may concern:

Be it known that I, WILLIAM B. POTTER, a citizen of the United States, residing at Schenectady, county of Schenectady, State of New York, have invented certain new and useful Improvements in Jet-Condensers, of which the following is a specification.

My invention relates to apparatus for condensing steam and other vapors and has special reference to that type of apparatus known as jet condensers.

The object of the invention is the provision of an improved condenser of this type which produces a high degree of vacuum and possesses other advantages all as set forth in the following description and claims.

In the accompanying drawings illustrating one of the embodiments of my invention, Figure 1 is a vertical section of the condenser; Fig. 2 is a section on the line 2—2 of Fig. 1; and Fig. 3 shows a condenser as installed with a steam turbine.

The condenser is illustrated as employed with a turbine of the well known Curtis type, but obviously it may be used with other types of turbines or with various forms of steam engines. The condenser, Fig. 3, is attached to the base 1 of the turbine by a flange 2 of any suitable shape. Exhaust steam from the turbine bucket wheels passes from the base through the opening 3 of the flange 2 and the exhaust conduit 7 into the condensing chamber 4 under normal conditions but a free exhaust pipe 5 is provided to convey the exhaust steam to the atmosphere when the operation of the condenser is interrupted at any time. The pipe 5 is controlled by any well known type of relief valve which opens automatically when the condenser ceases operation or its vacuum is seriously impaired. The flanged opening 6 to which the free exhaust pipe is joined is shown as formed on the exhaust conduit 7 constituting a part of the condenser structure but as is well known it can be located on other parts of the system when necessary or desirable.

Injection water from any suitable source or intake enters the opening 8, Fig. 1, of the pipe or conduit 9 which passes into and through the interior of the conduit 7. Both conduits discharge into a cone 10 suspended within the condensing chamber 4 and having a throat 11 at its lower end. The flow of water from the delivery opening 12 of the conduit 9 is regulated by an adjustable spraying-cone 13. The opening 12 and the spraying-cone are preferably provided with series of peripheral teeth or projections, 14 and 15 respectively, for breaking up or dividing the column of injection water to expose the largest possible surface to the steam to be condensed. The spraying-cone is secured to the end of a spindle 38 having a threaded portion engaging a nut 16 mounted in the sleeve 17 forming a part of the same casting as the conduits 7 and 9. Leakage along the spindle is prevented by a suitable stuffing box 18. The operating gear for the spindle is located to suit the conditions existing at the place of installation. By turning the spindle in its nut the cone can be raised or lowered. The upward adjustment can bring the teeth 15 into engagement with the spaces between the teeth 14 to make the effective opening of very small size or to close it completely when desirable.

The inlet cone 10 is provided with an annular flange 19 at its upper end which is secured between the flanges 20 and 21 on the conduit 7 and the chamber 4 respectively. Above the flange 19 the cone merges into a cylindrical ring or projection 22 which forms an annular chamber or reservoir 23 between it and the walls of the conduit 7. A pipe 24, Fig. 3, delivers water from the injection water supply to the opening 25 in the wall of the elbow at the end of the conduit 7. A hood 26, Fig. 2, directs the water from the opening 25 downward into the reservoir 23 from which it overflows in an annular sheet over the edge 27 and along the inner surface of the cone 10. The discharge from the condenser is carried off by the tail-pipe 28 which may be a barometric tail-pipe or stand-pipe through which the discharge flows by gravity against atmospheric pressure and passes from the apparatus, or a pump may be employed to remove the discharge if the conditions of installation make it preferable.

An opening 29, Fig. 2, is provided at the upper end of the chamber 4. This opening may be connected by a pipe 37 with an air pump of the usual construction for such service which removes any entrained air which would tend to interfere with the operation of the condenser. My improved con-

denser, however, will operate very satisfactorily without the aid of an air pump, if desired. Baffling devices located adjacent the throat of the cone 10 prevent the passage of particles of water with the air drawn upward by the action of the pump. The lower end of the cone 10 is provided with an outwardly flaring flange or edge 30. Mounted on the outside of the cone is a flange 31 substantially parallel to the flange 30 and some distance above it. Projecting from lugs 32 on the inner walls of the chamber 4 into the space between the flanges 30 and 31 is a similarly inclined flange or baffling plate 33. A baffle plate 34 is mounted on the lugs 35 above the plate 31. These baffling plates compel the current of air to follow a tortuous course and the inertia of the heavier particles of liquid causes them to strike the plates and flow downward through the chamber into the tail-pipe 28.

As ordinarily constructed, a jet condenser is provided with a spraying nozzle located near the upper part of the cone and the exhaust steam from the engine or turbine is condensed by the spray from this nozzle only, in its passage downward through the cone. Where high vacuum is to be secured, it is customary to further provide the jet condenser with an air pump, but to the extent that the air is entrained and carried into the discharge pipe by the condensing water, the duty of the air pump is reduced, and if all the air could be entrained, no air pump would be required. In my improved condenser, in addition to the spraying-cone or nozzle, an annular chamber or reservoir is provided around the top of the cone which is supplied with water preferably from a bypass out of the intake pipe. The reservoir is supplied with sufficient water to maintain a flow from the top of the cone and thus line the interior of the cone throughout its length with a sheet of water. This arrangement provides a mass of water in the upper part of the condenser tending to keep it cool and by lining the inside of the cone with water an earlier contact and a better mingling of the steam and water are insured as the steam passes downward into the cone. It also provides for a better entrainment of the air as the water falling down the sides of the cone is contracted at its discharge into a stream of water of tubular form which tends to retain the air and carry it downward into the discharge or tail-pipe. The condensing performance of these improved condensers in service has been very satisfactory. There is a considerable gain in vacuum by admitting the water at the top of the cone as described and the condenser may be operated without an air pump, depending wholly upon the efficient entrainment of the air by the water column within the condenser.

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 as new and desire to secure by Letters Patent of the United States, is,—

1. In a condenser, the combination of means for forming a hollow stream of water within the condenser, devices for discharging exhaust steam and condensing water into the open upper end of the stream, and a conduit receiving the resultant discharge from the condenser.

2. In a condenser, the combination of means for forming a hollow converging stream of water within the condenser, devices for discharging exhaust steam and condensing water into the interior of the converging stream, and a conduit receiving the resultant discharge from the condenser.

3. In a condenser, the combination of means for forming a hollow conical stream of water which decreases in diameter in the direction of its flow, a condensing water conduit discharging into the water cone, an exhaust conduit also discharging into the water cone, and a tail-pipe receiving the resultant discharge from the condenser.

4. In a condenser, the combination of a cone, means delivering water to the inlet end of the cone to line its interior with a sheet of flowing water, a conduit discharging a stream of exhaust steam into the upper end of the conical sheet, a conduit discharging water into the stream of exhaust steam, and a tail-pipe receiving the discharge from the condenser.

5. In a condenser, the combination of a chamber, a cone in the upper portion of the chamber, the inlet to the chamber being through the interior of the cone, a reservoir surrounding the inlet end of the cone, means supplying water to the reservoir to overflow over the edge of the cone and line its interior throughout its length with a sheet of water, a conduit discharging exhaust steam to the interior of the conical sheet of water, a spraying device discharging water into the exhaust steam as it passes through the cone, and a conduit receiving the discharge from the condenser.

6. A condenser comprising a chamber, an inlet cone mounted in the upper portion of the chamber, the upper end of the cone merging into a cylindrical ring which forms between it and the walls of the condenser a reservoir which discharges over its edge into the cone, a water conduit which directs its supply into the reservoir, a spraying device located in the upper part of the inlet cone, a conduit delivering water to the spraying de-

vice, a conduit discharging exhaust steam into the cone, and a tail-pipe receiving the discharge from the lower end of the chamber.

7. In a condenser, the combination of a chamber, a cone mounted in the upper portion of the chamber which forms a converging inlet to the interior thereof and is provided with a cylindrical projection or ring on its inlet end, a spraying device centrally located in the upper portion of the cone, a conduit delivering water to the spraying device, an exhaust conduit having a circular nozzle connected to the upper end of the chamber to deliver steam to the cone, the ring extending into the nozzle and forming between it and the walls of the nozzle a reservoir, a conduit delivering water to the reservoir, the overflow from the reservoir passing over the edge of the ring and downward over the inner surface of the cone, and a tail-pipe receiving the resultant discharge from the apparatus.

8. In a condenser, the combination of a chamber provided with a flange at its upper end, an exhaust conduit leading to the chamber and having a flanged elbow at its delivery end, an inlet cone having a flange adjacent its upper end which is secured between the flanges of the chamber and the elbow, a ring into which the upper end of the cone merges, said ring projecting into the elbow and forming an annular reservoir between it and the walls of the elbow that discharges a sheet of water over the top of the ring to flow downward along the inner surface of the cone, a spraying-cone centrally located in the upper portion of the inlet cone, means for regulating the delivery from the spraying-cone, a conduit which supplies water to the spraying-cone, and a tail-pipe receiving the discharge from the lower end of the chamber.

9. In a condenser, the combination of a chamber, a cone mounted on the upper end of the chamber which projects downward into it and forms the inlet thereto, a reservoir surrounding the inlet end of the cone and discharging a sheet of water over the inner surface of the cone, a conduit supplying water to the reservoir, a conduit discharging exhaust steam into the cone, a spraying nozzle located in the upper portion of the cone, means for supplying the nozzle with water, a conduit for removing air from the upper portion of the chamber, a baffling device located in the space between the lower portion of the cone and the adjacent walls of the chamber to prevent the passage of liquid particles to the air conduit, and a pipe for receiving the discharge from the lower end of the chamber.

In witness whereof, I have hereunto set my hand this 17th day of June, 1907.

WILLIAM B. POTTER.

Witnesses:

HELEN ORFORD,

MARGARET E. WOOLLEY.