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D. W. R. MORGAN

JET CONDENSER

Filed Dec. 3, 1920

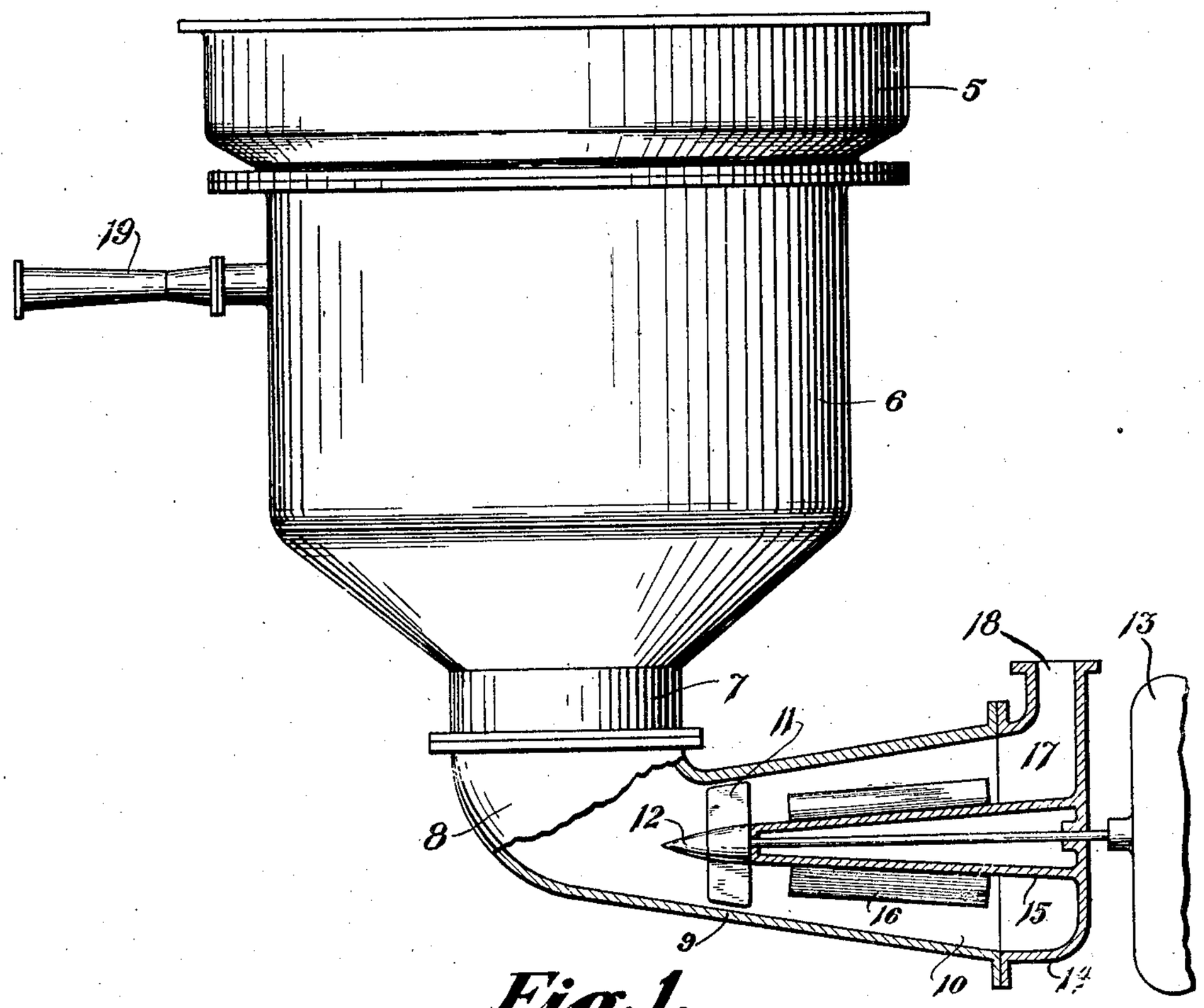

Fig. 1.

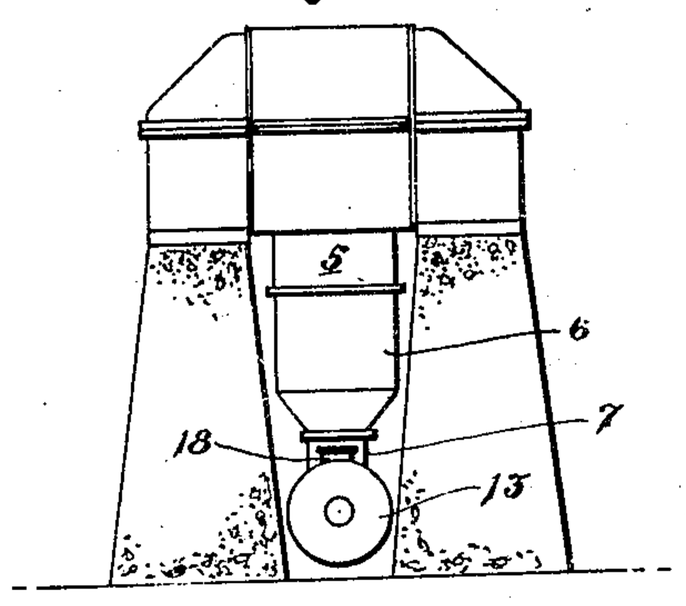

Fig. 2.

David W.R. Morgan
INVENTOR

BY

ATTORNEY

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UNITED STATES PATENT OFFICE.

DAVID W. R. MORGAN, OF SWARTHMORE, PENNSYLVANIA, ASSIGNOR TO WESTINGHOUSE ELECTRIC AND MANUFACTURING COMPANY, A CORPORATION OF PENNSYLVANIA.

JET CONDENSER.

Application filed December 3, 1920. Serial No. 428,061.

To all whom it may concern:

Be it known that I, DAVID W. R. MORGAN, a citizen of the United States, and a resident of Swarthmore, in the county of Delaware and State of Pennsylvania, have invented a new and useful Improvement in Jet Condensers, of which the following is a specification.

My invention relates to jet condensers and more specifically to condensate removing means therefor, and has for its object to provide apparatus of the character designated which shall be simple and effective in operation, which shall be readily removable for inspection and repair, and which shall be adapted for installation in relatively confined spaces.

In the accompanying drawing, Fig. 1 is a side view partially in section and partially in elevation of a jet condenser in accordance with my invention, and Fig. 2 is a view showing my condenser as applied to a turbine.

In jet condensers, as customarily built, a centrifugal pump is provided for the removal of the condensate, the rotor of this pump revolving in a vertical plane. With condensers of larger and larger capacities, it is necessary that the diameter of this rotor member be increased, leading to undue height for the entire condenser equipment because of the degree of submergence required for the pump rotor.

In a co-pending application of H. F. Schmidt and myself, Serial No. 428,062, filed December 3, 1920 and assigned to the Westinghouse Electric & Manufacturing Company, we disclose the application of a propeller pump to a jet condenser for the removal of condensate therefrom, the propeller of this pump rotating in a horizontal plane at the discharge throat of the mixing chamber. With this apparatus, extremely good results may be secured where the installation space is low but relatively wide.

I find, however, that in many cases the turbine foundations are designed, as shown in Fig. 2, that is to say, the turbine foundation flares toward its foot, providing a tunnel or tunnels underneath the turbine having relatively little head room, and also having relatively little width at the bottom thereof.

Under these conditions, I find that an elbow may be obviously placed below the discharge throat of the mixing chamber and a propeller pump mounted to rotate in a vertical plane beyond this throat for the removal of condensate and for relatively large amounts of air. For a more detailed understanding of my invention, reference need now be had to Fig. 1 wherein a jet condenser is shown embodying a water box 5 and a mixing chamber 6, terminating at its bottom in a discharge throat 7. An elbow member 8 is attached below the throat 7 and provides a throat 9, thereafter flaring, as shown at 10, a propeller member 11 is mounted to rotate in the throat 9 in a vertical plane and may be provided with a flow line hub 12 and may further be provided with a prime mover 13, such, for example, as an impulse turbine. The propeller member 11 and prime mover 13 are preferably mounted on a casting 14 having an inwardly extending conical boss 15 for carrying the propeller 11. By removal of the casting 14, the entire rotating system may be inspected and repaired.

The conical boss 15 may, if desired, be provided with radial vanes 16 to prevent eddying and swirling of the water discharged from the propeller 11, and these vanes in turn discharge the condensate to a collecting space 17 whence it may flow through any suitable discharge pipe 18.

Air cooling and removing means 19 of any desired form may be used to supplement the action of the water removal means and to maintain a high degree of vacuum.

Having thus described the arrangement of a jet condenser embodying my invention, the operation thereof is as follows: The condenser being in intimate connection with a prime mover, such, for example, as a steam turbine, steam flows in the upper end thereof and encounters water sprays within and below the water box 5, the condensate forming within the mixing chamber 6 and accumulated at and below the throat 7. The propeller pump 11 is driven at relatively high speed by the prime mover 13 and forces the condensate through the throat 9, a rapid and efficient flow being set up by joint action of the propeller 11 and the guide vanes 16, the condensate escaping through the collecting space 17 and the conduit 18. The propeller 11 is more effective

in removing air than is the runner of a centrifugal pump, for the reason that no centrifugal action is present, as in a cream separator, but the mixture of air and the water is seized and forced out without affording an opportunity of separation, as takes place in a centrifugal pump. Thus a relatively small amount of air and other non-condensible gases is left for removal by a means 19.

A noteworthy feature of the employment of a propeller pump, as distinguished from a centrifugal pump, is that it may be directly connected to a prime mover for relative high speed, such, for example, as an impulse turbine, high speeds being permissible with a propeller of proper design. In this way simplicity, efficiency and compactness are secured.

Turning to Fig. 2, it will be seen how a condenser arranged in accordance with my invention may be readily applied to a turbine installation wherein the foundation piers are relatively low and have relatively great flares. Substantially, my apparatus is placed beneath the mixing chamber so that head room is sufficient and the relatively small high speed rotating member may be the pump propeller and the direct connected impulse turbine may be readily mounted in a space between the pier footings. Not only this, but a high degree of accessibility is provided in that the propeller driving means and the propeller together with all the bearings may be removed as a unit for inspection, repair, or replacement.

While I have shown my invention in but one form, it will be obvious to those skilled in the art that it is not so limited but is susceptible of various other changes and modifications, without departing from the spirit thereof and I desire, therefore, that only such limitations shall be placed thereupon as are imposed by the prior art or as are specifically set forth in the appended claims.

1. The combination with a jet condenser embodying a mixing chamber, of an elbow member disposed at the lower end of said mixing chamber for the discharge of condensate therefrom, an outwardly flaring member carried by said elbow member, a conical boss projecting into said flaring member to the head thereof, a propeller carried by said boss at the head of said flaring member, and a driving means for said propeller.

2. The combination with a jet condenser embodying a mixing chamber, of an elbow member disposed at the lower end of said mixing chamber for the discharge of condensate therefrom, an outwardly flaring member carried by said elbow member, a conical boss projecting into said flaring member to the head thereof, a propeller carried by said boss at the head of said flaring member, a driving means for said propeller, and radial diffusion blades carried by said conical boss.

3. The combination with a jet condenser embodying a mixing chamber, of an elbow mounted at the bottom of said mixing chamber for the discharge of condensate therefrom in a horizontal direction, a flaring member carried by said elbow and provided at its outer end with a removable cap and collector member, and inwardly extending conical boss carried by said collector member and centrally disposed within said flaring member, a propeller mounted on said boss at the head of said flaring member, and driving means for said propeller, said driving means also being carried by said collector member, whereby by the removal of said collector member said propeller member and driving means therefor may be removed for inspection and repairs.

4. In a jet condenser, the combination with a mixing chamber, of a discharge member having an elbow portion communicating with the bottom of the mixing chamber and a portion extending horizontally from the elbow portion, and a propeller disposed in said horizontal portion adjacent to said elbow portion.

5. In a jet condenser, the combination with a mixing chamber, of a discharge member having an elbow portion communicating with the bottom of the mixing chamber and a divergent portion extending horizontally from the elbow portion, and a propeller disposed in said divergent portion adjacent the region of minimum flow area thereof.

6. In a jet condenser, the combination with a mixing chamber, of a convergent-divergent discharge member in the form of an elbow leading from the bottom of the mixing chamber, and a propeller disposed in said convergent-divergent discharge member adjacent the throat thereof.

In testimony whereof, I have hereunto subscribed my name this 30th day of November, 1920.

D. W. R. MORGAN.