No. 858,265. PATENTED JUNE 25, 1907.

I. S. DAVIS.

CONDENSER APPARATUS.

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Fig. 1.

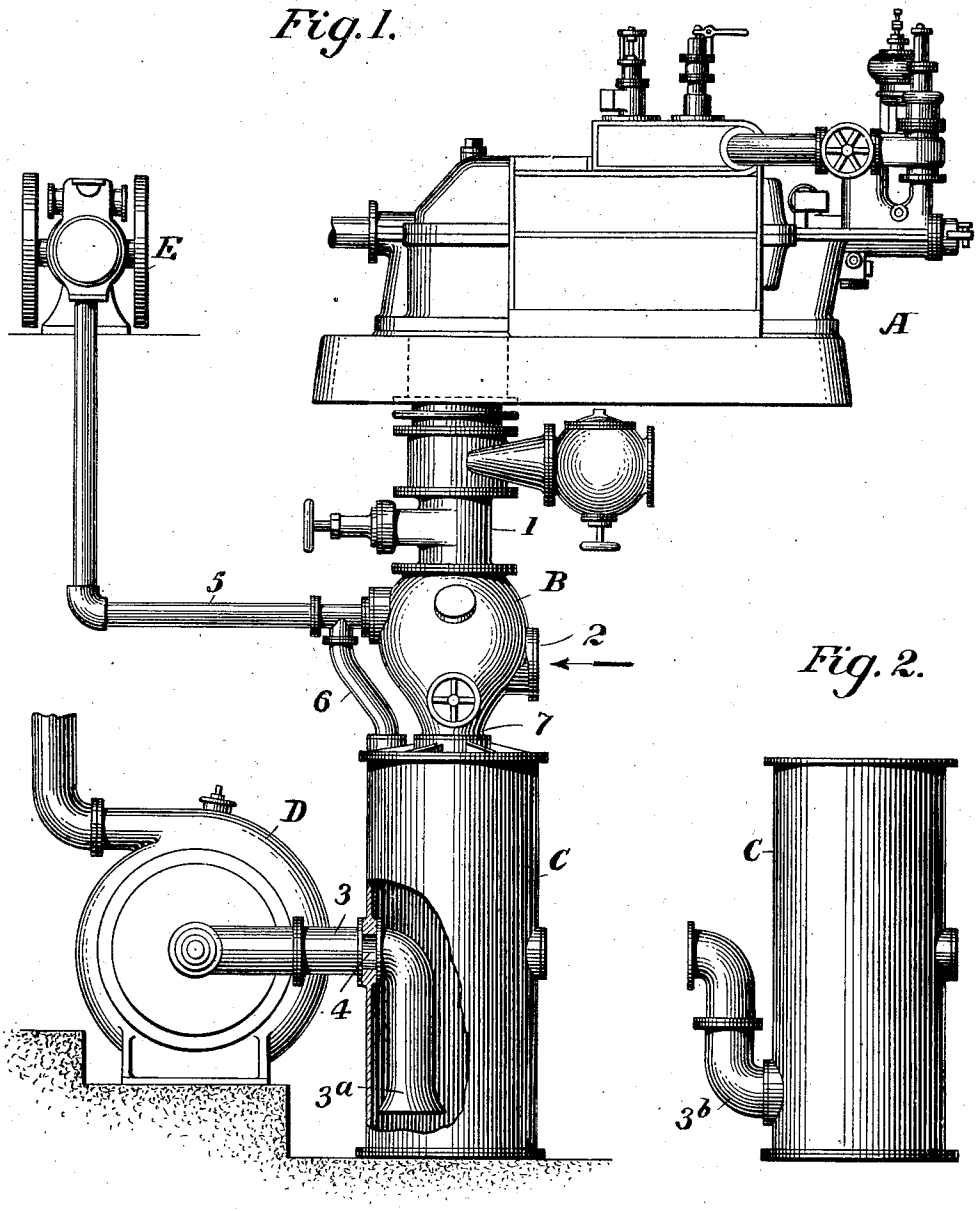


Fig. 2.

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IRVING S. DAVIS, OF BAYONNE, NEW JERSEY.

CONDENSER APPARATUS.

No. 858,265. Specification of Letters Patent. Patented June 25, 1907.

Application filed November 23, 1906. Serial No. 344,730.

To all whom it may concern:

Be it known that I, IRVING S. DAVIS, a citizen of the United States, residing at Bayonne, in the county of Hudson and State of New Jersey, have invented certain new and useful Improvements in Condenser Apparatus, of which the following is a specification.

The object of this invention is to overcome difficulties which arise in the use of centrifugal pumps for removing the water from jet condensers connected to steam turbines.

When a centrifugal pump is used to pump the water from a condenser the outflow of the water from the condenser sometimes exceeds the inflow to such an extent that the water level falls below the mouth of the suction pipe of the pump, and the air is thus permitted to enter the pump and the latter ceases to act. The air remains in the center of the pump, while the buckets of the pump simply churn the water which is thrown toward the periphery of the pump but cannot pass out owing to the back pressure in the delivery pipe. Even though the water in the condenser never sinks below the mouth of the suction pipe of the pump, it is found that rapid fluctuations in the water level will cause air to be entrained in the water and carried down to the mouth of the suction pipe. Thus, in a condenser of small capacity, as compared with the quantity of water normally flowing through it, if the outflow for a few moments is much in excess of the inflow, the entire body of water will flow downward suddenly and this, I have found, causes air to be entrained and carried by the vortex in to the centrifugal pump. In the course of time sufficient air is thus carried into the pump to cause its stoppage. I over come these difficulties by providing a closed hotwell having a sufficient storage capacity so that the fluctuations in the water level will be gradual, thus preventing air from being entrained and carried downward to the suction pipe; by extending the latter downward to a considerable distance below the average water level and connecting a vacuum pump to the upper part of the hot-well, so as to remove any air accumulating therein.

In the accompanying drawing, Figure 1 is a side elevation of a steam turbine having connected thereto a condenser system, comprising a condenser, a closed hot-well, a centrifugal pump and a vacuum pump, and the pipe connections for illustrating my invention, and Fig. 2 is a side elevation of the hotwell, showing the pipe connection for the centrifugal pump arranged upon the outer side of the well.

Referring to the drawing A indicates a steam turbine having an exhaust pipe 1 leading to a jet condenser B, and C indicates a closed hot-well connected to the discharge end 7 of the condenser. The cold water for condensing the steam enters at the inlet 2, as indicated by the arrow, and the water from the condenser is continuously removed from the hot-well by a centrifugal pump D having its suction-pipe 3, 3^a, connected to the condenser through an opening 4. From the opening 4 the section 3^a of the suction pipe extends downward to a point near the bottom of the hot-well, as shown in Fig. 1. Instead of arranging the section 3^a of the suction pipe within the hot-well, as shown in Fig. 1, a section 3^b, Fig. 2, may be arranged outside of the hot-well and connected at its upper end to the section 3 and at its lower end to the interior of the hot-well near the bottom of the latter. An air pump E is connected by the pipe 5 to the condenser as shown, in order to remove air from the condenser, and a branch pipe 6 extends from the pipe 5 to the upper part of the hot well in order to remove air from the latter.

When a considerable quantity of air accumulates in the center of a centrifugal pump, the latter ceases to act. By connecting the suction pipe of the pump to a point near the bottom of the hot-well, considerably below the average water level, and continually exhausting the air from the top of the well, the air is removed and the high vacuum maintained over the water in the well prevents the water level from sinking below the lower end of the suction pipe of the pump. If the hotwell were of small diameter, or sectional area, the fluctuations in the water level would be sudden, and the rapid lowering of the water in the hot-well occurring in the normal operation of the apparatus, would cause air to be entrained in the water and carried downward in the well to the suction pipe. In order to over come this difficulty I make the sectional area of the hot-well much greater than the sectional area of the discharge end of the condenser as shown in the drawing so that the hotwell will have considerable storage capacity. By properly proportioning the size of the well, with respect of the quantity of water flowing through

it, the fluctuations in the water level may be made so gradual that the air will not be entrained and carried down through the water, and the air will be given an opportunity to separate from the water at the top of the well and escape through the pipes 5 and 6. The pipe 5 leads into the condenser so as to remove air from the condenser.

What I claim is

1. The combination with a steam turbine and a jet condenser connected thereto, of a closed hot well connected to the discharge end of the condenser, a centrifugal pump connected to the hot well below the mean water level and means for exhausting air from the upper part of the hot well.

2. The combination with a steam turbine and a jet condenser connected thereto, of a closed hot well connected to the discharge end of the condenser, said well having a larger sectional area than the sectional area of the discharge end of the condenser, means for exhausting air from the upper part of the hot well, and a centrifugal pump connected to the hot well below the mean water level.

3. The combination with a jet condenser, of a closed hot well connected to the discharge end of the condenser, a centrifugal pump connected to the hot well below the mean water level and means for exhausting air from the upper part of the hot well.

In testimony whereof I affix my signature, in presence of two witnesses.

IRVING S. DAVIS.

Witnesses:
HORACE ROBERSON,
GEORGE E. GRISWOLD.