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O. H. DORER

WATERWORKS AUXILIARY PUMP

Filed Nov. 23, 1926

3 Sheets-Sheet 1

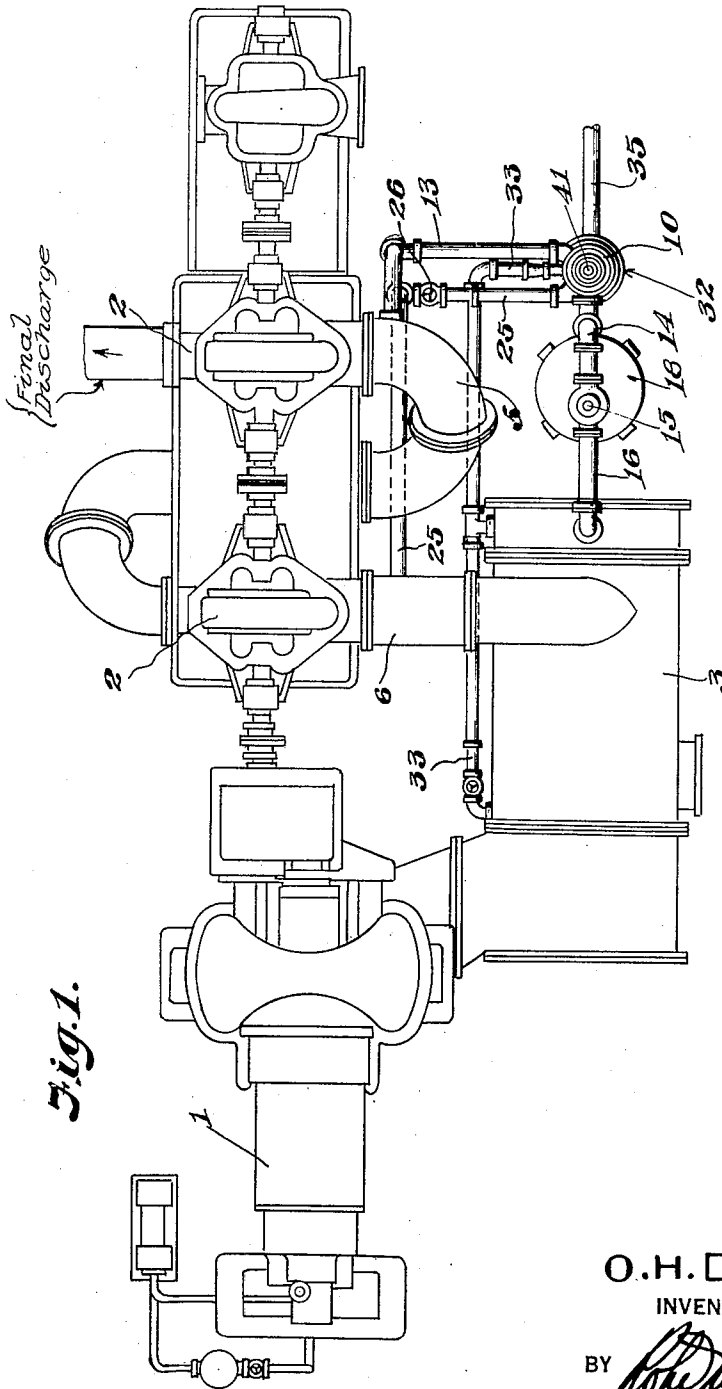


Fig. 1.

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Fig. 2.

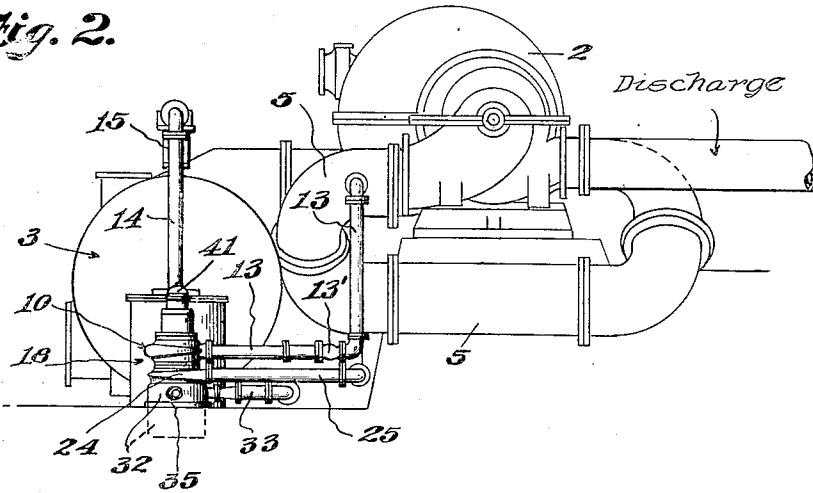
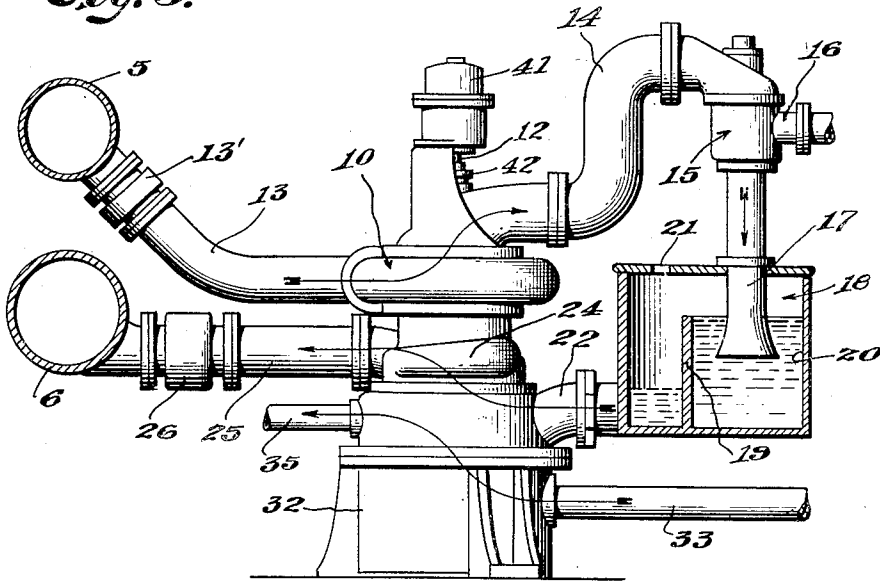


Fig. 3.



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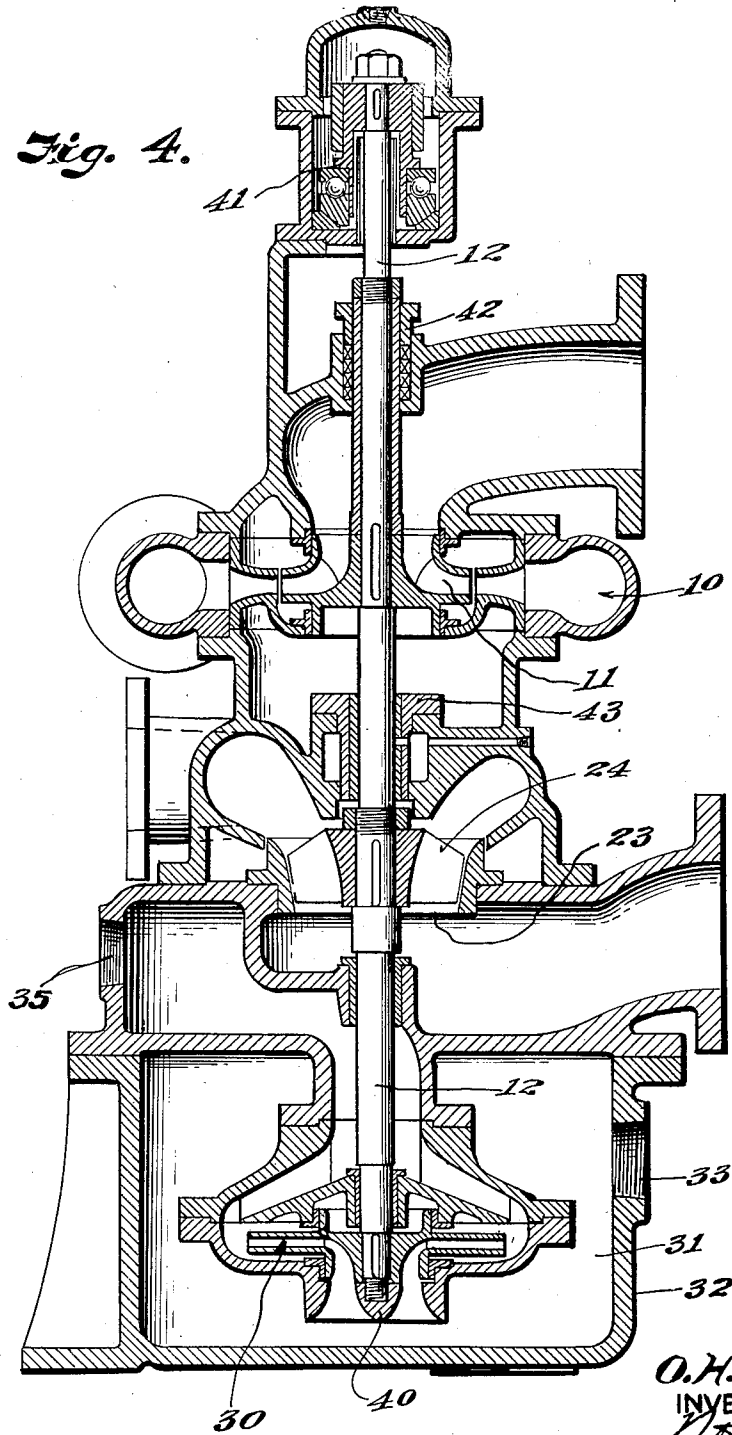
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Fig. 4.



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# UNITED STATES PATENT OFFICE.

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## WATERWORKS AUXILIARY PUMP.

Application filed November 23, 1926. Serial No. 150,220.

This invention relates to pumping plants embodying steam driven pumps, a condenser, and condenser auxiliaries.

An object of the invention is to provide in a waterworks pumping plant a system of condenser auxiliaries designed to provide relatively great economy to the plant with a maximum of simplicity and operating reliability.

In the past, in waterworks plants, a water turbine has in some cases been used to drive one of the auxiliaries of the condenser and the water for driving the hydraulic turbine has been taken from the mains. The operation of such units has been reliable and economical but with the waste water spilled into a suction well, the pressure from the water mains is often so high it has been found impractical to design a turbine for the small power at the high head at proper speeds. To overcome such difficulties and provide a practical solution thereto, the present invention has been devised in which the hydraulic head of the mains is divided between the hydraulic turbine, driving two or more of the auxiliaries and the hydraulic vacuum pump so that these driving members are in series so far as the supply of driving water is concerned, but otherwise independent. In one special application the same water performs two operations; that is, drives the hydraulic vacuum pump and removes the air from the condenser as well as driving the hydraulic turbine. The driving of the turbine reduces the head sufficiently to provide efficient operation of the hydraulic vacuum pump resulting in less power consumption in the main unit.

The present invention also comprehends the provision of the auxiliaries arranged and associated in such manner that the water used to operate the auxiliaries is employed at main unit economy which results in further economy of the station.

With these objects in view, the invention consists in various features of construction and combination of parts, which will be first described in connection with the accompanying drawings, showing a water works auxiliary pump of the preferred form embodying the invention, and the features forming

the invention will be specifically pointed out in the claims.

In the drawings—

Figure 1 is a top plan of a power plant showing the improved auxiliaries associated therewith.

Figure 2 is an end view of a power plant showing the improved auxiliary pump associated therewith.

Figure 3 is a side elevation of the improved auxiliary pumping unit illustrating the connections with the various pumps arranged slightly different from the arrangements shown in Figures 1 and 2 of the drawings, for the purpose of clearer illustration.

Figure 4 is a vertical section through the improved water works auxiliary pumping unit.

Referring more particularly to the drawings, the power plant shown in Figures 1 and 2 of the drawings comprises a steam turbine 1 of any approved construction which is used for driving the pumps 2 of the main pumping unit and with which a condenser 3 of approved construction is associated.

The auxiliary pumping unit illustrated in the drawings embodies a hydraulic turbine 10 the runner 11 of which is mounted upon the shaft 12 of the pumping unit. The inlet of the turbine 10 through the pipe 13, which is connected to the discharge pipe 5 of the main pumping unit 2 is clearly shown in Figures 1 and 2 of the drawings. In a plant of the type illustrated the pressure of the water in the discharge pipe 5 is sufficient to operate the turbine 10 and the various other auxiliaries associated therewith, which will be hereinafter more specifically described. The water turbine is designed to pass a quantity of water sufficient to operate the hydraulic vacuum pump 15, which may be of any conventional construction and which is utilized for pumping air from the condenser 3 through the pipe connection 16 with the condenser. The water which is delivered to the hydraulic vacuum pump 15 from the turbine 10 through the pipe 14 is passed with the air pumped from the condenser 3 through the delivery nozzle

17 into the tank or reservoir 18. The tank 18 is provided with a partition 19 providing the space 20 into which the nozzle 17 delivers and the water overflows from the space 20 into the tank 18 which tank is provided with an air vent 21 to permit air to escape which escape of air is facilitated by the spilling of the water over the partition 19. The hydraulic vacuum pump 15 discharges its combined mixture of water and air under atmospheric pressure so that the air can separate out. The water is drawn from the tank 18 through the pipe 22 into the suction 23 of a centrifugal or screw pump 24 which is mounted upon the shaft 12 and which discharges through the pipe 25 and check valve 26 into the suction pipe 6 of the main unit 2, thereby permitting the water to be used again as part of the supply water of the main unit. In many instances the main unit takes its supply water under pressure so that water from the tank 18 must of necessity be pumped to the suction against whatever pressure exists and the pump 24 is provided for this purpose. In installations where the main unit does not receive its supply under pressure or where the tank 18 may be positioned at such elevation that the gravity flow of the water therefrom will compensate for the pressure at which the main unit receives its supply water, the centrifugal pump 24, which is commercially known as the tail pump, may be eliminated and it is to be understood that the present invention comprehends the provision of an auxiliary pumping unit either with or without the tail pump 24. In some instances a screw pump, as illustrated in Figure 4 of the drawings is used to act as a tail pump because of the low pressure under which it operates, and the high speed which is required in order to generate the requisite pressure of the condensate pump 30, which is mounted upon the shaft 12 and is operated, like the pump 24, through the rotation of the shaft 12 by the operation of the turbine 10.

The condensate pump 30 which is of the centrifugal type is mounted in the chamber 31 formed by the shell 32 and it has communication with the condenser 3 through the pipe 33 for permitting the condensation to pass from the condenser 3 into the chamber 31 and therefrom, through the condensate pump 30, and under the pressure created by the pump 30 through the pipe 35 to a feed water heater boiler, or the like (not shown).

In the drawings, the turbine 10, tail pump 24 and condensate pump 30 are shown arranged vertically one above the other with the shaft 12 having its lower end terminating in the bearing 40 embodied in the construction of the condensate pump 30, while its upper end is mounted in a thrust bearing 41 of any approved construction. The ar-

angement of the various pumps and turbine as shown not only provides a relatively simple construction, which will require a small amount of space for installation but it provides a construction in which only one stuffing box, as shown at 42, is necessary and any leakage of water from the turbine 10 passes through the greased bearing 43 into the discharge of the tail pump 24.

The power developed and the characteristics of the two pumps balance, in the present construction, in such a way as to render the unit automatic and require no covering mechanism, while any unbalanced thrust is taken care of by the ball thrust bearing 41. A gate valve 13' is illustrated as mounted in the pipe 13.

It will be understood that the invention is not to be limited to the specific construction or arrangement of parts shown but that these may be modified widely within the invention defined by the claims.

What is claimed is:

1. The combination with a main pumping unit and a condenser, of a hydraulic vacuum pump for drawing air from the condenser and deriving its operating fluid from the discharge of said main pumping unit, a hydraulic turbine interposed in the connection between the hydraulic pump and main pumping unit and driven by the operating fluid, and a condensate pump for removing condensate from said condenser driven by said hydraulic turbine.

2. The combination with a main pumping unit and a condenser, of a hydraulic vacuum pump for drawing air from the condenser and deriving its operating fluid from the discharge of said main pumping unit, a hydraulic turbine interposed in the connection between the hydraulic pump and main pumping unit and driven by the operating fluid, a reservoir for receiving the operating fluid and air from said hydraulic vacuum pump, and a tail pump operated by said hydraulic turbine for returning the operating fluid from said reservoir to said main pumping unit.

3. The combination with a main pumping unit and a condenser, of a hydraulic vacuum pump for drawing air from the condenser and deriving its operating fluid from the discharge of said main pumping unit, a hydraulic turbine interposed in the connection between the hydraulic pump and main pumping unit and driven by the operating fluid, a reservoir for receiving the operating fluid and air from said hydraulic vacuum pump, and a tail pump operated by said hydraulic turbine for returning the operating fluid from said reservoir to said main pumping unit, and a condensate pump for removing condensate from said condenser driven by said hydraulic turbine.

4. The combination with a main pumping

unit and a condenser, of a hydraulic vacuum pump for drawing air from the condenser and deriving its operating fluid from the discharge of said main pumping unit, a hydraulic turbine interposed in the connection between the hydraulic vacuum pump and main pumping unit and driven by the operating fluid whereby the pressure of the operating fluid will be reduced and permit discharge of the operating fluid and air from said hydraulic vacuum pump at atmospheric pressure to permit escape of the air, and a pump operated by said turbine for pumping the operating fluid to a pre-determined point after its passage through the vacuum pump.

5. The combination with a main pumping unit and a condenser, of a hydraulic vacuum pump for drawing air from the condenser and deriving its operated fluid from the discharge of said main pumping unit, and a hydraulic turbine interposed in the connection between the vacuum pump and main pumping unit and driven by the operating fluid whereby the pressure of the operating fluid will be reduced and permit discharge of the operating fluid and air from said hydraulic vacuum pump at atmospheric pressure to permit escape of the air, a reservoir for receiving the operating fluid and air from said hydraulic vacuum pump, and a tail pump operated by said turbine, for returning the operating fluid to said main pumping unit.

6. The combination with a main pumping unit and a condenser, of a hydraulic vacuum pump for drawing air from the condenser and deriving its operating fluid from the discharge of said main pumping unit, a hydraulic turbine interposed in the connection between the hydraulic vacuum pump and main pumping unit and driven by the operating fluid, and a tail pump operated by said hydraulic turbine for returning the operating fluid to said main pumping unit.

7. The combination with a main pumping unit and a condenser, of a hydraulic vacuum pump for drawing air from the condenser, a hydraulic turbine, a water passageway between the discharge of said main pumping unit and turbine for driving the turbine by a part of the discharge fluid from the main pumping unit, said turbine discharging to said hydraulic vacuum pump for operating it, a shaft rotated by said turbine, and a condensate pump for removing condensate from said condenser mounted upon said shaft.

8. The combination with a main pumping unit and a condenser, of a hydraulic vacuum pump for drawing air from the condenser, a hydraulic turbine, a water passageway between the discharge of said main pumping unit and turbine for driving the turbine by a part of the discharge fluid from the main pumping unit, said turbine discharging to

said hydraulic vacuum pump for operating it, a shaft rotated by said turbine, a condensate pump for removing condensate from said condenser mounted upon said shaft, and a tail pump mounted on said shaft and operated by the turbine for returning fluid from said hydraulic vacuum pump to the main pumping unit.

9. In an auxiliary pumping unit the combination of a hydraulic turbine, a hydraulic vacuum pump operated by the discharge from said turbine, and a tail pump operated by said turbine, said tail pump for receiving the discharge from said hydraulic vacuum pump.

10. An auxiliary pumping unit comprising a vertical shaft, a casing surrounding said shaft, a hydraulic turbine having its rotor mounted on said shaft within said casing, a condensate pump having its rotor mounted on said shaft within said casing, said shaft having one end enclosed within the casing and the other end extending out of the casing, and a single stuffing box about said shaft and positioned at the upper end of the casing.

11. The combination with a main pumping unit and a condenser, of a hydraulic vacuum pump for drawing air from the condenser and deriving its operating fluid from the discharge of said main pumping unit, a hydraulic turbine interposed in the connection between the vacuum pump and main pumping unit and driven by the operating fluid, and a tail pump operated by said hydraulic turbine for receiving the operating fluid from the vacuum pump and pumping it to a pre-determined point.

12. The combination with a main pumping unit and a condenser, of a condensate pump for withdrawing condensate from the condenser, and a hydraulic turbine driving said condensate pump and receiving its operating fluid from the discharge of the main pumping unit.

13. The combination with a main pumping unit and a condenser, of a condensate pump for withdrawing condensate from the condenser, a hydraulic turbine for driving said condensate pump and receiving its operating fluid from the discharge of the main pumping unit, and a tail pump driven by said hydraulic driving mechanism for receiving the operating fluid from the turbine and delivering it to a predetermined point.

14. The combination with a main pumping unit and a condenser, of a condensate pump for withdrawing condensate from the condenser, a hydraulic turbine for driving said pump and receiving its operating fluid from the main pumping unit, and a tail pump driven by said turbine for receiving the operating fluid from the turbine and delivering it to a predetermined point, said pumps and turbine being housed in one cas-

ing and mounted upon a single shaft to provide a compact unit.

15. The combination with a main pumping unit and a condenser, of a hydraulic vacuum pump for drawing air from the condenser and deriving its operating fluid from the main pumping unit, a hydraulic turbine interposed in the connection between the hydraulic vacuum pump and main pumping  
10 unit whereby the pressure of operating fluid

will be reduced and permit discharge of the operating fluid and air from said hydraulic vacuum pump, at atmospheric pressure to permit escape of air, and a condensate pump for withdrawing condensate from said condenser, said condensate pump operated by said hydraulic turbine. 15

In testimony whereof I affix my signature.

OSCAR H. DORER.