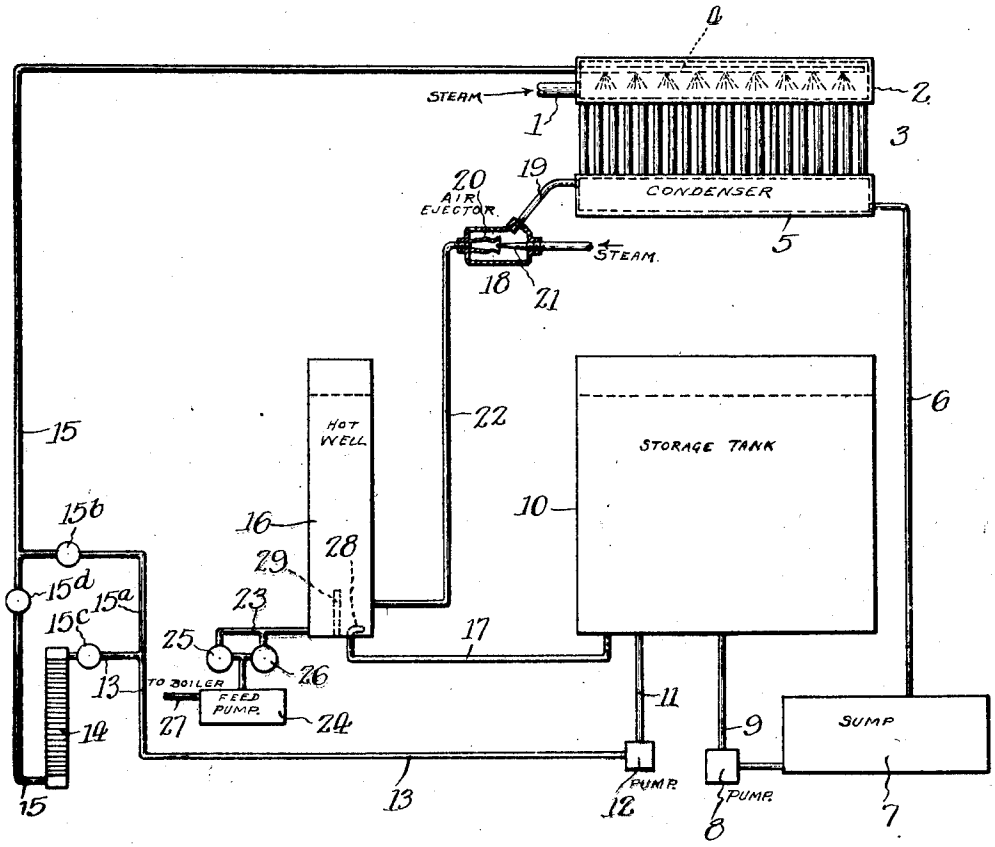
Aug. 7, 1928. 1,679,489

C. B. PAGE ET AL

WATER SYSTEM

Filed Sept. 28, 1925




Inventors:
Charles B. Page,
Warren Dean Burton,
By Churchill Parker & Carlson
Attys.

Patented Aug. 7, 1928. 1,679,489

# UNITED STATES PATENT OFFICE.

CHARLES B. PAGE AND WARREN DEAN BURTON, OF EVANSTON, ILLINOIS, ASSIGNORS TO GEORGE W. DULANY, JR., OF CHICAGO, ILLINOIS.

## WATER SYSTEM.

Application filed September 28, 1925. Serial No. 58,996.

This invention relates to power plants in which steam is condensed after expansion in a prime mover and returned to the boiler. The invention is especially applicable to an automotive vehicle, as, for example, a locomotive or a railway car driven by a steam engine or a steam turbine. The object of the invention, generally stated, is to provide an efficient system adapted to contain sufficient water for supplying feed water to the boiler and cooling water to the condenser, means being provided to heat the water supplied to the boiler and to cool the water that is used in the condenser.

The accompanying drawing is a diagram of a water system embodying the features of our invention.

Reference may be made to our copending application Serial No. 62,062 filed Oct. 12, 1925, for a disclosure of a steam turbine-driven railway car to which the present invention is especially, although not exclusively, applicable. Exhaust steam from the turbine or turbines is conducted through a pipe 1 to the header 2 of a radiator or condenser 3. Water is sprayed upon the steam in the header 2 by means of a perforated pipe 4 within said header. The cooling water and water of condensation is collected in the lower header 5, whence it flows through a pipe 6 to a sump 7 preferably located at the lowest point in the system. From the sump 7 water is forced by a pump 8 through a pipe 9 to a storage tank 10, the upper end of which is open to atmospheric pressure. Water is withdrawn from the lower portion of the storage tank 10 through a pipe 11 by means of a pump 12 and forced through a pipe 13 to the upper end of a radiator 14 preferably located at the forward end of the car. From the lower end of the radiator water flows through a pipe 15 to the perforated pipe 4 within the header 2.

A by-pass pipe $15^a$ extends from the pipe 13 to the pipe 15. $15^b$ is a normally closed valve in said by-pass pipe. A normally open valve $15^c$ is provided in the pipe 13 between the radiator 14 and the junction of the pipes 13 and $15^a$. Another normally open valve $15^d$ is located in the pipe 15 between the radiator and the junction of the pipes 15 and $15^a$. It will be seen that in case of damage to the radiator 14, the valves $15^c$ and $15^d$ may be closed and the valve $15^b$ opened to permit of continued operation.

A hot well 16 is connected at its lower end to the lower portion of the storage tank 10 by means of an equalizing pipe 17. The upper end of the hot well 16 is open to atmospheric pressure. Air which may enter the water system is withdrawn from the lower header 5 by means of an air ejector 18 of any preferred character, said ejector being connected to the header 5 by a pipe 19. The air ejector herein shown comprises a Venturi tube 20 through which steam is discharged from a nozzle 21. The mixture of steam and air leaving the ejector 18 flows through a pipe 22 to the hot well 16, from which the air escapes, the steam serving to heat the water in the hot well. Water is withdrawn from the lower portion of the hot well 16, through a pipe 23 by a boiler feed pump 24. 25 and 26 represent diagrammatically a hand feed-water control and an automatic feed-water control, respectively. The boiler feed pump 24 delivers water to the boiler through a pipe 27.

In order that cool water shall not flow directly from the pipe 17 to the pipe 23, the end of the pipe 17 is extended into the hot well and directed away from the outlet of the hot well, as indicated at 28, and a baffle or partition 29 is provided in the hot well between the inlet 28 and the outlet 23. The steam pipe 22 may enter the hot well at any preferred point; it is herein shown as discharging steam and air at or just below the level of the upper end of the partition 29.

The major portion of the water in the system is contained in the cool-water storage tank 10. Before delivery to the boiler, the water is warmed in the hot well 16, the latter being relatively small, for efficiency in the pre-heating of the boiler feed water. Water which is to be used to assist in the condensation of steam is withdrawn from the body of cool water in the tank 10 and is further cooled by means of the radiator 14. It will therefore be seen that the coldest water is employed for spraying the steam, thus obtaining a high degree of efficiency.

We claim as our invention:

1. A water system comprising, in combination, a radiator for condensing steam, a sump to receive water from said radiator, a cool-water storage tank, a pump for forcing

water from the sump to the storage tank, a relatively small hot well, an equalizing pipe connecting the lower portions of said storage tank and hot well, an air ejector for withdrawing air from the radiator, said ejector comprising a steam nozzle, the mixture of air and steam being delivered to said hot well, a pump for delivering hot boiler feed water from the hot well, a second radiator, a spray pipe operatively related to the first radiator, and a pump for forcing cool water from said storage tank through the second radiator and thence to said spray pipe.

2. A water system comprising, in combination, a radiator for condensing steam, a cool water storage tank receiving water from the radiator, a relatively small hot well, an equalizing pipe connecting the lower portions of said storage tank and hot well, means to heat the water in the hot well, a pump for delivering hot boiler feed-water from the hot well, a second radiator, a spray pipe operatively related to the first radiator, and a pump for forcing cool water from said storage tank through the second radiator and thence to said spray pipe.

3. A water system comprising, in combination, a radiator for condensing steam, a cool-water storage tank to receive water from said radiator, connections for delivering boiler feed water from the storage tank, a second radiator, a spray pipe operatively related to the first radiator, and a pump for forcing cool water from said storage tank through the second radiator and thence to said spray pipe.

4. A water system comprising, in combination, a radiator for condensing steam, a cool-water storage tank to receive water from said radiator, a relatively small hot well, an equalizing pipe connecting the lower portions of said storage tank and hot well, an air ejector for withdrawing air from the radiator, said ejector comprising a steam nozzle, the mixture of air and steam being delivered to said hot well, a pump for delivering hot boiler feed water from the hot well, a spray pipe operatively related to the radiator, and a pump for forcing cool water from said storage tank to said spray pipe.

In testimony whereof we have hereunto affixed our signatures.

CHARLES B. PAGE.
WARREN DEAN BURTON.