

A. B. WALLEM.
 COMBINED STEAM ENGINE AND HEATER.
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Fig. 1,

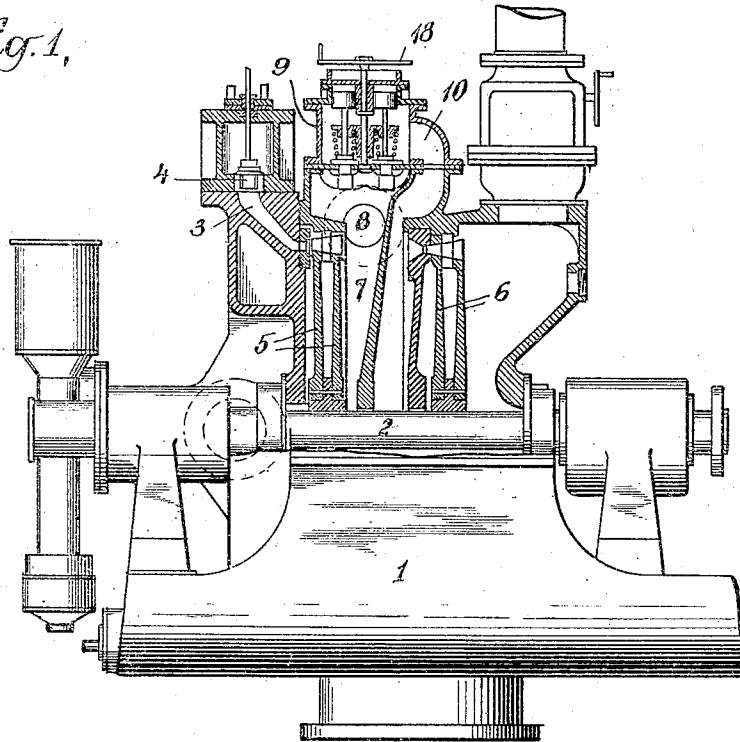
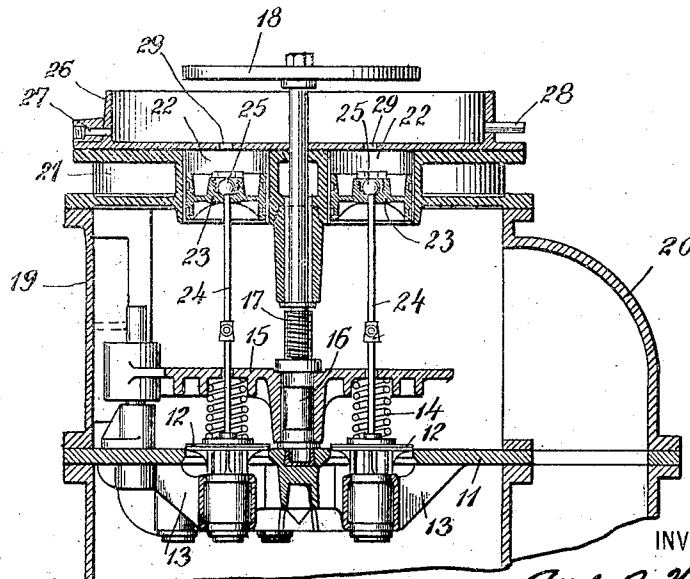


Fig. 2,



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COMBINED STEAM-ENGINE AND HEATER.

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Specification of Letters Patent.

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To all whom it may concern:

Be it known that I, AXEL B. WALLEM, a citizen of the United States, residing at Cynwyd, in the county of Montgomery and State of Pennsylvania, have invented certain new and useful Improvements in Combined Steam-Engines and Heaters, of which the following is a specification.

This invention relates to steam systems in which steam, delivered by an engine, is supplied to a heater and also to a second steam engine.

The invention is of particular utility in connection with a multi-stage turbine wherein live steam is supplied to the high-pressure stage of the turbine and from the low-pressure side of that stage is carried to a heater of any suitable character, such for instance, as an open feed-water heater and also to the low-pressure stage of the turbine. As the invention is of special utility in such apparatus, it will be described in connection therewith though it is to be understood that the invention is not limited to this particular use.

The invention is directed to the provision of valve-mechanism for controlling the flow of the steam to the heater and to the low-pressure stage of the turbine. This valve-mechanism is such that the steam passing through the high-pressure stage of the turbine is delivered to the heater and any excess of such steam above that required for the heater will pass to the low-pressure stage of the turbine. In this way the heater will always be supplied with steam sufficient for its requirements and any excess over such requirements will be automatically supplied to and utilized in the low-pressure stage of the turbine in developing power.

In accordance with the invention, a chamber of any suitable character is provided between the two stages of a turbine. This chamber receives steam from a high-pressure stage of the turbine and a passageway leads therefrom to the heater. A valve is provided for controlling an outlet from this chamber to the low-pressure stage of the turbine. This valve is acted upon by the pressure of the steam within the chamber in such a way that the steam tends to open the valve. This opening movement of the valve, however, is opposed by atmospheric pressure and also by a pressure which may be readily regulated as to its amount. In the pre-

ferred form of the invention, a plurality of valve-members are provided controlling the passage of the steam to the low-pressure stage of the turbine, these valve-members being independently movable, each acted upon by atmospheric pressure to hold it in closed position, each provided with a spring tending to hold it in the closed position, and all of the springs being capable of regulation as to the pressure which they exert upon the valve members. In this way, steam will always pass from the chamber to the heater and after the pressure in the chamber rises above a predetermined amount, one or more of the valve-members will open so as to allow the excess of the steam in the chamber above the requirements of the heater to pass into the low-pressure stage of the turbine. Such a valve-mechanism is of simple construction, can be manufactured at low cost, occupies but little space and permits of ready regulation of the point at which the valves will open so as to maintain the desired pressure of steam in the heater.

The preferred embodiment of the invention is illustrated in the accompanying drawings in which—

Figure 1 is a sectional elevation of a turbine constructed in accordance with the invention and Fig. 2 is a sectional view of the valve on a large scale.

Referring to these drawings, 1 indicates the frame of a multi-stage turbine and 2 is a shaft mounted for rotation therein and carrying the stage-wheels of a multi-stage turbine. The inlet for the live steam is shown at 3, this inlet being controlled by suitable valve-mechanism 4. The wheels of the high-pressure stage are shown at 5 and the wheels of the low-pressure stage are shown at 6. The construction of the parts so far described may be changed from that shown in the drawings in any desired manner.

Within the casing of the turbine a chamber 7 is provided which receives steam from the high-pressure stage of the turbine, that is, steam issuing from the stage-wheels 5 after having acted upon the buckets upon the periphery of those wheels. The chamber 7 is provided with an outlet 8 which outlet leads to a heater of any suitable character, such, for instance, as an open feed-water heater. The chamber 8 is provided with a valve-mechanism 9 which controls the outlet

of steam from the chamber 7 to a passageway 10, which passageway leads to the low-pressure stage-wheels 6. The construction of this valve-mechanism will now be described.

An opening is provided in the wall of the chamber 7 over which opening is secured a plate 11. In this plate are a plurality of openings, each of which is adapted to be closed by a movable valve-member 12, the several valve-members being independently movable. To the bottom of the plate 11 is secured a casting 13 in which chambers are formed to receive pistons connected to the valve-members 12 whereby dash-pots are provided for regulating the movements of the valve-members, in a manner well understood. Each of the valve-members 12 is pressed toward its seat on the plate 11 by a spring 14. The upper ends of all of these springs are received in recesses formed in the under side of a pressure-plate 15. This pressure-plate has a bushing 16 secured therein having a threaded opening through and this opening receives a threaded shaft 17 which extends upwardly through the casing of the valve and on its upper end has a hand-wheel 18. Upon the plate 11 is secured a cylindrical member 19 forming the casing of the valve and provided with an outlet opening 20. The upper end of this member 19 is closed by a casting 21. In this casting or top-plate 21 are formed a plurality of cylindrical chambers 22, one for each of the valve-members 12 and each in alignment with a corresponding valve-member. Each of these cylinders 22 has a piston 23 therein adapted to reciprocate within the cylinder in accordance with the movements of the corresponding valve-member 12. Each valve-member 12 is connected to the corresponding piston 23 by means of a rod 24. The connection of the rod 24 to the piston 23 is made by means of a ball and socket joint 25 so as to permit of a slight amount of flexibility. Upon the top plate 21 is secured a pan 26 having inlet and outlet openings 27 and 28 respectively. In the bottom of the pan 26 are openings 29 each leading to one of the cylinders 22. The spindle 17 carrying the hand-wheel 18 passes up through the bottom of the pan 26. When the apparatus is in use the pan 26 is kept partly filled with water and this water runs down into the chambers 22 so as to fill the space therein above the pistons 23.

With the apparatus thus constructed steam is admitted to the turbine through the passage 3, acts upon the high-pressure stage-wheels 5 and then passes to the chamber 7. The valve-members 12 being closed, the only outlet from this chamber would be through the passageway 8 to the heater. The valve-members 12 are held upon their seats by the springs 14 and also by atmospheric pres-

sure acting upon the upper ends of the pistons or auxiliary valve-members 23. On the other hand, the pressure of the steam in the chamber 7 would act upon the under sides of the valve-members 12 in a direction to raise those valve-members and thus provide a passageway through the openings in the plate 11, the outlet 20 and the passageway 10 to the low-pressure stage of the turbine. When the steam entering the chamber 7 is in excess of that required by the heater connected to the passage 8, the pressure of the steam in chamber 7 will rise, and, acting upon valve-members 12, will raise those valve-members against atmospheric pressure and the pressure of the springs 14. Thereupon steam will pass through the valve and the passage 10 to the low-pressure stage of the turbine and such flow of the steam will continue as long as the steam supplied to the chamber 7 from the high-pressure stage of the turbine is in excess of that required by the heater. At any time during the operation of the apparatus, the pressure of the steam in the heater may be regulated as desired by merely turning the hand-wheel 18 so as to change the pressure exerted by the springs 14 upon their respective valve-members 12.

It will be seen that the several auxiliary valve-members 23 are all water-sealed and also the bearing for the spindle 17 is water-sealed. By reason of this or an equivalent provision a partial vacuum formed in the passage 10 by a condenser connected to the low-pressure stage of the turbine will not cause air to be drawn into the passageway 10 around the pistons 23 and the spindle 17. Such partial vacuum in the passage leading to the low-pressure stage of the turbine would not affect the other elements acting to position the valves 12 because of the fact that, in the preferred embodiment of the invention, the diameter of the pistons 23 is substantially the same as that of the valves 12, as a consequence of which the valves are balanced. Thus in the operation of the apparatus described, the heater connected to the outlet 8 from chamber 7 is given the preference with respect to the steam delivered from the high-pressure stage of the turbine; if this steam be delivered in such quantity as to exceed the requirements of the heater, such excess is permitted to flow into the low-pressure stage of the turbine where it develops energy in the form of mechanical motion.

Having described my invention, what I claim as new therein and desire to secure by Letters Patent of the United States is:

1. The combination of a multi-stage turbine, a chamber receiving steam from a high-pressure stage thereof, an outlet from said chamber to a heater, a passageway from said chamber to a low-pressure stage of the

turbine, a valve controlling said passageway urged toward the open position by steam in said chamber, a member connected to said valve for closing the same, having one side thereof exposed to atmospheric pressure and the other side subjected to the pressure within said passageway, and a second means independent of and additional to said member for urging said valve toward the closed position, substantially as described.

2. The combination of a multi-stage turbine, a chamber receiving steam from a high-pressure stage thereof, an outlet from said chamber to a heater, a passageway from said chamber to a low-pressure stage of the turbine, a valve controlling said passageway urged toward the open position by steam in said chamber, means for causing atmospheric pressure to urge said valve toward the closed position, a spring pressing the valve toward the closed position and means for regulating the tension of said spring from the exterior of the valve, substantially as set forth.

3. The combination of a multi-stage turbine, a chamber receiving steam from a high-pressure stage thereof, an outlet from said chamber to a heater, a passageway from said chamber to a low-pressure stage of the turbine, a valve controlling said passageway having a plurality of balanced independently-movable valve-members therein urged toward the open position by steam in said chamber, means for causing atmospheric pressure to urge the valve-members toward the closed position, a spring for each of said valve-members pressing the latter toward its seat, a pressure-plate engaging all of said springs, and means for moving the pressure-plate from the exterior of the valve to regulate the tension of all of said springs, substantially as set forth.

4. The combination of a multi-stage turbine, a chamber receiving steam from a high-pressure stage thereof, an outlet from said chamber to a heater, a passageway from said chamber to a low-pressure stage of the turbine, a valve-member controlling said passageway urged toward the open position by steam in said chamber, a spring pressing said valve toward its seat and an auxiliary valve-member connected to said valve-member and subjected to atmospheric pressure on one side thereof, substantially as set forth.

5. The combination of a multi-stage turbine, a chamber receiving steam from a high-pressure stage thereof, an outlet from said chamber to a heater, a passageway from said chamber to a low-pressure stage of the

turbine, a valve-member controlling said passageway urged toward the open position by steam in said chamber, a spring pressing said valve-member toward its seat, an auxiliary valve-member connected to said valve-member and subjected to atmospheric pressure on one side thereof, and means for effecting a seal of said auxiliary valve-member, substantially as set forth.

6. The combination of a multi-stage turbine, a chamber receiving steam from a high-pressure stage thereof, an outlet from said chamber to a heater, a passageway from said chamber to a low-pressure stage of the turbine, a valve controlling said passageway having a plurality of independently-movable valve-members therein urged toward an open position by steam-pressure in said chamber, a spring for holding each of said valve-members yieldingly upon its seat, a pressure-plate engaging said springs, means for moving the pressure-plate from the exterior of the valve chamber, a plurality of auxiliary valve-members each connected to one of said valve-members and each subjected to atmospheric pressure on one side thereof and means for effecting a seal of all of said auxiliary valve-members, substantially as set forth.

7. The combination of a multi-stage turbine, a chamber receiving steam from a high-pressure stage thereof, an outlet from said chamber to a heater, a passageway from said chamber to a low-pressure stage of the turbine and a valve controlling said passageway, said valve comprising a casing, a plurality of independently-movable valve-members therein urged toward the open position by steam-pressure in said chamber, springs holding said valve-members yieldingly on their seats, a pressure-plate engaging all of said springs, a vertically disposed shaft extending through the upper wall of the casing of the valve and connected to said pressure-plate so as to actuate the same, a plurality of auxiliary valve-members, each connected to one of said valve-members and each acted upon on its upper side by atmospheric pressure and on its lower side by pressure within the valve, and means for effecting a seal of said auxiliary valve-members and of the bearing for said shaft, substantially as set forth.

This specification signed and witnessed this 20th day of December, 1911.

AXEL B. WALLEM.

Witnesses:

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