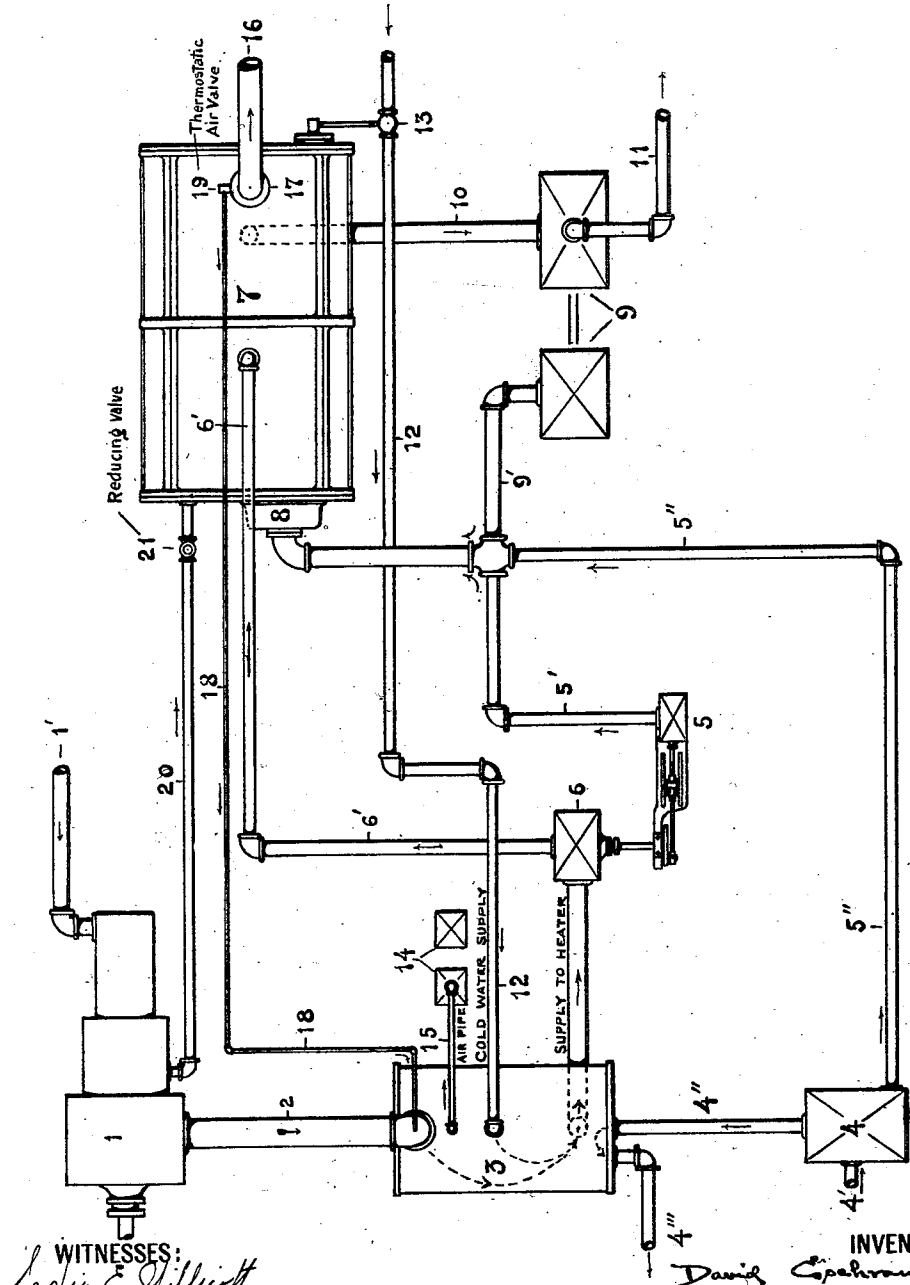
No. 770,264. PATENTED SEPT. 20, 1904.

D. COCHRANE.

METHOD OF WATER HEATING.

APPLICATION FILED SEPT. 17, 1903.

NO MODEL.



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No. 770,264. Patented September 20, 1904.

UNITED STATES PATENT OFFICE.

DAVID COCHRANE, OF PHILADELPHIA, PENNSYLVANIA.

METHOD OF WATER-HEATING.

SPECIFICATION forming part of Letters Patent No. 770,264, dated September 20, 1904.

Application filed September 17, 1903. Serial No. 173,580. (No model.)

To all whom it may concern:

Be it known that I, DAVID COCHRANE, a citizen of the United States, and a resident of Philadelphia, in the county of Philadelphia and State of Pennsylvania, have invented certain new and useful Improvements in Methods of Water Heating, Regulating, and Feeding, of which the following is a specification.

My invention relates to improvements in the methods of heating and regulating feed-water for steam-generators, and particularly to those cases where the feed-water is heated in an open heater by the exhaust from auxiliary motors in connection with part of the exhaust from the main motor.

The objects of my invention are to attain increased economy both of fuel, water, and labor, to render the function of boiler-feeding more nearly automatic, to insure the highest practicable temperature of the feed, and to increase the general efficiency and convenience of any installation employing my improved method.

Where open feed-water heaters are used in connection with surface condensing plants, they are generally installed so that the water from the surface condenser is discharged into them, the supplementary water needed to make good the leakage being introduced into the heater, and the exhaust from the auxiliaries being used to heat the water in the heater. In some cases this auxiliary exhaust may be supplemented by steam from an intermediate receiver in connection with the main engine or from other sources. In such cases it is of course important that the least possible demand be made upon the supplemental steam-supply, while attaining the greatest practicable temperature in the feed-water, and the regulation of the supply of feed-water should be dependent upon the amount in the heater available for feeding to the boilers.

The drawing represents in general plan view an arrangement or system of embodying my improvements, and in this instance I have chosen an installation where a turbine is employed and where the steam is expanded.

1 is the main steam-turbine, taking steam through the pipe 1′ from the boiler.

2 is the exhaust-pipe from turbine to condenser.

3 is the surface condenser, receiving the exhaust from 2.

4 is an auxiliary engine driving a circulating-pump taking cold water through suction-pipe 4′ and forcing it through pipe 4″ into the condenser to condense the exhaust-steam therein, and 4‴ is outlet-pipe carrying waste to sewer or elsewhere after having fulfilled its function of condensing the exhaust-steam in condenser.

5 is an auxiliary engine driving a pump 6 for drawing the water from condensed steam from the condenser and delivering it to the heater 7 through pipe 6′. 5′ is the exhaust-pipe from this auxiliary engine joining the exhaust 5″ from 4.

7 is an open feed-water heater receiving the exhaust from the auxiliaries through the separator 8.

9 is a feed-water pump taking water from heater through pipe 10, and discharging to boilers through pipe 11 it exhausts through the pipe 9′, joining the other auxiliary exhausts, and all entering the separator 8.

12 is the supplementary cold-water-feed supply emptying into the condenser 3 to make up any deficiency in the water from condensed steam. This supplementary feed is controlled and regulated according to the level of the heated water in the heater 7 through the valve 13, automatically opened or closed by a float and connecting mechanism, as fully described in my Patent No. 530,749, dated December 11, 1894, lines 41 to 53, page 1, except that in the latter case the regulation permits an overflow, while in this case the regulation affects the supply of supplementary cold water to the condenser, where it becomes partially heated before coming to the heater proper. As this mechanism is not a part of my present invention, I will not further describe it.

14 is an air-pump exhausting air from the condenser 3 through the pipe 15. This may be driven by any suitable power, as electric motor or auxiliary steam-engine. In the latter case the exhaust would join the other auxiliary exhausts into 8.

16 is the exhaust from heater into the atmosphere. It is provided with a back-pressure valve 17, as will be further explained.

18 is an air-pipe leading into the condenser. It is provided with the air-valve 19 at the heater, set to open when the air which is liberated from the water by heating it in the heater cools to the same temperature at which the valve is set to operate, thus leaving a free passage for the air into the condenser, from which it is drawn by the dry-air pump 14. When the air is all forced out of the heater and the steam reaches the air-valve, the higher temperature closes the latter and prevents any waste of steam. The back-pressure valve 17 operates in a similar manner to the back-pressure valve described in the patent of mine before mentioned. (See page 2 thereof.) In short, should there be more exhaust from the auxiliaries than the heater will condense or otherwise dispose of the pressure will increase until it is high enough to open the back-pressure valve 17, the surplus escaping to the atmosphere. It often occurs, however, that the steam from the auxiliaries is insufficient to properly heat the feed-water in the heater. Therefore I carry a pipe 20 from a receiver or other suitable point connected with the motor (in the case illustrated it is taken from such a point of expansion in the turbine as to insure the least loss of effectiveness with the greatest potentiality) to the heater 7, so that this live steam shall make up the possible deficiency in the auxiliary exhaust. I place in this pipe 20 an automatic throttling reducing-valve 21, so adjusted that the pressure of the steam when it enters the heater 7 shall be below the pressure at which the back-pressure valve 17 is set. Thus the supply of supplemental live steam from the motor through 20 depends upon the pressure in the heater 7 and is regulated by the needs of the heater itself, manifested by the pressure existing therein, and therefore also by the temperature therein. I do not, however, claim or limit myself to any special form, design, or kind of valve, or means for regulating the supplemental steam-supply other than one operating as above indicated.

The operation and advantages of my improvement will be apparent. The steam after accomplishing its mission in the motor 1 is condensed in the condenser 3 and is then drawn by the pump 6 into the heater 7, where it is heated by the exhaust-steam from the auxiliaries 4, 5, and 9. When this exhaust is insufficient, the supplemental live steam from 1 through 20 at a pressure sufficiently reduced by the valve 21 is admitted to the heater 7, where it further raises the temperature of the water from the condenser, itself, together with the auxiliary exhausts, being to a certain extent condensed at the same time and because of this function of heating. The resultant hot water nearly at boiling-point is then pumped to boilers by the pump 9 as it is needed. Should this feed from the heater be insufficient, the dropping of the water-level in 7 opens the valve 13 in the supplemental cold-water-supply pipe 12, allowing sufficient additional cold water to enter the condenser 3 when it assists to condense the exhaust-steam from the motor 1 and is at the same time itself raised to a considerable temperature. It then is pumped, as before described, into the heater 7, where it is further heated and eventually finds its way to the boilers, as already explained. Thus the boiler-supply of water heated to a high degree is made practically automatic. There is no sudden lowering of the temperature of the feed by the direct admission of supplemental cold water, and the highest possible temperature in the water fed to the boilers is attained with the least amount of supplemental steam from the receiver or motor, and it will be evident that the vacuum in the condenser, the condensed-steam supply to heater, the carrying the supplemental cold-water feed first to the condenser regulated by the needs of, as shown by the level in, the heater, and the supplemental exhaust from main motor into the heater all coöperate to attain this end.

I do not limit myself to any special shape, design, arrangement, or character of motor, pump, condenser, heater, or other component part or parts of such system, my invention covering a method of heating and feeding and regulating and not the apparatus itself.

Where I have used the words "exhaust-steam" or "waste steam," I mean by this steam that has done its work or any other steam that is capable of further utilization—as, for instance, exhaust from a motor, exhaust from a heating system, or any other instance where steam may be advantageously condensed and the condensation subsequently utilized.

What I claim is—

1. The method of heating and regulating a supply of water which consists in condensing the exhaust from main motors, heating the water of condensation by exhaust from auxiliary motors—supplementing the exhaust from auxiliaries by steam at higher temperature, supplementing the water of condensation by supply from other source, and regulating said supplemental supply automatically according to the quantity reheated, substantially as described.

2. The method of heating and regulating a supply of water which consists in condensing the exhaust from main motors, heating the water of condensation by exhaust from auxiliary motors, supplementing the water of condensation by supply from another source, and regulating said supplemental supply automatically according to the quantity reheated, substantially as described.

3. The method of heating and regulating a supply of water which consists in condensing waste steam, reheating the water of condensation by waste steam, automatically supple-

menting the reheating medium by steam at a higher temperature, supplementing the water of condensation by supply from another source, automatically regulating said supply according to the quantity reheated, substantially as described.

4. The method of heating and regulating a supply of water which consists in condensing waste steam, separately reheating the water of condensation, supplementing the water of condensation by supply from another source, automatically regulating said supply according to the total quantity reheated, substantially as described.

5. The method of heating and regulating a supply of water which consists in condensing waste steam, separately reheating the water of condensation, automatically regulating the supply of water to be reheated according to the total quantity reheated, substantially as described.

6. The method of heating and regulating water which consists in condensing waste steam, reheating the water of condensation, automatically supplementing the reheating medium according to its temperature by a medium of higher temperature, automatically regulating the supply of water to be reheated according to the quantity reheated, substantially as described.

7. The method of heating and regulating a supply of water which consists in continuously condensing waste steam, separately reheating the water of condensation, exhausting the air from the reheated water, and automatically regulating the supply of water to be reheated according to the total quantity reheated, substantially as described.

8. The method of heating and regulating a supply of water which consists in continuously condensing waste steam, supplementing the water of condensation at the place of condensation by a supply from another source, separately reheating the entire water-supply, and automatically regulating the supplemental water-supply according to the total quantity reheated, substantially as described.

9. The method of heating and regulating a supply of water which consists in continuously separately reheating condensed steam, automatically supplementing the condensation according to the total quantity reheated, substantially as described.

10. The process of water-heating which consists in condensing waste steam, separately heating the condensation by waste steam, automatically supplementing the waste steam as a heating medium by steam at a higher temperature, substantially as described.

11. The process of water-heating which consists in automatically removing the air, liberated by said heating, according to its temperature, substantially as described.

12. The method of heating and regulating a supply of water which consists in condensing waste steam, automatically supplementing the condensation, separately heating the condensation and supplement, automatically regulating the temperature of the heating medium, substantially as described.

Signed at Philadelphia, in the county of Philadelphia and State of Pennsylvania, this 11th day of September, A. D. 1903.

DAVID COCHRANE.

Witnesses:
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JOSEPH M. HUTCHINSON.