

J. PRIMROSE.

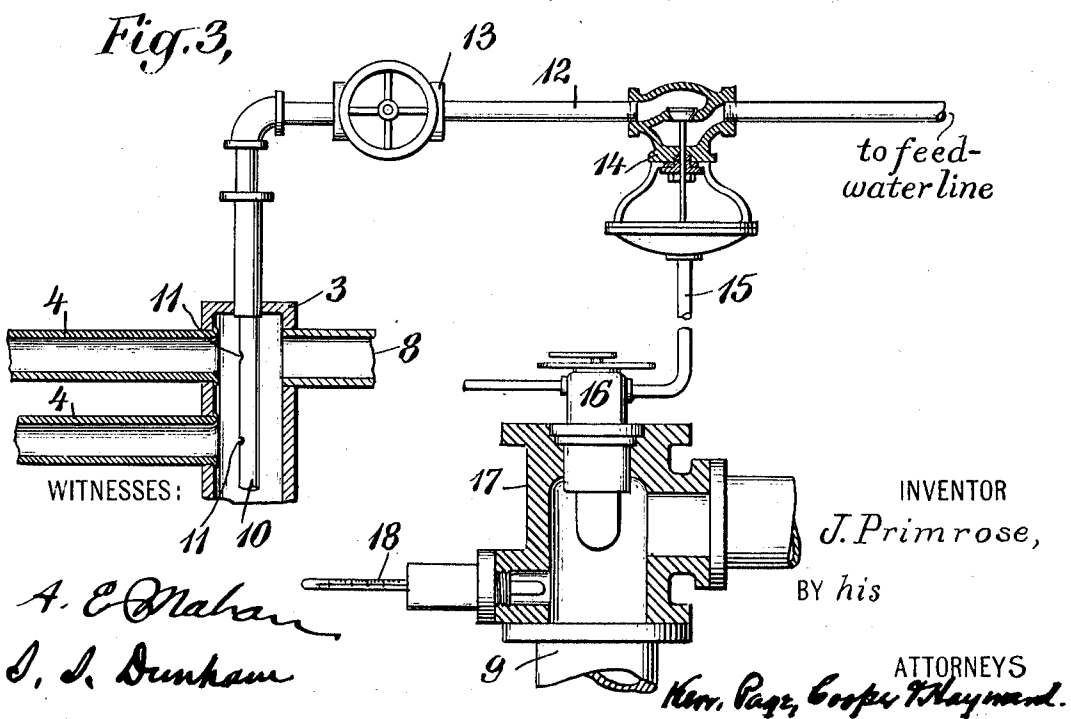
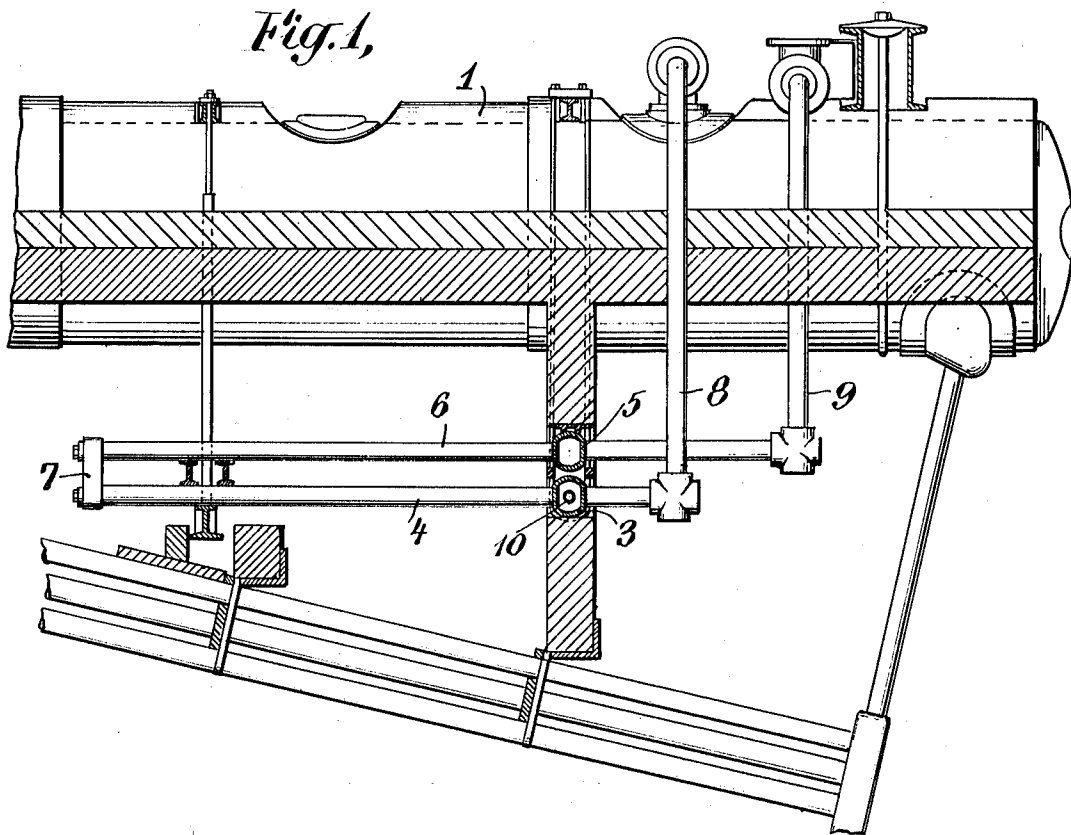
REGULATION OF THE TEMPERATURE OF SUPERHEATED STEAM.

APPLICATION FILED JUNE 21, 1909.

1,003,792.

Patented Sept. 19, 1911.

2 SHEETS—SHEET 1.

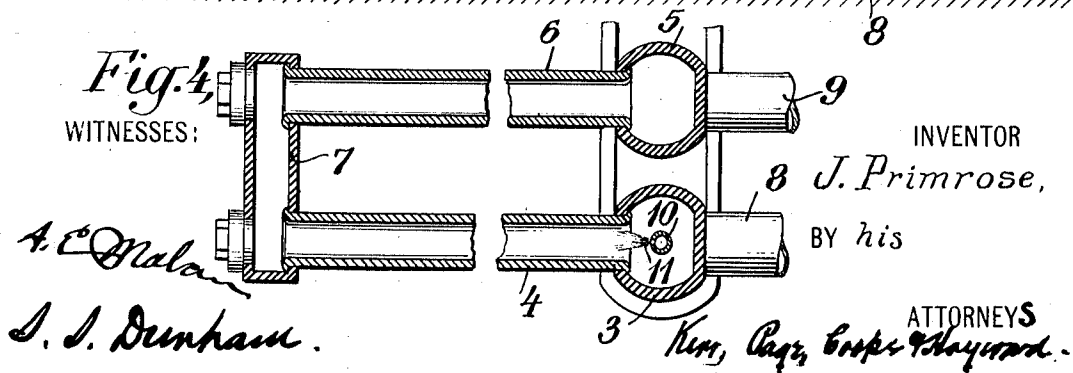
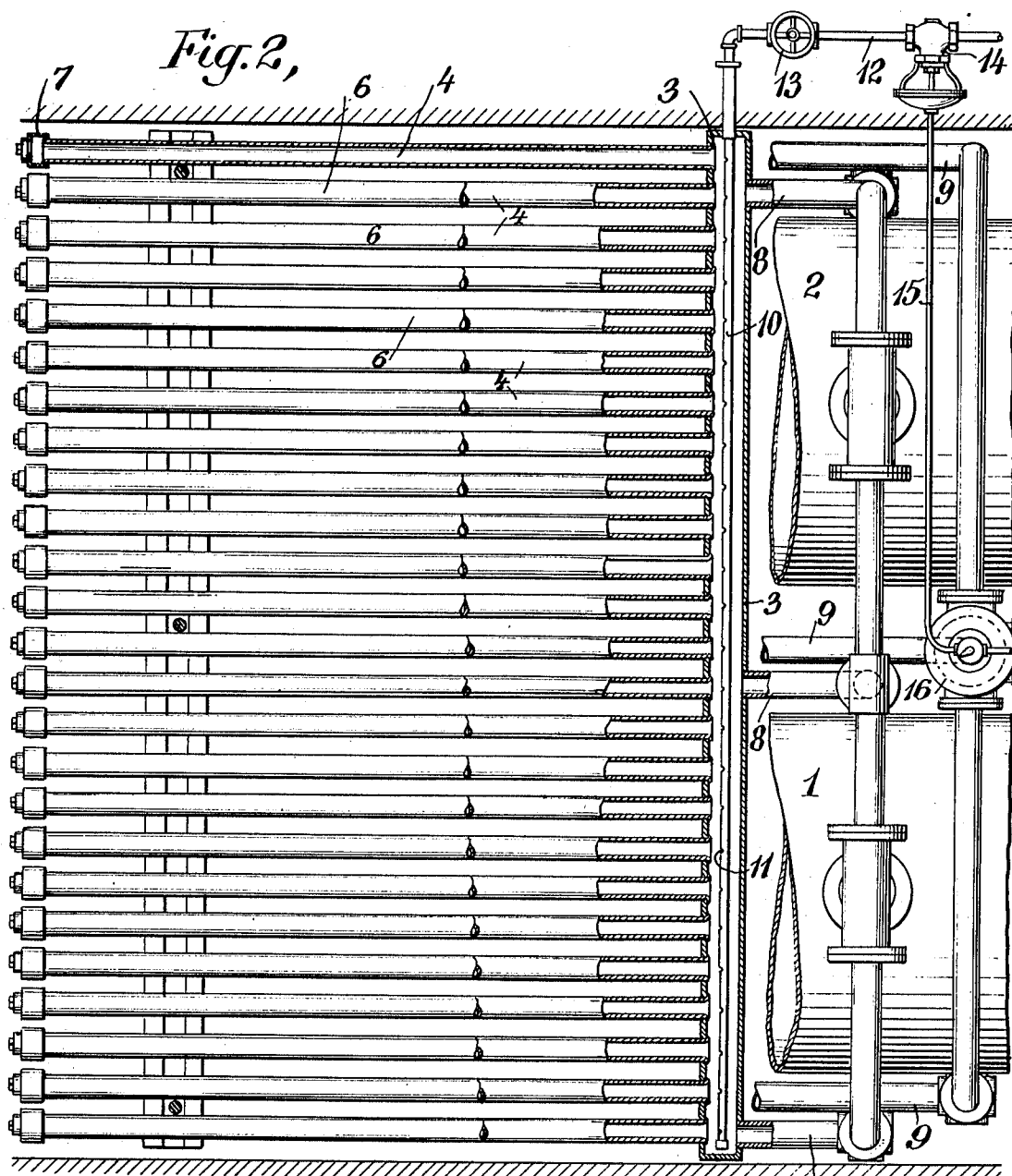


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UNITED STATES PATENT OFFICE.

JOHN PRIMROSE, OF DANSVILLE, NEW YORK.

REGULATION OF THE TEMPERATURE OF SUPERHEATED STEAM.

1,003,792.

Specification of Letters Patent. Patented Sept. 19, 1911.

Application filed June 21, 1909. Serial No. 503,281.

To all whom it may concern:

Be it known that I, JOHN PRIMROSE, a subject of the King of Great Britain, residing at Dansville, county of Livingston, and State of New York, have invented certain new and useful Improvements in the Regulation of the Temperature of Superheated Steam, of which the following is a full, clear, and exact description.

In steam plants equipped with superheaters it is sometimes desirable to deliver steam to the point of utilization at a temperature considerably lower than the maximum, even as low as saturation. Heretofore the common method for such purpose has been to "flood" the superheater with water, so that more or less of the heat, according to the amount of water admitted, will be expended in vaporizing the water. This method, while satisfactory in some respects, is in other respects objectionable. For example, the circulation of the water in a flooded superheater is imperfect, making the superheater inefficient as a heating surface. Moreover, the flooding of the superheater makes it impossible or impracticable to deliver the steam through the outlet employed for the steam when superheated, thus making an additional steam outlet necessary, and requiring an additional valve and more or less complicated piping from the two outlets in the steam main. I have therefore been led to devise my present invention, which has for its chief objects to provide simple, effective, and withal thoroughly efficient means for supplying saturated steam from a boiler provided with a superheater.

A further object is to provide means whereby the steam can be delivered to the point of utilization at practically any temperature desired, between the maximum and that of saturation.

To these and other ends the invention consists in the novel features of construction, arrangements of parts, and combinations of elements, hereinafter described and more particularly pointed out in the appended claims.

In devising my invention I have availed myself of the one advantageous feature of

the prior method referred to, namely, utilizing the surplus heat to evaporate water, the steam resulting from such evaporation being delivered to the steam main along with that flowing through the superheater from the boiler; but I bring the steam and water into contact in a novel manner, whereby an effective circulation in the superheater is maintained and the heating surface of the superheater utilized most efficiently.

The gist of my invention resides in introducing water into the inlet header of the superheater in the form of a spray. The result is that the particles of water are carried by the currents of steam through the superheater and finally vaporized, without material impairment of the circulation therein, thus insuring complete evaporation of the water and proportionate reduction of temperature in the steam delivered from the superheater. Moreover, the superheater thus becomes in effect a part of the boiler, in that steam is generated in the superheater, so that it amounts practically to an addition to the heating surface of the boiler. In consequence a boiler and superheater equipped with my invention can deliver more steam at saturation or any other temperature below the maximum degree of superheat than could the same boiler without the superheater. The efficient circulation maintained in the superheater has another and not unimportant advantage in that the tendency to deposit scale, from the water evaporated in the superheater, is much less than in the case where the circulation of the water is slow or irregular.

In the accompanying drawings I have illustrated what I consider at the present time the best mode of applying my invention.

In the drawings, Figure 1 is a side view of a boiler and superheater with the headers of the latter in section, showing the spray-pipe for discharging water into the superheater. Fig. 2 is a plan view with the boiler drums broken away to show the superheater, the headers of the latter and a portion of the superheating elements being in horizontal section to show the spray-pipe.

Fig. 3 is a detail view, partly in section, of a thermostatic system suitable for controlling the supply of water to the superheater. Fig. 4 is a detail sectional view of the superheater, taken longitudinally of a pair of superheating tubes or elements.

My invention may be applied to any steam generator, and in the drawings I have illustrated it as applied to a generator of a well-known water-tube type.

The drums of the generator or boiler are designated by 1, 2, and below the same is the superheater, which may be of any convenient and suitable type. That herein illustrated comprises an inlet header 3 connected to lower superheating tubes 4, and an outlet header 5 connected to upper superheating tubes 6, said tubes being themselves connected by return headers 7. The inlet header is connected to the boiler drums by steam-supply pipes 8, and the outlet header is connected to the steam line by delivery pipes 9. Inside the inlet header and extending lengthwise thereof is a spray-pipe 10, having a series of lateral spraying apertures 11 each so located as to discharge into a superheating tube, as clearly shown in Figs. 2, 3 and 4. This spray-pipe is connected by a tube 12 to the feed-water line or any other suitable source of water under sufficient head or pressure to cause the water to be discharged from the apertures 11 in the form of fine spray, said tube 12 having a hand-valve 13 to permit manual regulation of the water supply. In the tube 12 is also a pneumatically operated valve 14, of any convenient type, the actuating mechanism of which is connected by a tube 15 to suitable thermostatic devices 16 of the pneumatic type, associated with the union fitting 17 by which the delivery pipes 9 are connected with the steam line. The thermostatic devices include regulating means for determining the temperature at which said devices operate. At this point it may be stated that in general any suitable thermostatic system may be employed, the invention not being limited to that specifically illustrated. A thermometer may also be provided to indicate the temperature of the steam leaving the superheater and may be located at any convenient point. In the present instance the thermometer 18 is associated with the union 17 so as to indicate the temperature of the steam thereat.

From the foregoing the operation of the invention will be readily understood. When steam at the maximum degree of superheat is desired the valve 13 is closed and no water is admitted to the superheater. For a temperature below the maximum the valve 13 is opened and the thermostat, set at the temperature desired, thereafter operates to ad-

mit the amount of water necessary to keep the temperature constant between certain limits determined by the sensitiveness of the thermostat. The water being injected in the form of spray directly into the superheating tubes the minute particles of water are carried along by the currents of steam and are vaporized quickly without materially impeding the flow of steam as would be the case if the water were introduced by flooding the superheater. The result is a thoroughly efficient utilization of the heat taken by the superheater from the furnace gases, the excess of heat above the degree of superheat desired being expended in evaporating the water and hence increasing the quantity of steam delivered to the steam line. The superheater is thus in effect a part of the boiler-heating surface at all times when water is being delivered to the superheater.

As previously stated, the invention is not limited to the construction herein specifically shown and described but may be embodied in various other forms without departure from its proper spirit and scope as defined by the appended claims.

What I claim is:

1. In means for regulating the temperature of superheated steam, the combination with a superheater having an inlet header for receiving steam from a boiler and having a plurality of superheating tubes extending laterally from the said header; of a spray-pipe inside the header and arranged to direct a spray of water into each of the said superheating tubes; as set forth.

2. In means for regulating the temperature of superheated steam, the combination with a superheater having an inlet header; of means for spraying water directly into each of the superheating tubes connected with said header; as set forth.

3. In means for regulating the temperature of superheated steam, the combination with a superheater having an inlet header; of means for spraying water directly into each of the superheating pipes connected with said header; and thermostatic devices for regulating the amount of water discharged; as set forth.

4. In means for regulating the temperature of superheated steam, in combination a superheater comprising a common header and a plurality of laterally extending sections comprising upper and lower branches and connected to said header by the lower branch, a spray pipe extending into said header and longitudinally thereof, and lateral nozzle openings in said pipe one in line with each laterally extending lower branch and adapted to introduce water directly into said lower branches.

5. In means for regulating the temperature of super-heated steam, in combination a superheater comprising a common header and a plurality of laterally extending sections connected to said header, a spray pipe extending into said header and longitudinally thereof, and lateral nozzle openings in said pipe one in line with each laterally

extending section and adapted to introduce water directly into each section. 10

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

JOHN PRIMROSE.

Witnesses:

F. P. MAGEE,

F. FIELDER.