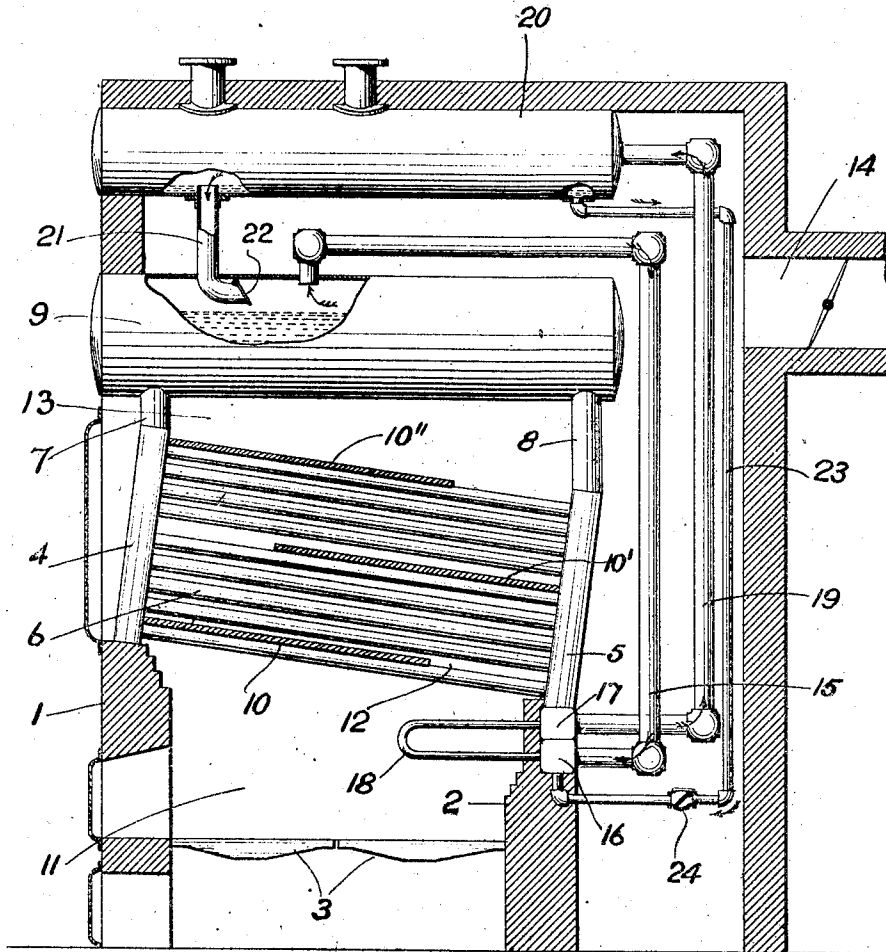


J. C. PARKER.
 STEAM SUPERHEATER.
 APPLICATION FILED NOV. 28, 1908.

1,063,585.

Patented June 3, 1913.



WITNESSES:

Robt. R. Kitchell
Geo. G. Wemyss Jr.

INVENTOR

John C. Parker
 BY *Charles N. Butler*
 ATTORNEY.

UNITED STATES PATENT OFFICE.

JOHN C. PARKER, OF PHILADELPHIA, PENNSYLVANIA.

STEAM-SUPERHEATER.

1,063,585.

Specification of Letters Patent.

Patented June 3, 1913.

Application filed November 28, 1908. Serial No. 464,931.

To all whom it may concern:

Be it known that I, JOHN C. PARKER, a citizen of the United States, residing in the city of Philadelphia, county of Philadelphia, and State of Pennsylvania, have invented certain Improvements in Steam-Superheaters.

My invention is a superheater which will maintain, in relation to the generator, an approximately constant efficiency ratio or a substantially equal rate of heat absorption by the saturated and the superheated steam, under the widest variations of steam output, so that the superheat temperatures will remain practically the same through different rates of working and the highest efficiency be attained, while the superheater tubes, subjected to the highest heating effects, are designed so that steam actively flowing therethrough will protect them by carrying away substantially the same number of heat units per unit of area and time as are carried away from the similarly situated generator tubes, and when there is no steam or insufficient steam therein to carry away the heat, said superheater tubes are protected by the automatic admission of water thereto, the water being evaporated and automatically excluded by the rise of temperature and the pressure of the steam generated thereby.

The characteristic features of my improvements will fully appear from the following description and the accompanying drawing in illustration thereof.

In the drawing, the superheater is illustrated as applied to a conventional type of steam generator shown in sectional elevation.

The drawing represents furnace walls 1 and 2 with the grate 3 disposed between them, and, supported by the walls, the headers 4 and 5 with the tubes 6 connecting them, the headers being connected by the respective conduits 7 and 8 with the steam and water drum 9. A baffle 10 directs the heated products of combustion from the primary combustion chamber 11 through the pass 12 adjacent to the bridge wall 2, whence the hot gases are carried along the tubes 6 by the baffles 10' and 10'', escape into the chamber 13 containing the drum 9, and flow thence through the flue 14.

A conduit 15 is carried, within the furnace walls, from the top of the drum 9 to a box or header 16 which is supported by the wall 2. A second box or header 17 is

supported above the box 16 and is connected therewith by the bent tubes 18, which are disposed in the primary combustion chamber 11, directly below the tubes 6, in the path of the products of combustion flowing to the pass 12. A conduit 19, within the furnace walls, leads from the box 17 to the drum 20 which is placed in the chamber 13 above the drum 9. A conduit 21, having an inlet at a level above the bottom of the drum 20, leads from this drum to the steam space in the top of the drum 9 and has the automatically closing valve 22 for preventing reverse flow therethrough. A conduit 23, having an inlet lower than the inlet to the conduit 21, leads from the bottom of the drum 20 to the box 16 and has therein the automatically closing valve 24 for preventing reverse flow therethrough.

Steam is generated and evolved from the water circulating through the tubes 6, collects in the top of the drum 9, flows through the conduit 15 to the box 16, thence through the tubes 18 into the box 17, and thence through the conduit 19 into the drum 20. Water collected in the drum 20 may discharge through the conduit 21, down to the top thereof, into the drum 9, and the remainder through the tube 23, the box 16 and the tubes 18 when the pressure of steam from these tubes tending to close the valve 24 is less than the pressure of water from the drum tending to open it. When the fires are banked or are being started and there is insufficient steam or no steam flowing through the tubes 18 of the superheater, the said tubes will be supplied with water from the superheated steam drum or reservoir 20. The evaporating water in the superheater and the steam generated therefrom discharges through the conduit 19 into the drum 20. There is thus provided a separate circuit comprising the superheater tubes and the superheater drum, with means for holding a limited quantity of water in the superheater drum and delivering it to the superheater tubes when the steam ceases to circulate therethrough sufficiently.

The superheater tubes, located so that they are subjected to substantially the same direct action of the fire and consequent high heating effects as the lower generator tubes, are of small bore, preferably about one inch in internal diameter, with consequent high heat transmitting capacity per unit of surface for a given frictional loss or drop in

pressure; with greater ability to withstand high temperatures and with greater range of capacity so as to meet all conditions of operation with safety.

5 To maintain a superheating surface directly exposed to the fire, it is necessary to secure rapid movement of the steam particles in direct contact with the inside superheating surface in order to carry away the
10 heat with sufficient rapidity to keep the temperature of the metal below the danger point. Excessive friction in the superheater tubes is to be avoided since proper circulation is prevented thereby and it is
15 desirable that the loss in pressure due to such friction should not exceed ten pounds at the rated capacity of the boiler, while it is preferable that it should not be more than five pounds. With a given number
20 and length of tubes, both friction and velocity decrease with an increase in the diameter of the tubes until a point is reached where the tubes will be destroyed because the heat is not carried away with sufficient
25 rapidity and also there is a loss in superheating efficiency. If the tubes are large in diameter, in order to obtain the desired degree of superheat and protect the tubes an objectionable resistance, in excess of the
30 practicable drop in pressure, would be developed owing to the internal friction between the particles of steam, which would have no useful effect in the absorption of heat and the protection of the tubes, a
35 comparatively small number of the steam particles coming or being kept in contact with the heating surfaces. In other words, if all of the steam were passed through a
40 single tube of large diameter an excessive and impracticable length of tube and velocity of flow would be required to carry the heat away at the rate necessary for preventing the tube from burning, because of the relatively small proportion of the steam
45 particles in contact with the heating surface per unit of cross section and the high pressure requisite for moving the film of steam in contact with the tube at a sufficiently high rate. In practice it is found
50 that it is not desirable to use a tube of more than about one inch or less than about three-fourths inch internal diameter, the length being determined by the degree of superheat desired and the number by the permissible drop in pressure and the horsepower required. With the practicable
55 length and number of tubes, I have found that for economy, efficiency and safety, their internal diameters should not be more
60 than an inch and a quarter and generally not less than three-quarters of an inch. The lower diameters with proportionately increasing numbers and decreasing lengths are theoretically preferable, but below the
65 given limit increase the expense, while the

diameter of one inch and, with some designs, slightly more have been found capable of withstanding the highest heating effects of the fire. A typical construction that has been used successfully directly over the fire, 70 in a one thousand horse power boiler with the production of one hundred and fifty degrees of superheat at one hundred and seventy-five pounds pressure, comprises
75 fifty tubes, fourteen feet in length and one inch in internal diameter. I have found that a substantial increase in this diameter cannot be made with safety without an impracticable increase in the length or an impracticable decrease in the number of these
80 heater tubes.

It has been proposed to use superheater tubes directly over the fire but they have failed because it was not understood how to prevent them from burning out and attain the efficiency ratio, attained by my improvements. 85

Having described my invention, I claim:

1. In a superheater, the combination of a furnace and a generator having a steam
90 collecting chamber, with a set of superheater tubes exposed to the direct action of the furnace fire, a conduit for carrying steam from said collecting chamber to said superheater tubes, a reservoir, a conduit for carrying
95 steam from said superheater tubes to said reservoir, and a conduit for carrying water from said reservoir to said superheater tubes.

2. In a superheater, the combination of
100 a generator with a set of superheater tubes, a conduit for carrying steam from said generator to said superheater tubes, a reservoir, a conduit for carrying steam from said superheater tubes to said reservoir, a conduit
105 having an inlet above the bottom of said reservoir for carrying water therefrom to said generator, and a conduit for carrying water from said reservoir to said superheater tubes. 110

3. In a superheater, in combination with
110 a generator, a set of superheater tubes, a conduit for carrying steam from said generator to said superheater tubes, a reservoir, a conduit for carrying water from said
115 reservoir to said superheater tubes, a check valve for preventing reverse flow through the second named conduit, and a conduit for carrying water from said reservoir to said generator, said last named conduit having
120 an inlet above the inlet to said second named conduit.

4. In a superheater, in combination with
125 a generator having a steam collecting chamber, a set of superheater tubes, a conduit leading from said collecting chamber to said superheater tubes, a reservoir, a conduit leading from said superheater tubes to said reservoir, a conduit having an inlet
130 above the bottom of said reservoir and lead-

ing therefrom to said collecting chamber, a
check valve for preventing reverse flow
through said conduit last named, a conduit
leading from the bottom of said reservoir
5 to said superheater tubes, and a check valve
for preventing reverse flow through said
last named conduit.

5. In a superheater, the combination of
a furnace and a generator, with a set of
10 superheater tubes, a conduit for carrying
steam from said generator to said tubes, a
reservoir, a conduit for carrying steam from
said tubes to said reservoir, and a conduit
for carrying water from said reservoir to
15 said generator.

6. In a superheater, the combination of

a furnace and a generator, with a set of
superheater tubes, a conduit for carrying
steam from said generator to said tubes, a
reservoir, a conduit for carrying steam from
20 said tubes to said reservoir, and a further
conduit for carrying water from said reser-
voir to said tubes.

In witness whereof I have hereunto set
my name this 24th day of November A. D. 25
1908, in the presence of the subscribing wit-
nesses.

JOHN C. PARKER.

Witnesses:

ROBERT JAMES EARLEY,
CHARLES N. BUTLER.