

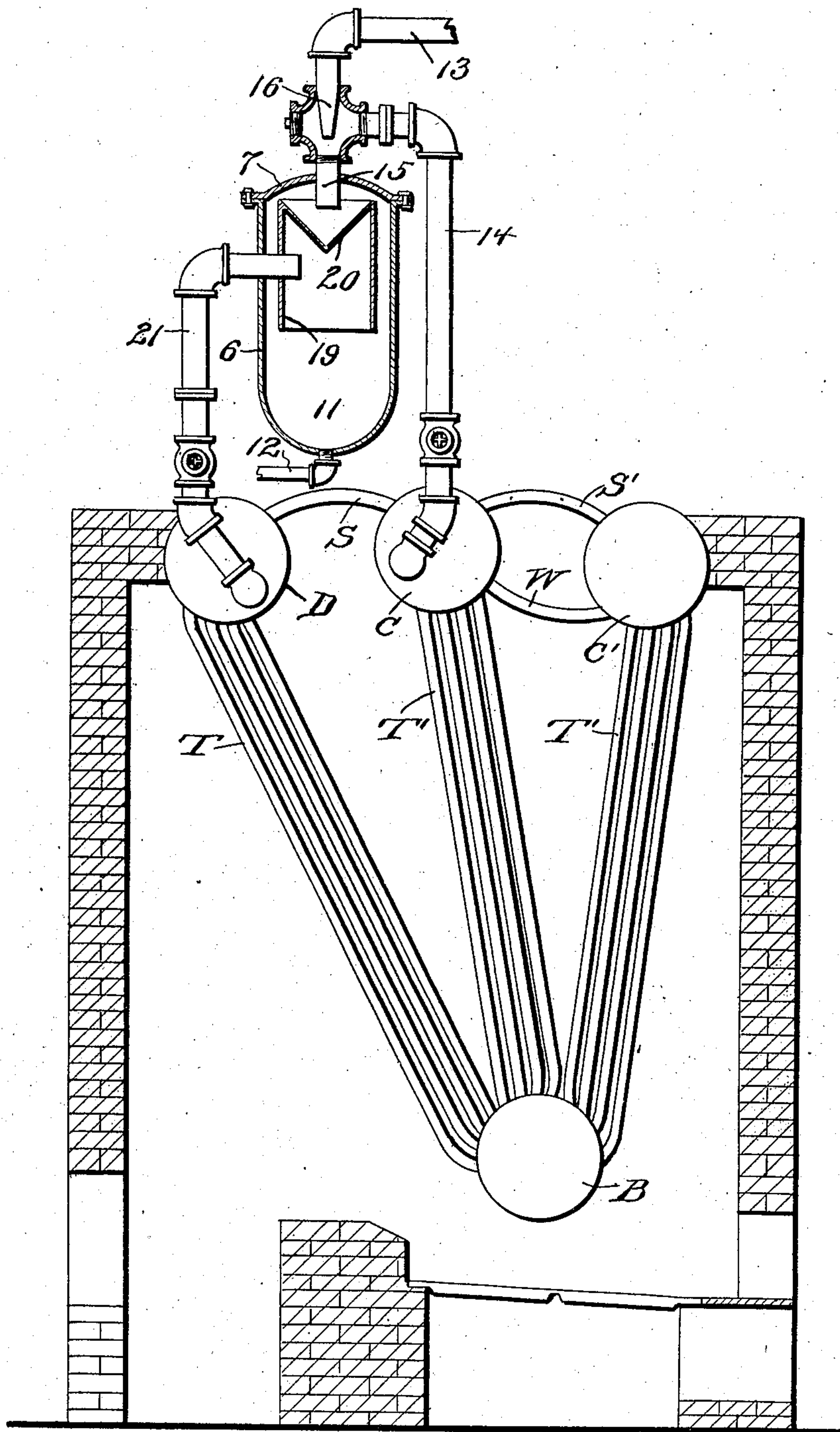
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WATER CIRCULATING APPARATUS FOR STEAM BOILERS.

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WATER-CIRCULATING APPARATUS FOR STEAM-BOILERS.

No. 827,203.

Specification of Letters Patent.

Patented July 31, 1906.

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To all whom it may concern:

Be it known that I, JOHN N. BARNUM, a citizen of the United States, residing at Cleveland, in the county of Cuyahoga and State of Ohio, have invented new and useful Improvements in Water-Circulating Apparatus for Steam-Boilers, of which the following is a specification.

This invention relates to steam-boiler circulation in connection with the purification of the feed-water, the circulation and purification being produced by the combination, with a boiler, of a feed-water purifier (which is also a heater) and which also serves by its action to produce a rapid circulation of water in the boiler.

The solids which form the sediment in a boiler enter by way of the feed-water supply, and heretofore they must either be removed before they enter the boiler or be deposited therein. With this invention a circulation is provided which is continuous through the purifier, and hence any impurities not removed at first may be collected and removed subsequently. A particular advantage of this is that it keeps the whole boiler clean and dispenses with the use of the old mud-drum as such, utilizing it as a steam-generator in addition to the other parts of the boiler.

It is known that a rapid circulation in water-tube boilers is decidedly advantageous, being characterized as the life of a water-tube boiler. It has been found by experiment that a velocity of water of two miles per hour in the tubular system doubled the efficiency of the boiler in heat absorption, and this circulation becomes more important the less the difference in temperature between the heating and heat-receiving elements—that is, the greater the temperature of the water or the nearer it approaches that of the fire the greater the necessity for rapid circulation. Such circulation also reduces the liability of sudden expansion and contraction to a minimum and effects the most positive water-line obtainable in a boiler of the Stirling type. In this type of boiler a difference usually exists between the water-level in the front or steam drums and the water-level in the rear drum, the former being higher and subject, as is well known, to much fluctuation. The invention herein disclosed pro-

vides a connection between these drums otherwise than through the tubes of the boiler, and said connection has a siphon action which tends to correct any difference in level and any excessive fluctuation. This invention avoids the necessity for any storage-space for the storage of impurities which may enter the boiler, because such space detracts just that much from the available effective space of the boiler. With this invention every part of the boiler performs its duty in steam generation.

The circulation is effected by means of water which is taken from the boiler and conveyed to a heating and purifying device located outside the boiler. Such device is conveniently the one shown and described in my United States Patent No. 772,774, and the invention is illustrated in connection with the Stirling boiler, to which the invention is particularly but not exclusively applicable.

The accompanying drawing is a sectional view of a boiler of that kind embodying the invention.

The feed-water heater and purifier comprises a cylindrical vessel 6, which, with its cover 7, forms the outer casing of the heater. At the bottom is a sediment-chamber 11, from which all matter separated from the water and heavy enough to precipitate will be deposited and may be blown out through the pipe 12 whenever desired. The feed-water pipe 13, leading to the heater, is of sufficient capacity to supply the boiler. The hot-water pipe 14 is of sufficient capacity to heat the feed-water to a temperature nearly equal to that of the water in the boiler. The feed-water is discharged through the feed-nozzle 16, which is entirely surrounded by water which enters through the hot-water pipe 14, injecting both feed and heating water through the tube 15, which extends into the hollow of a conical plate 20, which is at all times filled with water and makes the discharge easy. The water then passes over the top of the cylinder 19 and down through the space between said cylinder and the outer casing, after which it takes an upward course through the cylinder 19, which is open at the bottom, to the discharge-pipe 21 and thence to the boiler. It will be noticed that the capacity of the cylinder 19 is large and the ve-

locity of the water in its upward course is greatly reduced, which favors the dropping of sediment in the quiet space 11. This construction is substantially that shown and described in my patent above referred to.

The boiler is of the usual Stirling type, comprising an upper drum D, into which the feed-water enters, connected by tubes T to the lower drum B, which is connected by sets of tubes T' to the pair of steam-drums C and C'. The drums C and D have steam connections S, and the drums C and C' have steam and water connections S' and W.

It is to be noticed that the lower or mud drum B instead of being located beyond the bridge-wall of the furnace is positioned directly over the fire in direct line of the heat, and, in fact, the whole boiler is so placed that all of its parts will receive the most intense heat possible, since with the circulation provided by my invention it is unnecessary that any part of the boiler should be kept cool or relatively cool, all parts being utilized for generation. Heretofore the way these boilers were set about nineteen per cent. of the heating-surface of the boiler absorbed fifty per cent. of the heat, so that this nineteen per cent. of heating-surface generated fifty per cent. of the steam. By my invention and the rapid circulation induced thereby all parts of the boiler may receive a share of the heat and will receive nearer a proper proportion.

The hot-water pipe 14 leads from the middle drum C to the purifier, opening into said drum just below the low-water line and as near said line as possible. The supply-pipe 21 from the purifier dips into the drum D and has its outlet lower than the inlet to the pipe 14. Most of the steam generated by the boiler is generated in the first and second bank of tubes T', whereby the water-line of the first and second drums C' and C is buoyed up and held at a higher level by the rising currents of steam, and any rise of water-level in said drums will accordingly lower the water-level in the drum D, producing a siphon action through the purifier in consequence of the greater weight of water in the leg 21. This action is automatic with the operation of the boiler and is assisted by the injection of water through the feed-water pipe 13 and nozzle 16, the result being that a relatively large quantity of water is drawn up through the pipe 14 and flows down through the pipe 21 after mixing with the feed-water needed to supply the loss by steam. A corresponding circulation is thereby produced down through the bank T and through the drum B and up through the banks T' and the steam-drums C and C'. In short, the purifier and heater and its connecting-pipes form a siphon connection between the drums C and D,

which tends to keep the levels in these drums equal and sets up a continuous water circulation through all parts of the boiler. This circulation is augmented when the feed-pump or injector is in operation, because the weight and force of the feed-water is being added to the longer leg of the siphon. This keeps up a continuous circulation of water through the entire heating system, including the lower drum B, which keeps all parts swept clean of deposits. The purifier performs its heating and purifying function as described in my patent above referred to; but should any matter escape collection in its first passage through the heater it is at once carried by the water-currents through the boiler and to the drum C, where it is picked up by the hot-water pipe 14 and carried again to the purifier. This action is continued as long as the boiler is in operation, whereby all the impurities are collected in the purifier-space 11, and no deposits can find lodgment in any portion of the boiler.

As above indicated, the circulation provided is decidedly advantageous in the generation of steam and greatly increases the efficiency. The change of the so-called "mud-drum" into a steam-generator adds greatly to the efficiency of the boiler. A high temperature is maintained by reason of the circulation throughout all the parts of the boiler.

What I claim as new, and desire to secure by Letters Patent, is—

1. The combination with a steam-boiler having banks of upright water-tubes terminating in headers at the top, of a feed-water heater and purifier having connections with the respective headers arranged to provide a flow of water through the heater and purifier from one header to another, and also having a feed-water supply.

2. The combination with a water-tube boiler having drums at the upper ends of separate banks of upright tubes, of a siphon connecting said drums and embodying a purifying-chamber for the deposit of sediment.

3. The combination with a water-tube boiler of the Stirling type, of a feed-water heater and purifier located above the same and having a hot-water pipe connected to one of the front or "steam" drums and a supply-pipe connected to the rear drum, said heater and pipes providing a circulation between said drums.

4. The combination with a furnace, of a steam-boiler having upper drums and a lower drum, connected by water-tubes, the lower drum being located in the combustion-chamber of the furnace and the upper drums being connected to each other by a siphon into which the feed-water is delivered.

5. The combination with a water-tube boiler having separate drums connected by

water-tubes, of a feed-water heater and purifier having a hot-water pipe which dips below the water in the hotter or "steam" drum and a supply-pipe which dips below the water in the cooler or rear drum, said heater and pipes providing for a flow of water from the former drum to the latter, thereby inducing a circulation through the boiler-tubes.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

JOHN N. BARNUM.

Witnesses:

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