

(No Model.)

2 Sheets—Sheet 1.

J. J. BUSH.
STEAM GENERATOR AND WATER CIRCULATOR.
No. 549,992. Patented Nov. 19, 1895.

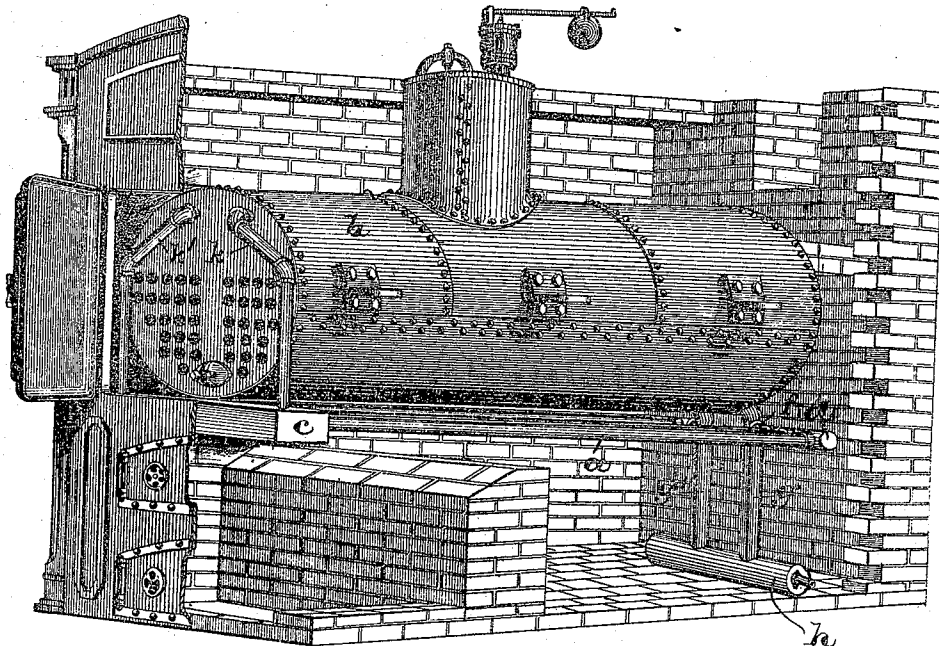


FIG. 1

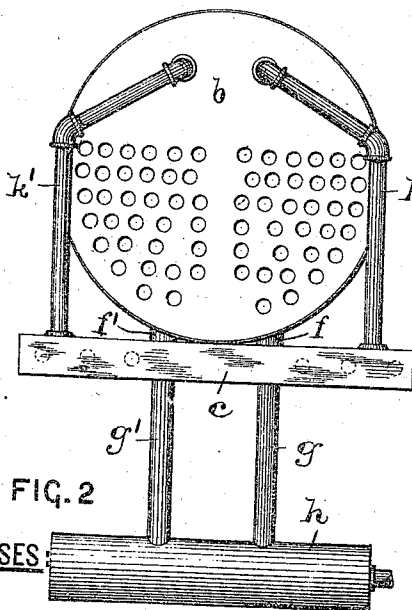


FIG. 2

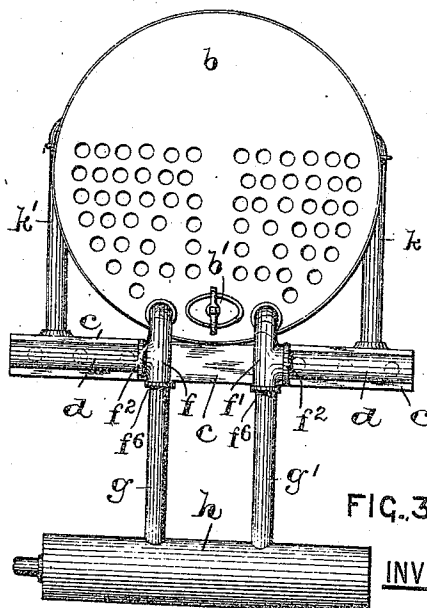


FIG. 3

WITNESSES:

Wm. H. Canfield, Jr.
Walter G. E. Ward

INVENTOR:

BY JAMES J. BUSH.
Fred C. Fraentzel,
ATTORNEY

(No Model.)

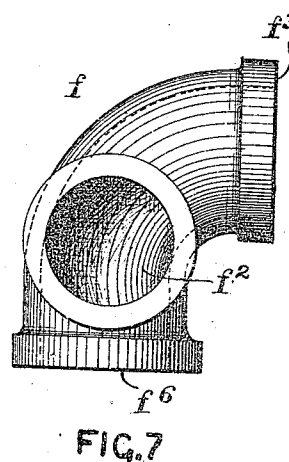
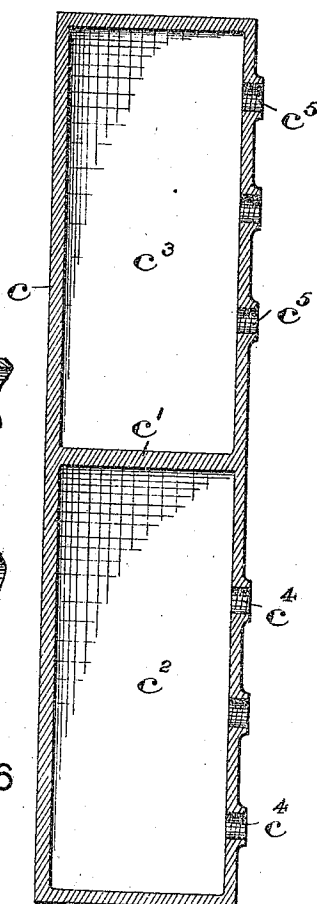
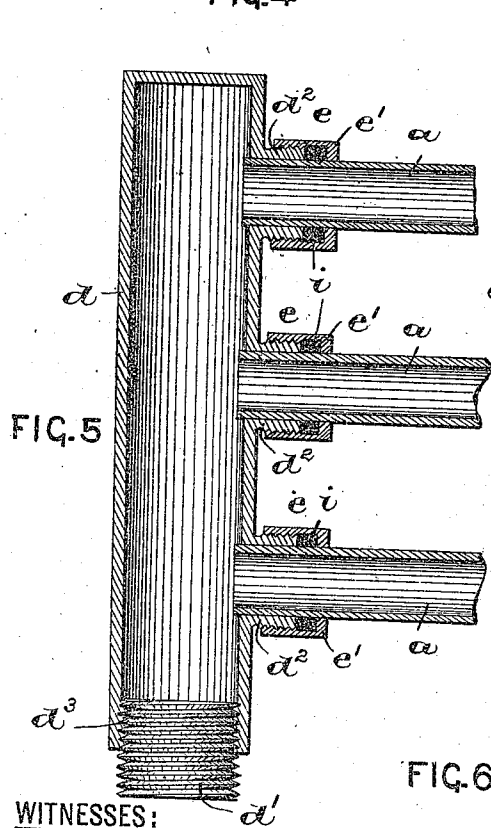
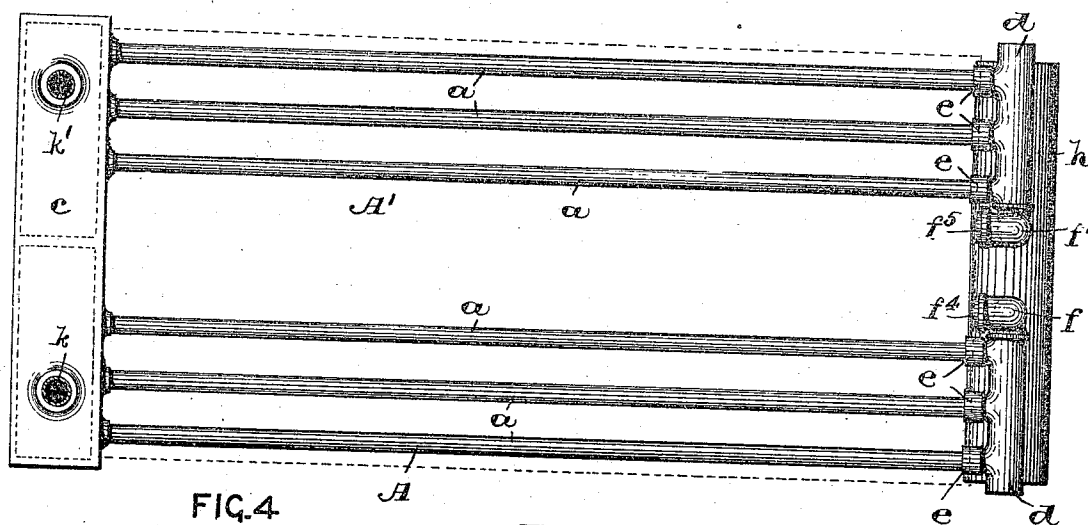
2 Sheets—Sheet 2.

J. J. BUSH.

STEAM GENERATOR AND WATER CIRCULATOR.

No. 549,992.

Patented Nov. 19, 1895.



WITNESSES:

Wm. H. Gamfield, Jr.
Walter G. E. Ward

INVENTOR:

JAMES J. BUSH.

BY

BT
Fred C. Fraentzel,
ATTORNEY

UNITED STATES PATENT OFFICE.

JAMES J. BUSH, OF NEWARK, NEW JERSEY.

STEAM-GENERATOR AND WATER-CIRCULATOR.

SPECIFICATION forming part of Letters Patent No. 549,992, dated November 19, 1895.

Application filed June 14, 1895. Serial No. 552,788. (No model.)

To all whom it may concern:

Be it known that I, JAMES J. BUSH, a citizen of the United States, residing at Newark, in the county of Essex and State of New Jersey, have invented certain new and useful Improvements in Steam-Generators and Water-Circulators; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same, reference being had to the accompanying drawings, and to letters of reference marked thereon, which form a part of this specification.

My present invention has reference to improvements in steam-generators and water-circulators, and is designed to provide an efficient and simply-constructed device, the invention having for its main purpose to prevent incrustation of the shell of the boiler; to produce a constant and positive circulation of the water through the same; to provide a means whereby when the fire is hottest on the one side of the furnace a positive circulation of the water must result, the construction being such as to prevent the "backing up" of the steam in the generator-pipes, whereby superheated steam is caused and results in the burning out of the pipes, and, finally, to heat the water in the boiler to a high degree and generate steam more rapidly than under ordinary circumstances, all of which is accomplished by an economical and simply-constructed device without adding greatly to the cost of the boiler.

In my previous Letters Patent Nos. 447,865 and 447,866, granted March 10, 1891, I have shown a construction of water-heater and steam-generator consisting of a series of pipes underneath the boiler, (arranged in pairs,) each series being in communication at one end through couplings, which are rectangular in shape, and communicating at the other end through a water-box, both of said series of pipes leading into one and the same chamber in said water-box. I have found that the construction of couplings and the water-box employed and as set forth in my said previous Letters Patent hereinabove mentioned is impractical, for the reasons that the rectangular couplings cannot be used on account of the limited space at the lowest portion at the

back of the boiler, and also that when the water-box is made with one continuous chamber, when the fire is hottest on one side in the furnace, the water will be caused to circulate directly through said continuous chamber from one series of pipes to the other series of pipes, instead of passing directly into the boiler, thereby generating superheated steam in the pipe-sections and finally resulting in the burning out of the pipes. In my present invention I have successfully overcome these serious difficulties, and the invention therefore consists, first, in the novel construction of steam-generator and water-circulator as a complete device; second, in the novel construction of expansion-header provided with slip-joints; third, in the novel construction of a partitioned water-box; fourth, in the novel arrangement and combinations of these parts with certain other parts to form an efficient and successfully-operating steam-generator, and, finally, the invention consists in the details of construction of certain other parts and such minor arrangements and combinations of parts, as will be hereinafter fully described, and finally embodied in the clauses of the claim.

The invention is illustrated in the accompanying sheets of drawings, in which—

Figure 1 is a perspective view of a boiler and the improvement applied thereto. Fig. 2 is a front end view, and Fig. 3 a back end view, of the boiler and steam-generator and water-circulator. Fig. 4 is a plan view of the sections or series of piping, expansion-headers, water-box, and the various connections comprising my novel form of steam-generator and water-circulator. Fig. 5 is a horizontal section of one of the expansion-headers and its slip-joints to allow for the expansion and contraction of the generator-pipes connected with the header. Fig. 6 is a horizontal section of my novel form of partitioned water-box connected with the heater or generator pipes, and Fig. 7 is a side view of a novel form of elbow used in connection with my present invention.

Similar letters of reference are employed in each of the above-described views to indicate corresponding parts.

Referring to said drawings, *b* indicates a suitable construction of boiler, with parts of

the side walls of the furnace broken away, clearly illustrating the arrangement and application of my novel form of steam-generator and water-circulator to this type of boiler.

5 My novel form of steam-generator and water-circulator is arranged within the combustion or flame chamber of the furnace in close proximity to the boiler, and consists, essentially, of a series of heater or generator pipes
10 a , arranged in two series to both sides of a central dividing-line through the middle of the boiler, as clearly illustrated in Fig. 4. For the sake of clearness in the following description I shall hereinafter designate these two
15 series of pipes by the reference-letters A and A'. The pipes in each series A and A' communicate at the front with a suitable water-box c , having a centrally-placed wall or partition c' forming two chambers c^2 and c^3 , the
20 pipes a in the series A being connected with openings or holes c^4 in the wall of the chamber c^2 and the pipes a in the series A' being connected with openings or holes c^5 in the wall of the chamber c^3 . At the rear said pipes
25 connect with the slip-joints e on the suitable teats of a pair of expansion-headers d , substantially as illustrated in Figs. 4 and 5. Said headers d are open at their ends near the center line of the boiler, being provided with
30 suitable nipples d' or other suitable means for connecting the ends d^3 of the headers d with an opening f^2 in the specially-constructed elbow-fittings f and f' . In the upper openings of the respective elbows are fitted short
35 pieces of piping f^4 and f^5 , (see Fig. 4,) secured in the end of the boiler to establish direct communication with the lower part of the said boiler. Directly connected with the lower
40 openings f^6 of said elbows are the vertical pipes g and g' , which communicate with the mud-drum h , as clearly illustrated in Figs. 1 and 3.

My novel construction of elbow (illustrated more particularly in Fig. 7) permits me to tap
45 the boiler b at the lowest possible point, on both sides of the hand-hole b' , (see Fig. 3,) and connect the same with the ends of the comparatively-large expansion-headers without interfering with the utility of the hand-hole
50 and the parts of the appliance applied to the boiler. In my previous patents hereinabove mentioned the expansion-joints set forth therein are cumbersome and useless in that,
55 owing to the arrangement of the connecting-pipes in the center of the joint-fittings, the latter are brought too closely to the hand-hole in the end of the boiler and interfere with the utility of the said hole, preventing the
60 workman from removing the cover over said hole when necessary. This is a very serious objection and has been successfully obviated by the use of my novel form of elbows (illustrated in Fig. 7) and the manner of connecting
65 the same with the expansion-headers d .

Each pipe a in the series A and A' is loosely arranged in an opening in certain screw-

threaded teats or enlargements d^2 on the said headers, and a steam-tight joint is made by slipping the perforated caps e' over the ends
70 of said pipes a and screwing them down upon said teats, with a suitable packing i behind said caps, in the manner substantially as illustrated in Fig. 5. The front ends of said pipes
75 a being permanently fixed in the holes or openings in said partitioned water-box c will cause said pipes to expand in a direction toward the back of the boiler, said pipes slipping
80 back and forth in the slip-joints of said headers when they expand or contract, as will be readily understood.

As has been previously stated, the pipes f^1 and f^5 are in communication with the lower part of the boiler and the chambers c^2 and c^3 are respectively connected by means of pipes
85 k and k' with the upper portion of the boiler above the water-line thereof.

I have found by experience that when the two series of pipes A and A' communicate with
90 but one and the same chamber in the water-box, when the fire is hottest on one side of the furnace a circulation of water will be caused from the section of pipes on the hottest side to the series of pipes on the colder
95 side, resulting in generating superheated steam in the pipes and hence causing the early destruction of the same.

When the water-box c is provided with a partition, forming chambers, and with each
100 of which but one series or section of pipes a is in direct communication, an independent circulation of the water will be caused through each series of pipes, its respective chamber in
105 the water-box, and finally through the boiler and back into the series of pipes, irrespective of the intensity of the heat of the fire at any point of the furnace, and a perfectly-operating device for the purposes for which it is intended will be the result.

Of course it will be understood that each series of pipes A and A' may comprise therein
110 any suitable number of pipes a , usually ranging from two to eight pipes in each series. It will also be understood that the water-box c may be provided with several partitions, if
115 desirable, forming within said box more than two chambers.

As will be seen from an inspection of Fig. 1, the water-box c can be employed to take
120 the place of the usual form of brick arch employed in furnace constructions, and the heat heretofore wasted by absorption now materially assists in the generation of steam, as will be evident.

Of course it will be evident that many other modifications of the construction shown and
125 described may be made without departing from the scope of my present invention, and I therefore do not limit my invention to the exact arrangements and combinations of the parts herein shown.

By my novel arrangement and combinations of parts I have virtually devised two

independently-operating steam-generators and water-circulators used in connection with one boiler, resulting in a positive, continuous, direct, and unobstructed flow of the water through the sections or series of pipes, chambers in the water-box, and the boiler, the water being taken at the lower part at one end and being delivered at the top of the boiler, whereby the circulation is such to prevent any deposition of dirt, sediment, or other foreign substances on the inner surface of the boiler, all such substances being duly deposited in the mud-drum.

Having thus described my invention, what I claim is—

1. The combination, with a boiler, of a steam generator and water circulator, consisting of a series of pipes, as A and A', arranged immediately below the boiler and in the fire box or flame-chamber, communicating with the lower portion of the rear end of the boiler, and at the other end of said pipes, a partitioned water box forming separate chambers with which said series of pipes are independently connected, and means for establishing communication between said box and the boiler at or near the top thereof, substantially as and for the purposes set forth.

2. The combination, with a boiler, of a steam generator and water circulator, consisting of a series of pipes, as A and A', arranged immediately below the boiler and in the fire box or flame-chamber, communicating at one end through expansion headers, as d, having slip joints e, and a pipe at one end of each header which communicates with the boiler at or near the bottom thereof, and at the other end of said series of pipes, a partitioned water box forming separate chambers with which said series of pipes are independently connected, and pipes connected with said box for establishing communication between said box and the boiler at or near the top thereof, substantially as and for the purposes set forth.

3. The combination, with a boiler, of a steam generator and water circulator, consisting of a series of pipes, as A and A', arranged immediately below the boiler and in the fire box or flame-chamber, communicating at one end through expansion headers, as d, having screw-threaded teats d², a perforated cap e' on each teat and a packing in each cap, forming slip joints, a pipe at one end of each header which communicates with the boiler at or near the bottom thereof, and at the other end of said series of pipes, a partitioned water box forming separate chambers with which said series of pipes are independently connected, and pipes connected with said box for establishing communication between said box and the boiler at or near the top thereof, substantially as and for the purposes set forth.

4. The combination, with a boiler, of a steam generator and water circulator, con-

sisting of a series of pipes, as A and A', arranged immediately below the boiler and in the fire box or flame-chamber, communicating at one end through expansion headers, as d, having slip joints e, an elbow at one end of each header, said elbows having openings f², f³ and f⁶, pipes in said elbows connecting them with the boiler at or near the bottom thereof, pipes also connecting said elbows with a mud drum, and at the other end of said series of pipes, a partitioned water box forming separate chambers with which said series of pipes are independently connected, and pipes connected with said box for establishing communication between said box and the boiler at or near the top thereof, substantially as and for the purposes set forth.

5. The combination, with a boiler, of a steam generator and water circulator, consisting of a series of pipes, as A and A', arranged immediately below the boiler and in the fire box or flame-chamber, communicating at one end through expansion headers, as d, having slip joints e, and a pipe at one end of each header which communicates with the boiler at or near the bottom thereof, and means at the other ends of said series of pipes, for establishing communication at or near the top of the boiler, substantially as and for the purposes set forth.

6. The combination, with a boiler, of a steam generator and water circulator, consisting of a series of pipes, as A and A', arranged immediately below the boiler and in the fire box or flame-chamber, communicating at one end through expansion headers, as d, having screw-threaded teats d², a perforated cap e' on each teat, and a packing in each teat, forming slip joints, and a pipe at one end of each header which communicates with the boiler at or near the bottom thereof, and means at the other ends of said series of pipes, for establishing communication at or near the top of the boiler, substantially as and for the purposes set forth.

7. The combination, with a boiler, of a steam generator and water circulator, consisting of a series of pipes, as A and A', arranged immediately below the boiler and in the fire box or flame-chamber, communicating at one end through expansion headers d, having slip joints e, an elbow at one end of each header, said elbows having openings f², f³ and f⁶, pipes in said elbows for connecting them with the boiler at or near the bottom thereof, pipes also connecting said elbows with a mud drum, and means at the other ends of said series of pipes, for establishing communication at or near the top of the boiler, substantially as and for the purposes set forth.

8. The herein described header d, for a steam generator and water circulator, having screw-threaded teats, as d², perforated caps e' on said teats, and a packing between said teats and caps, and an opening d³ in one end

of said header, adapted to receive a nipple, substantially as and for the purposes set forth.

9. The herein described water box *c*, for a steam generator and water circulator, having
5 a partition or wall *c'* integral with the inner sides on the box forming chambers *c*² and *c*³, substantially as and for the purposes set forth.

In testimony that I claim the invention set forth above I have hereunto set my hand this 13th day of June, 1895.

JAMES J. BUSH.

Witnesses:

FREDK. C. FRAENTZEL,
WM. H. CAMFIELD, Jr.