(No Model.) 2 Sheets—Sheet 1.

G. H. BABCOCK, S. WILCOX & N. W. PRATT.

STEAM BOILER.

No. 261,122. Patented July 18, 1882.

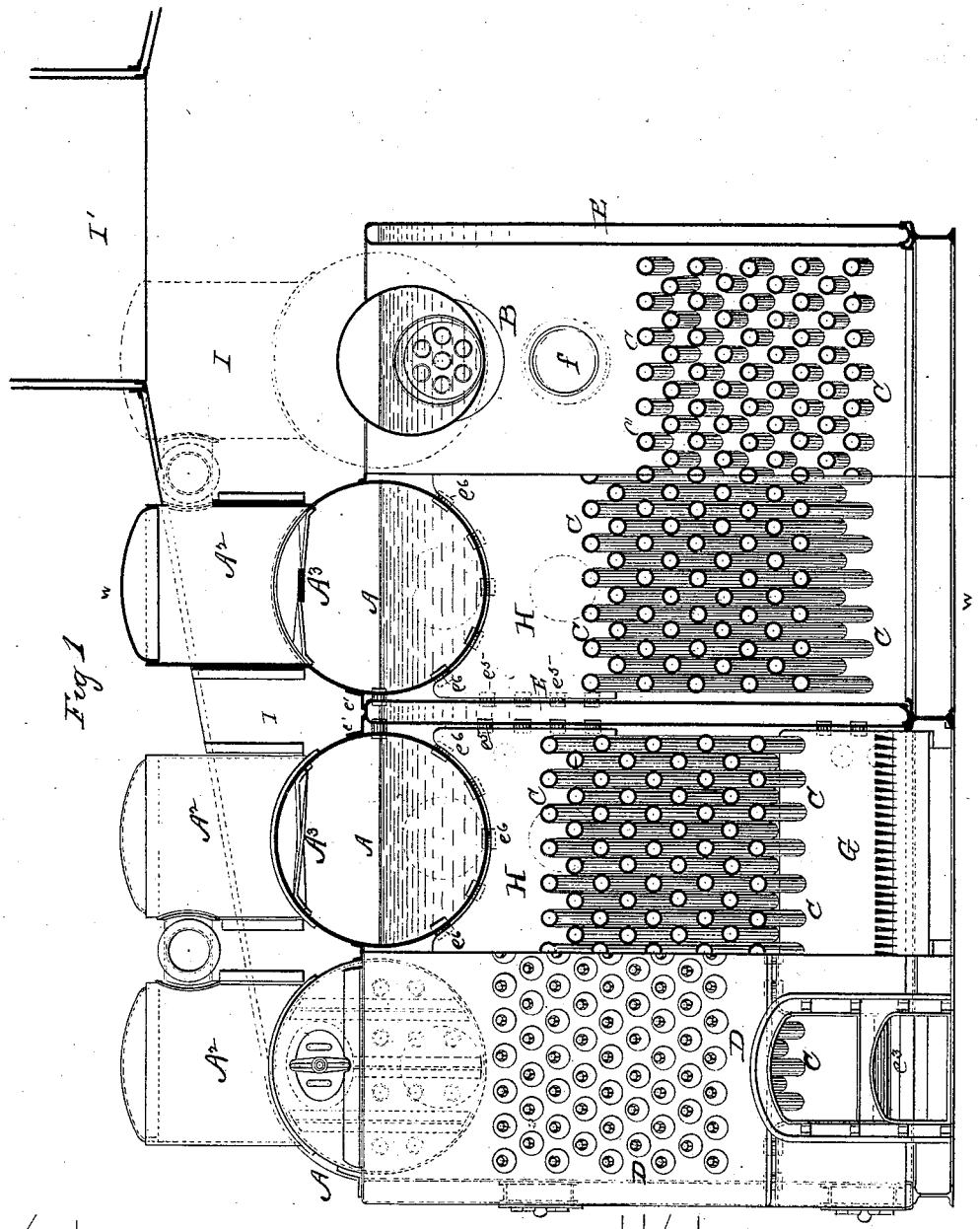

Fig 1

WITNESSES

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B. E. D. Stafford.

INVENTORS

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(No Model.) 2 Sheets—Sheet 2

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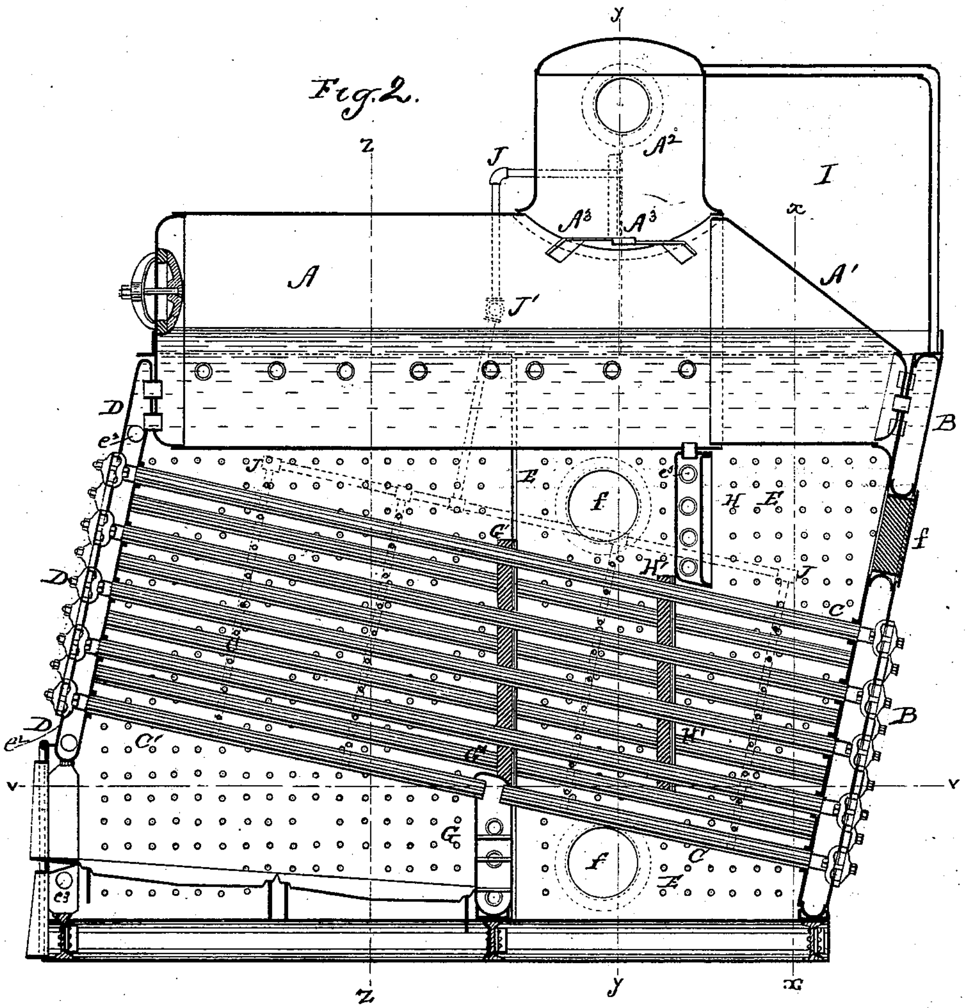
Fig. 2.



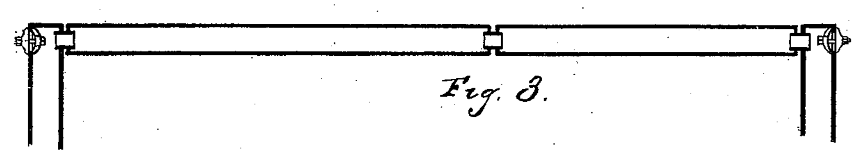


Fig. 3.

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UNITED STATES PATENT OFFICE.

GEORGE H. BABCOCK, OF PLAINFIELD, NEW JERSEY, AND STEPHEN WILCOX AND NATHANIEL W. PRATT, OF BROOKLYN, NEW YORK, ASSIGNORS TO THE BABCOCK & WILCOX COMPANY, OF NEW YORK, N. Y.

STEAM-BOILER.

SPECIFICATION forming part of Letters Patent No. 261,122, dated July 18, 1882.

Application filed September 13, 1881. (No model.)

To all whom it may concern:

Be it known that we, GEORGE H. BABCOCK, a citizen of the United States, residing at Plainfield, in the county of Union, State of New Jersey, STEPHEN WILCOX, a citizen of the United States, residing in Brooklyn, in the county of Kings, State of New York, and NATHANIEL W. PRATT, a citizen of the United States, residing at Brooklyn aforesaid, have invented certain new and useful Improvements relating to Steam-Boilers, of which the following is a specification.

Our improvements pertain to that class in which a number of inclined tubes extend through the furnace with an active circulation of water and steam through them, the water descending at the back connections and rising, mingled with steam, through front connections into a barrel or separating-chamber above. We make the barrel of the boiler tapered at the back end; but instead of tapering concentrically the lower side is straight quite to the end, the taper being all on the top and sides. It is, in brief, a truncated cone set obliquely relatively to the cylindrical portion, so that its lower side is in line with the bottom of the cylindrical part. The casing in which the boiler is inclosed extends straight or without taper. The spaces provided by the tapering form of the boiler at the rear serve as uptakes for the flow of the hot gases from the furnace to the chimney. When a number of our boilers are placed side by side and used together, as is the case where liberal quantities of steam are required—on shipboard, in manufactories, or elsewhere—the casing is extended across the rear of several of the boilers, rising at an inclination to collect the gases from several boilers into one stack or chimney. We provide a drum or dome on the top of each separating chamber or barrel and brace or stay strongly across the bottom to compensate for the weakening due to the breaking of the continuity of the barrel by the aperture thus formed. We place the dome as far as practicable away from the agitation, which occurs at the front, where the steam is delivered from the tubes. We form the front and back connections from the barrel to the tubes of boiler-iron, instead of castings, as have been usually employed for the purpose; but in what we esteem the most perfect form of the invention we employ castings to make the seats for the covers of the holes which are opposite to the tubes, and so construct and apply the castings that they extend across and serve as stays. All this part relating to the front and back connections is made the subject of a separate application for Letters Patent, and need not be further referred to here. We provide water-legs formed from sheets of boiler-iron properly stayed at little distance apart, and so connect these that there is a liberal circulation of water and steam in them, the water descending in the connections and circulating through the sides. The sides are connected to the barrel, and also to the front and back connections, by short tubes or thimbles. We provide a water-bridge at the rear end of the grate, connected to the sides and to the lower series of tubes, so that there is an active circulation through it. We provide a hanging water-bridge connected to the barrel and to the sides, so that an active circulation obtains through it. We provide fixed tubes with provisions for supplying steam from the barrel at intervals, as required, and having nozzles arranged at the proper levels to blow strongly through the spaces between the several tubes to clear them from accumulations of soot and ashes. This being caused to throw a strong blast of steam at intervals, varying with the kind of coal and other conditions, keeps the exterior of the tubes clear and this important portion of the boiler in its most efficient condition with very little trouble.

The accompanying drawings form a part of this specification, and represent what we consider the best means of carrying out the invention.

Figure 1 is a front elevation, partly in section. This figure shows half of a set of eight barrels or separating-chambers, with their accompanying parts. They are aggregated together so as to constitute a single steam-generating apparatus. The barrels are more intimately associated in pairs, each pair being

mounted over a single furnace and divided from the adjacent pair by a water-leg or water-space. The boilers of each pair are also connected near the upper portions of their drums, and the steam is taken to the main steam-pipe (not represented) by branches to the short connecting-pipe thus formed. The barrel on the left and its entire accompaniments are represented in front elevation, simply the doors of the furnace and ash-pit being removed. The three remaining parts of Fig. 1 show the several barrels and the parts immediately connected therewith sectioned in different planes, the second barrel adjacent to the one on the left being sectioned on the line *z z*, the next on the line *y y*, and the last on the line *x x*, Fig. 2. Fig. 2 is a vertical section through a boiler on the line *w w*, Fig. 1, and Fig. 3 is a horizontal section of certain parts on the line *v v*, Fig. 2.

Similar letters of reference indicate like parts in all the figures.

A is the cylindrical portion of the barrel, and A′ the tapered back end. The axis of the tapered portion is so inclined relatively to the axis of the cylindrical portion that, whether the water is low or high, it always bathes the small end and insures that there shall be an active circulation through the whole apparatus, the water being largely mingled with steam at the front and middle portions, but nearly free from steam at the small end. The dense water flows out through the thimbles at the small end into the back connection, B, in which it descends and is distributed into the lower and hotter portions of the boiler, which expose a great heating-surface and make steam rapidly.

C C are the inclined pipes which communicate between the back connection, B, and the front connection, D. The front connection communicates with the front end of the barrel A through thimbles, as shown.

E E are extended plane sheets of boiler-iron, liberally stayed, so as to withstand a high temperature, and arranged to form sides, which we will term "water-legs." They are connected to the side of the back connection by thimbles *e* at the base. These deliver a constant supply from the back connection into the base of the rear part of the water-leg E. It will be observed that the water-leg is not in one continuous sheet from the front to the back, but that there is a dividing-line down the middle. We make each water-leg in two separate parts for greater facility of transportation and repairs. The lower part of the rear section of each water-leg is connected to the front part by one or more thimbles near the base, (not represented,) through which the dense water is transmitted into the front section, and all contribute to the efficient heating-surface. The steam generated in the water-legs escapes into the barrel A through the thimbles e'. There are man-holes *f* through the back connection and through the water-legs, which allow access when required. They are provided with suitable covers (not shown) when the boiler is at work. There are thimbles e^2, which connect the front portion of the water-legs with the front connection, D. A pipe, e^3, extends across under the furnace-door, and serves as a means for free communication of water from one water-leg to another, as also for a brace between the parts.

G is a water-bridge, formed of boiler-iron strongly stayed and extending up from the bottom of the structure. Near the top it is deflected downward, so as to have the same inclination as the front and back connections, B and D. The lowermost tubes are in two lengths, connecting respectively to the front and back sides of this water-bridge. The water can circulate through them in the ordinary way from the extreme rear of the rear length through the water-bridge to the extreme front of the front length. There is also a sufficient interval or space within the water-bridge between the two ends, so that the steam generated in the water-bridge may also join that current and flow out through the forward length of the two. The water-bridge is connected at each side to the respective water-legs by thimbles e^4. Dense water is received through these into the water-bridge, and thus active circulation is secured through this important part of the apparatus.

H is a hanging bridge, also formed of strong boiler-iron riveted and kept filled with water. It constitutes additional heating-surface. It is connected with the water-legs E by thimbles e^5, and with the lower portion of the barrel A by thimbles e^6.

G′ is an extension upward, formed of metal defended with fire-brick.

H′ is an extension downward from the hanging bridge H, similarly made. The effect of the bridge G and its extension G′ is to compel the gases from the furnace to circulate upward across the entire mass of tubes C. The effect of the hanging bridge H, with its extension H′, is to compel the hot gases to again circulate downward across nearly all the tubes. The hot gases then rise again across the tubes C and flow upward past the tapered rear ends, A′, of the barrel into a gas-passage or breechen, I.

It will be understood that the tapered portion A′ at the rear of the barrel affords liberal spaces, which would appear triangular in a plan view, through which the gases can flow upward from the rear end of the furnace or combustion-chamber below. The breechen I may be formed of sheet metal covered with thin bricks or other good non-conductor. The height of the smoke-passage or breechen I increases from left to right in the drawings. If the other four barrels, A A′, of this set were shown, they would appear to the right of those here represented. The breechen over that other portion would increase in height from the right to the left.

I′ is a stack in which the gases are allowed to flow upward to the required height and discharged into the atmosphere.

J J are what we term "blow-pipes." They connect at the upper end with steam-drums A^2, and are provided with cocks J′, by which their action can be controlled. They extend downward within the furnace to or near the level of the lower series of pipes C, and are provided with nozzles J^2, through which a strong blast of steam is directed across the spaces between the tubes when the cock J′ is open. By opening these cocks J′ at proper intervals the soot and the ashes are blown off from the tubes C, and the exterior of these tubes is kept clean and ready to absorb heat efficiently. A single cock, J′, controls the supply of steam to all the nozzles in one complete set, so as to blow the ashes from the entire length of a quantity of the pipes C. The joining of the dome A^2 to the barrel involves a considerable weakening of the latter if all that portion of the barrel covered by the dome is cut away. We prefer to cut away all that and to strongly tie or brace across the junction of the dome to the barrel by cross-braces A^3.

Modifications may be made in many of the details. Parts of the invention may be useful without the whole.

Instead of nesting together two barrels and supplying each pair with a single grate and taking steam from the pair as from one barrel, three or other required number may be similarly nested together; or the boilers may be worked, if desired, without nesting, but providing a separate furnace for each barrel and its adjuncts, and taking steam from each separately. We prefer the constructions and proportions shown. It will be observed that there is one water-leg, E, to each pair of barrels A and the next adjacent pair.

The tapering portion A^3 possesses the full strength due to its circular form. Its arrangement with its lower side coincident with the line of the bottom of the cylindrical portion allows the circulation to continue so long as there is any water in the barrel.

We claim as our invention—

1. In a steam-boiler, the barrel described, composed of a cylindrical horizontal portion, A, and a tapered end, A′, arranged as shown, in combination with a furnace at a lower level, and with pipes C and connections B D, substantially as herein specified.

2. In a steam-boiler, the barrel A A′, dome A^2, and stays A^3, combined as and for the purposes herein specified.

3. In a steam-boiler, the independently-formed sectional water-legs E, in combination with the barrel A A′ and connections for insuring an efficient circulation of water, as herein specified.

4. In a steam-boiler, the water-bridge G and suitable connections for supplying dense water thereto, in combination with inclined pipes C, communicating therewith, and with connections B D to a suitable barrel, A A′, as herein specified.

5. In a steam-boiler, the hanging bridge H and thimbles e^5 e^6, in combination with the barrel A A′, tubes C, and connections B D, as herein specified.

In testimony whereof we have hereunto set our hands in the presence of two subscribing witnesses.

GEO. H. BABCOCK.
S. WILCOX.
NAT. W. PRATT.

Witnesses:
CHARLES A. KNIGHT,
CHARLES C. STETSON.