(No Model.) 4 Sheets—Sheet 1.

J. P. SERVE.

INTERIOR FURNACE FOR STEAM BOILERS.

No. 552,009. Patented Dec. 24, 1895.

Fig. 1.

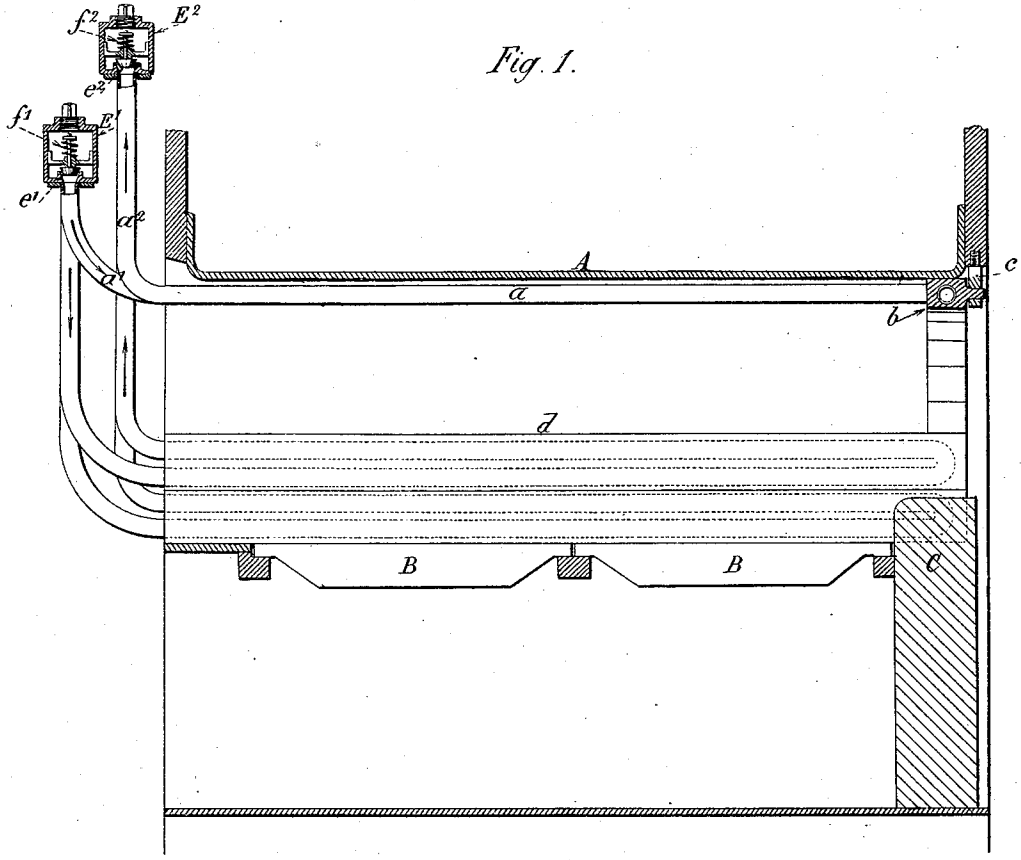
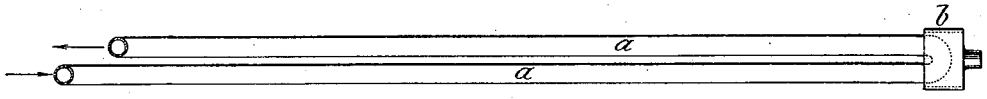


Fig. 3



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(No Model.) 4 Sheets—Sheet 2.

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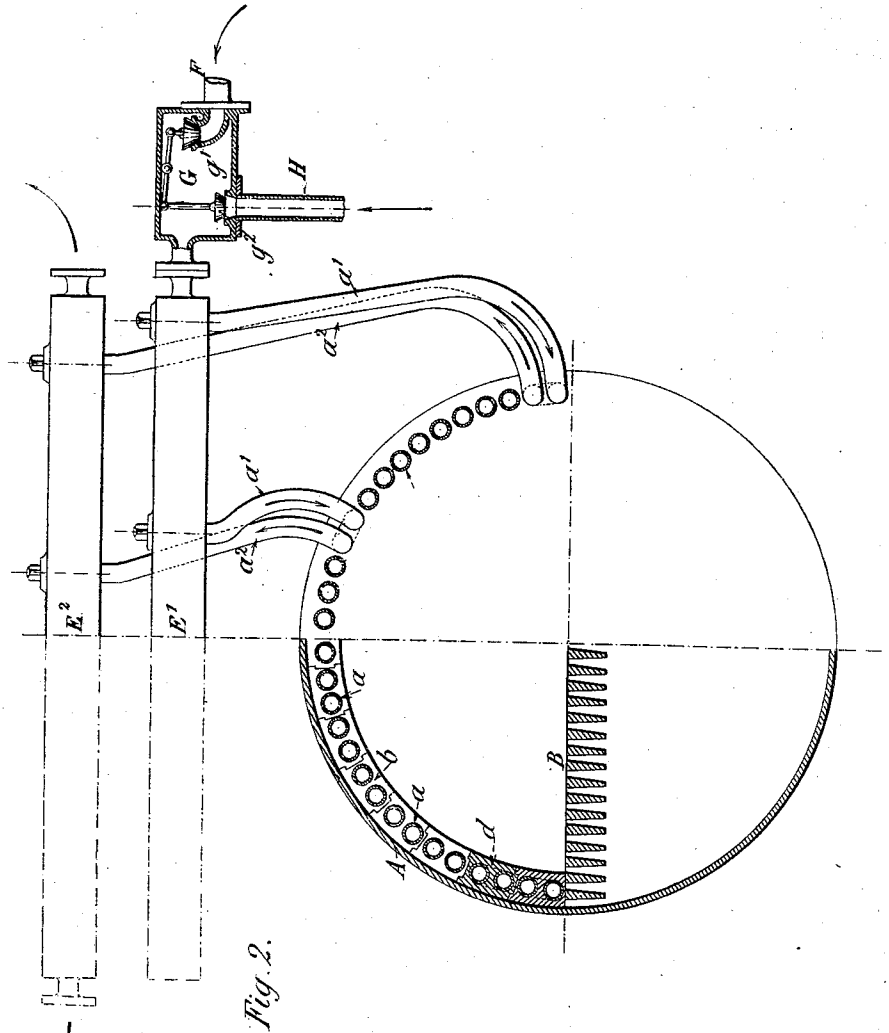

Fig. 2.

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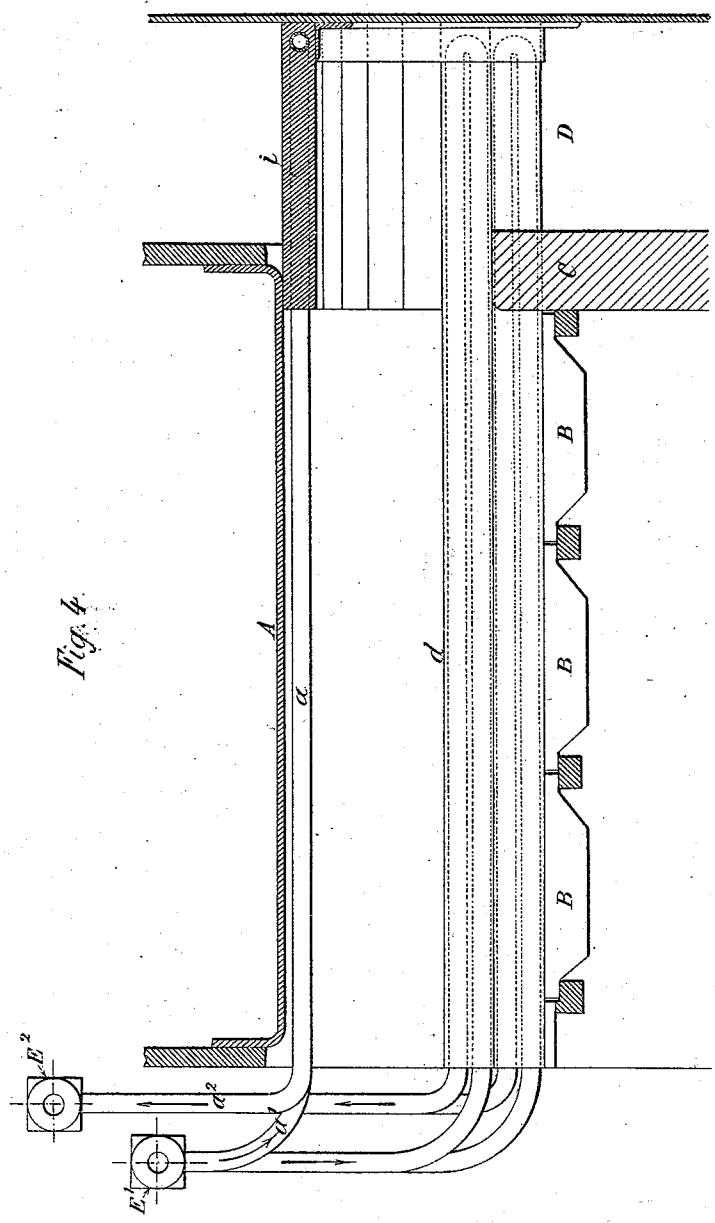

Fig. 4.

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INTERIOR FURNACE FOR STEAM BOILERS.

No. 552,009. Patented Dec. 24, 1895.

Fig. 5.

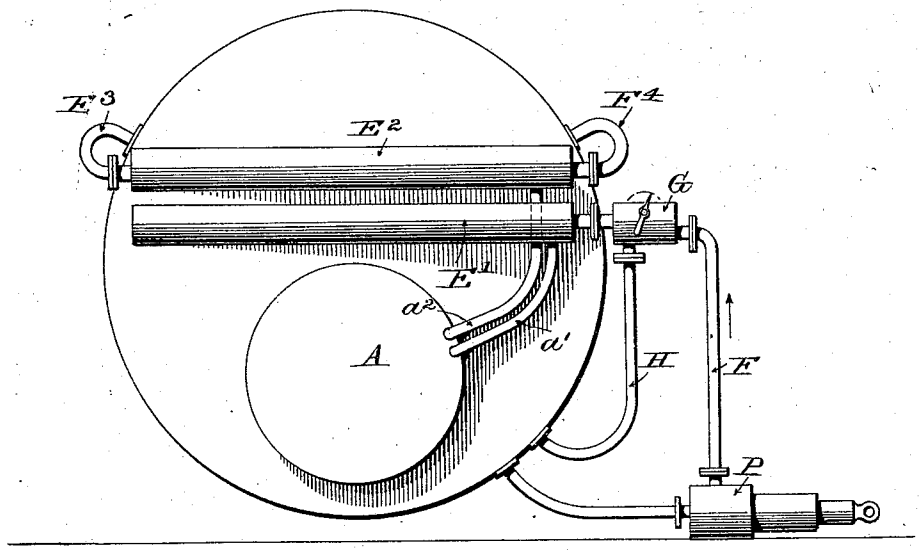
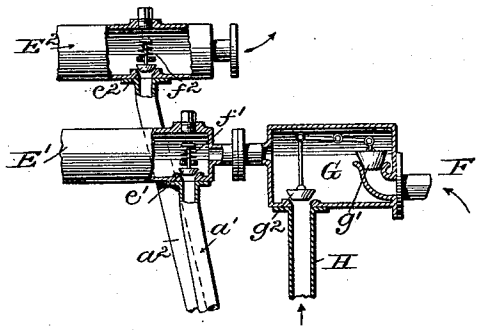


Fig. 6.



WITNESSES

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UNITED STATES PATENT OFFICE.

JEAN PIERRE SERVE, OF PARIS, FRANCE.

INTERIOR FURNACE FOR STEAM-BOILERS.

SPECIFICATION forming part of Letters Patent No. 552,009, dated December 24, 1895.

Application filed July 10, 1894. Serial No. 517,057. (No model.)

To all whom it may concern:

Be it known that I, JEAN PIERRE SERVE, engineer, a citizen of the Republic of France, residing at Paris, France, have invented certain new and useful Improvements in Interior Furnaces for Steam-Boilers, of which the following is a specification.

This invention relates to improvements in the furnaces of steam-boilers, in which the air-feed is produced by mechanical means for obtaining a more active combustion than by the draft of the chimney alone.

It has also for its object to effectively protect the parts of these boilers which are exposed to the direct action of the fire and thus to avoid the serious deterioration which is frequently produced in the plates of the furnace in consequence of the very high temperature developed there.

The surface of the furnace situated above the grate is provided with a series of tubes of small diameter, in which a sufficiently-active circulation of water is maintained by means of a pump to prevent this water being transformed into steam during its passage through these tubes.

The invention will now be described, reference being made to the accompanying drawings, in which—

Figure 1 is a vertical longitudinal section showing the furnace of a boiler provided with my improvements. Fig. 2 is a transverse section. Fig. 3 is a detail view of one of the circulating-tubes. Fig. 4 is a longitudinal section showing a modification of the apparatus. Fig. 5 is a front elevation of the boiler, showing the arrangement of the pipes for securing a forced circulation of the water in the boiler through the small circulating-tubes. Fig. 6 is a section on an enlarged scale showing the automatically-operating valves controlling the flow of the water.

On the drawings, A is the internal furnace of the boiler, B is the grate, C is the bridge, and D the combustion-chamber.

As may be seen in Figs. 1 and 2, the part of the furnace A situated above the grate B is provided with a continuous series of circulating-tubes arranged in pairs, each being formed of a tube *a*, bent back on itself, as shown in Fig. 3. The two free ends of each pair of tubes pass through the front plate of the furnace, which serves as a support for them and are connected with water-circulating apparatus which will be described hereinafter, and the elbow of each pair is inserted in a block *b*, of cast-iron, steel or the like, of the form of a keystone or arch-block in such a way that when these blocks are placed together they form a vault or dome, which keeps in place the ends of the tubes *a* at the back of the furnace. In order to give more solidity to this collection of blocks *b*, each block is provided with a projecting flange intended to fit into a socket *c*, screwed in the plate of the boiler. It is evident that I can, if desired, support the tubes *a* at certain points of their length, providing at these points blocks similar to those hereinbefore described and forming a dome or vault or by fitting thereon metallic rings, which may be fixed by means of bolts to the plate of the furnace.

The first pairs of tubes *a* placed above the grate B are embedded in a rectangular cast-metal casing *d*, which forms a solid wall with an internal circulation of water into which the clinkers cannot penetrate.

In order to produce in the tubes *a* a circulation of water sufficiently active to prevent steam being produced, the free ends of these tubes are connected by means of passages a' and a^2 with two vessels E′ E^2 placed on the front of the boiler or in any other suitable position. One of the vessels E′ receives from a powerful pump *p*, Fig. 5, water drawn from the bottom of the boiler through pipes F′ and F, while the other vessel E^2 communicates with the upper part of this boiler by pipes F^3 and F^4. In this way a circulation is established in each tube *a* in the direction indicated by the arrows.

It will be seen in Fig. 1 that the connecting-pipes a' and a^2 are provided at the point where they enter the vessels E′ E^2 with valves e' e^2 kept in a raised position by springs f' f^2, the force of which is only sufficient to maintain them in this position during the normal working of the apparatus. It is evident then that in case one of the tubes *a* should happen to be burned or to burst, the increased pressure of the water in the vessels E and E′ would cause the instantaneous closing of the valves e' e^2 and the corresponding tube would thus

be cut out without the circulation being interrupted in the others. Each of the connecting-pipes a' and a^2 may, however, be provided with a tap allowing the stoker to shut off completely the pair of tubes which has been injured and which is promptly melted and destroyed by the intense heat of the furnace. If we take now the case in which the circulation-pump should cease to work from any cause whatever, it is of importance that in such a case there should be automatically established in the tubes a a sufficient circulation of water to prevent their destruction, until the pump shall have resumed its normal working. In order to attain this result, I arrange on the supply-pipe of the water-vessel E' a sort of valve-box G, Fig. 2, which receives the pipe F coming from the circulating-pump and a pipe H directly connecting the box G with the lower part of the boiler. It will be seen from the figure that the openings of these two tubes are provided with valves g' and g^2 connected together by a hinged lever in such a way that when one of these valves is closed the other is open. Further, I take care that the valve g' should be heavier than the valve g^2 or its lever-arm shall be longer than that of the valve g^2. In the ordinary course of working, the valve g^2 remains on its seat and the pump p forces the water drawn from the lower portion of the boiler into the pipes F, the box G, pipe E', and from there into the pipes a', a, and a^2, thence into the pipe E^2, whence it returns to the boiler. In case the pump p ceases to act, the valve g', being heavier than the valve g^2 and being no longer raised by the pressure of the water, falls on its seat, thereby raising valve g^2. Communication is then established by the pipe H between the boiler and the box G, and as the water in this case is highly heated in the tubes a, and steam may even be formed, a natural circulation of the water is set up in the tubes, because the point x, where the water is drawn from the boiler, is considerably lower than the point where it is returned to the boiler through pipes F^3 and F^4; but as soon as the pump again commences to work, the water forced back by its action in the tube F will immediately raise the valve g' and lower the valve g^2, thus re-establishing the forced circulation of the water in the apparatus. I may mention, finally, that the axis of the lever which connects the two valves g' and g^2 has at the end of the box G a needle which indicates the relative position of these valves, and consequently allows it to be seen whether the pump is working or not, and, if required, allows the stoker to move by hand the valves g' and g^2 when he considers it necessary.

It is evident that any equivalent arrangement to that which I have just described might be employed for the same object.

In Fig. 4 I have shown the arrangement of circulating-tubes a when the gases coming from the furnace have to circulate in lower passages before penetrating into the boiler-tubes, such as I have described in my patent of December 13, 1893, No. 493,534. In this case the tubes a are prolonged beyond the furnace into the combustion-chamber D, and in this place each pair of tubes is buried in a cast-metal casing i in the form of a keystone, all of which keystones together form the vault or the part of the vault necessary for directing the heated gases in the desired direction. It must be understood that I do not limit myself to the forms and arrangements shown as specimens on the drawings for practically realizing my invention. Thus, for instance, the tubes a may be covered all along their length with a cast-steel covering of suitable form for forming a sort of longitudinal rib or ribbing, which insures for them sufficient rigidity not to require any intermediate points of support.

I declare that what I claim is—

1. The combination with a boiler furnace of a series of tubes of small diameter arranged in pairs and extending side by side at the inner side of the boiler plates, supply and discharge receptacles located at the front of the boiler, with which the free front ends of the tubes are connected respectively, a force pump, a pipe connecting said force pump with the boiler below its water line and a pipe connecting the discharge receptacle with the boiler above its water line.

2. In combination with the interior furnace of a boiler, a series of pairs of tubes covering the roof of the furnace and through which tubes there is an active circulation of water, each pair of tubes being provided with blocks of cast metal having a section in the shape of a keystone, in such a way that their connection forms a vault or dome with the object of supporting the said tubes in the furnace, substantially as hereinbefore described.

3. In combination with the series of tubes extending side by side at the inner sides of the furnace plates, a supply and discharge receptacle, with which the free ends of said tubes communicate, a valve located at the junction of each tube with said receptacle, and springs acting on said valves to hold the same open; whereby under the proper pressure the said valves will permit free communication between the tubes and receptacles, but under undue pressure will close.

4. In combination with the pairs of circulating tubes protecting the furnace plates of a boiler, two separate vessels with which the two free extremities of each pair of tubes respectively communicate, one of these vessels receiving by means of a pump water drawn from near the bottom of the boiler and the other vessel communicating with the upper part of the boiler, substantially as hereinbefore described.

5. In combination with the circulating tubes protecting the furnace of a boiler and with a vessel supplying the water forced by the pump, a valve box having two tubes, one of

which receives the water supply tube provided with a valve and the other receives a tube connected with the bottom of the boiler and provided with a lighter valve than the preceding, these two valves being connected by a lever mounted on an axis having an external indicating arm, which may be moved in order to effect the action of these two valves by hand, substantially as hereinbefore described and with the object set forth.

6. In combination with the furnace A of a boiler, several pairs of circulating tubes *a*, the upper pairs of which are provided with keystones of metal *b* and the lower pairs of which are entirely covered with metal casings *d*, vessels E′ and E² containing spring valves *e′ e²* arranged on the ends of the circulating tubes, a valve box G receiving the tube F bringing the water and a tube H connected with the boiler, these two tubes being provided with valves connected by a hinged lever, substantially as hereinbefore described, and shown on the accompanying drawings.

7. In combination with the interior furnace A of a boiler in which the furnace gases must circulate in lower or lateral passages before penetrating into the boiler tubes, circulating tubes *a* arranged in pairs in the manner hereinbefore described and prolonged into the combustion chamber D in which each pair of tubes is coated with a casing I in the form of a keystone, the connection of which keystones forms a dome or vault at this point, substantially as hereinbefore described, and shown on the drawings.

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

JEAN PIERRE SERVE.

Witnesses:

EUGENE DUMAL,

JACQUES CONDOMY.