(No Model.)

J. H. KENDALL.

STEAM GENERATOR.

No. 529,391. Patented Nov. 20, 1894.

Fig. 1.

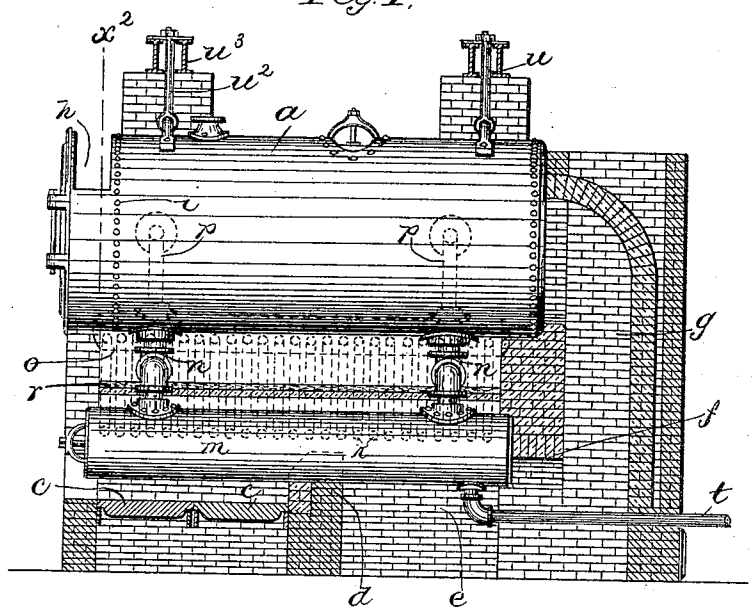


Fig. 2.

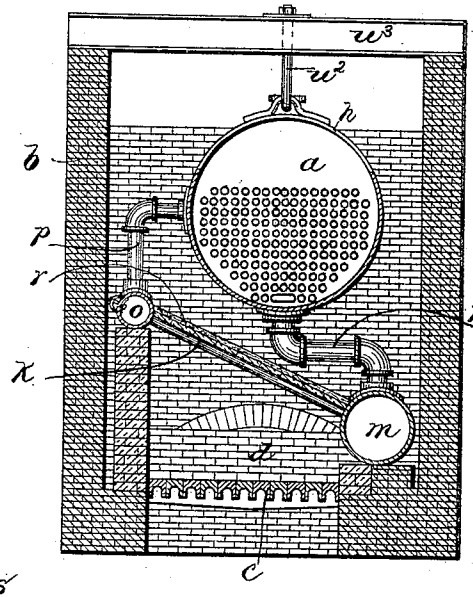
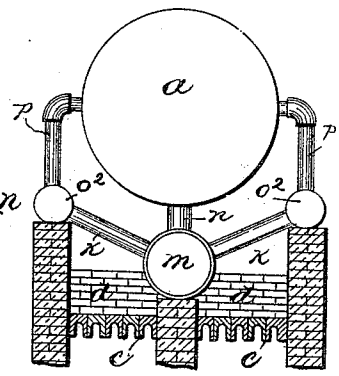


Fig. 3.



Witnesses
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UNITED STATES PATENT OFFICE.

JAMES H. KENDALL, OF CAMBRIDGE, MASSACHUSETTS.

STEAM-GENERATOR.

SPECIFICATION forming part of Letters Patent No. 529,391, dated November 20, 1894.

Application filed February 19, 1894. Serial No. 500,690. (No model.)

To all whom it may concern:

Be it known that I, JAMES H. KENDALL, of Cambridge, county of Middlesex, and State of Massachusetts, have invented an Improvement in Steam-Generators, of which the following description, in connection with the accompanying drawings, is a specification, like letters on the drawings representing like parts.

My invention relating to steam generators is shown embodied in an apparatus comprising a furnace and horizontal return flue boiler, the object of the invention being to produce a steam generator capable of carrying high pressures with efficiency and safety. With steam generators of this class and others where the boiler shell constitutes the top of the fire box or furnace proper or where there is a crown sheet in such relation to the fire box, it is unsafe to use plates of very great thickness thus exposed to the direct radiant heat of the fire as the plate or a portion thereof is likely to become heated much in excess of the temperature of the water in the boiler, especially if any sediment accumulates over the plate, and under such conditions the plate may soften so as to yield under the high pressure carried in the boiler.

In the steam generator forming the subject of this invention a number of circulating tubes are interposed between the fire and the portion of the boiler directly over the fire box, said tubes thus constituting a screen or partition, either alone or preferably in conjunction with refractory material supported over them, between the fire and boiler shell, and thus themselves receive the direct heat radiated from the fire and protect the boiler shell from the direct radiant heat so that the boiler shell cannot be heated substantially above the temperature of the water contained in it and may thus be made of any desired thickness necessary for the pressure to be carried by the boiler, without danger of being softened or weakened by the action of the fire. When the invention is embodied in a horizontal return flue boiler the said screen is preferably extended substantially the entire length of the boiler over the furnace proper, bridge wall, and combustion chamber at the rear thereof.

The invention is capable of considerable variation as to details of construction and arrangement and it is not limited to the specific construction herein shown.

Figure 1 is a longitudinal vertical section of the steam generator embodying this invention; Fig. 2, a transverse vertical section on the plane indicated by the broken line x^2, Fig. 1, and Fig. 3 a diagram view illustrating in transverse vertical section a modification to be referred to.

The boiler *a* may be of any suitable or usual construction being herein shown as of the return flue type, and the boiler setting *b* is herein shown as of masonry of the usual construction except that the boiler may be somewhat higher in the setting than in the usual construction of steam generators of this class. In the front portion of the setting is the usual fire box containing the grate bars *c* separating the fire chamber above from the ash pit below and the bridge wall *d* at the rear of the fire chamber over which the products of combustion pass into the combustion chamber *e*, thence under the arch *f* and through the vertical flue *g*, into the rear end of the flues of the boiler through which they pass to the uptake (not shown) located over the opening *h* at the front of the flue sheet the position of which is indicated by the line of rivets at *i*, Fig. 1.

Instead of having the shell of the boiler *a* itself constitute the top of the fire and combustion chambers as has been usually practiced with steam generators of this kind, there is in accordance with this invention a series of circulating tubes *k* interposed between the top of the fire chamber and preferably of the combustion chamber, and the bottom of the boiler, said tubes being shown as extending transversely from side to side of the boiler setting and connecting at one end with a longitudinal drum *m* communicating by pipes *n* with the lower part of the interior of the boiler while the other ends of the circulating pipes connect with another longitudinal pipe or manifold *o* that communicates with the boiler through pipes *p*, entering the interior of the boiler at some distance above the point of connection of the pipes *n* as shown. As shown in this instance, the circulating pipes *k* are set in inclined position, their lower ends being connected with the drum *m* and higher

ends with the manifold *o* in order to enhance the circulation from *m* to *o*. The said circulating pipes *k* thus receive the heat directly radiated from the fire and from the combustion in the combustion chamber at the rear of the bridge wall and serve to protect the shell of the boiler from such heat, and in order to afford a more efficient screen for the bottom of the boiler and to more efficiently direct the products of combustion to pass under the arch *f* into the rear vertical flue *g* the said circulating pipes *k* are shown as supporting upon them a layer *r* of refractory material, thus affording therewith a complete screen or partition between the fire and the boiler shell.

The drum *m* and manifold *o* are provided with suitable hand-holes for access to their interior and said manifold *o* also has hand holes opposite the circulating pipes to facilitate the substitution and removal of the pipes when required.

By the arrangement shown, there will be a natural circulation of water from the bottom of the boiler through the pipes *n* into the drum *m*, thence through the circulating pipes to the manifold *o* and pipes *p* to a higher point in the boiler, and the sediment will naturally accumulate mainly in the drum *m* from which it may be readily removed, the blow-off pipe *t* for the boiler being shown as connecting with the bottom of said drum *m* as shown in Fig. 1, and the feed water may be introduced into the drum *m* through this or another suitable pipe.

The boiler is shown as having its rear end supported upon the arch *f* of the masonry and also by hangers *u* while the front end of the boiler is supported mainly from the hangers u^2 depending from cross bars u^3 supported on suitable piers at the side of the boiler setting.

It is not necessary that the arrangement should be as shown in all particulars. In some cases, it may be desirable to use a double fire box, as shown for example in Fig. 3, in which case there may be a single drum *m* over the middle of the boiler setting connected by circulating pipes with manifolds o^2 one at each side of the setting, the arrangement being otherwise substantially the same as shown in the other figures.

By the herein described construction, the entire boiler shell is protected from the heat radiated from the fire and largely from any direct contact with the products of combustion which mainly affect the water in the circulating tubes and around the flues of the boiler, and thus while efficient heating surface is afforded for the generation of steam there is no danger of over-heating the shell of the boiler itself, which may be of such thickness as may be required to withstand the internal pressure, the thickness not being limited by the requirements of the conduction of heat through the metal of the shell itself, as is the case when the boiler shell is exposed directly to the fire.

I claim—

The combination of a horizontal return flue boiler with a drum at one side of the fire box or of a portion thereof connected with the lower part of the boiler; a manifold at the other side of the fire box, connected with the boiler at a higher point than the drum, and a series of circulating pipes extending from said drum to said manifold across the top of the fire box, between the same and the boiler shell, and a covering supported thereon and constituting therewith a screen which prevents the heated products from coming in contact with the boiler shell, substantially as and for the purpose described.

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

JAMES H. KENDALL.

Witnesses:
JOS. P. LIVERMORE,
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