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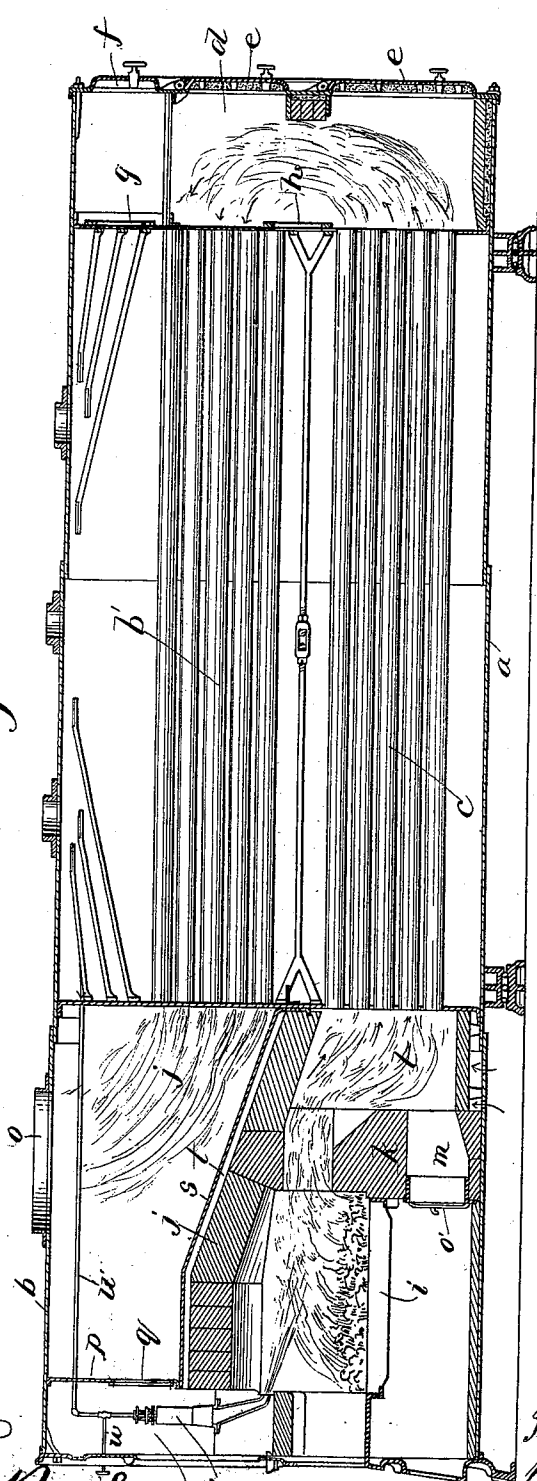
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T. R. BUTMAN.
STEAM BOILER FURNACE.

No. 512,536.

Patented Jan. 9, 1894.

Fig 1



Witnesses
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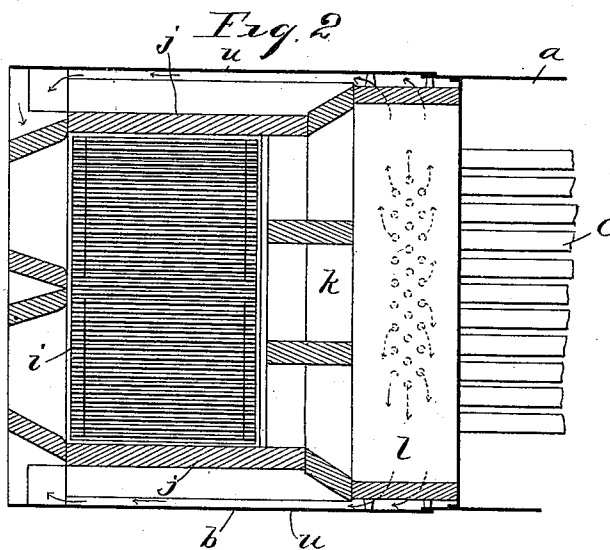
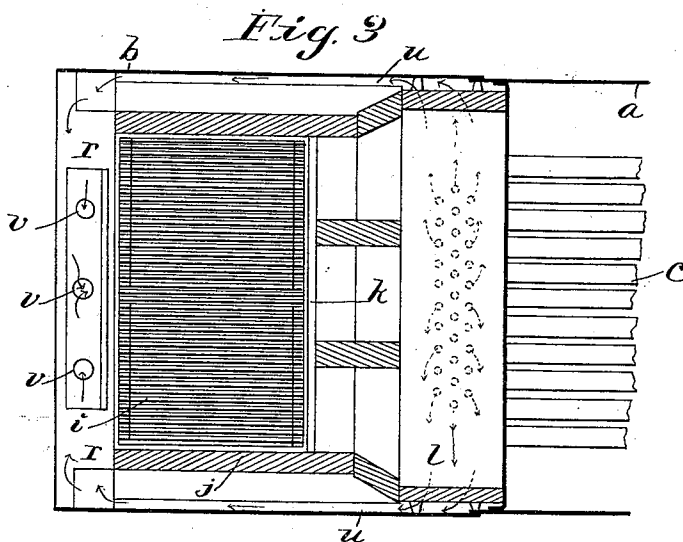
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STEAM BOILER FURNACE.

No. 512,536.

Patented Jan. 9, 1894.



Witnesses

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(No Model.)

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Fig. 4

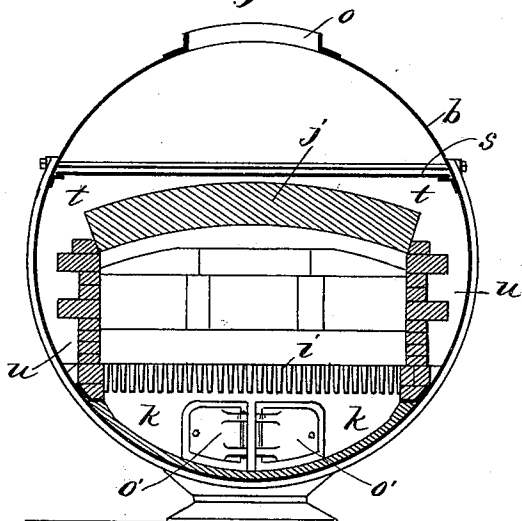
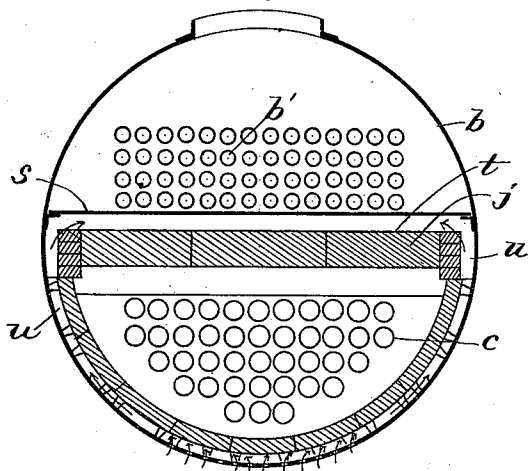


Fig. 5



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UNITED STATES PATENT OFFICE.

THOMAS REED BUTMAN, OF CHICAGO, ILLINOIS.

STEAM-BOILER FURNACE.

SPECIFICATION forming part of Letters Patent No. 512,536, dated January 9, 1894.

Application filed March 30, 1893. Serial No. 468,321. (No model.)

To all whom it may concern:

Be it known that I, THOMAS REED BUTMAN, of Chicago, in the county of Cook and State of Illinois, have invented certain new and useful Improvements in Steam-Boiler Furnaces; and I do hereby declare that the following is a full, clear, and exact description of the invention, which 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 the letters of reference marked thereon, which form part of this specification.

This invention relates to certain improvements in steam boiler furnaces.

The object of the invention is to provide an improved steam boiler exceedingly cheap, simple and durable in construction, and wherein all the heat will be fully utilized with a minimum expenditure of fuel.

A further object of the invention is to improve certain details in construction, and in arrangements of parts whereby a greatly improved and highly efficient stationary boiler of the marine or locomotive type is produced, possessing many features of advantage and great utility.

The invention consists in certain novel features of construction and in combinations of parts more fully described hereinafter and particularly pointed out in the claims.

Referring to the accompanying drawings, Figure 1 is a longitudinal vertical sectional view of the improved boiler. Fig. 2 is a horizontal sectional view of a portion thereof taken in the plane of the lines C, C', Fig. 1. Fig. 3 is a similar view on line D—C', Fig. 1. Figs. 4 and 5, are cross sectional views, respectively, on the lines A—A and B—B, Fig. 1.

In the drawings the reference letter *a*, indicates the outer shell of the horizontal tubular boiler of the marine or locomotive type. This shell is provided with the extension *b*, from one end thereof. The horizontal fire tubes traversing the water space of the boiler are arranged in upper group *b'*, and lower group *c*; the tubes of the lower group *c*, being preferably larger in diameter than the tubes of the upper group *b'*. The rear ends of these tubes communicate through the medium of the smoke box or chamber *d*, in the rear end of the shell. The outer head of the boiler is

provided with doors *e*, opening into the said smoke box or chamber so that access can be easily had to the rear ends of the fire tubes for the purpose hereinafter more fully described. The outer end or head of the boiler is also provided with a man hole *f*, to permit easy access to the man hole *g*, through the tube sheet into the boiler. A man hole *h* is also located in the rear tube sheet at the space between the rear end of the upper and lower groups of tubes.

In the front extension of the boiler shell a furnace is located. This furnace is built up of fire brick or any other suitable refractory material within the front extension of the boiler shell.

i, indicates the grate bars of the furnace above which the fire pot is located and formed by the refractory sides, and the arch *j*, of refractory material located longitudinally within said extension of the shell, and separating the front ends of the two groups of fire tubes.

k, indicates the bridge wall located a distance from the front tube sheet and the front ends of the fire tubes, so as to leave the combustion chamber *l*, between the fire tubes and the bridge wall, the products of combustion, &c., passing over the bridge wall and just below the arch of refractory material. The bridge wall is provided with transverse openings *m*, in its lower portion, normally closed by doors *o'* so that access can be had to the ash pit through said openings into the combustion chamber in rear of the bridge wall to remove the collection of soot, &c., which will become deposited in the bottom of said combustion chamber. This is a point of importance. The arch forming the top of the furnace extends from the front tube sheet of the boiler, separating the front ends of the two groups of tubes, through the front end or front of the furnace, thus forming the smoke chamber within the upper portion of the extension of the shell above said arch, the chamber opening into the uptake or chimney *o*. A vertical partition *p* is located in the front portion of this chamber separating off the hot air chamber *r*, in the front end of the shell. A door or manhole *q*, is located in this partition so that access can be had through the front of the furnace and through said door to the interior of the combustion chamber. A me-

tallic or other jacket *s*, is located above the arch forming the top of the furnace so as to leave the air space *t*, between said jacket and the arch or partition of refractory material.

5 The air space is arranged to open into the front air chamber at the front end of the furnace as clearly shown in Fig. 1. The refractory material within the shell forming the sides of the combustion chamber is located a distance from the shell so as to leave the air space or channel *u*, as shown, at the upper ends communicating with the air space between the arch and the metallic jacket. The bottom of the shell is provided with holes or

10 apertures as shown so that air from the outer atmosphere can flow into said air space around the combustion chamber wherein it is highly heated and will then flow up above the arch into the said hot air chamber. By this arrangement the heat is prevented radiating off from the furnace and furthermore the shell and metallic parts are prevented from being injured by the interposed air space. A series of injectors *v*, are located

25 within said hot air box with their discharge ends opening into the fire box of the furnace so as to discharge over the incandescent fuel in the fire box. Steam is supplied to these injectors through pipes *w*, each pipe being provided with a controlling valve *w*, extending to the exterior of the furnace front. By means of these injectors the hot air and steam are discharged over the incandescent fuel in the fire box, thereby furnishing the requirements of a perfect combustion of fuel, and tending to consume all carbon and thereby prevent smoke and deposit of soot, &c., without mentioning economy in fuel and a maximum degree of heat produced.

40 It should be carefully noted that the furnace is so arranged and constructed and the other parts of the entire boiler are so arranged and constructed that no waste of heat occurs, but all the heat is utilized in accomplishing the object desired of converting heat into energy by vaporizing the water by burning the fuel in a furnace lined with refractory material, more perfect combustion is obtained, the gases are prevented from coming in contact

50 with the metal surfaces, until combustion is completed; hence better results are obtained from the fuel and the deposit of soot in tubes, and emission of smoke is largely abated. The doors and manholes at the rear end of the boiler are provided so that the tubes can be cleaned from the rear end. The soot, &c., falling out into the combustion chamber can be removed through the doors in the bridge wall.

It is evident that various changes and variations might be made and resorted to in the forms, constructions and arrangements of the parts described without departing from the spirit and scope of my invention; hence I do not wish to limit myself to the exact construction here shown, but consider myself entitled to all such changes as fall within the spirit and

65 scope of my invention.

Having thus fully described my invention, what I claim as new, and desire to secure by Letters Patent of the United States, is—

1. A boiler having its furnace located in an extension thereof, air spaces surrounding said furnace, and means arranged to discharge the heated air therefrom into the fire pot of the furnace, substantially as described.

2. A tubular boiler of the locomotive or marine type having its extension provided with a furnace built therein of refractory material, air spaces around the refractory material, and means for discharging the heated air from said spaces into the fire pot of the furnace, substantially as described.

3. The furnace built of refractory material, air spaces around said furnace communicating with the outer atmosphere, a hot air chamber into which said air spaces are adapted to discharge, injectors located in said hot air chamber, and arranged to discharge upon the fuel in the furnace, and steam connections from the boiler to said injectors substantially as and for the purposes set forth.

4. The horizontal tubular boiler provided with the furnace built of refractory material in its front end extension, with the combustion chamber between the bridge wall of the furnace and the front ends of the fire tubes, air spaces between the lining of said combustion chamber, and the shell communicating with the outer atmosphere, and an air space on the arch of the furnace with which said first mentioned air spaces communicate, and a hot air chamber located above said furnace and from which the hot air is discharged into the fire pot of the furnace, substantially as described.

5. The horizontal tubular boiler of the locomotive or marine type having its tubes arranged in upper and lower groups, the smoke chamber at the rear end of the boiler connecting the rear ends of said tubes, doors in the rear end of the boiler head through which access can be had to clean said tubes, the front end of the boiler having the shell extension, a furnace located in said shell extension having the bridge wall a distance from the front ends of the lower group of tubes forming the combustion chamber, openings through the lower portion of the bridge wall into the bottom of said chamber so that the soot and dirt forced out of the tubes into said chamber by cleaning the tubes can be removed from the chamber through said opening, substantially as and for the purposes set forth.

6. A steam boiler comprising the horizontal elongated shell of substantially the same size throughout including the horizontal fire tubes extending through a portion only of the length thereof and the furnace built of refractory material in the front end of said shell as described, so as to be in communication with the front end of the fire tubes, substantially as described.

7. The boiler composed of the horizontal

elongated shell of the same size throughout, the horizontal fire tubes extending throughout a portion of the length of said shell, said fire tubes arranged in lower and upper series
5 communicating at their rear ends by a smoke chamber in the shell, the furnace built in the lower portion of the front of said shell so as to communicate with the front of the lower series of the fire tubes, the arch of said furnace of refractory material forming a smoke
10 chamber in the upper portion of the front end of the shell into which the upper series of the fire tubes discharge, and doors through the front end of the shell, substantially as described.
15

8. The boiler of the marine or locomotive type having the forward extension, said boiler being of the same diameter throughout, the furnace in said extensions built up entirely
20 of refractory material and having the arch

extending longitudinally of the extension, said furnace communicating with the fire tubes of the boiler, a hot air chamber above said arch, steam injectors in said air chambers extending downward and arranged to
25 discharge into the fire pot of the furnace, air chambers surrounding said refractory material of the furnace and communicating with said hot air chamber at their upper ends, and air inlets through the bottom of the shell into
30 said hot air chambers, substantially as described.

In testimony that I claim the foregoing as my own I affix my signature in presence of two witnesses.

THOMAS REED BUTMAN.

Witnesses:

M. L. ALLEN,
T. E. WICKLIN.