E. BOELZNER.

STEAM BOILER.

APPLICATION FILED JULY 22, 1910.

1,015,936.

Patented Jan. 30, 1912.

Fig. 1.

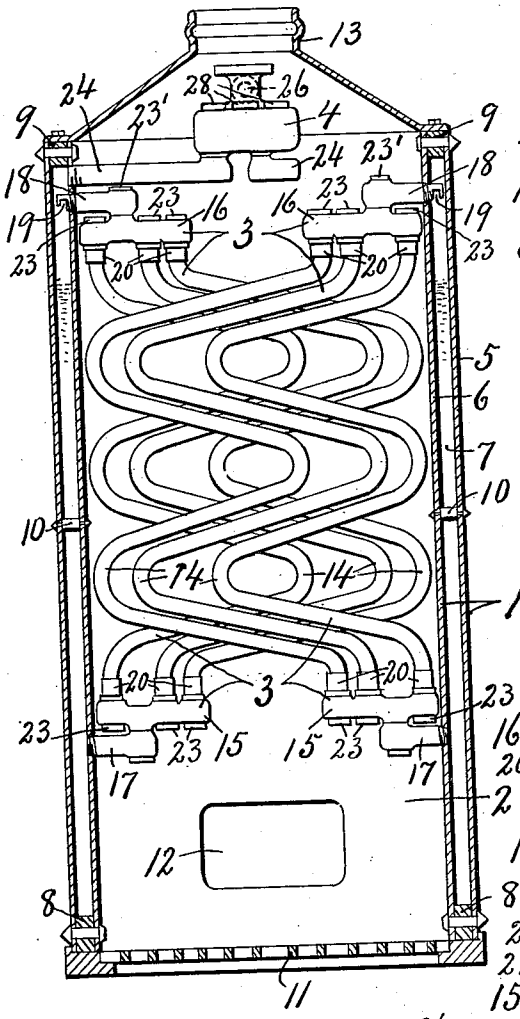


Fig. 2.

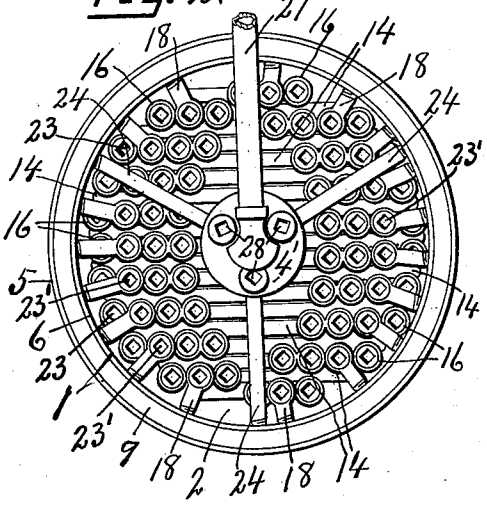


Fig. 3.

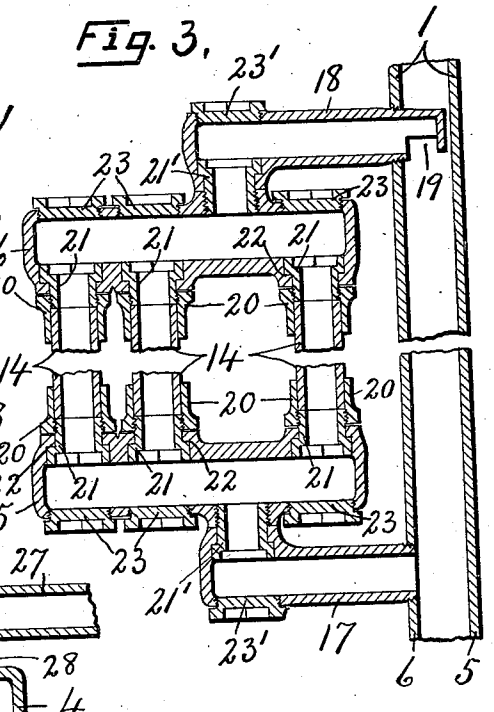
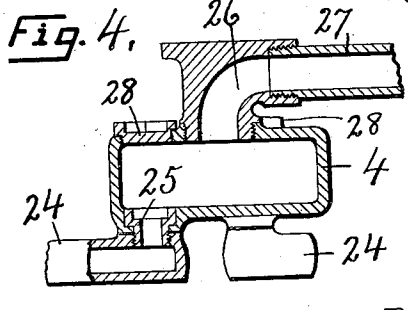


Fig. 4.



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UNITED STATES PATENT OFFICE.

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STEAM-BOILER.

1,015,936. Specification of Letters Patent. Patented Jan. 30, 1912.

Application filed July 22, 1910. Serial No. 573,315.

To all whom it may concern:

Be it known that I, ERNST BOELZNER, of No. 719 South Division street, Elmira, in the county of Chemung, in the State of New York, have invented new and useful Improvements in Steam-Boilers, of which the following, taken in connection with the accompanying drawings, is a full, clear, and exact description.

This invention relates to certain improvements in steam boilers, adapted more particularly for fire engine service in which lightness, compactness and rapidity of steaming are important factors, and constitute the main object of the invention.

Another object is to direct the upflow water in separate continuous circuits from the base of the water leg in tortuous or serpentine paths across the combustion chamber and return to the upper steam chamber of said water leg so as to produce a multiplicity of independent circulating systems, each constituting a distinct generator.

A further object is to provide each separate system with a plurality of comparatively small upflow conduits, and to terminate such conduits in suitable manifolds which communicate with the base and top respectively of the water leg and lie wholly within the combustion chamber so that all of the elements of each system will be enveloped by the products of combustion.

A still further object is to provide for the individual expansion and contraction of the upflow tubes without liability of overstraining their connections with the manifolds or the connections between the manifolds and water leg.

Another object is to provide means whereby the conduits of each system may be tightly connected to the manifolds without turning either of such parts.

Another object is to collect the steam from different points of the water leg into a central distributing head directly over the center of and within the combustion chamber where it may be entirely enveloped in the products of combustion for superheating the steam before entering the lead to the engine.

Other objects and uses will be brought out in the following description:

In the drawings: Figure 1 is a central vertical sectional view of the boiler, showing two of the separate circulating systems in elevation and the steam distributing head or superheater in section. Fig. 2 is a top plan of the main body of the boiler shown in Fig. 1, omitting the smoke hood or cap. Fig. 3 is an enlarged vertical sectional view of the lower and upper manifolds of one of the circulating systems. Fig. 4 is an enlarged sectional view of the detached superheater or steam dome.

This boiler comprises a cylindrical double walled water leg —1— inclosing a combustion chamber —2— in which is located a plurality of water and steam circulating systems —3— and a steam distributer dome or superheater —4—.

The water leg —1— is composed of outer and inner concentric shells —5— and —6—, spaced a uniform distance apart from bottom to top, forming an intervening water chamber which is closed at the bottom and top by suitable spacing rings —8— and —9—, the intervening portions of the shells being tied together at intervals by stay-bolts —10— to hold the shells in fixed relation against undue buckling or collapse of the inner shell.

The base of the combustion chamber is provided with a suitable grate bottom —11— and fuel inlet —12—, while the upper end is capped by a suitable hood or smoke flue —13—, which is preferably conical and provided with a suitable outlet.

Each of the separate circulating systems —3— comprises one or more, preferably a plurality of, in this instance, three continuous upflow pipes or tubes —14—, extending from the base to the top of the combustion chamber and lower and upper manifolds or headers —15— and —16— for receiving the terminal ends of the tubes —14—, the under side of the lower manifold —15— being connected by a conduit —17— to one side of the base of the water leg —1—, while the top side of the upper manifold —16— is connected by a similar conduit —18— to the same side of the upper portion of the water leg. These manifolds —15— and —16—, and their conduits —17— and —18—, are therefore secured in the same vertical plane within the combustion chamber to the same side of the water leg, the conduit —18— being projected some distance into the water leg and provided in its lower side with an opening —19— communicating with the intervening space between the shells —5— and —6— for diverting the upflow of water or steam into the upper portion of the water leg and completing the circulation through the corresponding circulating system —3—.

The upflow pipes or tubes —14— of each circulating system extend back and forth in inclined tortuous or serpentine paths across or from side to side of the combustion chamber from the lower manifold —15— to the upper manifold —16— and are disposed in the same vertical plane with their offset portions nested one within the other, alternate circulating systems being reversely arranged, that is, the manifolds of alternate circulating systems and their connections with the water leg are arranged at opposite sides of the combustion chamber so that the offset portions of the upflow tubes of alternate systems project in opposite directions, and in close proximity to each other, leaving sufficient clearance between the tubes of each system and those of alternate systems for the passage of products of combustion therebetween.

The manifolds —15— and —16—, and conduits —17— and —18— are comparatively shallow and may be made of cast iron or other suitable material, while the upflow tubes —14— may be made of copper or other easily bendable tubing of comparatively small diameter, thereby affording a large heating surface for comparatively small water and steam channels. These manifolds and upflow tubes are entirely enveloped in the products of combustion so as to produce rapid conversion of the water into steam with a minimum consumption of fuel.

The several sets of manifolds with their connecting tubes are arranged in parallel planes side by side so as to substantially fill the combustion chamber between the fuel inlet —12— and steam dome —4—, except for the small intervening spaces between such sets and the interior of the water leg. The transverse width of each set is nearly equal to the transverse width of the combustion chamber in the planes in which such sets are located, and therefore the transverse width of the individual sets gradually decrease from the center toward the opposite sides of the boiler. In order that a maximum number of these separate circulating systems may be employed, two of the extreme outer sets at opposite sides of the combustion chamber are shown as provided with two upflow tubes instead of three as in all other sets, this reduction in number being necessitated by reason of the fact that the end sets are of considerably less width transversely than the intervening sets.

The nipples or conduits —17— and —18— by which the manifolds —15— and —16— are connected to the water leg are adjustable rotarily so as to enter radially the adjacent side of the inner shell —6— of the water leg into which they are screwed.

One of the important features of this invention is that the upflow tubes of either system may be secured in place or removed independently of the others and without turning or rotation, and for this purpose the terminal ends of each tube are provided with an internally threaded nipple —20— abutting against the upper and lower sides respectively of the manifolds —15— and —16— and registering with corresponding openings in said sides, the threaded nipples —20— being engaged by hollow nuts or bushings —21— which are inserted in their respective openings. The inner ends of these openings are enlarged forming shoulders —22— which are engaged by similarly enlarged ends of the nuts —20— so that as the nuts are tightened their enlarged ends will abut against the shoulders —22— and draw the adjacent ends of the nipples tightly against the corresponding sides of the manifolds. The inner ends of the hollow nuts or bushings —21— are provided with angular sockets for the reception of a wrench, the opposite sides of the manifolds being provided with threaded openings in vertical alinement with the nuts —21— for the reception of such wrench by which the nuts may be tightened or loosened to secure or release the tubes. The openings are normally closed by screw plugs or caps —23— also provided in their outer ends with angular sockets for receiving the same wrench by which they may be removed or replaced when necessary.

The tortuous or corrugated structure of the tubes allows them to expand and contract freely under varying temperatures without liability of overstraining or loosening their connections with the manifolds and also permits them to be easily sprung into and out of their operative positions.

The nipples or conduits —17— and —18— are connected to their respective headers —15— and —16— by hollow nuts or threaded bushings —21′— having wrench sockets similar to the bushings —21—, the opposite sides of the headers being provided with wrench openings in axial alinement with the nuts and normally closed by threaded plugs —23′— similar to the plugs —23—. This permits the manifolds to be attached to or detached from its corresponding nipple without turning either of such parts.

It will now be seen that each set of tubes —14— and their corresponding manifolds constitutes a distinct and separate heater as well as a separate circulating system each connected to a different part of the water leg. That is, the water from the base of the water leg enters the nipple —17— and passes into the corresponding manifold —15— and then upwardly back and forth across the combustion chamber through the tubes —14— where a part of said water is converted into steam and the steam and water circulation then continues through the manifold —16— and nipple —18— back into the upper portion of the water leg which con-

stitutes a steam chamber above the water line indicated by dotted lines in Fig. 1. This steam is concentrated from the upper portion of the water leg through suitable pipes or conduits —24— leading radially from the upper end of the inner shell —6— above the manifold —16— and discharged into a central dome or distributing chamber —4—, which is also located in a plane above the manifolds. This distributing chamber is provided with an outlet —26— adapted to be connected by a pipe —27— to the throttle valve of an engine not shown. This distributing head —4— is located in the central upper portion of the combustion chamber and is connected by a plurality of, in this instance, three radial conduits —24— to the upper end of the water leg, said pipes being preferably located an equal distance apart so as to rapidly concentrate the steam into the chamber —4— where it is superheated to increase its expansive force before passing to the engine.

The pipes —24— are adapted to be connected to the superheater —4— without turning either of the parts and for this purpose the upper sides of the conduits —24— are provided with threaded apertures registering with corresponding openings in the under side of the superheater, such openings receiving hollow nuts —25— which are similar to the nuts —21— and screwed into the threaded apertures of the pipe —24—, the upper ends of the nuts being enlarged and provided with angular sockets for receiving a suitable wrench.

The upper side of the superheater —4— is provided with wrench openings in vertical alinement with the nuts —25— to permit access to the latter, said openings being normally closed by screw plugs or caps —28— similar to the caps —23—.

It will be observed that when the boiler is not in use all of the screw plugs and threaded bushings or nuts are accessible either from the top or underside of the boiler by simply removing the hood or opening the fuel door, and that by removing the plugs —23'— and then loosening the corresponding nuts —21'— of any one of the sets of manifolds, such set with the tubes —14— connected thereto may be removed or replaced through the open top of the boiler without disconnecting any of the other manifolds. In like manner any one of the tubes —14— may be removed from the corresponding manifolds without displacing the others by simply removing their attaching nuts or bushings —21— after the adjacent plugs —23— have been removed.

The couplings or nipples —20— are brazed or otherwise rigidly secured to the respective tubes —14— and when the hollow nuts —21— are firmly tightened, the end faces of the nipples are drawn tightly against the adjacent faces of the manifolds —15— and —16— so as to form a tight joint and thereby protect the threads from injury or accumulations from the products of combustion. In like manner when the hollow nuts —21'— are tightened the pipes or nipples —17— and —18— are drawn tightly against the adjacent faces of the manifolds to form a tight joint and to protect the threads against such injury or accumulations, the same being also true of the pipes —24— and —27— to protect the threaded connections between said pipes and superheater —4—. The threads of the plugs —23— and —23'— and —28— are also similarly protected by shoulders thereon which engage the adjacent faces of the parts into which they are screwed and also to form tight joints. By protecting these threaded parts in the manner just described such parts may be readily disconnected after a long period of use and reconnected without showing any symptoms of deterioration; that is, the threads are protected against corrosion or burning tight and are therefore less liable to strip in screwing and unscrewing the same.

By making all of the angular sockets in the hollow nuts and plugs of the same size and angular, preferably square, the same wrench or square bar can be used for tightening and loosening all of them.

It will be observed that by making the pipes —3— continuous, all of the parts of the boiler may be readily assembled with a comparatively small number of joints thereby increasing the permanency of the boiler and facilitating the circulation of water and steam which moves upwardly through a succession of inclines through such tubes.

What I claim is:

A steam boiler including zig-zag upflow pipes arranged in sets and extending transversely of the boiler and nesting one within the other whereby the bends of one set are opposite the spaces between the laterally-projecting portions of the next adjacent set, superposed headers at opposite sides of and within the boiler, means for connecting opposite ends of certain of said sets to the superposed headers at one side of the boiler, and means for connecting the opposite ends of the other sets to the heads at the other side of the boiler.

In witness whereof I have hereunto set my hand this 16th day of July 1910.

ERNST BOELZNER.

Witnesses:
H. E. Chase,
Emily F. Spearing.