June 28, 1927. 1,633,663

E. A. HARDISON

HIGH PRESSURE STEAM BOILER

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Fig. 1

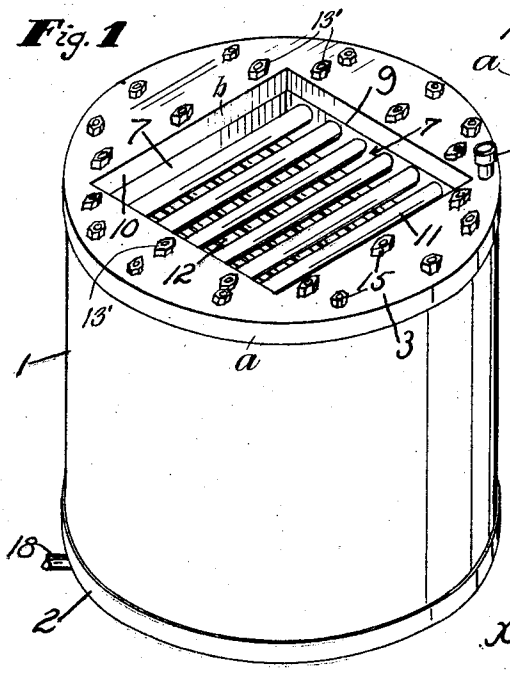


Fig. 3

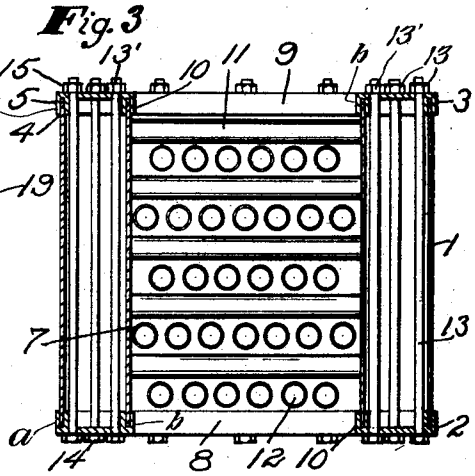


Fig. 2

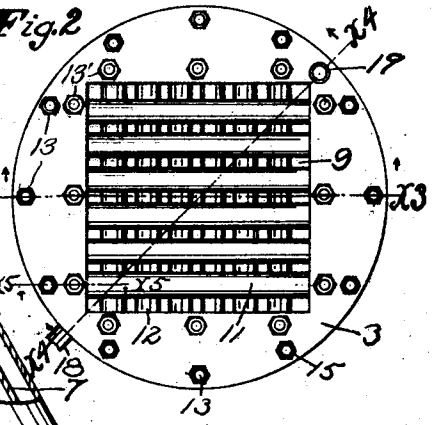


Fig. 4

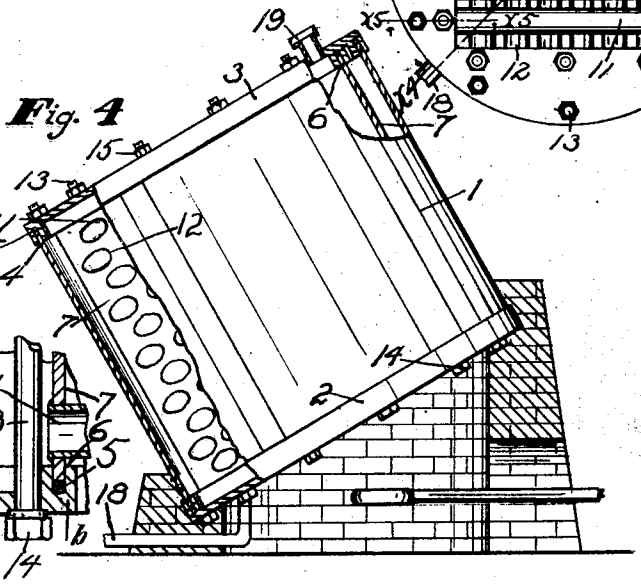
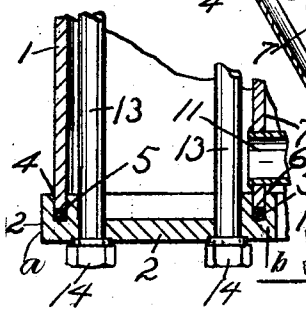


Fig. 5



Witness:
L. Whipple

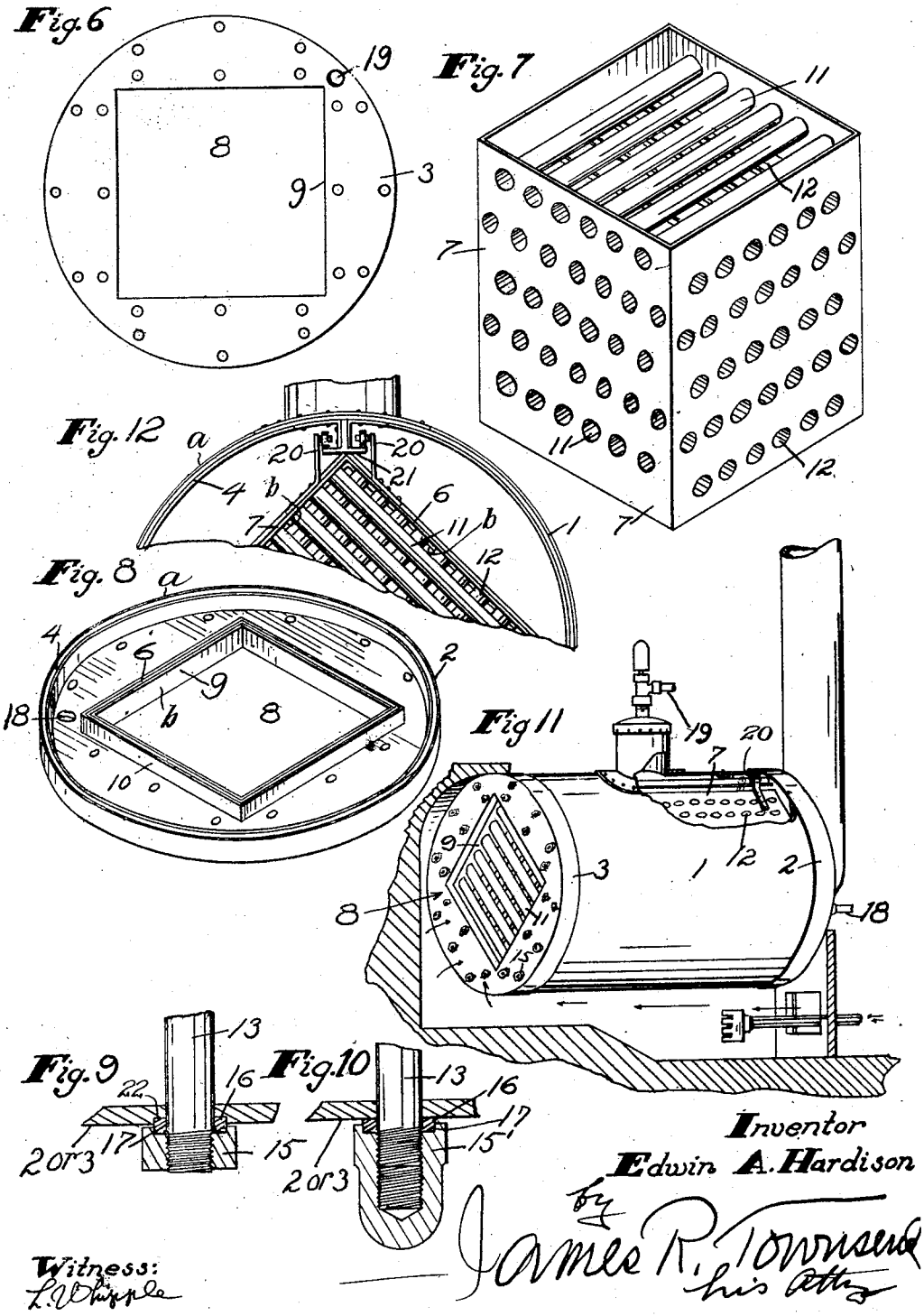
Inventor
Edwin A. Hardison.
by James P. Townsend
his atty

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E. A. HARDISON

HIGH PRESSURE STEAM BOILER

Filed April 18, 1921 2 Sheets-Sheet 2



Witness:
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Patented June 28, 1927. 1,633,663

UNITED STATES PATENT OFFICE.

EDWIN A. HARDISON, OF LOS ANGELES, CALIFORNIA, ASSIGNOR TO FIRST NATIONAL BANK & TRUST CO., OF SANTA PAULA, CALIFORNIA.

HIGH-PRESSURE STEAM BOILER.

Application filed April 18, 1921. Serial No. 462,100.

This invention is applicable to steam boilers, steam condensers, refrigerators and the like in which heat is to be translated or transferred from one medium to another.

This invention relates to a steam boiler of that type in which there is provided within a water and steam container or shell, a nest of open ended water tubes arranged criss-cross relative to each other; said nest comprising a flue across which the water tubes extend to open at both ends into the water and steam space inside the shell and outside the flue.

An object of this invention is to provide a water tube boiler of cheap and simple construction which is easily constructed and can be easily taken apart for cleaning and repairing, or for replacing tubes, and can be easily put together without disturbing the fittings or connections of the boiler.

An object is to provide a water tube boiler of the type just referred to which is cheap and simple in construction and is adapted to supply steam at extremely high pressure and with great economy of heat, and with which a maximum heating surface is developed.

An object of the invention is to so construct the boiler that it will sustain excessive pressures, and to make provision whereby good circulation within the boiler is secured; also to provide for an effective steam dome in any position in which the boiler is placed.

Other objects, advantages and features of invention may appear from the accompanying drawings, the subjoined detail description and the appended claims.

The accompanying drawings illustrate the invention in some of the forms in which it may be applied.

Figure 1 is a perspective view of an embodiment of the invention applicable as an element of a steam generator, or a water heater, a condenser, or a refrigerating apparatus.

Fig. 2 is a top view of the embodiment shown in Fig. 1.

Fig. 3 is an axial section on line x^3, Fig. 2.

Fig. 4 is a side elevation showing an embodiment like that of the preceding views arranged aslant to an exaggerated degree on a brick work fire box or furnace. Portions are broken away and partly sectioned on line x^4, Fig. 2, to expose exterior and also interior construction of the flue.

Fig. 5 is a fragmental view in section on line x^5, Fig. 2, showing union of shell and head.

Fig. 6 is an outside plan of either head removed.

Fig. 7 is a perspective view of the water tube nest or flue shown in preceding views.

Fig. 8 is a view of the inside face of either head removed.

Fig. 9 is a fragmental view illustrating a joint between a head and the stay bolts that hold the parts together.

Fig. 10 is a view analogous to Fig. 9 showing another form in which a steeple nut is used.

Fig. 11 is a perspective view illustrating a steam boiler in place constructed in accordance with this invention and having a flue trolley.

Fig. 12 is a fragmental view of the boiler shown in Fig. 11; the head being removed to allow the flue to be withdrawn.

The shell 1 is of any suitable form and is shown as a cylindrical wall connected to the heads 2, 3. Each of these heads is provided with an outer grooved flange 4 in which the shell 1 is seated on a copper wire washer 5. Said heads are also provided with an inner grooved flange 6 in which is seated the parallel walled flue 7 which is formed with four flat sides. The shell 1 and flue 7 are fitted at each end to bear upon copper washers as at 5. The shell and flue forces the copper washers 5 against the outer wall *a* of the outer grooved flange for the shell and the inner wall *b* of the inner grooved flange for the flue, thereby making the joints steam tight when the heads are secured in place.

The heads are provided respectively with a flue opening 8, and the inner grooved flange formed by the annular walls 9, 10 forming the flue seat. The flue openings 8, are preferably square and are surrounded by the annular walls 9, 10 to receive the ends of the flue 7 which fits in said inner grooved flange or seat 6.

Said flue is provided with series 11, 12 of water tubes. The axes of the tubes of each series are arranged in planes at right angles to the axis of the flue; the tubes 11 of one series being transversely arranged to the tubes 12 of another series. The tubes of

each respective series are arranged in staggered relation to the tubes of the other series. The flue is seated in the seat 6 and when the shell and the heads are in place, said water tubes extend directly across the flue, and their open ends are expanded into the walls of the flue, in a well known way. These water tubes may be disposed as closely together as may be practical to leave a tortuous but otherwise clear passage for flame and heated air through the flue.

After the parts are all assembled with the shell and the flue in the seats 4 and 6 in the bottom and top heads, the parts are secured together by the stay bolts 13, 13′, each having nuts 14 and 15 at the opposite ends and ductile washers 16 preferably of copper, held in annular seats 17 therefor.

In the case of a boiler, water is fed thereto by the low level pipe 18 and steam is drawn out through the high level pipe 19.

The unit constructed of the flue and tubes is complete within itself and can be detached from and applied to the service desired; and whenever repairs are required, the whole unit may be taken out and a new unit substituted therefor in a very short time.

It is also apparent that by removing the top head 3 the flue 7 can be removed and a new one inserted; thereby further reducing the expense of repairing, when only the flue is damaged.

In the horizontal boiler shown in Figs. 11 and 12, the flue is carried by a carriage as the antifriction trolley at 20, adapted to travel on a track formed by flanges of a flanged beam 21 secured to the crown of the shell. By this construction and arrangement it is made convenient to run the flue with its tubes out of the shell on the antifriction means supported by the track 21 and any extension thereof, which may be temporarily provided outside the boiler in an obvious manner; so that the labor and expense of repairing the boiler and of removing and replacing tubes is reduced to a minimum as compared with the labor and cost of such repairs of efficient boilers heretofore known.

In practical use the boiler may be placed in any position but is preferably arranged as suggested by Figs. 4 and 11 with one corner of the flue at a relatively low level so that the tubes are all aslant thus to insure circulation. In the forms shown in Figs. 11 and 12, the flue is practically horizontal and the shell is set so as to cause all the tubes to be aslant, thus affording the greatest facility for circulation from lower shell surface up through the flue.

If the shell or the flue or the tubes should need repair, they are very readily reached by removing one head and withdrawing the flue and its nest of tubes bodily from the shell, thus giving unobstructed access to the flue and to the shell for inspection and repairs and in case of large boilers such as indicated in Fig. 11, the interior of the shell will be accessible to the workman who can go inside and repair by welding or riveting.

The replacing of tubes can be performed outside of the boiler. It is apparent from Fig. 11 that the fire space for the boiler may extend on the outside of the shell and tubes and on the inside of the flue thus giving a maximum heating surface.

The stay bolts 13 are inserted through holes that exactly fit the unthreaded portion of said bolts; and channels 22 in the units or heads may be provided to receive the washers 16 of copper or other suitable material; or the nuts alone may be provided with channels to receive the washer. The steeple nuts 15′ may be used on the ends of the stay bolts. With this form of nut and the copper washer shown, leakage is practically impossible.

The stay bolts are so disposed relative to each other, the shell and the flue as to equalize the pressure on the gaskets, the shell, the flue and the heads; and to this end are shown arranged in two groups, the group of stay bolts 13 being arranged close to the outer shell 1 and the group of stay bolts 13′ being arranged near the wall of the flue 7 so that when the nuts 14 and 15 are tightened, the necessary pressure is equalized as to the heads and as applied to the copper gaskets, and it is possible to so apply such pressure as to withstand very high generated pressure in the boiler.

I have constructed boilers of this type which have been tested to cold pressure of 1150 pounds before any leakage was apparent, and as the pressure was reduced to 1100 pounds the leakage ceased, and upon again increasing the pressure to 1150 pounds the leakage was apparent. Either of the heads 8 or 9 can be quickly removed by loosening the nuts 14 or 15. The stay bolts are so distributed as to equalize the pressure on all of the bolts.

I claim:

1. A steam boiler of the character set forth comprising a shell and two heads therefor to form a container, said heads provided with orifices and inner and outer grooved flanges; a flue open to said orifices and being formed with four flat sides having ends seated in said inner grooved flanges, said flue forming with said shell a chamber therebetween; criss-cross tubes for said flue communicating at their ends with said chamber; a flanged beam secured to the crown of said shell and forming a track; and a carriage secured to said flue and having an anti-friction trolley adapted to travel on said track to facilitate removal of the flue container when one of the heads is detached.

2. A steam boiler of the character set forth comprising a shell and two end heads to form a container, said heads provided with orifices and inner and outer grooved flanges; a flue open to said orifices and having ends seated in said inner grooved flanges, said flue forming with said shell a chamber therebetween; criss-cross tubes for said flue communicating at their ends with said chamber; a flanged beam secured to the crown of said shell and forming a track; and a carriage secured to said flue and having an anti-friction trolley adapted to travel on said track for normally supporting said shell and to facilitate removal of the same in its entirety.

In testimony whereof, I have hereunto set my hand at Los Angeles, California, this 30th day of March, 1921.

E. A. HARDISON.