March 27, 1928. 1,663,910

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WATER TUBE BOILER

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Fig. 1.

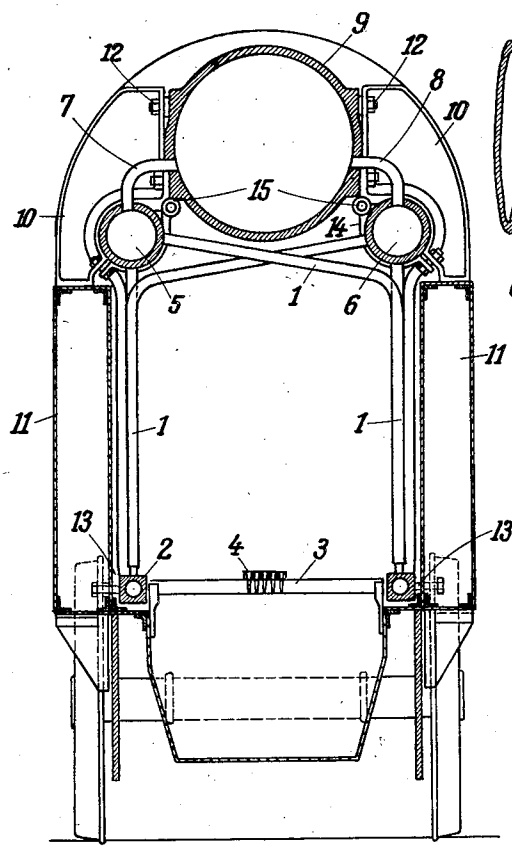
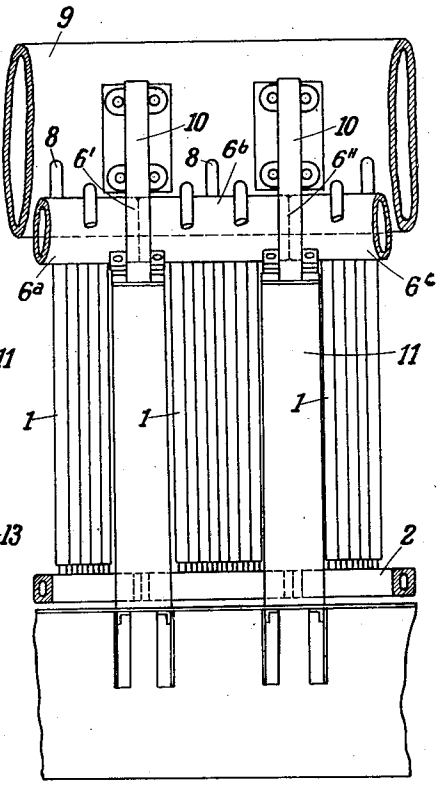


Fig. 2.



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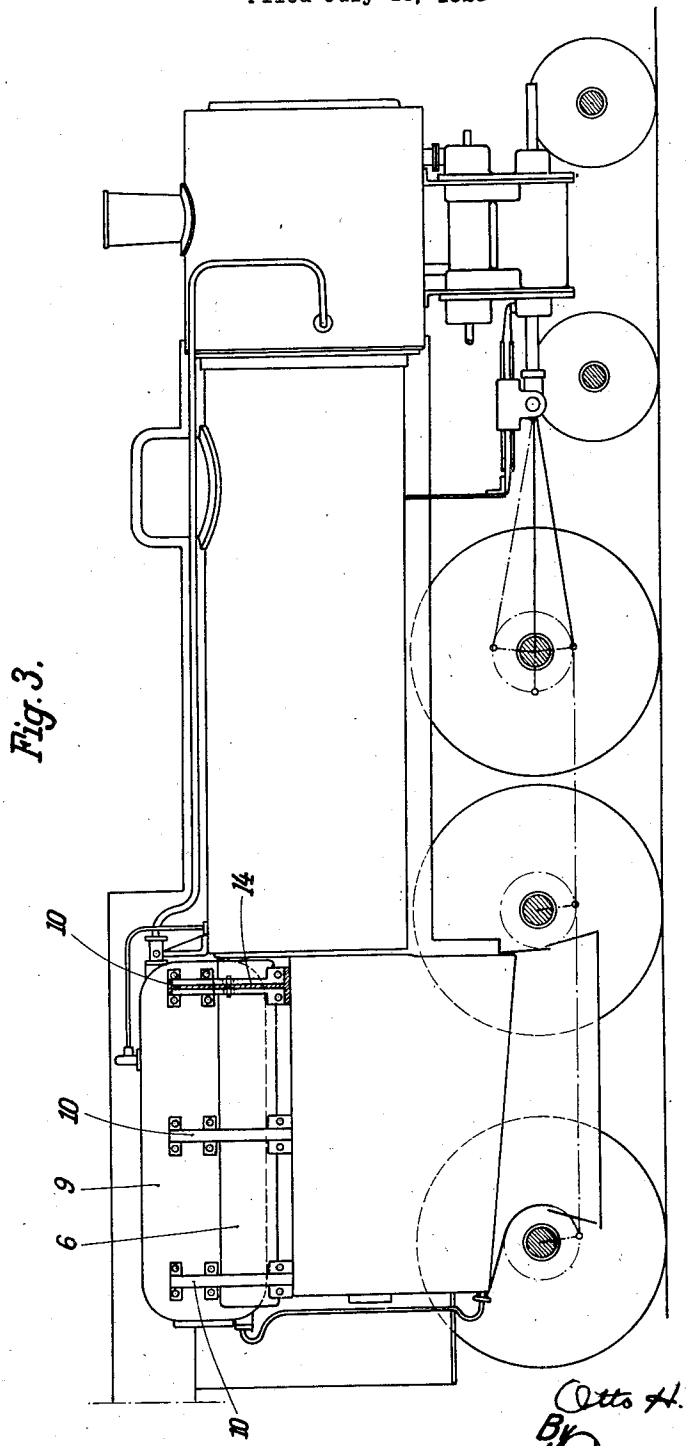


Fig. 3.

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Fig. 4.

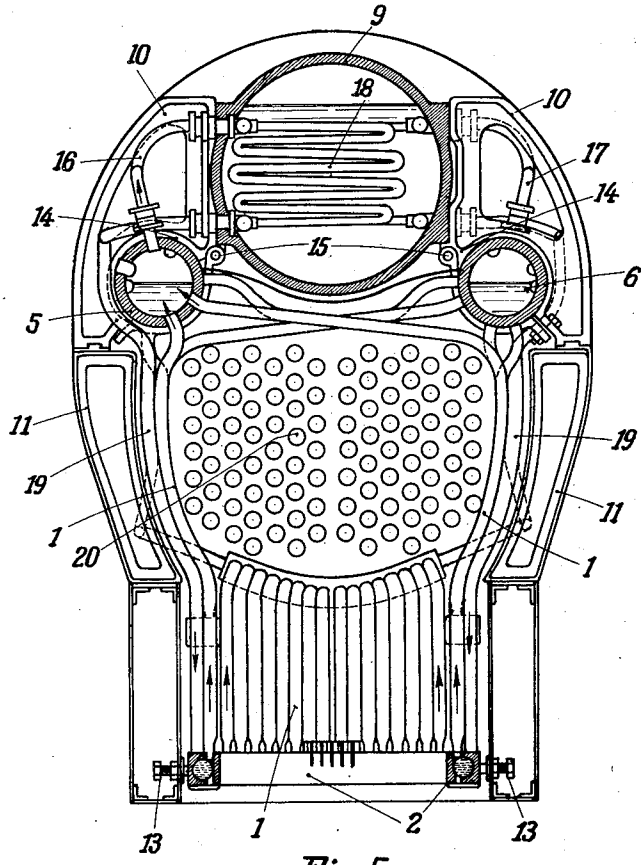
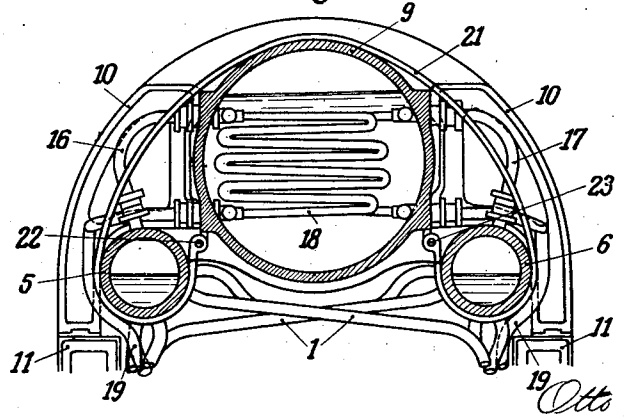


Fig. 5.



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UNITED STATES PATENT OFFICE.

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WATER-TUBE BOILER.

Application filed July 13, 1926, Serial No. 122,234, and in Germany July 23, 1925.

My invention relates to a water-tube boiler constructed as a fire-box and applicable to locomotives and other moving power plants.

Water-tube fire boxes of locomotives generally consist of water tubes connected at their upper ends to water collectors or headers and at their lower ends to water headers or the like. Heretofore, it has been considered necessary in order to protect the water tubes and their connections to the collectors or headers from shocks caused by hard running or "rolling" of the locomotives, to support both the upper and the lower headers on, and to fix them to the locomotive frame. It was assumed that this interconnection between the headers and water tubes on one hand and the locomotive frame on the other hand rendered the fire box rigid and able to withstand especially the upwardly-directed shocks and the strains caused by them. This construction has, however, certain disadvantages.

It is the object of my invention to overcome these disadvantages. My invention chiefly considers the protection of the water tubes and the steam and water headers and their connections from said shocks by means which allow the water tubes freely to expand. With this object in view according to the present invention, the lower part of the boiler, e. g. the lower water headers or the like are supported not directly on a locomotive frame as is usual but the water tubes together with the water headers are freely suspended as a unit by means of the upper headers either from the supporting brackets of an upper boiler, which are fixed to the locomotive frame, or from this upper boiler itself. This arrangement has the advantage not only that the water tubes are protected from compressing or breaking strains resulting from the upwardly-directed shocks and can freely expand but also that the entire water-tube boiler can be inserted as a unit into the space between the bounding walls of the combustion chamber and can be suspended there in the manner indicated. Thus the erection and the dismantling of the fire-box boiler is greatly simplified and the removal of the boiler or of parts of it for repair or exchange is facilitated.

In addition, it is desirable that the lower end of the water-tube boiler, the construction of which has a considerable degree of rigidity, should be prevented from lateral movement in order to relieve from stress the points where the tubes are expanded into the upper collectors on violent oscillations of the locomotive taking place. The invention, therefore, further provides means to obtain this object.

In the accompanying drawings which show illustrative examples of the invention:

Fig. 1 is a cross-section of a fire box constructed in accordance with the invention; Fig. 2 is a part-elevation of said fire box; Fig. 3 is an elevation of a fire box and other parts of a locomotive showing another construction; Fig. 4 is a cross-section through a fire box in which the working steam is generated indirectly, and Fig. 5 is a detail sectional view of a modification.

In Figs. 1 and 2 water tubes, 1, of the high-pressure boiler which forms the fire box of a locomotive, are connected at their lower ends to a ring, 2, forming a water header or collector within which the brackets, 3, of the grate, 4, are arranged. Two other drums or headers, 5, and, 6, serve as water collectors. They are connected by pipes, 7, and, 8, respectively to an upper boiler drum, 9. Brackets, 10, are supported by the locomotive frame, 11, and have fastened to them the upper boiler, 9, by means of bolts and nuts, 12, or the like. The collectors, 2, are steadied against lateral oscillations by means of set or stop screws, 13, held in a part of the locomotive frame, 11. The drums, 5, and, 6, are freely suspended by means of detachable stirrups, 14, pivoted at, 15, to the brackets, 10.

It will be seen that the water-tube boiler forming a fire box and comprising the water tube, 1, the collectors, 2, and the drums, 5, and, 6, hangs as a whole freely from the yoke-like bearers, 10, bearing the upper boiler, 9, and carried by the locomotive frame. By this arrangement the tubes, 1, are not strained by upwardly-directed shocks, i. e. they are protected from compressing or breaking strains resulting from those shocks, and they can freely expand. This arrangement further allows the entire water-tube boiler to be inserted as a unit into the space defined by the bounding walls of the combustion chamber, i. e. by the

frame, 11, and suspended there in the manner indicated.

By these means, leakage and the working trouble due thereto is substantially decreased.

As will be seen in Fig. 2, the water collectors 6, are divided into several short portions 6^a, 6^b, 6^c, etc., each constituting a separate drum and meeting the adjacent drum with its face, 6′, 6″, etc. The brackets, 10, and the stirrups, 14, are spaced apart at corresponding distances in such manner that each stirrup holds two adjacent drum parts.

If drums, 5, and 6, running the full length of the fire-box boiler, are employed, it may be sufficient to provide the brackets and stirrups in a smaller number, one on each end and perhaps a third one in the middle.

In Fig. 3 such a construction is shown. There are three brackets, 10, on which the drum, 6, which extends from one end of the fire box to the other end, is suspended by means of the stirrups, 14.

The upper boiler, 9, may take the form of a high-pressure working boiler heated indirectly by means of the steam generated in the water-tube boiler 1—2—5—6. The flue gases pass after heating the water-tube boiler through the smoke tubes of the usual longitudinal boiler.

Such a construction is shown in Fig. 4. Water tubes, 1, collectors, 2, and drums, 5, and, 6, constitute the generating part of the water-tube boiler. Steam from the drums, 5, and 6, flows through pipes, 16, and, 17, respectively to heating elements, 18, situated in the water of upper boiler drum, 9. The condensate of the heating steam returns through return tubes, 19, to the collectors, 2. The longitudinal boiler has smoke tubes, 20, through which the flue-gases pass after having given up part of their heat in the fire-box. The frame, 11, of the locomotive also supports brackets, 10, which hold the upper drum, 9. Stirrups, 14, clasping the drums, 5, and, 6 are again suspended by means of pivots, 15, from the brackets, 10. Set or stop screws, 13, may likewise be provided.

In this case the locomotive has three boilers of different pressures, for example, 90 atmospheres in the water-tube boiler, 60 atmospheres in the upper boiler, 9, heated by steam from the water-tube boiler, and 12 to 15 atmospheres in the longitudinal boiler.

In Fig. 5 another form of suspension of the water-tube boiler is shown. Here the collectors, 5, and 6, are not suspended from the brackets, 10, but from the upper boiler drum, 9. This is accomplished by means of clamps or the like, 21, being held on one end by a pivot, 22, secured to the boiler drum, 9, these clamps passing around the collector, 5, then over the drum, 9, around the collector, 6, and to another pivot, 23, secured to the drum, 9. Thus the whole water-tube fire box is suspended on the boiler drum, 9, which is supported by brackets, 10, carried by the locomotive frame. This construction also serves the purpose of protecting the water tubes and their connections to the lower and upper collectors from compressing or breaking strains resulting from upwardly-directed shocks, because it allows a free expansion of the water tube system.

I claim:

1. In a locomotive having a water-tube fire box, said fire box comprising lower water collectors, upper headers positioned above said collectors, an upper boiler drum located at a higher level than said upper headers, water-tubes connecting said collectors, upper headers and upper boiler drum with each other and forming a fire box, brackets supporting said upper boiler drum from the locomotive frame, means for suspending the upper headers from said brackets, the lower collectors and the fire box being thereby suspended as a unit from said brackets through the medium of the upper headers.

2. In a locomotive, a water-tube fire box comprising lower water collectors, headers positioned above said collectors, and water-tubes connecting said collectors and said headers, a boiler drum located at a higher level than said headers and connected thereto, brackets supporting said boiler drum and fixed to the locomotive frame, and stirrups secured to said brackets and supporting said headers.

3. In a locomotive, a boiler drum, headers connected thereto, supporting means for said drum and said headers, water-tubes depending from said headers and forming a fire box, collectors at the lower ends of said water-tubes, and stop means preventing lateral movement of said collectors while permitting vertical and longitudinal movement thereof.

4. In a locomotive, a boiler drum, headers connected thereto, brackets fixed to the locomotive frame and supporting said drum, stirrups pivotally secured to said brackets and supporting said headers, water-tubes depending from said headers and forming a fire box, collectors at the lower ends of said water-tubes, whereby said water-tubes and said collectors are freely suspended from said headers, and stop means preventing lateral movement of said collectors while permitting vertical and longitudinal movement thereof.

5. In a locomotive, a boiler drum adapted to contain steam and water, headers positioned adjacent thereto, brackets carried by the locomotive frame and supporting said drum, stirrups secured to said brackets and supporting said headers, water-tubes depending from said headers and forming a fire box, collectors at the lower ends of said water-tubes, and heating elements leading

from said headers, extending into the water space of said boiler drum, and communicating with said collectors to form a closed circuit for the steam generated in said fire box.

6. In a locomotive, a boiler drum adapted to contain steam and water, headers positioned adjacent thereto, brackets carried by the locomotive frame and supporting said drum, stirrups secured to said brackets and supporting said headers, water-tubes depending from said headers and forming a fire box, collectors at the lower ends of said water-tubes, heating elements leading from said headers, extending into the water space of said boiler drum, and communicating with said collectors to form a closed circuit for the steam generated in said fire box, and stop means preventing lateral movement of said collectors while permitting vertical and longitudinal movement thereof.

In testimony whereof I have hereunto set my hand.

OTTO H. HARTMANN.