April 19, 1932. K. L. MARTIN 1,854,947

WATER TUBE BOILER

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Fig 1

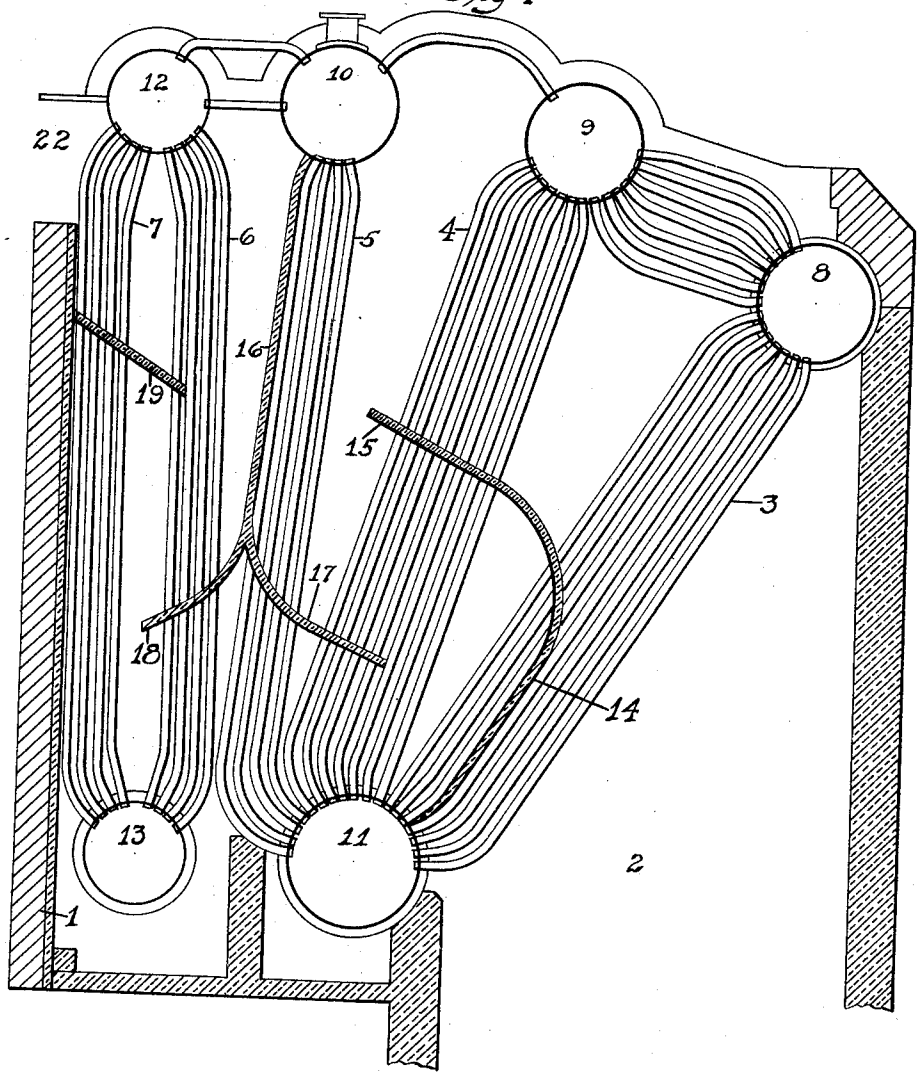


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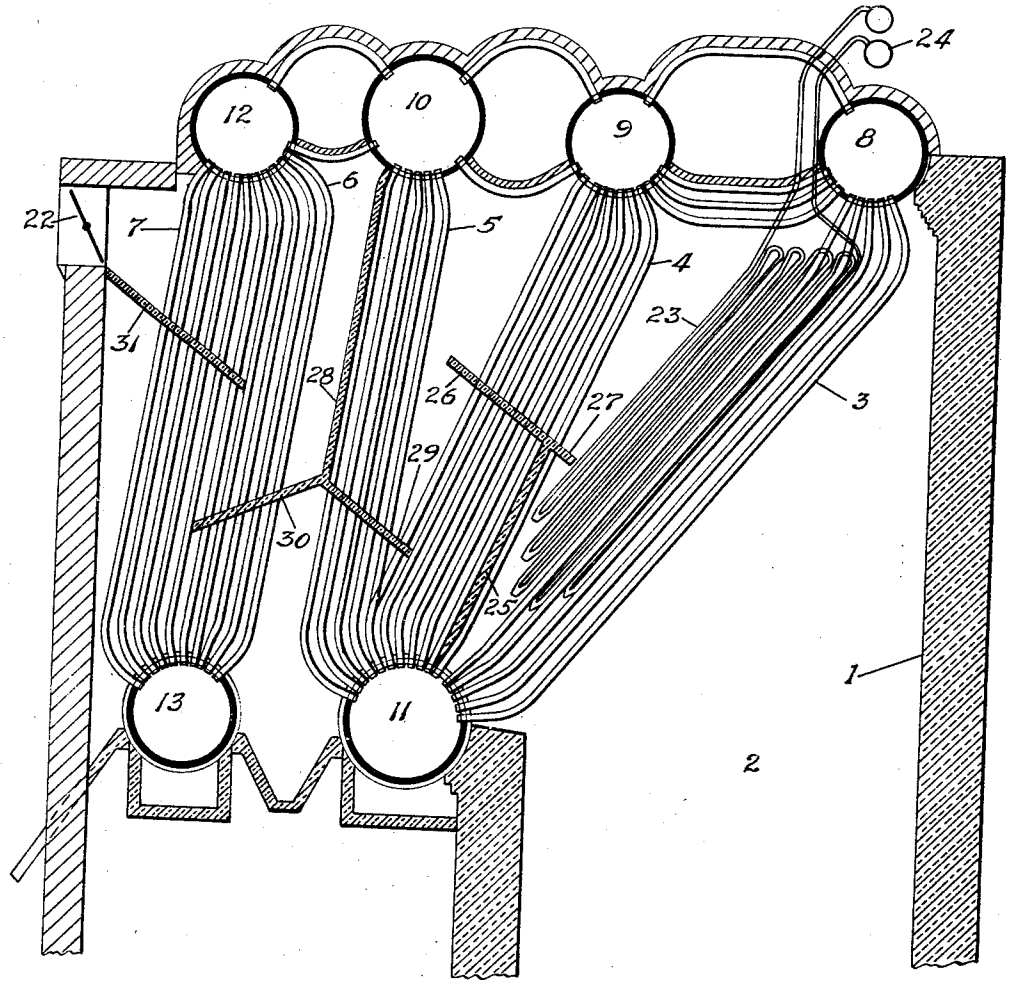
Fig 2

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Patented Apr. 19, 1932 1,854,947

# UNITED STATES PATENT OFFICE

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## WATER TUBE BOILER

Application filed October 22, 1931. Serial No. 570,322.

The invention relates to water tube boilers and more particularly to such boilers with integral economizers of the bent tube type. The best known boilers of this type are the Stirling, Heine and Connelly and consist of a boiler having four or more drums. The lower drum in the boiler is commonly called the mud drum and is connected to two or more spaced drums by bent boiler tubes more or less inclined. The economizer is placed to the rear of the boiler and consists commonly of an upper and a lower drum connected by bent tubes, the upper drum being connected by tubes to the rear upper drum of the boiler. It may, however, consist of one lower drum connected by tubes to the rear upper drum of the boiler.

The economizer is traversed by the gases which have passed through the boiler and is used to heat up the boiler feed water; the heat in the gases not transmitted to the boiler and economizer being lost up the stack.

This invention has for its primary object (1) the most efficient application of the gases of combustion to the heating surfaces of both the boiler and the economizer so as to increase their economy (2) to reduce the draft loss through the unit so as to permit greater quantities of gas to be drawn through the unit with the available stack draft and thereby greatly increase the steaming capacity of the unit and (3) minimize the expansion strains on the economizer by equalizing the temperature in the tubes connecting the upper and lower drums. Certain embodiments of the invention are shown in the accompanying drawings, wherein:

Figure 1 is a vertical section through one form of boiler and economizer construction.

Fig. 2 is a similar section through a modification.

Referring to Fig. 1, the boiler and economizer shown comprise the setting 1, firebox 2, three banks of boiler tubes 3, 4 and 5, the drums 8, 9, 10 and 11, the economizer banks of tubes 6 and 7, the economizer drums upper and lower 12 and 13, the boiler baffles, the front baffles comprising the sections 14 and 15 and the rear baffle the sections 16 and 17, the sections 14 and 16 extending longitudinally of the tubes and the sections 15 and 17 extending transversely of the tubes.

In the economizer, the baffles extend transversely of the tubes, two sections 18 and 19 being used in this particular design. The gas outlet from the boiler setting is through the upper rear opening 22.

Fig. 2 shows another application of the invention, in which there is some modification of the baffling, and in which a superheater of the loop type is shown, such superheater lying in part to the front of the second bank of tubes. The same reference numerals are used on the economizer and boiler parts as are used on Fig. 1. The loops or elements 23 of the superheater are connected to the headers 24 and lie in part between the first and second banks of tubes 3 and 4 and in part in the spaces between the front bank 3. The front baffle comprises the three sections 25, 26, and 27 arranged as shown, with the section 27 acting as a gas seal to prevent the gases from by-passing the superheater at this point. The baffle 28 leads from the rear steam drum 10. The baffle sections 29, 30 and 31, are similar to and correspond in function with the sections 17, 18 and 19, of the Fig. 1 construction.

The advantages incident to the constructions shown and described may be summarized as follows.

The cross baffling arrangement increases efficiency as compared with the longitudinal baffling heretofore employed with water tube boilers having economizers, since the hot gases flowing transversely across tubular surfaces transmit their heat more rapidly and completely than where flowing parallel to such surfaces, due probably to greater turbulence, more intimate contact and direct impingment. The present arrangement insures cross flow both in the boiler and economizer, instead of the customary longitudinal flow in one or both.

The construction decreases draft losses very materially as compared with customary longitudinal baffles, due in part to the wider passageways which are possible. Friction losses are further reduced by the curved joining sections between the longitudinal and

transverse baffle wall sections, and the tendency of soot, dust, and the like to collect at the junctures of the structures and thus clog the draft area is reduced. This feature also facilitates the work of steam and soot blowers in cleaning the tubes and baffles, in order to increase boiler efficiency.

If induced draft fans are used the driving power for the fan required for a given steam output will be materially reduced, and it will be possible with a given size fan to develop materially greater capacity in the boiler. This results in marked economy in first cost and operation.

The method customarily used for passing the gases leaving the boiler over the heating surface of the economizer is to flow them longitudinally along the tubes on the forward half of the economizer and turn them at the end and return them longitudinally along the rear half. Obviously the hot gases in the front half cause the tubes to expand more than the comparatively cooler gases in the rear half cause the tubes in the rear half to expand, thereby introducing temperatures stresses in the drums tending to cause troublesome leaks where the tubes connect with the drums.

Certain embodiments of the invention are shown in the accompanying drawings but it should be understood that there is a wide variation in the types of boilers and economizers commonly used; and I do not limit the application of my invention to the exact construction shown unless otherwise limited by the terms and the claims are applicable to all types.

What I claim is:

1. In combination with a water tube boiler having upper steam drums and a lower mud drum with tubes connecting them and a vertical tube economizer lying back of the rear tubes of the boiler and having upper and lower drums, baffling for the boiler, including a baffle extending downward from the vicinity of the rear steam drum, along the tubes of the rear bank, and then to the front across the tubes, whereby the gases of combustion are circulated transversely of the boiler tubes and delivered to the rear across the lower sections of said tubes, a baffle for the economizer extending laterally from the lower end of said longitudinal baffle across the economizer tubes, a second baffle spaced above the first economizer baffle, and extending in the reverse direction, and an outlet flue above the upper economizer baffle.

2. In combination with a water tube boiler having upper steam drums and a lower mud drum with tubes connecting them and a vertical tube economizer lying back of the rear tubes of the boiler and having upper and lower drums, baffling for the boiler including a baffle extending downward from the rear steam drum along the back sides of the rear bank of boiler tubes and then to the front across such tubes whereby the gases of combustion are delivered to the rear across the lower sections of the tubes, a baffle for the economizer extending laterally from the lower end of said longitudinal baffle partly across the economizer tubes, a second baffle spaced above said first economizer baffle and extending to the rear from the wall of the boiler setting; and an outlet flue above the upper economizer baffle.

In testimony whereof, I have hereunto subscribed my name this 14th day of October, 1931.

KINGSLEY L. MARTIN.