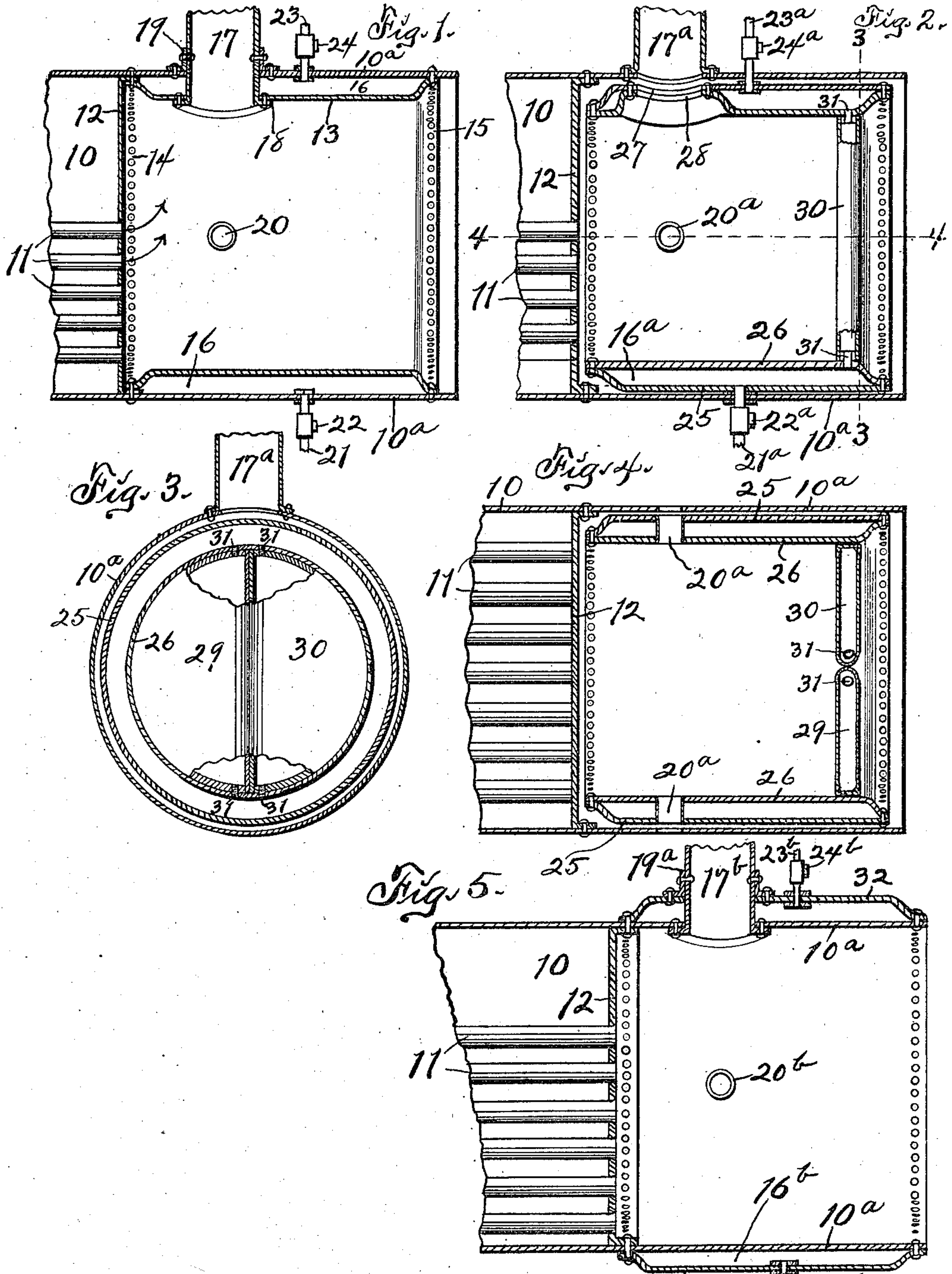


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 FEED WATER HEATER AND SMOKE BOX PROTECTOR.
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UNITED STATES PATENT OFFICE.

CHARLES S. ALLEN AND BENJAMIN F. CRONEY, OF DES MOINES, IOWA.

FEED-WATER HEATER AND SMOKE-BOX PROTECTOR.

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Specification of Letters Patent.

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To all whom it may concern:

Be it known that we, CHARLES S. ALLEN and BENJAMIN F. CRONEY, citizens of the United States, residing at Des Moines, in the county of Polk and State of Iowa, have invented a new and useful Feed-Water Heater and Smoke-Box Protector, of which the following is a specification.

The object of this invention is to provide improved means for utilizing waste heat in preliminary heating of feed water for steam boilers.

A further object of this invention is to provide improved means for utilizing a water jacket, adapted to contain feed water for steam boilers, in protecting a smoke box from excessive and damaging heat.

A further object of this invention is to provide an improved construction for a feed water heater adapted to be placed in and removed from a steam boiler independent of the primary construction and use of such boiler.

Our invention consists in the construction, arrangement and combination of elements hereinafter set forth, pointed out in our claims and illustrated by the accompanying drawing, in which—

Figure 1 is a longitudinal vertical section of the forward end portion of a steam boiler, the front closure thereof being removed, illustrating one form of our improved construction as adapted to be built into the boiler coincident with its primary construction. Fig. 2 is a similar view illustrating our improvement constructed as an attachment and adapted to be applied to the boiler independent of its primary construction. Fig. 3 is a cross-section on the indicated line 3—3 of Fig. 2. Fig. 4 is a horizontal section on the indicated line 4—4 of Fig. 2. In Figs. 2, 3 and 4 water doors are shown in the attachment. Fig. 5 is a view similar to Figs. 1 and 2 illustrating the construction of our improvement exteriorly of the front end portion of the boiler and is designed to be applied thereto coincident with the primary construction of the boiler.

In the construction of the apparatus as illustrated in Fig. 1 the numeral 10 designates a boiler having flues 11 longitudinally thereof and communicating at their forward ends through a crown sheet 12 with a smoke

box 10^a, all of common and well known construction. A shell or lining 13 is formed with expanded end portions or peripheral flanges 14, 15 adapted to be riveted to the boiler and smoke box. The flange 14 is concentric with and within a flange of the crown sheet 12 and said flanges are riveted conjunctively to the boiler. Thus a water space 16 is constructed between the body of the shell or lining 13 and the smoke box. A smoke stack 17 extends through registering openings in the shell or lining 13 and the smoke box 10^a. The smoke stack 17 is secured to the lining 13 by a flange 18 riveted to said lining and is secured to the smoke box by a flanged collar 19 riveted to the smoke stack and smoke box. Exhaust pipes 20 (one of which is shown in Fig. 1) lead laterally through the smoke box 10^a, water space 16 and lining 13 and are adapted to convey the exhaust from engine cylinders not shown to the interior of said lining. The front of the boiler may be closed by any desired means and in respect of Figs. 1 and 5 of the drawing such closure forms no part of our invention. A supply pipe 21 leads from a source of water supply not shown through the lower portion of the smoke box 10^a and communicates with the lower portion of the water space 16. The supply pipe 21 is controlled by a check valve 22 which prevents return flow of the water from the space 16. A feed pipe 23 is mounted through the upper portion of the smoke box 10^a and leads from the upper portion of the water space 16 to the interior of the boiler at some point below the water line therein and is adapted to convey heated feed water from the space 16 to the boiler. The feed pipe 23 is controlled by a check valve 24 which prevents return flow of water to the space 16. In the practical use of this device the space 16 is filled with water and such water is heated by radiation from smoke and exhaust steam contained in the lining 13 in the passage of such smoke and steam from the flues 11 and exhaust pipes 20 to the smoke stack 17.

In the construction of the apparatus as shown in Figs. 2, 3 and 4 the boiler 10, smoke box 10^a, flues 11 and crown sheet 12 are the same as in Fig. 1. In this construction the smoke stack 17^a is flanged and riveted at

its lower end directly to the smoke box 10^a in a common manner. Our attachment in this instance is constructed as follows: A casing 25 is contracted or interiorly flanged at one end and a lining 26 is mounted within, concentric with and spaced from the casing and is expanded or exteriorly flanged at the opposite end. The flange of the casing 25 is riveted to one end portion of the lining 26 and the flange of said lining is riveted to the opposite end portion of the casing, thus forming and producing a water space 16^a between them. Holes 27, 28 are formed in the casing 25 and lining 26 respectively and registering with the lower end of the smoke stack 17^a. The lining 26 is flanged around the hole 28 and is riveted to the casing 25 around the hole 27. Semi-circular hollow doors 29, 30 are mounted in the forward end portion of the lining 26 and are pivoted therein by means of pipes 31 affording communication between the forward end portion of the water space 16^a and the interior of the doors. Any desired means may be employed to retain the doors 29, 30 in closed position. Exhaust pipes 20^a communicate laterally through the smoke box 10^a, casing 25 and lining 26 and are adapted to convey exhaust steam from engine cylinders not shown to the interior of said lining. A supply pipe 21^a having a check valve 22^a communicates through the lower portions of the smoke box 10^a and casing 25 with the water space 16^a and a feed pipe 23^a having a check valve 24^a communicates through the upper portions of the smoke box and casing with the water space and is adapted to convey feed water to the boiler as previously described. In the practical use of this apparatus the water in the space 16^a is heated by radiation from the smoke and exhaust steam discharged into the lining 26 from the flues 11 and pipes 20^a and the water jacket thus provided protects the smoke box 10^a from excessive heat. Water circulates through the hollow doors 29, 30 by way of the pipes 31 and protects such doors from excessive heat. This apparatus may be constructed separately from and independent of the smoke box and be mounted therein even after a boiler and smoke box have been used indefinitely without it; thus providing a means for utilizing and embodying our improvement in steam boilers not constructed and designed especially to receive it.

In the construction of the device as illustrated in Fig. 5 the boiler 10, smoke box 10^a, flues 11 and crown sheet 12 are the same as in Figs. 1, 2, 3 and 4. A casing 32 is mounted around, concentric with and spaced from the smoke box 10^a and said casing is contracted or interiorly flanged at its ends. The rear flanged end portion of the casing 32 is riveted conjunctively with the crown

sheet to the boiler 10 while the front flanged end portion of said casing is riveted to the forward end portion of the smoke box. Registering holes are formed in the smoke box 10^a and casing 32 to receive the lower end portion of a smoke stack 17^b. The lower end of the smoke stack 17^b is flanged and riveted to the smoke box 10^a. The stack 17^b is connected to the casing 32 by a flanged collar 19^a riveted to said stack and casing. Exhaust pipes 20^b, one of which is shown, are mounted laterally through the casing 32 and smoke box 10^a and are adapted to convey exhaust steam from engine cylinders not shown to the interior of said smoke box. A supply pipe 21^b, provided with a check valve 22^b, is mounted through the lower portion of the casing 32 and communicates with a water space 16^b between said casing and the smoke box. A feed pipe 23^b, provided with a check valve 24^b, is mounted in the upper portion of the casing 32, communicates with the upper portion of the water space 16^b and is adapted to convey heated water from said space to the boiler. The front portion of the smoke box 10^a may be closed in any desired manner.

In the practical use of the apparatus as shown in Fig. 5 water is heated in the space 16^b by radiation from smoke and exhaust steam supplied to the smoke box by the flues 11 and exhaust pipes 20^b.

In each and either instance the water jacket, however constructed, serves to contain water to be heated by radiation otherwise wasted or destructively employed and also serves to protect the smoke box from the destructive influence of smoke, excessive heat therein and the augmenting heat of the exhaust steam.

We claim as our invention—

1. In a steam boiler having a smoke box, the combination of a lining mounted within and spaced from and concentrically of said smoke box, said lining formed with expanded end portions riveted to said smoke box, a smoke stack extending through said smoke box and lining and communicating with the interior of the lining, an integral flange on said smoke stack riveted to said lining, a flanged collar on said smoke stack riveted to said smoke box, exhaust steam pipes extending through said box and lining and communicating with the interior of the latter, a valve-controlled water supply pipe communicating with the bottom of the space between the smoke box and lining, and a valve-controlled water feed pipe communicating with the top of the space between said smoke box and lining.

2. In a steam boiler having a smoke box, the combination of a water jacket within and concentric of said smoke box, smoke and steam exhaust pipes communicating through said water jacket and smoke box, imperfor-

rate hollow doors mounted in said water jacket and pipes hinging said doors to said water jacket, said pipes communicating with the interior of the doors and the interior of the water jacket respectively whereby a flow of water is permitted between said water jacket and hollow doors, and means for supplying and discharging water from said water jacket.

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Copies of this patent may be obtained for five cents each, by addressing the "Commissioner of Patents, Washington, D. C."
