May 2, 1933. C. T. CARLSON 1,906,838

STEAM GENERATOR

Filed Aug. 29, 1929 3 Sheets-Sheet 1

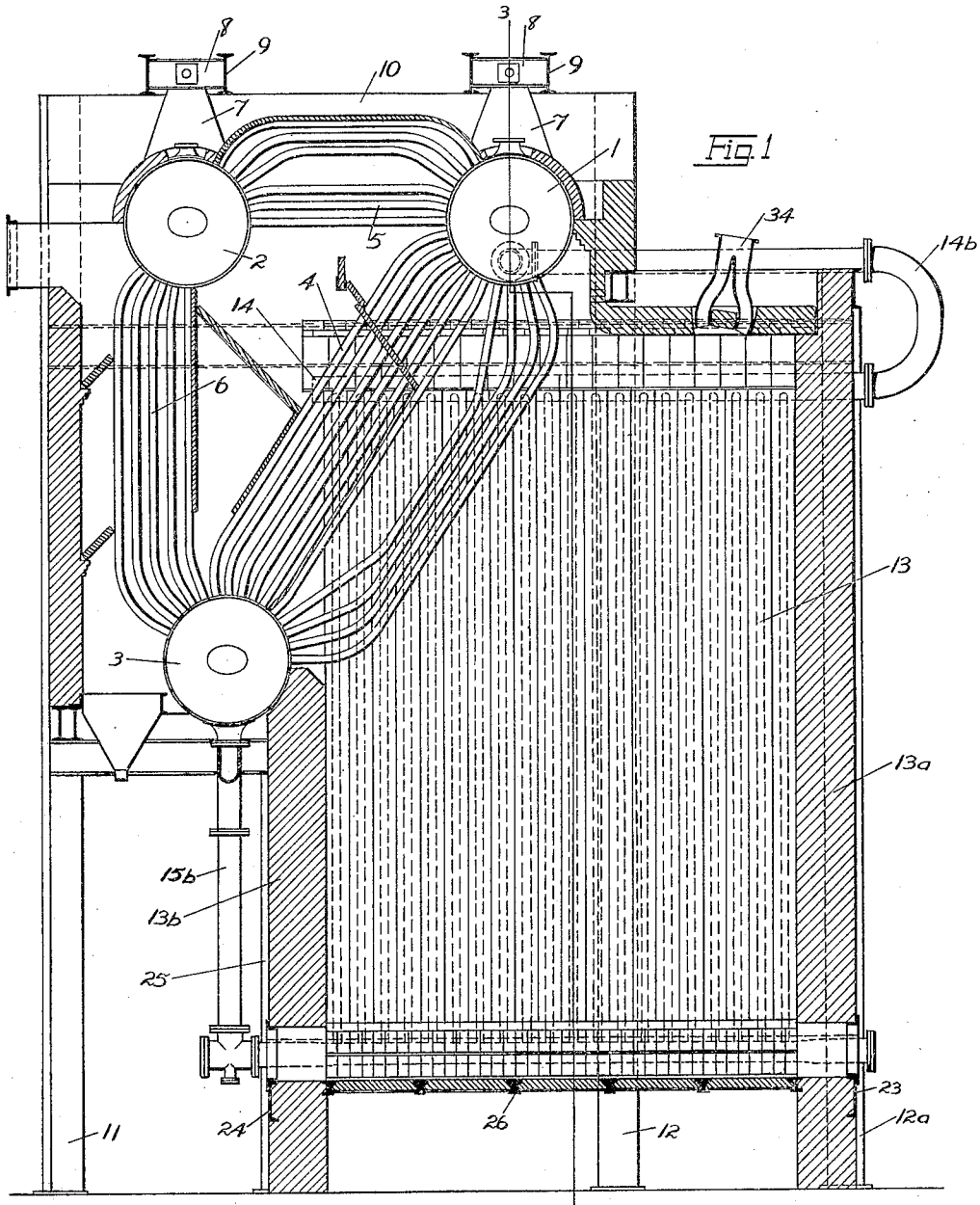


Fig. 1

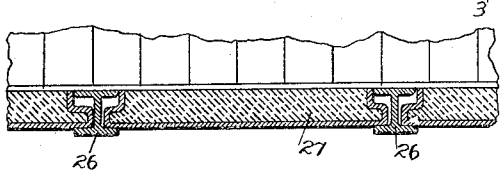


Fig. 2

Carl T. Carlson

INVENTOR.

BY W. L. Lowe

ATTORNEYS.

May 2, 1933. C. T. CARLSON 1,906,838

STEAM GENERATOR

Filed Aug. 29, 1929 3 Sheets-Sheet 2

Fig. 3

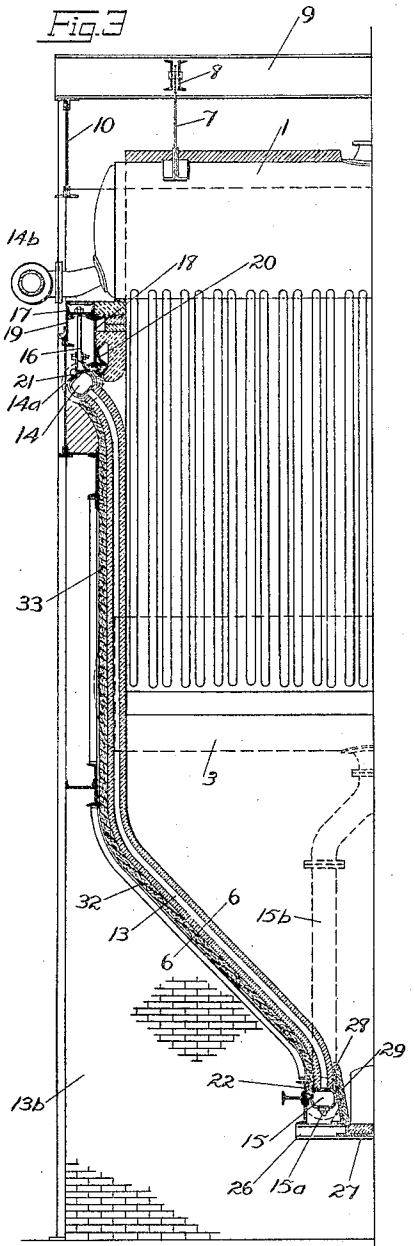
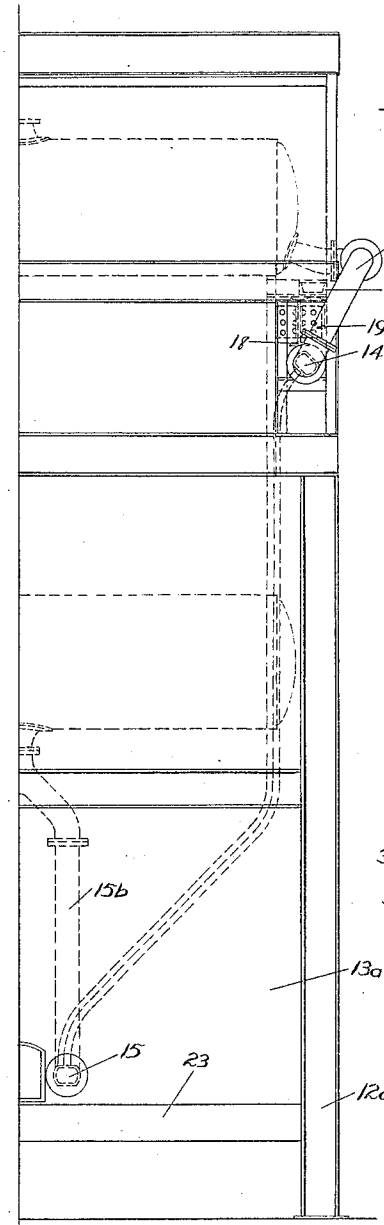


Fig. 3a



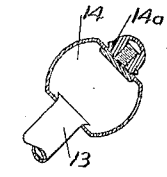


Fig. 4

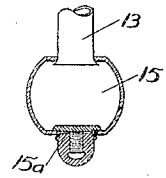


Fig. 5

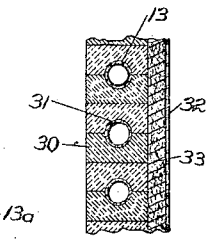


Fig. 6

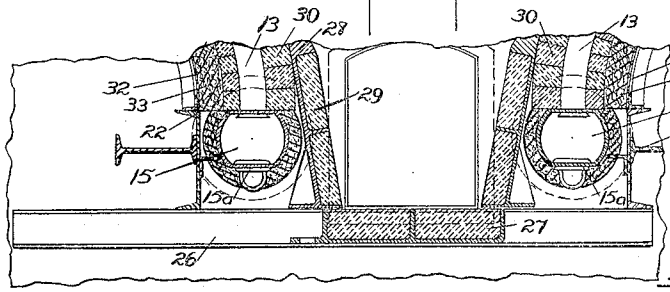


Fig. 7

Carl T. Carlson
INVENTOR.

BY

ATTORNEYS.

May 2, 1933. C. T. CARLSON 1,906,838

STEAM GENERATOR

Filed Aug. 29, 1929 3 Sheets-Sheet 3

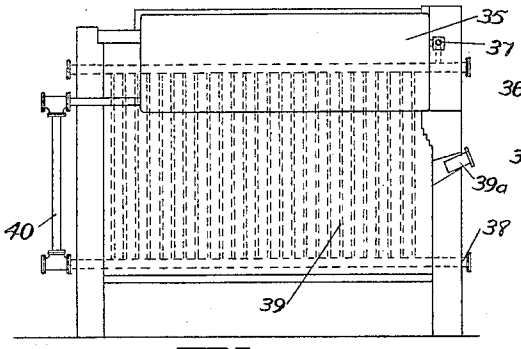


Fig. 8

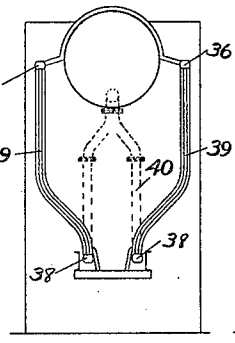


Fig. 9

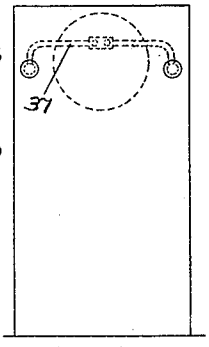


Fig. 10

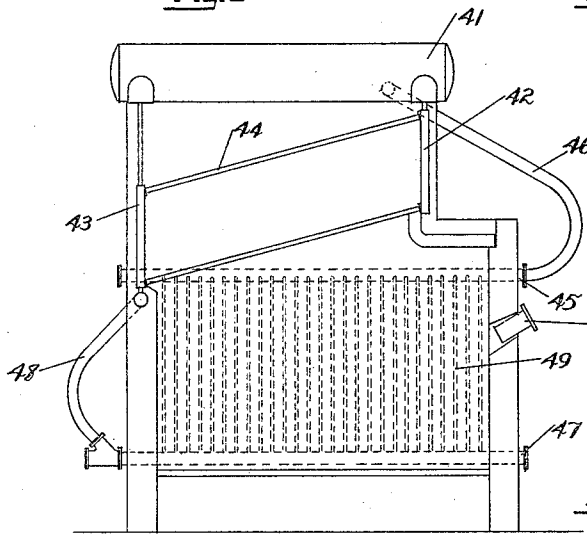


Fig. 11

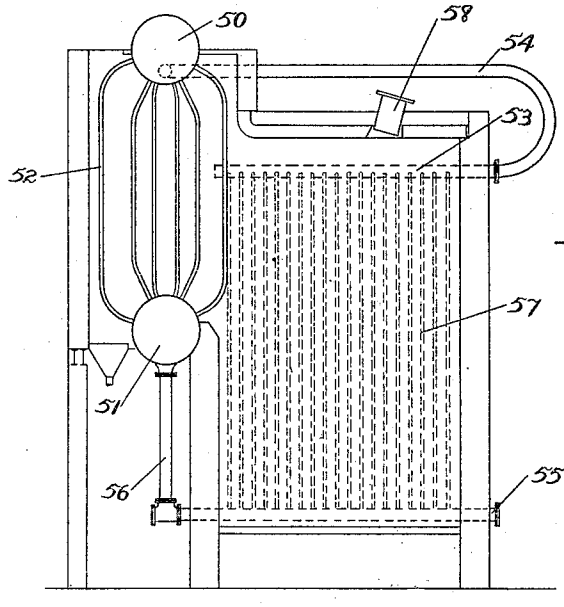


Fig. 12

Carl T. Carlson

INVENTOR.

BY N. Z. Lord

ATTORNEYS.

Patented May 2, 1933 1,906,838

UNITED STATES PATENT OFFICE

CARL T. CARLSON, OF ERIE, PENNSYLVANIA, ASSIGNOR TO ERIE CITY IRON WORKS, OF ERIE, PENNSYLVANIA, A CORPORATION OF PENNSYLVANIA

STEAM GENERATOR

Application filed August 29, 1929. Serial No. 389,176.

The present invention is designed to improve the manner of supporting and associating the boiler and furnace of a steam generator. The invention further contemplates improvements in the furnace. Steam boilers as ordinarily mounted, particularly with the high ratings to which they are now subjected, present difficulty with relation to wide variations of temperature and consequent strains and stresses which such differences of temperature impose upon the structure. In the present invention the units are suspended and are arranged to have freedom of expansion and contraction and thus such stresses are very largely avoided. Further the arrangement is such as to involve a very rapid circulation through the different elements of the generator and in consequence there is a more even distribution of temperature throughout the unit. The invention also is so formed that it may be readily erected and put in service. The furnace proper also involves a structure in which there are small heat losses and from which the ash may be readily removed. Features and details of the invention will appear from the specification and claims.

Preferred embodiments of the invention are illustrated in the accompanying drawings as follows:—

Fig. 1 shows a front to rear section of the generator.

Fig. 2 an enlarged view of the bottom of the furnace.

Fig. 3 a section on the line 3—3 in Fig. 1.

Fig. 3*a* is a partial front elevation of the generator.

Fig. 4 a section through the manifold at the top of the furnace.

Fig. 5 a section through the manifold at the bottom of the furnace.

Fig. 6 an enlarged sectional view of the furnace wall.

Fig. 7 an enlarged sectional view of the bottom of the furnace.

Fig. 8 a side elevation of an alternative construction showing the furnace adapted to a horizontal boiler.

Fig. 9 a sectional view of the same boiler.

Fig. 10 an end view of the same boiler.

Fig. 11 shows my improved furnace in connection with a horizontal type of water tube boiler.

Fig. 12 a view of a furnace in connection with a vertical type of water tube boiler.

In the preferred construction shown in Figs. 1 to 7, the boiler comprises the forward upper drum 1, the rear upper drum 2, the lower drum 3, a front bank of tubes 4 between the drums 1 and 3, an upper bank of tubes 5 between the drums 1 and 2 and a rear bank of tubes 6 between the drums 2 and 3, these drums and tubes being preferably arranged to accomplish a ring circulation from the drum 1 to the drum 2 and from the drum 2 to the drum 3 and from the drum 3 to the drum 1, the different banks of tubes being properly baffled to assure a movement of the hot gases through them.

The boiler and furnace in this construction are suspended from a steel frame. The drums 1 and 2 are suspended by hangers 7 from cross pieces 8. The cross pieces 8 are arranged between I-beams 9, which I-beams are supported on girders 10. The girders 10 are supported by posts 11 and 12 extending from the floor. The furnace is formed with a skeleton of tubes 13 forming water-cooled side walls. These tubes are secured at their upper ends in manifolds 14 and at their lower ends in manifolds 15. The tubes extend downwardly from the upper manifold to give the outline of the side walls and the tubes at the opposite sides converge forming the bottom of the furnace, an ash trough being formed between the bottom manifolds for the discharge of ash from the furnace. A series of hangers 16 extend from the upper manifold and are supported from a channel 17. The channel 17 rests on girders 18 and

19 extending lengthwise of the boiler from the posts and secured to the posts 11 and 12 and to a post 12*a*. An angle strip 20 is secured to the lower end of the I-beam 18 and forms a support for a filling 21 closing the space between the manifold and the I-beam and thus closing the wall of the furnace. The lower manifolds rest against beams 22 extending from front to back of the boiler supported on cross girders 23 and 24, the cross girder 24 being mounted on posts 25 extending upwardly from the floor at the rear of the furnace wall. Gate supports 26 are secured to the bottoms of the beams 22 and form guide channels for sliding gates 27, these sliding gates being preferably covered with refractory material on their upper faces adapted to slide in the I-beam so as to open the bottoms of the troughs. Side plates 28 are arranged on each face of the gutter protecting the manifolds 15 and these plates are covered with refractories 29.

A skeleton provided by the tubes 13 is closed by refractories 30, these refractories being provided with grooves 31 which engage the tubes 13 and these form the side walls of the furnace and are cooled from the heat exchange from the tubes and, of course, the water circulating in the tubes is heated directly through these walls.

The furnace is closed at the front and rear by ordinary furnace walls 13*a* and 13*b*. A metal casing 32 is arranged outside of the refractories 30 and slightly spaced therefrom. This metal case may be supported in any desirable manner from the frame members. An insulating material 33 is filled into this space, preferably from the opening at the top adjacent to the manifold 14.

The manifold 14 is provided with hand holes 14*a* and the manifold 15 with hand holes 15*a* opposite each tube. It will be noted that the manifold 14 while receiving the tubes from within the furnace extends to without the furnace wall so that the hand holes 14*a* are readily accessible outside the furnace walls.

The lower manifold is connected with the lower drum 3 by a pipe 15*b* and the upper manifold 14 is connected by a pipe 14*b* with the drum 1.

Fuel may be fed to the furnace in any manner desired but preferably powdered fuel is fed to the furnace from the top through a burner 34. In this structure the furnace and boiler being suspended from the top and free to expand and contract from such suspension very little strain is put upon the generator members and it will also be noted that the suspension of the furnace is close to the top of the boiler, a large part of the furnace overlapping the lower part of the boiler, so that the expansion of the tubes is coincident. In this structure the furnace is suitable for very high rating in that the furnace walls are protected, but at the same time the actual skeleton of tubes is so insulated from the furnace as to prevent cooling, reducing the furnace temperatures below what would be effective for rapid ignition. The sloping floor terminating in the central gutter with the removable gates provides an easy method of disposal of any ash that may be deposited. The cooling of the lower wall assists in preventing the accumulation of slag upon it.

In Fig. 8, I show a furnace of similar construction adapted to a horizontal boiler. In this structure the boiler shell 35 is provided. This is connected with manifolds 36 by pipes 37. The lower manifolds 38 are connected by tubes 39 forming the speketon frame for the furnace in the manner of the preferred construction. The lower manifold is connected with the boiler proper by a pipe 40. Fuel is delivered ordinarily from the end of the furnace as indicated by a burner 39*a*.

In the alternative construction shown in Fig. 11 an upper drum 41 is provided with headers 42 and 43 and connecting water tubes 44. The upper manifolds 45 are connected by pipes 46 with the drum 41. The lower manifold 47 is connected by a pipe 48 with the lower header 43. Furnace walls 49 comprise the tubes connecting the manifolds and the refractories as in the preferred construction. Fuel may be delivered to this furnace as indicated my a burner 49*a*.

In the alternative construction shown in Fig. 12, an upper drum 50 is connected with a lower drum 51 by tubes 52. The furnace has an upper manifold 53 and is connected by a pipe 54 with the upper drum. The lower manifold 55 is connected by a pipe 56 with the lower drum. The furnace wall 57 comprises the skeleton of tubes connecting the manifolds 53 and 55 with the refractories as in the preferred construction and the furnace is fired from the top through a burner 58 as in the preferred construction.

It will be noted that the angle strip 20 which maintains the closing cement 21 is deflected outwardly from the beam 18 along its upper edge forming a hook on which the refractories protecting the girder 18 and also the plate 20 are supported.

What I claim as new is:—

1. In a steam generator, the combination of a supporting frame comprising posts and cross girders; a boiler comprising an upper and a lower drum and connecting boiler tubes suspended from the girders on said frame; a furnace chamber associated with the boiler formed of a skeleton of tubes; manifolds along the upper ends of the tubes to which the furnace tubes are connected and from which said furnace tubes are suspended, said manifolds being suspended from the girders of the frame and arranged immediately below said girders; an angle plate secured to said

girders; and a cement filling between the manifold and the girders retained by the angle plate.

2. In a steam generator, the combination of a supporting frame comprising posts and cross girders; a boiler comprising an upper and a lower drum and connecting boiler tubes suspended from the girders on said frame; a furnace chamber associated with the boiler formed of a skeleton of tubes; manifolds along the upper ends of the tubes to which the furnace tubes are connected and from which said furnace tubes are suspended, said manifolds being suspended from the girders of the frame and arranged immediately below said girders; an angle plate secured to said girders; a cement filling between the manifold and the girders retained by the angle plate; and refractories supported by the angle plate and protecting the girders and the plate.

In testimony whereof I have hereunto set my hand.

C. T. CARLSON.