

H. A. POPPENHUSEN.  
 STEAM BOILER FURNACE.  
 APPLICATION FILED DEC. 18, 1909.

996,939.

Patented July 4, 1911.  
 2 SHEETS—SHEET 1.

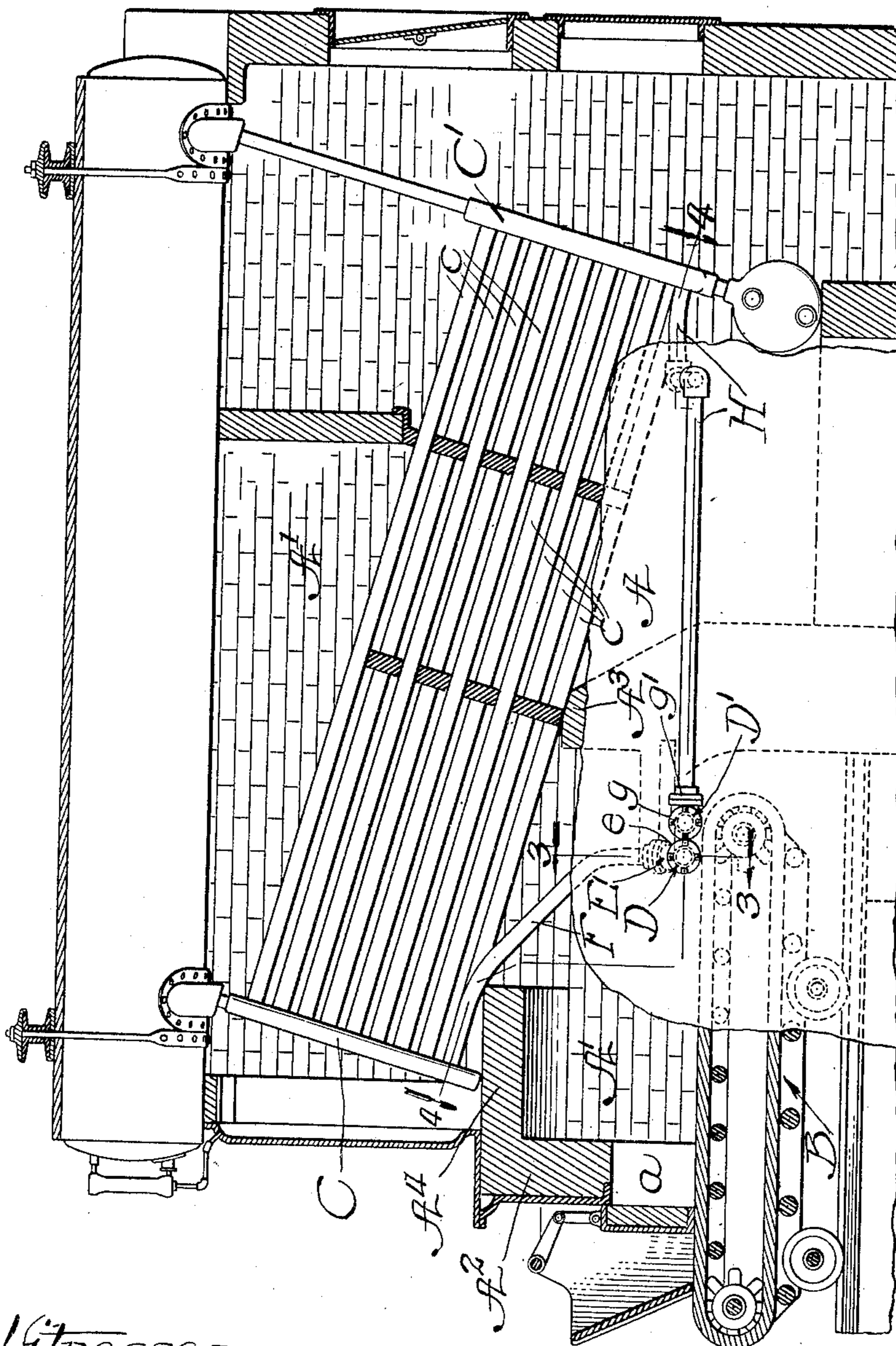


Fig. 1.

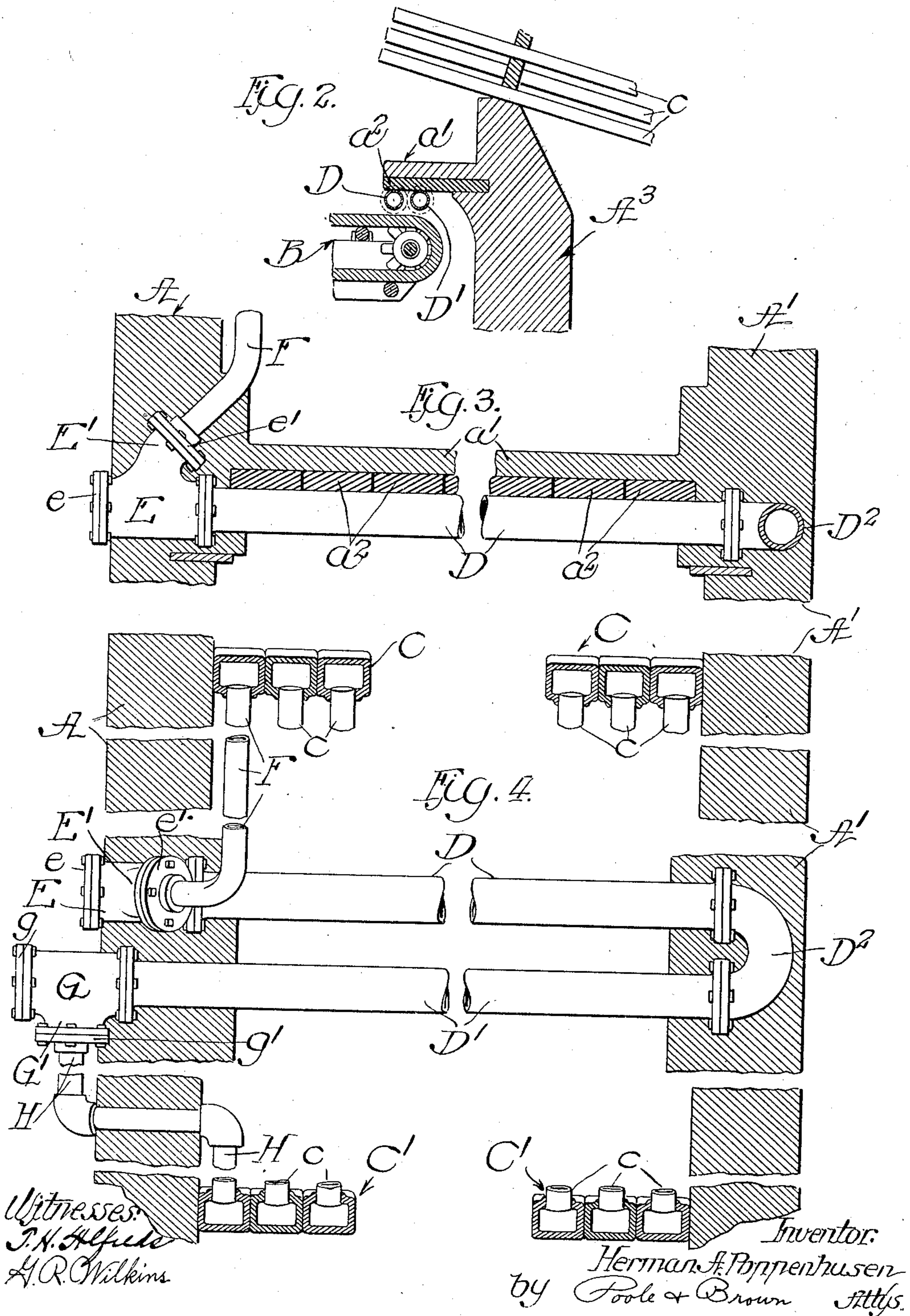
Witnesses:  
*J. H. Alford*  
*G. R. Wilkins*

Inventor:  
*Herman A. Poppenhusen*  
 by *Pool & Brown*  
*Attys.*

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# UNITED STATES PATENT OFFICE.

HERMAN A. POPPENHUSEN, OF EVANSTON, ILLINOIS.

STEAM-BOILER FURNACE.

996,939.

Specification of Letters Patent.

Patented July 4, 1911.

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*To all whom it may concern:*

Be it known that I, HERMAN A. POPPENHUSEN, a citizen of the United States, and a resident of Evanston, in the county of Cook and State of Illinois, have invented certain new and useful Improvements in Steam-Boiler Furnaces; and I do hereby declare that the following is a full, clear, and exact description thereof, reference being had to the accompanying drawings, and to the letters of reference marked thereon, which form a part of this specification.

This invention relates to means for closing the space between the layer of ashes resting on the grate of an automatic stoking furnace and a part of the bridge wall of such a furnace which overhangs the rear end of the grate, to prevent the passage of air between the rear end of the grate and the bridge wall, and more especially to a water-cooled, metal bridge piece or water back, located forward of the bridge wall over the rear end of the grate.

The invention consists of the matters hereinafter described and pointed out in the appended claims.

As shown in said drawings:—Figure 1 is a view partially in side elevation and partially in longitudinal vertical section of a steam boiler furnace provided with a water back and connections made in accordance with my invention. Fig. 2 is a detail view showing in longitudinal vertical section the water-cooled bridge piece and adjacent parts. Fig. 3 is a transverse sectional view taken on line 3—3 of Fig. 1. Fig. 4 is a detail section with parts broken away, taken upon line 4—4 of Fig. 1.

As shown in said drawings, A, A<sup>1</sup> indicate the side walls of a steam boiler furnace, A<sup>2</sup> the front wall, and A<sup>3</sup> the bridge wall thereof.

A<sup>4</sup> indicates a fire arch or coking breast extending rearwardly from the front wall A<sup>2</sup>.

B indicates a traveling chain grate of the usual construction by which the fuel is carried from the feed opening *a* in the front wall A<sup>2</sup> rearwardly toward the bridge wall.

C, C indicate a set of front, and, C<sup>1</sup>, C<sup>1</sup> a

set of rear headers of a water tube boiler; said front and rear headers being connected by means of water tubes *c, c, c* in the usual manner.

The bridge wall A<sup>3</sup> is provided with a forwardly extending horizontal portion *a*<sup>1</sup> overhanging the rear end of the chain grate B and constructed of tiles or fire bricks.

D, D<sup>1</sup> indicate two horizontal, metal pipes or tubes which are arranged parallel with each other, are supported at their ends in side walls A, A<sup>1</sup>. Said tubes extend transversely of the furnace, over the rear end portion of the chain grate B and are in contact with and serve to support the overhanging part *a*<sup>1</sup> of the bridge wall. That one of said tubes, D, which is nearest the front of the furnace mainly performs the function of the similarly located water-cooled bridge pieces heretofore employed for like purposes, the same serving to close the space between the grate and the bridge wall against the passage of air. In other words, said tube D is arranged at such distance above the rear part of the grate, that the part of the layer of fuel resting on the rear portion of the grate will be constantly in contact with the same, it being understood that the layer of ashes or burned out products of combustion carried rearwardly on the grate will pass beneath said tubes, while at the same time continuous contact of the bottom of the said tube with the top surface of said layer of ashes or burned out fuel will be maintained.

As shown in the drawings, the two tubes D, D<sup>1</sup> are arranged in horizontal alinement with each other and are arranged to afford support for horizontal tiles *a*<sup>2</sup>, *a*<sup>2</sup>, forming the lower part of the overhanging portion *a*<sup>1</sup> of the bridge wall. The rear ends of said tiles are embedded in the bridge wall and the forward ends thereof rest on the top surfaces of said pipes, as clearly seen in Fig. 2.

The ends of the tubes D, D<sup>1</sup>, at one side of the furnace, are connected with each other by a curved tube section D<sup>2</sup> which, together with the adjacent ends of said tubes, is embedded in the side wall A<sup>1</sup>, as clearly seen in Figs. 3 and 4. At the opposite side

of the furnace the forward tube has its end inserted or embedded in the side wall A and has attached to it a T-fitting E which forms an endwise extension of said tube D. The  
 5 outer end of said fitting extends through the wall A and is provided with a removable cap or head *e*. The body of the fitting E is provided with a lateral extension or neck E<sup>1</sup> with which is connected a water return pipe  
 10 F, by means of which circulating connection is made between said tube D and one of the front headers C of the boiler. As illustrated, the neck E<sup>1</sup> is arranged obliquely and is directed upwardly and inwardly,  
 15 while the pipe F is located inside of the side wall A and is connected at its rear end with the fitting E by having its lower or rear portion bent into an oblique position and extended through part of the wall A above the  
 20 said fitting E. A connection is made between the neck E<sup>1</sup> of the fitting E and said pipe F, by means of a head *e*<sup>1</sup> bolted to the flanged end of the neck E and to the center of which said pipe F is secured. Said fit-  
 25 ting E is arranged to form a straight extension of the tube D with which it is connected, in order to give free access to the interior of said tube when the cap *e* is removed from the fitting, for the purpose of inspecting and  
 30 cleaning the tube.

To the end of the tube D<sup>1</sup> which is adjacent to the wall A, is secured a T-fitting G which extends outwardly beyond the outer  
 35 face of said wall A<sup>1</sup> and is, as shown in the drawings, located mainly outside of said wall. The body of said fitting G constitutes an endwise extension of the tube D<sup>1</sup> and its outer end is closed by means of a removable cap *g*. The body of said fitting G  
 40 forms a straight extension of said tube D<sup>1</sup> in order to give free access to the latter, when the cap *g* is taken off, for the purpose of cleaning and inspecting the inside of said tube. The body of said fitting G is provided  
 45 with a laterally extending neck G<sup>1</sup> through the medium of which a water supply pipe H is connected with the fitting. The connection between said pipe H and the fitting is afforded by means of a cap or plate *g*<sup>1</sup> which  
 50 is secured to the flanged end of said neck G<sup>1</sup> and to which the forward end of the circulating pipe H is attached. Said pipe H extends rearwardly from the fitting G outside of the wall A of the furnace and is provided  
 55 with a transverse, horizontal part which extends inwardly through said wall A; its rear end portion being located inside of said wall and being connected with the lower part of one of the rear headers C<sup>1</sup>.

60 The front and rear headers C C<sup>1</sup>, as usual in boilers of this kind and as shown in the drawings, extend vertically and are arranged side by side. The circulating pipes F and H are connected with the lower end of the  
 65 headers C C<sup>1</sup> which are nearest the wall A;

the ends of said circulating pipes being inserted in holes left for the purpose by the omission of the lowermost water tube that usually extends between said headers.

In the arrangement of the parts, con- 70  
 structed as described, water from the rear boiler header C<sup>1</sup> passes through the supply pipe H to the end of the rearmost tube D<sup>1</sup> with which said pipe H is connected, passes  
 75 through the tube D<sup>1</sup> and from the same to the forward tube D, and from the latter is delivered by the return pipe F to the lower part of the front header C. In a tubular boiler of the character shown, the circula- 80  
 tion of water is in a forward direction through the water tubes *e* from the rear headers C<sup>1</sup> C<sup>1</sup> to the front headers C C. By the circulating connections described a constant circulation of water is maintained  
 85 through said tubes D<sup>1</sup> and D, so as to keep the same at such a low temperature as to avoid any injury to or weakening of the same through the action of the great heat to which they are subjected. Inasmuch as the  
 90 water to effect cooling of the said tubes D<sup>1</sup> and D first enters the rearmost pipe D<sup>1</sup>, the latter will be kept usually at a lower temperature than the forward pipe D which is more directly exposed to the heat from the interior of the furnace; it being understood 95  
 that said rearmost pipe D<sup>1</sup> will be relied upon principally to support the weight of the overhanging part of the bridge wall which rests on said tubes, while the forward tube D performs mainly the function of 100  
 closing the space between the grate and the bridge wall, as hereinbefore stated, although the rearmost pipe D<sup>1</sup> will also perform this function to some extent. It will be appar- 105  
 ent, therefore, that the rearmost pipe D<sup>1</sup> not only serves to form a part of the circulating passages by which water is supplied to the forward pipe D which is subjected to the greatest heat, but also serves to aid in sus- 110  
 taining the overhanging part of the bridge wall, the two tubes D and D<sup>1</sup> together serving to give a reliable support for the overhanging part of the bridge wall and giving greater strength and durability to the structure as a whole than would be afforded by a 115  
 single tube arranged to serve as the sole means of closing the space between the bridge wall and the layer of fuel on the grate.

Advantages gained by the construction 120  
 described, embracing two water cooled tubes connected with each other at one side of the furnace, and supply and return pipes at the opposite side of the furnace connected with the ends of the tubes there located at points 125  
 outside of the combustion chamber; the supply pipes being located exterior to the combustion chamber and the return pipes within the same, may be stated as follows: By reason of the supply pipe being located 130

outside of the combustion chamber, and the return pipe within the same, the supply pipe is maintained at a much lower temperature than the return pipe, with the result of promoting the circulation of the water in the said pipes and in the water cooled tubes in a direction toward the water cooled tubes in the supply pipe and from said tubes in the return pipe. Moreover, by reason of the connection of both the supply and return pipes with the tubes at points outside of the combustion chamber, the joints between said pipes and the ends of the tubes are protected from the extreme heat within the furnace, and remain always at a moderate, or practically the same temperature, and there will be no expansion and contraction of the parts such as would tend to injure the joints or result in leakage. Furthermore, an important advantage is gained by having the ends of the water cooled tubes with which the supply and return pipes are connected, located at one side of the furnace, because the endwise expansion and contraction of the said tubes in this construction, may take place without producing any shifting or moving of the tubes with relation to the supply and return pipes; it being obvious that in the construction illustrated, the ends of the tubes to which the supply and return pipes are attached, may be made fixed or immovable so that any endwise expansion and contraction of the tubes will produce shifting movement of the tubes at their opposite or connected ends only. Furthermore, the construction by which the ends of the water cooled member, to which the supply and return pipes are attached, are both located at one side of the furnace, affords this advantage that the device can be used equally well in connection with double furnace, or two furnaces placed closely together side by side, as in a single furnace; it being manifest that said ends of the tubes, through which access is gained to the same for the purpose of removing sediment, etc. as well as the supply and return connections will, in such case, be located at and accessible from the outer side of each of the two furnaces.

It is to be understood that I do not desire to be limited to the specific details of construction illustrated in the accompanying drawings, but that the features constituting my invention may be embodied practically in various structural forms.

I claim as my invention:—

1. The combination with the side walls and bridge wall of a furnace, of a grate adapted to effect movement of the fuel resting thereon rearwardly in the furnace, said bridge wall being provided with a part which overhangs the rear end of said grate, two tubes which extend across the furnace, at least one of which is located beneath and

supports said overhanging part of the bridge wall, the ends of said tubes being connected with each other at one side of the furnace by a circulating connection and extending through the side wall at the other side of the furnace, a supply pipe located in a space subject to a substantially lower temperature than that within the furnace and connected with the receiving end of one of said tubes exterior to the inner surface of the said side wall, and a return pipe located within the furnace and connected with the discharge end of the other of said tubes at a point exterior to the inner surface of said side wall.

2. The combination with the side walls and bridge wall of a furnace, of a grate adapted to effect movement of the fuel resting thereon rearwardly in the furnace, said bridge wall being provided with a part which overhangs the rear end of said grate, forward and rear tubes located beneath said overhanging part of the bridge wall, the forward portion of said overhanging part of the bridge wall resting on and being supported by one of said tubes and the ends of said tubes being connected with each other at one side of the furnace by a circulating connection and extending through the side wall at the opposite side of the furnace, a supply pipe located in a space subject to a substantially lower temperature than that within the furnace and connected with the receiving end of the rearmost tube exterior to the inner surface of the said side wall and extending from said tube rearwardly, a return pipe located within the furnace and a pipe fitting for connecting said return pipe with the forward tube, said fitting being attached to the end of said forward tube exterior to the inner surface of the said side wall and being provided with an upwardly and inwardly inclined neck to which the end of said return pipe is attached.

3. The combination with the side walls and bridge wall of a furnace, of a grate adapted to effect movement of the fuel resting thereon rearwardly in the furnace, said bridge wall being provided with a part which overhangs the rear end of said grate, forward and rear tubes located beneath said overhanging part of the bridge wall, the forward portion of said overhanging part of the bridge wall resting on and being supported by one of said tubes and the ends of said tubes being connected with each other at one side of the furnace by a circulating connection and extending through the side wall at the opposite side of the furnace, a supply pipe located outside of the said side wall of the furnace and connected laterally with the receiving end of the rearmost tube, said supply pipe extending from said tube toward the rear part of the furnace, and having its rear end carried inwardly

through said side wall, and a return pipe  
located within the furnace and connected  
laterally with the discharge end of the for-  
ward tube at a point exterior to the inner  
5 surface of the said side wall.

In testimony, that I, claim the foregoing  
as my invention I affix my signature in the

presence of two witnesses, this 9th day of  
December A. D. 1909.

HERMAN A. POPPENHUSEN.

Witnesses:

CLARENCE E. MEHLHOPE,  
GEORGE R. WILKINS.

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