R. G. SEAMAN.

STEAM BOILER FURNACE.

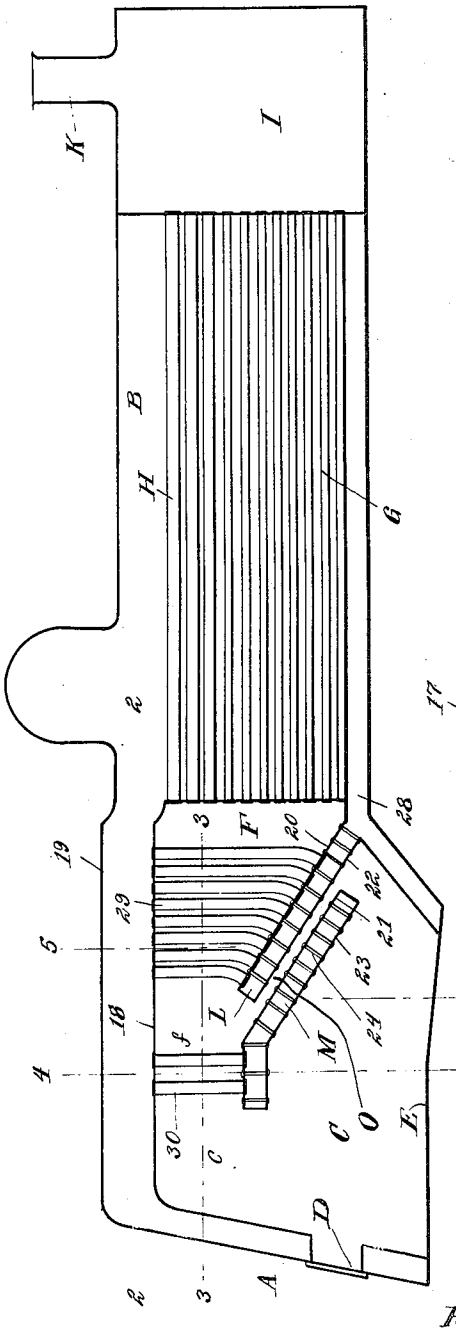
APPLICATION FILED DEC. 8, 1917.

1,346,769.

Patented July 13, 1920.

2 SHEETS—SHEET 1.

Fig. 1



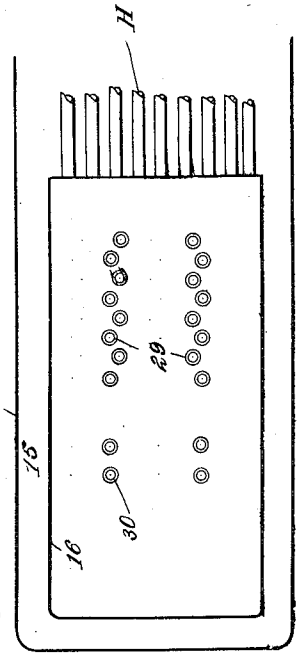


Fig. 2

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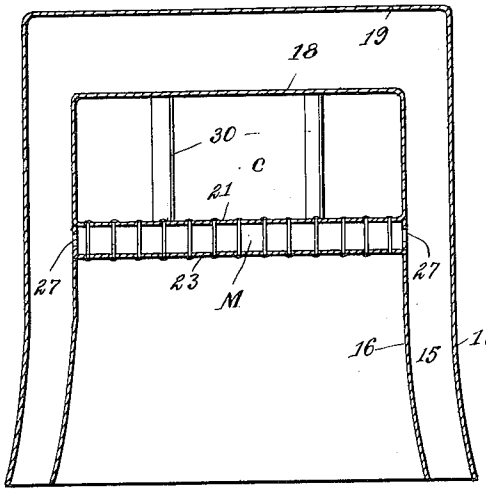

Fig. 4

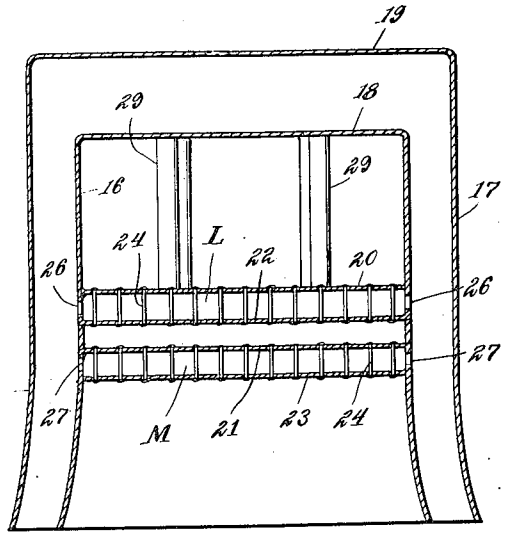

Fig. 5

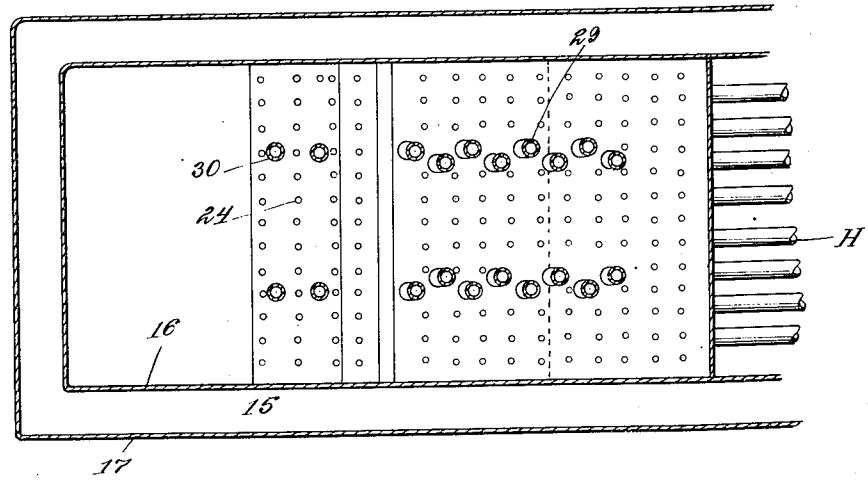

Fig. 3

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UNITED STATES PATENT OFFICE.

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STEAM-BOILER FURNACE.

1,346,769. Specification of Letters Patent. Patented July 13, 1920.

Application filed December 8, 1917. Serial No. 206,337.

To all whom it may concern:

Be it known that I, ROBERT G. SEAMAN, a citizen of the United States, residing at Summerhill, in the county of Cambria and State of Pennsylvania, have invented new and useful Improvements in Steam-Boiler Furnaces, of which the following is a specification.

This invention relates to steam boiler furnaces and it has for its object to promote the thorough combustion of fuel in order that the same may be utilized, as far as possible, without waste in the making of steam.

The invention consists more specifically in the arrangement within the boiler furnace of water arches of large area between, under and over which a large proportion of the gases of combustion will be compelled to pass before reaching the gas chamber in passing to the boiler flues, the object being to mix the gases of combustion so that combustion will be more perfect, and also raise the temperature of the water contained in said arches, thereby inducing a perfect circulation of water in the spaces of the boiler.

A further object of the invention is to simplify and improve the construction and arrangement of the said water arches.

A further object of the invention is to so arrange and support the said water arches by means of pipes connecting with the water space of the boiler, as to present no obstruction to the passage of the gases of combustion from the rearward portion of the furnace upwardly through the fire chamber and then forwardly to the gas chamber and the boiler flues.

With these and other ends in view which will readily appear as the nature of the invention is better understood, the same consists in the improved construction and novel arrangement and combination of parts which will be hereinafter fully described and particularly pointed out in the claim.

In the accompanying drawings has been illustrated a simple and preferred form of the invention, it being, however, understood that no limitation is necessarily made to the precise structural details therein exhibited, but that changes, alterations and modifications within the scope of the claim may be resorted to when desired.

In the drawings:

Figure 1 is a longitudinal sectional view of a boiler and furnace constructed in accordance with the invention.

Fig. 2 is a horizontal sectional view taken on the line 2—2 in Fig. 1.

Fig. 3 is a horizontal sectional view taken on the line 3—3 in Fig. 1.

Fig. 4 is a transverse sectional view taken on the line 4—4 in Fig. 1.

Fig. 5 is a transverse sectional view taken on the line 5—5 in Fig. 1.

Corresponding parts in the several figures are denoted by like characters of reference.

Referring to the drawings, A designates the furnace and B the boiler. C is the fire chamber, the upper portion of which is specifically designated by *c*. D is the fire door opening, E the grate bar level and F is the gas chamber, the rearward portion of which is specifically designated by *f*, see Figs. 1 and 5. G designates the lower boiler flues and H the upper or superheater unit tubes which are usually of larger diameter than the lower flues G. I is the smoke box and K the chimney or exit for products of combustion.

The side walls of the furnace are formed by water legs 15 which communicate in the customary manner with the water space of the boiler, said water legs comprising inner and outer plates or wall members 16 and 17 the upper ends of which are connected together respectively by the crown sheet 18 and the outer casing 19. Inclined water arches L and M are arranged within the furnace, said arches being inclined downwardly and forwardly and suitably spaced apart for the upward and rearward passage of products of combustion therebetween. Arches L and M, respectively, include top plates 20—21 and bottom plates 22—23, said top and bottom plates being securely connected together and reinforced by numerous stay bolts 24. The top and bottom plates or sheets of the respective arches extend between the inner walls 16 of the water legs 15 with which the respective arches communicate through openings 26—27 in the walls 16. The arch M has at the rearward end thereof a substantially horizontal portion 27, the same being produced by properly bending the top and bottom sheets of said arch as will be clearly seen in Fig. 1. The forward arch L communicates at its lower front end directly with the water space of the boiler through a port or opening 28.

The top sheet 20 of the arch L is connected with the crown sheet 18 by means of

a plurality of pipes 29 arranged in longitudinal rows or series, and preferably in staggered relation as will be most clearly seen in Figs. 2 and 3. Pipes 30, extending between the top sheet 21 of the arch M and the crown sheet 15 connect the water space of said arch, and more particularly of the horizontal portion thereof, with the water space of the boiler.

The operation of my invention will be understood from the following:

In firing a boiler there is a time when fuel reaches its highest degree of heat efficiency, or in other words, a time when it throws off its maximum number of heat units in a given period. When replenishing fuel over any portion of the grate area on fuel that has reached the highest degree of heat, the said area becomes momentarily cooled because of the addition of non-ignited fuel, and again in the process of a quick ignition of said fuel, free carbon is thrown off in the form of carbonaceous gas, commonly called smoke, which forms a cloud or veil between the fuel on the grate area over which it passes, and the firebox crown and wall sheets. This cloud of free carbon passing over the hotter portions of the grate area and between the crown sheet, arch sheets, and side wall sheets prevents the crown, arch and side wall sheets from gathering and absorbing the maximum of heat units from heat rays, radiating from the hottest portions of the fire bed. Thus if the fire be replenished on the forward grate area, gases of combustion in the form of free carbon will rise and pass directly up and rearwardly through the flue O and meet with the hottest gases of combustion, not containing free carbon, emanating from the fire chamber C and will mix in gas chamber F with the gases of a lower degree of heat containing free carbon, and will raise the heat to the igniting point, ignite the free carbon and consume it. Again if the fire be replenished on the back grate area, gases of combustion in the form of free carbon will rise in the lower fire chamber C to the upper fire chamber *c* and will pass forwardly through passage N over arches L and M and meet with the hottest gases of combustion, not containing free carbon, coming from the forward grate area through flue O and will mix in the gas chamber F where the hottest gases, not containing free carbon, will unite and mix with the gases of a lower degree of heat containing free carbon, raising the heat of the free carbon to the igniting point, ignite and consume it and vice versa on all fuel replenished areas of the grate surface. In the burning of a great quantity of fuel, the non-combustible materials found in most fuels are also drawn forwardly and deposited on the forward grate areas, stopping or clinkering the forward grate area, thereby preventing a flow of air through the same. Inasmuch as the flow of air is stopped, there will be no flow of oxygen to mix with the carbon to form a perfect combustion. Therefore, with a restricted flow of oxygen at the forward grate area the fuel will carbonize or form coke. The vibration of the boiler and the action of the drafts have a tendency to break the coke up into smaller parts and form what is commonly known as a peanut fire. When more fuel is placed on this peanut fire, it will expand in its process of forming coke and swell up against the arch sheets, forming what is known as a blocked arch. In the operation of my improvement, it will be observed that when the forward grate area is stopped up by a non-combustible material that tends to prevent the flow of air through said area, the draft through the flue O will draw through the back grate area, and said flue will supply oxygen to the forward grate area and will decarbonize fuel at that point and thereby promote the combustion of the carbonaceous fuel.

Having thus described the invention, what is claimed as new is:

A boiler furnace having water legs at the sides thereof, a downwardly and forwardly inclined water arch extending between and communicating with the water legs and communicating at its lower forward end with the lower portion of the water space of the boiler, a second water arch communicating with the water legs and arranged below and to the rear of the first-named water arch in spaced relation thereto and also in spaced relation to the front wall and the rear wall of the furnace, upright tubes establishing communication between the first-named water arch and the crown of the boiler, and upright tubes communicating with the second-named arch and the crown of the boiler; the said arches forming between them a flue.

In testimony whereof I affix my signature.

ROBERT G. SEAMAN.