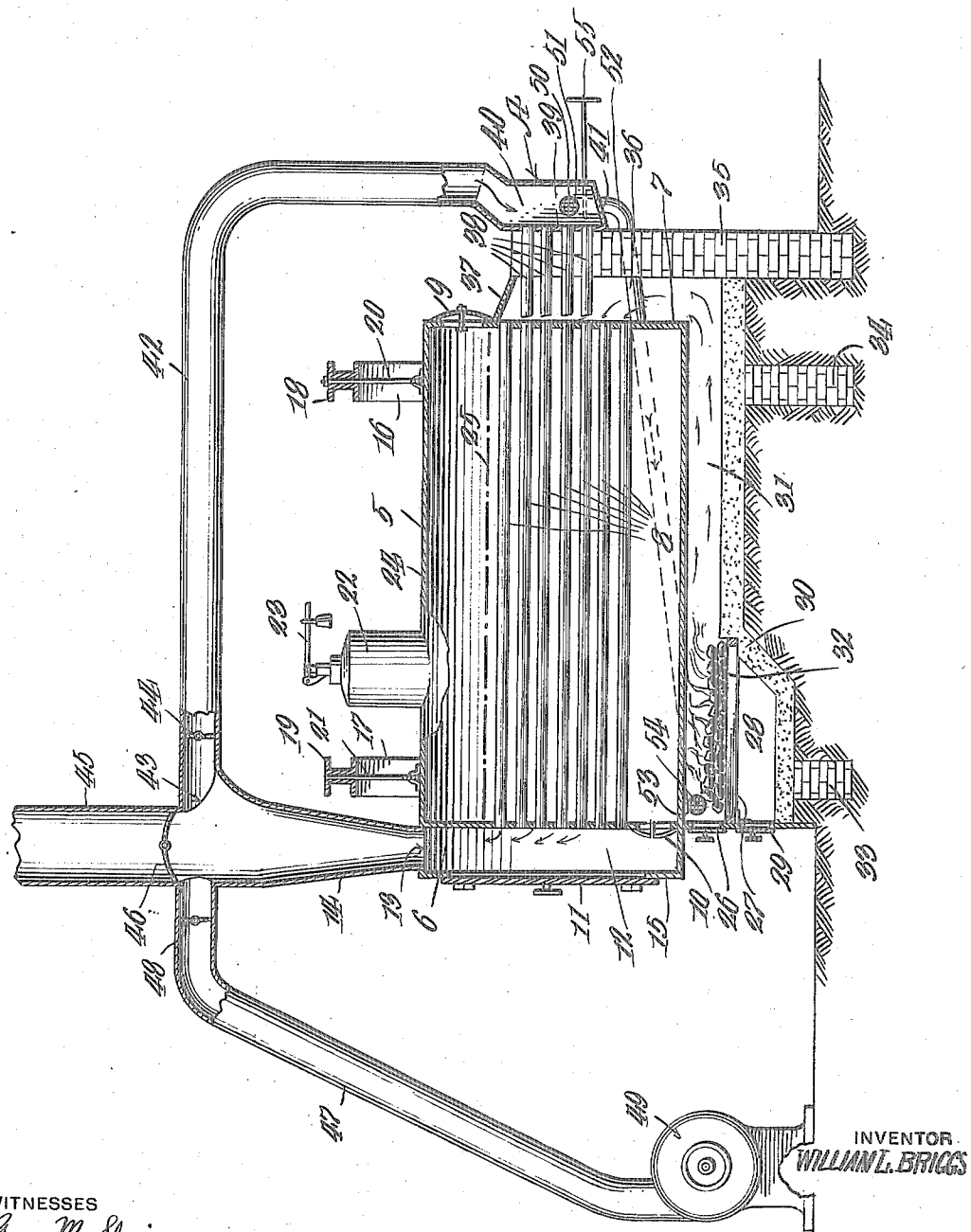
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SMOKE CONSUMER.

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1,284,053. Patented Nov. 5, 1918.



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## SMOKE-CONSUMER.

1,284,053. Specification of Letters Patent. Patented Nov. 5, 1918.

Application filed April 6, 1918. Serial No. 227,077.

*To all whom it may concern:*

Be it known that I, WILLIAM L. BRIGGS, a citizen of the United States, residing at Gadsden, in the county of Etowah and State of Alabama, have invented certain new and useful Improvements in Smoke-Consumers, of which the following is a specification.

This invention is a smoke consumer more particularly adapted for use with boilers that do not consume the fuel to the best advantage resulting in a loss of heat units that consist of unburned gases passing out through the chimney, wherein the unburned gases are caused to pass and to circulate a second or more times by mechanically mixing them with the fresh gases and products of combustion prior to the imparting of their heat to the water in the boiler.

One object of the invention is to provide a system of utilizing the smoke and unburned gases by mixing them with the fresh gases arising from the fuel burning on the grate at the point where the fresh gases are sub-divided to pass through the separated portions of the water of a boiler.

Another object of the invention is to provide a boiler with suitable piping or flues that connects with a blower or other air moving devices and the smoke stack, and then connecting the stack by another pipe or flue that leads to the opposite end of the boiler and causes the stack gases to recirculate in contact with the boiler for consuming the gases and the unburned carbon in the gases.

A further object of the invention is to provide a receiver that has tubes employed as outlets for the second pipe or flue and thus serve for mechanically mixing the stack gases with the furnace gases immediately prior to their passing through the boiler.

A still further object of the invention is to provide a method of consuming gases that will economize fuel by causing the gases to circulate over and over again in contact with the boiler to give up their heat units by reheating following their mixing with the fresh gases, and thus provide for a complete consumption of the carbon monoxid and carbon dioxid.

Broadly stated the invention comprises an air blower having its outlet connected with the stack of a boiler so as to force air therein, a duct or flue connected with the stack at a point approximately opposite the inlet for the air and having its other end connected with a receiver, said receiver being preferably disposed at the rear end of a return fire tube boiler, said receiver being provided with a series of spaced pipes that are preferably arranged in longitudinal alinement with the fire tubes but spaced therefrom to provide a gap therebetween, said air blower forcing air through its duct into the stack and mixing with the stack gases to force them through the duct leading to the receiver, the pipes serving as outlets for the receiver forcibly ejecting or projecting the stack gases and air into the furnace gases producing a mechanical mixture immediately prior to the mixture entering the fire tubes thus causing this mixture to circulate in communication with the fresh gases, the unburned gases with a certain amount of air (oxygen) for consuming the unburned gases and carbon, means for controlling the flow of air to the stack, means for controlling the flow of the stack gases to the receiver, means for permitting a control flow of the mixture from the receiver to a point in the fire box chamber, and means for controlling the flow of the burned gases through the stack.

One practical form of construction and assembly will be described and illustrated in the accompanying drawings, in which:—

The figure represents a vertical sectional view of a return fire tube boiler with its settings and the ducts necessary to produce the consumption of the unburned gases.

In the preferred embodiment and method of carrying out the invention there is provided a return fire tube boiler having the shell 5 and the heads 6 and 7. At suitable points the heads 6 and 7 are provided with holes to receive the fire tubes 8 that may be rolled or beaded as is customary in boiler construction. The boiler may be provided at each end with suitable hand and manholes. The head 7 is provided with the manholes 9 so that access may be had to the interior of the shell 5.

The hand and cleaning hole 10 is provided in the head 6 for cleaning out the shell at its lower portion. The head 6 has spaced

from it a smoke box door 11 that provides access to the smoke box 12. This smoke box is provided at its upper end with an outlet 13 to which is connected the stack 14. The smoke box door 11 may be connected to the front 15 in any usual or customary manner that will provide a more or less tight closure for the smoke box 12.

The shell 5 may be supported in the usual or customary manner from the pillars 16 and 17, carrying the I beams 18 and 19. As shown the shell is suspended from these I beams by means of the bolts 20 and 21. The shell 5 may be also provided with the steam dome 22 carrying the usual safety valve 23. The steam dome 22 is in communication with the steam space 24 that exists above the water line 25.

This steam dome serves the usual purpose of collecting the steam so that it may pass to the steam line in a more or less dry condition. The boiler may be provided with the fire doors 26 that afford an entrance to the grate, the bars of which are indicated at 27. Below the grate bars 27 there is an ash pit 28 and access to the ash-pit 28 is had by means of the ash-pit door 29.

The inner ends of the grate bars 27 may be supported in any usual or customary way and in the figure are shown as resting upon a shoulder formed in the foundation 30. This foundation as shown is continuous and forms a floor of the ash-pit and also serves as the lower wall of the passage 31 between it and the lower portion of the shell 5.

The grate bars 7 may be adapted to burn any usual or customary fuel; in the present instance it is illustrated by means of coal 32. The foundation 30 may be supported upon the piers 33 and 34. The pier 33 being located under the ash-pit floor, while the pier 34 is adapted to support and strengthen the part of the foundation forming the lower wall of the passage 31.

The boiler setting includes the back wall 35. The wall 35 is spaced from the head 7 and forms the chamber 36 therebetween. The upper end of this chamber 36 may be closed in any suitable manner and in the present showing a plate 37 extends between the wall 35 and the head 7. This will effectively close the upper end of this chamber 36.

The upper end of the wall 35 has passing through it a plurality of spaced pipes 38 whose inner ends are spaced from the ends of the fire tube 8 in the head 7. It will be seen from the drawing that a gap is provided between the ends of these tubes 38 and the fire tubes 8 and that the ends of the tube 38 terminate in the chamber 36. These tubes 38 may be passed through suitable spaces provided in the upper end of the wall 35.

As shown their outer ends are connected with the wall 39 of the receiver generally indicated at A. This receiver A is adapted to provide a chamber 40 therein. The lower end of the receiver A is closed by means of the wall 41. The upper end of the receiver A has connected to it a duct or pipe 42 that extends upward and over the boiler so as to connect with the stack 14 at the point 43. At a suitable point in this duct 42 there is provided a damper or other closure 44.

This damper will serve to control the passage of fluid through the duct 42. The stack 14 continues upward from the point 43 as indicated at 45. Adjacent the juncture of the duct 42 with the stack 14 and its extension 45 there is provided a damper or other fluid controlling device 46.

The stack 14 has connected to it at a point opposite to the connection of the duct 42 a duct 47. Adjacent the connection of the duct 47 with the stack 14 there is provided a damper or other fluid controlling device 48. This duct 47 extends laterally and then downwardly and is connected at its lower end with an air blower or other suitable air moving device 49.

The air blower 49 serves to force air through the air duct 47 to the stack 14. The flow may then be controlled by the revolutions of the blower or by means of the damper 48. It will be noticed that the outlet of the duct 47 is substantially opposite the inlet openings for the duct 42.

If the damper 46 in the extension 45 is partially closed, and assuming that coal 32 is burning in the grate bars 27 the gases arising from combustion will pass through the chamber 41 through the fire tubes 8 into the smoke box 12 and thence into the smoke stack 14. The direction of the gases will be that indicated by the arrows.

When these gases reach the upper end of the stack 14 their flow outward may be retarded by means of the damper 46. If the dampers 48 and 44 are open, air will pass from the duct 47 across the upper end of the stack 14 and into the duct 42. The unburned gases in the stack 14 will thus be mixed with air supplied by the blower 49.

As the natural tendency for the hot gases has to move upward they are restricted in their passage outward by means of the damper 46. This means that the mixture of air and stack gases must pass into the duct 42. Thus the mixture is forcibly moved to the receiver A. When these gases reach the chamber 40 of the receiver A they will tend to pass outward through the tubes 38.

As these tubes are substantially in longitudinal alinement with the fire tubes 8 this will tend to increase the draft. As these gases and air leave the outer ends of the tubes 38 they pass into the chamber 36 and

are mechanically mixed with the gases arising from the combustion of the fuel.

As these gases are forcibly ejected from the tubes 38 they tend to create a draft and at the same time forming a mechanical mixture of the furnace gases immediately before they enter the return fire tubes 8. This will cause the gases to move through the fire tubes 8 with an increased velocity. By the addition of the air to the stack gases the resulting mechanical mixture with the fresh unconsumed gases will tend to increase the consumption of the carbon and with a consequent chemical change in the production of the carbon oxids.

The cycle of circulation being constantly repeated practically all of the unburned gases will be burned during the circulation. The damper 46 is preferably open a sufficient distance to provide suitable natural draft for the burning of the fuel. The evolution of the carbon dioxid and carbon monoxid is large and by the constant addition of air the carbon is fully consumed.

There are two different points where a mechanical mixture of air and gases is performed. One of these is when the air passes from the duct 47 into the duct 42 and again where this mixture is mechanically mixed with the gases of combustion arising from the burning of the fuel 32.

The receiver A has an opening 50 in one side and this opening may be closed by a foraminous plate 51 as shown. If the plate 51 be used it has the function of preventing solid particles of the smoke from passing therethrough. The side of the receiver A opposite to the opening 50 may be provided with any usual means for allowing access to its interior. This means is not shown as it would be on the side which is removed in the figure.

A pipe or conduit 52 is connected with the opening 50 and this pipe leads to the forward end of the fire box. The pipe preferably passes outside of the boiler as shown in the figure. This forward end 53 of the pipe 52 is bent so that its open end is in communication with the air space above the fuel 32 on the grate bars 27, and the opening may be closed by a foraminous closure 54 as illustrated. The pipe 52 being in communication with the receiver A, will permit a portion of the air and gas mixture to be diverted to the zone of combustion for mingling with the gaseous products and heat arising from the fuel 32.

In order to control the amount of division of mixture through the pipe 52, a valve 55 may be employed. As the valve is opened it will permit more of the mixture to pass through the pipe 52, and a closing will restrict their passage. By permitting this mixture to pass to the zone of combustion above the fuel 32 the carbon dioxid will be changed in carbon monoxid and in doing so, heat will result and the oxygen will be free to combine with carbon atoms.

The one particular point of the invention is that the blower serves to increase the draft and also to effect a mechanical mixture of the stack gases with the fresh gases before they enter the fire tubes.

The foregoing description and the drawings have reference to what may be considered the preferred, or approved, form of my invention. It is to be understood that I may make such changes in construction and arrangement and combination of parts, material, dimensions, et cetera, as may prove expedient and fall within the scope of the appended claims.

What I claim is:

1. A smoke consumer for a return fire-tube boiler, which comprises an air blower, a stack for the boiler, and in communication with the smoke-box at the front thereof, a duct for connecting the blower with the stack, means for controlling the movement of air in the duct, a receiver disposed at the back and exteriorly of the boiler, a duct connected for connecting the stack and blower duct with the receiver, a plurality of tubes arranged in spaced alinement with the fire-tube of the boiler and serving to forcibly project for a mechanically mixing of the stack gases with the fresh furnace gases immediately before entering the fire-tubes, and means to control the flow of the stack and flue gases to the receiver.

2. A smoke consuming device, which comprises in combination with a return fire tube boiler, a gas receiver, means for mechanically mixing air with the stack gases and causing the mixture to pass to the receiver, outlets for the receiver whose outer ends are spaced from the ends of the fire tubes, said means further serving to forcibly eject the mixture through the outlets to produce a mechanical mixture with the gases of combustion immediately before their entering the fire tubes and serving to increase the velocity of the resulting mixture of air and gases through the tubes to increase the draft and also to separate the carbon and oxygen of the gases to produce a more complete combustion.

3. A smoke consumer for a return fire tube boiler comprising a combination with a primary fuel combustion chamber, an air blower, a stack for the boiler, and in communication with the smoke box at the front, a duct for connecting the blower with the stack, means for controlling the movement of the air in the duct, a receiver disposed at the back and exteriorly of the boiler, a duct connected for connecting the stack and blower duct with the receiver, a plurality of

tubes arranged in spaced alinement with the fire tubes of the boiler and serving to forcibly project for a mechanically mixing of the stack gases with the fresh furnace gases immediately before entering the fire tubes, means for controlling the flow of the stack and flue gases to the receiver, and a conduit connected to the receiver and terminating in the primary chamber, said conduit having its ends closed by a perforated plate.

In testimony whereof I affix my signature in presence of two witnesses.

WILLIAM L. BRIGGS.

Witnesses:
A. S. BEGGS,
W. U. PASCHAL.