Dec. 15, 1925. 1,565,463

C. P. JOHNSON

DEVICE FOR ELIMINATING SMOKE IN BOILER FURNACES

Filed Aug. 11, 1924 2 Sheets-Sheet 1

FIG. 1.

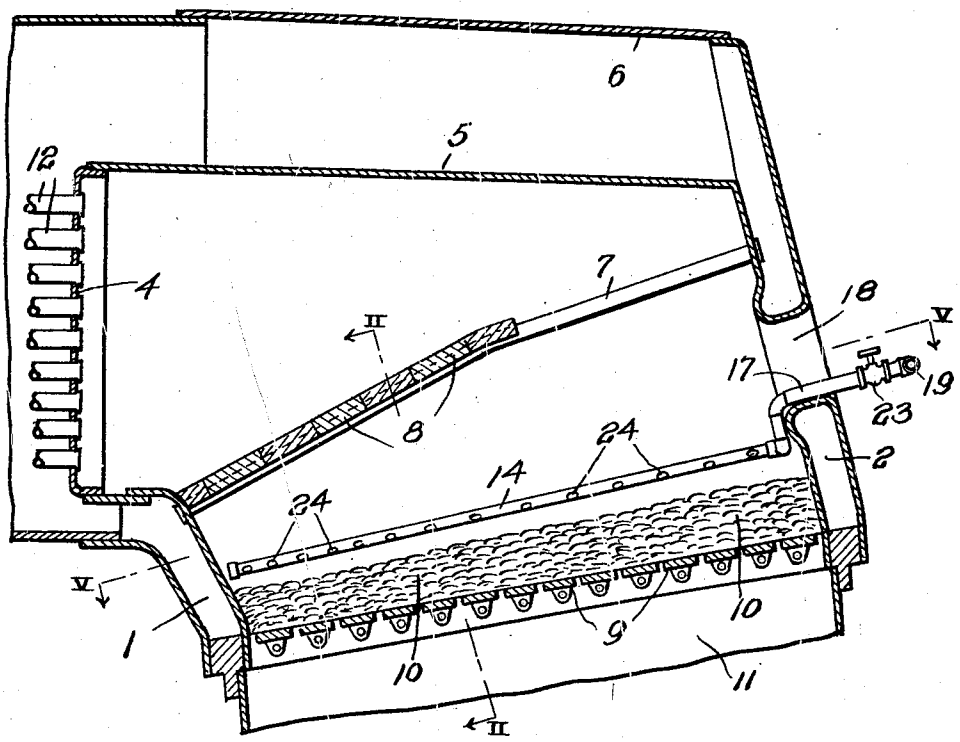


FIG. 2.

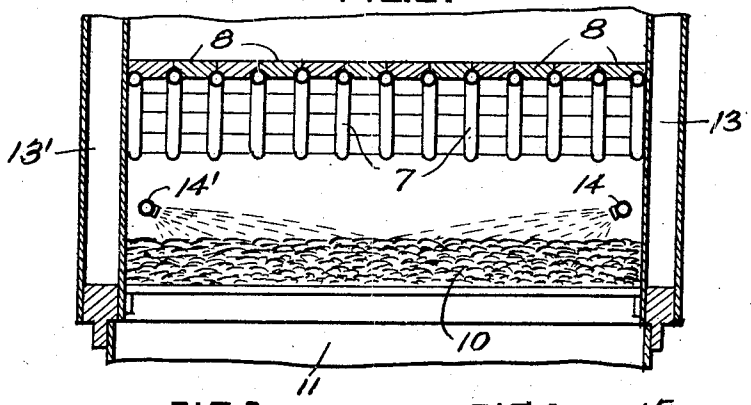


FIG. 3.

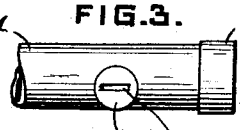
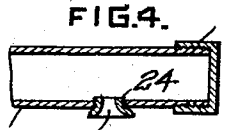


FIG. 4.



WITNESSES

J. Blair Bradley.

C. R. Halbert

INVENTOR

Charles P. Johnson

By Minter, Brown & Critchlow

His Attys.

Dec. 15, 1925. 1,565,463

C. P. JOHNSON

DEVICE FOR ELIMINATING SMOKE IN BOILER FURNACES

Filed Aug. 11. 1924 2 Sheets-Sheet 2

FIG. 5.

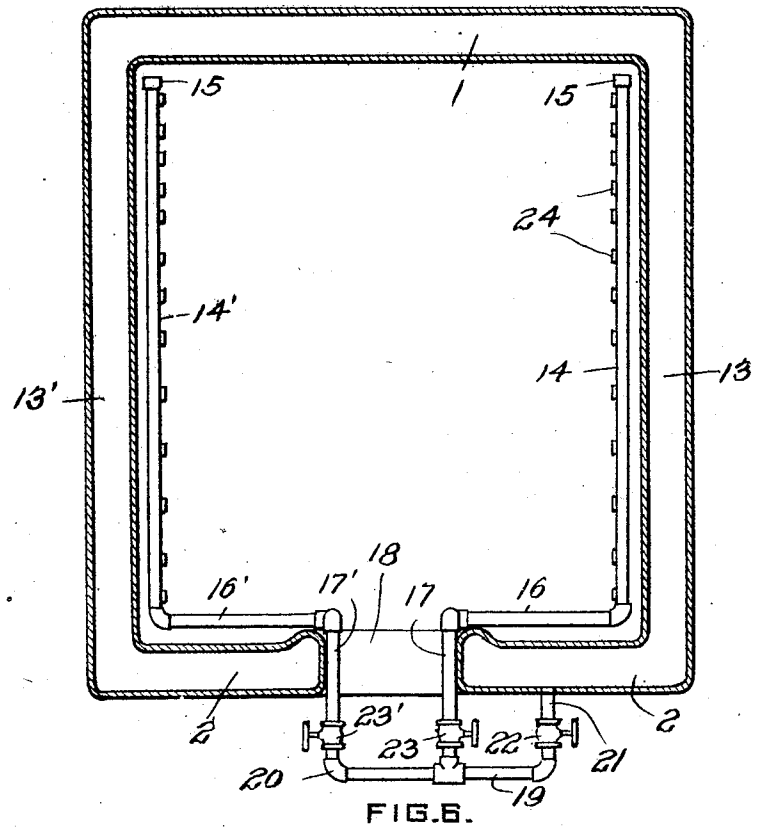


FIG. 6.

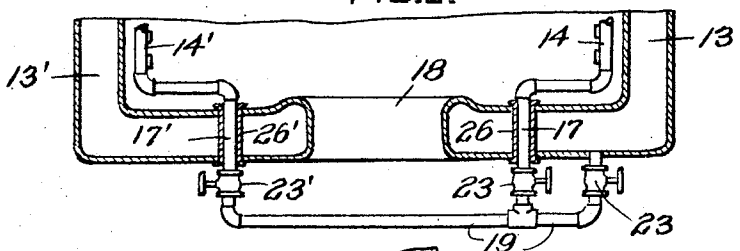
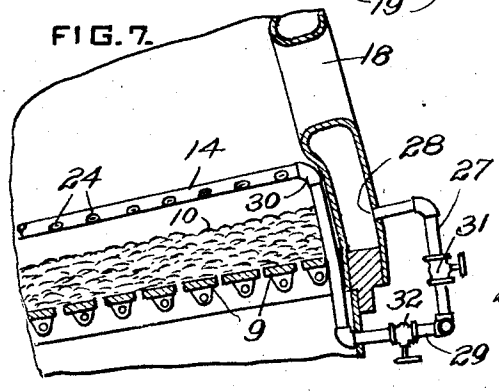


FIG. 7.



WITNESSES
J. Hibbert Bradley.
C. R. Halbert

INVENTOR
Charles P. Johnson
By Winter, Brown & Critchlow
His attys.

Patented Dec. 15, 1925. 1,565,463

UNITED STATES PATENT OFFICE.

CHARLES P. JOHNSON, OF PITTSBURGH, PENNSYLVANIA.

DEVICE FOR ELIMINATING SMOKE IN BOILER FURNACES.

Application filed August 11, 1924. Serial No. 731,252.

To all whom it may concern:

Be it known that I, CHARLES P. JOHNSON, a citizen of the United States, and a resident of Pittsburgh, in the county of Allegheny and State of Pennsylvania, have invented a new and useful Improvement in Devices for Eliminating Smoke in Boiler Furnaces, of which the following is a specification.

This invention relates to locomotive boiler furnaces, and particularly to a device for use in connection therewith for eliminating smoke and increasing the efficiency of the furnace.

Of the many schemes heretofore employed, in attempts to eliminate smoke in boiler furnaces, the most effective has apparently been the injection of quantities of steam into the furnace, the additional oxygen furnished by the injected steam combining with the unburned suspended particles of carbon and thus securing more nearly complete combustion with a consequent lack of smoke. In order to employ this method with any decided degree of success, it has been necessary to inject the steam both under high pressures and in large quantities into the furnace above the fuel bed. This has given rise to great difficulties in connection with locomotives due to the obstruction by the steam to the free flow of the products of combustion to the tubes of the boiler. While the injection of steam in the manner noted, if properly regulated, will reduce the quantities of smoke produced and slightly increase the efficiency of the boiler, nevertheless, its utility is confined to narrow limits with locomotives and it is impossible to obtain the maximum results in heating effects from the fuel used, or a substantial elimination of objectionable clinkering.

Applicant has found that by injecting suitably regulated quantities of water directly into the fire box upon the fuel bed that the objections noted are overcome, smoke is substantially eliminated, a greater heating efficiency with less fuel is secured, coal may be readily burned without danger of forming clinkers, there is less dirt, and the flues or tubes of the furnace are free of troublesome honeycoming previously present.

It is an object of this invention to provide a device for conveniently injecting regulated quantities of water directly upon the fuel bed in a locomotive furnace in such a manner as to secure the advantages above mentioned.

It is also an object to provide such a device which will not interfere with the normal operation of the furnace, which will distribute greater quantities of water at the portions of the fuel bed found to give maximum efficiency, which can be easily manipulated by the operator in charge thereof, and which will not easily get out of order.

It is another object to provide a device of this character which is simple, compact, durable, easy to construct, and install, and which may be fabricated at a comparatively low cost.

These and other objects of the invention will more fully appear when taken in conjunction with the following description and the appended claims.

In the accompanying drawings Fig. 1 is a fragmentary view of a locomotive boiler furnace, having associated therewith one embodiment of the invention, parts being shown in elevation and parts in vertical section; Fig. 2 a transverse vertical sectional view taken substantially on the line II—II of Fig. 1; Fig. 3 a detail fragmentary view, in elevation, showing the exterior of one of the water headers with the nozzles associated therewith; Fig. 4 a detail fragmentary view of the portions shown in Fig. 3 taken in section; Fig. 5 a sectional plan view taken substantially on the line V—V of Fig. 1; Fig. 6 a fragmentary view, partly in horizontal section and partly in elevation, showing a modified arrangement for feeding water from the boiler to the distributing headers; and Fig. 7 a fragmentary view, partly in elevation and partly in vertical section, showing a still further modified form of the invention for feeding water to the headers.

In the drawings, the invention is illustrated as applied to a conventional type of locomotive boiler comprising the usual front water leg 1, the rear water leg 2, the tube plate 4 and the crown sheets 5 and 6. A series of spaced tubes, such as indicated at 7 connect the front and rear water legs and serve as a supporting means for the arch 8, the rear end of the arch terminating about midway between the said legs. The customary grate is designated at 9, extending between the front and rear water legs, and is adapted to support thereupon the fuel bed 10, the space 11 below the grate serving as the ash pit. The boiler tubes for conducting the hot products of combustion from the furnace toward the forward end of the boiler are shown at 12, and are associated with the

tube plate 4 in a well known fashion. The side walls of the furnace are also in the form of water legs, being indicated at 13, 13′, respectively.

The apparatus for regulably distributing quantities of water directly upon the fuel bed 10, and forming the subject matter of this invention, comprises a pair of water distributing headers 14, 14′. The header 14 is positioned above the fuel bed 10 closely adjacent the side wall 13 of the furnace, while the header 14′ is likewise positioned with respect to the opposite side wall 13′. The front ends of the headers are closed by means of the end caps 15, 15′, while their rear ends are respectively connected to the pipes 16, 16′ positioned adjacent the rear water leg 2. A branch pipe 17 forms a continuation of the pipe 16 and extends rearwardly through the opening 18, constituting the opening for feeding the fuel into the furnace, to the exterior of the furnace where it is connected to a manifold pipe 19. Similarly, a branch pipe 17′ forms a continuation of the pipe 16′ and connects with the manifold 19 at 20. The branch pipes 17 and 17′ are preferably located at the opposite sides of the opening 18 closely adjacent the side walls thereof so as not to unduly obstruct the same.

The manifold 19 is tapped into the boiler at any convenient point such as that indicated at 21 in the rear water leg, and is provided with a control valve 22 for governing the supply of water to the manifold, and to both of the branch pipes 17 and 17′. In addition, branch pipe 17 is equipped with the regulating control valve 23 for independently controlling the quantity of water delivered thereto, so as to regulably govern the quantity of water supplied to the header 14, and the branch pipe 17′ is also equipped with its own regulating valve 23′ so that the quantity of water delivered to the header 14′ may be governed, as desired, and independently of the quantity supplied to the remaining header.

Each of the water distributing headers 14 and 14′ lie closely adjacent the side walls of the furnace, and are slightly inclined from their rear ends towards their front ends so as to more closely approach the fuel bed 10 at the front end of the bed in proximity to the front water leg 1. The headers are equipped, at the side thereof opposite the side wall of the furnace with which it is associated, with a plurality of spaced apart nozzles, such as indicated at 24. These nozzles may be associated with the headers in any suitable manner, the method shown in the drawings for attaching the nozzles consisting in exteriorly threading the shanks of the nozzles and securing them into place within correspondingly internally threaded openings in the header, such as clearly shown in Fig. 4 of the drawings. The nozzles are tubular, and in order to distribute the water in the form of a comparatively thin sheet, the opening 25 extending through the body of the nozzle is elongated in the manner shown in Fig. 3, and preferably gradually increases in width from its inner end towards its discharge end. All of the nozzles are inclined slightly downwardly below the horizontal so as to direct the water discharged therefrom downwardly upon the fuel bed, and the nozzles are more closely spaced toward the forward end of the header so as to increase the quantity of water discharged at the region of the fuel bed adjacent the front water leg 1. The downward inclination of the nozzles is clearly shown in Fig. 2, and the relatively closer spacing thereof toward the front end of the headers is illustrated in Fig. 1 of the drawings.

It was previously pointed out that it has been found necessary to discharge relatively greater quantities of water at some portions of the fuel bed than at others, in order to secure the most beneficial results, and both the inclination of the headers with respect to the fuel bed, as well as the closer spacing of the nozzles at the forward end of the headers, aid in securing the intended results. It is likewise noted that the water must be directly injected upon the fuel bed in a manner to obviate the production of great quantities of steam throughout the upper portions of the furnace in order to prevent the clogging or obstructing of a comparatively free flow of the products of combustion to the boiler tubes 12. For this reason, the nozzles 24 are inclined downwardly towards the fuel bed, which in connection with the features previously mentioned, coact to secure the maximum results. By employing the pair of headers 14 and 14′ located at the opposite sides of the furnace for directing the sheets of water sprayed therefrom towards the mid point of the fuel bed, and properly regulating the valves 23 and 23′, as well as the valve 22 for governing the water supplied to both headers, a spray in the form of a sheet throughout the entire upper surface of the fuel bed and of the character required may be obtained. It is particularly pointed out that by directly injecting the water upon the fuel bed in the manner explained, in proper quantities, the water sheet apparently functions as a screen to prevent the vapors formed by contact of the particles of water with the heated fuel from rising to the upper portions of the furnace and clogging or obstructing the flow of the products of combustion towards the boiler tubes, while at the same time effectively furnishing the additional quantities of oxygen required for completing combustion of all of the particles of fuel within the furnace.

The operation of the apparatus will be obvious from the above description. By regulating the degree of opening of the valve 22, the supply of water to the headers may be governed, while manipulation of the valves 23 and 23′ will govern the spray from the respective headers. By properly regulating each of the valves the operator may vary not only the quantity of water injected, but also the character of the water sheet injected upon the fuel bed. In this connection, it is noted that the provision of the separate controls for the headers is of considerable importance due to variations in the condition of the furnace throughout its extent, as will be obvious to those skilled in this art.

Instead of leading the branch pipes 17 and 17′ through the fuel opening 18, the same may be passed directly through the rear water leg 2 in the manner shown in Fig. 6 of the drawings. In this modified form of the invention, the branch pipe 17 passes through a special enclosing tube 26, the opposite ends of which form sealed joints with the boiler sheets. Likewise the branch pipe 17′ extends through a similar tube 26′, the tubes 26, 26′ being disposed at the opposite sides of the fuel opening 18. Otherwise, the embodiment illustrated in Fig. 6 corresponds to that previously described in connection with Figs. 1 to 5, inclusive, of the drawings.

Under some conditions, it may be found desirable to conduct the water supply to the headers upwardly through the grates 9 at some convenient point. In Fig. 7 of the drawings has been illustrated one way of supplying the water in this manner. As shown, the manifold pipe 27 is tapped into the front water leg at a point below the fuel opening 18, as indicated at 28. The branch pipe 29 for the header 14 is shown as passing into the ash pit below the grate 9, then upwardly adjacent the rear leg of the furnace, communicating with the header 14 by means of the elbow 30. In this form, the manifold is equipped with the control valve 31, and each of the branch pipes leading to the respective headers has its separate control valve such as shown at 32. The method of operating this embodiment corresponds to the forms previously described, and will be fully understood from an inspection of the drawings.

It is thus seen that the invention illustrated and described provides a simple, economical and convenient means for injecting suitably regulated quantities of water into a locomotive boiler furnace directly upon the fuel bed supported therein for the purpose of securing the advantages previously mentioned. It has been found that with the invention, the furnace may be operated with a substantially complete elimination of smoke, with comparatively perfect combustion of coal, that the heating efficiency is greatly enhanced, that very little dirt is produced, and that coal may be burned without danger of objectionable clinkering and without the formation of the previously objectionable honey-combing in the boiler tubes, and that due to the injection of the water directly upon the fuel bed in the manner set forth, the passage of the products of combustion from the furnace to the tubes is free and unobstructed.

While the invention has been described and illustrated as embodied in forms now considered the most desirable, it is obvious that many changes in details and arrangements of parts may be made without departing from the spirit of the invention. It is therefore not intended to restrict the scope of the invention beyond that particularly defined by the appended claims.

I claim:

1. The combination of a furnace having a fire box provided with a grate adapted to support a fuel bed, a header disposed within the fire box adjacent the side wall thereof, said header being positioned so as to gradually approach the said grate at its front end, a series of spaced nozzles for distributing water from the header above the grate downwardly upon the fuel bed, said nozzles being arranged to discharge a greater quantity of water at the front end of the grate than at its rear end.

2. The combination of a furnace having a fire box provided with a grate adapted to support a fuel bed, a header disposed within the fire box adjacent the side wall thereof, said header being positioned so as to gradually approach the grate at its front end, a series of spaced nozzles for distributing water from the header above the grate downwardly upon the fuel bed, said nozzles being more closely spaced toward the front end of the header and inclined slightly downwards toward the grate.

3. The combination of a furnace having a fire box provided with a fuel supporting grate, a pair of separate headers freely exposed and disposed entirely within the interior of the fire box intermediate the side edges of the grate and spaced inwardly therefrom, means for regulably supplying water to both said headers simultaneously from a single source, means for independently controlling the supply of water to the respective headers, said headers being provided with a series of spaced nozzles for directing water towards the region intermediate thereof.

In testimony whereof, I sign my name.

CHARLES P. JOHNSON.