D. L. SHAFFER.

LOCOMOTIVE FURNACE GRATE.

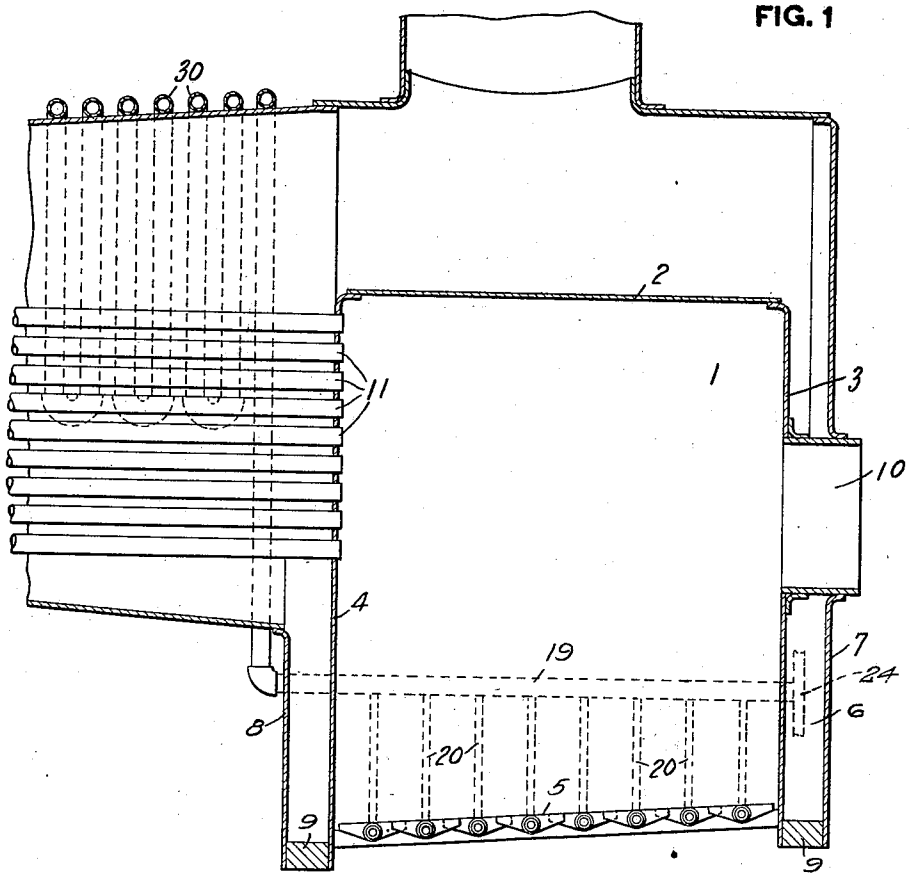
APPLICATION FILED JUNE 16, 1916.

1,369,939.

Patented Mar. 1, 1921.

2 SHEETS—SHEET 1.

FIG. 1



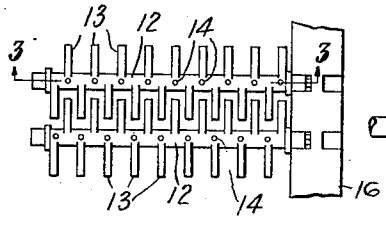


FIG. 2

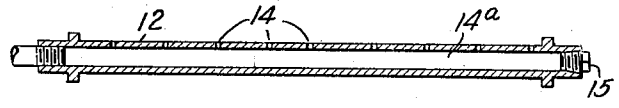


FIG. 3

WITNESSES

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2 SHEETS—SHEET 2.

FIG. 4

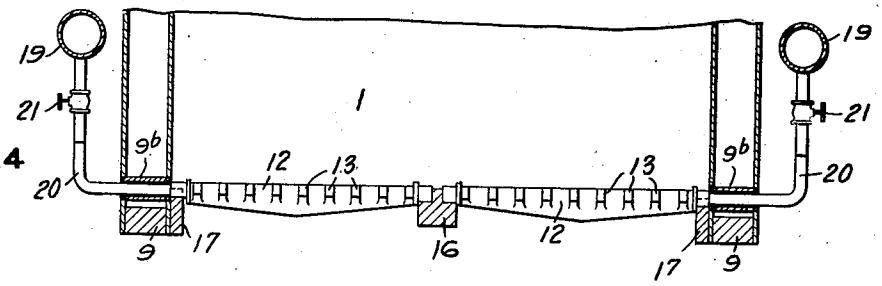


FIG. 5

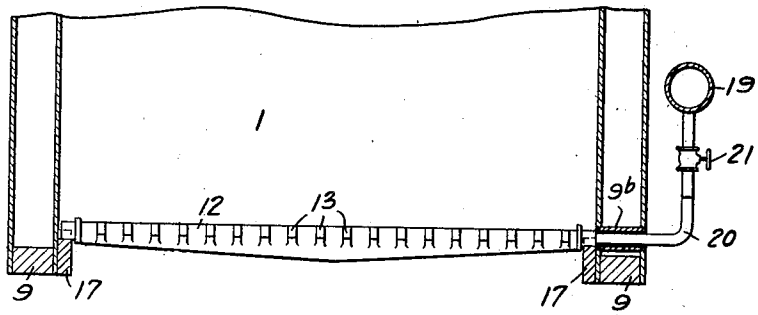


FIG. 6

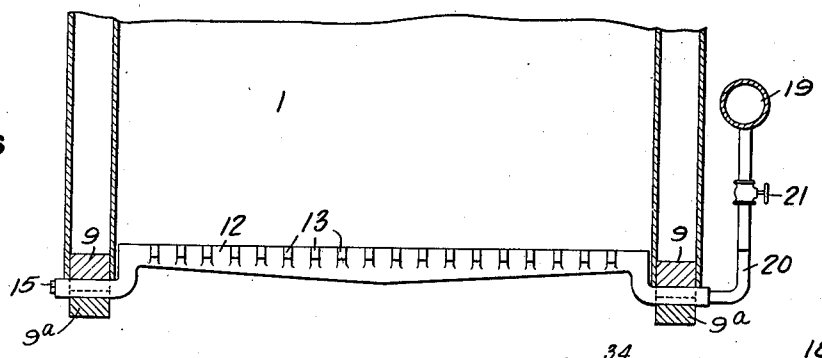
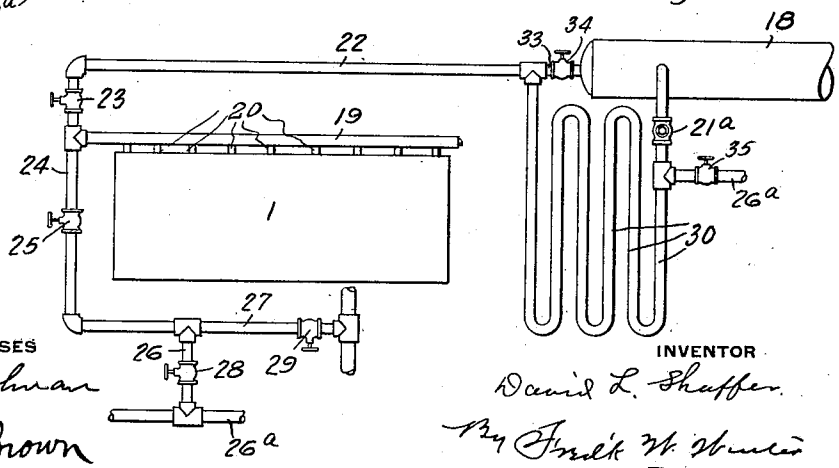


FIG. 7



WITNESSES

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LOCOMOTIVE-FURNACE GRATE.

1,369,939. Specification of Letters Patent. Patented Mar. 1, 1921.

Application filed June 16, 1916. Serial No. 104,057.

To all whom it may concern:

Be it known that I, DAVID L. SHAFFER, a resident of Pittsburgh, in the county of Allegheny and State of Pennsylvania, have invented a new and useful Improvement in Locomotive-Furnace Grates of which the following is a specification.

My invention relates to steam boiler furnaces, and its general object is to improve the efficiency of such furnaces by giving a more even blast and efficient combustion of the fuel used therein.

Further objects of the invention are to secure greater heat from the fuel, more complete combustion, and to provide means for consuming a larger amount of the smoke generated than is customary in the present construction. Also, my invention provides means for using either a fluid or a solid fuel, or a fluid fuel together with a solid fuel, furnishes means to quickly extinguish the fire, and the particular construction for securing these objects includes grate bars having longer life than those customarily in use.

These, and other advantages which will be plain to those familiar with these structures, are attained by a construction such as that below described, but I do not limit myself to any particular form of grate bar, or bearing, or boiler, since my invention can be utilized in a variety of forms.

One embodiment of my invention is shown in the accompanying drawings, wherein Figure 1 is a vertical longitudinal section through a locomotive fire box constructed according to my invention; Fig. 2 is a plan view of two grate bars in normal position; Fig. 3 is a longitudinal vertical section through one of the grate bars on the line 3—3 of Fig. 2; Fig. 4 is a vertical transverse section through a part of the furnace, showing the grate bars divided into two sections and supported at their middle ends; Fig. 5 is similar to Fig. 4, but shows a single grate bar extending across the furnace; Fig. 6 is similar to Fig. 5, but shows modifications in the mounting of the grate bar; and Fig. 7 is a diagram of a pipe arrangement for supplying different fluids to the hollow grate bars, and for heating the fluids.

I have shown my invention as applied to the ordinary locomotive boiler, but it will be understood that I am not limited to this construction, and that it may be applied to any form of steam boiler, whether stationary, horizontal, upright, or locomotive.

It has been customary to form the bottom of boiler furnaces from cast iron grate bars These have been solid or skeleton, and air to support combustion was supplied by means of an exhaust through the smokestack, drawing air through the ash box, up through the grate bars and burning fuel, but this exhaust is rapid and violent, resulting in blowing a great deal of unburnt fuel and gases out the stack. As the heat from combustion, and the completeness of consumption of the fuel depend largely upon the free supplying of oxygen thereto, it is essential that air be forced evenly and rapidly throughout the burning material. After combustion is started, and a high degree of heat has been attained, additional heat generated largely depends upon the amount of oxygen which can be brought into contact with the burning material. The nozzle in the front end may be much larger than usual. Stationary boilers will not need such high smokestacks as now used, because there will be no need for violent exhausts. A blower of the ordinary type will be used in the stack in all cases, however, to draw the fumes and gases out, as will be understood.

In order to secure the objects herein stated, I have provided a construction embodying hollow grate bars, having perforations of any suitable size through their upper sides and connecting with the central openings therein, and connections from the bars to a source of compressed air. By having these perforations in all of the bars, and comparatively close together, and by supplying the air under considerable pressure, I am enabled to give an even and rapid draft through the entire body of burning fuel. By this means I secure more complete combustion, with the smallest possible escape of smoke and unburned gases.

I prefer that the grate bars be rockably mounted in the furnace frame, and that suitable means be provided for actuating them to shake down the ashes and break up the cinders. Also, two of the bars may be connected so as to form a dump grate. Such means are well known in the art, and are not peculiar to my invention, the grate bars being mounted in any suitable manner in the furnace wall.

Referring to the drawings, 1 is the ordi-

nary furnace chamber or fire box, which is formed by crown plate 2, a rear plate 3, a flue plate 4, and the grate 5. This fire box is surrounded by water chamber 6, which is made up of the inner wall members 2, 3 and 4, and outer walls 7 and 8. This water space has the usual mud ring 9 at the bottom thereof. The fuel is supplied through an opening 10, and the heated air and burning gases pass out through the boiler tubes 11.

The grate is made up of hollow bars 12 which have laterally extending fingers 13, and which have central perforations 14 from the top of the bar to the central hollow spaces 14ª. These grate bars are mounted in the side frame of the fire box, and their fingers are arranged after the ordinary fish-bone construction of grate, as shown in Fig. 2. This is the preferred form, but any class of bars may be used.

The particular manner of constructing the hollow grate bars is not a part of my invention, but they may be made by pouring cast iron around a hollow pipe, the pipe forming a central opening 14ª through the bar, and the outer mold being so shaped as to form the fingers 13 and general outer construction of the grate bar. I prefer to have the opening in the grate bar extend through to both ends, and to close one end with a removable plug 15, as shown in Fig. 3, so that by removing this plug the hollow bar may be cleaned. Also, I prefer to cast the grate bars larger in the middle and tapering to each end, so as to form a reinforcement at the middle portion to prevent warping, and to generally strengthen the construction. Where the fire box is large, grate bars extending only half way across may be used, and in that case a central bearing support 16 is provided and the closed ends of the grate bars are carried thereby, but I prefer the single-bar type. The open ends of the bars pass through the walls of the furnace and emerge on the outside. This passage may be just above the mud ring 9, as shown in Fig. 4, or just underneath it, as shown in Fig. 6. In the latter case a bearing 9ª is provided. Where the bars, or their connections, pass through the furnace walls, as in Figs. 4 and 5, a sleeve 9ᵇ is fixed in the walls as shown. The closed ends may also pass through the furnace wall and be exposed, as shown in Fig. 6. A bearing 17 is provided on the inside of the fire box to engage a rounded portion of the grate bars, which are preferably rockably mounted therein.

From any convenient source, such as tank 18, compressed air is supplied through a main 19, and flexible connections 20, which may be in the form of hose, to the open ends of the grate bars. Valves 21 are provided between the main 19 and the open ends of the grate bars, so that any individual bar may be cut out, for repair, to decrease the amount of fluid supplied, or for other purposes. A check valve 21ª is provided to prevent the carrying of anything by back pressure into the tank 18.

By the construction above described air may be supplied to each of the hollow grate bars, and when forced therethrough escapes by the perforations 14 throughout the entire mass of burning fuel. This air will have the double function of supplying oxygen for combustion and of forming a draft to draw other air up between the grate bars.

In Fig. 7 I have shown diagrammatically a piping arrangement by which the engineer can shut off the supply of air to the pipes, and instead, supply steam. By this arrangement, also, water may be forced from the boiler, or by the ejector pump, through the grate bars to extinguish the fire. The pipe 22 leads to the air supply tank 18. It is controlled by a valve 23, before its connection to the main supply pipe 19, which runs to the hollow grate bars. Beyond the connection of pipe 22 to pipe 19 there is a branch pipe 24, controlled by a valve 25, which in turn has branches 26 and 27, controlled by valves 28 and 29, respectively. The branch 26 connects with a steam supply source, and the branch 27 with a water supply source. When air is being supplied to the grate the valve 23 is open and the valve 25 closed. To supply steam the valves 23 and 29 are closed and the valves 25 and 28 opened. To supply water the valves 23 and 28 are closed and the valves 25 and 29 opened. These operations will be entirely obvious. An arrangement by which either the steam or air may be heated is described below.

It may be desirable in some cases, to heat the air or dry the steam before forcing it through grate bars. For this purpose I may provide a series of bends 30 in the air pipe 22, saddling them on, and in contact with, the heated boiler surface, as partially shown in Figs. 1 and 7. A by-pass 33 may be provided, having a valve 34, so that the air may be used without passing through the heater coils. The steam pipe 26 may be connected to the heating coils, as by extending pipe 26ª to the inlet end of the coil and providing a valve 35 therein. It will be understood that all of the piping arrangement is diagrammatic merely.

It will be obvious that another advantage of my invention is that the fluid supply through the hollow grate bars will tend to keep them cooler than would be the case with solid members, and therefore will add to their life.

I may also force through these grate bars a fluid fuel, such as gas, or a mixture of steam and oil, and thereby aid combustion, and secure a combined solid and gaseous

fuel supply. Such changes will be understood to apply to different types of boiler furnaces and will be advisable or not according to the particular purposes for which the boiler is designed.

I claim:—

1. In a furnace, the combination of hollow perforated grate bars, a source of fluid pressure, connections therefrom to said hollow grate bars, a portion of said connection being formed as a heater, and a by-pass connection around said heater from the source of fluid pressure to said grate bars.

2. In a furnace, the combination of hollow perforated grate bars, a source of air pressure, connections therefrom to said hollow grate bars, a portion of said connection being formed as a heater, a source of water fluid connected to said hollow grate bars, and a by-pass connection from said source of water fluid to said heater.

In testimony whereof, I have hereunto set my hand.

DAVID L. SHAFFER.

Witnesses:
O. E. COWARD,
J. THOS. BEALL, JR.