A. H. LIGHT.

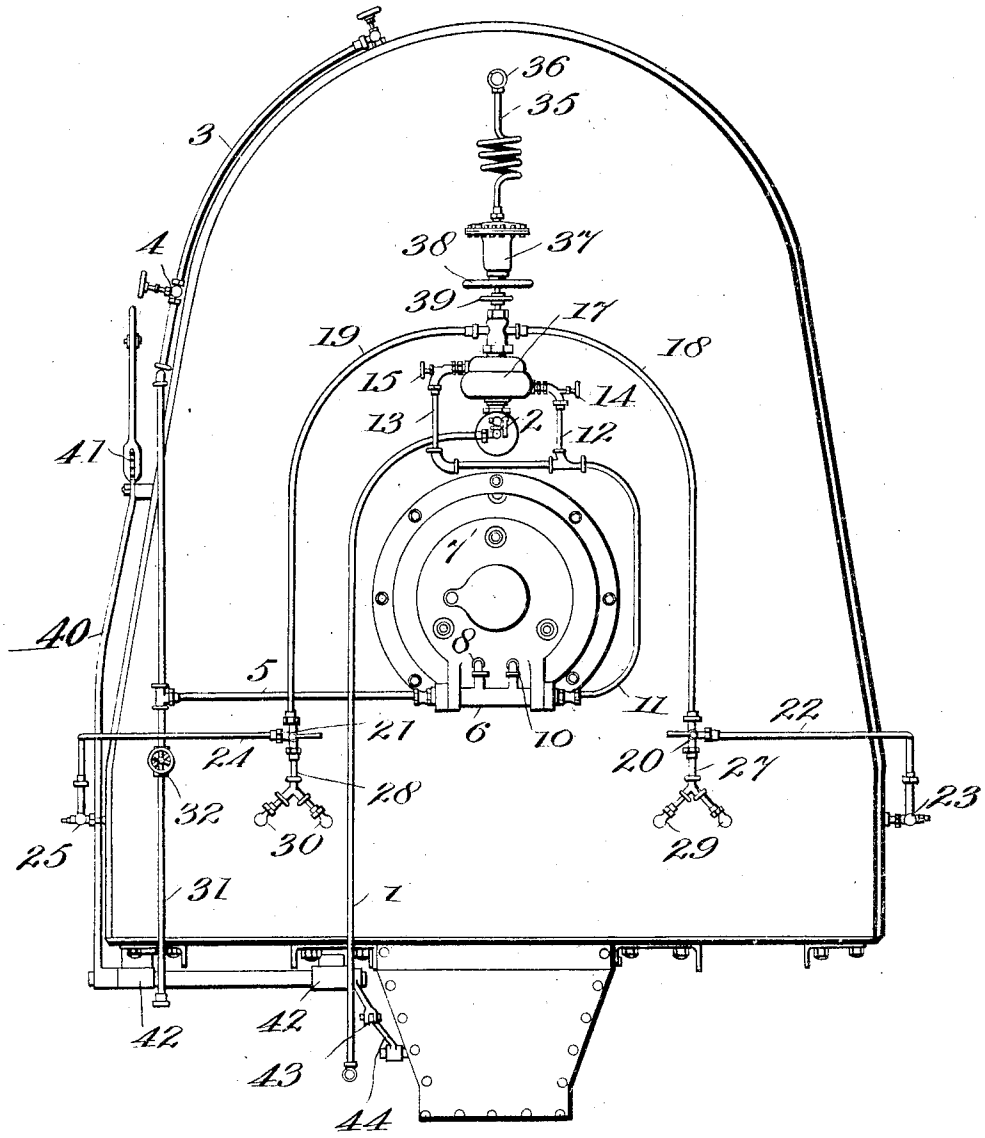
OIL FED FURNACE.

APPLICATION FILED AUG. 23, 1909.

980,806. Patented Jan. 3, 1911.

3 SHEETS—SHEET 1.

Fig. 1.



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3 SHEETS—SHEET 2.

Fig. 2.

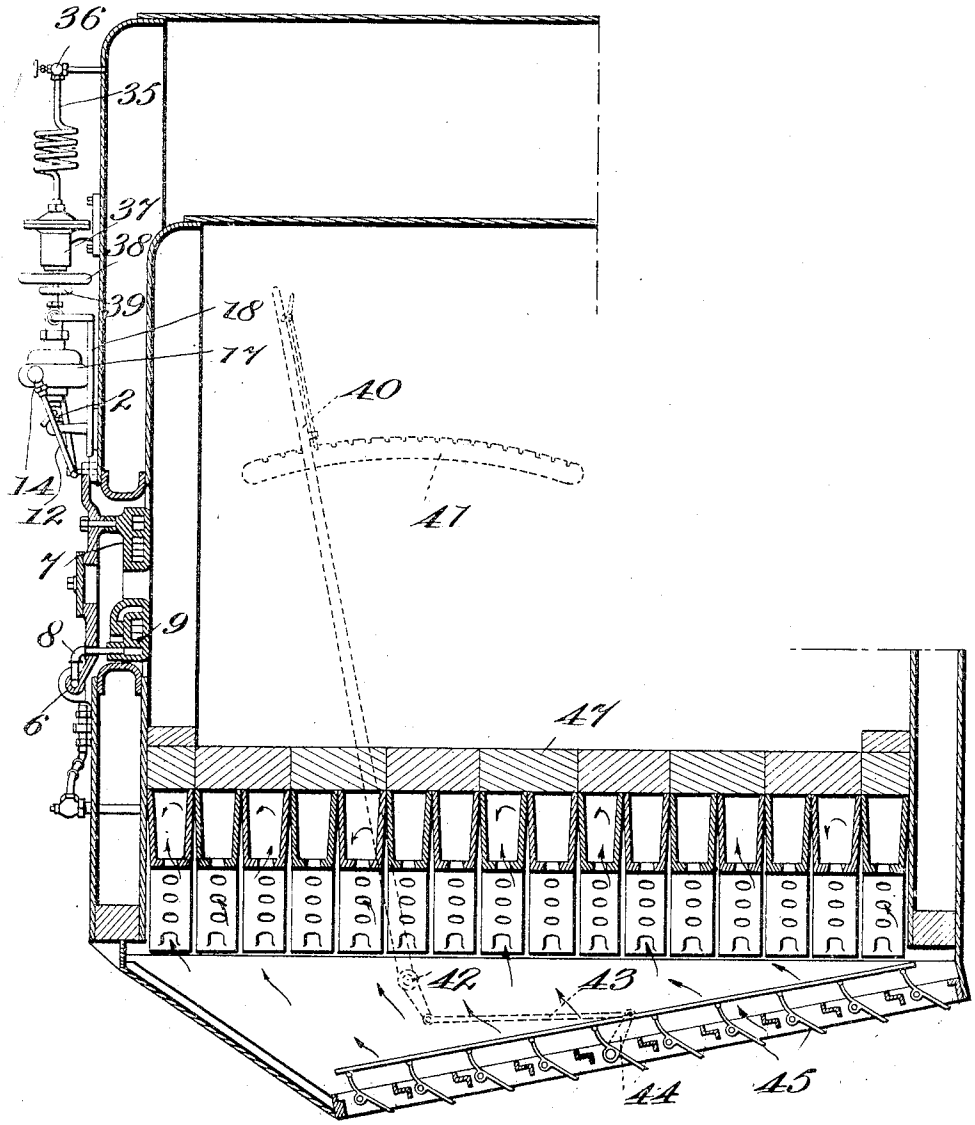
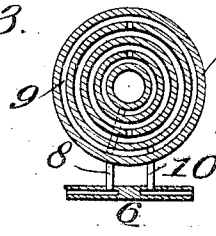


Fig. 3.



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3 SHEETS—SHEET 3.

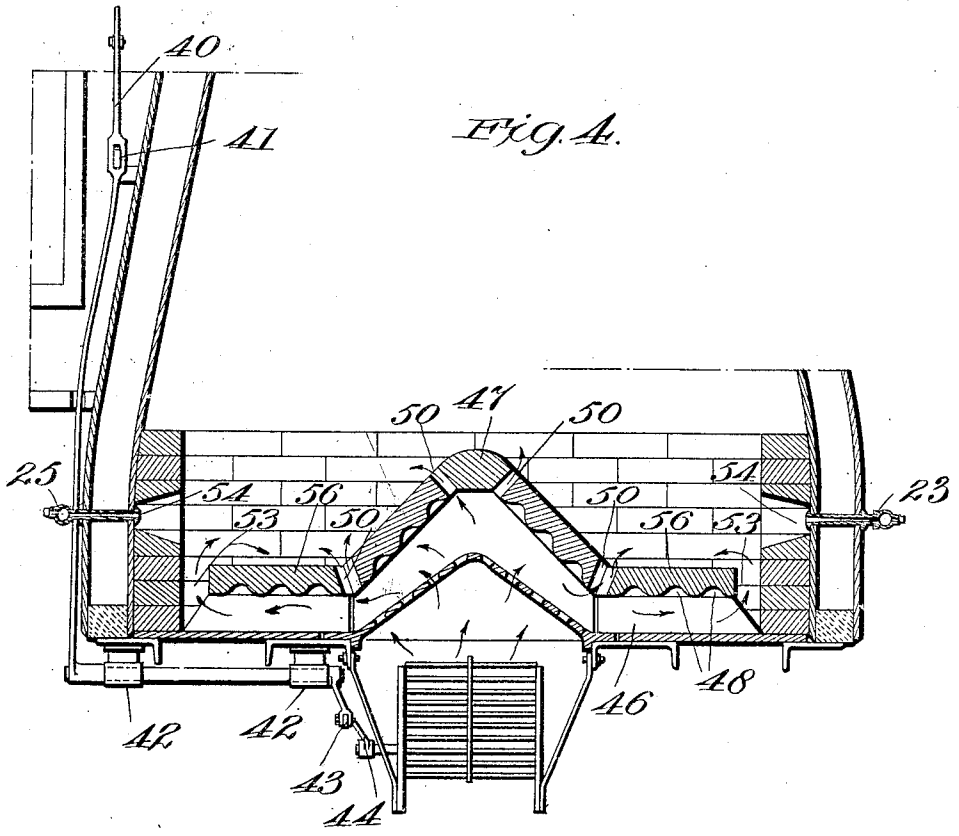
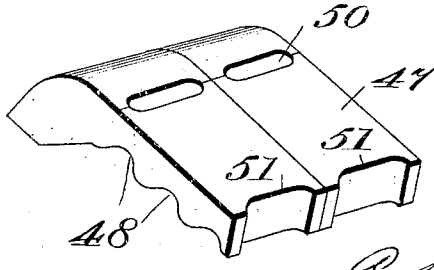


Fig. 4.

Fig. 5.



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UNITED STATES PATENT OFFICE.

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OIL-FED FURNACE.

980,806. Specification of Letters Patent. Patented Jan. 3, 1911.

Application filed August 23, 1909. Serial No. 514,222.

To all whom it may concern:

Be it known that I, ARTHUR H. LIGHT, a citizen of the United States, residing at Los Angeles, in the county of Los Angeles and State of California, have invented certain new and useful Improvements in Oil-Fed Furnaces; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

This invention relates to oil fed furnaces, and has for its object to produce a furnace of this nature in which the fuel mixture and oxygen are uniformly fed or distributed to every portion of the fire box, and in which a minimum of free oxygen passes through the furnace.

To these ends the invention consists in the novel details of construction and combinations of parts more fully hereinafter described and particularly pointed out in the claims.

Referring to the accompanying drawings forming a part of this specification in which like numerals refer to like parts in all the views:—Figure 1 represents an end elevational view of an oil fed furnace of the locomotive type; Fig. 2, is a sectional side elevational view of a portion of said furnace; Fig. 3, is a sectional view of the superheater used in connection with the furnace; Fig. 4, is a detail sectional view of the grate portion of the furnace; and, Fig. 5, is a perspective view of a pair of fire clay tiles used in the furnace.

1 represents any suitable oil supply, as for example, a pipe leading to a tank carried by the tender of the locomotive, and having a constant pressure maintained therein. 2 represents a suitable valve controlling said pipe, 3 a steam supply controlled by the valve 4, and connected with a pipe 5 passing to the hinge 6 of the superheater 7, which hinge is hollow and communicates with a short pipe 8 connected with one end of the coils 9 of said superheater, the other end of said coils being connected with a similar short pipe 10, communicating with another hollow portion of the hinge 6 and connected with the distributing pipe 11 provided with the branches 12 and 13, controlled by the valves 14 and 15, respectively, and leading into a suitable atomizing and mixing chamber 17, all as clearly set forth in my companion application for oil burners filed August 23, 1909 Serial Number 514,221.

Leading from the atomizing chamber 17 are a plurality of pipes 18 and 19, controlled respectively by the three-way valves 20 and 21, and leading from the valve 20 is a connection 22 for feeding the side burners 23, while leading from the valve 21 is a similar pipe 24 communicating with the side burners 25.

The short connections 27 and 28, respectively, lead from the valves 20 and 21 to the pilot lights 29 and 30.

Connected to the pipes 3 and 5, is a short pipe 31 controlled by the valve 32, and adapted to connect with any extraneous source of steam, in order to furnish fuel to the burners 23 and 25 before steam has been raised in the locomotive boiler.

35 represents any suitable supply pipe for live steam controlled by the valve 36, and communicating with the pressure regulator 37, controlled by the hand wheel 38, and adapted to control the supply of oil in the chamber 17, in accordance with the variations of the steam pressure.

39 represents a hand wheel which permits the supply of oil in the chamber 17 to be automatically controlled, or which permits the same to be controlled by hand, all as is fully and clearly set forth in my companion case above.

It is well known that firemen on locomotives using oil, under present conditions, have to give practically all their attention to the oil supply to the furnace, and very little attention can be given to the control of the air supply. In fact, with the present devices employed, it would be very difficult, if not impossible, for them to attend to both of these features in a perfect manner. For this reason, there is placed above the atomizing chamber 17 an automatic regulator controlled by the pressure of the steam in the boiler, so that the amount of carbon entering the furnace, will always be in proportion to the amount of steam required. In addition to this, there is provided the hand lever 40 playing over the rack 41, and pivoted at 42, as illustrated. The lower end of this lever

is joined to the link 43, which connects with the crank 44 controlling the draft damper 45, all as will be clearly understood.

The grates 46 are of a simple design, and are provided with fire clay tile 47, of a peculiar construction. These tiles are corrugated as at 48 on their under side, in order to permit free circulation of air underneath the same, and thereby, keep the grates themselves cooler than would be the case did the air not circulate between them and said tile. In addition to this, these corrugations can be made to double the heating surface exposed to the incoming air, and, therefore, to raise its temperature to a very high point before it is allowed to pass upward into the furnace through the passages 50, as indicated by the arrows. These passages are conveniently formed by providing the ends of the tile with curved recesses 51, as indicated, and then abutting said ends. In addition to the passages 50, however other larger passages 53 are provided at the sides of the furnace, just below the tips 54 of the side burners 23 and 25. These passages 53 are formed by making the side tile 56 sufficiently short to leave wider passages 53 between their edges and the side walls of the furnace, and these passages are made to extend the entire length of the fire box and their centers are located say about four and one-half inches inside the furnace from each burner tip, so that a very large percent. of highly heated air passes up next to the side walls of the furnace, and into intimate contact with the jets of fuel delivered by the burner tips 54. As said jets naturally tend to enlarge to a cone-shape as they enter the furnace, they will meet the rest of the air passing through the passages 50, and will be so intimately commingled therewith, that a practically perfect combustion is assured, so long as sufficient air is permitted to pass the damper vanes 45. In other words, the combustion is so perfect, owing to the air being properly distributed and so highly heated, that the fire clay tile 47 often reach a white heat, and, therefore, automatically tend to maintain the perfect combustion desired; so that when the furnace is once in operation there is no tendency at all, provided, of course, sufficient oxygen is fed thereto, for the temperature to fall to the low points that it necessarily does under the present conditions.

The operation of this oil fed furnace is as follows: The fireman, on leaving the station, or after he has made a lengthy stay at a station and extinguished all of his fires except the pilot lights 29 and 30, takes his place at his seat, manipulates the lever 40 which controls the damper shutters 45 and turns on the oil and steam supplies. After his fires in the burners 23 and 25 have been burning for a short time he notices if black smoke is being emitted from his stack. If it is, he admits more air, and if this does not clear away the smoke, he continues to admit air until the smoke appears a hazy gray at all times, which indicates that the furnace is functioning properly. If, on the other hand, he notices the smoke to clear away entirely, it is an indication that he is admitting too much air for the carbon delivered to the furnace, and he then turns the lever 40 in the opposite direction until the smoke returns to a hazy gray color.

Under the present conditions, the furnaces heretofore employed make no provision for the proper distribution of oxygen nor for the high temperatures attained by the furnace disclosed, and when black smoke is emitted from the stack, of any of these furnaces, it, of course, is said that sufficient oxygen is not present in the fire box; but this really only means that there is a lack of oxygen in the center of the most active part of the fire, or just above the point where substantially all of the carbon is being supplied by one or two jets. At the other points of the firebox, outside of this active portion, however, free oxygen may exist, and generally does exist, in ample quantity, but the temperature is so poor, or the intimate mixture of the fuel and oxygen is so imperfect, that the carbon at such points is not all consumed; therefore, black smoke will still be observed to be emitted from the stack even when the whole furnace has sufficient oxygen for perfect combustion; and simply because of the uneven manner in which the carbon is distributed to the different parts of the furnace and the uneven temperatures that are allowed to exist in different parts thereof. With the structure disclosed above, on the other hand, it will be observed, that air is supplied near the burner tips where there is more fuel in greater quantities, than it is farther away where there is less fuel, and that in all cases it is highly heated before ignition takes place. In practice it is found, therefore, that black smoke is not emitted, unless there is a real lack of oxygen supplied to the furnace. The perfect combustion attained in this furnace is also greatly aided by the fact that the atomizing steam is superheated before it passes into the atomizing chamber 17, and, therefore, the fuel mixture is in a state closely bordering that of vaporization before it enters the furnace. This superheater, it will be observed, is bolted to the furnace door, and the steam passes through its hinge, so that it is unnecessary to disconnect the same when access to the fire box is desired.

It is obvious that those skilled in the art may widely vary the details of construction and the arrangement of parts without departing from the spirit of this invention and, therefore, it is not desired to limit the

same to either of these features, except as may be required by the claims.

What I claim is:

1. In an oil fed furnace, the combination of an oil supply pipe; a steam supply pipe; a superheater through which the steam passes; an atomizing chamber connected to said superheater and with said oil supply pipe in which said oil and steam are finely divided; a plurality of burner tips delivering into the furnace; connections between said chamber and said tips; and means to supply air to said furnace comprising a plurality of passages located at varying distances from said tips, the passage nearest said tips being larger than those away from the same; substantially as described.

2. In an oil fed furnace the combination of an oil supply pipe; a steam supply pipe; a superheater through which the steam passes; an atomizing chamber connected with said superheater and said oil supply pipe in which said oil and steam are finely divided; a burner tip delivering into the furnace; a connection between said chamber and said tip; means comprising a horizontal and a vertical passage for supplying a quantity of air near said tip; means comprising a passage of less dimensions than said vertical passage and connected with said horizontal passage for supplying a less quantity of air farther away from said tip; and means for heating said air before it reaches the fuel mixture, substantially as described.

3. In an oil fed furnace the combination of an oil supply pipe; a steam supply pipe; a superheater through which the steam passes; an atomizing chamber connected with said superheater and oil supply pipe in which said oil and steam are finely divided; a burner tip delivering into the furnace; a connection between said chamber and said tip; means for supplying air near said tip; additional means for supplying air away from said tip in a less quantity and comprising a plurality of passages inclined toward said tip; means for heating said air before it reaches the fuel mixture; and a damper controlling the admission of air to said air supplying means, substantially as described.

4. In an oil fed furnace, the combination of an oil supply pipe; a steam supply pipe; a superheater through which the steam passes; an atomizing chamber connected to said superheater and oil supply pipe, in which the oil and steam are finely divided; a burner tip in said furnace; a connection between said chamber and said tip; a passage located in said furnace to supply air near said tip; additional passages each of a less size than said last named passage adapted to supply air elsewhere in the fire box of said furnace; tiles provided with corrugated lower surfaces and having said additional passages between them, located in said fire box for heating the air before it reaches the fuel mixture; and a damper for controlling the admission of air to all of said passages, substantially as described.

5. In an oil fed furnace having a fire box provided with grate bars the combination of a fuel supply pipe; means to deliver the fuel to said furnace; means to regulate the air supplied to said furnace; and corrugated tile resting on said grate bars adapted to heat said air before it reaches said fuel; said tile provided with the smaller air passages 50 near the center of said fire box, and providing the larger air passages 53 at the sides of said box; substantially as described.

6. In an oil fed furnace having a fire box provided with grate bars, the combination of a fuel supply pipe; a plurality of burner nozzles delivering said fuel through the sides of said fire box; means to regulate the air supplied to said furnace; and corrugated tile resting on said grate bars adapted to heat said air before it reaches said fuel; said tile provided with the smaller air passages 50 near the center of said fire box, and providing the larger air passages 53 at the sides of said box; substantially as described.

7. In an oil fed furnace having a fire box, the combination of a superheated steam supply pipe; an oil supply pipe; a mixing chamber connected to said pipes; means for controlling the flow of fuel through said oil supply pipe; means for feeding the mixed oil and steam to said fire box; means for controlling the air supply to said furnace; and means comprising ports of successively diminishing areas to distribute said air in said box to the places containing the mixed oil and steam, and in proportion to the fuel to be consumed at said places, substantially as described.

8. In an oil fed furnace having a fire box, the combination of a superheated-steam pipe; an oil pipe; a mixing chamber connected to said pipes; means for controlling the flow through said pipes; means for feeding the mixed oil and steam to said fire box; means for controlling the air supply to said furnace; means to heat said air to a high temperature before it reaches said oil and steam; and means comprising ports of successively diminishing areas to distribute said air in said box to the places containing said mixed oil and steam in proportion to the fuel to be consumed at said places, substantially as described.

9. In an oil fed furnace, having a fire box, the combination of an oil supply pipe; a steam supply pipe; a mixing chamber for said oil and steam; means connected to said chamber for feeding the mixed oil and steam to the sides of said fire box; means for controlling the air supply to said furnace; means to heat said air to a high temperature before it reaches said oil and steam; pas-

sages near the center of said furnace for said air; and larger passages at the sides of the fire box, below said feeding means for the admission of larger quantities of air; substantially as described.

10. In an oil fed furnace having a fire box, the combination of a plurality of nozzles adapted to feed mixed oil and steam, entering the sides of said box; air passages arranged under said nozzles at the sides of said fire box; smaller air passages for feeding air near the center of said box; and means for heating said air, before it enters the box; substantially as described.

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

ARTHUR H. LIGHT.

Witnesses:

L. C. POTTER,

MAMIE RUHE.