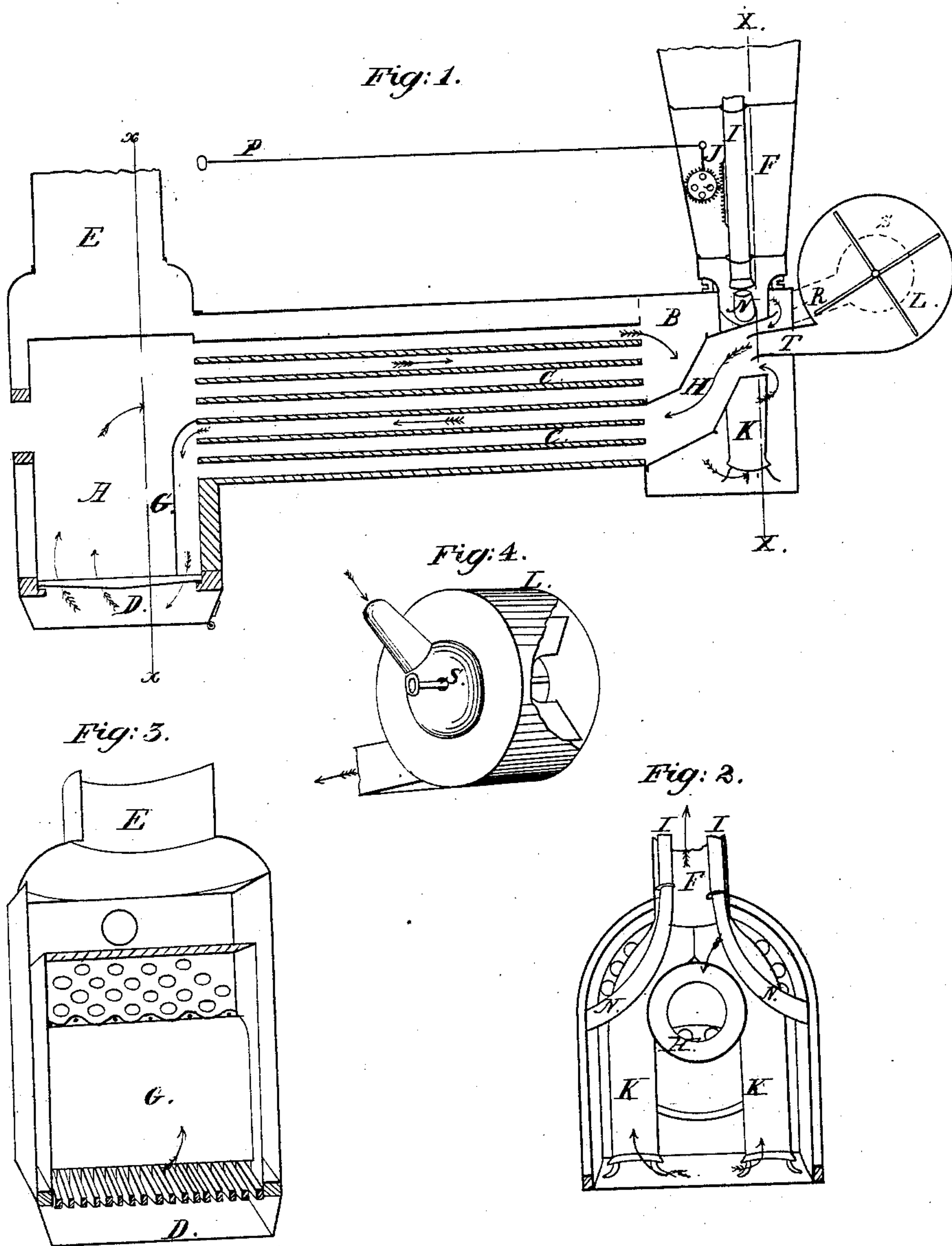


B.F. Blood,
Spark Arrester and Consumer,
No. 18,951, *Patented Dec. 29, 1857.*



Witnesses:
John Blood
Mary E. Blood.

Inventor:
Benjamin F. Blood

UNITED STATES PATENT OFFICE.

BENJAMIN F. BLOOD, OF PORT JACKSON, NEW YORK.

IMPROVEMENT IN FURNACES.

Specification forming part of Letters Patent No. **18,951**, dated December 29, 1857.

To all whom it may concern:

Be it known that I, BENJAMIN F. BLOOD, of Port Jackson, in the county of Montgomery and State of New York, have invented certain improvements in furnaces specially adapted to the generation of steam, but applicable to furnaces designed for other purposes, of which the following is a full, clear, and accurate description, reference being had to the accompanying drawings, (part of this specification,) and in which—

Figure 1 represents a vertical longitudinal section of a tubular or locomotive boiler embracing my improvements. Fig. 2 represents a transverse section of Fig. 1 at the line X X. Fig. 3 represents a transverse section of Fig. 1 at the line x x. Fig. 4 represents an elevation of the fan-blower of Fig. 1, showing the arrangement of the eyes thereof.

The principal objects of my improvements are to economize fuel by consuming the most combustible portions of those gases and cinders which usually escape through the draft or chimney under the general name of "smoke," and to quench those cinders or sparks which escape unconsumed in the generation of heat for mechanical purposes.

By referring to the accompanying drawings my invention will be comprehended in detail.

The boiler is the usual cylindrical shell of modern locomotive-boilers connected at one end with a fire-box A and at the other end with a smoke-box B, and having a steam-dome E and the usual flues C, and supposed to possess the usual fixtures of boilers of its class in every other particular than is hereinafter specified. The alterations and additions which I make to such a boiler depend in some particulars upon whether the engine thereto attached is of outside or of inside "connection"—in other words, whether the cylinders of the engine are fixed beneath or beside the boiler. If the engine is of outside connection, then my alterations and additions are as follows: I make the ash-box D as nearly air-tight as may be conveniently, and without the usual draft-opening, yet give it a door which may be opened for natural draft when the fire is kindling. Inside the fire-box A, I place a flat scuttle or flue G, wide enough to cover all the lower half of the flues C, and extending downward and resting on the grate,

and so fastened with set-screws to the flue-sheet at the top and sides as to exclude from the lower half of the flues all communication with the fire-box except by a competent passage behind the scuttle down through the grate into the ash-box and upward through the fuel. This scuttle G is of cast or wrought iron, and is made corrugated or grooved for the double purpose of presenting a large surface and leaving sufficient passage for the contents of the flues covered or inclosed by it in entering the ash-box. The grate may be so constructed that the bars shall not extend under the scuttle. (This scuttle may be made in such manner as to be connected to the upper half of the flues instead of the lower half, and carried along the crown-sheet to the front part of the boiler (looking into the same through the doorway) and thence downward to the grate.) In the smoke-box B, I cover the ends of these same flues (the lower half) with a nozzle H, whose forward end is cylindrical and of from ten to twenty inches in diameter, extending to near the top and front of the smoke-box. Passing directly through the door of the smoke-box is the blast-pipe T of a fan-blower L, extending a short distance into the nozzle H. The comparative sizes of the blast-pipe and this nozzle depend entirely on the capacity of the flues—a matter which all competent engineers will readily understand. The blower or fan is fixed to the door of the smoke-box and swings around with it when it is opened. The boxes in which the journals of the fan rest are fixed to the blower-shell. One eye of the blower is always exposed to the atmosphere, (being expanded or diminished by the usual valves.) The other eye is covered with a flue S, through which is a small perforation for the journal, which flue connects with the smoke-box near the top of the latter through an orifice at R in such a manner that the flue shall cover the said orifice when the smoke-box door is closed. The blower receives motion from either a belt or gearing driven by a small engine placed conveniently beneath the shell and supplied with steam from the boiler of the main engine. When applied to stationary boilers, the small engine may generally be dispensed with by connecting the belt with neighboring shafting.

The smoke-stack F, which usually starts from the top of the smoke-box, is continued down through the top of the latter until it reaches the nozzle H, where it becomes bifurcate, one fork or leg K passing downward on either side of the nozzle H until within eight or ten inches of the bottom of the smoke-box, where it is sustained by proper feet. The exhaust-pipes of the engine pierce these legs, as seen at N in the drawings, and turn upward within them. Just above the exhaust-pipes N rise pipes I, of equal size with the exhaust-pipes, to near the top of the smoke-stack F. Each of these pipes is fitted with a rack, in which rolls the segment J, by which the pipes are raised and lowered (through proper guides, which hold them perpendicular) by the engineer handling the rod P.

Having now described these parts of my arrangement, their operation is easily imagined. Open the door of the ash-pit or ash-box D, apply the fuel and fire in its proper place, and the smoke and gases will rise to the upper flues, traverse them to the smoke-box, and escape through the smoke-stack and the orifice at R. When steam enough has been generated in the boiler to run the small engine, set the blower in motion. The action of the fan draws smoke and gas from the smoke-box through the orifice at R into that eye of the blower which is covered by the flue, while at the opposite eye it draws in fresh air. The gases and fresh air thus drawn into the shell together are mingled and driven through the blast-pipe T into the nozzle connected with the lower flues. At the same time that this blast enters the nozzle it draws the smoke of the smoke-box after it in the same manner that the exhaust-steam when escaping up the smoke-stack draws the smoke after it. This volume of gas and air thus drawn and driven into the nozzle H escapes through the lower flues, (with which the nozzle is connected,) and reaching the scuttle G at the front end of the fire-box it is turned downward, and passing through into the ash-box (which must be closed while the blower is running) it escapes upward through the fuel to the flames and the combustible portions of it are more or less consumed. Whatever gases rise from the flames, whether portions of the blast or fresh gases from the fuel, rise to the upper flues and traverse them to the smoke-box. Reaching the smoke-box, the gases distribute themselves through all parts of the same, being prevented from escaping at the top by reason of the smoke-stack being continued downward into the box. Meantime the heavier sparks, or those which retain their ignition longest and are most dangerous when escaped from the locomotive, are dejected to the bottom of the smoke-box, there to remain as a general thing, the exhaust-pipes being so arranged above that draft through the pipes K is not as strong as is usual in the smoke-stack (a point herein-after explained). The main engine being

now supposed to be in action, the gases in the smoke-box find three passages from it. One passage is through the orifice at R to the eye of the blower. Another passage is into the nozzle H, around the blast-pipe T, and another through the legs K of the smoke-stack. All the smoke or gases entering the nozzle H are thoroughly mingled with and oxidized by the fresh air drawn into the exposed eye of the blower and forced through the blast-pipe T. When these oxidized gases reach the scuttle G, which is in the hottest part of the flames that mount to the upper flues, they are reheated by this scuttle arresting them with its broad flat or grooved surface at pleasure and turned downward into the ash-pit and thence upward to the flames. Being oxidized and reheated, they burn readily. (That smoke or gas burns most readily when hottest any person may assure himself by igniting the smoke of a newly-quenched candle at greater or less distances from the wick. The nearer the ignition is to the burning snuff or wick the more actively and surely does it communicate flame to it.)

The object to be sought in the arrangement of the legs K is as follows: A locomotive-boiler is required to furnish more steam in proportion to its size than any other, and consequently such a boiler must be heated with an extraordinary fire. For this reason I desire at times to urge the fire with both the fan-blower and the exhaust; but if the hole through the top of the smoke-box were left open, as usual, the hottest gases, which are lightest also, would escape in precedence to the cooler, leaving the least eligible portions to be returned through the flues to the fire. Therefore I continue the stack downward past the nozzle H on either side thereof, but not allowing the legs K to approach so near the bottom of the smoke-box as to arrest the more heavy and dangerous sparks which may settle there. By thus urging the fire and using the exhaust the amount of escaping gases is greater than it would be otherwise; but so fierce is the fire requisite in a locomotive that it is impossible to burn all, even of the most combustible, gases of the smoke with economy or to return any but the hottest of them through the flues. Another object in allowing the exhaust to make a draft through the stack is that where a powerful blast is communicated to the fire if there were no escape from the boiler except that of pressure on a common orifice or pipe the engineer would be driven from his post by the escaping flames whenever he opened the feed-door, a circumstance which would prevent a proper attendance on the fire. Thus by the action of the fan I and the exhaust-pipes N in the legs of the stack a cogent and eligible circulation of the hot gases is carried on through the boiler and effecting a necessary and powerful generation of steam therein. Doubtless all the sparks of the fire will not be retained in the smoke-box. In order that fewer of these shall

escape in dangerous vicinities by reason of the action of the exhaust, and also in order that the force of the exhaust upon the smoke-stack draft may be controlled at any time, I place the pipes I directly over the exhaust-pipes. When the effect of the exhaust needs to be stopped, as above mentioned, the pipes I (or either of them singly) are let down upon the mouths of the exhaust-pipes N, whereupon the steam rises through the pipes I and causes no agitation of the surrounding air or gas until it reaches the top of the smoke-stack, when it will escape with little effect.

In applying my improvements to boilers whose cylinders are beneath the boiler, or otherwise attached so as not to interfere, I place the blower L within the smoke-box with its blast-pipe fitting either loosely or tightly into the nozzle H, according to the capacity of the flues. The blower is fixed to one side of the smoke-box, the eye of the former fitted to a corresponding orifice in the side of the smoke-box without pipe or flue. The other eye is exposed to the gases of the smoke-box. The nozzle H in this case is turned to one side, not only to accommodate itself to the blast-pipe, but to make room for the leg of pipe R to pass down beside it. This continuation of the smoke-stack is not bifurcate in this application. The journals of the fan rest in boxes outside the smoke-box, piercing the large orifice before mentioned on the one side and a close-fitting orifice on the other. Space is left between the leg K and the blower for the gases which go into the eye thereof. The journals mentioned pass through the leg K, which has proper perforations for that purpose. The exhaust-pipes of the engine must be formed of proper proportion and shape to enter this leg and rise to near the top of the smoke-box, as before. The utility of this latter arrangement as compared with the former consists in saving the blower from exposure to the cooling influence of the atmosphere; but aside from this advantage the arrangement has another form of utility. The placing of the blower-shell directly against the side of the smoke-box, so that the action of the fan shall draw in fresh air without allowing the same to come in contact with any other smoke or gas of the smoke-box than that which is drawn in at the other eye of the shell, is of much advantage. If the blower were placed in the center of the smoke-box and fresh air allowed to enter promiscuously among the gases of the smoke-box, it would settle to the bottom on account of its specific gravity, and consequently fail to oxidize the upper gases, which alone it is desirable to oxidize; but being placed as in my arrangement the blower draws fresh air into one eye and smoke and gas into the other no faster

than is useful, and mixing the two drafts thoroughly drives them to the scuttle G to be reheated, and thence to the fire itself.

Having thus described the arrangement of parts and the operation of my invention, what I claim and what I disclaim as original with me is as follows: I do not claim the returning of smoke to a fire either with or without oxidation, whether under the grate or into the flames, whether through the boiler or outside of the boiler, all of which processes are old and unpatentable; neither do I claim placing a fan-blower either within or without the smoke-box, smoke-stack, or any chimney-flue for the above purposes or any of them.

I am aware that David Matthew obtained a patent May 15, 1855, for a pipe of less diameter than the inside of the base of the smoke-stack set up in the same and extending downward to the vicinity of the bottom of the smoke-box, having the exhaust-pipes beneath it, and an annular space between it and the base of the stack, the whole designed to draw the smoke from the top of the smoke-box into the annular space and thence up the stack, and also to draw the sparks from the bottom of the smoke-box lest they do injury thereto. I do not claim such an arrangement nor one that will effect the purpose for which he claims it.

I claim—

1. A scuttle G, in combination with the flues of the boiler, as heretofore described, as a protection, a guide, and a reheater for the gases passing through the flues, substantially as set forth, for the purpose specified, whether the said scuttle be made plain or indented and whether it pass directly downward to the grate or traverse some other portion of the inside surface of the fire-box.

2. A downward bifurcated continuation of the smoke-stack without any egress from the smoke-box between this continuation and the base of the stack, and extending downward as far as may be without disturbing those heavier sparks which may have fallen to the bottom of the smoke-box, into which bifurcations the exhaust-pipes turn upward, the whole being designed by closing egress for the smoke at the top to give the sparks an opportunity to settle in the smoke-box or be returned to the fire through the nozzle H, also to restrain the hot air and gas from immediately leaving the smoke-box at the top at the same time that the legs K will select the matter of their draft from the cooler and lower instead of the lighter and hotter gases of the top of the smoke-box.

BENJAMIN F. BLOOD.

Witnesses:

JOHN BLOOD,

MARY E. BLOOD.