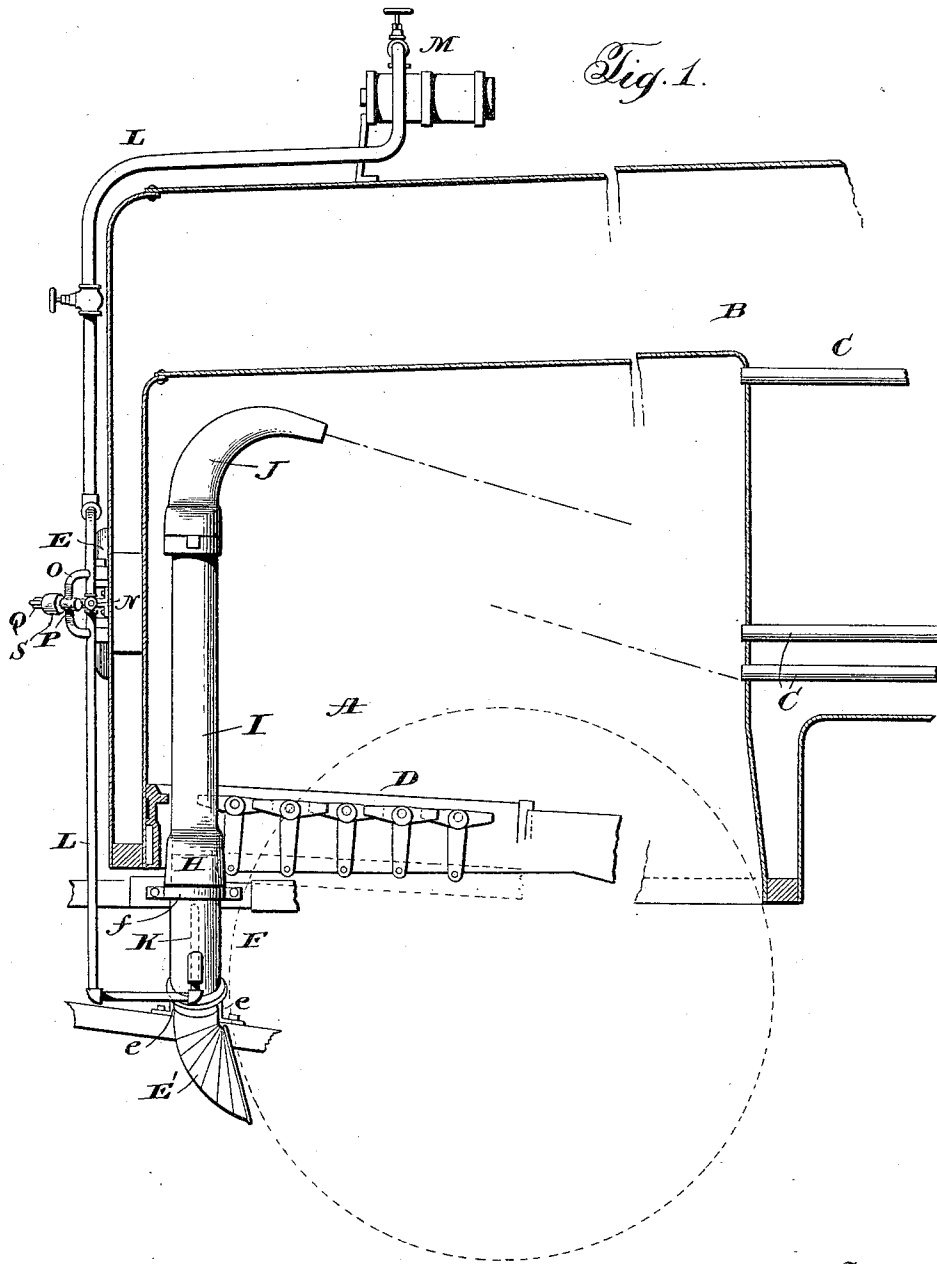


J. H. PARSONS.
METHOD OF SECURING COMBUSTION OF COAL AND SIMILAR PRODUCTS.
APPLICATION FILED NOV. 1, 1907.

1,066,043.

Patented July 1, 1913.

3 SHEETS—SHEET 1.



Witnesses:

Jas. E. Hutchinson
Calvin T. Trilene

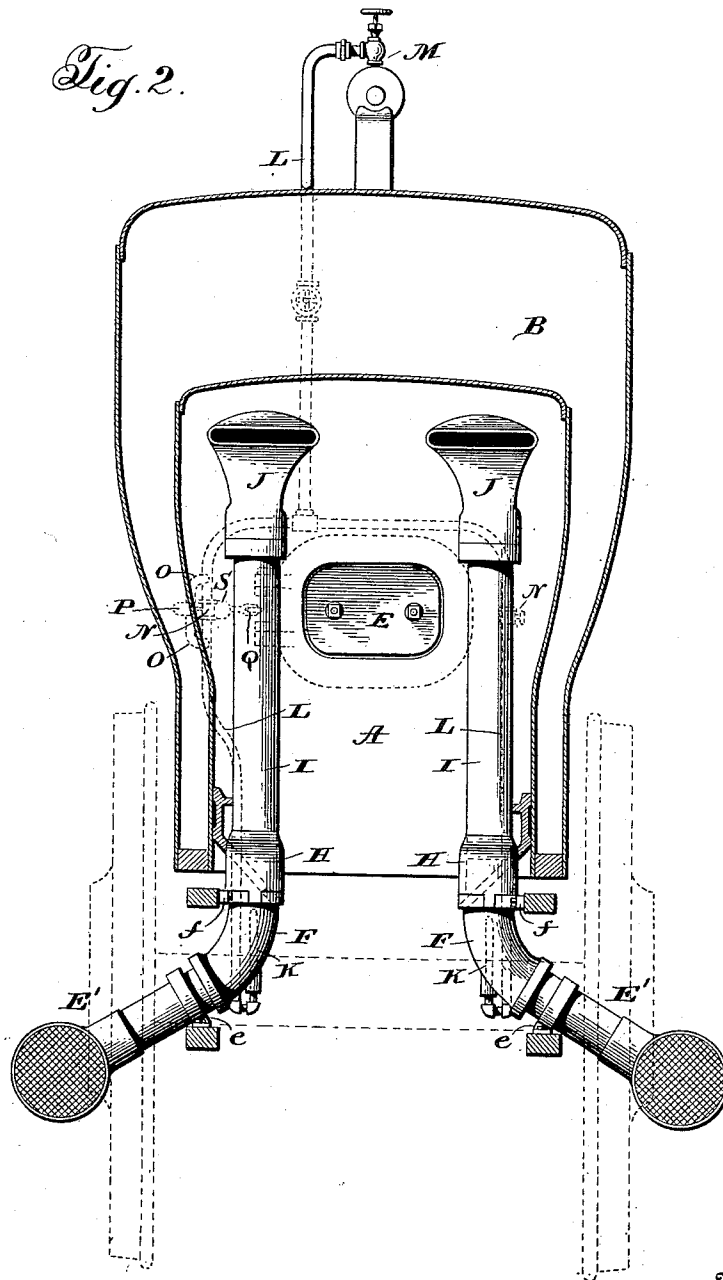
Inventor:

John H. Parsons
By T. M. Williams Attorneys

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Witnesses:

Jas E. Hutchinson:
Cabin St. Paul, Minn.

Inventor:

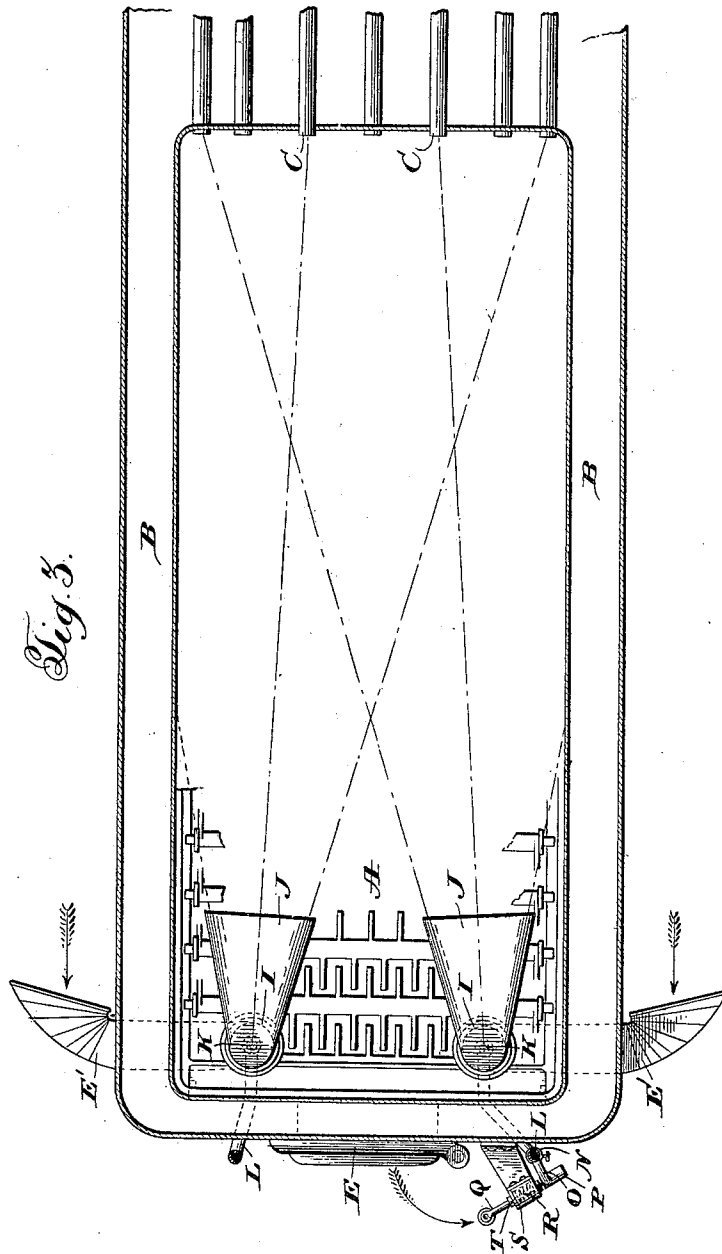
John H. Parsons,
By Nathan Williams Attorneys:

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3 SHEETS—SHEET 3.



Witnesses:

James Hutchinson
Calvin T. Milane

Inventor:

John H. Parsons,
By J. Milne Milane Attorneys:

UNITED STATES PATENT OFFICE.

JOHN H. PARSONS, OF PHILADELPHIA, PENNSYLVANIA, ASSIGNOR TO PARSONS ENGINEERING COMPANY, OF WILMINGTON, DELAWARE, A CORPORATION OF DELAWARE.

METHOD OF SECURING COMBUSTION OF COAL AND SIMILAR PRODUCTS.

1,066,043.

Specification of Letters Patent.

Patented July 1, 1913.

Application filed November 1, 1907. Serial No. 400,169.

To all whom it may concern:

Be it known that I, JOHN H. PARSONS, a citizen of the United States, residing at Philadelphia, in the county of Philadelphia and State of Pennsylvania, have invented certain new and useful Improvements in Methods of Securing Combustion of Coal and Similar Products, of which the following is a specification, reference being had therein to the accompanying drawing.

This invention relates to the art of fuel combustion, and has for its object the provision of an improved method of insuring substantially complete combustion of coal and similar products, from which any or all of the following successful and practical results may be obtained, to wit: first, a substantial saving in fuel; second, more intense heat and corresponding greater efficiency of an engine or furnace; third, the facilitation of the maintenance of any required draft through the fuel while supplying adequate air, steam, or air and steam, to the gaseous or other products arising from the burning; fourth, the practical elimination of objectionable smoke and gas; fifth, the preservation of the furnace from damage by rapid fluctuations in temperature; and sixth, the saving of labor on the part of the attendants.

With reference to the characteristic features of the present method it may be noted that they are ancillary to the method disclosed in my copending application filed November 23, 1906, Serial No. 344,794.

This invention embraces the method of introducing into a furnace or engine fire box air, steam, or air and steam, in volume of sheet formation substantially covering the fuel area and forcing said sheet over the fuel in the direction of the general line of draft through the fire box, the volume or body of air, etc., thus introduced and its impetus being such that the sheet is not materially dissipated or consumed in its passage directly over the fuel whereby it is adequate upon reaching the combustion area beyond the fuel bed to fully commingle with the products arising from the burning fuel and practically insure the consumption of the finer particles of fuel, and gases

etc., without impairing the required draft through the fire grate. The air, prior to its discharge into the fire box, is preferably heated to near the point of combustion when commingled with the gaseous products arising from the fuel.

The invention also comprehends the feeding of fuel to the furnace in relatively small quantities or shallow layers as compared with the mode of furnace feeding ordinarily employed, whereby the fuel will readily and quickly ignite and burn incident to the draft through the body thereof, and supplying a volume of highly heated air forcibly thereover in sufficient quantity to perfect the combustion of the arising or floating products, and in a way not to impede the required draft through the fuel bed.

When the invention is carried into practical effect in connection with the ordinary type of steam locomotive wherein the exhaust from the engine is utilized to create a forced draft through the fire grate, fuel and boiler tubes, the power of such exhaust being usually more than necessary to create the desired draft, whereby damaging influences exist, the volume of air, in addition to the good results otherwise obtained therefrom, supplies the added medium to relieve the exhaust, thus preventing the same from carrying off the smaller particles of unconsumed fuel, while at the same time, as the suction of the exhaust is reduced, the current of air over the fuel bed being under considerable force or pressure induces the draft through the bed of fuel, so that a substantially uniform and efficient draft through the fuel is constantly maintained.

Theoretically I might add that in carrying out the present method in the locomotive, wherein the grate surface is sufficient to permit an intake of air to supply the draft-creating exhaust, and wherein the intake of air is correspondingly prevented by the barrier constituted by the bed of fuel, resulting in the sucking up of the fuel itself by the exhaust, then my volume of air is at least sufficient to supply an amount equal to the difference between the maximum air intake of the grate, and its reduced intake when obstructed by the bed of fuel, whereby

the suction of the exhaust is correspondingly relieved. This air also being under force, assists the draft through the fire grate and fuel, and being highly heated, when it commingles with the gaseous products or particles of fuel arising from the fuel bed, a highly combustible mixture is created which ignites and is wholly consumed in the combustion area in the rear of the fire box and through the boiler tubes.

In some instances the amount of air may be obtained by the suction of the exhaust alone.

In the case of stationary furnaces the volume of air, whether injected under the suction of the usual smoke stack or under other force, assists the draft through the fire grate and fuel, and insures the combustion of the smoke, gases, and smaller particles of fuel, the same as hereinabove stated in connection with locomotive use. In both instances, however, I have found that there is a great saving of fuel, ranging between thirty and sixty per cent., the efficiency of the furnace or steaming capacity of the engine or boiler greatly increased, and smoke practically entirely dispensed with. In both cases, also, the temperature of the furnace although increased considerably beyond the heat usually obtained therein, is nevertheless a more consistent or uniform temperature, thus overcoming serious fluctuations with the resultant shrinkage and contraction of the tubes or flues, etc., which so frequently cause the joints to weep or leak with the inherent impairment of operation and expense of repairs.

Still another feature of the invention resides in the simultaneous feeding of the fuel (such as coal) to the fire and the forcing of an increased volume of air above the fuel to enable complete combustion of the dense or heavier products which initially arises from a fresh supply of fuel.

Specifically, the invention comprehends the introduction of the air in a sheet made up of converging fan-like sheets the inner or adjoining edges of which impact with each other and the outer edges of which impact against the side walls of the fire box whereby the united sheet is to a large extent diffused into a spray at a point within the combustion area in rear of the bed of fuel, and preferably substantially in line with the bottom of the flue of the furnace or the lower series of boiler tubes, and away from objectionable contact with the bridge-wall or flue-sheet, whereby return or counter currents are prevented.

With a view to facilitating a better understanding of my present invention, I have shown in the accompanying drawings an engine in connection with which my method may be carried into practical effect, the special features of which engine will be appar-

ent from the detailed description hereinafter contained when read in connection with said drawings.

In the drawings, Figure 1 is a vertical sectional view through the fire box, and immediately associated parts of the locomotive, Fig. 2 is a vertical transverse sectional view of the same, and Fig. 3 is a horizontal sectional view showing both of the discharge nozzles in elevation.

Referring more specifically to the drawings, wherein like reference characters designate corresponding parts in the several views, A represents the fire box of the locomotive, B the steam boiler thereof, C the tubes or flues of the steam boiler, D the fire box grate and E the door of the fire box, the exhaust mechanism operating through the engine stack being of the usual type (not shown).

Projecting laterally beyond the sides of the fire box A, and occupying positions somewhat lower than the plane of the grate D are a pair of intake funnels E', the openings thereof being disposed forwardly of the engine whereby to receive the air forced thereinto during the travel of the engine. The funnels are supported from the engine frame by brackets e, and fit at one end into transverse connecting pipes F in turn supported from brackets f. The pipes F lead inwardly to points near the rearmost corners of the fire box whence they are connected to short upright pipes H preferably of metal, terminating at points slightly below the plane of the grate D. The upright pipes H last referred to support the nozzle connecting sections I, and near the upper ends of the sections I are supported the nozzles J. The sections I and nozzles J are preferably made of a material capable of withstanding the intense heat within the fire chamber, for instance, fire-brick.

Each nozzle J is of a curved elbow type of decreasing interior area toward its outlet and merges from a circular cross-section, at its connection with the section I, into a horizontally disposed elongated flat discharge end whereby to emit fan-like sheets of air as indicated by dotted lines in Fig. 3 which together form a sheet of air passing over substantially the whole of the bed of fuel. Owing to the peculiar formation of the nozzle, it will be clear that as the air passing therethrough becomes heated to increasing temperature, its expansion is likewise greater and the restricted capacity of the exit portion of the nozzle causes the escape of the air to be with great impetus.

The discharge ends of the nozzles extend to and occupy a position near the top of the fire box and are forwardly and downwardly inclined slightly substantially on the line indicated in Fig. 1, whereby to point toward the lower series of boiler tubes C so

that in practice the sheets of air will be forced forwardly in substantially the same general line as the draft through the grate and fuel and in line with the boiler tubes, whereby not to create reverse or counter currents, or be otherwise opposed to said general line of draft.

As is known to those skilled in the art, the fire grate or the bed of fuel placed thereon does not extend forwardly to the flue sheet, but that a space known as the combustion area is maintained intermediate the flue sheet and the bed of fuel, and upon an inspection of Figs. 2 and 3 it will be seen that the adjacent or inner converging lines of the fan-like sheets of air emitted from the nozzles J cross at a point rearward of the bed of fuel and within this combustion area, also that the outer or diverging lines of said fan-like sheets tend in a direction to intersect the walls of the fire box at points substantially within the same plane, transversely of the fire box, as said point of intersection of the inner or converging lines. This arrangement enables the utilization of the forced sheets of air to assist the draft through the fire grate and bed of fuel, maintains a constant and unbroken current above the fuel, and insures at the point where the combustion of the products arising from the fuel is desired and where it cannot seriously interfere with the draft through the fuel, an intimate commingling of the air with the products arising from the fire and practically complete combustion thereof within the combustion area and through the boiler tubes, the impact of the fan-like sheets with each other and with the walls of the fire box diffusing the air into a spray and filling substantially the entire area of the combustion chamber whereby the ignition and consumption of the mixture secured thereby is practically instantaneous. This air also, as stated in the forepart of this specification, relieves the exhaust through the engine stack, overcoming any disturbance of the bed of fuel thereby.

Owing to the volume of air injected into the furnace and the force with which it is passed over the body of fuel, it will be apparent that the sheet will constitute a moving barrier extending across the combustion area between the bed of fuel and the flue or flues moving in the general direction of the draft but with which all products arising from the burning fuel must contact and commingle as is obvious, while in addition to this the contacting edges of the sheet are converted into a spray within the combustion area. Thus it will be appreciated that it is impossible for any unconsumed gases, or particles of fuel, arising from the fuel bed to escape the process of commingling with the air and being consumed therewith.

The sheet of air may be introduced with

the desired force by employing a steam injector, the nozzle of which is represented at K connected by a pipe L with a source of steam supply M, or compressed air may be used if desired. A valve N controls the ejector under normal conditions. The pipe L, however, has a by-pass O in which is a valve P having an operating stem Q, a spring R keeping the valve closed when the door of the fire chamber is shut or but partially opened. The valve stem Q is so arranged, however, that it passes through a retarding device S comprising a cylinder containing a liquid such as oil, and a piston T adapted to reciprocate therein secured to the valve stem Q, the spring R, before mentioned, bearing against the piston to keep the valve P closed under normal conditions. However, when the door E is thrown open in the direction of the arrow (Fig. 3), the same contacts the end of the stem Q, forces the same inwardly against the pressure of the spring R, opens the valve P and permits the steam to pass to the jet nozzle K. The door may be immediately closed but the action of the retarding device will permit the valve stem to be restored to normal position and the valve closed only by a slow gradual movement whereby the injection of steam and air will be continued for the required period of time after the door is closed to insure the complete combustion of the heavier or dense gases or products arising from the bed of fuel immediately following the introduction of the fresh supply of fuel. This valve and the retarding mechanism therefor need not be further considered in detail herein, inasmuch as the same constitutes subject matter of a copending application for the apparatus, Serial No. 427,119 filed April 15, 1908.

By the foregoing arrangement, it will be appreciated that the steam injector may be operated at will by the valve N when the furnace door is closed, and that the same may be actuated automatically through the medium of the by-pass and valve P when the door is opened the required distance, and also that the door may be fully opened without actuating the steam injector should it be desired simply to cool the fire chamber, which desideratum may arise under some conditions of service.

It is further to be noted that the lower ends of the nozzles being embedded in the burning body of fuel, the air passing there-through becomes heated to substantially the same degree as the air of the usual draft passing through the grate and fuel, whereby the temperature of both supplies of air when they commingle with the gaseous and other products in the combustion chamber is substantially the same, this evening or balancing of temperatures of the several supplies to the finally commingled product seemingly

being prerequisite to complete or perfect combustion. In this way the regulation of the temperature of the additional air supplied in keeping with my invention is controlled by the fire itself.

I claim:

1. The art of promoting combustion in furnaces consisting in igniting a body of fuel supported upon a grate, supplying air to the fuel from below the grate, and forcibly introducing above the fuel while the furnace door is closed a volume of heated air in the general direction of the draft of the furnace and in sheet formation to intercept and in volume to insure the consumption of the combustible gases and particles arising from the body of fuel, the volume and velocity of the introduced air being such as to assist the draft through the grate and fuel and facilitate the maintenance of the required draft through the fuel, said volume and force of the introduced air being such that the sheet is not materially dissipated or consumed in its passage directly over the fuel whereby it is adequate upon reaching the combustion area beyond the fuel bed to fully commingle with the combustible products arising from the burning fuel and insure the consumption thereof, and augmenting the supply of heated air above the fuel by the opening of the furnace door for the introduction of fresh fuel.

2. The art of promoting combustion in

furnaces consisting in igniting a body of fuel supported upon a grate, supplying air to the fuel from below the grate, and forcibly introducing above the fuel, while the furnace door is closed a volume of heated air in the general direction of the draft of the furnace and in sheet formation to intercept and in volume to insure the consumption of the combustible gases and particles arising from the body of fuel, the volume and velocity of the introduced air being such as to assist the draft through the grate and fuel and facilitate the maintenance of the required draft through the fuel, said volume and force of the introduced air being such that the sheet is not materially dissipated or consumed in its passage directly over the fuel whereby it is adequate upon reaching the combustion area beyond the fuel bed to fully commingle with the combustible products arising from the burning fuel and insure the consumption thereof, the sheet being diffused into a spray within the combustion area to facilitate the result stated, and augmenting the supply of heated air above the fuel by the opening of the furnace door for the introduction of fresh fuel.

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

JOHN H. PARSONS.

Witnesses:

THOS. R. HEATH,
JOS. H. MILANS.

Copies of this patent may be obtained for five cents each, by addressing the "Commissioner of Patents, Washington, D. C."