

(No Model.)

B. SLOPER.
Hydrocarbon Furnace.

No. 236,098.

Patented Dec. 28, 1880.

Fig. 1.

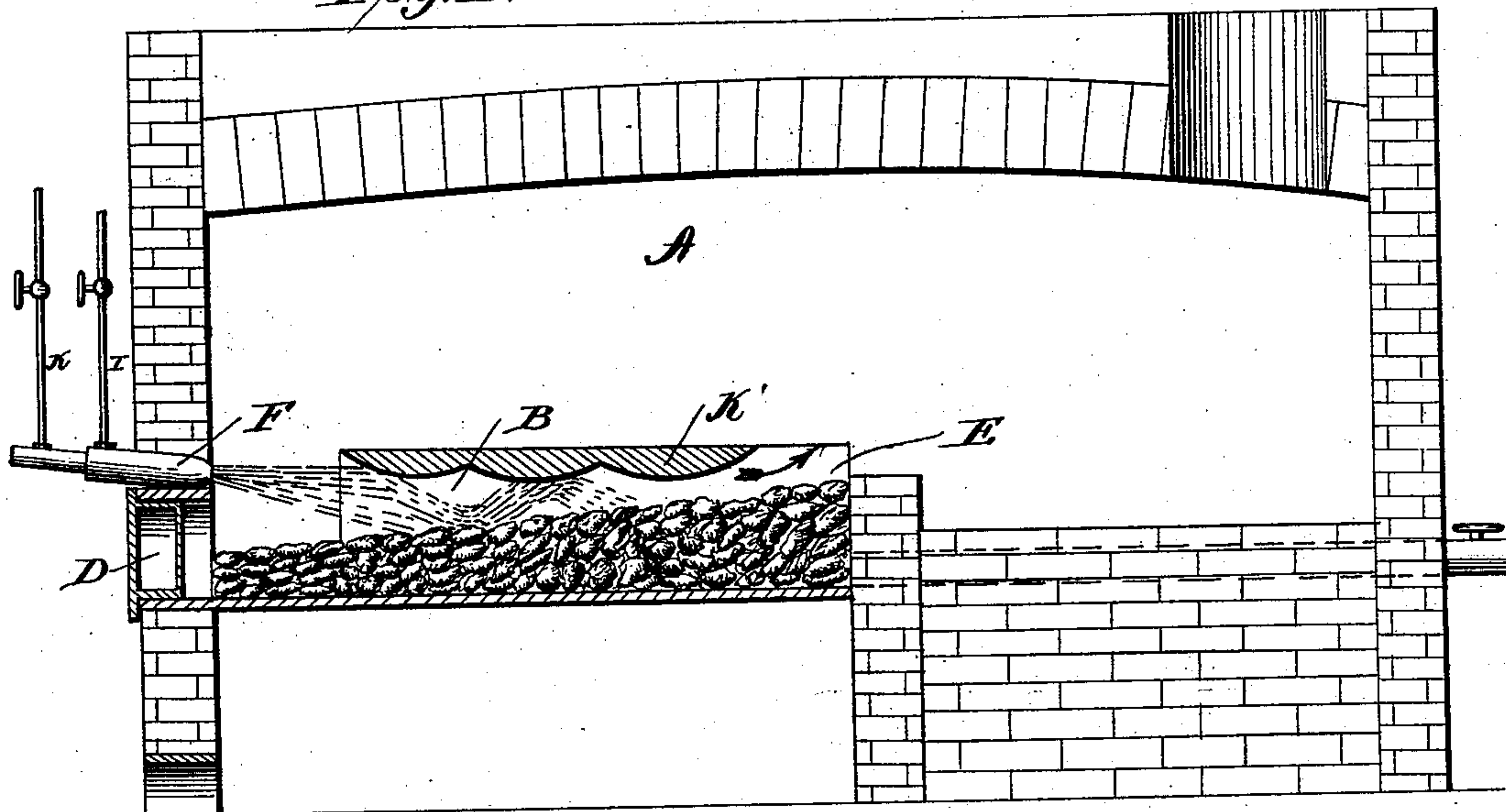


Fig. 2.

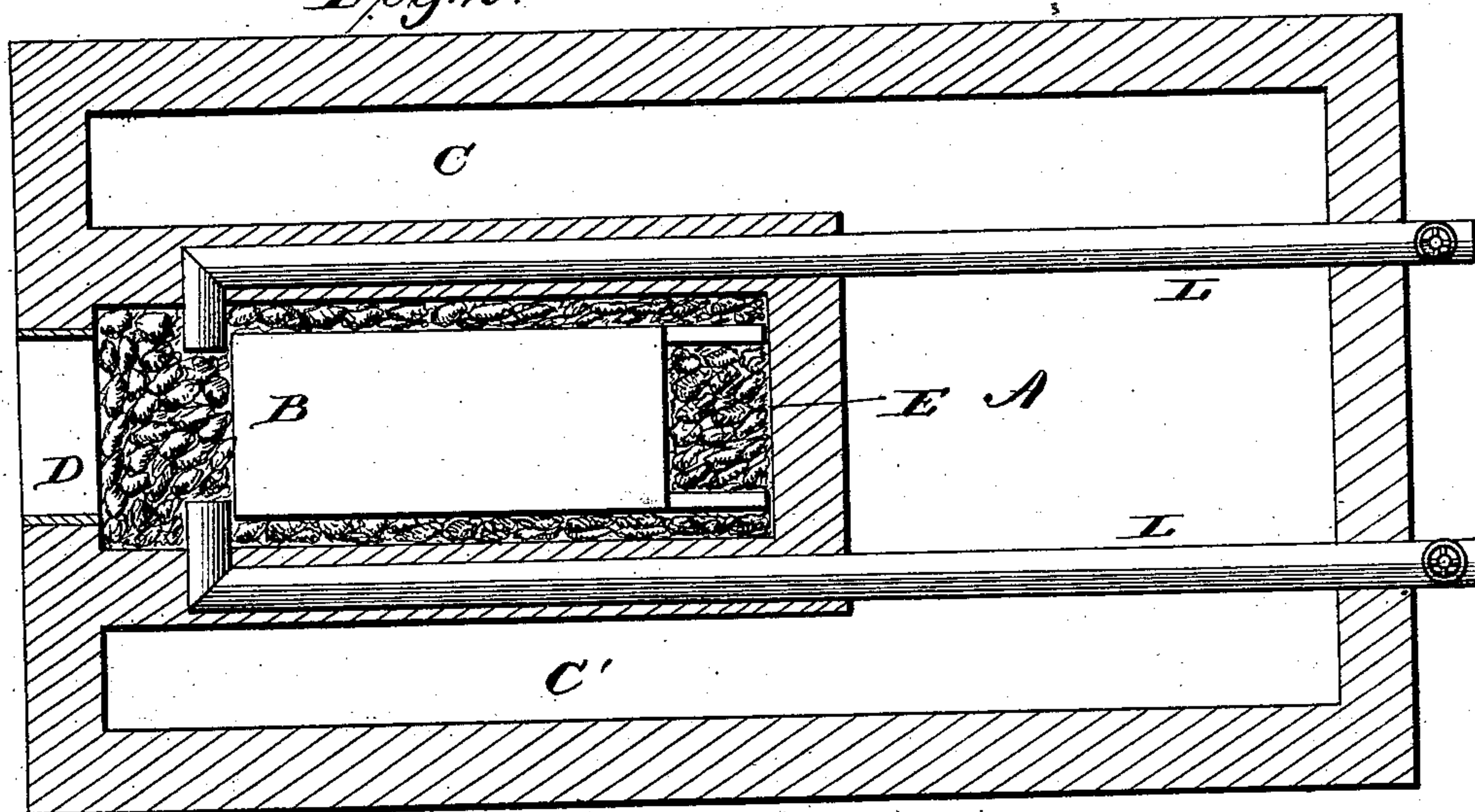
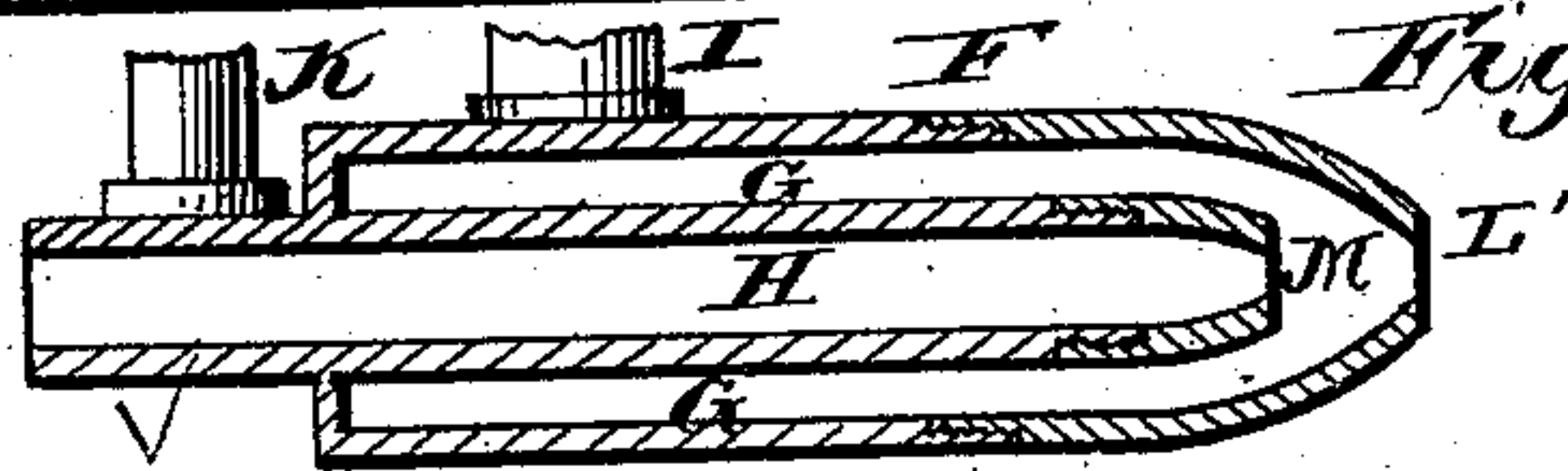


Fig. 3.



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UNITED STATES PATENT OFFICE.

BYRON SLOPER, OF NEW YORK, N. Y., ASSIGNOR OF ONE-HALF TO WALTER M. JACKSON, OF PROVIDENCE, R. I.

HYDROCARBON-FURNACE.

SPECIFICATION forming part of Letters Patent No. 236,098, dated December 28, 1880.

Application filed November 16, 1880. (No model.)

To all whom it may concern:

Be it known that I, BYRON SLOPER, citizen of the United States, residing at New York city, in the county of New York and State of New York, have invented certain new and useful Improvements in Furnaces; and I 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, reference being had to the accompanying drawings, and to letters or figures of reference marked thereon, which form a part of this specification.

This invention relates to certain improvements in hydrocarbon-furnaces—*i. e.*, in the application of liquid fuel in conjunction with decomposed steam for the production of heat, and in furnaces for carrying such improvements into effect.

Heretofore, in the employment of liquid fuel for the production of heat, it has been injected into a furnace by means of steam under pressure and there ignited, the steam serving simply as a medium for its introduction, the heat produced depending almost entirely upon the consumption of the liquid fuel. When thus applied, the carbon of the fuel, being simply burned by uniting with the atmospheric air in a cold state carried into the furnace by the natural draft, produces a white flame of comparatively small heating capacity, and the steam passes off mostly undecomposed, and its valuable gaseous constituents are not utilized.

I have discovered by practical experience an improved method in which the gaseous constituents of the steam can be utilized by decomposing the steam in the furnace and burning the resultant gases in conjunction with the liquid fuel, which gases consist principally of pure hydrogen and carbonic oxide, the latter being an inflammable gas generated by the union of the oxygen of the steam with the carbon of the fuel, and a valuable heating agent. To accomplish this result, however, I have found it absolutely necessary to modify the existing furnaces and to effect the decomposition by bringing the steam into contact with solid carbon at an intense white heat in a decomposing-retort or combustion-chamber

in the furnace, as will be more fully hereinafter specified. When the steam is thus decomposed and the resultant gases are burned in conjunction with the liquid fuel, I have found that the combustion of the liquid fuel is not only complete, as indicated by the blue flame developed, but that the heat is greatly intensified and the consumption of the liquid fuel largely reduced, owing to the instantaneous decomposition of the steam and the utilization of the gases arising therefrom.

Throughout the present specification I refer to solid fuel as a decomposing agent in contradistinction to the liquid fuel employed, and by such solid fuel I mean either coal, coke, charcoal, or other similar material, whether compact, such as coal, or porous, such as charcoal, coke, or the like.

My invention consists, first, in a process of burning liquid or liquefiable fuel in conjunction with the gases resulting from the decomposition of steam by atomizing and injecting such fuel, together with a current of steam, upon a bed of solid fuel heated to an intense white heat in a suitable decomposing-retort and combustion-chamber combined and located in a furnace, whereby the mutual decomposition of the steam and fuel into hydrogen and carbonic oxide is effected by the successive contact of the steam and the liquid fuel upon the solid fuel in the said decomposing-retort and combustion-chamber, and perfect combustion of the resultant gases is effected and the most intense heat is produced, as more fully hereinafter specified; second, in an improved process of burning liquid or liquefiable fuel by atomizing and injecting the same by means of a current of steam upon a bed of solid fuel heated to an intense white heat in a decomposing-retort and combustion-chamber combined, and causing it, together with the gases generated, to reverberate over the solid fuel, so as to bring it and said gases into contact with successive fresh portions of the solid fuel, as more fully hereinafter specified; third, in the process of burning liquid or liquefiable fuel by atomizing and injecting the same by means of a current of steam upon a bed of solid fuel heated to an intense white heat in a decomposing-retort and combustion-

chamber combined, in conjunction with a current of heated air, and causing the whole to reverberate over the solid fuel, so as to bring the gases developed into contact with successive fresh portions of the solid fuel, whereby the thorough decomposition of the steam and combustion of the liquid fuel is effected and an intense heat produced; fourth, in the combination, in a furnace for burning liquid or liquefiable fuel, of a decomposing-retort and combustion-chamber combined, and having its top provided with a series of deflecting or reverberating surfaces to deflect or reverberate the liquid fuel and steam and the gases arising therefrom and cause the same to come successively into contact with fresh portions of the solid fuel; fifth, in the combination, in a furnace for burning liquid or liquefiable fuel, of a decomposing-retort and combustion-chamber adapted to hold solid fuel, and provided with a series of reverberating-surfaces on its roof, directly above the solid fuel, and a suitable injector for introducing liquid fuel by means of a current of steam, whereby the gases generated therefrom are united and caused to "hug" the surface of the solid fuel, as more fully hereinafter specified; sixth, in the combination, in a furnace, of a decomposing-retort and combustion-chamber adapted to contain solid fuel with an atomizing-injector for injecting liquid or liquefiable fuel into said retort and chamber and suitable air-passages, whereby heated air may be introduced into the retort and combustion-chamber in conjunction with the liquid fuel and steam and caused to reverberate over the solid fuel, for the purpose of completing the combustion and intensifying the heat, as more fully hereinafter set forth; seventh, in the combination, with the improved furnace and the combined decomposing-retort and combustion-chamber contained therein, of an injector, whereby atomized fuel, in conjunction with a current of steam, may be supplied to said retort and combustion-chamber, as more fully hereinafter specified.

In the drawings, Figure 1 illustrates a longitudinal vertical section of an improved furnace for carrying out my invention. Fig. 2 represents a horizontal section of the same, and Fig. 3 a detached sectional view of my improved injector.

The letter A indicates the furnace, which may be constructed of any suitable material, and which may be of the ordinary or any approved form for the different purposes for which the heat may be desired.

The letter B indicates a decomposing-retort and combustion-chamber located in the furnace. This may be constructed of any suitable refractory material. In the present instance it is represented as constructed of fine tiles built up in the central part of the furnace at the forward end of the same, leaving the heating-spaces C C' at each side.

The letter D indicates the door of the furnace, located directly in front of the decomposing-retort or combustion-chamber, so that

the solid fuel (indicated by the letter E) can be conveniently charged into said chamber and retort.

The letter F indicates an atomizing-injector, by means of which the liquid fuel is introduced into the furnace. This injector is constructed of cast metal, with the body in one piece, having the chambers G and H, provided with suitable pipes I K, by means of which it can be connected with a suitable steam-generator and liquid-fuel tank or supply-chamber. The said injector is provided with detachable screw-nozzles L' M, which have their walls in parallel conical planes when in place, and which can be adjusted by means of suitable washers interposed between them and their seats on the body of the injector, so as to vary the relative distance between their respective openings, in order to regulate the injection of the liquid fuel. One or more of said injectors may be employed, as occasion requires, and said injector or injectors are located just in front of the furnace, projecting through a suitable aperture or apertures in the same, in a line about on a level with the top of the inside of the decomposing-retort and combustion-chamber, so as to project the liquid fuel directly against the first of a series of deflecting or reverberating surfaces, and from such directly into the body of coal or solid fuel. The injector or injectors are preferably swiveled to their connecting oil and steam pipes, so that they can be swung back or forth in order to be under ready control for the purpose of cleaning. The top of the decomposing-retort and combustion-chamber is provided with a series of deflecting or reverberating surfaces, K', the object of which is to deflect the injected fuel and the gases generated therefrom and the steam employed in injecting the fuel and cause the same to reverberate through the combustion-chamber or retort and hug the solid fuel therein, so as to be thoroughly decomposed and consumed, and thereby create an intense heat.

The letter L indicates the air-pipes entering at the rear or other portion of the furnace and extending through the hottest part of the furnace to the front of the decomposing-retort and combustion-chamber, where they terminate in such position that the draft caused by the injected steam and liquid fuel will create an induced current of heated air, which will enter the decomposing-retort and combustion-chamber along with the injected fuel and steam, and thus assist in the combustion, the air in its passage through the pipes being heated to an intense heat, by which the combustion is further intensified.

The connections leading to the injector, as well as the air-pipes, are provided with suitable cocks and valve-, by means of which the supply of steam and liquid fuel and the air admitted may be controlled.

In order to observe the interior of the decomposing-retort and chamber and the combustion taking place therein, one or more

"bull's-eyes" may be provided at any convenient point in the walls of the furnace for the purpose.

The operation of my invention will be readily understood with the above description, and is as follows: The decomposing-retort and combustion-chamber is properly charged with the solid fuel, which forms an inclined bed therein, as indicated in the drawings. This fuel being ignited and brought to a white heat, the liquid fuel is introduced through the injector by means of steam under pressure. The steam and liquid fuel in an atomized condition enter the front of the decomposing-retort or combustion-chamber, being deflected directly upon the bed of the solid fuel, where the steam is instantaneously decomposed by the carbon of the liquid fuel and oxygen from the steam uniting by contact of the two with coals in the decomposing-retort or combustion-chamber at an intense heat, thus converting the steam completely into carbonic-oxide and hydrogen gases, the heated air at the same time serving to perfectly consume the gases, creating an intense heat. The gases resulting from the decomposed steam furnish the main and most important heating factor, thus largely reducing the consumption of the liquid fuel.

Having thus fully described my invention, what I claim, and desire to secure by Letters Patent, is—

1. The process of burning liquid or liquefiable fuel in conjunction with the gases resulting from the decomposition of steam by atomizing and injecting such fuel, together with a current of steam, upon solid or porous fuel heated to an intense white heat in a suitable decomposing-retort and combustion-chamber, combined and located in a furnace, whereby the mutual decomposition of the steam and fuel into hydrogen and carbonic oxide is effected by the successive contact of the steam and the liquid fuel upon the solid fuel in the said retort and combustion-chamber, and perfect combustion of the resultant gases is effected, substantially as specified.

2. The process of burning liquid or liquefiable fuel by atomizing and injecting the same by means of and together with a current of steam upon a bed of solid fuel heated to an intense white heat in a combined decomposing-retort and combustion-chamber, and causing it, together with the gases generated, to reverberate over the solid fuel, so as to bring it and said gases into contact with successive fresh portions of the solid fuel, whereby the thorough decomposition and combustion of the gases are effected and an intense heat is produced, substantially as specified.

3. The process of burning liquid or liquefiable fuel by atomizing and injecting the same by means of a current of steam upon a bed of solid fuel heated to an intense white heat in a decomposing-retort and combustion-chamber combined, in conjunction with a current of heated air, and causing the whole to reverberate over the solid fuel, so as to bring the gases developed into contact with successive fresh portions of solid fuel, whereby the thorough decomposition of the steam and combustion of the liquid fuel are effected, substantially as specified.

4. In combination with a furnace for burning liquid or liquefiable fuel, a combined decomposing-retort and combustion-chamber having its top provided with a series of deflecting or reverberating surfaces to deflect and reverberate the liquid fuel and the steam onto the solid fuel successively, substantially as specified.

5. The combination, in a furnace for burning liquid or liquefiable fuel, of a decomposing-retort and combustion-chamber combined, adapted to hold solid fuel and provided with a series of reverberating-surfaces on its roof, directly above the solid fuel, and a suitable injector for introducing liquid fuel by means of a current of steam, whereby the gases generated are united and caused to hug the surface of the solid fuel, substantially as specified.

6. The combination, in a furnace, of a combined decomposing-retort and combustion-chamber adapted to contain solid fuel with an atomizing-injector for injecting liquid or liquefiable fuel into said chamber and suitable air-passages leading from the rear through the heated portion of the furnace, whereby heated air may be introduced into said decomposing-retort and combustion-chamber in conjunction with the liquid fuel and the gases resulting from the decomposition of the same and the steam, for the purpose of completing the combustion and intensifying the heat, substantially as specified.

7. In combination with the improved furnace and the combined decomposing-retort and combustion-chamber contained therein, the injector, whereby atomized fuel, in conjunction with a current of steam, may be supplied to said retort and combustion-chamber, substantially as specified.

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

BYRON SLOPER.

Witnesses:

VINTON COOMBS,
J. J. COOMBS.