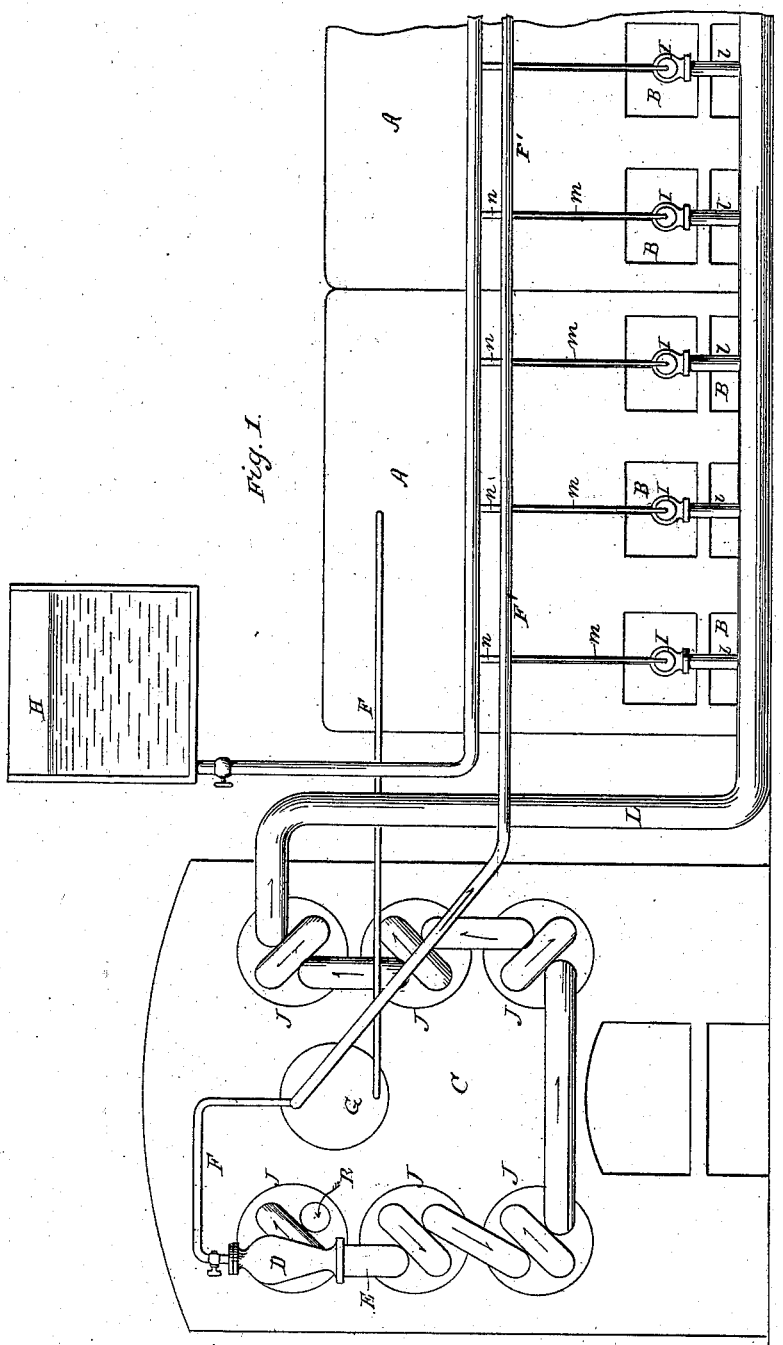
3 Sheets—Sheet 1.

S. C. SALISBURY.

Apparatus for Burning Hydrocarbons.

No. 205,143. **Patented June 18, 1878.**

Fig. 1.



Witnesses:

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Fig. 3.

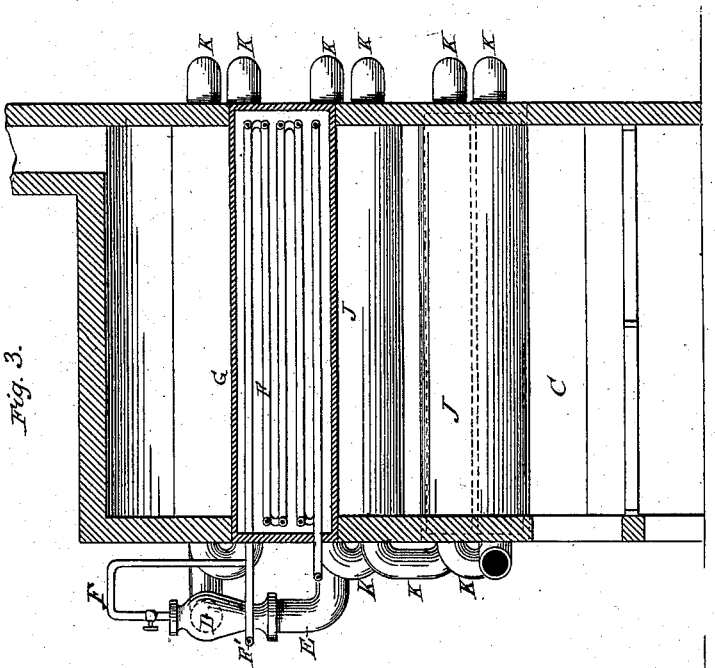
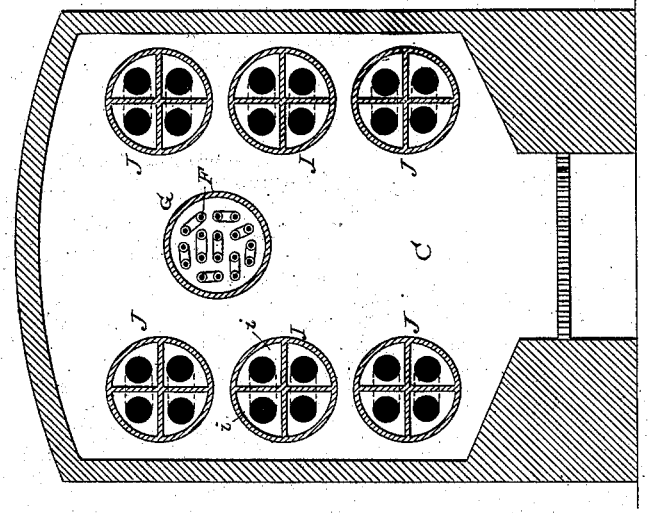


Fig. 4.

Fig. 2.



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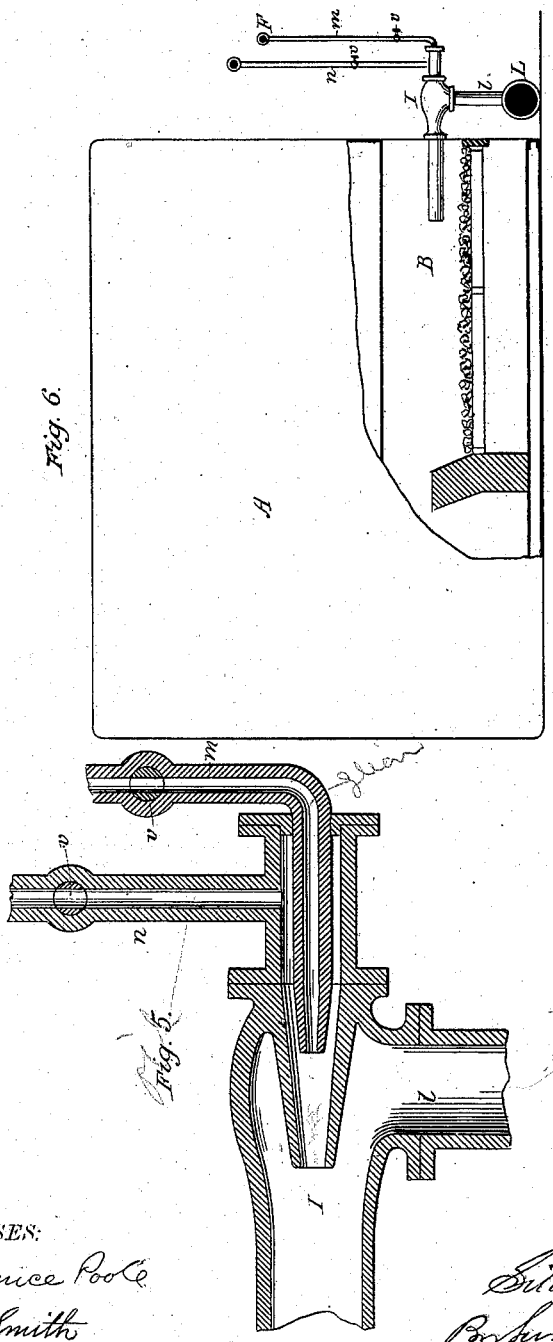

Fig. 6.

Fig. 5.

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UNITED STATES PATENT OFFICE.

SILAS C. SALISBURY, OF NEW YORK, N. Y.

IMPROVEMENT IN APPARATUS FOR BURNING HYDROCARBONS.

Specification forming part of Letters Patent No. **205,143**, dated June 18, 1878; application filed March 8, 1878.

To all whom it may concern:

Be it known that I, SILAS C. SALISBURY, of New York, in the county and State of New York, have invented new and useful Improvements in Apparatus for Burning Hydrocarbon for Fuel, and that the following is a full and clear explanation of the same.

Heretofore patents have been allowed me for apparatus for manufacturing gas from liquid hydrocarbon upon the general principles of operation shown herein; and I therefore do not claim, broadly, the general method of operation, but only the particular method whereby my invention is rendered easy of application to steamships, &c.

It is well known that in the combustion of solid fuel, such as coal, a small percentage only of such fuel is actually consumed in the furnace, and that the remainder passes out at the smoke-stack unconsumed in the condition of smoke, carbonic oxide, &c. Therefore, the principal object is to convert the fuel first into combustible carbureted hydrogen, and to consume said gas in the furnace or elsewhere, it being well known that combusion of said gas can be made very nearly or quite complete and perfect. It is evident, therefore, that under such circumstances there will be a very great economy of fuel, and the only question to be solved is the cost of converting the fuel into gas. By my previous invention that question was solved, as I was enabled to convert liquid hydrocarbon into gas at a cost almost nominal.

My invention relates to burning hydrocarbon in furnaces for heating purposes. It also includes the mode of applying my apparatus particularly to steamship-furnaces; and it consists in a bench of retorts with communicating pipes for heating a blast of air and superheating steam, a blast-injector and hydrocarbon-pipes, combined with one or more steam-generators, marine or otherwise, in the furnace of which the hydrocarbon gas is discharged and consumed, in part or wholly, in place of solid fuel.

That others may fully understand my invention, I will particularly describe it, having reference to the accompanying drawings, wherein—

Figure 1 is a front elevation of a bench of retorts and boilers, as arranged on board steamships. Fig. 2 is a transverse section of the bench of retorts. Fig. 3 is a longitudinal section of the same. Fig. 4 is a longitudinal section of air-heating retort. Fig. 5 is a longitudinal section of injector with steam and hydrocarbon pipes. Fig. 6 is a longitudinal section of furnace.

A A are the boilers, say, of a steamship, arranged with the furnaces in the usual way. C is a bench of retorts or ovens for heating the blast-air and superheating the steam. D is the blast-injector, and E is the blast-pipe.

Steam from the boiler is conducted by the pipe E to the superheater G. The great pressure of the steam from the superheater G causes it to seek an outlet in every direction, and a part is therefore discharged in the injector D, and a part is conducted by the pipe F′ to the front of the furnace.

H is a tank for liquid hydrocarbon, which may be located at any convenient or desirable place, at a sufficient elevation to give it free discharge, and sufficiently far from the furnace to render it secure against fire. I I are hydrocarbon-injectors, whereby the liquid hydrocarbon is injected into the furnace in the form of gas, or, if the feed is excessive, in combined gas and spray, and complete combustion is secured without reference to artificial draft produced by smoke-stacks, &c.

The general principles of operation have been fully set forth by me heretofore.

The employment of the blast-injector, operating with a jet of superheated steam to propel a blast of air through an oven or retort, and the injection of liquid hydrocarbon into said hot-blast is, therefore, not new. My present invention, therefore, relates more particularly to the compact arrangement of the parts with reference to certain purposes.

The bench of retorts C has its own fire for the heating of the retorts J, and said fire may be produced, as usual, by the combustion of coal upon the grate, or by a gas-flame or a combination of coal and gas. Probably it may be necessary to make a starting-fire of some solid fuel; but after the parts are all hot gas may be substituted.

The retorts J consist of cylindrical vessels,

divided longitudinally by partitions into four passages, as shown. This is the manner which at present I prefer. The same end may be attained less advantageously by means of pipes placed one within the other. The connection from one division to the next may be formed by means of pipes *k*, or by making the partitions *i* short at alternate ends, as shown in Fig. 1.

The retort G contains coils of steam-pipes, as shown in Figs. 2 and 3, through which the steam passes from the boiler and is superheated before it reaches the injector D.

The air-blast from the injector D is forced through the retorts J successively, and is thereby heated nearly or quite to the temperature of flame, and from the last of said series of retorts it is conducted in pipe L in front of the furnaces B, and by a branch, *l*, opposite each furnace it is conducted to the fire-space above the grate.

The nozzle of the pipe L constitutes a second injector, as shown in Fig. 5, receiving superheated steam by the pipe *m* from the branch F′ of the superheated-steam pipe, hot air through the pipe *l*, and liquid hydrocarbon through the pipe *n*.

The separate supplemental injector I at each furnace is required to give efficient control over each furnace separately.

The liquid hydrocarbon is drawn in by the jet of steam and hot air in such quantity as may be desired, and permitted by the adjustment of the controlling valve, and by the heat of the air and steam jet it is instantly volatilized and projected into the fire-chamber in the condition of gas already heated nearly to the point of ignition, and, in company with the blast of hot air, sufficient to supply nearly or quite all of the oxygen required for its combustion. Little or no extraneous draft will be required.

The ordinary grate of the furnace is covered with lumps of coke, asbestus, &c., to catch the unvolatilized liquid which may, by reason of an excess of feed, be blown unvolatilized out of the nozzle. The intense heat within the combustion-chamber will quickly volatilize all such spray and cause its combustion.

By these means I am enabled to apply liquid hydrocarbons to the heating of steam-boilers, and especially to marine boilers, with the fullest control, and with all the advantages which attend the saving of about three-fourths the space now occupied by coal, the saving of nearly all the expense of handling this solid fuel and its residuum of ashes, and the saving of all the present waste of fuel up the smoke-stack in smoke and unconsumed carbonic oxide, &c.

My improvements herein shown are equally well adapted to use with boilers on land; but, as the same necessity for economy of space does not exist on land, I therefore represent and describe its application to marine boilers.

Having described my invention, what I claim as new is—

1. One or more boilers, A, with the furnaces B, as set forth, combined with the bench C of retorts for heating the blast and superheating the steam, the blast-injector D, and the blast-pipe E L, extending from said retort in front of the furnace B, to furnish hot-blast for the injection and combustion of hydrocarbon, substantially in the manner as set forth.

2. The bench of retorts C, wherein the blast is heated and the steam is superheated, and the bank of steam-generators A, combined with hot-blast pipe L, steam-pipes F and F′, and injectors D and I, with the required connecting-pipes for hot-air, steam, and hydrocarbon, whereby hydrocarbon is discharged in the fire-chamber B, as set forth.

SILAS C. SALISBURY.

Witnesses:

HULBERT PECK,

R. D. O. SMITH.