S. C. SALISBURY.

Apparatus for Burning Hydrocarbons.

No. 216,977. **Patented July 1, 1879.**

Fig. 1.

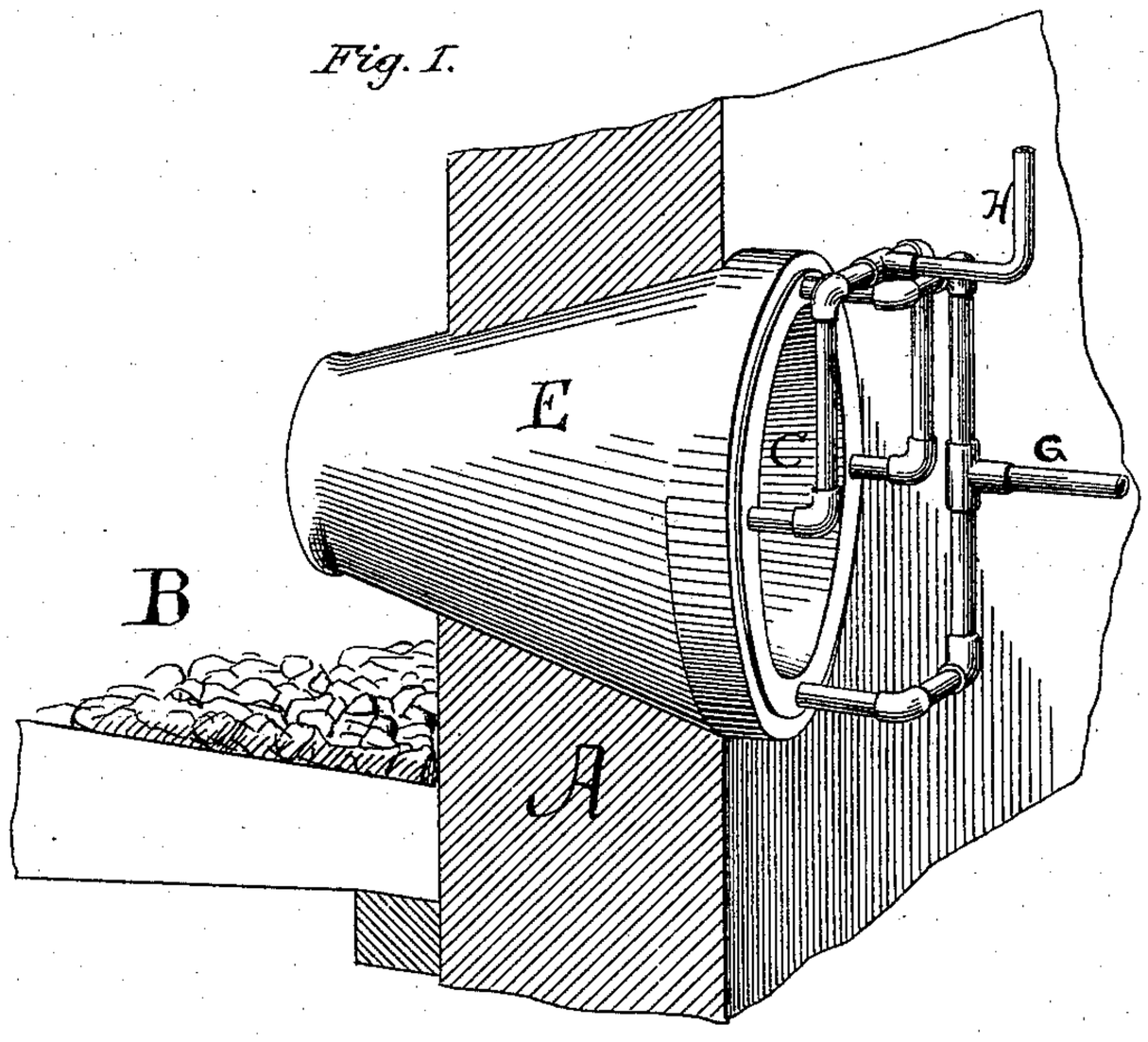


Fig. 2.

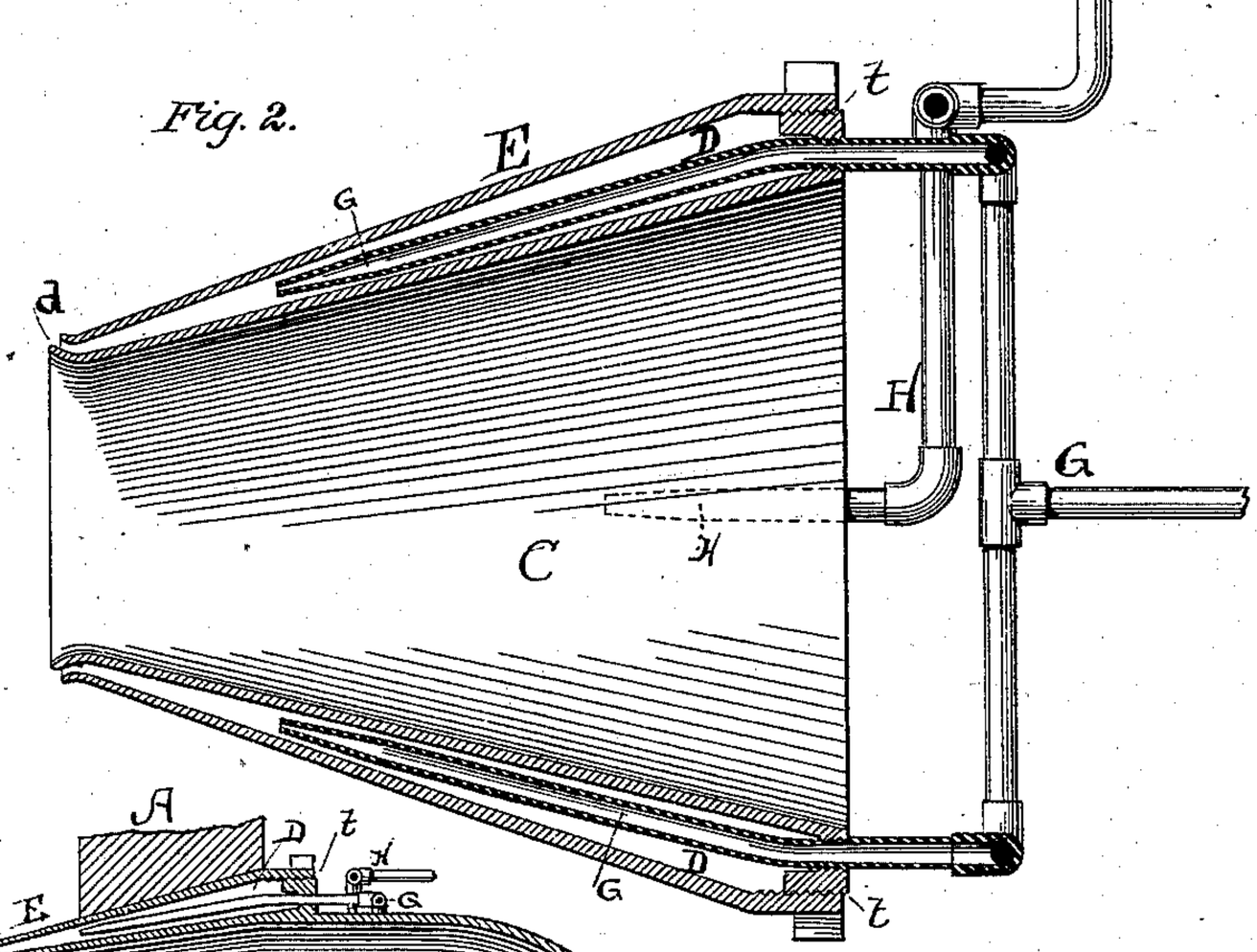
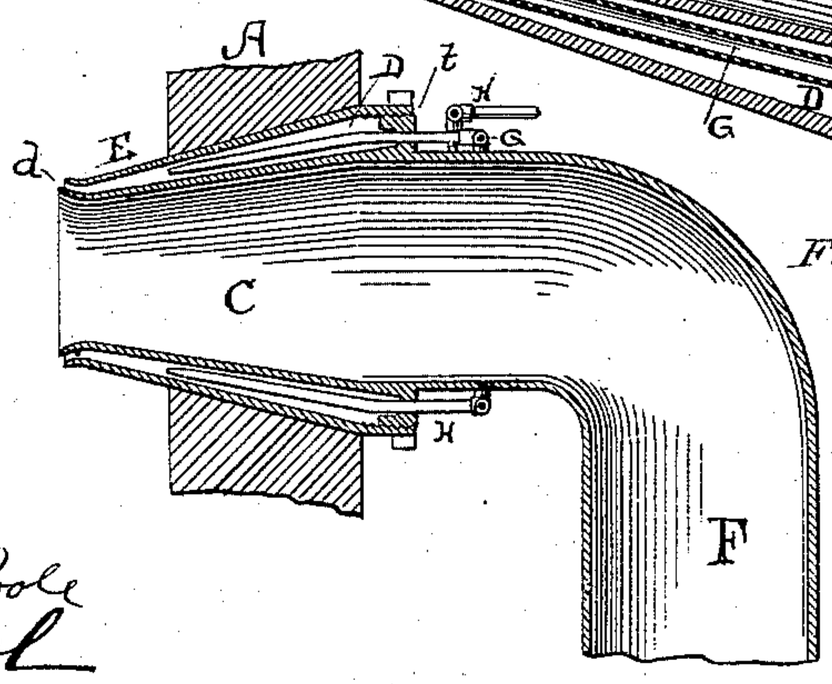


Fig. 3.



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UNITED STATES PATENT OFFICE

SILAS C. SALISBURY, OF NEW YORK, N. Y., ASSIGNOR, BY MESNE ASSIGNMENT, TO AMERICAN LIQUID FUEL COMPANY, OF SAME PLACE.

IMPROVEMENT IN APPARATUS FOR BURNING HYDROCARBONS.

Specification forming part of Letters Patent No. **216,977,** dated July 1, 1879; application filed November 12, 1878.

To all whom it may concern:

Be it known that I, SILAS COVEL SALISBURY, of New York, in the county and State of New York, have invented a new and useful Improvement in Apparatus for Burning Hydrocarbons; and that the following is a full and exact description of the same.

My improvement consists, essentially, in a mixing-chamber for the reception of liquid hydrocarbon and superheated steam at a temperature of 800° Fahrenheit, or thereabout, and an annular jet for the resultant hydrocarbon gas surrounding and inclosing the induced jet or current of air required to support the combustion of said gas.

I have experimented extensively in the burning of liquid hydrocarbon for fuel, and have been most successful, when using it in furnaces for steam-generation and other purposes requiring intense heat, if the hydrocarbon is vaporized and introduced by a jet of superheated steam at a temperature of, say, 800° Fahrenheit, and when the treatment of the hydrocarbon by the superheated steam takes place directly before entering the furnace; but with injectors such as have heretofore been used, with a central steam-jet, I have observed considerable loss from unvaporized spray of the hydrocarbon, and the difficulty of gaging the quantity of air to be properly admitted. The imperfect combustion of the unvaporized spray produces deposits of solid carbon upon the grate-bars and elsewhere, and fills the flues with soot.

To obviate these difficulties, and to completely prevent the spray and its resultant deposits and imperfect combustion, I make my injector with a mixing-chamber, and an annular jet-opening inclosing a central duct for air.

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

Figure 1 is a perspective view of my injector in position, the furnace-wall being shown in section. Fig. 2 is a longitudinal section of the same. Fig. 3 is a longitudinal section of the same, showing the hot-blast pipe attached.

A is the wall of the furnace, and B is the fire-chamber. These parts are represented as illustrative merely, and without reference to the purposes for which they may be used.

C is the inner shell of the injector, in the form of a hollow conical frustum, open at the smaller end for the egress of air to the furnace. Surrounding C there is an annular conical chamber, D, inclosed by the corresponding jacket E. The chamber D is closed at its larger end and open at its smaller end, which is in the same plane, or thereabout, as the open end of the duct C.

The larger end of the duct C may be open or closed, according to the use to which it is to be applied. For instance, if hot air is to be introduced with the hydrocarbon vapor, the hot-blast pipe F will be connected with the larger end of said duct, as shown in Fig. 3, the hot air being supplied from any proper hot-blast oven; but if it is desired to blow cold air, then said duct may be left open, as in Fig. 2.

Superheated steam at a temperature of, say, 800° Fahrenheit, or upward, is admitted to the chamber D through two or more pipes, G, which enter at or near the base of said chamber, and at equal intervals around the periphery. Steam from pipe G fills the chamber D, and issues from its narrow annular mouth *d* with a velocity due to its high pressure, and with an effect of exhaustion upon the interior of the duct C more effective than has been attained heretofore with a central jet.

Liquid hydrocarbon is introduced into chamber D by means of two or more pipes, H, also disposed at equal intervals around the base of said chamber. The hydrocarbon so introduced is vaporized immediately by the great heat of the steam; and as the steam-jet precedes the hydrocarbon, being introduced in front of or nearer the jet-opening of chamber D, there is no opportunity for the steam to catch up and blow any of the hydrocarbon out of the chamber unvaporized. In fact, the pressure of the steam will drive the liquid hydrocarbon toward the back or closed end of the mixing-chamber, and thus prevent its escape in a liquid form. For this reason, also, I find it advantageous to project the steam-pipes G into

the chamber D farther than the pipes H. The flow of hydrocarbon from the pipes H is, moreover, rendered more uniform from the exhaustive effect of the steam-jet in front of the mouths of said pipes H.

All of these pipes are provided with proper cocks and valves to regulate and limit the flow through them at will.

From the point of discharge at *d* the jet will naturally expand both from diminished velocity and from increased temperature as combustion takes place. I find it advantageous to give direction to the jets in accordance with the natural law of expansion, and therefore I flare outward the jet-opening *d*, as shown. I also make the outer and inner shells mutually adjustable by making one movable over the other, so that the width of the escape-mouth at *d* may be varied at pleasure. This is most readily effected by the uniting screw-thread *t*, which permits the outer shell to be moved longitudinally upon the interior shell and adjusted to stand at any point desired.

It appears manifest that no effect differing in principle from that described above will take place if, instead of a continuous annular discharge, *d*, a series of holes or jets be substituted.

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

1. An injector for blowing hydrocarbon vapor and air into a furnace, composed of a central air-duct and an annular discharge-opening for the hydrocarbon vapor, combined with suitable feed-pipes for said hydrocarbon and superheated steam, as described, and a mixing-chamber, wherein said hydrocarbon is treated by said steam.

2. An injector for blowing hydrocarbon vapor and air into a furnace, composed of a central shell, C, for an air-duct, and a corresponding jacket, E, inclosing between them the chamber D and the outwardly-flaring annular discharge-mouth *d*, as set forth.

3. An injector for blowing hydrocarbon vapor and air into a furnace, composed of a central shell, C, for an air-duct, and a corresponding outer jacket, E, inclosing a chamber, D, and an annular discharge-mouth, *d*, combined with a pipe, F, to conduct hot air and discharge the same through said duct, as set forth.

4. An injector for blowing hydrocarbon vapor and air into a furnace, composed of a central conical shell, C, with a flaring end, as described, for an air-duct combined with a jacket, E, having a correspondingly flaring end, and adjustable upon said shell, as set forth, so as to regulate the width of the discharge-opening *d*, as set forth.

5. An injector for blowing hydrocarbon vapor and air into a furnace, composed of a central hollow cone, C, for an air-duct, a corresponding conical jacket, E, forming an annular conical vaporizing or mixing chamber, D, and hydrocarbon and steam pipes G H, entering said chamber, substantially as described, whereby an annular jet of hydrocarbon vapor or gas is discharged into the furnace with a central jet or core of air, as set forth.

6. The interior hollow cone for an air-duct and the surrounding annular chamber, combined with steam-pipes G and hydrocarbon-pipes H, the former whereof enter said chamber a greater distance than the latter, as and for the purpose set forth.

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Witnesses:
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