

(No Model.)

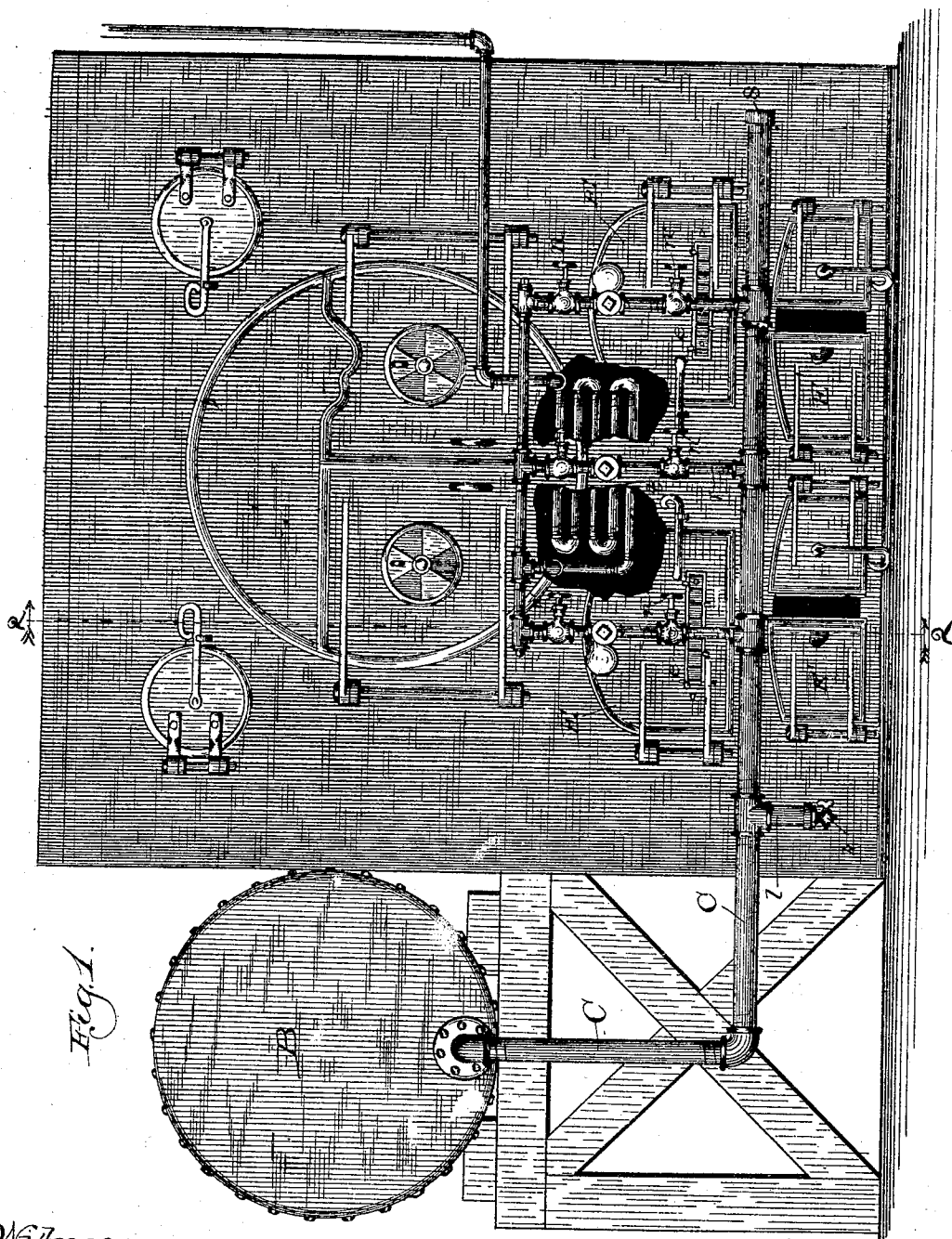
2 Sheets—Sheet 1.

H. MASON.

FUEL INJECTOR FOR FURNACES.

No. 321,736.

Patented July 7, 1885.



Witnesses:
Chas. E. Gaylord.
Wm. Bross

Inventor:
Henry Mason,
By Dyrenforth & Dyrenforth
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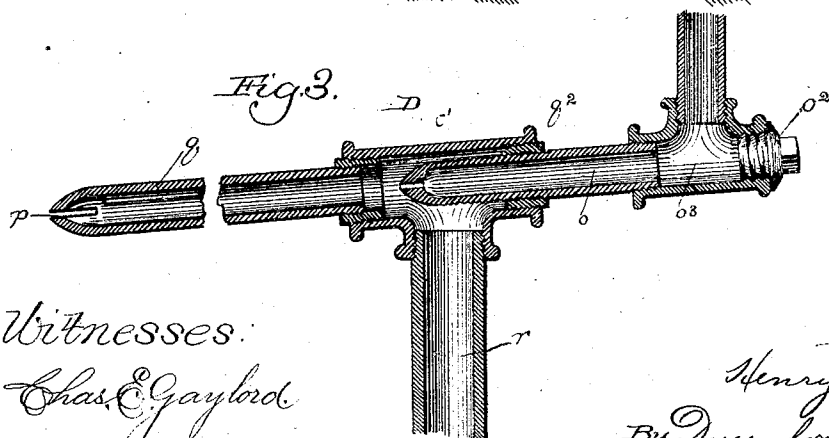
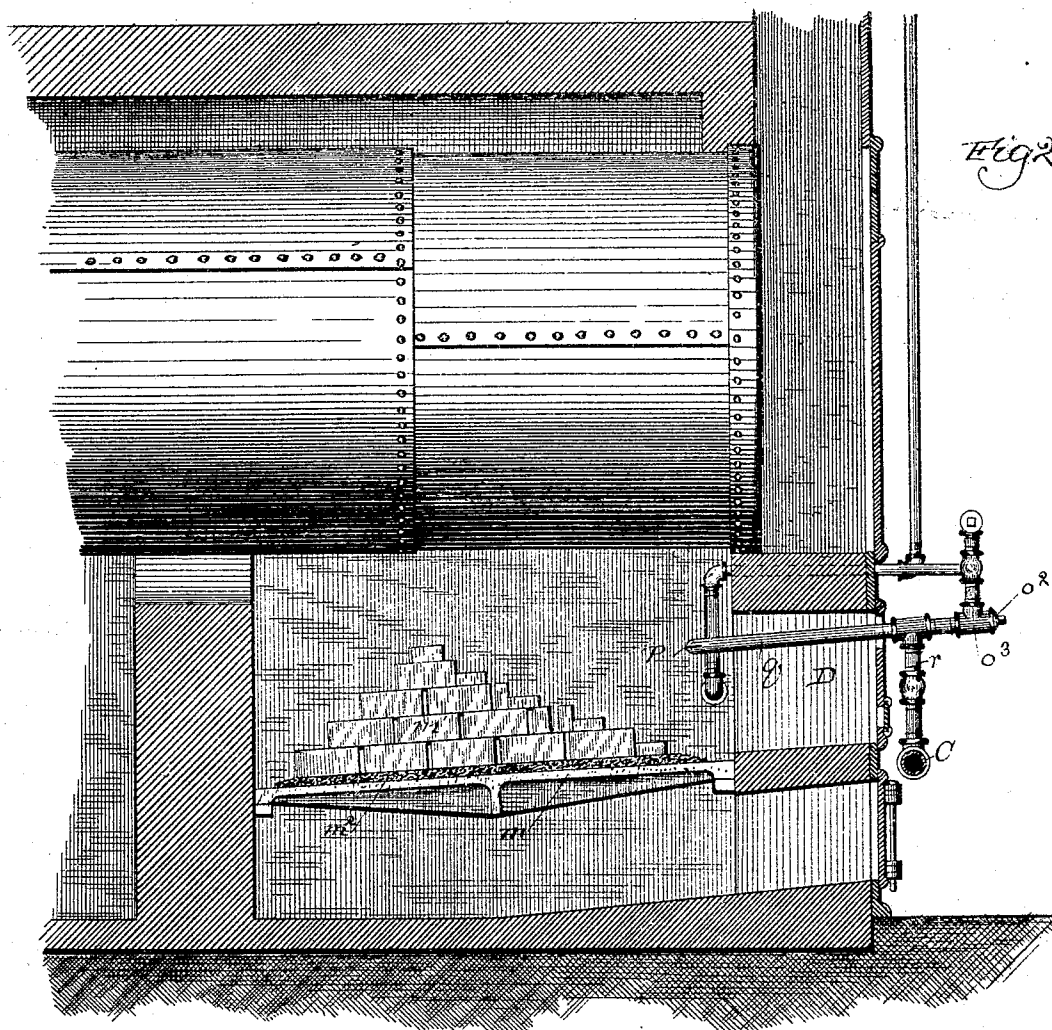
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UNITED STATES PATENT OFFICE.

HENRY MASON, OF CHICAGO, ILLINOIS, ASSIGNOR OF THREE-FOURTHS TO JAMES H. HILDRETH, JOHN RIORDAN, AND W. E. S. TROWBRIDGE, ALL OF SAME PLACE.

FUEL-INJECTOR FOR FURNACES.

SPECIFICATION forming part of Letters Patent No. 321,736, dated July 7, 1885.

Application filed February 7, 1885. (No model.)

To all whom it may concern:

Be it known that I, HENRY MASON, a citizen of the United States, residing at Chicago, in the county of Cook and State of Illinois, have invented certain new and useful Improvements in Fuel-Injectors for Furnaces; and I hereby declare the following to be a full, clear, and exact description of the same.

My invention relates to the class of injectors employed for the introduction into furnaces of a continuous supply of liquid fuel, usually in the form of hydrocarbon.

It is my object to provide an injector the construction of which shall afford to it rapid and uniform operation in feeding a furnace, and by means of which complete combustion shall take place of the fuel employed.

To these ends my invention consists, first, in the particular construction of injector, and, second, in its particular combination with auxiliary devices connected with the furnace to which the injector is applied, all as shown in the accompanying drawings, in which—

Figure 1 is a front elevation of a furnace provided with three of my improved injectors, and showing their connection with a steam-supply and with a receptacle containing hydrocarbon oil; Fig. 2, a vertical longitudinal section taken on the line 2 2 of Fig. 1, and viewed in the direction of the arrow-heads; and Fig. 3, a central longitudinal section of the injector.

A is a furnace of ordinary construction containing a steam superheater, *t*, suitably connected with a steam-supply or dome. (Not shown.)

B is a receptacle for hydrocarbon fuel, which receptacle is supported at one side of the furnace to lie somewhat above a level with the points of introduction into the fire-chamber of its contents.

C is the supply-pipe leading down from the lower side of the forward end of the receptacle B to a level below the doors of the furnace, and extending thence across the front side of the furnace, being suitably supported, and provided at its extremity with a cap, *s*.

D is the injector, comprising a pipe, *r*, leading upward from the supply-pipe C, and having a diameter of about three-quarters

of an inch, into a T-joint, *r'*, of the same diameter. A pipe, *q*, projects from one end of the T-joint *r'*, and has a diameter of about one-half an inch, and is hammered down toward its extremity to form a flat flaring opening, *p*; and a pipe, *o*, having the same diameter as the pipe *q*, and tapering toward one extremity, and which is provided with a cylindrical opening, *o'*, projects into the opposite end of the T-joint *r'*, beyond the vertical pipe *r*, in a manner to cause the aperture *o'* therein to be in line with the flaring opening *p* in the pipe *q*. Reducers *q'* and *q''* are employed to connect the parts *q* and *o* with the part *r'*. The dimensions of the parts of the injector above stated are intended to be merely relative, but the proportions are considered essential for the perfect operation of the apparatus, and should be observed as well in forming injectors of sizes varying from the size of injector shown in the drawings. The pipe *o* of each injector is suitably connected with the superheater *t*, and is provided with a valve, *n*, to control the supply of steam; and the pipe *q*, provided with a valve, *n'*, to regulate the supply of oil, is suitably connected with the horizontal portion of the supply-pipe C. A suitable stopper in the form of a screw plug or head, *o''*, is provided in the rear end of a T-joint, *o''*, connecting the pipe *o* with the steam-supply, the removal of which plug permits access to the interior of the pipes *o* and *q* for the purpose of cleaning them. The pipe *q* of each injector projects obliquely in a downward direction through an aperture provided to receive it in a furnace-door, E, toward its upper side, and is directed upon a pile of fire-brick, *m'*, arranged upon the furnace-grate *m*, or, preferably, upon a thin layer of cinders, *m''*, spread upon the grate, to prevent loss of oil by dripping through the interstices between the fire-brick in the pile *m'*. If desired, an additional injector may be provided to project into the furnace between the injectors, as shown in Fig. 1, of which one is provided for each door. A vertical hanging pipe, *l*, provided with a suitable cock, *k*, is connected upon the horizontal portion of the supply-pipe C, to communicate with the latter at a point between

the receptacle B and first injector D, to form an intermediate trap between the fuel supply and its outlet, to intercept water which may be mixed with the hydrocarbon, (crude petroleum being the form used,) and which will, owing to its specific gravity being greater than that of the oil, enter the pipe *l*, where it may from time to time be discharged through the cock *k*, and thus prevent its injection with the oil into the fire-chamber of the furnace and its consequent deleterious effect upon the fire.

The operation of the injector is as follows: The oil, owing to the level above the injector of the receptacle in which it is contained, will enter the pipe *q* of the injector D through the supply-pipe C and vertical pipe *r* (in which latter its volume is controlled by the valve *n'*) in a continuous stream, which is rapidly forced by a jet of superheated steam (of which the volume introduced into the pipe *o* is regulated properly to correspond with the volume of oil employed by means of the valve *n*) into the fire-chamber of the furnace upon the pile of fire-brick contained therein. Air in suitable quantities is introduced upon the fire through dampers *e*, provided in the furnace-doors, by means of which dampers such air-supply is also regulated, and the doors E' of the ash-pit are usually open in a slight degree, as shown, to supply air from underneath, which, owing to its previous contact with the glowing fire-brick before commingling with the injected hydrocarbon fuel, will reach the latter in a heated condition, producing the desirable effect of hot air. Of course to regulate the heat of the furnace the ingress of air through the doors E' and dampers *e* and supply of fuel is properly controlled.

Owing to the particular construction above set forth complete combustion of the hydrocarbon fuel takes place within the fire-chamber of the furnace, whereby the generation of smoke is avoided, and the furnace demands comparatively little attention in its continuous operation, since the feeding of fuel is automatic, since there are no ashes to be removed, and since access is never required to the interior of the furnace until, with time, repairing shall become necessary. The degree of heat within the fire-chamber is never diminished by the admission in large quantities of cold air, since it never is necessary, while the furnace is in operation, to open the doors E.

I am well aware that the injector of the present application resembles in its construction and mode of operation other injectors for analogous purposes hitherto invented, and of which some may now be in use, and in all of which the aim appears to be to afford perfect combustion by the particular method devised of introducing hydrocarbon into the furnace; but my invention, owing to the particular construction of the injector, by means of which a large furnace has for the last four months been continuously operated without neces-

sitating once opening the furnace-doors, affords advantages that are not attained by the other devices referred to. Perfect combustion is only attained by the union, in proper proportions, of the oxygen of the air with the carbon of the fuel, the hydrogen of the steam introduced with the fuel producing no appreciable deleterious effect upon the combustion unless admitted in excessive quantities. The fuel employed in this connection (crude petroleum) is rich in carbon, and oxygen, to afford its complete combustion, must be properly brought in contact with the gases emanating from it. Whatever surplus may be produced of any one of the gases introduced into the furnace must, in proportion to the quantity of such surplus, interfere to prevent the desired result. If there be an insufficient supply of oxygen to unite in proper proportions with the carbon, the surplus of the latter will either pass off as smoke or accumulate in the form of soot, or both. An excess of hydrogen not only prevents proper union of the oxygen and carbon, but, uniting with the latter, forms an incrustation of creosote on the boiler-plates, flues, &c., which injuriously affects the iron. Herein lies the objection to an excess of steam. An excess of oxygen can do very little harm beyond lowering the temperature of the furnace, since, whatever such excess there may be, it will pass off in the form of an invisible gas.

The peculiar effectiveness of my device consists in providing the steam-jet *o* with a small cylindrical aperture, *o'*, which admits only a minimum quantity of steam, but with great force, to impel the hydrocarbon, which enters the discharge-pipe *q* from below, by which entrance from below a more uniform flow is obtained than if it were admitted from above, and consequently a more uniform result in the action upon it of the steam upon the heap of fire-brick *m'*, through the flaring opening *p*, which sprays the liquid and permits proper union with it of the oxygen introduced. As the injector is directed against the pile of fire-brick *m'* in the furnace-chamber, the oil will strike against the obstruction and react, producing a secondary spray or distribution of carbon atoms, whereby the fuel will still further be held in suspense and permit perfect union with it of the oxygen of the air introduced.

One device is known to me which is constructed to vaporize liquid fuel before introducing it into the furnace by the expansion of the vapors. The construction of the device referred to is different from mine, (by means of which the liquid fuel is introduced directly into the furnace,) and necessarily so, owing to the different purpose it is intended to serve, the discharge-pipe being tapped into a vaporizing retort within the fire-chamber, and having its flaring outlet-opening out of line with the cylindrical mouth of the discharge-pipe, and with the orifice in the steam-pipe, which does not extend beyond the inlet of the fuel-sup-

ply, and my claims do not include such construction.

What I claim as new, and desire to secure by Letters Patent, is—

5 1. An injector comprising, in combination, a discharge-pipe provided toward one extremity with a flaring opening and communicating at its opposite extremity with the fuel supply, and a pipe provided toward one extremity
10 with a cylindrical orifice in line with said flaring opening, and communicating with the said discharge-pipe beyond the inlet of the said fuel-supply, and communicating toward its opposite extremity with a suitable steam-sup-
15 ply, substantially as described.

2. The combination, with a furnace, of an injector, D, projecting into the fire-chamber of the said furnace, and comprising the discharge-pipe *g*, provided toward one extremity with
20 the flaring opening *p*, and a pipe, *o*, provided toward one extremity with a cylindrical orifice, *o'*, in line with the said flaring opening *p*, and communicating toward its opposite ex-
25 tremity with a suitable steam-supply, and a receptacle, B, for liquid fuel, supported to lie above the level of the point of introduction of the said injector into the said furnace, and communicating with the discharge-pipe *g* of
30 the said injector on the lower side of the same, behind the forward extremity of the said orifice *o'*, the whole being constructed and arranged to operate substantially as described.

3. The combination, with a furnace, of an in-
35 jector, D, projecting obliquely into the fire-chamber of the said furnace, containing piled fire-brick *m'*, and comprising the discharge-pipe *g*, provided toward one extremity with the flaring opening *p*, and a pipe, *o*, provided
40 toward one extremity with a cylindrical orifice, *o'*, in line with the said flaring opening

p, and communicating at its opposite extremity with a steam-superheater, *t*, connected with a suitable steam-supply, and a receptacle, B, for hydrocarbon oil, supported to lie above the level of the point of introduction of the said
45 injector into the said furnace, and communicating with a discharge-pipe, *g*, of the said injector on the lower side of the same, behind the forward extremity of the said orifice *o'*, the whole being constructed and arranged to op-
50 erate substantially as described.

4. The combination, with a furnace, of an injector, D, projecting obliquely into the fire-chamber of the said furnace, containing piled
55 fire-brick *m'*, upon a layer of cinders on the grate-bars *m*, and comprising the discharge-pipe *g*, provided toward one extremity with the flaring opening *p*, and a pipe, *o*, provided toward one extremity with a cylindrical orifice, *o'*, in line with the said flaring opening
60 *p*, and at its opposite extremity with a removable plug, *o''*, and communicating toward said opposite extremity with a steam-superheater, *t*, connected with a suitable steam-supply, a
65 receptacle, B, for hydrocarbon oil, supported to lie above the level of the point of introduction of the said injector into the said furnace, and communicating with the discharge-pipe *g* of the said injector on the lower side of the same, behind the forward extremity of the said
70 orifice *o'*, and a pipe, C, forming the connection between the said receptacle B and injector D, and provided with a trap, *l*, having a suitable cock, *k*, the whole being constructed and arranged to operate substantially as and for
75 the purpose set forth.

HENRY MASON.

In presence of—

W. E. S. TROWBRIDGE,
MASON BROSS.