

J. ROGERS.
Supplying Liquid Fuel to Furnaces.
No. 217,154. Patented July 1, 1879.

Fig 1.

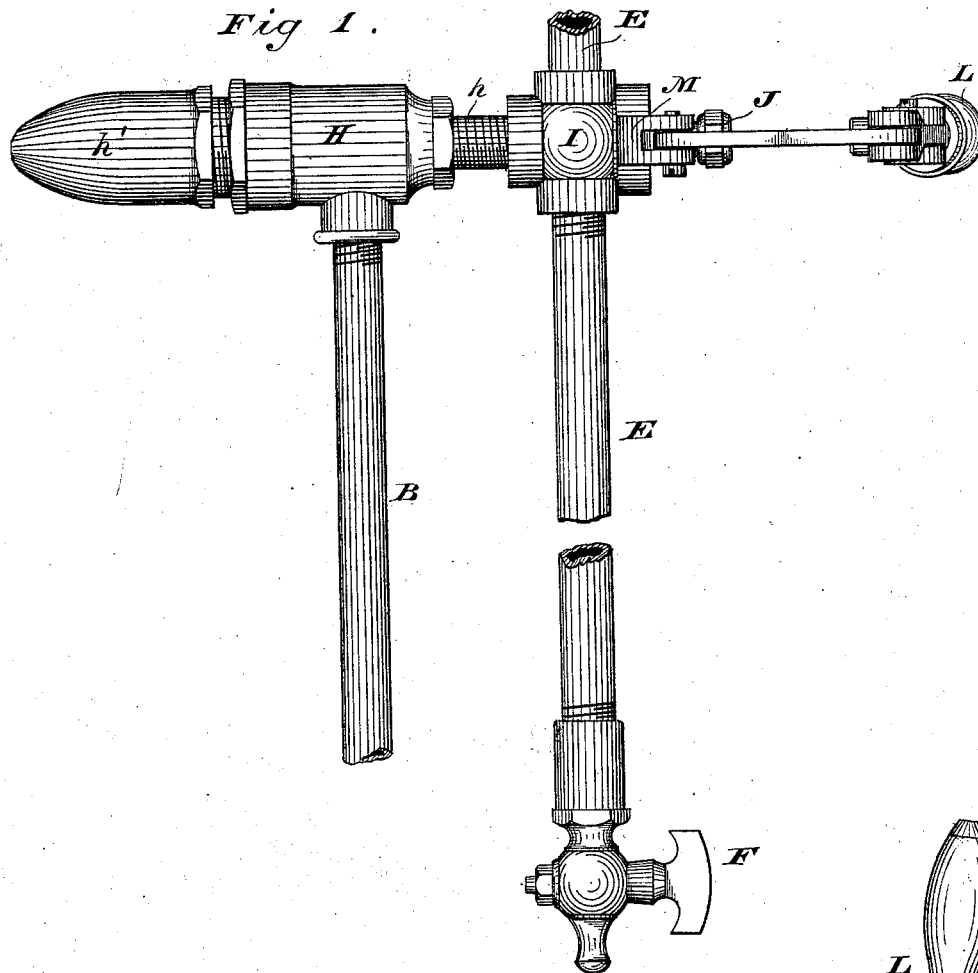
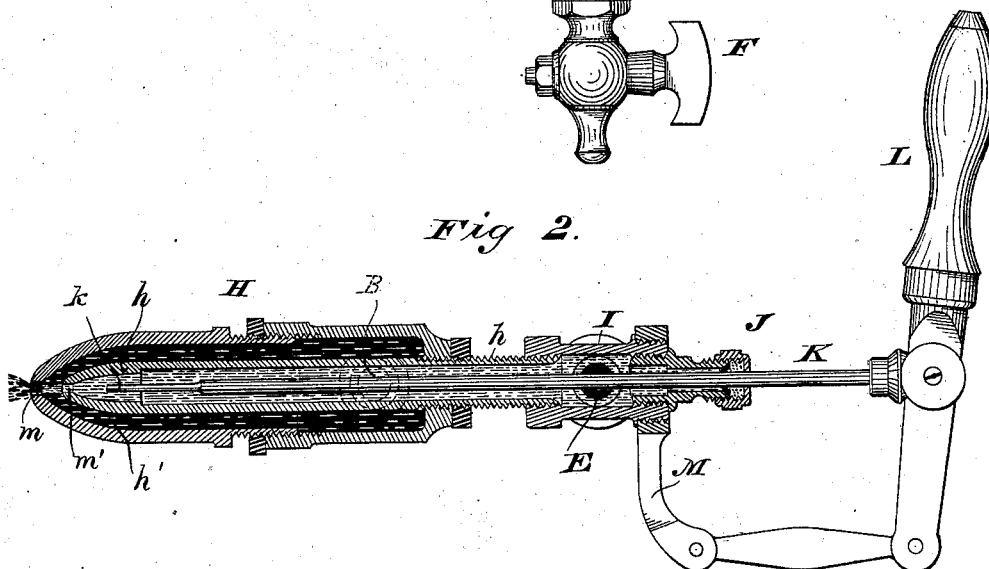


Fig 2.



WITNESSES

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INVENTOR

John Rogers.

By his Attorneys

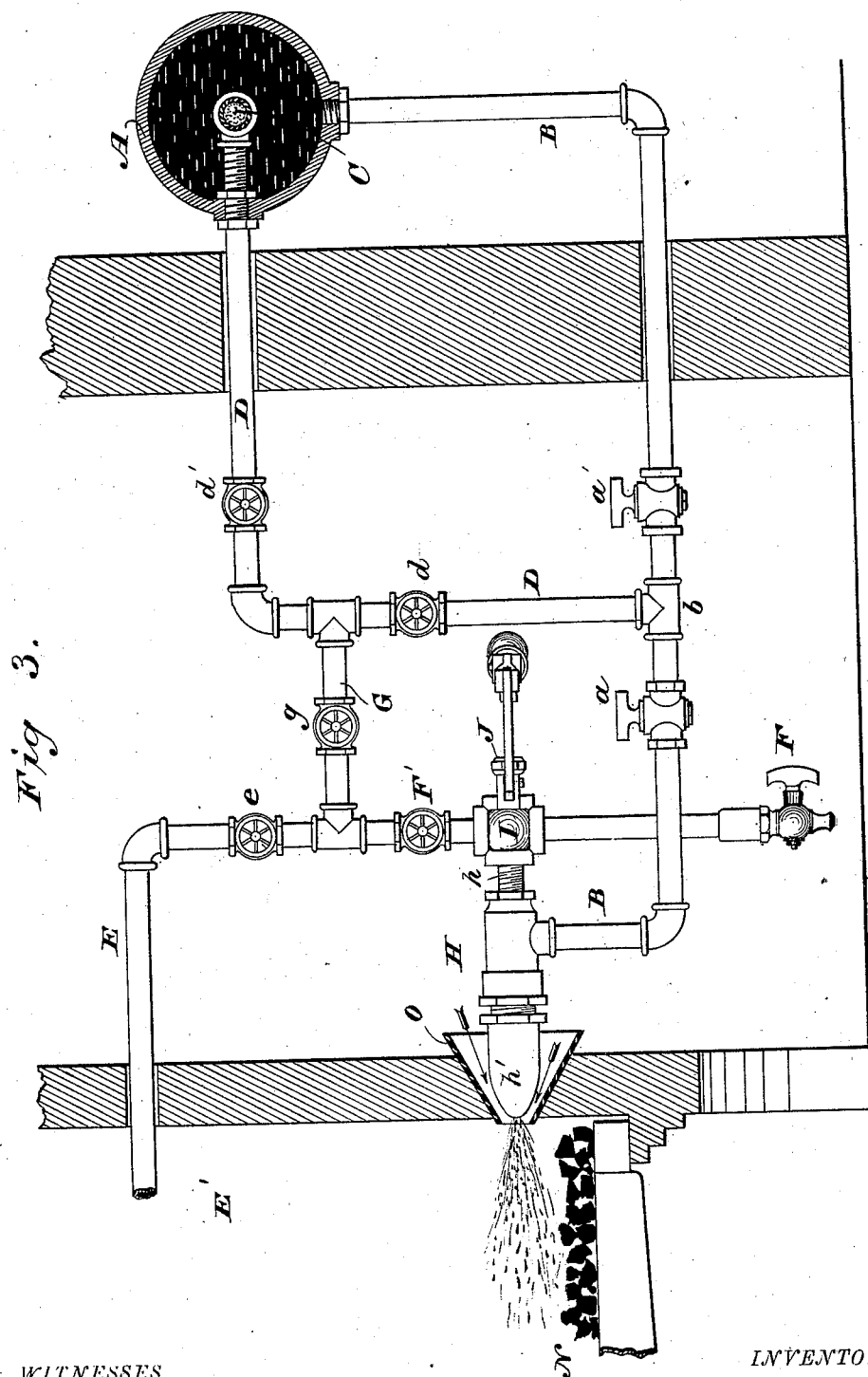
Baldwin, Hopkins & Taylor.

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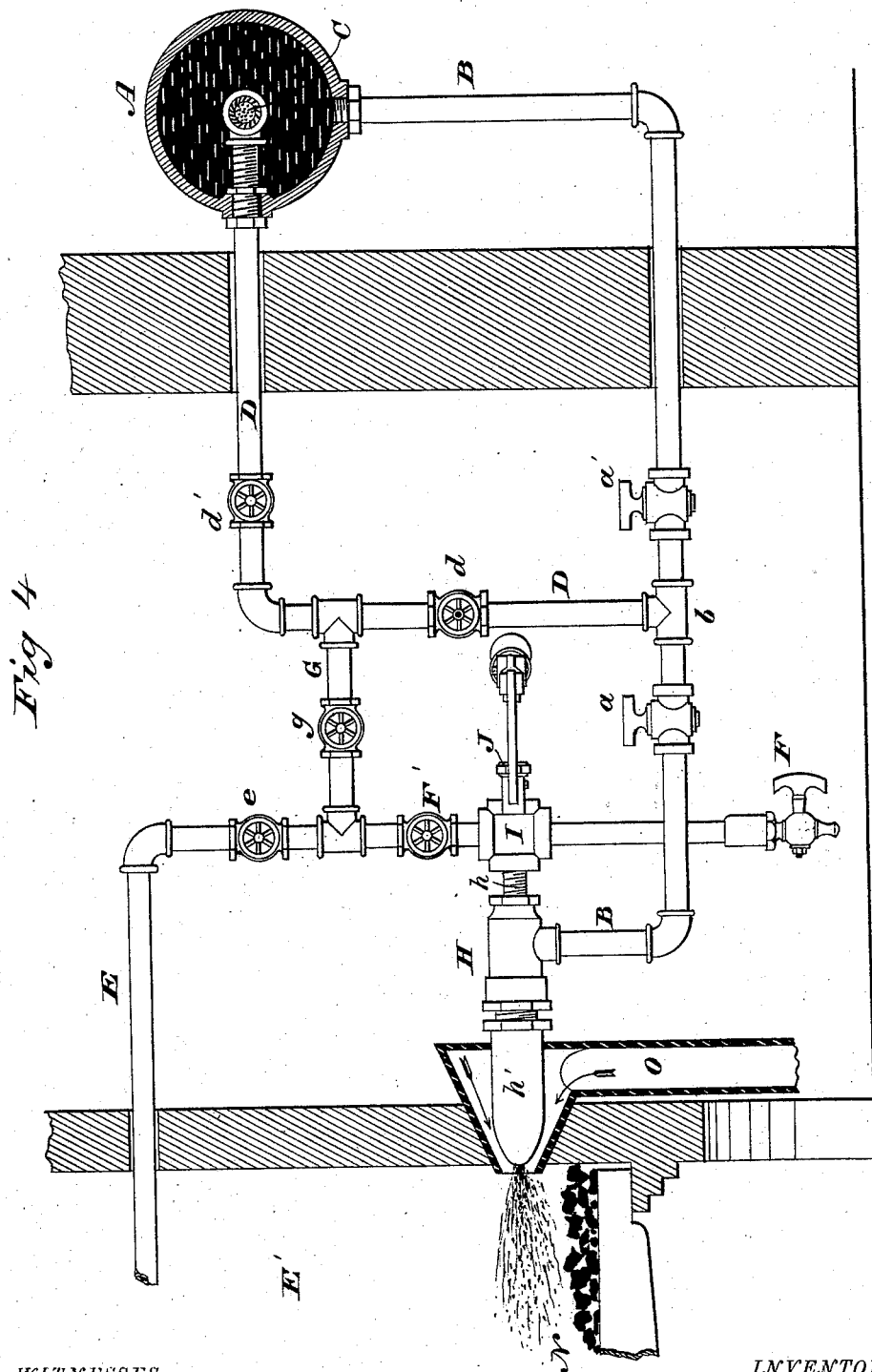
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UNITED STATES PATENT OFFICE.

JOHN ROGERS, OF COLUMBUS, OHIO, ASSIGNOR, BY MESNE ASSIGNMENT,
TO AMERICAN LIQUID FUEL COMPANY, OF NEW YORK, N. Y.

IMPROVEMENT IN SUPPLYING LIQUID FUELS TO FURNACES.

Specification forming part of Letters Patent No. **217,154**, dated July 1, 1879; application filed
January 20, 1879.

To all whom it may concern:

Be it known that I, JOHN ROGERS, of Columbus, in the county of Franklin and State of Ohio, have invented certain new and useful Improvements in Apparatus for Supplying Liquid or Semi-Liquid Fuels to Furnaces for heating them, of which the following is a specification.

My invention relates to improvements in apparatus for supplying and burning suitable hydrocarbon fuels for heating furnaces for boilers, for manufacturing iron, for making glass, &c. Coal-tar, gas-tar, or any other suitable liquid or semi-liquid fuel may be employed.

To more particularly designate my invention, it may be stated to be, in some of its leading features or in general respects, similar to or to belong to the same class as certain inventions shown and described in Letters Patent of the United States heretofore granted to Silas C. Salisbury.

My objects, generally, are to improve and perfect apparatus for supplying and burning hydrocarbons, and especially to provide means by which a proper feed or supply of the fuel to the furnace or igniting-chamber by an injector is rendered more certain than heretofore, by which the injector may be prevented from clogging, or be cleared in event of clogging or partial obstruction by the baking or hardening of the fuel, or by any foreign substance, and by which to clear out the fuel-supply tube.

My improvements, as will hereinafter specifically be designated by the claims, consist in the combination, with an injector having an inner and an outer tube, forming concentric fuel and steam passages, of a plunger or reciprocating clearing-rod working in the injector and through the jet nozzles or ports of both the inner and outer tubes; also, in the combination, with the injector and the clearing-rod working endwise in the central tube thereof, of a handle or lever for working said clearing-rod without interfering with the connections by which steam and fuel are supplied to the injector; also, in the combination of the injector having the steam and fuel passages, the clearing-rod supported by the shank or extension of one of the injector-tubes, a fuel-feed pipe connecting with the injector, and a steam-pipe

connecting with the shank of the injector-tube in which the clearing-rod works, and in advance of the handle by which said rod is operated; also, in the combination of the injector having fuel and steam tubes or passages, a fuel-feed pipe connected with said fuel-passage, a pipe for supplying superheated steam to the injector steam-passage, a pipe for supplying live steam to the injector fuel-passage, and cocks in the fuel-feed pipe, superheated-steam pipe, and live-steam pipe, whereby the fuel and the superheated steam may be admitted to the injector-passages, or either or both be shut off, and live steam may be admitted to the injector fuel-passage when the fuel-supply is stopped, to clear it and its jet opening or nozzle; also, in the combination of the injector having the inner and outer tubes, forming the concentric passages or chambers for steam and fuel, a fuel-feed pipe connecting with the fuel-chamber of the injector, a steam-pipe connecting with the steam-chamber for supplying superheated steam thereto, a steam-pipe for live steam, also communicating with said steam-chamber, and a series of cocks in the pipes by which to regulate or shut off the supply of fuel and steam and to direct either the live steam or the superheated steam to the injector at will, whereby the superheated steam may be used in connection with the hydrocarbon fuel, and both nozzles of the injector may be cleared out by the live steam admitted to the steam-passage either when the superheated steam is being supplied or is cut off; also, in the combination of the injector having the inner and outer tubes or concentric steam and fuel passages, a fuel-feed pipe connected with said fuel-passage, a pipe for supplying superheated steam connected with the injector steam-tube or inner passage, a pipe for supplying live steam connected both with the fuel-feed pipe and the superheated-steam pipe, and a series of cocks in the several pipes and their connections by which to regulate and shut off the supply to the injector of the fuel, superheated steam, and live steam, and admit of directing the live steam either to the steam-passage or to the fuel-passage of the injector by the superheated-steam pipe and the fuel-feed pipe respectively, whereby, when the fuel has clogged

or become baked in the injector by the intense heat of the superheated steam, it may be softened and entirely removed by directing the live steam first to one passage and then to the other passage of the injector, or to both passages at the same time, so as not only to clear the fuel-passage, but also clean out thoroughly both jet openings or nozzles; also, in the combination of a fuel reservoir or pipe, a steam-pipe passing therethrough to warm the fuel, a feed-pipe leading from said reservoir to supply the injector with fuel, a connecting steam-pipe communicating with the reservoir steam-pipe and fuel-feed pipe, and cocks in said pipes by which to cause the steam to pass from the reservoir steam-pipe to the fuel-feed pipe to clear it or to soften the fuel; also, in the combination of the fuel-reservoir, the fuel-feed pipe leading therefrom to the injector, the steam-pipe in the reservoir, its connecting steam-pipe leading to the fuel-feed pipe, the superheated-steam pipe connecting with the injector steam-passage, the connecting-pipe between the superheated-steam pipe and steam-pipe leading from the reservoir steam-pipe to the fuel-feed pipe, and cocks in the several pipes by which to shut off the superheated steam or direct it to the injector or to the live-steam pipe, and by it to the fuel-feed pipe or to the fuel-reservoir, and also to admit of shutting off the supply of live steam from the reservoir steam-pipe, or to direct it to the fuel-feed pipe, and by it either to the fuel-reservoir or to the injector, and also allow of the live steam being admitted to the injector by the superheated-steam pipe.

My improvements are designed to be used in connection with any number of furnaces for heating boilers, manufacturing iron, &c., it being only necessary to duplicate the parts shown by the accompanying drawings for each additional furnace in an obvious way.

In the drawings which show the best way now known to me of embodying my improvements in apparatus suitable for carrying out or practicing my invention, Figure 1 is an elevation of the injector and its immediate connections; Fig. 2, a horizontal central section through the injector, showing its internal construction and the points of connection with it of a fuel-supply pipe and a superheated-steam pipe. Figs. 3 and 4 are views, partly in elevation and partly in vertical section, of the complete apparatus, alike in all respects except that in the former cold air is admitted to the furnace with the commingled fuel and steam, while in the latter hot air is supplied.

In this instance the apparatus is especially designed for burning gas-tar, which is supplied to a tank or reservoir, shown as consisting of a large suitably-located pipe, A, having a fuel-feed pipe, B, passing out from its bottom. There is a feed-pipe, B, for every furnace.

A steam-pipe, C, for heating the fuel passes longitudinally and centrally along the reservoir-pipe A, and takes its steam from any suitable source. This pipe C should pass out at

one end of the reservoir and be provided with a blow-off cock, and should also have a cock to regulate the admission of steam. One of the objects of providing this pipe is to enable the fuel to be readily warmed to a sufficient degree to reduce it to a fluid or semi-fluid condition, so as to flow by way of the feed-pipe B.

A steam-pipe, D, one for every fuel-feed pipe, connects with the reservoir steam-pipe C at one end, and at the opposite end is connected with the feed-pipe at a suitable point, as at *b*, between two cocks, *a* and *a'*, of the feed-pipe, for a purpose hereinafter to be explained. A cock, *d*, is provided in the vertical portion of the connecting steam-pipe D, so that the live steam from the reservoir-pipe C may be admitted to or shut off from the fuel-pipe.

A pipe, E, for superheated steam, taken from a coil of pipes heated in suitable manner, designed to be arranged in the furnace E', in this instance communicates with an injector, presently to be described, and is provided with a cock, F', above the injector and with a blow-off cock or exhaust-nozzle, F.

A connecting-pipe, G, between the superheated-steam-pipe E and live-steam pipe D, and the cocks *e*, *g*, and *d'* enable the attendant to direct the superheated steam to the fuel-supply pipe B or to the injector at will, or even to cause the superheated steam, or a part of it, to pass to the reservoir steam-pipe C, should there be any interruption of the usual supply of live steam to the pipe C. In some cases it may be found advisable to use the superheated steam in the pipe C.

It will be understood that there is a pipe, E, and, when used, a connection, G, and suitable cocks for every pipe D and B.

The injector H for every fuel-feed pipe B is made in adjustably-connected sections, and of an inner tube, chamber, or steam-passage, *h*, and a surrounding or concentric outer tube having the fuel chamber or passage *h'*, to the bottom of which the end of the fuel-supply pipe B leads. The superheated-steam pipe E communicates with the steam-passage or inner tube, *h*, of the injector by a box or coupling, I, adjustably connected with the shank, extension, or rear end of this tube *h*. A stuffing-box, J, is fitted to the coupling-box I, and through it plays a clearing-rod or plunger, K, worked by any suitable handle or lever. In this instance the plunger is jointed to a lever, L, provided with a handle at one end and linked at its opposite end to a rest or arm, M, secured by a screw to the threaded end of the coupling I. The plunger or clearing-rod may be reciprocated endwise in the steam-passage or inner tube, *h*, of the injector at any time to clear the jet-nozzles or perforated ends *m* and *m'* of the injector. The small end *k* of the plunger works through these nozzle-openings when the lever is properly worked, and forcibly ejects any solid substance which may have entered the openings.

Practice has demonstrated the utility of the plunger not only to remove any foreign clog-

ging matter that may have by accident gotten jammed in the nozzles *m'* or *m*, especially the latter, which is very liable to be clogged when used about metallurgic furnaces, but to clear away the fuel (gas-tar) when it becomes baked and clogs up the injector, fuel-chamber, or passage *h'* and its nozzle *m* so firmly as to render it extremely difficult to entirely remove the obstruction by the pressure of the steam alone.

In operation, it is only necessary to occasionally work the plunger to insure the proper supply of the fuel and steam to the furnace over the incandescent fuel on the grate *N*, or to indicate that the fuel-chamber in rear of the injector-nozzles is clogged. When so clogged steam is admitted under pressure to the injector, as presently explained.

An air-inlet funnel or supply-box, *O*, for cold air, as in Fig. 3, or for hot air from any suitable source, as in Fig. 4, supplies the air to support and insure combustion of the commingled superheated steam and fuel sprayed into the fire-chamber of the furnace by the injector, as is well understood.

In operation, the fuel in the reservoir, having been sufficiently warmed by the steam in pipe *C*, flows to the injector and into the furnace, the cocks *a* and *a'* in the fuel-feed pipe *B* and the cocks *F'* and *e* of the superheated-steam pipe being open, and the cock *F* of the superheated-steam pipe, the cock *g* of the connecting-pipe *G*, and the cock *d* of the steam-pipe *D* being closed. Should the fuel become clogged in the fuel-passage *h'* of the injector, the cocks *a* and *d*, and also *d'*, when employed, are all opened, and live steam admitted to the fuel-pipe *B*, to warm and force out the clogging matter in the fuel-passage of the injector. If desired, superheated steam may be directed to the fuel-passage of the injector for the same purpose by properly adjusting the cocks. By closing the cock *a* and opening the cock *a'* in the feed-pipe *B*, this pipe may be cleaned out between the point at which the pipe *D* connects with it and the reservoir, and the steam may be allowed to pass into the reservoir to facilitate the softening of the fuel in starting. By the arrangement of pipes and cocks shown I am enabled, should it become necessary or expedient to do so, to admit steam directly to the contents of the reservoir, and at the same time to heat at the center by the pipe *C*.

It will be seen also that live steam may be directed to the injector steam-passage by way of the pipes *D*, *G* and *E* by manipulating the cocks in the several pipes so as to clear the jet-nozzle *m'* as well as the nozzle *m* and the space between them at the same time. The live steam serves to soften the tar, which sometimes becomes baked by the intense heat to which it is subjected by the superheated steam and furnace-fire.

Instead of employing the fuel-feed pipe *B* to conduct the steam to the fuel-chamber of the injector during the intermission of the sup-

ply of fuel, as above explained, it is obvious that a separate steam-pipe—such, for instance, as a branch pipe from the pipe *E* or the pipe *D*—may be connected with said chamber, and be provided with a cock or cocks to admit steam to the chamber to clear it. I prefer the construction shown, however.

Obviously two, or even more, injectors and their adjuncts may be employed for a single furnace. When a large furnace is to be heated two injectors answer better than one. It will, of course, be understood that all co-operating parts (steam-pipes, feed-pipes, air-boxes, &c.,) are duplicated for every injector added, and properly connected with it.

I do not claim admitting the liquid fuel together with superheated steam into the furnace in the form of spray.

I claim as of my own invention—

1. The combination, with the injector, of the plunger or clearing-rod movable endwise therein and playing at its end through the nozzles or jet-openings of both the inner and outer tubes thereof, substantially as and for the purpose hereinbefore set forth.

2. The combination of the injector-tubes, the plunger working in the inner tube, the lever to which the plunger is jointed, and the arm or rest supported on the shank or extension of the inner tube of the injector in rear of the fuel and steam pipe connections therewith, to which arm the lever is linked, substantially as and for the purpose hereinbefore set forth.

3. The combination, substantially as hereinbefore set forth, of the injector having the liquid-feed passage and the steam-passage in its outer and inner tubes, respectively, the clearing-rod or plunger movable at its end through the tube-nozzles or jet-openings, the fuel-pipe communicating with the fuel-passage in the injector around the inner tube thereof, and the steam-pipe communicating with the steam-passage in the inner tube, through which the plunger works.

4. The combination of the injector having the steam and fuel passages in the inner and outer tubes thereof, and the nozzles or jet-openings in line with each other, the plunger, its lever, the arm or rest for said lever, the coupling-box by which the arm is secured to the shank or extension of the inner tube of the injector, the superheated-steam pipe connecting with said tube by way of said box, and the fuel-feed pipe, these members being and operating substantially as hereinbefore set forth.

5. The combination, substantially as hereinbefore set forth, of the injector having the fuel and steam passages, the fuel-feed pipe connected with the injector fuel-passage, the pipe for supplying superheated steam to the injector steam-passage, the pipe for supplying live steam, having communication with the fuel-passage of the injector, and cocks in the different pipes by which to admit the superheated steam and fuel to their respective passages in the injector and admit of clearing out

the injector by the live steam admitted to the fuel-passage when the supply of fuel is cut off, as set forth.

6. The combination, substantially as hereinbefore set forth, of the injector having the passages for fuel and steam, the fuel-feed pipe, the pipe for supplying superheated steam, the pipe for supplying live steam and having communication with the steam-passage of the injector, and the cocks in the fuel-feed pipe, superheated-steam pipe, and live-steam pipe, by which to admit to the injector-passages the fuel and superheated steam, or admit the live steam alone, or with the superheated steam, to the injector steam-passage to clear the nozzles of both the injector-passages, as described.

7. The combination of the injector having the inner and outer tubes or concentric steam and fuel passages, the fuel-feed pipe, and the pipe for superheated steam, connected, respectively, with the fuel and steam passages of the injector, the pipe for live steam connected both with the fuel-feed pipe and the superheated-steam-pipe, and the series of cocks by which to regulate or shut off the supply of fuel, superheated steam, and live steam, and serving also to direct the live steam to the fuel-passage of the injector by way of the fuel-feed pipe, and to the injector steam-passage by way of the superheated-steam pipe, these members being and operating substantially as hereinbefore set forth.

8. The combination, substantially as hereinbefore set forth, of the fuel-reservoir, the steam-pipe therein, the fuel-feed pipe leading to the injector, the connecting steam-pipe communicating with the reservoir steam-pipe and fuel-feed pipe, and the cocks to cause the steam to pass from the reservoir steam-pipe by way of the connecting-pipe to the feed-pipe, to clear it or to soften the fuel, as described.

9. The combination, substantially as hereinbefore set forth, of the fuel-reservoir, its steam-pipe, the fuel-feed pipe, its cocks *a a'*, the connecting steam-pipe communicating with the reservoir steam-pipe and with the fuel-feed pipe between its cocks, and the cock *d* in said connecting-pipe, for the purpose described.

10. The combination of the fuel-reservoir, the fuel-feed pipe leading from the reservoir to the injector, the reservoir steam-pipe, the connecting steam-pipe leading therefrom to the fuel-feed pipe, the superheated-steam pipe, the steam-pipe connecting it with the pipe which communicates with the reservoir steam-pipe and fuel-feed pipe, and the cocks in the several pipes, these members being and operating substantially as hereinbefore set forth.

In testimony whereof I have hereunto subscribed my name.

JOHN ROGERS.

Witnesses:

F. F. HOFFMAN,
T. P. OGDEN.