

(No Model.)

J. FEHRENBATCH.
FURNACE FOR MAKING GAS.

No. 505,759.

Patented Sept. 26, 1893.

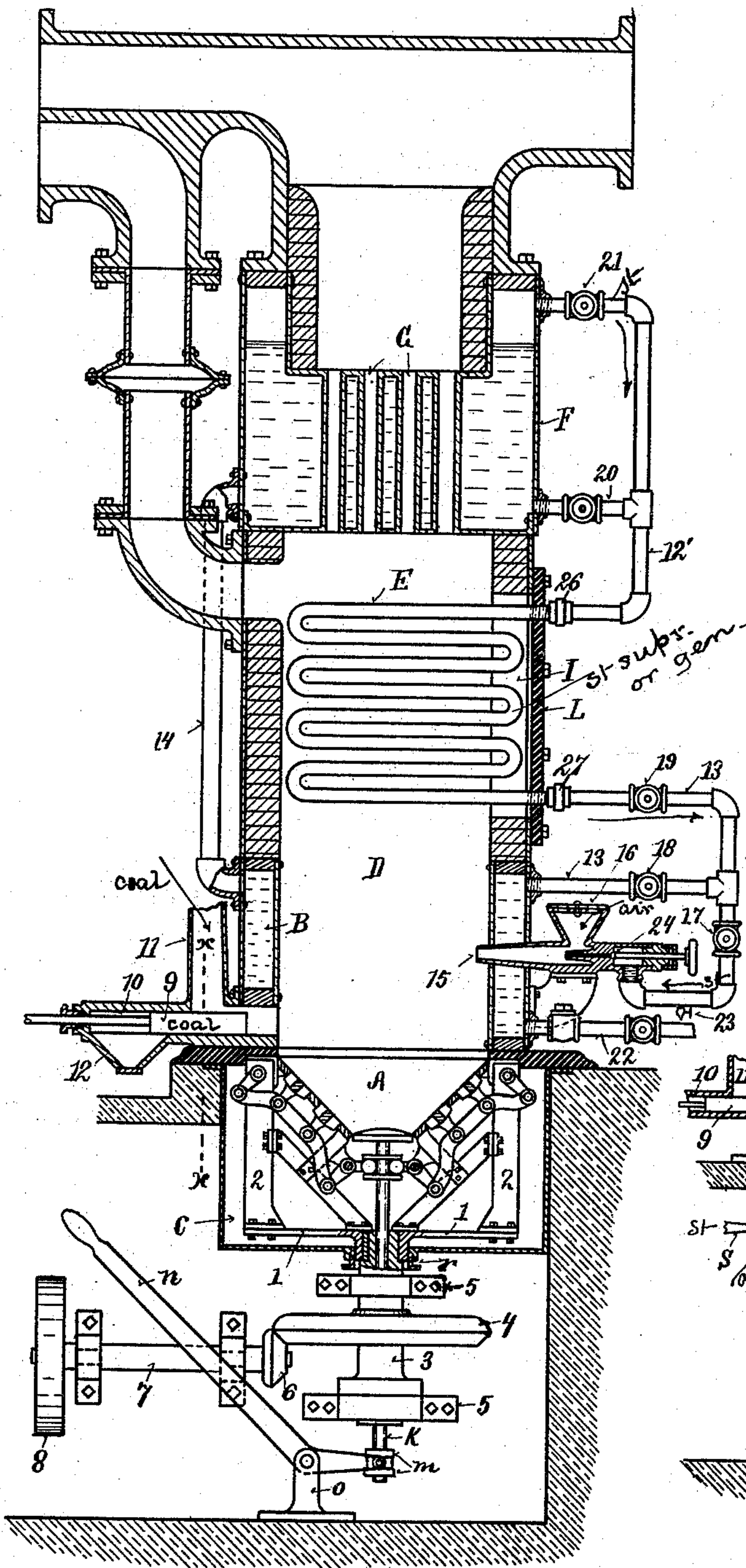


Fig. 1.

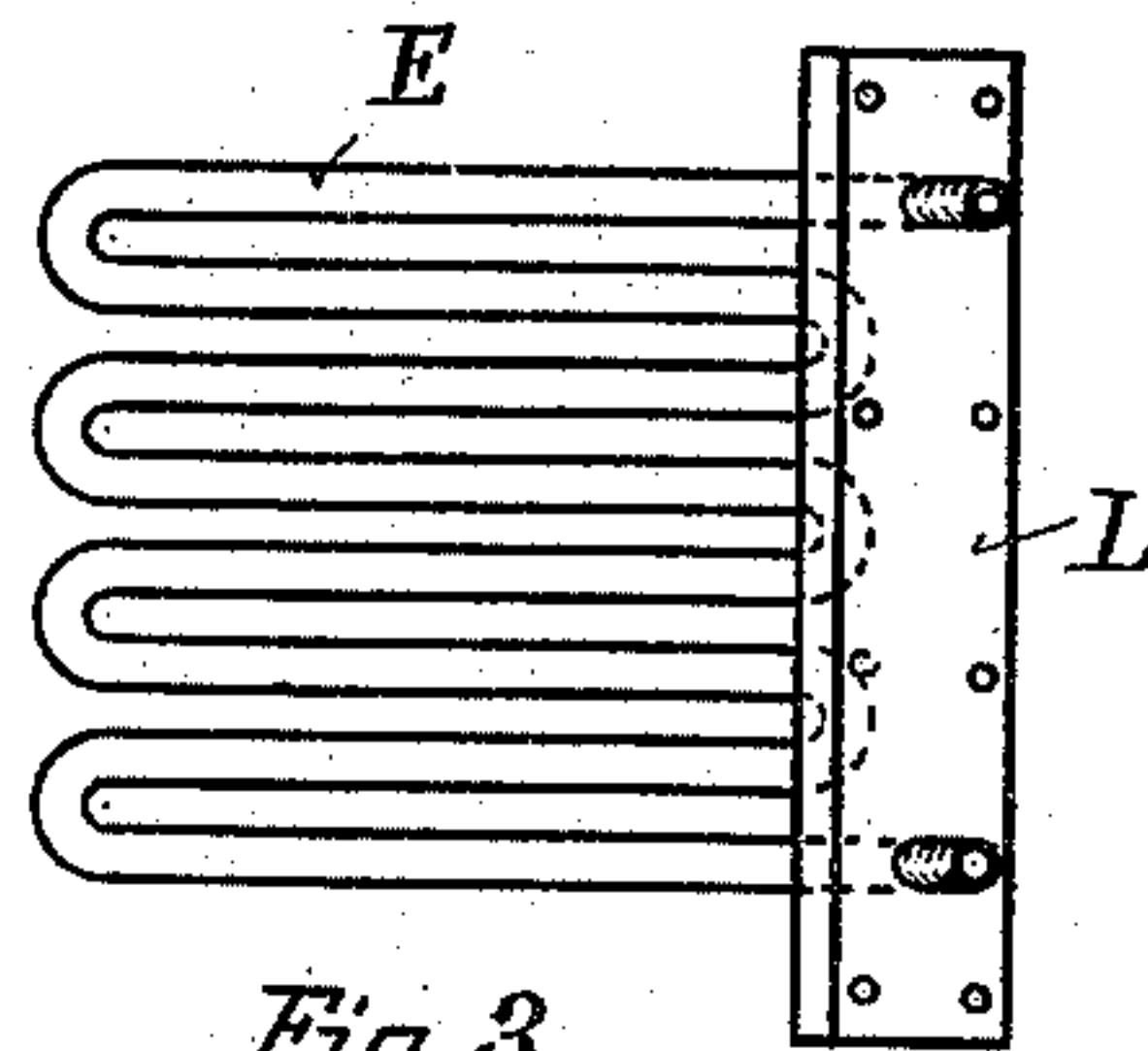


Fig. 3.

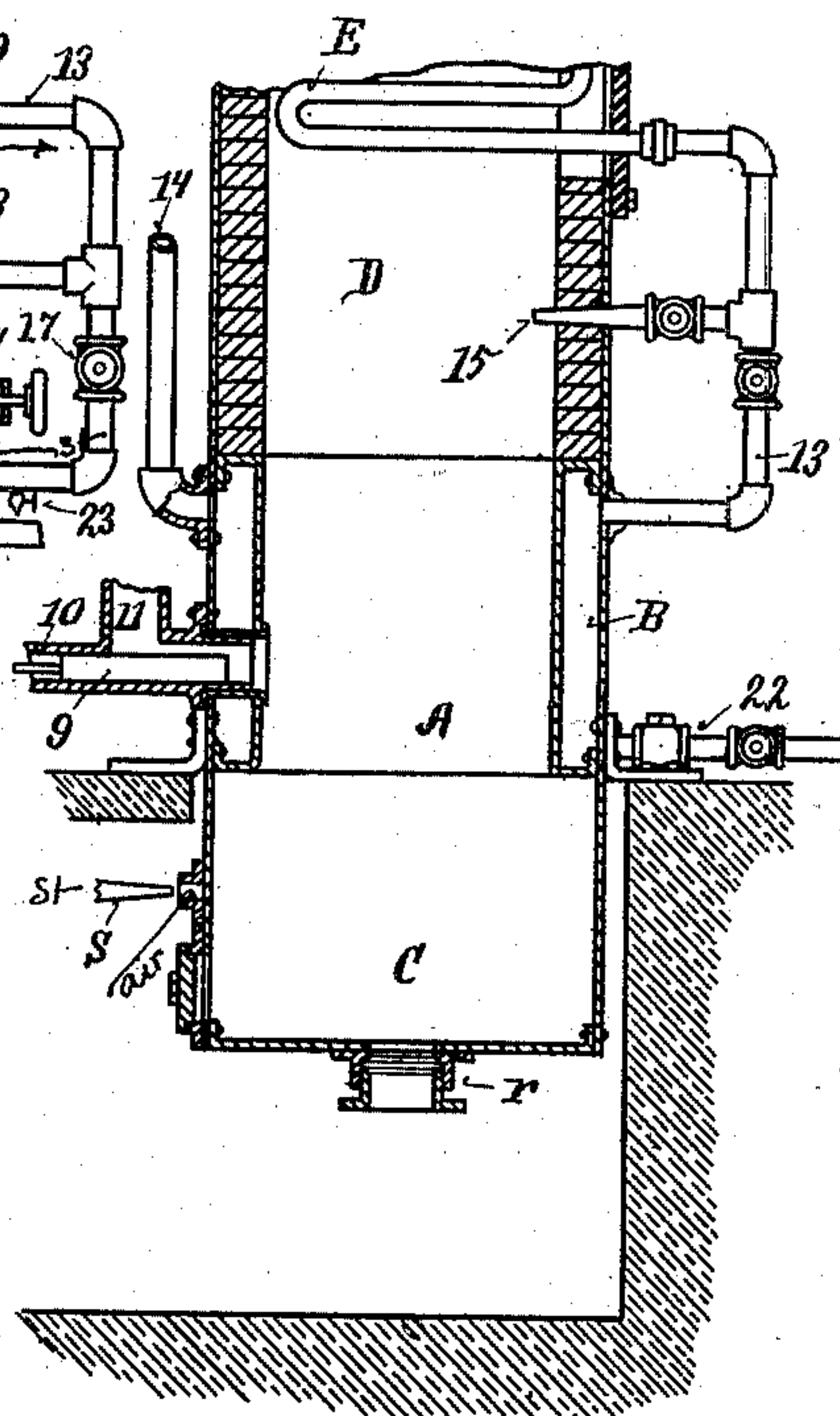


Fig. 2. mod.

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Witnesses
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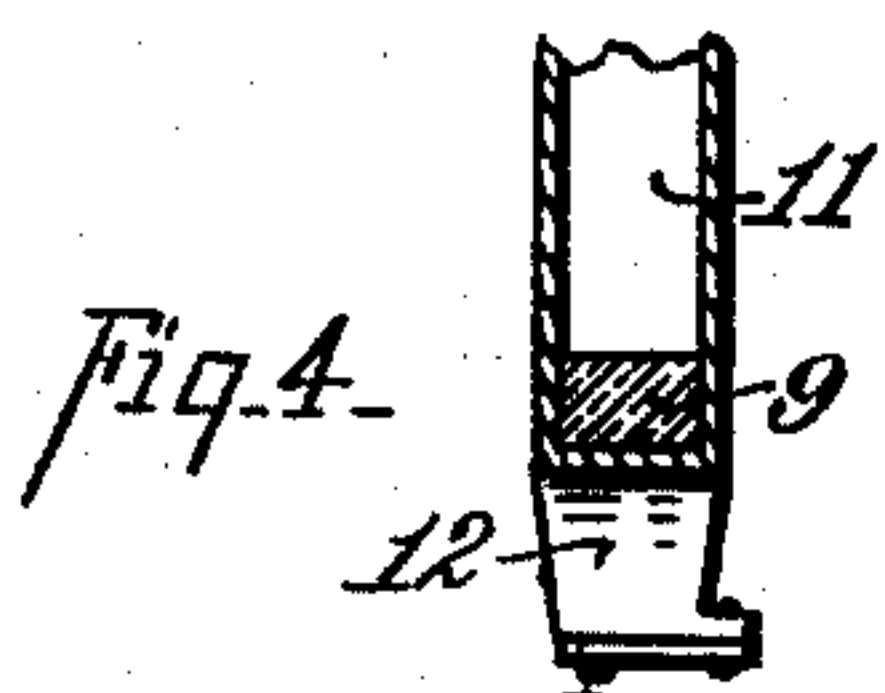


Fig. 4.

UNITED STATES PATENT OFFICE.

JOHN FEHRENBATCH, OF CINCINNATI, OHIO, ASSIGNOR OF TWO-THIRDS
TO FREDERIC C. WEIR, OF SAME PLACE.

FURNACE FOR MAKING GAS.

SPECIFICATION forming part of Letters Patent No. 505,759, dated September 26, 1893.

Application filed January 21, 1893. Serial No. 459,189. (No model.)

To all whom it may concern:

Be it known that I, JOHN FEHRENBATCH, a citizen of the United States, residing at Cincinnati, in the county of Hamilton and State of Ohio, have invented new and useful Improvements in Furnaces for Making Gas, of which the following is a specification.

The object of my invention is to provide a furnace with appliances which enable it to be run continuously and uniformly and primarily for the purpose of making producer gas, which may be conducted directly to a furnace without the use of gasometers or gas-holders; or conducted directly to explosive gas engines.

Another object of my invention is to provide a furnace with appliances for converting the products of combustion directly into gas.

Another object of my invention is to provide means for a steady, continuous and uniform production of gas of any desired quality.

Another object of my invention is to provide means for getting rid of clinkers.

Another object of my invention is to provide a coil for superheating of steam with means for preventing the burning of the coil pipe, and also means for readily renewing the same.

Another object of my invention is to provide means for a positive feed and a proper distribution of the coal over the grate surface of furnaces.

The various features of my invention are fully set forth in the description of the accompanying drawings making a part of this specification, in which—

Figure 1 is a central vertical section of my improvement. Fig. 2 is a central, vertical section of the lower portion of the apparatus, omitting the rotary-grate and grate-operating mechanism, and showing a modified form of super-heating steam pipe and water-jacket. Fig. 3 is a sectional elevation of the super heating pipe coil, and means for supporting it. Fig. 4 is a section on lines x, x , Fig. 1.

It is a desideratum in the use of furnaces to prevent clinkers from forming and adhering to the walls thereof from overheating. I therefore provide a water jacket wall which surrounds the fire chamber. The combustion or mixing chamber is lined with fire

brick, or other suitable material to obtain high heat at that point.

In the accompanying drawings Fig. 2 is the preferred form of constructing the shell of the lower part of the furnace, in which A represents the combustion chamber or that portion of it occupied by the fuel. B represents a water jacket shell formed of suitable material. C represents the ash pit. D represents the mixing or upper portion of the combustion chamber. E represents a super-heating steam coil. The upper portion of the furnace is covered with a boiler F; its special form of construction is not claimed herein as any form may be employed. G represents the flues of the boiler.

It is necessary for a uniform and continuous generation of gas to keep the grate covered by a proper distribution of coal over the surface thereof, and this I accomplish by means of a revolving grate and a positive forced feed. 1 represents a series of arms carrying a series of uprights 2, constituting the frame work upon which the grate is mounted. 3 represents a hollow shaft to which the arms 1 are rigidly connected. 4 represents a bevel wheel rigidly secured to said shaft. 5 represents journal brackets secured to any suitable foundation supporting the furnace, and not shown in the drawings. 6 represents a bevel pinion meshing with the bevel wheel 4, and driven by a belt over pulley 8 on shaft 7, or by other suitable means.

The revolving grate H, which is carried by the arms 1 of the rotary shaft 3, is connected also to a shaft k , that projects down through the hollow rotary shaft 3 and is provided with a grooved collar m to which is attached a lever n hinged upon a bracket o , so that by oscillating the lever and thus raising and lowering the shaft k the grate bars may be rocked to shake down clinkers and ashes.

In the generation of gas it is desirable to have the ash-pit closed; this is required when it is desired to force air in through the ash pit, and for this purpose I employ an injector s as shown in Fig. 2. A stuffing-box r closes the aperture around shaft k . In order to feed the coal uniformly I employ a forced feed, preferably a plunger 9 working in the cylinder 10 under hopper 11; the mouth of said

cylinder being above the grate bars, and suitable means being employed to reciprocate said plunger. 12 represents a receptacle for dust and prevents the choking of the plunger by the accumulation of dust at the back end.

Great difficulty has been experienced in the use of superheated steam coils in furnaces because of their rapid deterioration under the intense heat to which they are subjected; this is occasioned chiefly by lack of circulation at certain times, as when the parts are shut down. I overcome this difficulty by providing means for maintaining a circulation at all times through the coil, which is accomplished in the following manner: 12' represents a pipe connecting the coil E with the boiler. 13 represents the pipe connection to the water-jacket space B. 14 represents another pipe connecting the water-jacket with the boiler, which I prefer to employ. The injector 15 projects through the water jacket into the fire chamber. In Fig. 1 I have shown an air register 16 so as to admit air with steam; in Fig. 2 the air register is omitted. 17 represents a valve for closing off the steam from the injector. 18 represents a valve for closing off the pipe 13. 19 represents another valve on the same pipe which may be omitted. 20 represents a cross pipe valve connecting the pipe 12' with the boiler below the water line. 21 represents a valve in pipe 12', which taps the steam space in the boiler. 22 represents a pipe for filling the boiler, preferably connected to the water-jacket space B, as it is desirable to fill the water space and coil with water when starting up, and the boiler is preferably filled through these.

The method of securing circulation when the parts are in operation is as follows: The water-jacket, coil and boiler being filled, fire is started on the grate and continued; steam is first raised in the coil; valve 20 is opened; as the steam rises up through the coil E the water will gravitate from the boiler down through that coil, or else it will pass by pipe 14 through the waterspace B, thence through the pipe 13 to the coil, valves 18, 19 and 20 being opened. When steam has been raised high enough in the boiler to utilize it for the generation of gas, valve 20 is closed, and 21 is opened; valve 17 is also opened and pet-cock 23 is opened to carry off the water, if any, in the coil. The needle 24 is turned to admit the steam through the injector and then pet-cock 23 is closed; so long as there is a circulation of steam downwardly through the coil E, it will not be materially injured by the heat; but when it is desired to shut off the injector, valves 20 and 18 are opened. Pet cock 23 is opened. Then the injector is cut off. Pet cock 23 is then closed. This allows the water in the boiler to pass down through the coil E, into the water jacket B, or vice versa, by pipe 14 to the water jacket, and thence up through the coil which is probably the course which it will ordinarily take.

The grate-bar frame is set in motion and revolves continuously. The coal being fed in by the plunger 9 is supplied successively to all portions of the grate. I have shown the grate bars as inclined downward so as to carry the coal toward the center of the grate, thereby insuring the covering of the center portion of the grate as well as the outer. The hand lever *n* is operated from time to time to remove the clinkers and ashes. I have shown an injector *s* for forcing air into the ash-pit, and thence up through the grate, but a blower may be employed in lieu thereof. In case the steam coil E should be accidentally burned out I make the same readily removable by securing it to the plate L, which covers a slot I in the shell of the furnace; by unscrewing the union couplings 26, 27, the plate L and its contained coil may be withdrawn and repaired, or a new one inserted, as occasion may require. By means of the water jacket space surrounding the base of the combustion chamber, it is kept from being unduly heated and clinkers from forming and adhering to the walls thereof, and by means of the brick lining above the water jacket a heated surface is obtained at the point where the gas is mixed and where the heat is required for the fixing of the same. When the furnace is used to generate gas and conduct it off for use elsewhere a closed ash-pit is essential and some form of shaking grate must be employed to remove ashes and clinkers, but when it is desired to obtain a complete combustion of the gases in the generating chamber the closed ash-pit is not required.

In order to regulate the amount of carbon fed to the furnace and to secure proper distribution thereof, I provide a revolving grate and a force feed; and accomplish the shaking of the grate by a reciprocating rod journaling in the sleeve of shaft 3 by connecting mechanism, which allows the grate to be agitated while it is being revolved and this is the preferred form of shaking grate, as no stoppage of the feeding and generation of gas is required.

I have shown my improved furnace in the form adapted to make producer gas, or to produce complete combustion within the furnace, the result depending upon the proportions of atmospheric air and carbon, either of which can be increased or diminished so as to produce whichever result may be desired. Therefore I do not wish to limit the clauses of claim herein to a gas producer or generator. I have shown a form of boiler of the vertical type merely for the purpose of illustration, and do not limit myself to any particular form.

I claim—

1. The combination of the furnace having a closed ash pit, a water jacket, a grate, means for forcing air into the ash pit, a brick lined mixing chamber above the combustion chamber, a positive force coal feed communicating with the combustion chamber, one or more steam injectors leading into the gas generat-

ing chamber, above the fuel and a steam coil suspended in the mixing chamber for superheating the steam introduced into the gas-generating chamber, substantially as specified.

2. The combination of the furnace having a closed ash pit, a water jacket, a grate, means for forcing steam and air into the ash pit, a brick lined mixing chamber above the combustion chamber, a positive force coal feed communicating with the combustion chamber, one or more steam injectors leading into the gas generating chamber above the fuel, and a steam coil suspended in the mixing chamber for superheating the steam introduced into the gas generating chamber, substantially as specified.

3. The combination with a furnace, a boiler, and a water jacket surrounding the combustion chamber of the furnace and communicating with the boiler, of a superheating steam coil placed in the furnace and communicating with the water jacket and with the water and steam spaces of the boiler, and valves for controlling the communication of said coil with the water and steam spaces of the boiler, whereby a continuous circulation of steam or water can be maintained through said coil at all times, substantially as described.

4. The combination of a furnace, a water jacket surrounding the combustion chamber of the furnace, a boiler communicating with said water jacket, a superheating steam coil, located in the furnace and communicating with the water jacket and with the water and steam spaces of the boiler, and a positive forced coal feed communicating with the combustion chamber, substantially as described.

5. In combination with a furnace having a boiler forming the top of the furnace and a water jacket space adjoining the fire chamber, a coil placed within said furnace and pipes for connecting said coil with the water and steam space in the boiler and one or more pipes connecting said coil with the water jacket, substantially as specified.

6. The combination with a furnace, a boiler and a water jacket, of the coil E, pipes connecting said coil with the steam and water

space of the boiler, a pipe connecting said coil with the water jacket, and a pipe connecting the water-jacket with the water space of the boiler, substantially as described.

7. The combination of a furnace having a slot I in one of its walls, the removable plate L covering said slot, the superheating coil E secured to said plate and located in the furnace, a boiler, a water jacket surrounding the combustion chamber of the furnace, valved pipes connecting the superheating coil with the boiler and water jacket, and union-couplings connecting said pipes with the superheater at the outside of the removable plate, whereby the coil may be introduced into the furnace or detached therefrom together with said plate, substantially as described.

8. The combination of a furnace, a boiler forming the top of the furnace, a water jacket surrounding the combustion chamber of the furnace, a revolving grate, a superheating steam coil located in the furnace and connected with the steam and water spaces of the boiler, a pipe connecting said coil with the water jacket, and a pipe connecting the water jacket with the boiler, substantially as described.

9. The combination of a furnace having a combustion chamber surrounded by a water jacket, a revolving grate, a positive forced coal feed communicating with the combustion chamber above one side of said grate, a boiler forming the top of the furnace, a superheating steam coil located in the furnace below the boiler, valved pipes connecting said coil with the steam and water spaces of the boiler and with the water jacket, a pipe connecting the water jacket with the boiler, and a steam injector leading from the super-heating steam coil into the combustion chamber, substantially as described.

In testimony whereof I have hereunto set my hand in the presence of two subscribing witnesses.

JOHN FEHRENBATCH.

Witnesses:

GEORGE W. REA,
T. A. GREEN.