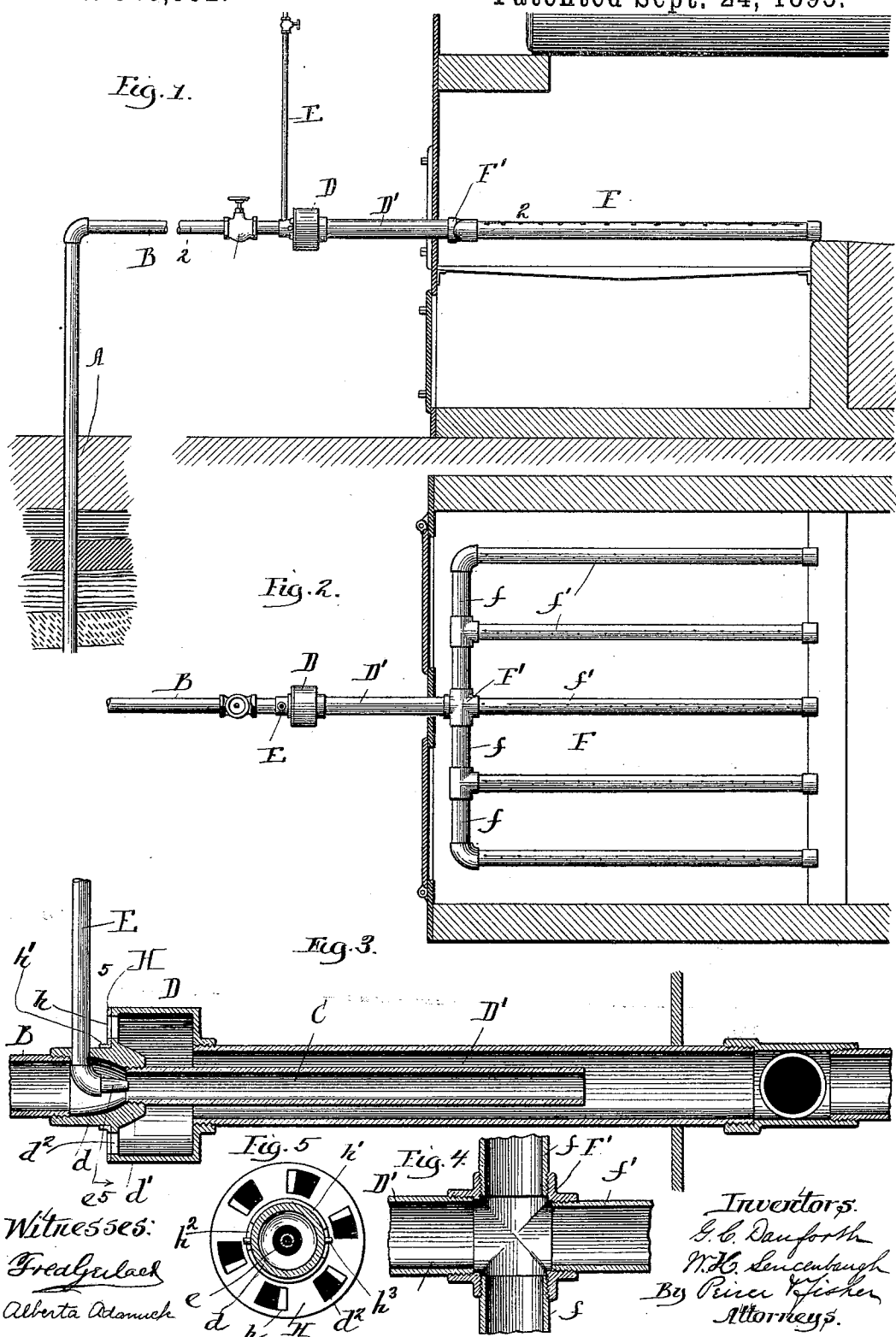


(No Model.)

G. C. DANFORTH & W. H. SENCENBAUGH.  
APPARATUS FOR WITHDRAWING GAS FROM NATURAL GAS WELLS, &c.

No. 546,952.

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Witnesses:

*Frederick*

*Alberta Adams*

Inventors:

*G. C. Danforth*

*W. H. Sencenbaugh*

*By R. C. Fisher*  
Attorneys.

# UNITED STATES PATENT OFFICE.

GEORGE C. DANFORTH AND WILLIAM H. SENCENBAUGH, OF WASHINGTON,  
ASSIGNORS, BY DIRECT AND MESNE ASSIGNMENTS, TO SAID DANFORTH,  
AND WM. C. HART, OF CHICAGO, ILLINOIS.

APPARATUS FOR WITHDRAWING GAS FROM NATURAL-GAS WELLS, &c.

SPECIFICATION forming part of Letters Patent No. 546,952, dated September 24, 1895.

Application filed May 22, 1894. Serial No. 512,038. (No model.)

*To all whom it may concern:*

Be it known that we, GEORGE C. DANFORTH and WILLIAM H. SENCENBAUGH, citizens of the United States, residing at Washington, Tazewell county, Illinois, have invented certain new and useful Improvements in Apparatus for Withdrawing Gas from Natural-Gas Wells and for Supplying Gaseous Fuel to Furnaces, of which we do declare the following to be a full, clear, and exact description, reference being had to the accompanying drawings, forming a part of this specification.

Our present invention, while applicable for use in other situations, is especially advantageous as a means for withdrawing gas from natural-gas wells and supplying gas mingled with steam and air to the burners of boiler or other furnaces. A serious difficulty encountered in the operation of natural-gas wells is that the flow of gas is not at all times uniform, and in some wells the flow at times becomes very sluggish and at other times stops entirely, and, indeed, it not infrequently happens that in such wells there will be a positive downward draft of air instead of an upward flow of gas. Hence it is that gas-wells which when first opened furnish a copious supply of gas are frequently abandoned after short usage because of the irregularity or entire stoppage of the flow.

By our present invention we have provided a means whereby a positive and uniform flow of gas may be had from natural-gas wells in which the natural flow has not only become sluggish, but has altogether ceased.

Our invention also affords a most effective apparatus for supplying mingled gas, air, and steam to the burners of boiler-furnaces or in other situations.

Our invention consists in the improvements hereinafter described, illustrated in the accompanying drawings, and particularly pointed out in the claims at the end of this specification.

Figure 1 is a view in vertical section through part of a boiler-furnace to which our invention is applied. Fig. 2 is a view in horizontal section on line 2 2 of Fig. 1. Fig. 3 is an enlarged detail view, in central vertical section, through a part of the burner and the

tubes for delivering the gas, steam, and air thereto. Fig. 4 is an enlarged view, in horizontal section through the coupling by which the air-delivery tube is connected to the burner, adjacent parts being also shown. Fig. 5 is a view in vertical section on line 5 5 of Fig. 3.

Referring to the accompanying drawings, A designates the tube of the natural-gas well, it being understood, of course, that the gas is to be conducted from said well by a suitable pipe B to the point of consumption. The pipe B, that leads from the well or gas-supply, is provided with a tubular section C, this section being preferably connected to the pipe B through the medium of the end chamber D at the front or induction end of the air-delivery tube D'. The chamber D is by preference formed with the neck *d*, having an interior thread to receive the exteriorly-threaded end of the pipe B, and the front end of this chamber is formed with a boss *d'*, having a threaded opening to receive the threaded end of the tube-section C. By preference the tube-section C is contracted or of smaller diameter than the main delivery-pipe B, and the purpose of this arrangement will presently more fully appear. The chamber D is provided, also, at its rear end with an interiorly-threaded opening of large diameter, to which connects the outer end of the air-tube D', and this tube D' is of such size as to afford a free passageway for air around the tube-section C, through which the supply of mingled gas and steam is delivered, the steam being admitted into the mouth of the tube-section C through a steam-pipe E, that terminates in a jet *e*, located at the mouth of the tube-section and pointing in the direction of the discharge end of said section. It will be understood that the steam-pipe E will be suitably connected with the boiler of the furnace.

In order to regulate the supply of air through the air-delivery tube D', we prefer to provide the induction port or ports *d'* at the front of the chamber D with the register-valve H, having ports *h*, corresponding in number and arrangement with the ports in the end of chamber D. The register-valve H is mounted in manner free to turn upon the hub *d* of the

casing and is furnished, preferably, with the flange  $h'$ , having notches  $h^2$ , into which project pins  $h^3$ , that are fixed to the hub  $d$  of chamber D and serve to limit the turning movement of the valve H as it is brought to the open or closed position.

The burner F preferably comprises a coupling F', from which lead the lateral burner-carrying branch pipes  $f$ , and, if desired, also the central burner-tube  $f'$ . Any desired arrangement of the burner-tubes and branch pipes may be employed, as this is not an essential part of our invention.

From the foregoing description it will be seen that when steam is injected into the tube-section C through the jet  $e$  of the steam-pipe E the force of the steam will create a vacuum within the pipe B, thus drawing the gas through this pipe and from the well A, to which this pipe is connected. By this means a copious supply of gas can be had from the well, and we have found in practice that the steam-jet will serve to effectively draw the gas from wells that have been abandoned because of the cessation of the natural flow of gas therefrom. We have found in practice, also, that by injecting the steam into a contracted tube-section the force of the steam is much more effectively applied than would be possible if the steam were injected into a pipe of larger diameter, and for this reason we prefer to employ the contracted tube-section C. By means of the air-delivery pipe D' a supply of air necessary to insure an effective burning of the mingled gas and steam is secured, and by locating the induction-ports of this air-delivery pipe at a distance from the discharge end of the tube-section C a much more effective action of the steam in withdrawing the gas from the well is had than would be possible if the steam and air were commingled with the gas at about the same point.

While our invention has proven in practice a most effective means for withdrawing gas from natural-gas wells, we do not wish the invention to be understood as restricted to this particular use, since certain features of the invention can be effectively employed in situations in which other than natural gas is used as a fuel.

Having thus described our invention, what we claim as new, and desire to secure by Letters Patent, is—

1. An apparatus of the character described, comprising a gas delivery pipe having induction and discharge ends and having a contracted throat, a long discharge pipe commencing at said contracted throat and of substantially the diameter of said throat, and a steam jet having its discharge end located at said contracted throat and pointing in the direction of the discharge, substantially as described.

2. An apparatus of the character described, comprising a continuous gas delivery pipe B

having induction and discharge ends, a long discharge pipe C provided at its induction end with a contracted throat and of substantially the diameter of said throat, a steam jet located at the throat of said pipe section C and pointing into said section, an exterior or admission tube D' inclosing said long tube section C, the outer end of said tube D' being constructed for the admission of air, substantially as described.

3. An apparatus of the character described, comprising a gas delivery pipe B having the discharge section C of smaller diameter than said pipe B and connected therewith by a contracted throat, a steam jet located at said contracted throat and pointing into the tube C, and an exterior air admission tube D' inclosing said tube C for a considerable distance whereby a strong draft of gas may be obtained before the mingled gas and steam are admitted to the air entering the tube D', and a chamber D at the induction end of the tube D', the front wall of said chamber being perforated to receive the gas delivery tube, substantially as described.

4. An apparatus of the character described, comprising the combination of a gas delivery tube, a steam pipe extending within said gas delivery tube and pointing in the direction of its discharge end, and an exterior air delivery tube provided with an induction port or ports at a distance from the discharge end of said tube, substantially as described.

5. An apparatus of the character described, comprising the combination of a tube C, a steam pipe E, entering said tube at a distance from its end, and an exterior air delivery tube D' having its induction end located at a considerable distance from the discharge end of said tube C, and a valve for controlling the flow of air through said exterior tube, substantially as described.

6. An apparatus of the character set forth, comprising the combination of an inner tube C for gas, a steam pipe E entering said inner tube and pointing in the direction of its discharge end, an exterior tube for air and a burner connected to said air tube and into which said inner tube also discharges, substantially as described.

7. An apparatus of the character described, comprising the combination of an inner tube C, a steam pipe E at the mouth of said inner tube, an exterior tube D' having an enlarged front end portion or chamber D, a burner connected to said exterior tube D', said interior tube also terminating adjacent said burner and at a considerable distance from the induction end of said air tube, substantially as described.

GEORGE C. DANFORTH.  
WILLIAM H. SENCENBAUGH.

Witnesses:

DENNIS S. SHEPPARD,  
ASA H. DANFORTH.