(No Model.) 3 Sheets—Sheet 1.

O. W. DEGEN.

FURNACE AND LIQUID FUEL BURNER.

No. 603,556. Patented May 3, 1898.

Fig. 2.

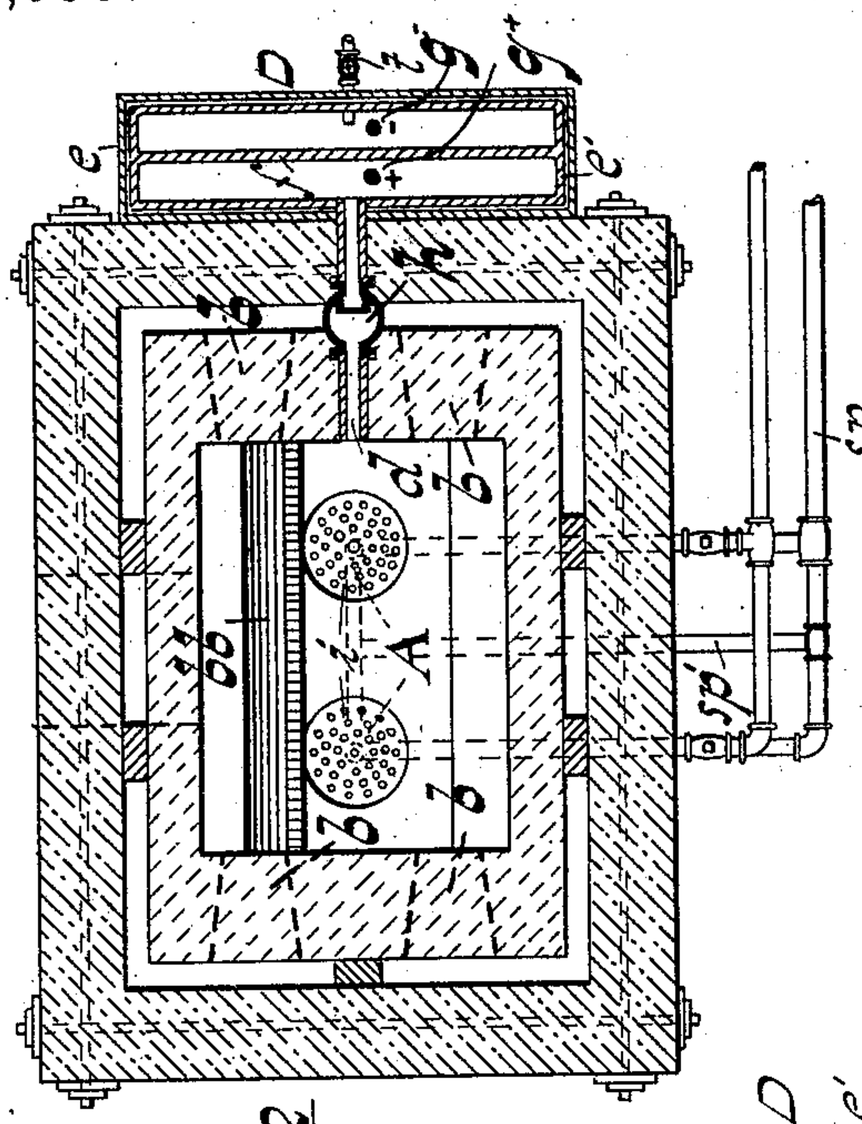
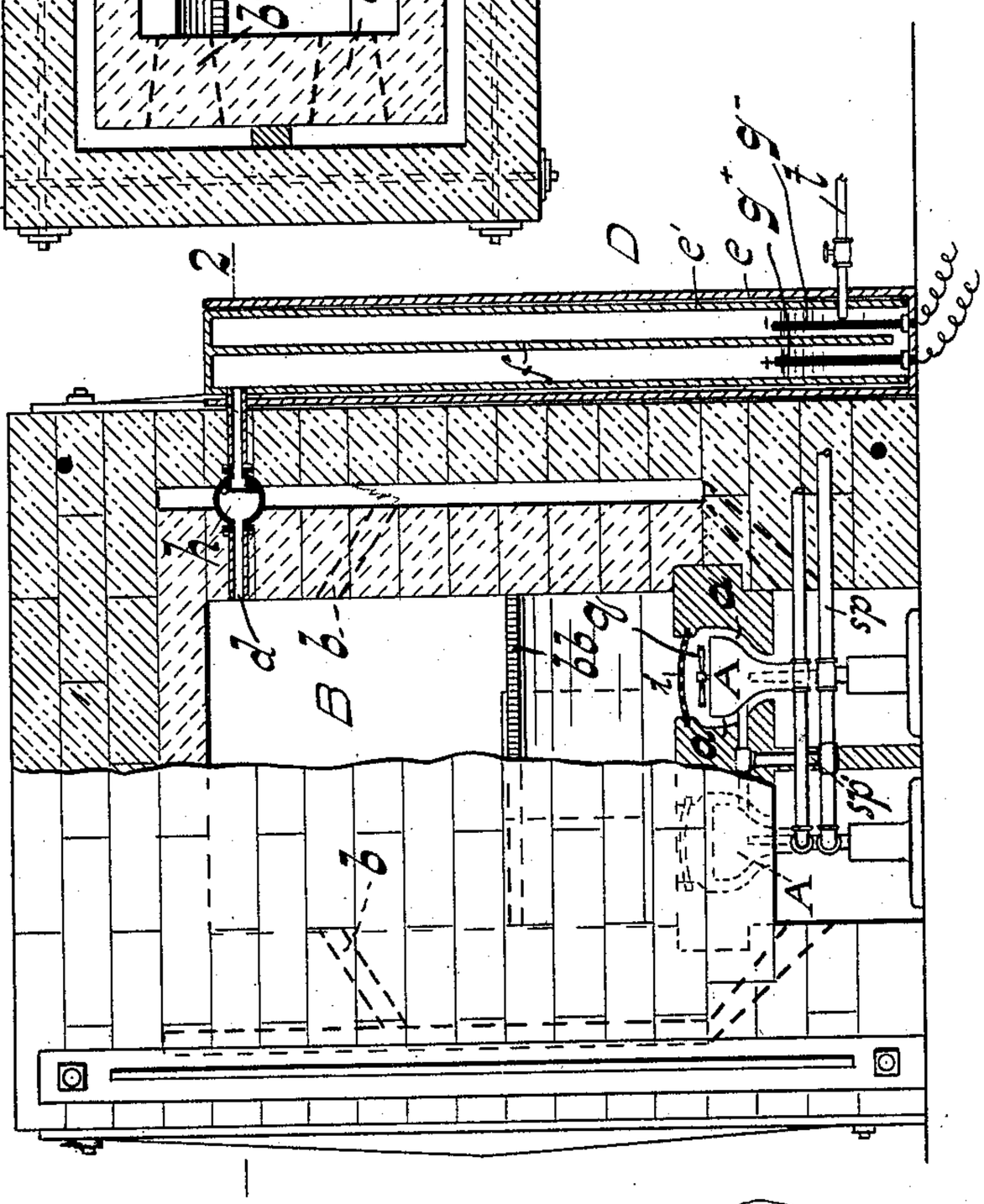


Fig. 1.



Witnesses
A. W. Kurz
Harry Calhoun

Otto William Degen Inventor

By Schreiter, Van Iderstine & Mathews, his Attorneys.

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O. W. DEGEN.

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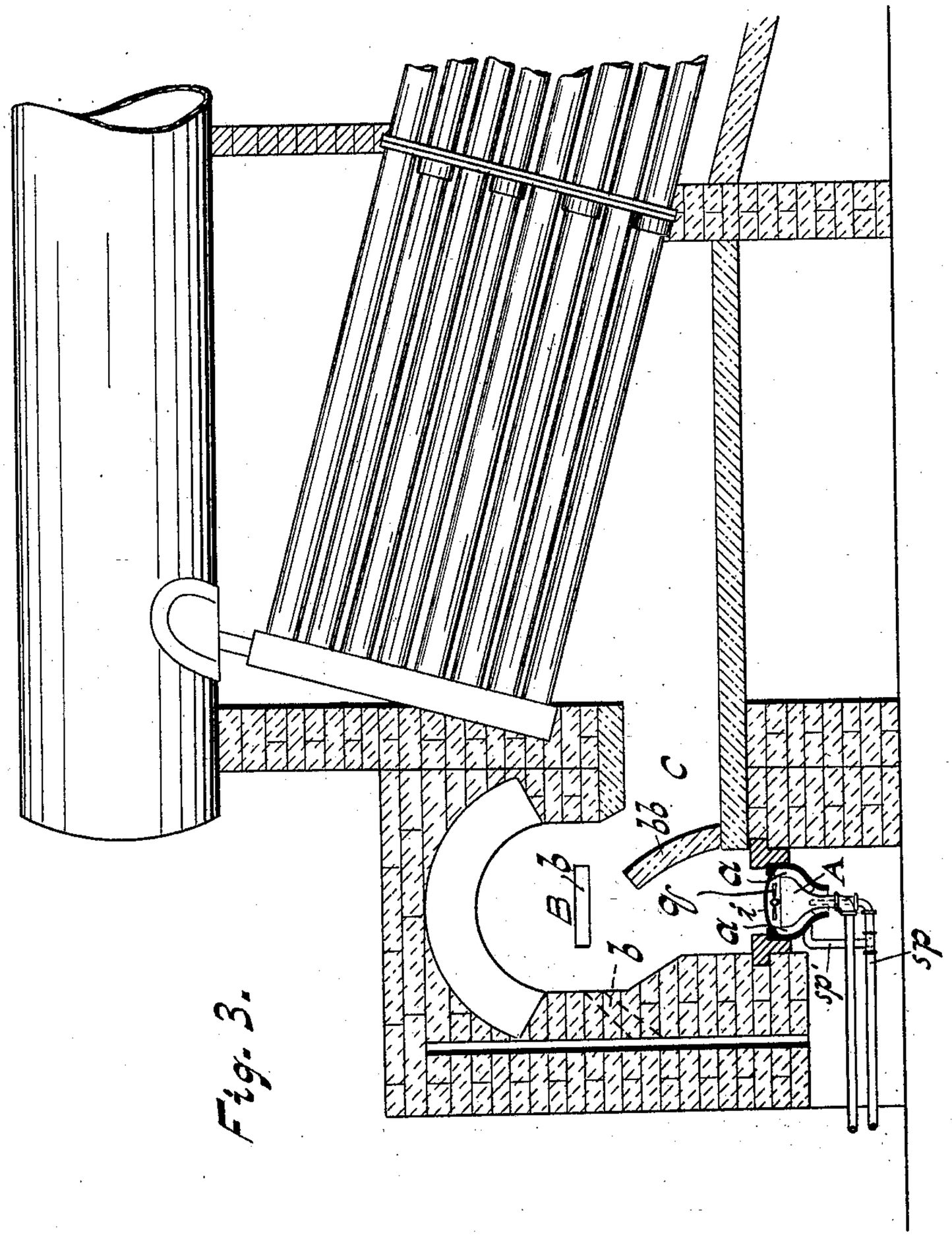


Fig. 3.

Witnesses
A. W. Kurz
Harry Calhoun

Otto William Degen, Inventor
By Schroeter, Van Orsdestine & Mathews, his Attorneys.

(No Model.) 3 Sheets—Sheet 3.

O. W. DEGEN.

FURNACE AND LIQUID FUEL BURNER.

No. 603,556. Patented May 3, 1898.

Fig. 4.

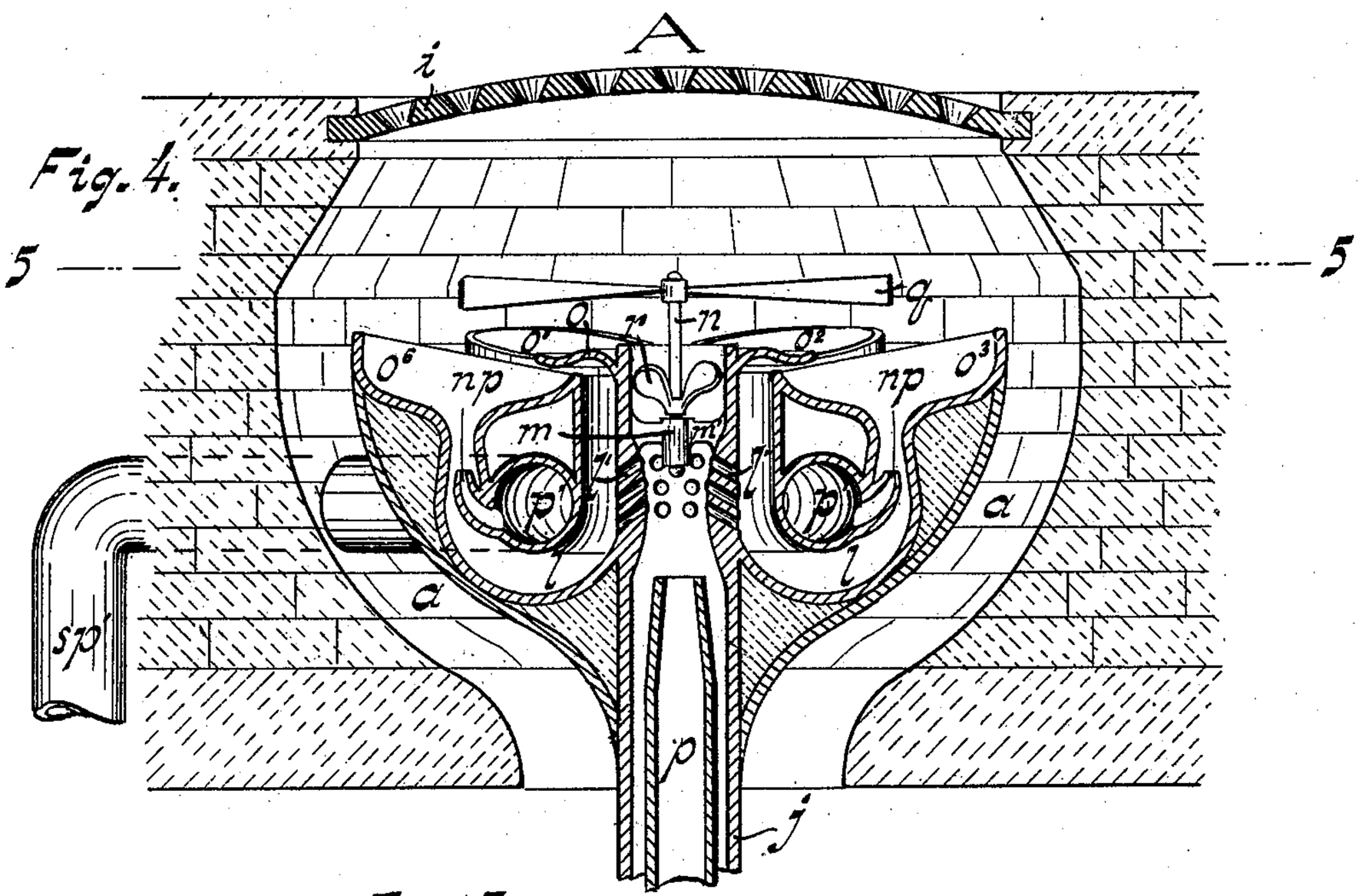
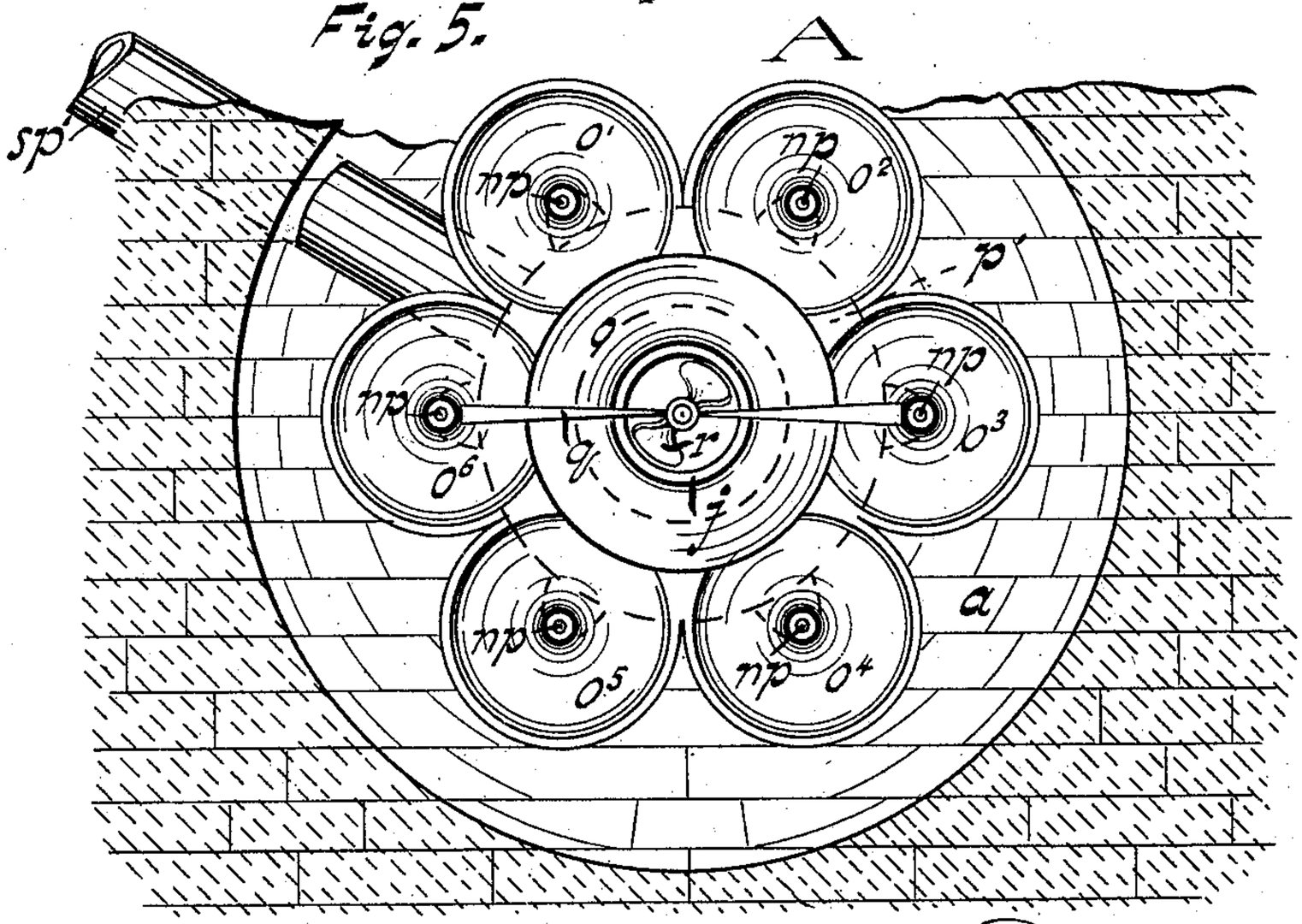


Fig. 5.



Witnesses
A. W. Kurz
Harry Calhoun

Otto William Degen Inventor

By Schreiter, Van Iderstine & Mathews, his Attorneys.

UNITED STATES PATENT OFFICE.

OTTO WILLIAM DEGEN, OF NEW YORK, N. Y.

FURNACE AND LIQUID-FUEL BURNER.

SPECIFICATION forming part of Letters Patent No. 603,556, dated May 3, 1898.

Application filed March 5, 1897. Serial No. 626,074. (No model.)

To all whom it may concern:

Be it known that I, OTTO WILLIAM DEGEN, a citizen of the United States, and a resident of New York, county and State of New York, have invented certain new and useful Improvements in Furnaces and Liquid-Fuel Burners, of which the following is a full, clear, and exact specification, reference being had to the accompanying drawings, wherein—

Figure 1 is an elevation, partly in section, of my improved furnace. Fig. 2 is a horizontal section thereof on line 2 2, indicated in Fig. 1. Fig. 3 is a section of a boiler-furnace, (somewhat modified sectional view on lines 3 3, indicated in Fig. 2,) showing the furnace applied to heating a boiler. Fig. 4 is a sectional view, on enlarged scale, of my improved liquid-fuel burner. Fig. 5 is a top view thereof.

Similar letters of reference indicate corresponding parts in all views of the drawings.

My invention relates to furnaces; and the object of my invention is twofold: first, to produce with a minimum consumption of fuel very high temperature in the furnace, and, second, to prevent a direct contact of the flame with a boiler or other apparatus to which the heat is to be applied.

The parts of a boiler when exposed directly to the flame, especially in furnaces where forced draft is used, suffer in two ways: First, the direct contact with the flame reduces the consistency of the metal, thus producing brittle spots, and, secondly, by the unequal application of the heat to the different parts of the boiler an unequal expansion and contraction of these parts is produced, and thereby the joints and connecting-seams are disrupted. At the same time in furnaces where in the flame is directly in contact with the parts of the boiler only a limited temperature can be produced for the reasons stated, because the higher the temperature of the flame brought in direct contact with the boiler the more rapid is the destruction.

My improved furnace thus consists, mainly, of one or more burners A, the combustion-chamber B, and passage or flue C, connecting the same with the casing of a boiler. The walls of the furnace are constructed of fire-proof bricks or some other suitable material. They may be constructed as double walls with insulating-flues between the inner and the outer walls, as shown in Figs. 1 and 2 or as shown in Fig. 3.

The combustion-chamber B is preferably arched and constructed in the shape shown in Fig. 3 in section, because this construction produces the desired effect of confining the combustion to the combustion-chamber and at the same time directs the current of heat toward the bottom of the boiler-casing from where it rises, circulating through the parts of the boiler, (or through a kiln, oven, &c.,) according to what purpose the furnace is applied.

Draft-air is supplied to the combustion-chamber through the flues *a*, surrounding the burner, and through the flues *b*, located in the upper part of the combustion-chamber. The purpose of supplying air underneath the sieve *c*, separating the burner from the combustion-chamber, is to assist in the upward flow of the fluid fuel generated as will be explained hereinafter into the combustion-chamber. An additional supply of air is conducted through flues *b* into the combustion-chamber to secure therein a complete combustion of all fuel. These flues *b* are so located in the walls of the furnace that the air passing through them is heated before entering the combustion-chamber, and their outlets are so arranged that a current having rotary motion of considerable force is produced therein.

The capacity of the combustion-chamber, the arrangement of the flues, and also the number of burners may vary according to the purpose for which a furnace is designed. The manner of its connection with the apparatus wherein the heat is to be applied will necessarily be more or less modified according to the purpose.

In Fig. 3 the bridge-wall *bb* is shown as a part of an arch separating the boiler-casing from the lower part of the combustion-chamber. This bridge-wall *bb* could, however, equally well be built up vertically and the combustion-chamber extended upward, if the circumstances would permit such arrangement. The furnace could also be erected separately, (not immediately adjoining the boiler-casing,) and two or more boilers, kilns, &c., could be supplied with heat from one fur-

nace, in which case suitable dispositions of the connecting-flues C would be required.

These details of construction may be varied and modified as circumstances and particular cases may require; but any particular arrangement thereof comprising the combination of the combustion-chamber provided with the flues producing the rotary current and the diverting bridge-wall is included within the scope of my invention as disclosed in this specification.

These principles of construction of my improved furnace can be applied to constructing furnaces for any purpose without regard to the kind of fuel used. Fluid fuel, however, as may be produced from fuel-oils, is best adapted for the purpose of my invention, and for this reason I have devised the apparatus as an integral part of my invention.

The construction of the apparatus for producing fluid fuel from crude oils and for diffusing the same is shown in Figs. 4 and 5 in enlarged detail. This apparatus, shortly designated as "burner A," is designed to utilize heavy or crude earth-oils for producing fluid fuel for the furnace. The purpose of its construction is to disintegrate the oils into minute particles or molecules and commingle them intimately with very hot steam and with an abundant quota of atmospheric air. This mixture is then driven through a screen or sieve *i* into the combustion-chamber.

The apparatus consists of a series of pans, of which the central pan *o*, surrounding the outlet of the main oil-supply pipe *j*, is located highest. The other pans *o'*, o^2, o^3, o^4, o^5, and o^6 are located underneath the central pan *o* in a circle and are connected with the main supply-pipe *j* by branch pipes *l* and perforations *l'*. Between the main central pan *o* and the peripherically-arranged pans o^2, &c., is located a steam-coil *p'*, supplied with steam through connection *sp'* from the steam-supply pipe *sp*. The steam-pipe *sp* is connected to nozzle *p*, discharging the steam into the main oil-pipe *j*, underneath the perforations *l'*. By the suction thus created the oil is driven upward partly through the upper opening of the main tube *j* and partly through the perforations *l'* into the branch pipes *l*. It will be readily understood that while a larger proportion of steam will pass through the outlet of the main pipe *j* the larger proportion of the oil will flow through the perforations *l'* into the branch tubes *l*, feeding the pans *o' o²*, &c. Steam-coil *p'* is joined to or cast in one piece with these branch pipes *l*, and nozzles *np*, discharging into the throats of the secondary pipes *l*, are connected thereto. The suction produced by the discharge of steam from these nozzles drives the oil into the pans *o o' o²*, &c., in the same manner as described above. The oil is heated by the steam and its more volatile components will readily rise. The heavier components of the oil accumulate constantly in the throats of pipes *l*, and being thus repeatedly exposed to the action of the steam driving them upward are successively disintegrated into very small particles, almost molecules, which finally are carried into the combustion-chamber with the current.

Above the nozzle *p* is mounted spindle *n*, rotating in bearing *m*, supported by webs *m'*, cast on the walls of the pipe *j*, and to the spindle *n* is secured propeller *r*. The steam and oil passing upward through the pipe *j* drive this propeller and thereby also the fan *q*, mounted on top of spindle *n*. The purpose of this device is to facilitate an intimate commingling of the particles or molecules of the oil with the steam and with the air. The fan creates a strong current upward toward the screen *i* and also prevents the air flowing through the flues *a* from reacting on the ascending particles of fuel. The fluid fuel thus produced is driven through the meshes of the screen *i* into the combustion-chamber and there consumed.

An additional supply of fuel (hydrogen gas) is conducted into the upper part of the combustion-chamber B through the pipe *d*, passing through the wall of the furnace and connecting it with the generator D. This generator consists of a telescopic vessel composed of parts *e* and *e'*, the latter being set within the former and divided by a partition-wall *f* from its closed top down to near the bottom of the part *e*. The generator is filled partly with water supplied continually by tube *t*, and the termini of an electric conduit (*g*+ and *g*−) are immersed in it, one in each of the respective divisions of the generator.

Tube *d* connects the upper part of the combustion-chamber B with the top of the section of the generator wherein the hydrogen gas accumulates. To prevent a reaction of the buring-gases, which at some time may be under considerable pressure there, and might then be forced into the generator D, I provide the connecting-tube *d* with a reacting-valve *h*, closing it automatically whenever the pressure of the gases within the chamber B increases above that of the hydrogen gas within the generator.

I claim and desire to secure by Letters Patent—

1. A furnace comprising a combustion-chamber having an inlet for fluid fuel in its bottom, an outlet connecting the combustion-chamber with the apparatus where the heat is to be applied and a bridge-wall partly closing the outlet and extending over the inlet so as to deflect the flow of the fuel into the apex of the combustion-chamber.

2. A furnace comprising a combustion-chamber having an inlet for fluid fuel in its bottom, an outlet connecting the combustion-chamber with the apparatus where the heat is to be applied, air-flues arranged to produce a current having rotary motion in the upper part of the combustion-chamber, and a bridge-wall partly closing the outlet and

extending over the inlet so as to deflect the flow of the fuel into the apex of the combustion-chamber.

3. An apparatus for producing fluid fuel from crude oils, comprising a main supply-pipe provided with perforations near its outlet, a shallow pan set upon the outlet, branch pipes communicating with the perforations of the main supply-pipe, shallow pans set upon their outlets, steam-coil located underneath the pans, means for conveying crude oil into the apparatus, means for heating and means for disintegrating them.

4. An apparatus for producing fluid fuel from crude oils, comprising a main oil-supply pipe provided with perforations near its outlet, a shallow pan set upon the outlet, a steam-pipe set within the main oil-supply pipe, a nozzle, set on the steam-supply pipe, and discharging into the oil-supply pipe underneath the perforations, branch oil-pipes communicating with the perforations of the main oil-supply pipe, shallow pans set upon their outlets, steam-coil located underneath the pans, and nozzles set in the steam-coil and discharging into the throats of the branch supply-pipes.

5. An apparatus for producing and diffusing fluid fuel from crude oils, comprising a main oil-supply pipe provided with perforations near its outlet, a shallow pan set upon the outlet, a steam-pipe set within the main oil-supply pipe, a nozzle, set on the steam-supply pipe and discharging into the oil-supply pipe underneath the perforations, branch oil-pipes communicating with the perforations of the main oil-supply pipe, shallow pans set upon their outlets, steam-coil located underneath the pans, and nozzles set in the steam-coil and discharging into the throats of the branch supply-pipes, a bearing supported by webs in the mouth of the main oil-supply pipe, a shaft rotating in the bearing, a propeller and a fan secured to the shaft, and air-flues arranged around the pans.

6. A furnace comprising the combination with a combustion-chamber having an inlet for fluid fuel in its bottom, of an apparatus for producing and diffusing of fluid fuel from crude oils, comprising a main oil-supply pipe provided with perforations near its outlet, a shallow pan set upon the outlet, a steam-pipe set within the main oil-supply pipe, a nozzle, set on the steam-supply pipe and discharging into the oil-supply pipe underneath the perforations, branch oil-pipes communicating with the perforations of the main oil-supply pipe, shallow pans set upon their outlets, steam-coil located underneath the pans, and nozzles set in the steam-coil and discharging into the throats of the branch supply-pipes, a bearing supported by webs in the mouth of the main oil-supply pipe, a shaft rotating in the bearing, a propeller and a fan secured to the shaft, air-flues surrounding the apparatus and a screen set above the fan and separating the combustion-chamber from the apparatus.

In witness that I claim the improvements described in the foregoing specification I have signed my name in the presence of two subscribing witnesses.

OTTO WILLIAM DEGEN.

Witnesses:
A. W. KURZ,
HARRY CALHOUN.