

(No Model.)

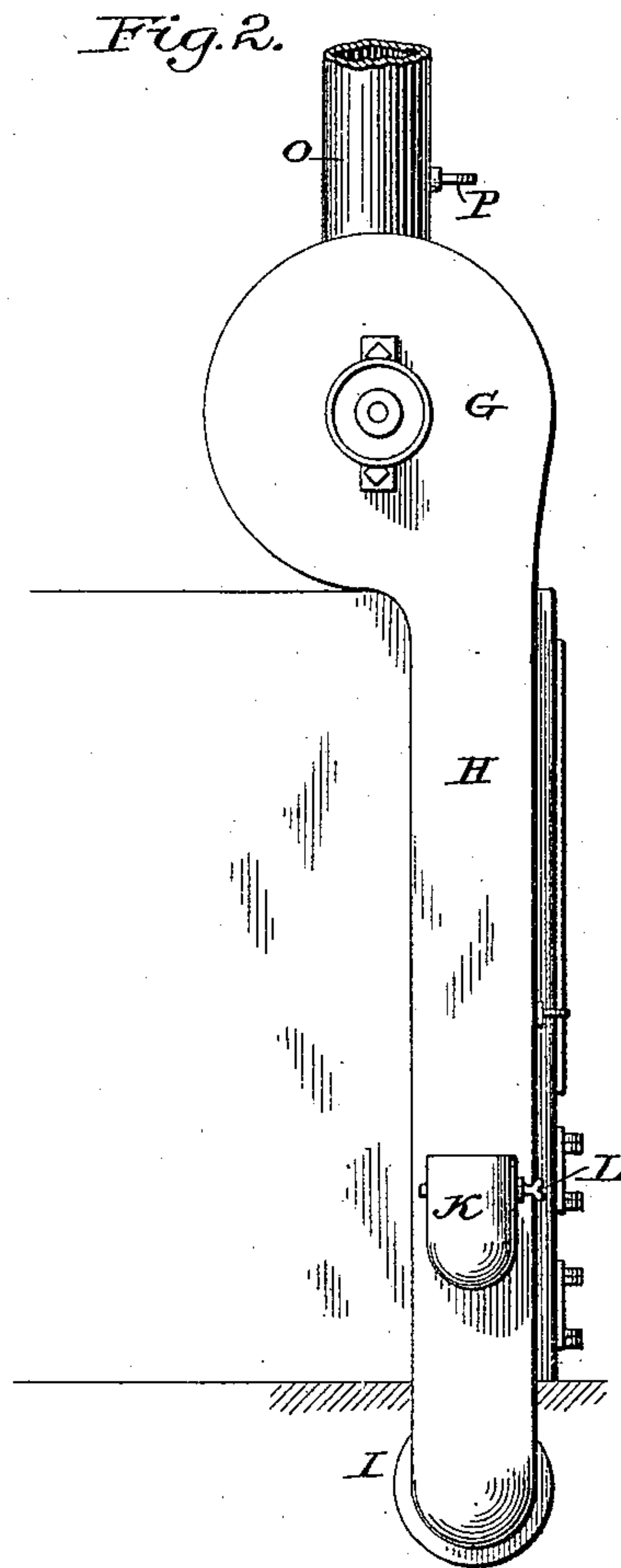
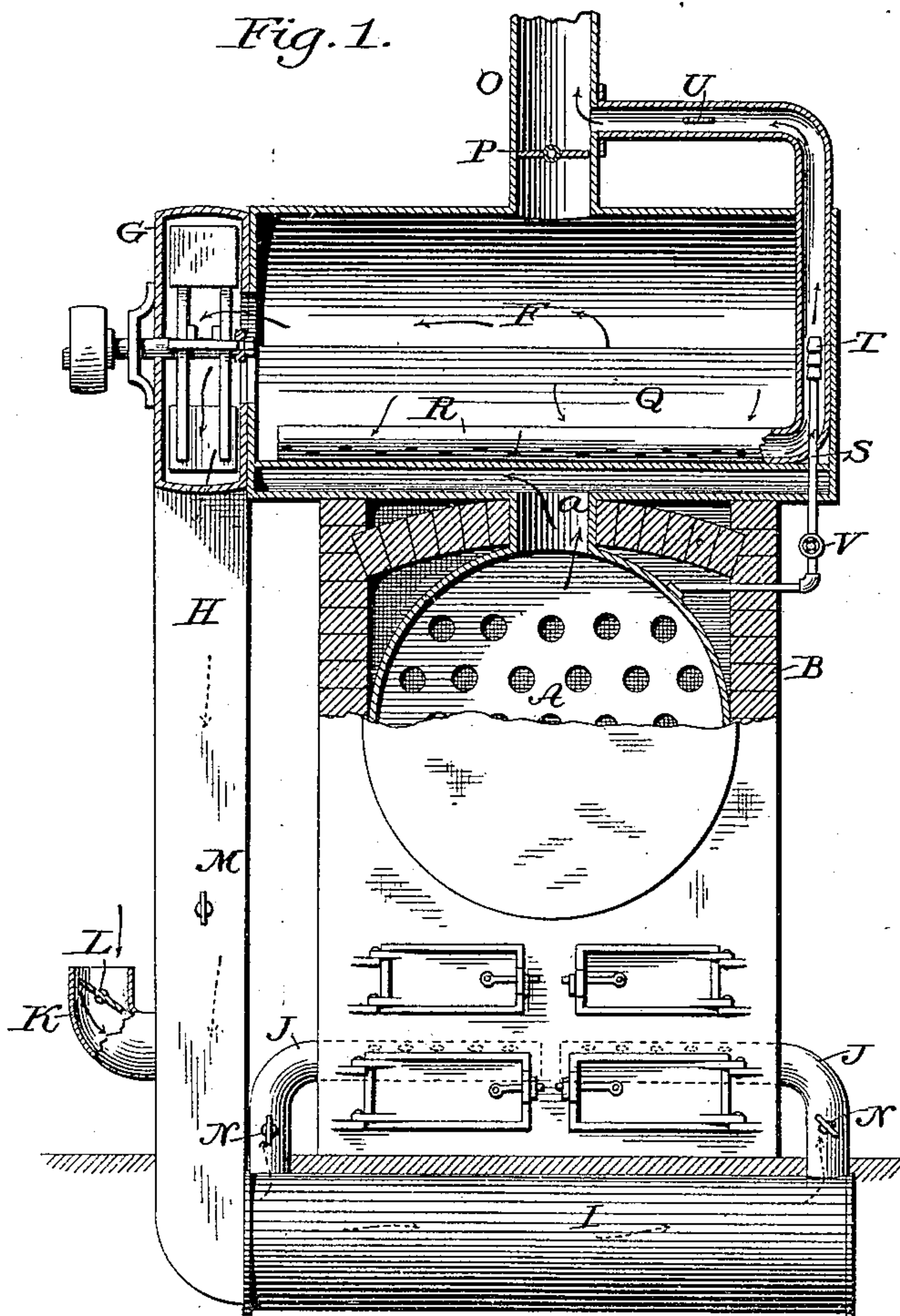
2 Sheets—Sheet 1.

T. S. WILKIN.

SMOKE CONSUMING FURNACE.

No. 334,066.

Patented Jan. 12, 1886.



Witnesses:

James F. O'Hamel.
C. S. Ferguson

Inventor:

Theodore S. Wilkin,
by Rodger Son,
his Attys.

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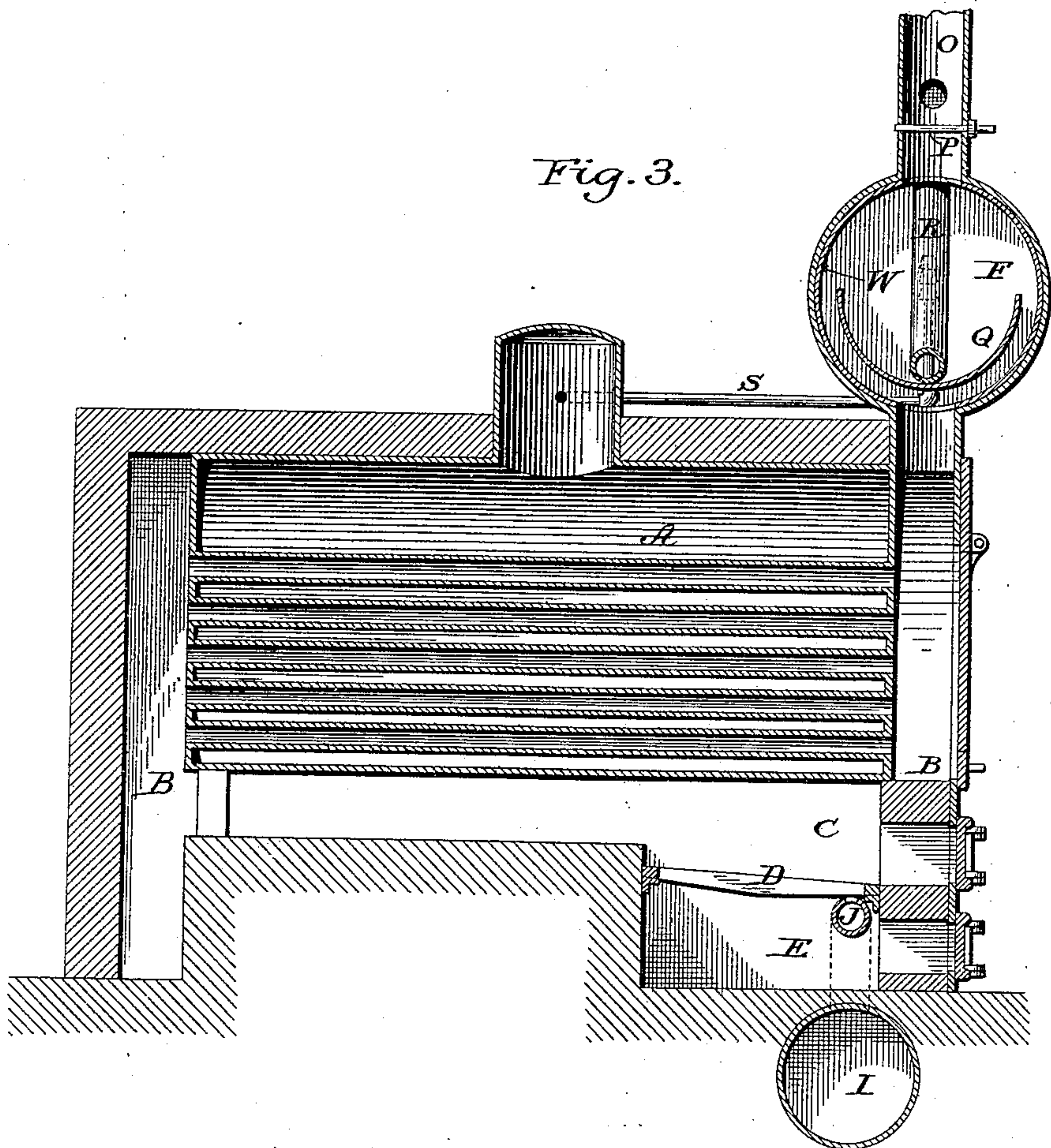
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T. S. WILKIN.

SMOKE CONSUMING FURNACE.

No. 334,066.

Patented Jan. 12, 1886.



Witnesses:

James F. Duhamel.
R. S. Ferguson

Inventor:

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UNITED STATES PATENT OFFICE.

THEODORE S. WILKIN, OF MILWAUKEE, WISCONSIN.

SMOKE-CONSUMING FURNACE.

SPECIFICATION forming part of Letters Patent No. 334,066, dated January 12, 1886.

Application filed September 11, 1885. Serial No. 176,803. (No model.)

To all whom it may concern:

Be it known that I, THEODORE S. WILKIN, of Milwaukee, in the county of Milwaukee and State of Wisconsin, have invented certain new and useful Improvements in Smoke-Consuming Furnaces, of which the following is a specification.

My invention relates to furnaces, more particularly boiler-furnaces, and is designed to cause or facilitate the consumption of the smoke and gases or products of combustion, and thus more perfectly to utilize the fuel, while at the same time avoiding the many evils attending the discharge of such products directly into the atmosphere.

The invention consists, essentially, in an arrangement of air-forcing devices by which the smoke and gases are withdrawn from above the fire, separated into two bodies of different character, and discharged, one beneath or into the fire and the other into the smoke-stack or directly into the atmosphere. It is important that this separation be made previous to passing any portion of the products back to the fire-chamber and before the products pass through the fan or air-forcing device, as the non-combustible gases, if returned with the combustible gases, retard the combustion of the fuel and impair the action of the apparatus, and as the mixture, being a mechanical one, is made more intimate by the action of the fan, whereas by taking out the non-combustible gases before passing any of the products back to the fire-chamber, and before they are acted upon by the air-forcing apparatus, the return of the combustible gases alone is rendered practicable, and the combustion of the fuel is greatly improved.

The details of the apparatus by which I effect the separation of the gases and products of combustion may be considerably varied; but the form which I now deem best embraces as essential features a drum or reservoir, in which the smoke and gases are collected and allowed to settle to a greater or less extent, an air forcing or drawing device communicating with said drum or reservoir and with the fire-chamber, and a separate air forcing or drawing device, also communicating with said drum

or reservoir and with the smoke-stack, or directly with the outer atmosphere.

Fans, steam-blast devices or injectors, or any recognized equivalent of these devices may be used for producing the requisite air-currents; but I prefer a fan for the main current and a blast or jet device for the secondary current, for reasons hereinafter explained.

In the accompanying drawings, Figure 1 is a front elevation, partly in section, of my apparatus in its preferred form; Fig. 2, a side elevation of the forward portion of the same; Fig. 3, a sectional view on the line *x x* of Fig. 1.

A indicates a steam-generator, which, in the present instance, is of the horizontal fire-tube type, set in masonry B, as usual.

C indicates the fire box or chamber, D the grate, and E the ash-pit, which may be of usual construction and arrangement, or specially designed and proportioned with reference to the remaining portions of the apparatus.

F indicates a drum or reservoir, into which the smoke, gases, &c., pass from the boiler-flues or from the furnace, and which is here represented as placed directly above the boiler-setting—a position which I deem advantageous because of the space available, the convenient support, and the facility with which the smoke and gases can be carried into it at that point.

G indicates a fan or blower communicating with the drum or reservoir F by a pipe or trunk, H, through which the products of combustion are withdrawn from the drum or reservoir. The trunk or pipe advisably connects with the drum or reservoir at or about the middle, and may advantageously open into the top thereof, where the lighter and more volatile gases, which are likewise the more combustible, naturally accumulate. From the fan or blower G and pipe H the smoke and gases are discharged into a trunk or drum, I, which may be conveniently located beneath the floor of the furnace-room, and from this trunk they enter the fire-chamber by pipes J, branching from the drum and extending into the space above or below the grate, or partially above and partially below the same, as found expedient. The pipes J pass through the walls

of the furnace setting or masonry, are closed at their inner ends, and the portions within said walls are perforated to permit the gases and smoke to escape, but to cause them to escape in the shape of numerous small jets or streams. The trunk or pipe H is provided with a branch pipe, K, opening into the atmosphere, and furnished with a damper or valve, L, in order to admit and regulate the admission of fresh air sufficient to properly support combustion. Said pipe H is also furnished with a valve or damper, M, to control the current passing through it, and the branch pipes J J are likewise supplied with dampers N, to regulate the passage of smoke and gases through each independently, and to prevent either from drawing away from the other by reason of difference in relation to the fan and the supply-trunk. In like manner the smoke stack or pipe O is furnished with a valve or damper, P, which may be opened to give the necessary draft in starting the fire, and which is generally kept very slightly open at other times.

Within the lower half of the drum or reservoir F is placed a semi-cylindrical guard or shield, Q, extending from end to end of the drum and set away from the interior thereof a few inches, as illustrated in Figs. 1 and 3. This guard or shield causes the smoke and gases entering the drum or reservoir F through the neck or pipe a to be thrown outward against the walls of said drum until they reach the upper edges of the shield, and, owing to the comparatively small space thus afforded for their passage, the smoke and gases pass between the drum and shield under some pressure, which is relieved the instant they rise to said level. This insures a proper delivery or discharge of the heavy as well as the lighter gases into the drum or reservoir; but as soon as the mixed gases reach the enlarged open space of the drum and are relieved from the strong draft or pressure occasioned by the suction of fan G, drawing through the space between the drum and guard or shield, a separation of the gases takes place by reason of the difference in specific gravity. In this way the carbonic-acid gas, which greatly impedes, and in sufficient quantity would entirely prevent, combustion, drops down to the bottom of the space within the guard or shield, while the lighter and inflammable or combustible gases, the sooty particles, &c., are taken up and carried off by the current produced by fan G.

R indicates a pipe, which extends along the bottom of the concave receptacle or space above the shield or guard, and which is perforated or cut away along its under side, as shown in Fig. 1, to prevent the heavy gases settling within said space to enter the pipe. Said pipe is carried from the drum or reservoir F to the smoke stack or pipe O, which it enters at a point above the damper P, or the pipe R may open directly into the atmosphere.

Within the pipe R, I place a blast-pipe, S,

having a suitable jet or injector nozzle, T, and communicating with the steam-space of the boiler, so that when the valve U is opened steam is caused to pass through said pipe to issue from the jet or nozzle and to create a strong upward current through the pipe R. This draft or current is supplied from the contents of drum F, and as the inner end of the pipe R is immersed or enveloped in the heavier non-combustible gases which settle within the hollow of shield Q, said heavier gases supply the draft of pipe R and pass off through said pipe to the smoke-stack or to the open air. The steam-pipe S is furnished with a valve, V, by which the flow of steam may be regulated or cut off at will.

In order to prevent the drum from burning out, I provide it with an interior lining of asbestos, fire-clay, or other refractory or indestructible material, each lining being indicated by W in Fig. 3.

The operation of the apparatus is as follows: Fuel is placed upon the grate and the fire is started in the usual way, the damper of the smoke-stack and the ash-pit doors being opened to give the necessary draft and the boiler being supplied with a proper quantity of water. When steam is formed in sufficient quantity to drive either the engine which the boiler is specially intended to supply or a small engine provided for the purpose of driving the fan, said fan is put in motion and the damper in the smoke-stack is nearly or quite closed. The dampers or valves of the pipes leading from the smoke reservoir or drum to the fire-chamber are then opened more or less, as required, and the valve of the steam-engine is likewise opened. The fan draws the products into the drum or reservoir, the heavy carbonic-acid gas and other heavy non-combustible gases settle in the concave upper side of the shield or guard and are drawn out through the pipe leading into the smoke-stack or into the air through the action of the steam-jet, and the lighter and combustible gases are carried from the drum or reservoir by the fan and passed back to the combustion-chamber. The relative sizes of tubes and passages will of course depend upon the character of the furnace, the nature of the fuel, and like considerations; but to meet all contingencies I prefer to make all of ample capacity and reduce the capacity as required by the aid of dampers or valves.

It will be seen that a fan may be substituted for the steam-jet, and that other air-moving devices may be employed instead of the fan shown. I, however, prefer the arrangement shown and described, because for moving a large volume of light gases the fan is very convenient and efficient, while for moving the heavier gases the strong steam-blast is peculiarly useful, and the moist steam serves to settle the dust and quench the sparks which otherwise would pass off in greater or less quantity. For these reasons I consider the

steam jet or blast as something more than the mere equivalent of the fan, and it is also more compact and convenient.

In speaking of the fire-space I mean to include not only the space actually occupied by the fire, but the grate-space above and below the same.

It will be observed that by my apparatus I effect the separation of the gases before they undergo the intimate mingling and mixing incident to passage through the rapidly-revolving fan, after which passage separation is exceedingly difficult. It will also be observed that by my plan and construction the non-combustible gases are carried only a short distance, and are removed from the drum without traveling therefrom through other parts of the apparatus. This is an exceedingly important consideration, because if the mingled gases were carried together down to or below the fire-space and an escape were provided beyond said point it is apparent that the lighter gases would naturally pass to such escape and leave the heavier non-combustible gases to circulate through the furnace.

It will of course be understood that this invention is applicable to any and all furnaces, and is not restricted to boiler-furnaces.

I am aware that it is not broadly new to return the smoke and gases to the space beneath the fire, that it is not new to discharge the surplus smoke and gases into the atmosphere, and that it has been proposed to separate the combustible and incombustible gases, discharging the former beneath the fire-space and the latter into the atmosphere; but I am not aware that any one has ever before practically attained this important result. As stated at the outset, such separation can only be effectually made before the products pass through the fan or air-forcing device, and it is further necessary that the separation be made before the intercommingling of the gases has been carried to any considerable extent. If the gases be drawn by force through a pipe before the separation is effected, it will be exceedingly difficult, and, as I believe, impossible, to separate them to any considerable extent. To practically and successfully attain this end the gases must be allowed to spread out in a large body and to separate naturally by the difference in specific gravity; hence a large drum or reservoir directly receiving said products from the furnace is essential.

In the only apparatus hitherto proposed for effecting such separation, so far as I am aware, the smoke and gases were to be drawn downward into a box containing two fan-chambers separated by a perforated diaphragm or grating. Such an apparatus I believe impracticable, for the reason that it necessitates a downward passage of the products through a pipe to reach the box, which passage could only be secured by the aid of suction or blast, either of which would cause a very intimate mixing of the gases, and for

the further reason that in passing through a perforated diaphragm the mixing of the gases would be further increased.

While therefore disclaiming the construction spoken of, I believe myself to be the first to construct an apparatus in which the separation is permitted to take place before the smoke and gases are in any manner acted upon by blast or suction, and such apparatus I desire to claim accordingly.

Having thus described my invention, what I claim is—

1. In a smoke-consuming furnace, the combination, with a fire-chamber, of a smoke drum or reservoir, into which the smoke and products of combustion pass directly from the furnace, a pipe communicating with said reservoir and with the fire-chamber, an air-forcing device in or communicating with said pipe, a separate pipe communicating with the smoke-drum and with the atmosphere, and an air-forcing device in or communicating with said second pipe, whereby the products of combustion are separated into two classes previous to being acted upon by the air-forcing devices, one class returning to the fire-chamber and the other class discharged into the air.

2. In combination with a furnace, a smoke-drum above said furnace, and into which the gases rise by their own buoyancy, a passage leading from the upper part of the drum to the fire space, and a passage leading from the lower part of the drum to the outer atmosphere, whereby the lighter and more volatile gases are separated and conducted from the drum to the fire-space, and the heavier and non-combustible gases are delivered into the air.

3. In combination with a furnace, a drum or reservoir communicating directly therewith and receiving the gases free from pressure, a pipe passing from the lower part of said drum to the atmosphere, a second pipe connecting with the drum above the opening of the first, and air-forcing devices for each pipe, adapted to produce an outward current through the same from the drum.

4. In combination with a furnace, a smoke-drum communicating with the interior thereof, a concave shield or guard within the lower part of said drum, but separated therefrom by an open space or passage beneath, a passage leading from the drum to the fire-space, a separate passage leading from the concave upper side of the shield to the outer air, and air-forcing devices communicating with said passages, and serving to produce a current of air or gases through each.

5. The herein-described furnace and smoke-consumer, consisting of a fire-space and grate, a drum, F, opening therefrom, a shield, Q, located in the lower part of said drum and concave on its upper side, a trunk or passage, H, leading from the drum to the fire-space, a fan or air-forcing device, G, communicating

with said pipe, a pipe, R, extending along the upper side of the shield and opening into the atmosphere, and an air-forcing device communicating with said pipe R.

- 5 6. The combination, substantially as described and shown, of a furnace, a smoke-drum, F, having shield Q, pipe H, extending from drum F to the fire-chamber and pro-

vided with fan G, pipe R, communicating with the space above the shield Q and with the air, and steam-pipe S, provided with jet or nozzle T.

THEODORE S. WILKIN.

Witnesses:

CHARLES ALLIN,
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