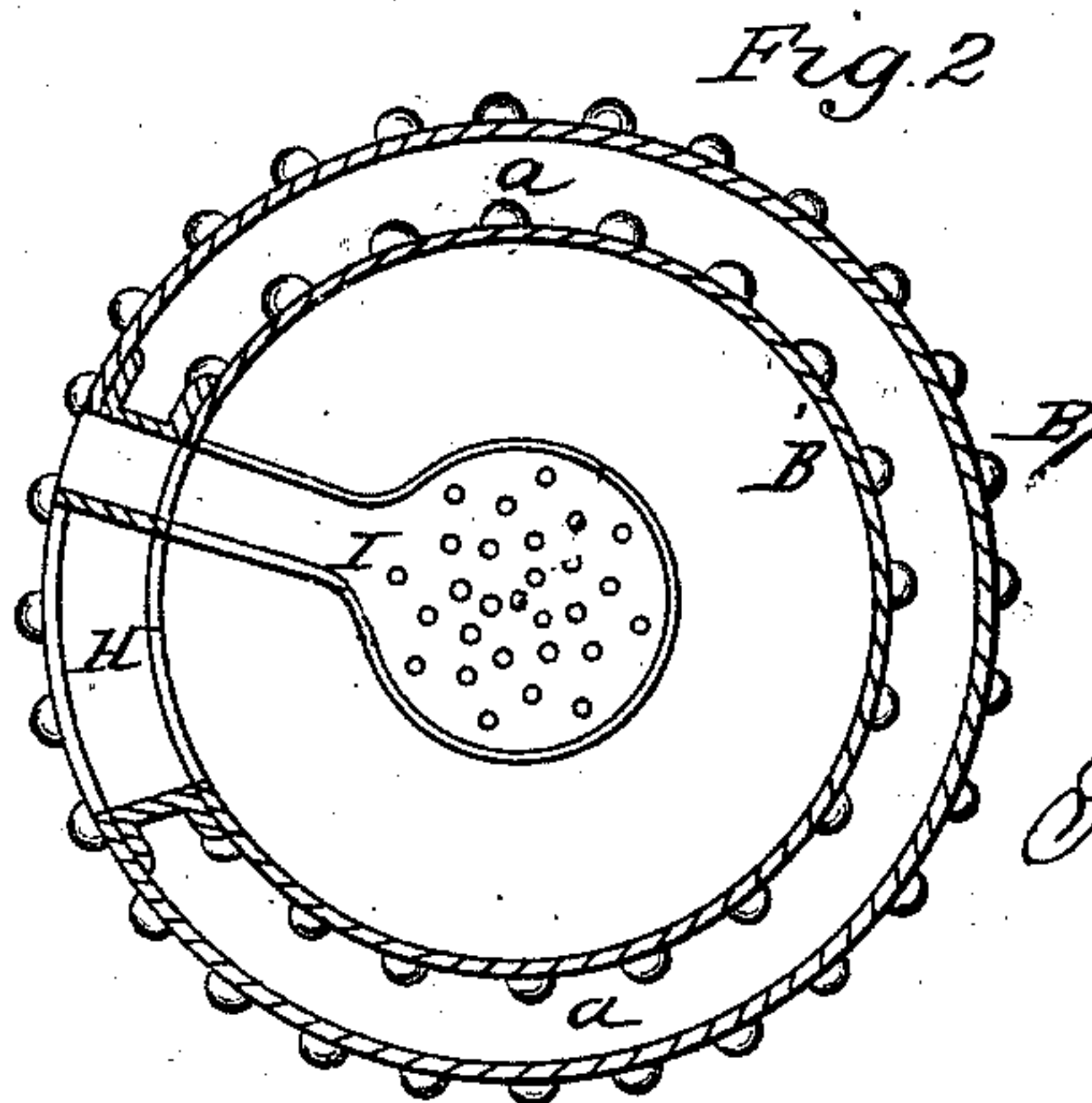
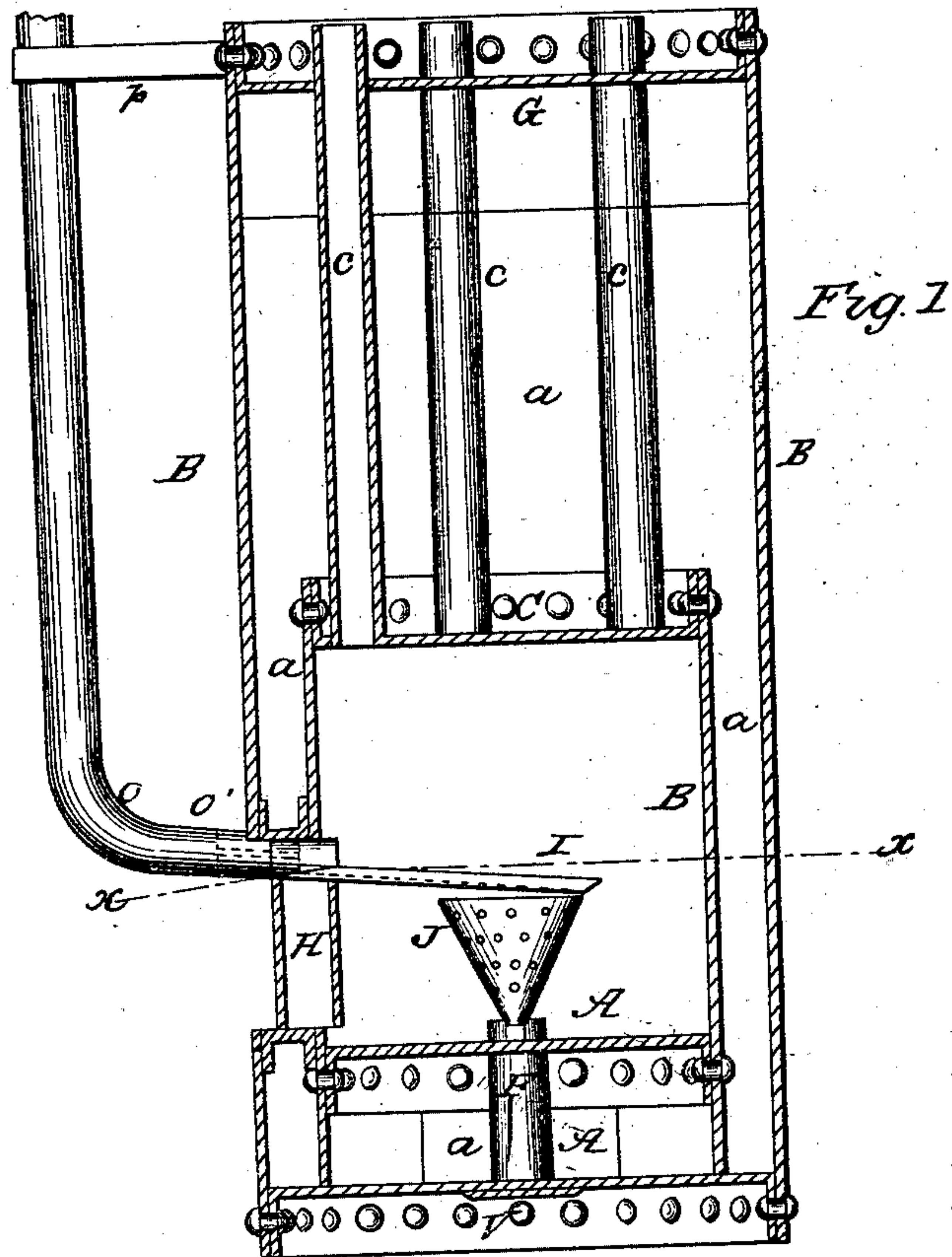


S. P. LEGG.  
Hydrocarbon Burner.

No. 80,413.

Patented July 28, 1868.



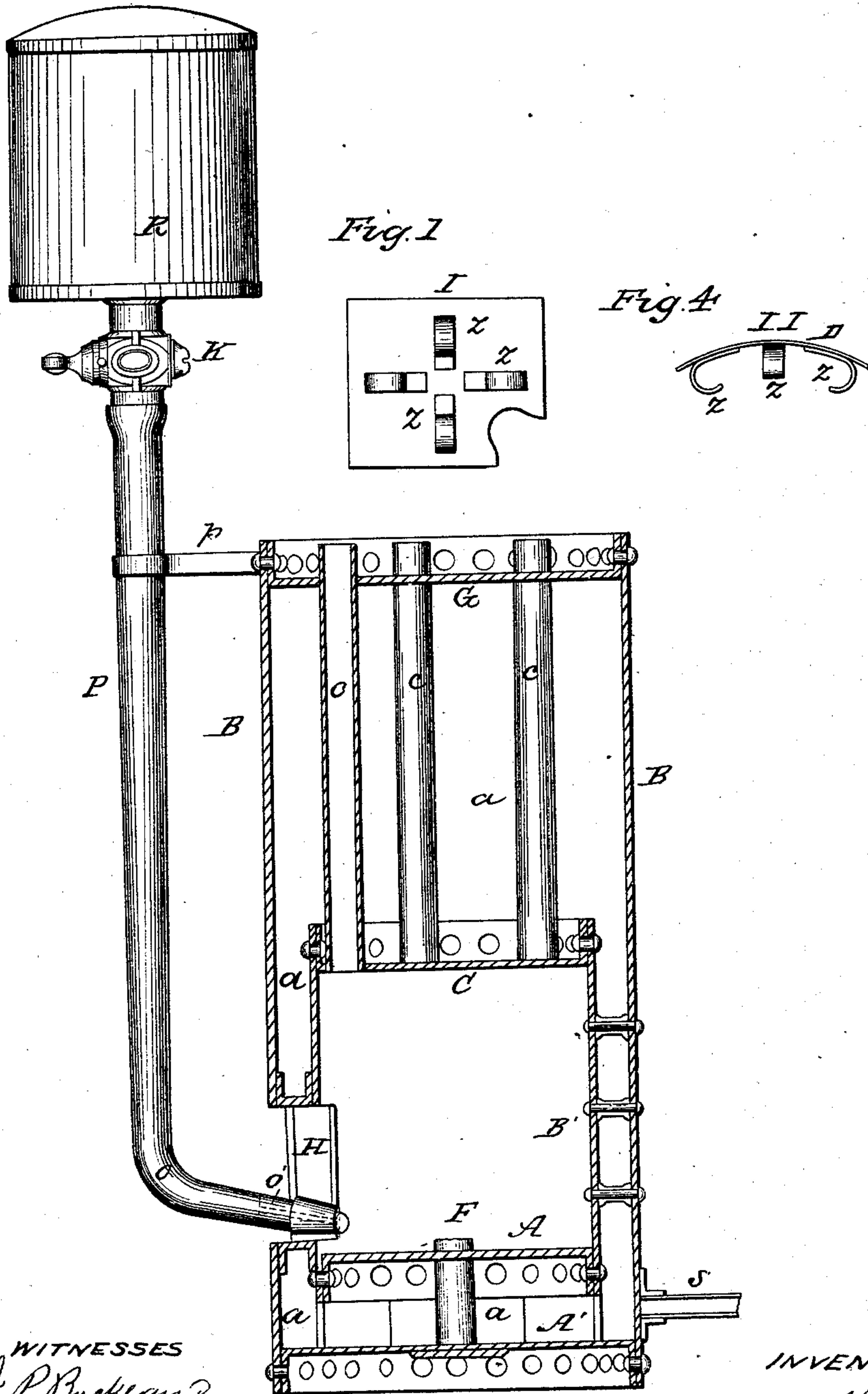
WITNESSES  
J. P. Buckland  
E. J. Somner

INVENTOR  
James P. Legg

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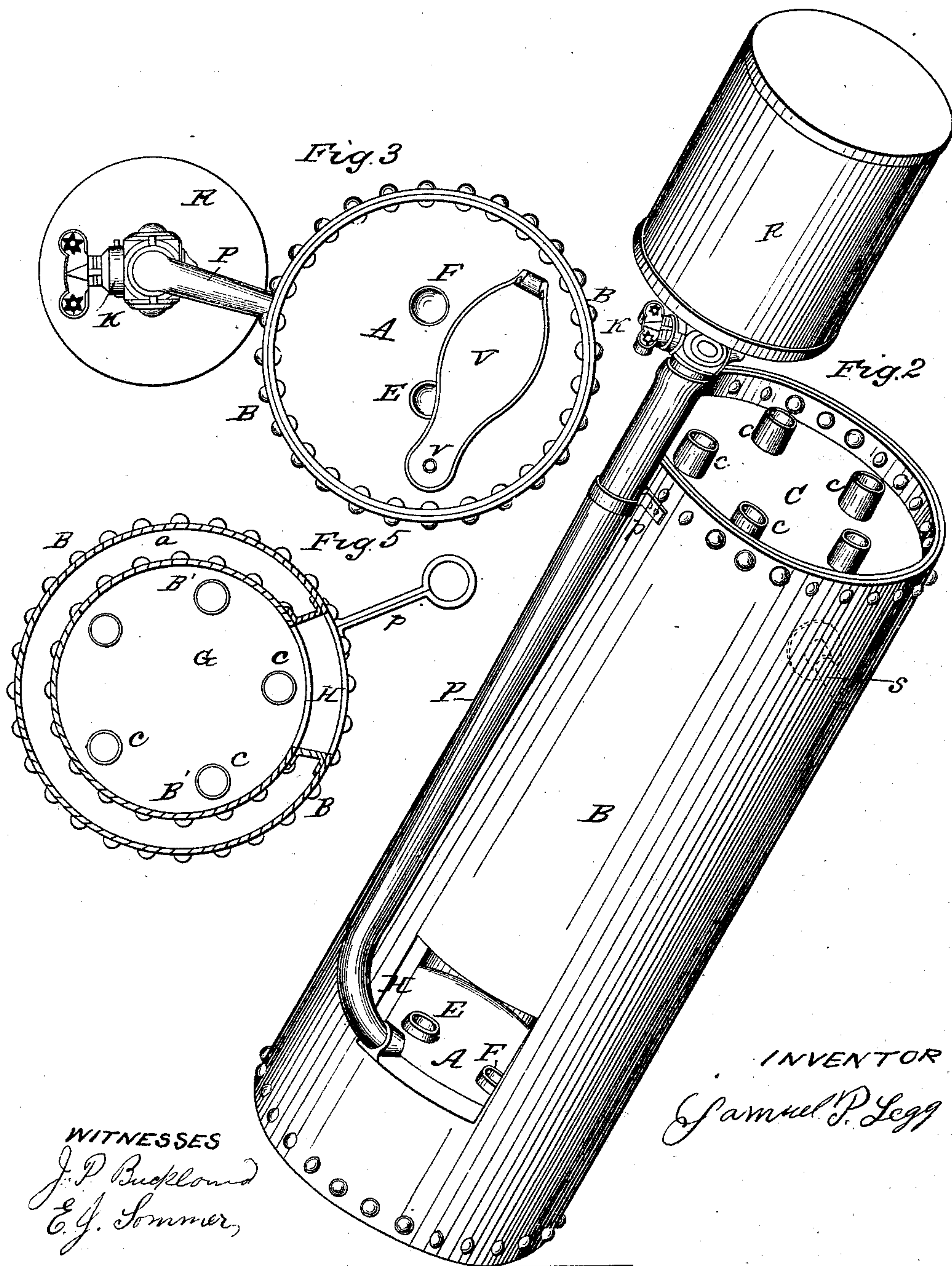


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3 Sheets—Sheet 3.

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INVENTOR  
Samuel P. Legg



# United States Patent Office.

SAMUEL P. LEGG, OF SPRINGFIELD, MASSACHUSETTS.

*Letters Patent No. 80,413, dated July 28, 1868.*

## IMPROVEMENT IN HYDROCARBON-BURNERS.

*The Schedule referred to in these Letters Patent and making part of the same.*

TO ALL WHOM IT MAY CONCERN:

Be it known that I, SAMUEL P. LEGG, of Springfield, in the county of Hampden, and Commonwealth of Massachusetts, have invented a new and improved Apparatus for Using Liquid Fuel in Steam-Boilers; and I do hereby declare that the following is a full, clear, and exact description thereof, reference being had to the accompanying drawings, making a part of this specification, and to the letters and figures of reference marked thereon, in which,

In plate 1—

Figure 1 is a vertical axial section of a steam-boiler, the fire-box of which is fitted for burning liquid fuel, and

Figure 2 is a horizontal sectional view of the said boiler, the plane of section passing through the line  $x y$ , fig. 1; and

In plate 2—

Figure 1 is a vertical axial section of the same steam-boiler shown in plate 1, in the fire-box of which the liquid fuel is introduced and burned in a different manner.

Figure 2 is a perspective view of such steam-boiler.

Figure 3 is a reverse plan of the same, and

Figure 5 is a plan view of said steam-boiler, the fuel-tank and supply-pipe being removed.

Figure 4 (I and II) shows the inside of the door of the fire-box, and also a side elevation of the same.

My invention is shown as applied to an upright-flue boiler, but may be applied, with equal efficiency, to any of the usual forms of steam-boilers.

It consists in a certain construction and arrangement of the fire-box with reference to the water-space of the boiler, and with reference also to the admission of the supply of draught or air; and further, to the manner of introducing the liquid fuel into the fire-box and burning it therein.

The liquid fuel herein referred to is petroleum, or any of the compounds or products thereof, alcohol, or any hydrocarbon or liquid which is of an inflammable nature, and will support combustion without being percolated through wicks or porous substances. I find, however, that crude petroleum or naphtha, being articles readily procured at a cheap rate, make a serviceable fuel for use in my apparatus.

In my invention, the fuel is contained in a reservoir, which is elevated so as to project the liquid forcibly through a tube into the fire-box, or the same effect may be obtained by using a direct-acting pump, or by injecting air into the reservoir, so as to cause pressure upon the surface of the liquid. The aperture in the conducting-pipe is much contracted at the end which enters the fire-box, and the flow of the liquid is regulated by a stop-cock. The fire-box is provided with a door which closes tightly, so that no air is allowed to enter except through one or more flues, which extend from the bottom of the boiler to a point above the bottom of the fire-box. The ends of the air-flues are carried above the floor of the fire-box, to prevent any of the liquid injected from running out through the flues. These flues are closed by valves, so that the supply of draught can be accurately regulated, and entirely cut off when the fire is to be extinguished. The smoke-flues extend upward from the top of the fire-box in the usual manner. As the floor of the fire-box will become highly heated by the liquid burned upon it, the box is elevated, so as to leave a clear water-space between the bottom of the fire-box and the bottom of the boiler, and the feed-water can be advantageously introduced at this point.

The liquid may be injected directly upon the bottom of the fire-box, and there burned without difficulty, after the plate becomes somewhat heated; but I prefer to allow the fuel to pass first into a perforated conductor, where it is ignited, and thence to trickle into another perforated vessel below, from which any unconsumed liquid falls upon the floor of the fire-box, and there burns. The liquid fuel, thus extended over perforated surfaces, ignites more readily, and the conductor and vessel beneath being made of thin metal, soon become heated to a high degree, and the combustion goes on rapidly.

The construction of my invention is as follows:



B is the shell of an upright-flue boiler, with head G and bottom-plate A', in which latter plate are the lower ends of two air-flues, F F, which flues may be proportioned in size and number to the capacity of the fire-box.

An opening, H, is made in one side of the boiler and fire-box, and is closed by the door D, fig. 4, which is made so as to close the opening H as nearly air-tight as possible.

I consider it essential to the efficient working of my invention that the draught should be entirely supplied through the air-flues, and that, after the fire is once kindled, all openings in the sides of the fire-box should be closed, unless the air-flues are made to enter at the side near the bottom.

The fire-box itself is made of heavy boiler-iron, and is cylindrical in section, like the shell of the boiler in which it is enclosed. It may, however, be of any shape, to conform to boiler-shell. It is elevated a few inches above the bottom, A', of the boiler, and also is of so much less diameter, that a free water-space is left entirely around the box.

The box may be supported by flanges extending down to the bottom-plate A' of the boiler, and so arranged as not to obstruct the circulation of the water, or by stay-bolts, or by other devices used in boiler-work.

I prefer to inject the feed-water at the lower part of the boiler, through the pipe S, so that it will first meet the heated bottom, A, of the fire-box.

From the top, C, of the fire-box the smoke-flues *c c* extend, through the head G of the boiler, into the smoke-space above, and these flues are to be inserted precisely as in boilers heated with coal or wood.

The liquid fuel is placed in the reservoir R, and conducted thence to the fire-box by the tube P, provided with a stop-cock, K, and supported by a stay, *p*.

The opening *o* in the pipe is contracted to a very small diameter at *o'*, inasmuch as a small jet only of the liquid is necessary to produce a strong and steady combustion. The lower end of the pipe P is entered at one corner of the door H, but may be inserted at any point in the side of the boiler.

The reservoir R may be placed at any distance from the boiler, and the containing-barrel may itself be used as the reservoir, and connected by tubing with the pipe P.

In plate 1, figs. 1 and 2, is shown the device for receiving the liquid fuel from the pipe P, which consists of the conductor I and funnel J. The bowl of I is perforated with fine openings, while the narrower part extends beneath the nozzle of the pipe P, and serves as a trough to carry the liquid to the perforated bowl. A short distance beneath the bowl is the perforated funnel J, which rests upon a stem set in the bottom of the fire-box.

When the liquid is admitted into the conductor I, it is evident that it will diffuse itself over the bowl of the conductor and over the funnel J, and, if ignited, will soon heat the conductor and funnel and the contained liquid, and that the latter will thus become much more inflammable. The liquid, thus ignited and heated, will then pass through the openings in the funnel; and fall upon the bottom of the fire-box, where it will be entirely consumed. The fuel may also be thrown directly upon the bottom of the fire-box, as represented in figs. 1 and 2, plate 2, and there burned; but in this method it will be expedient to place in the fire-box a small quantity of waste or shavings, saturated with the liquid, and kindle the same, so as to heat the bottom of the fire-box at the start. But I find that the fuel burns more readily and rapidly if allowed to percolate through perforated plates, and thus become highly heated before it comes in contact with the bottom of the fire-box.

It will be seen that a fire-box of this construction can be applied without difficulty to many steam-boilers now in use, and that it is much cheaper than the fire-boxes now used for the burning of coal and wood, and also that the conveying-pipe P cannot become heated so as to generate gas in the pipe or ignite the contained liquid.

I am aware that many methods of burning liquid fuel in steam-boilers have been made public, and I do not claim the construction of the steam-boiler shown, except so far as relates to the particular construction and arrangement of the fire-box, air-flues, and the management of the draught-supply. Nor do I claim the use of liquid fuel as a means of heating steam-boilers, except substantially in the manner described.

Having described my invention, what I claim as new therein, and desire to secure by Letters Patent, is—

1. A fire-box for burning liquid fuel in a steam-boiler, having the bottom-plate A elevated above the bottom of the boiler, for the purpose specified, and air-flues F F, closed by valves, and so arranged that the draught is entirely supplied through the air-flues, in combination with the reservoir R and supply-pipe P, having a contracted nozzle, *o'*, and so inserted in the fire-box as to prevent heating the liquid fuel until it leaves the pipe P, the whole arranged and operating substantially as described.

2. The combination and arrangement of perforated conductor I, perforated funnel J, and the pipe P, having a contracted opening, *o'*, applied to the fire-box of a steam-boiler, substantially as described.

In witness whereof, I have hereunto set my hand, this 13th day of May, 1868.

SAMUEL P. LEGG.

Witnesses:

J. P. BUCKLAND,  
E. J. SOMMER.