(No Model.) 3 Sheets—Sheet 1.

J. W. F. SOLE.

FURNACE.

No. 560,657. Patented May 26, 1896.

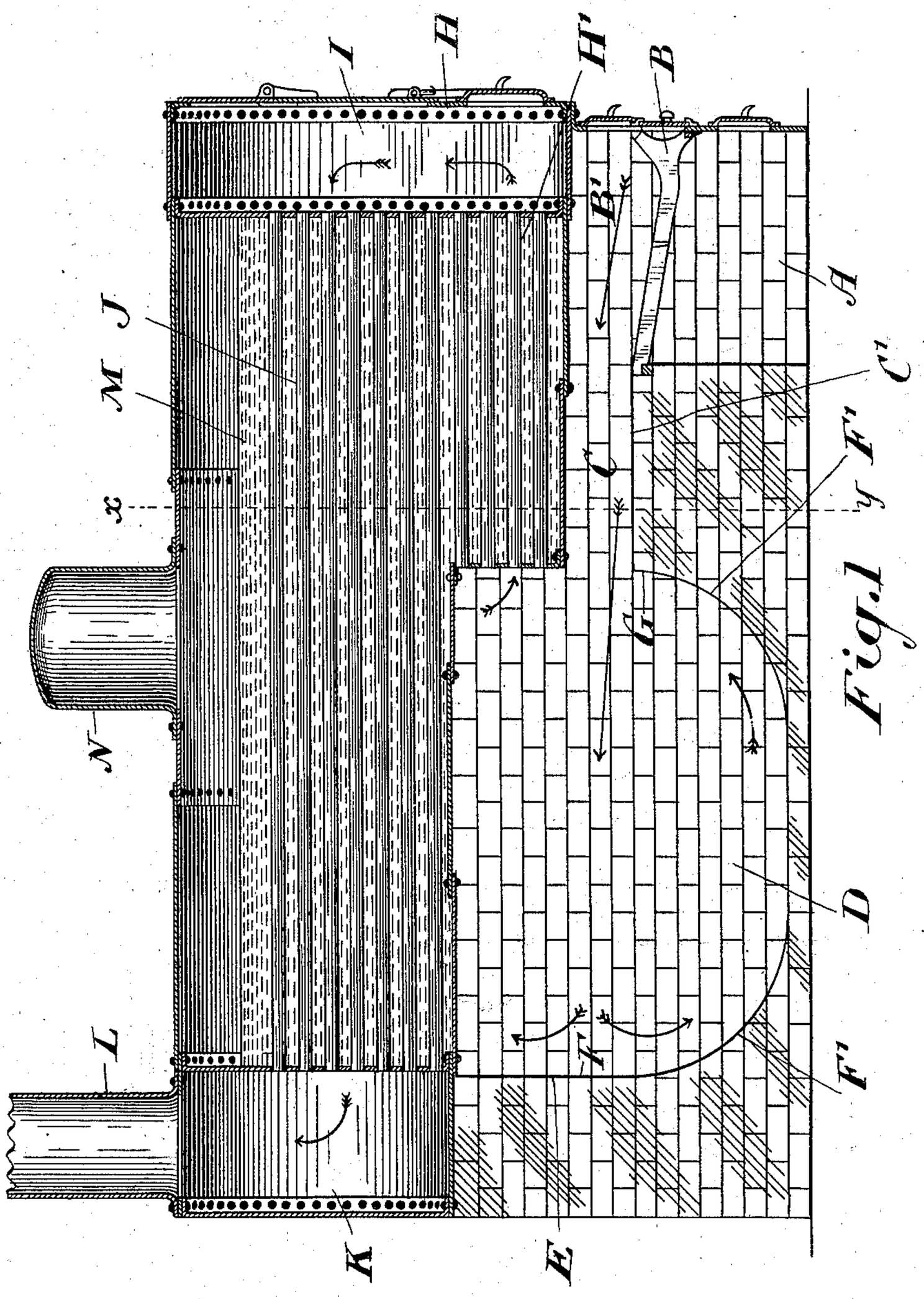

Fig. 1.

Witnesses

W. G. McMillan

Fred Clarke

Inventor

J. W. F. Sole

by

Ridout & Maybee

Attys

(No Model.) 3 Sheets—Sheet 2.

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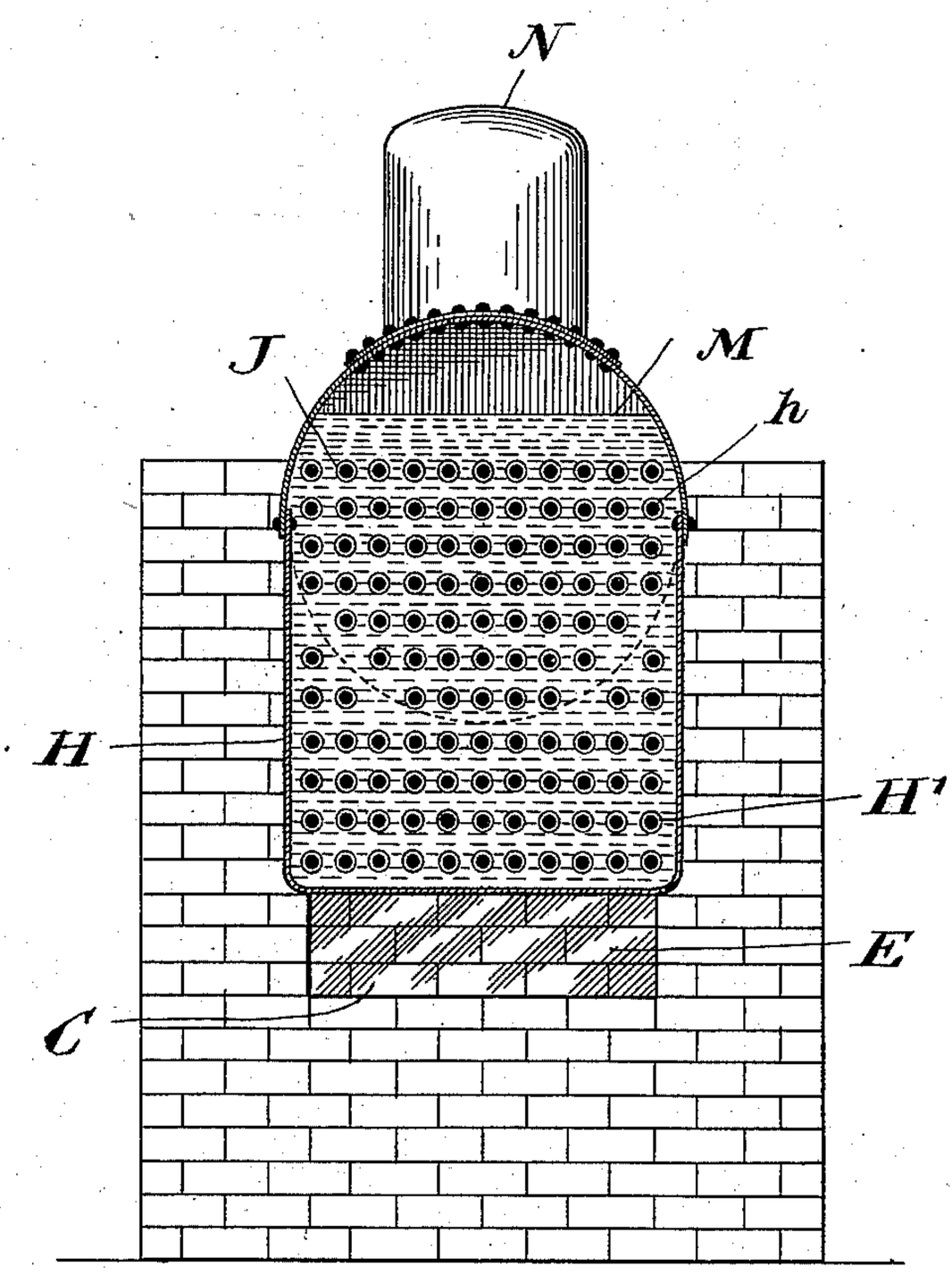

Fig. 2.

Witnesses

W. J. McMillan

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(No Model.) 3 Sheets—Sheet 3.

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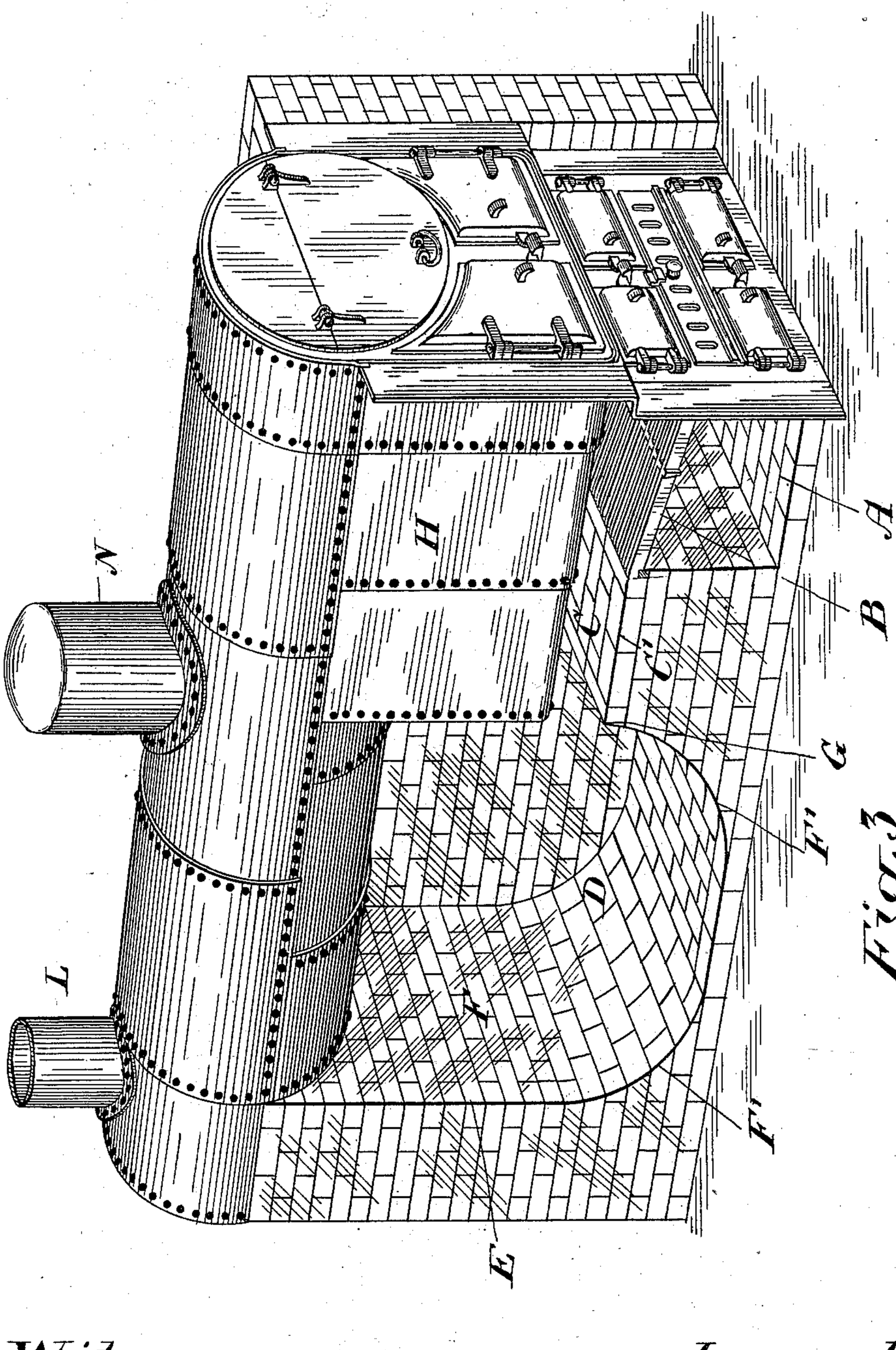

Fig. 3

Witnesses
W. G. McMillan
Fred Clarke

Inventor
J. W. F. Sole
by Ridout & Maybee
Att'ys

UNITED STATES PATENT OFFICE.

JOHN W. F. SOLE, OF GUELPH, CANADA.

FURNACE.

SPECIFICATION forming part of Letters Patent No. 560,657, dated May 26, 1896.

Application filed October 25, 1895. Serial No. 566,914. (No model.)

To all whom it may concern:

Be it known that I, JOHN WALKER FLAVELL SOLE, baker, of the city of Guelph, in the county of Wellington, in the Province of Ontario, Canada, have invented certain new and useful Improvements in Furnaces, of which the following is a specification.

The object of my invention is to provide a furnace in which the combustion-chamber is so constructed as to secure a more perfect combustion of fuel than is usual and in which the fuel may be consumed without making smoke; and it consists, essentially, in providing a combustion-chamber closed at its rear end, against which the heat and liberated gases from the fire-chamber are projected by the draft in such a manner as to be deflected backward until finally, after the heavier particles have been completely consumed, the heated and inflamed gases pass through short tubes in the lower portion of the boiler immediately over the fire-chamber to a chamber in the front of the boiler, from whence they pass through the long tubes of the boiler in a highly-heated condition, and finally escape through the smoke-stack at the rear end of the boiler with a minimum amount of smoke, as hereinafter particularly described and then definitely claimed.

Figure 1 is a longitudinal section through the center of the boiler and furnace. Fig. 2 is a transverse section through line *x y* in Fig. 1. Fig. 3 is a perspective view of my improved furnace.

In the drawings like letters of reference indicate corresponding parts in the different figures.

In Fig. 1 A is the ash-chamber, through which the air enters the interior of the combustion-chamber. B are grate-bars, which are preferably shown, as described in my Canadian Letters Patent No. 14,603, and which are specially adapted to my improved furnace, as they divert the heated and liberated gases so as to enter the combustion-chamber in an oblique direction. B′ is the fire-chamber, which, when used with the ordinary grate may be of ordinary construction. C is the inlet from the fire-chamber to the combustion-chamber. This inlet is formed between the fire-bridge wall C′ and the bottom of the boiler H. D is the combustion-chamber, preferably shaped as shown, with the bottom rounded, as at F′. E is the rear wall of any combustion-chamber. This rear wall in my improved furnace is extended upwardly, so as to reach the bottom of the boiler and thus completely close the rear end of the combustion-chamber for the purpose hereinafter more particularly set forth. F is a portion of the rear wall of the combustion-chamber, against which the heat and liberated gases from the fire-chamber are projected and thence deflected. H′ are short tubes formed in the bottom of the supplementary portion of the boiler H. I is the front chamber of the boiler, and J are the long tubes extending longitudinally through the boiler and which are surrounded by the water M. K is the rear chamber, which receives the heated and inflamed gases and smoke after passing through the long tubes in the boiler, and L is the smoke-stack, through which these gases and smoke may escape to the outside. N is a steam-dome on the boiler, of usual construction. In this figure it will be seen by the arrows the course the liberated and inflamed gases take in passing through my improved furnace and boiler.

After the heated gases are liberated from the fuel in the chamber they pass in the direction of the long arrow and impinge against the rear vertical wall of the combustion-chamber at that portion thereof marked by the letters F. Here these gases are deflected, the more completely-inflamed and lighter portions rising to the top of the combustion-chamber, as indicated by the small arrow, while the heavier particles, being the cooler or imperfectly-consumed portions, descend to the rounded portions of the combustion-chamber at F′, and thence are deflected backward to the front of the chamber, and, reaching the point G on the fire-bridge wall, they again meet with the inflowing gases from the fire-chamber and are carried back again toward the portion F of the rear wall E, when, being now more completely consumed and the gases being in an inflamed condition, they rise to the top of the combustion-chamber, as already indicated when referring to the lighter portions already referred to, and pass from

thence, being deflected backward, into the outlet formed by the short tubes H′, more particularly shown in the cross-section through line *x y*, Fig. 2.

By reason of the gases being thrown back by the closed rear wall and not being permitted to escape in the usual manner at the rear end of the combustion-chamber more perfect combustion of all the parts is attained, and I am enabled to consume the fuel without making smoke, which is preferable to trying to burn it after the smoke has been made.

This improved furnace, which diverts and throws back the inflowing gases, permits of the gases being mixed with the oxygen from the air flowing in from the ash-chamber and being converted into flame and passing through the increased length of the tubes, as shown, by the short tubes H′ and the long tubes J, will not only supply more heat than the smoke which ordinarily passes through the tubes of the boiler, but will also deposit little if any soot, as all the particles have been completely consumed in my combustion-chamber before entering these tubes. This non-deposition of the soot will be of great advantage, as soot is a non-conductor of heat.

Fig. 2 in cross-section shows the orifices *h* in the short tubes H, through which the heated and inflamed gases pass to the forward end of the boiler. This is a view looking to the rear into the combustion-chamber.

In Fig. 3 is shown more particularly the shape of the combustion-chamber with the vertical rear wall E closed and the lower portion thereof rounded, so as to facilitate the rotary motion of the heavier and unconsumed particles of fuel which enter the combustion-chamber, which as they are not permitted to escape at the rear end of the combustion-chamber, by reason of the closed wall E, are caused to circulate within the combustion-chamber until they have become completely consumed, and the gases are then carried over from the upper portion of the combustion-chamber, as already indicated.

The courses of the heated gases after entering the short tubes H′ are indicated by the arrows, which show the gases rising into the front chamber I and passing from thence through the long horizontal tubes of the boiler to the front chamber K, which communicates directly with the smoke-stack L in the usual manner.

The liability of my boiler burning at any point—such as directly over the bridge, as in the present way of setting boilers—is greatly lessened, the heat being distributed over the surface of the boiler and not concentrated at one point.

This improved form of furnace and boiler will prove very effective where forced drafts, such as steam-jets, are used, and will prove very economical in marine boilers or boilers where the combustion-chamber is surrounded by a water-chamber as well as in water-tube boilers.

In the ordinary method of boiler-setting the gases, after being liberated by the action of the heat of the furnace from the fuel, pass at once from a temperature too low to secure their complete combustion to a gradually-diminishing temperature till they finally escape in dense volumes of black smoke, thus involving a great loss of fuel as well as causing annoyance to residents in the neighborhood.

I claim that the gases liberated from the fuel in my form of furnace will be so mixed with sufficient oxygen as to insure perfect combustion within the combustion-chamber and pass from the furnace to a higher temperature in passing to the short tubes H′, which are located immediately over the fire-bridge wall and the fire-chamber, so that by the time the gases enter the front chamber I they are in a highly heated and inflamed condition and pass through the long tubes of the boiler in this state, thus affording a larger and more perfectly-heated surface to generate steam from the water surrounding these highly-heated tubes. It is thus evident that by the time the gases reach the smoke-stack they are nearly freed from smoke and the full benefit of the heating property derived from the fuel will have been attained.

What I claim as my invention is—

In a furnace, a fire-chamber, a fire-bridge wall at the rear thereof, a combustion-chamber having a closed rear end and communicating with said fire-chamber over said fire-bridge wall, the said combustion-chamber having rounded ends, short tubes over the fire-bridge wall and fire-chamber, and longer tubes extending to the rear of the furnace and forming passages from the short tubes to the smoke-outlet, the ends of said short tubes being substantially in line with the inner rounded end of the combustion-chamber, substantially as and for the purpose specified.

Guelph, October 19, 1895.

JOHN W. F. SOLE.

In presence of—

CLAYTON PETERSON,
WILLIAM PEER.