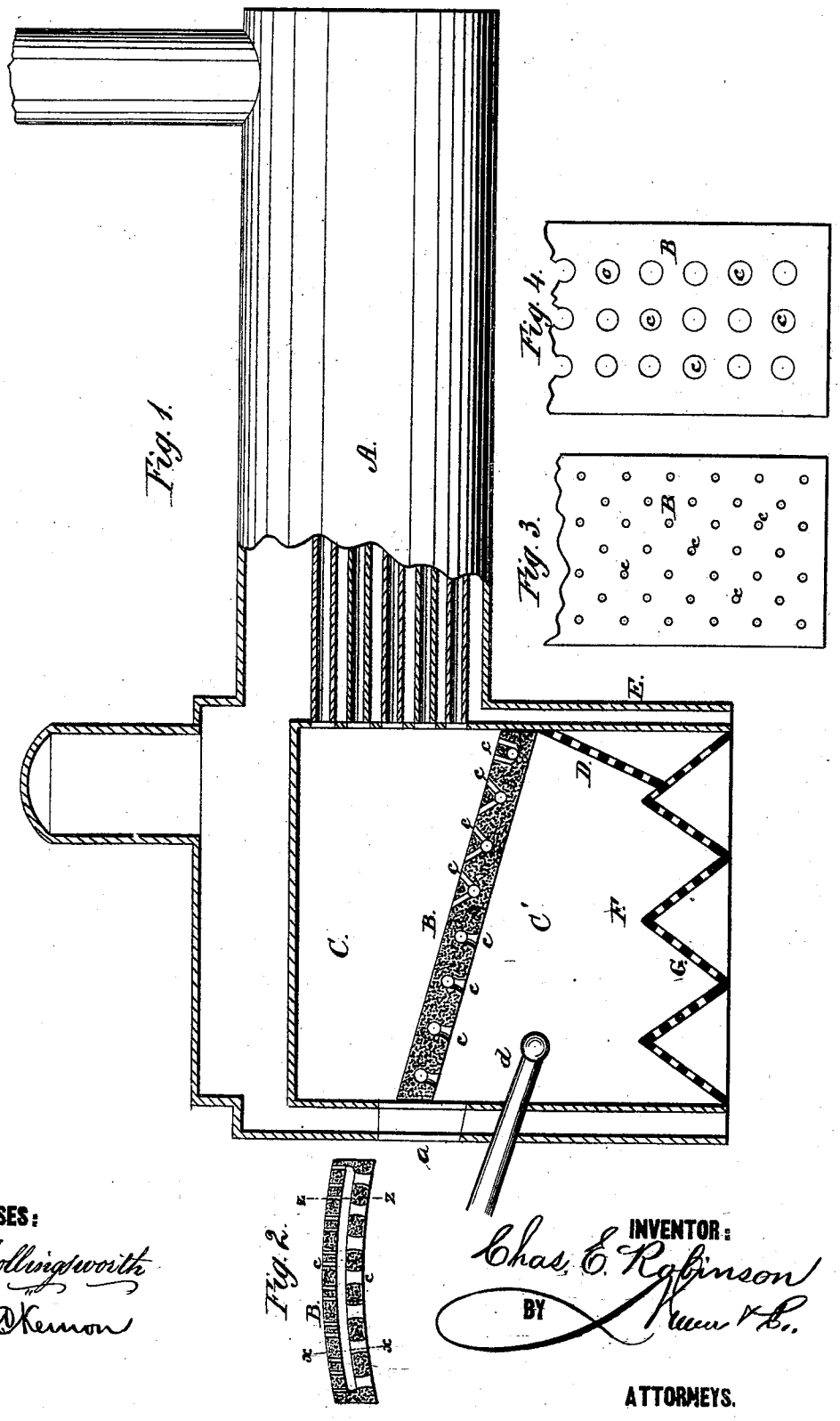
C. E. ROBINSON.

STEAM BOILER-FURNACE.

No. 171,632. Patented Dec. 28, 1875.



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IMPROVEMENT IN STEAM-BOILER FURNACES.

Specification forming part of Letters Patent No. **171,632**, dated December 28, 1875; application filed December 9, 1875.

To all whom it may concern:

Be it known that I, CHARLES E. ROBINSON, of Brooklyn, in the county of Kings and State of New York, have invented a new and useful Improvement in Furnaces for Steam-Boilers; and I do hereby declare that the following is a full, clear, and exact description of the same, reference being had to the accompanying drawing, forming a part of this specification.

My invention relates to improvements in furnaces for burning gases of petroleum or other liquid hydrocarbons. The attempts heretofore made to utilize petroleum as fuel for this purpose, more especially in locomotive-boilers, have failed of the desired success, chiefly because the combustion of gas or gases derived from said fuel has been attempted at too low a temperature, and for want of sufficiently free admission of air to the furnace-chamber. In order to effect the perfect combustion necessary to evolve heat of the desired intensity, and thus render the use of petroleum economical to the desired extent, it is requisite to divide the furnace-chamber into two parts by means of a perforated diaphragm, the same thus forming the top of the chamber in which the combustion is begun and the bottom of the chamber in which it is perfected. The bottom of the primary combustion-chamber is formed by a series of inclined perforated plates, which are joined at their upper and lower edges, and by which the air is admitted in the requisite quantity, and at the same time heated to the extent necessary to prevent lowering of the gases below the combustion-point as they meet and commingle. These elements and conditions are therefore essential to the object in view, to wit: The furnace-chamber must be divided, so that the combustible gases shall be raised to a higher temperature by contact with the diaphragm or partition-plate in passing through it. Second, air shall not be admitted, except at the bottom of the primary or lower combustion-chamber, and then only in a heated condition. Lastly, the supply of air shall be as abundant, or nearly so, as could be obtained if said chamber had no bottom, or were left entirely open.

In the drawing, Figure 1 is a sectional elevation of a tubular steam-boiler provided with my present improvements, the section of the diaphragm being divided on lines *x x* and *z z* of Fig. 2; Fig. 2, a cross-section of the foraminous diaphragm. Fig. 3 is a top-plan view, and Fig. 4 a bottom-plan view, of a fragment of the diaphragm.

A indicates a locomotive-boiler of the usual construction. A diaphragm, B, extends straight across the furnace-chamber C at an inclination downward from the door *a;* but all or a portion of it may have a different inclination or arrangement without departing from my invention. It is provided with numerous transverse vertical perforations or passages, *c*, so that the openings on one side do not coincide with those on the other. I make the openings in the upper side of the diaphragm smaller, as well as much more numerous, and so arrange them that each of the lower openings will be immediately beneath an imperforate portion of the diaphragm above, as clearly shown in the drawing, whereby the gases are caused to take a circuitous course in passing through. This arrangement of holes *c* prolongs or insures complete contact of the gases with the diaphragm without sensibly retarding them. The diaphragm is made of fire-clay, and, of course, becomes intensely heated soon after the fire has been started. The chief object and function of the same is, by thus dividing the furnace-chamber, to cause the gases evolved from whatever hydrocarbon may be used to pass in actual contact with it, and thus become more highly heated and thoroughly mixed or commingled, so that they will be perfectly consumed in the space above the diaphragm, thereby producing the desired result of a great increase in the heat capable of being developed from a given quantity of fuel. This absence of any loss in unconsumed gases, and the consequent higher evolution of heat, render this feature of my invention of great economic value.

The petroleum or other oil to be consumed is discharged from a suitably-constructed atomizer, *d*, under steam-pressure, into the primary combustion-chamber C, against a perforated fire-clay plate, D, set inclined against the back or inner side of the water-leg E. This plate, being necessarily maintained at intense

heat, aids in effecting the desired decomposition of the gas, and at the same time prevents contact of the latter with the water-leg, whereby its temperature would become so reduced as to render attainment of the desired thoroughness of combustion impossible.

As to the second feature of my invention—the bottom of the fire-box—it has been hitherto found impossible to supply atmospheric air to the furnace-chamber in sufficient quantity to supply the demands of the combustion of petroleum without employing an air-forcing apparatus, or else constructing the bottom of the chamber with so large spaces or openings for admission of the air that it entered the fire-box but slightly or insufficiently heated, and hence cooled the gases below the high temperature at which it is absolutely necessary to preserve them in order to perfect combustion. I have therefore contrived a bottom, F, composed of perforated plates G, each two being set inclined one toward the other, thus forming two sides of a triangle, and the whole presenting, in cross-section, a zigzag or serration.

It will be apparent that, by thus convoluting or, so to speak, "doubling up" the bottom F, its area may be increased twofold or more, as desired, and that the access and admission of air to the chamber C′ will be correspondingly facilitated. Besides this, the air becomes highly heated in passing over the sides of the plates composing the bottom F, and in passing through the numerous holes therein.

By this construction I overcome one of the great difficulties heretofore in the way of the adoption and practical use of oil as a fuel in boiler-furnaces.

In case coal is employed as the fuel an ordinary grate will, of course, be substituted for the bottom F. In such case the sparks or carbon particles carried up from the burning coal will be, for the most part, arrested by striking the under side of the diaphragm, or the imperforate portions thereof, which are directly above the lower openings *c*, and thus prevented escaping into the tubes or stack, except it be as dust-like particles or spent gases.

What I claim is—

1. For burning petroleum-gas, the combination of the following elements: the furnace-box C, having no air-inlet save at the bottom thereof, the foraminous diaphragm B, extending across the same, and the atomizer *d*, introduced or located beneath said diaphragm, all as shown and described.

2. The combination, in a furnace for burning petroleum-gas, of the bottom F of the fire-box, composed of perforated inclined plates G, joined together at top and bottom, the foraminous diaphragm B above the same, and the atomizer *d*, all arranged as shown and described, whereby the gas is introduced into the space or chamber to which atmospheric air has access only through said bottom, as and for the purpose specified.

CHAS. E. ROBINSON.

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