L. K. LEAHY.

LIQUID HYDROCARBON BURNING APPARATUS.

APPLICATION FILED MAY 31, 1904.

964,031.

Patented July 12, 1910.

2 SHEETS—SHEET 1.

Fig. 1

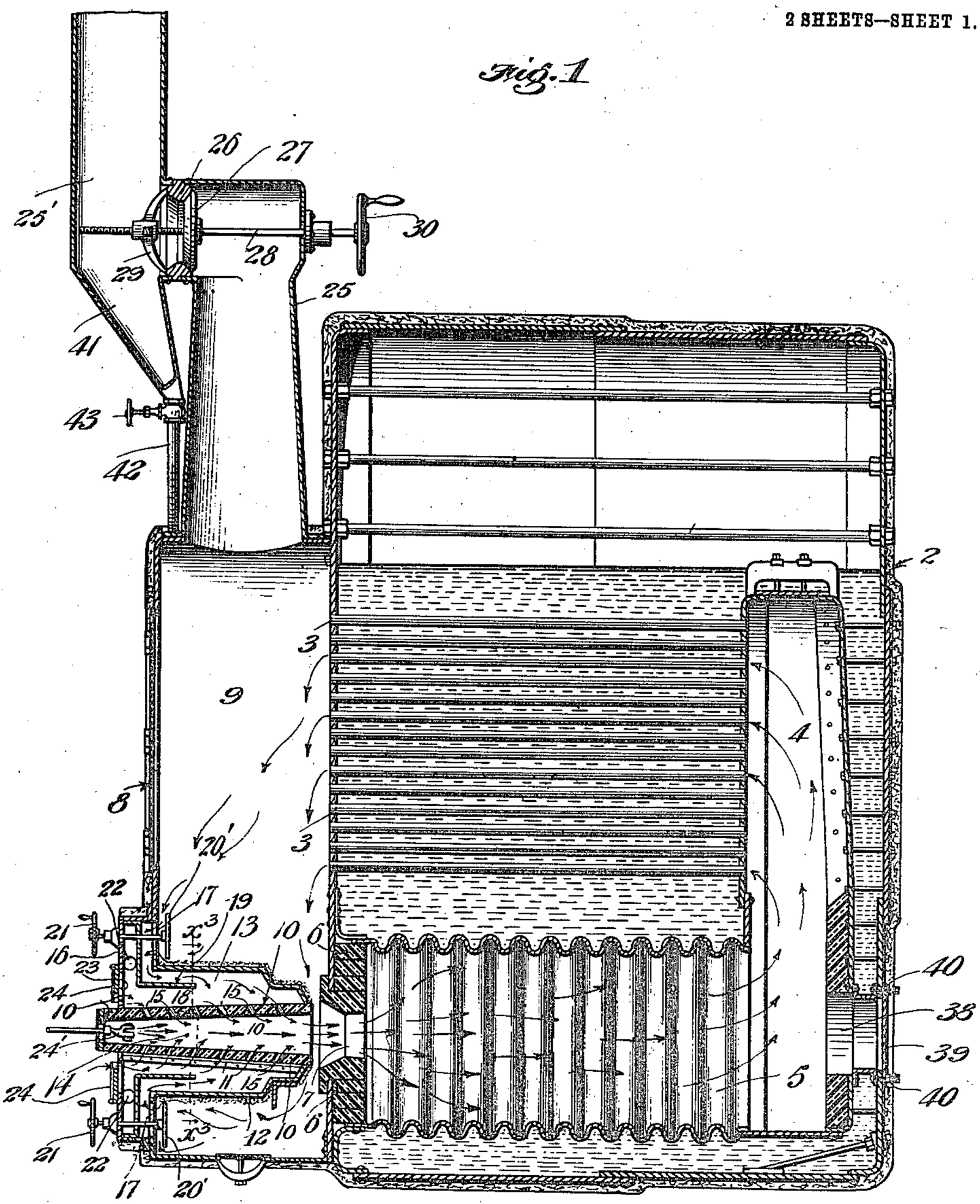
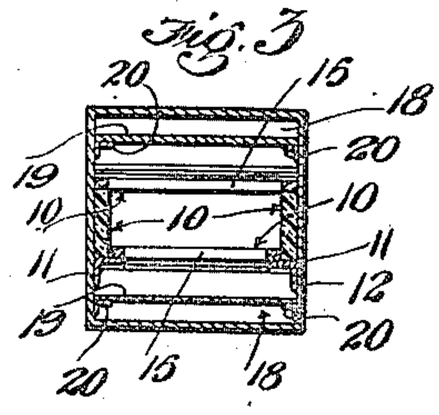


Fig. 3



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2 SHEETS—SHEET 2.

Fig. 2.

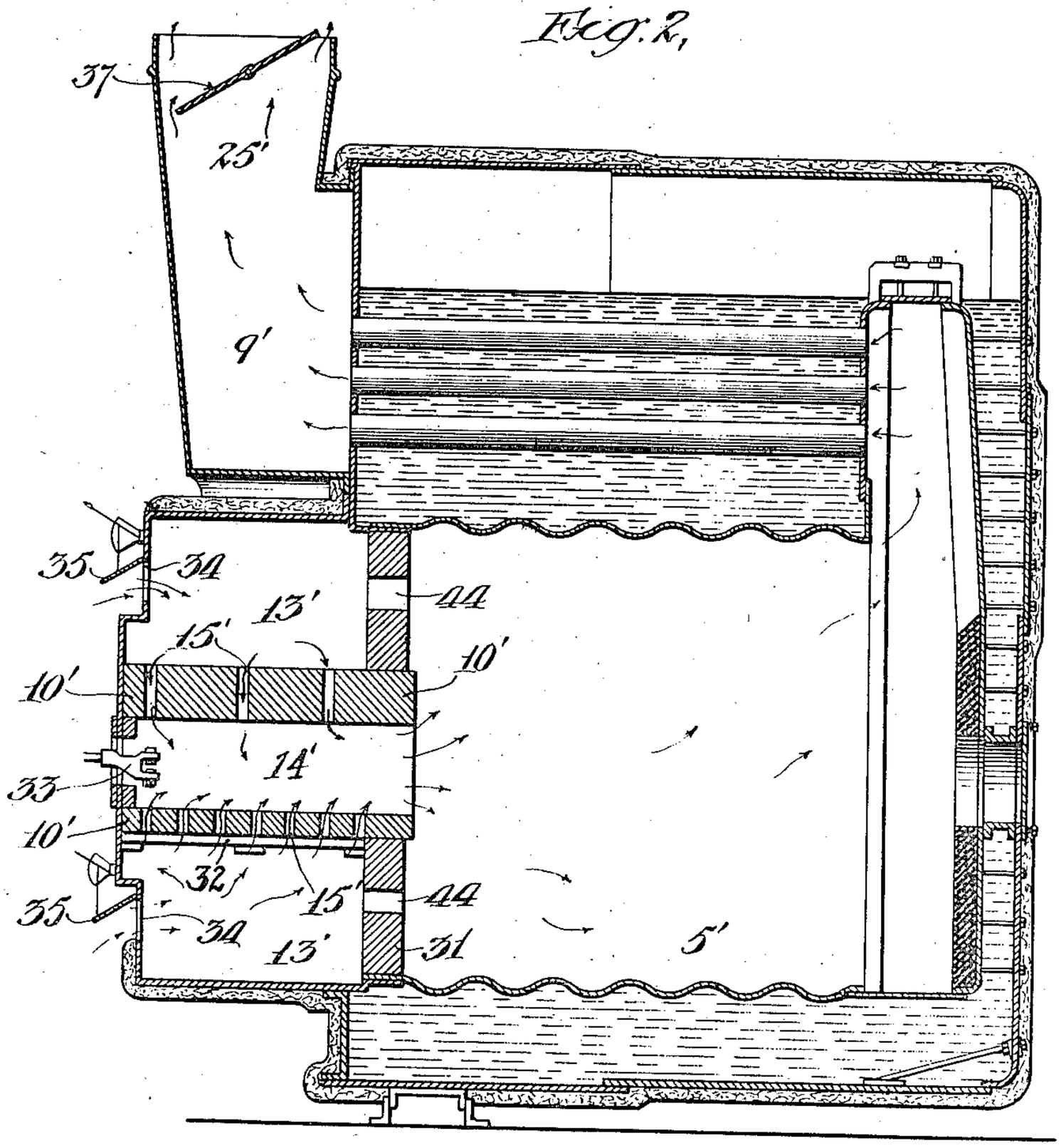
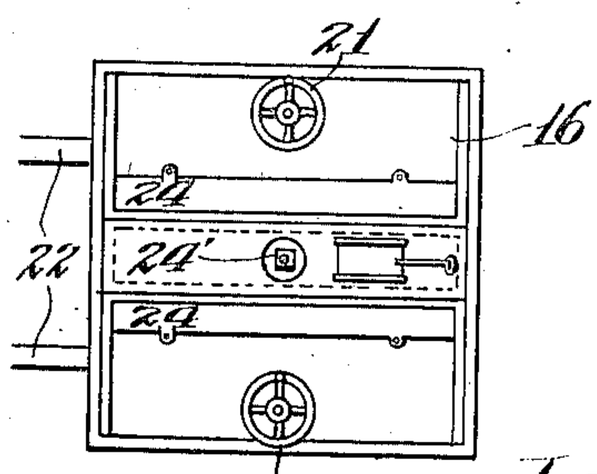


Fig. 4.



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UNITED STATES PATENT OFFICE.

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LIQUID-HYDROCARBON-BURNING APPARATUS.

964,031. Specification of Letters Patent. Patented July 12, 1910.

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To all whom it may concern:

Be it known that I, LOUIS K. LEAHY, a citizen of the United States, residing at Los Angeles, in the county of Los Angeles and State of California, have invented certain Improvements in Liquid-Hydrocarbon-Burning Apparatus, of which the following is a specification.

This invention relates to apparatus for burning liquid hydrocarbons for fuel purposes and more especially for heating purposes, either under steam boilers or other apparatus in connection with which it is desired to generate an intense heat.

The primary object of the invention is to eliminate the production of smoke in burning of such fuel and to entirely consume the fuel and all gases generated by such combustion and to do away with all the inconveniences and annoyances resulting from smoke and soot from chimneys.

A further object of the invention is to secure perfect and complete combustion of the fuel and the application of all heat thereby generated to heating the desired chamber or material.

A further object is to provide such apparatus in simple cheap, durable and efficient form, which shall not be likely to get out of order or to require expensive repairs or close attention and which shall be exceedingly economical.

To these, and such other objects and ends as hereinafter appear from the detail description of construction and operation, the invention consists primarily in an ignition chamber into which the liquid fuel is injected under pressure, a main burning or consumption chamber into which the burning fuel is projected from the ignition chamber, and a continuous duct or passage leading from said burning or consuming chamber under, about, or through the chamber or body to be heated, and back to and communicating with the main consuming or burning chamber, or which leads into the ignition chamber, or both.

The invention consists further in the provision of means whereby air under atmospheric pressure is supplied to the atomized fuel, in the ignition chamber, to supply the desired proportions of carbon, oxygen, hydrogen and nitrogen.

The invention further consists in means for returning the partially consumed gases, cooled by contact with the boiler flues or other surface to be heated, to the ignition chamber or the main consuming or burning chamber, or both, and intermingling the same with the injected fuel and thus again subjecting such partially consumed product to intense heat thereby insuring the total consumption thereof.

The invention consists further in the constructions and in combination of parts all as hereinafter described and particularly set out in the claims, and will be more readily understood by reference to the accompanying drawings, forming part of this specification, and in which:—

Figure 1 is a longitudinal sectional view of a liquid hydrocarbon burning apparatus embodying my invention. Fig. 2 is a partial longitudinal section of a slightly modified form thereof. Fig. 3 is a transverse sectional view on the line x^3—x^3 of Fig. 1. Fig. 4 is a detail front view of the removable ignition chamber.

In Fig. 1 I have shown my invention as applied to a marine boiler of the common type. 2 represents the boiler shell which may be of ordinary or any preferred construction, and 3 the boiler flues which, as shown, lead through the water chamber. At the rear end of the boiler flues I form a vertical chamber 4, which leads upward past the boiler flues from the main consuming or burning chamber 5, which chamber 5 may be of the ordinary or any preferred construction, its front wall being preferably made up of fire-brick 6 having a central inlet 7, the mouth of which is inwardly converging. 8 represents an outer fire-wall or shell for the front end of the boiler forming between the water chamber and main consuming chamber thereof and such front wall, a vertical chamber 9 which extends from below the inlet 7 up above the top flues 3 of the boiler. This wall 8 is provided with an opening at its base into which the removable fire-box, forming the ignition chamber, is adapted to be inserted into place, as shown. This fire-box consists of fire-brick 10 arranged to provide a tapering chamber, the walls of which diverge toward the outlet end of the chamber so that when the removable fire-box is placed in position the large or outlet end of the fire-box is oppositely disposed with respect to the inlet 7, but is preferably spaced apart from the walls of

the inlet 7 a sufficient distance to allow an indraft of gases from the chamber 9 into the inlet 7 as hereinafter referred to. The fire-brick 10 is supported by angle plates 11 suitably mounted upon the main frame 12 of the removable fire-box or pot, as shown best in Fig. 3.

Toward the outlet end of the removable fire-box the walls 12 are brought together so as to form an opening of such size that the edges of such walls rest upon the outer surfaces of the fire-brick 10, as shown. The chamber 13 is thus formed about the ignition chamber 14 formed within the fire-brick. A series of inlets 15 are provided through the fire-brick from the chamber 13 into the chamber 14, as shown. The front plate 16 is provided with a central aperture through which the fire brick 10 extends. This front plate may be supported in position in any suitable manner. From the chamber 9 inlets 17 are provided, through the extended walls 12, into the chamber 13. The inlets preferably communicate with the main portion of the chamber 13 through passages 18 formed by a partition 19, as shown; the partition 19 being suitably supported on the inner faces of the walls 12 by angle-plates 20 (see Fig. 3).

In order to regulate as desired, the inflow through the inlets 17, valves or dampers 20′ are provided. These dampers are provided with suitable stems leading out through bearings on the front plate and provided with hand wheels 21 whereby they may be operated to partially or wholly close the inlets 17.

22 represents pipes leading into the chamber 13, preferably behind the partition 19. These pipes preferably lead from the outer air outside the boiler room but may be connected with any suitable air supply.

The front plate 16 is provided with air inlets 23, dampers 24 being provided in connection therewith whereby the ingress of air through the inlets 23 may be regulated as desired.

24′ represents an atomizing burner for supplying atomized liquid hydrocarbon fuel to the ignition chamber 14. This atomizer is connected by suitable pipes with a suitable source of supply for furnishing liquid hydrocarbon and expansive fluid (either steam or compressed air) to the atomizer under pressure.

At the top of the chamber 9 I provide a chimney 25 which may be of any ordinary or preferred construction. This chimney is provided with a suitable damper by means of which the passage of gases out through the chimney may be cut off. This preferably consists in a seat 26 and a damper 27, the damper 27 being mounted on a revoluble rod 28 having its bearings in a spider 29. The outer end of the rod 28 is passed through the wall of the chimney and through a bearing provided therefor and an operating wheel 30 provided on its outer end. The spider 29 and ring 26 for the damper seat are preferably formed integral, though any other preferred construction may be employed.

In Fig. 2, I have illustrated a modified form of my apparatus. In this modification I have dispensed with the connection of the chamber 9′ (corresponding to the chamber 9 of Fig. 1) with the chamber 13′ (corresponding to the chamber 13 of Fig. 1,), and it will be noted that with this construction the gases will not be returned through the burning fuel in either the ignition chamber or the main consuming chamber. I provide an ignition chamber 14′ formed, preferably, by brick-work 10′ having air-inlets 15′ from the surrounding chamber 13′. This brick-work 10′ is supported on a brick-wall 31 supported on the floor of the main-combustion chamber as shown, the wall 31 being continued up to the top wall of such combustion chamber as shown. The brick-work 10′ is also supported on angle-irons 32 from the walls of the chamber 13′. 33 represents the atomizing liquid fuel burner or injector. 34 represents air-inlets into the chamber 13′, the entrance of air therethrough being controlled by means of dampers 35. Air-inlets 44 are provided in the wall 31, communicating from the chamber 13′ to the main consuming or fire chamber 5′. In the chimney flue 25′ a damper 37 is provided by which the outlet through the chimney flue may be regulated. This damper may be operated from without the flue by any of the well known means.

The operation is as follows: When it is desired to "fire up" the damper is turned to allow free draft out through the chimney. The supply of atomized liquid fuel is turned on and flows out through the atomizer into the ignition chamber where it is ignited in the usual or any preferred manner. In burning heavy crude asphaltum oil (as for instance the California oil) ignition may not be instantaneous and an accumulation, of highly inflammable gas, may take place in the main consuming chamber. The ignition of this may produce more or less of an explosion. To compensate for this and to relieve the boiler and walls of the chamber from the shock resulting from any such explosion, I provide an outlet 38 in the rear wall opposite the main consuming or fire chamber and provide a damper 39 therefor. The damper 39 is normally held closed by springs 40 but upon any such explosion yields outwardly to allow the force of the explosion to expend itself through the outlet 38. When the pressure is relieved the heavy springs 40 will immediately close the dam-

per. The fuel is ignited as it is projected from the atomizer into the ignition chamber and the brick walls of this chamber become highly superheated. The flames from the ignition chamber rush through the inlet 7 into the main consuming chamber 5 and expand therein. A heat of from 2500° to 3000° F. is generated in this chamber and the hot gases and products of initial combustion, thus highly heated pass through the chamber 4 through the tubes 3, heating the tubes and the water surrounding the same. These products then pass out into the chamber 9 and, the damper in the chimney having been closed or partly closed, a portion thereof is drawn down into the chamber 13, there intermingling with oxygen and being drawn into the chamber 14, thus superheated and entirely consumed; other portions are drawn into the chamber 5 through the inlet 7, where superheating and complete combustion thereof is effectuated. Chamber 13 thus serves as an air supply and mixing chamber for supplying the mixture of partially consumed gases and fresh air to the ignition chamber. By thus providing a continuous circulation of the partially consumed gases and by drawing such gases into chambers wherein the gases are subject to intense heat and admixing therewith fresh oxygen and hydrogen the gases are totally consumed and intense heat (from 2500° to 3000° F.) maintained in the ignition and main consuming chambers. Furthermore by utilizing an initial ignition chamber and permitting lateral expansion therefrom into the main consuming chamber I avoid the projection of any blast against any part of the boiler flues or shell.

By constructing the ignition chamber 14 with a surrounding chamber 13, having a partition 19, and inlets 17 from the return passages 9 into passages 18, and air inlets 23 into the chamber 13 back of the passage 18, fresh oxygen is fed into the gases drawn from the chamber 9 into the chamber 13 and the intermingled oxygen and gases drawn into the ignition chamber 14. This commingled oxygen and gases introduced through the inlets 15 of the highly heated brick-work 10 into the intense heat of the ignition chamber, is readily entirely consumed owing to the intense heat of the chamber and its consumption serves to intensify and supplement the combustion of the atomized liquid hydrocarbon fuel injected into the ignition chamber intermingled with steam or compressed air (preferably steam, as the hydrogen of the steam also intensifies the heat generated by the fuel. The ignition chamber being outside of the boiler is thoroughly insulated therefrom in such manner that a very high temperature can be obtained therein, and the complete combustion, above referred to, can be obtained, which would not be possible if the said chamber were located in direct heating relation with the boiler. Said ignition chamber is further insulated by its fire-brick walls and by the surrounding air supply and mixing chamber, and in some cases, the insulation so obtained, may be sufficiently effective without regard to the locality of the ignition chamber.

In Fig. 1, I have shown means provided in connection with the chimney flue for adapting this apparatus for use with submarine boats, so that the portion 25′ of the chimney flue having filled with water upon submersion of the boat, upon the rising of the boat to the surface this water may be drawn off therefrom. This consists in providing a downward extension 41 connected with a drain pipe 42 leading out from the boat. A valve 43 is preferably provided so that the flow may be controlled as required.

While I have shown my apparatus as adapted for use with a "marine" boiler. It is obvious that it may readily be adapted to any form of boiler and in place of connecting the chamber 9 with the main consuming chamber 5 through an inlet 7, through which the atomized fuel is also projected into the main consuming chamber, the ignition chamber may be open directly into the consuming chamber (as shown in Fig. 2) and inlets 44 provided through the wall 31 from the chamber 13′ into the main consuming chamber 5′, and the chamber 13′ in substantially the manner in which the chamber 13 is connected with the chamber 9 of Fig. 1, or no such connection may be provided.

Many changes in construction will readily suggest themselves to one skilled in the art and I do not confine myself to the exact constructions shown or described.

What I claim is:—

1. A liquid hydrocarbon burning apparatus, comprising a combustion chamber having an end wall provided with an opening, an ignition chamber communicating with the combustion chamber through said opening, an air supply chamber surrounding the ignition chamber and adjoining said wall and adapted to communicate with the combustion chamber, means for injecting atomized liquid hydrocarbon into the ignition chamber, and spring pressed means at the rear of the combustion chamber for automatically relieving excessive pressure at the time of ignition.

2. A liquid hydrocarbon burning apparatus, comprising a combustion chamber, having an end wall provided with openings, an ignition chamber communicating with the combustion chamber through one of said openings, an air supply chamber surrounding the ignition chamber and adjoining said wall to communicate through the other

openings therein, with the combustion chamber, the ignition chamber having inlet openings leading from the air supply chamber, and means for injecting atomized liquid hydrocarbon into said ignition chamber.

In testimony whereof I have signed my name to this specification, in the presence of two subscribing witnesses, at Los Angeles, county of Los Angeles, and State of California, this 23rd day of May, 1904.

LOUIS K. LEAHY.

Witnesses:

FREDERICK S. LYON,

JULIA TOWNSEND.