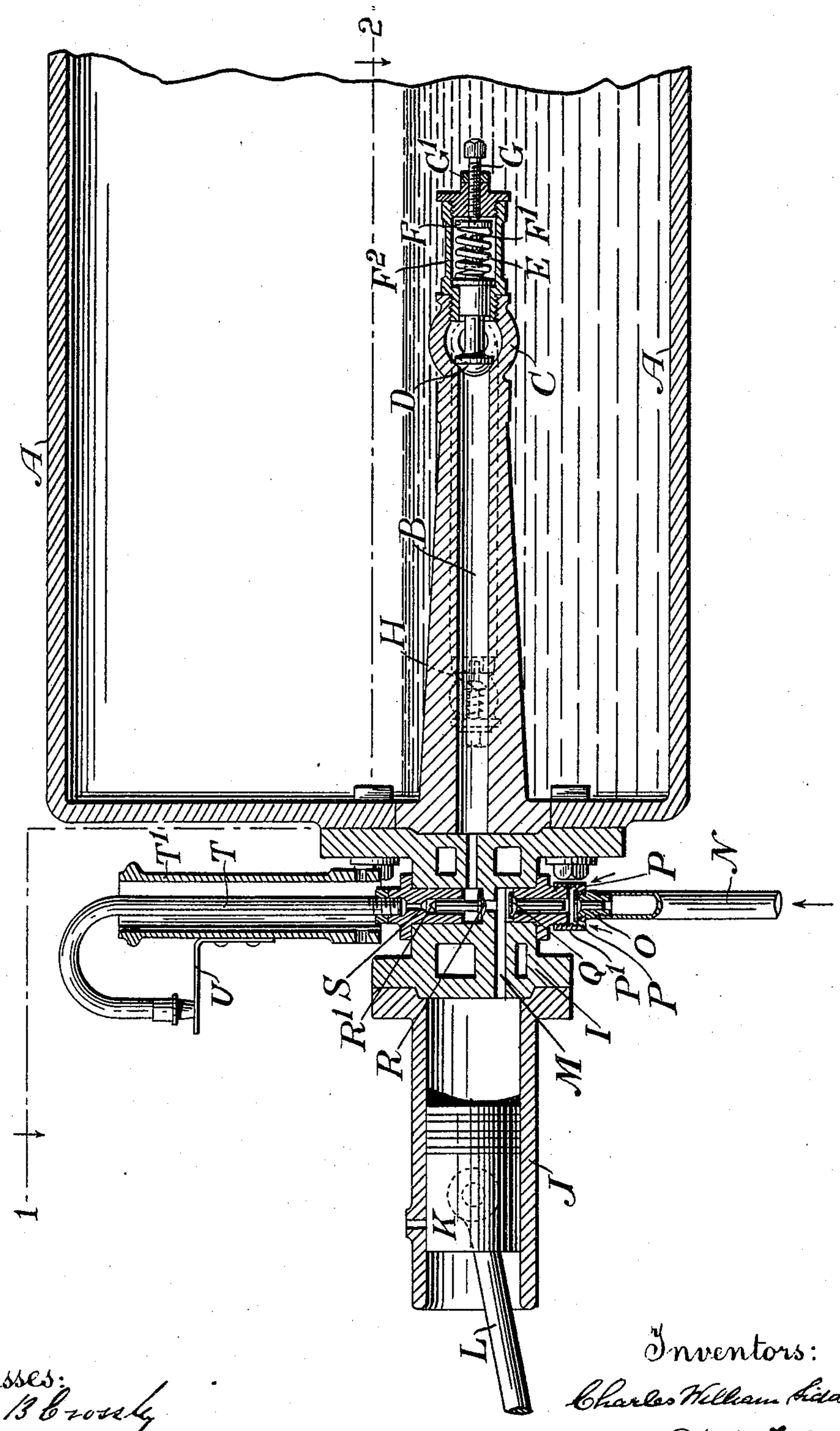
(No Model.) 2 Sheets—Sheet 1.

C. W. SIDDLE & R. FIELD.

STEAM GENERATOR.

No. 587,375. Patented Aug. 3, 1897.

Fig. 1



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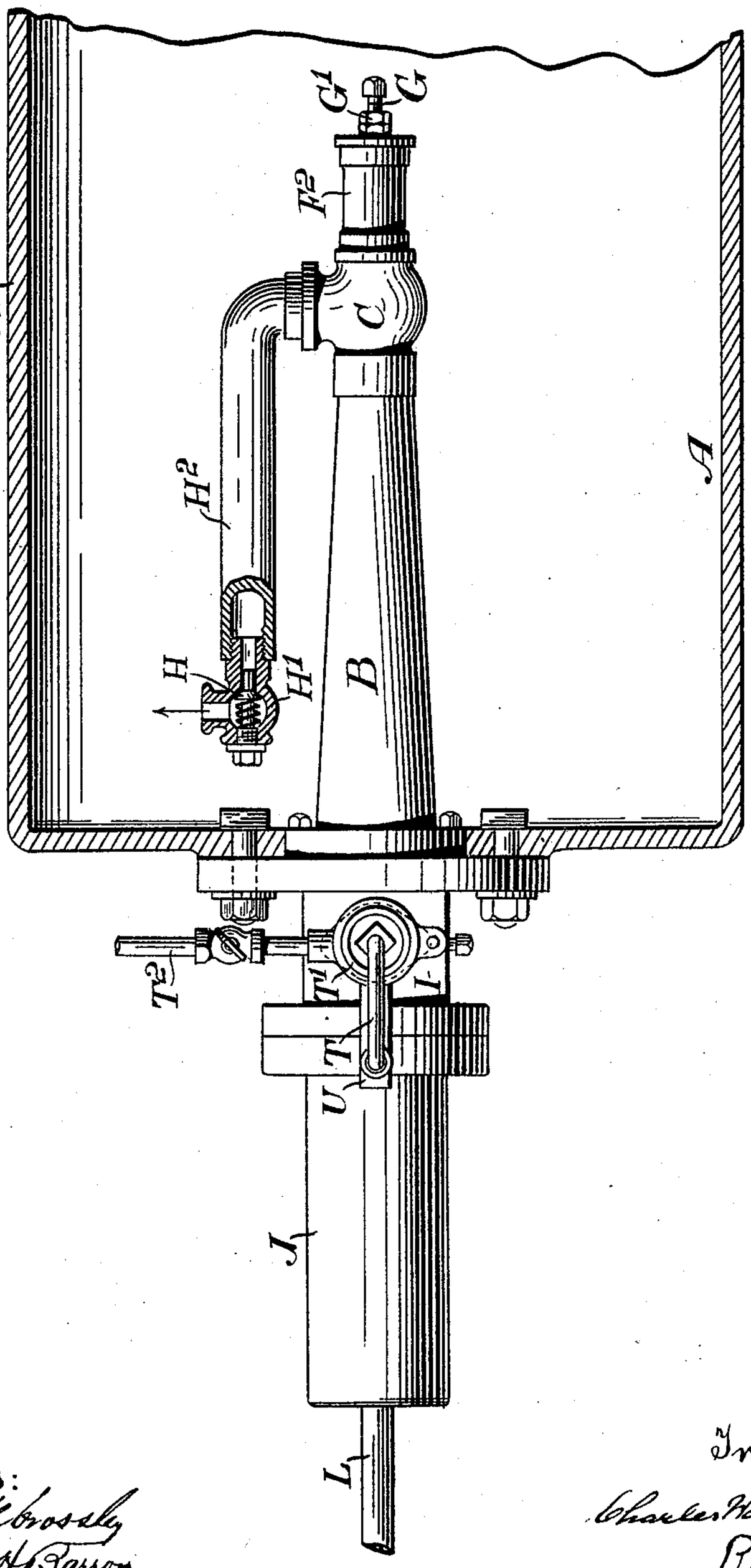
(No Model.) 2 Sheets—Sheet 2.

C. W. SIDDLE & R. FIELD.

STEAM GENERATOR.

No. 587,375. Patented Aug. 3, 1897.

Fig. 2.



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UNITED STATES PATENT OFFICE.

CHARLES WILLIAM SIDDLE AND ROBERT FIELD, OF HUDDERSFIELD, ENGLAND.

STEAM-GENERATOR.

SPECIFICATION forming part of Letters Patent No. 587,375, dated August 3, 1897.

Application filed April 5, 1897. Serial No. 630,717. (No model.)

To all whom it may concern:

Be it known that we, CHARLES WILLIAM SIDDLE and ROBERT FIELD, citizens of Great Britain, residing at Huddersfield, in the county of York, England, have invented certain new and useful Improvements in the Method of and Means for Generating or Producing Steam and for Heating Water, Air, or other Liquids, Fluids, or Gases; and we do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

This invention has reference to a new or improved method of and means for generating or producing steam for motive-power purposes and for heating water, air, or other liquids, fluids, or gases, the object of our improvements being to generate steam or to heat liquid or fluid bodies without the aid of a furnace or fire or burner.

Our said invention consists in bringing into direct contact with the water or body to be heated the products of combustion resulting from an explosion or successive explosions or firing in a chamber or confined area of an explosive mixture or substance—such as, for instance, vaporized oil or other suitable explosive and air, or gas and air, or gunpowder, dynamite, oberite, or like explosive substance, which may be found to answer. This we accomplish by employing in conjunction or combination with the boiler or vessel containing the water, air, or body to be heated a suitable form of explosion-chamber, within which an explosive mixture or substance can be fired or exploded.

The mixture of vaporized oil and air or gas and air is either drawn or forced into the vaporizer or explosion-chamber by pump or other suitable means and is fired or exploded by an ignition-tube heated by a lamp or burner or by electricity, the compression of the mixture to the degree desired being obtained by the action of the pump or means employed to draw or force the mixture into the chamber or by an additional pump or piston.

The vaporizer or explosion-chamber communicates with the boiler through a pipe or thoroughfare wherein is situated, if required, a non-return valve or valves of any suitable construction, which is or are maintained normally against the seating by a strong spring or springs apart from the resistance which the internal pressure in the boiler or vessel exerts upon the valve or valves. The force of each explosion expels the resulting products through or past the valve or valves into the water, which they enter at the highest temperature and therefore rapidly heat the water or other body therein and generate steam or raise the temperature to the point desired.

In order that our said invention may be fully understood, reference is hereinafter had to the annexed drawings, in which—

Figure 1 is a sectional elevation of a steam boiler or vessel and means for supplying and firing charges of explosive mixture or substance into the boiler according to our invention, and Fig. 2 is a plan of same taken on lines 1 2.

Referring to the drawings, letter A represents a steam-boiler or other liquid or fluid heating vessel which is of any ordinary or suitable construction and can be fitted with the usual appendages or accessories, as water and steam pressure gages, safety-valve, and water-inlet and steam-outlet, these being left to individual or special requirements and forming no part of our invention.

In the water-space of the boiler, preferably near to the bottom thereof, is placed an explosion-chamber B, having at its inner end a valve-casing C, in which is a valve D, adapted to be held against its seating to close the outlet end of the chamber by a strong spring E, confined between a collar on the valve-spindle and a washer or collar F on the end of a short spindle F′, located in a barrel or casing F^2, screwed into the valve-casing C. A short space intervenes between the spindle F′ and valve-spindle, which allows the valve D to open to the extent required, this space being adjusted and the tension of the spring varied by means of a setting-up screw G, whose position, after adjustment, is secured by a lock-nut G′.

The spring E is strong enough to keep the valve closed against the compression of an

explosive mixture in the chamber B, but will open to the force of explosion of such mixture and allow of the products of combustion escaping through said valve to the boiler. The valve D being a non-return valve no steam, water, or gases can pass from the boiler into the explosion-chamber. As an additional safeguard against the entrance of water or steam into the explosion-chamber, but also, more particularly, to slightly delay the expulsion of the products of combustion into the boiler, so that the highest temperature is attained at the instant they enter the water or steam space, we employ a second valve H, working in a casing H′, screwed directly into the valve-casing C or to a short chamber or pipe H^2, coupled to said casing C, as shown, the outlet-orifice from said valve being in the water-space, or it may be in the steam-space, of the boiler. A small spring normally holds the valve H to its seating. The said valve may be an equilibrium valve, so that the internal pressure of the boiler will press with equal force against two opposing faces and enable the valve to open easily to the pressure of the exploded mixture no matter what pressure there may be in the boiler.

The explosion-chamber B is bolted to or formed integral with a valve-box I on the outside of and bolted to the shell of the boiler A, said valve-box having cast on or secured to its outer side a cylinder J, wherein works a piston or plunger K, coupled by connecting-rod L to a crank-shaft, (not shown,) which is driven from any suitable or convenient source of motion. The said piston or plunger acts as a pump and at every outward stroke draws a charge of gas and air into the chamber M in the valve-box, which is open to the cylinder, the gas supplied through pipe N being drawn past the inlet-valve O by the vacuum created in the cylinder, which likewise draws a proportionate supply of air through fine holes or perforations P in the cap or nut P′, the mixture of gas and air also being drawn past a second valve Q, intermediate of the inlet-valve O and chamber M, which closes immediately the piston arrives at the end of its outward stroke and confines the mixture in the chamber M and cylinder.

On the return or inward stroke of the piston the mixture of gas and air is forced out of the cylinder and chamber M, past the valve R, into the explosion-chamber B, and compressed, the spindle of said valve being three-sided or having flats thereon to allow the mixture to pass up between the sides of same and the surrounding wall. While charging the explosion-chamber the upper end of the spindle of valve R, which forms a second valve R′, is held against a seating S and prevents communication with an ignition-tube T, screwed into the upper end of the valve-box. Immediately the piston reaches the end of its inward stroke the pressure of the explosive mixture forces down and closes valve R, thereby simultaneously opening valve R′, whereupon the mixture enters the ignition-tube T and is fired, the force of the explosion or pressure generated thereby forcing the products of combustion past the valve D and then past the second valve H into the water-space of the boiler, the water wherein is rapidly heated and steam generated.

It may be desirable or preferable to have the outlet for the products of combustion in the steam-space of the boiler, where the elasticity of the gases or steam will more readily admit of the compression which the rapid successive addition of other gases requires.

The ignition-tube T is surrounded by an asbestos-lined chimney T′ and is heated by a gas-jet in the same way as in gas-engines, the gas being supplied through pipe T^2. At each explosion a small quantity of the products of combustion remains in the ignition-tube, which, if no provision is made to allow of escape, will interfere with the efficient action of the engine or machine.

To insure the escape of any such gases left in this ignition-tube, we bend the upper end of the tube over the top of the chimney, as shown, and make an opening therein which is normally closed by a flat spring U or an equivalent valve adapted to be forced away from its seating at every explosion and admit of the expulsion of all gases from the tube.

The valve-box I is water-jacketed to keep it cool, and the water circulated therethrough may be that for feeding the boiler.

If vaporized oil and air be used as the explosive mixture, a vaporizer heated by lamp would be added to the box, the admission or inlet valve or valves being altered to suit the changed conditions and the ignition-tube inserted in said vaporizer somewhat on the same lines as in oil-engines. Although not perhaps so well adapted for the purposes of our invention as oil or gas and air, an explosive substance or compound could be used and charged into an explosion-chamber and fired or exploded.

In order to shut off or reduce the supply of gas or oil when the maximum pressure is attained in the boiler, a loaded or safety valve may be coupled by suitable connections to the inlet-valve, so that at a certain pressure or pressures the movement of the loaded valve outward or upward will control the opening of the valve and thus reduce or shut off completely the supply of gas or oil to the chamber.

If water or other liquids or fluids are to be heated for warming or like purposes only, for which a lower temperature is required, fewer explosions are given than when generating steam.

By the method and means set forth the whole of the heat obtained by the firing of an inexpensive explosive mixture is communicated or driven at once to the water or other liquid or fluid, which absorbs it, and is therefore rapidly raised to a high temperature and

steam generated, there being no loss from radiation and not the least waste of fuel or loss of heat such as takes place in furnaces or fires.

We claim as our invention—

1. The combination, with a boiler, of an explosion-chamber projecting within the boiler and provided with a spring-pressed outlet-valve D, a short chamber arranged beyond the said valve, and a second spring-pressed outlet-valve H closing the said short chamber, the pressure of the valve D on its seat being greater than that of the valve H, substantially as set forth.

2. The combination, with an explosion-chamber, and means for compressing an inflammable gaseous charge within the said chamber; of an ignition-tube, and a double valve R R′ operating to close alternately the inlet to the explosion-chamber and the passage between the said ignition-tube and the explosion-chamber, substantially as set forth.

3. The combination, with an explosion-chamber, and an ignition-tube connected thereto and provided with an outlet-hole connecting with the atmosphere; of a spring secured at one end to a stationary support with its free end portion normally closing the said outlet-hole and permitting a portion of the products of combustion to pass out of the ignition-tube, substantially as set forth.

In testimony whereof we affix our signatures in presence of two witnesses.

CHARLES WILLIAM SIDDLE.
ROBERT FIELD.

Witnesses:
ARTHUR B. CROSSLEY,
THOMAS H. BARRON.