L. R. CAMP.

PRESSURE GENERATOR.

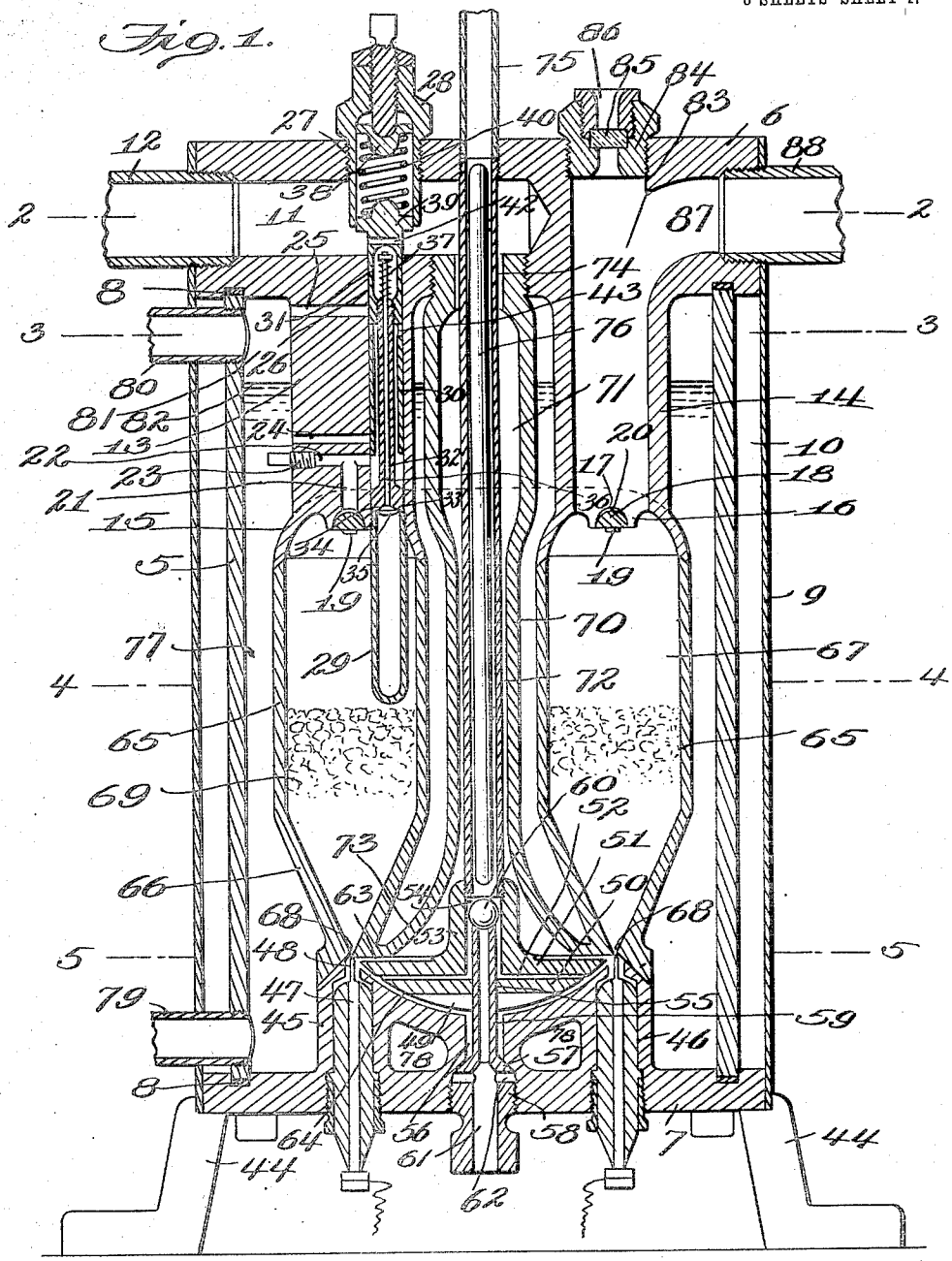
APPLICATION FILED JUNE 27, 1913.

1,099,019.

Patented June 2, 1914.

3 SHEETS—SHEET 1.

Fig. 1.



Witnesses:

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3 SHEETS—SHEET 2.

Fig. 2.

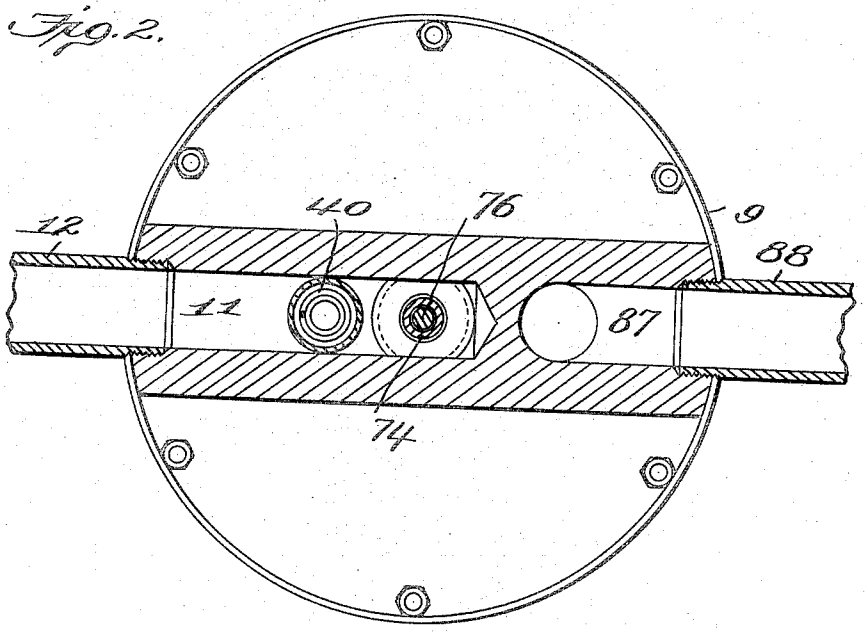
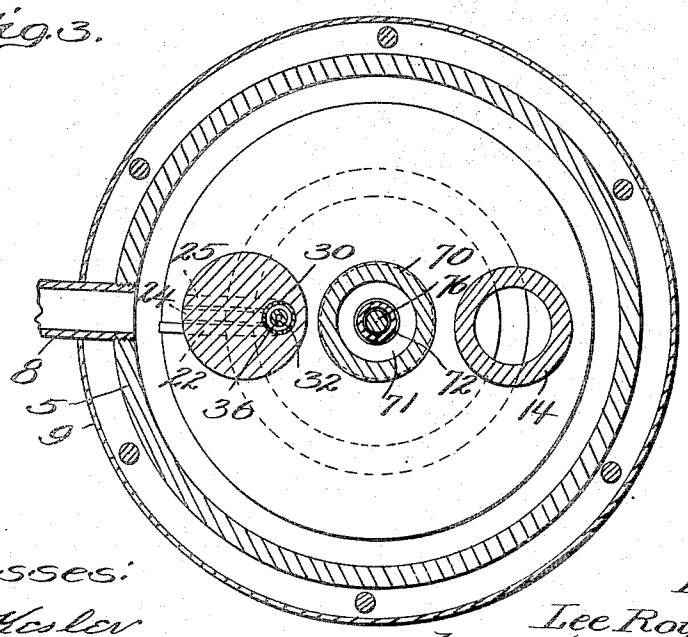


Fig. 3.



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3 SHEETS—SHEET 3.

Fig. 4.

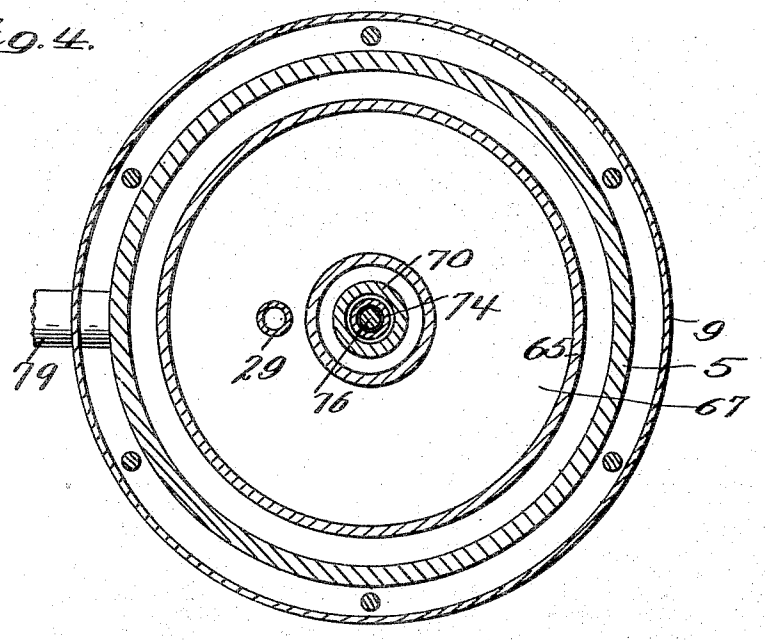
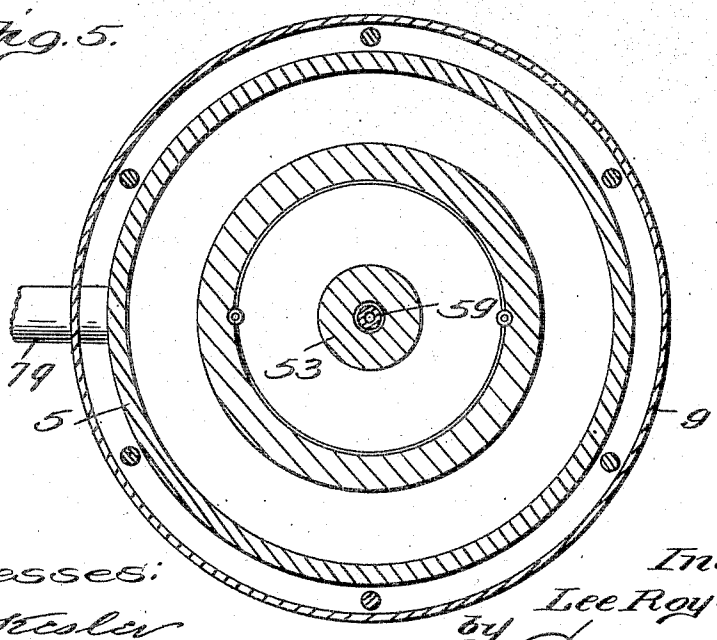


Fig. 5.



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UNITED STATES PATENT OFFICE.

LEE R. CAMP, OF MONTGOMERY, ALABAMA, ASSIGNOR OF ONE-HALF TO WARNER H. CAMP, OF ATLANTA, GEORGIA.

PRESSURE-GENERATOR.

1,099,019. Specification of Letters Patent. Patented June 2, 1914.

Application filed June 27, 1913. Serial No. 776,191.

To all whom it may concern:

Be it known that I, LEE R. CAMP, a citizen of the United States, residing at Montgomery, in the county of Montgomery and State of Alabama, have invented new and useful Improvements in Pressure-Generators, of which the following is a specification.

This invention relates to an internal combustion steam and gas generator and involves an apparatus for automatically transforming the heat units stored up in fuel of any character into work or into a more efficient energy medium for transmission to and utilization in a combustion cylinder or cylinders, turbine or any other power mechanism in which a propulsive medium may be employed.

The primary object of the invention is to generate by combustion and proportionate intermixture or intermingling of steam with products of combustion a propulsive medium having a uniform pressure and a working effect relatively to the mechanism to which it is applied materially in excess of steam alone produced by ordinary methods and hydrocarbon or gases converted into pressure medium by combustion.

A further object of the invention is to transpose the heat units of a liquid or gas fuel into a mixture of steam and combustion gas having a pressure, mass and temperature to supersede steam in operating those types of engines and to continue the transposition and production of the propulsive medium of the character specified in accordance with the demands and proportionate to the requirements of the engine, turbine or motor operated and thereby conserve in a gas and steam power system the advantages of steam engines in combination with the thermal efficiency of explosive gas engines.

A further object of the invention is to transpose the heat units of liquid or gas fuel into a mixture of steam and combustion gases maintained automatically at a predetermined temperature of such degree as to avoid burning out or injuring the generator or apparatus and also to effect in the same generator by the automatic intermixture or combination of the products of combustion and steam, a pressure proportionate to the work required or in accordance with the variation of load upon the engine, turbine or motor.

With these and other objects and advantages in view the invention consists in the construction and arrangement of the several parts which will be hereinafter described and claimed in preferred form and subject to such variations in proportions, dimensions and minor details as fairly fall within the scope of the claims.

In the accompanying drawings one practical form of the apparatus is illustrated for the purpose of demonstrating an operative means embodying the mechanical principles involved, and in the drawings: Figure 1 is a transverse vertical section through a generator or apparatus embodying the features of the invention. Fig. 2 is a horizontal section taken in the plane of the line 2—2, Fig. 1. Fig. 3 is a similar section taken in the plane of the line 3—3, Fig. 1. Fig. 4 is a similar section taken in the plane of the line 4—4, Fig. 1. Fig. 5 is a horizontal section taken in the plane of the line 5—5, Fig. 1.

The numeral 5 designates a steel shell or casing secured to upper and lower cast heads 6 and 7, metallic packing rings 8 being introduced between the ends of the shell or casing 5 and the portions of the heads 6 and 7 engaged thereby to form tight joints. An outer metallic retaining shell or band 9 is also secured to the heads 6 and 7 at a distance outwardly from the shell or casing 5, and between the said band and shell or casing an asbestos filling or jacket 10 is located to obstruct surface heat radiation. The head 6 is formed with an upper horizontally disposed air chamber 11, and connected to this chamber is an air supply pipe 12. The head 6 at one side of the center of the generator or apparatus is formed with a depending member 13, and at the opposite side of the center of the generator the said head is also formed with a depending tubular outlet 14, the lower extremities of the member 13 and tubular outlet 14 being connected and shaped to produce an annular dome 15 with a central annular rib or boss 16 having a semicircular seat or groove 17 therein. Disposed in operative relation to said seat or groove 17 is a semicircular spreader ring 18 which is suitably secured to the pendant

member 13 and outlet tube 14 or to the dome 15 by fastening means, as at 19. The apex of the spreader ring 18 is separated or held at a distance from the uppermost portion of the seat or groove 17 to provide a space 20, and communicating with this space is an inlet port means or bore 21 opening into a counter-bore 22 which is formed by boring through the member 13 in a horizontal plane and closing the outer end of the opening thus formed by a plug 23. Above the counter-bore 22 is a lower horizontal supply port 24, and above said port 24 is an upper supply port 25, both of the latter ports being bored through the member 13 in horizontal planes. The head 6 with the pendant member 13 is also formed with a vertical bore 26 forming means of communication or a chamber between the ports 25 and 24 and the counter-bore 22, the top portion of the head 6 having a larger screw-threaded bore 27 concentric with relation to the bore 26 below and having a hollow plug 28 inserted therein. In the lower extremity of the bore 26 a tube 29 is secured and depends below the dome 15, and above this tube 29 and movable in the bore 26 is an annular controller 30 fully open at its lower end and provided with a hollow head 31. Concentrically arranged within and spaced from the controller 30 is a tubular extension 32 having a lower valve seat head 33 provided with a valve seat 34 which normally has its lower portion opening into the tube 29 and engaged by a valve 35 with a stem 36 extending upwardly through the extension tube 32 and equipped with a spring 37 within the hollow head 31, the said spring 37 holding the valve 35 normally closed. In the tubular head 28 upper and lower yielding adjusting heads 38 and 39 are mounted and engaged by the opposite extremities of a spring 40, the head 38 having an adjusting screw 41 seated in the head 28 to regulate the tension of the said spring 40. The lower adjusting head 39 forms a part of the tubular head 31, and when the spring 40 is set at a predetermined tension the controller 30, tube 32, valve 35 and stem 36 will be prevented from moving until the tension of the said spring 40 is overcome. Air under pressure enters the tubular head 31 through a cross-inlet port 42, with which the said tubular head communicates. The port 42 is open to the chamber 11 and the air passes downwardly into the said tubular head 31 and through the tube 32 and unseats the valve 35 against the resistance of the spring 37, the valve 35 remaining open until the tube 29 is charged with air under pressure and subsequent expansion takes place, as will be more fully hereinafter explained. The tube 29, controller 30, extension tube 32, valve 35 and stem 36, together with the heads 31 and 39, constitute a thermal regulator, the controller 30 having an upper port 43 to register with the supply port 25. The controller 30 and stem 32, together with the valve 35, stem 36 and head 31 have united movement in the bore 26 by expansion and contraction.

The head 7 has suitable legs 44 attached thereto or any other annular base rest, and said head also includes an upwardly extending member 45 formed at opposite sides with sparking plug or igniting plug bores 46 which continue through the said head 7 and have therein sparking or igniting plugs 47 which are adjustably mounted in the usual manner and connected to any suitable electrical generating source. The bores 46 communicate at their upper extremities with contracted ignition bores 48 in which the upper terminals of the plugs 47 extend. The top of the member 45 is formed with a concave seat or cup 49, and located therein is a separating partition or flange 50 and above the latter is a second partition 51, the partitions 50 and 51 being practically a horizontally disposed passage-way having a feeding space or passage 52 for fuel. Extending upwardly from the center of the partition 51 is an elongated tubular collar 53 having a bore 54 in vertical alinement with a lower bore 55 through the center of the partition 50. A vertical bore or passage 56 extends downwardly through the center of the member 45 and is formed with a valve seat 57 at its lower portion with which the upper portion of a valve plug 58 coöperates, the said valve plug being intermediately screw-threaded to adjustably engage the head 7 and having also a tubular stem 59 projecting upwardly therefrom through the center of the concave seat or cup 49 and bore 56 and also through the bores 55 and 54 and supports a ball valve 60 on its upper end. The lower portion of the plug valve 58 has a bore 61 opening outwardly through the bottom thereof and also communicating with the bore through the stem 59, and below the upper portion of the plug valve which engages the seat 57 lateral ports 62 also communicate with the bore 61 and are adapted to establish communication between the latter and the bore 56. The top portion of the upper partition 51 is channeled, as at 63, and likewise the bottom of the seat or cup 49 is formed with a channel 64 continuing up to and intersecting the channel 63 and with which the passage-way 52 also has communication. The channels 63 and 64 open into the upper contracted or constricted bore 48 of each plug bore 46, and as the partitions 51 and 50 are practically circular and the seat or cup 49 of the member 45 essentially of the same contour, it will be understood that the supply of the fuel constituents coming through the channels and passage-way just explained will be effective or regular and positive with

respect to the contracted bores 48 opening into the plug bores 46, and as many of the plugs 47 may be used as desired and found necessary.

Between the dome 15 and the upper portion of the member 45, combustion shells 65 are interposed and suitably secured, the lower extremities 66 of the said shells being tapered toward the lower terminals of the same. The shells 65 are practically concentrically arranged metal bodies forming an annular combustion chamber 67 with a lower reduced inlet 68 communicating with the contracted bores or channels 48, and the upper reduced extremities of the plugs 47 terminate close to the inlet 68. A quantity of non-oxidizable refractory material 69 is introduced in this combustion chamber and is maintained at a predetermined elevation therein, and it will be understood that any suitable refractory material may be used for this purpose. Above the top surface of the refractory material 69 and the dome 15 a mixing chamber is produced, or a space is provided for effecting a thorough intermixture of the products of combustion under pressure and steam to complete the transformation of the heat units and produce the desirable propulsive medium in accordance with the features of the invention. Extending downwardly through the center of the annular combustion chamber or through the inner shell of the latter is an air feed 70 which is of tubular form and has its upper end secured in the head 6 and opening into the chamber 11. The upper extremity of the air feed 70 is chambered as at 71 and has the bore 72 adjacent to the inner shell of the combustion chamber diametrically reduced and the lower portion of the said bore flared at its lower or outlet terminal by forming a bell 73 at the lower end of the air feed to permit the air to expand over and feed through the channel 63 in the upper partition 51. Extending centrally through the air feed 70 is a fuel feed or pipe 74 having its lower end open and secured in the upper end of the collar 53 and its upper end fixed in the top portion of the head 6 and crossing the inner portion of the chamber 11. A fuel supply pipe 75 connects with the head 6 and communicates with the upper end of the fuel feed or pipe 74, and the ball valve 60 is so positioned relatively to the lower end of the fuel feed or pipe 74 that it may automatically operate to close the fuel feed in the event of back fire or excessive pressure. The fuel feed 74 may be employed for supplying either gaseous or liquid fuel; in other words, the fuel may be in the form of a gas first prepared, or liquid hydrocarbon or other liquid fuel may be employed in the generator and come through the pipe 75. When liquid fuel is used, a rod 76 is suitably held by open collars or otherwise in the fuel feed or tube 74 to cause the liquid fuel to pass through the liquid feed in the form of a thin film and be more quickly volatilized by contiguity to the combustion chamber. The fuel fed through the tube 74 passes downwardly through the bore 54 into the passage-way or feed channel 52, and from the latter enters the channel 64 of the cup or seat 49 and then continues upwardly through the inlet 68 of the combustion chamber.

The combustion chamber 65, together with the member 45 of the lower head 7 and the member 13 of the head 6, is concentrically arranged within and spaced from the shell or casing 5, and the space thus produced constitutes a water chamber or boiler 77 which is continued through openings 78 in the member 45 and between the member 13 and the upper portion of the air feed tube 70 and also between the latter and the inner shell of the combustion chamber as well as around the tubular outlet 14. By this arrangement of the water chamber or boiler the water is caused to circulate closely in and about the combustion chamber or the inner and outer shells of the latter, and the water is fed by means of a pipe 79 to the lower portion of said space or chamber, and at the upper part of the latter is a gage pipe 80, a steam space 81 being formed above the normal water level, as at 82.

A hand hold 83 extends through the top of the head 6 and communicates with the upper portion of the tubular outlet 14 for the purpose of cleaning the latter, said hand-hold being normally closed by a plug 84 having a glass insertion 85 intermediately positioned in a bore 86 of the said plug and by means of which also the combustion chamber may be viewed or inspected from the top of the generator. A lateral or elbow 87 also extends from the outlet tube 14, and inserted therein is an outlet pipe 88 that may extend any suitable distance to the clinder or cylinders of an engine or to a turbine or motor adapted to be operated from the generator.

Prior to describing the operation it will be undestood that the water, air and fuel supplies are pumped originally from the atmosphere temperature in proportions to the respective quantities of each required to maintain their proper operating proportions, and all enter into their respective chambers under the same pressures, and likewise enter the different parts of the generator, as for instance the pipes 79, 12 and 75, and will be regulated by valves enabling all areas of entrance to be controlled proportionately to the exact requirements of each material. It will also be understood that the thermal regulator hereinbefore described may be operated by any suitable ex-

pansive medium disposed in the tube 29, which extends into the combustion chamber, or instead of air in the said tube mercury or other volatile material ordinarily employed in thermostatic devices may be used.

In starting the generator the outlet pipe 88 is suitably opened to the atmosphere and a small quantity of fuel is permitted to pass through the pipe 75 into the fuel feed 74. The air inlet or pipe 12 and chamber 11, together with the air feed 70, will be charged at this time with air at a standing presure at, for instance, about one-hundred pounds. When the outlet 88 is open to air and air begins to circulate in the combustion chamber through the channel 63 and constricted inlet 68 and the bed 69 of refractory material, and when the fuel reaches the constricted inlet 68, it will have been fed in proper proportion relatively to the air and the intermingled air and fuel will become ignited from the sparking plugs 47 and heat the combustion bed 69, the products of combustion rising from this bed in the chamber above the same. The combustion chamber by the regular infeed in proper proportions of the air and fuel soon becomes heated to a high degree and this heat is transmitted to and affects the water in the space or chamber 77 to such an extent as to produce steam which gathers in the space 81 above the water level, and by the operation of the thermal regulator or the expansion of the contents of the tube 29, due to heat, the valve 35 closes and the controller with the tube 32 expands so as to bring the port 43 in coincidence with the supply port 25 and permit a proportionate quantity of steam to flow downwardly through the bore 26 and pass from the inner portion of the counter-bore 22 through the port 21 to the spreader ring 18 and by the latter be distributed in the mixing chamber over the combustion bed and be caused to mingle with the products of combustion. As the heat in the generator reaches a degree to cause effective radiation, both the air passing downwardly through the reduced portion 72 of the air feed 70 and the fuel coming through the fuel feed 74 will be preheated so that on their entrance into the lower section or portion of the bed of refractory material in the combustion chamber the fuel gases will be completely burned and the hot products of combustion will collect in the upper portion of this combustion chamber and operate the thermal regulator as explained. The steam admitted into the combustion chamber and sprayed by the ring 18 into the highly heated combustion gases causes superheating of the steam thus admitted and reducing of the same to a lower temperature which will correspond to a larger portion of heated volumes at a lower temperature. This expanded volume of heated gases and superheated steam will bring about a pressure equal to the pressure of air, water and fuel being admitted into the combustion chamber and the inflow of these respective materials or fuel components will be automatically stopped or checked according to the amount of mixed superheated steam and gases passing out through the outlet 14, lateral or elbow 87 and pipe 88 in working condition to the engine or motor adapted to be operated, and the primary components of the propulsive medium produced will flow into the combustion chamber according to the work demanded or the requirements as to load on the engine or motor and at a uniform temperature.

One of the most essential features of the generator or apparatus is the thermal regulator, which in the event of excessive heat generation in the combustion chamber causes a maximum expansion of the controller 30 and its coöperating parts and a consequent opening of the supply port 24 which will admit hot water into the combustion chamber through the ports 22 and 21 over the ring 18 and thereby more rapidly and effectually temper or reduce the temperature of the combustion chamber and constantly maintain the latter at a predetermined degree of temperature in accordance with the adjustment of the spring 40. This temperature regulation of the combustion chamber not only is materially advantageous in the practical transformation of the heat units stored up in fuel into a more efficient energy or propulsive medium, but also prevents the parts of the combustion chamber and the generator from being burnt out. When gas fuel is used or admitted through the gas inlet or fuel feed 74, the rod 76 is withdrawn or removed. Furthermore, as hereinbefore explained, in the event of back fire or explosion tension of an excessive character at the lower portion of the combustion chamber, the ball valve 60 will be forced upwardly against and close the lower end of the fuel feed pipe 74 and open the stem 55 to the outer atmosphere and thus relieve the confined excessive pressure and the disadvantageous effect of back fire. Furthermore, the tubular stem 59 and plug valve 58 may also be used for effecting a blow-out or cleaning of the lower portion of the generator by screwing the said plug valve inwardly and opening the ports 62 to the bore 56 when any sediment or deposit that may be lodged in the channel 64 as well as in the passage-way 52 may be blown out and in fact the whole apparatus may be cleaned in this manner and freed of accumulation.

The sparking plugs or ignition devices 47 will be heated to the ignition state by turning thereinto through the electrical connec-

tions a high pressure current to ignite the gases and the sparking plugs will continue their ignition service until the bed of refractory material in the combustion chamber has become hot enough to ignite the gases independently of the sparking plugs, and when the bed of refractory material has reached this state of heat the current is cut off from the plugs. It will also be seen that the air which is admitted in cool condition into the air feed tube 70 will become heated and expand in passing through the reduced portion 72 of the said air feed adjacent to the combustion chamber, and the latter therefore not only operates to form the products of combustion which result from the burning of the gases, but also heats the water in the chamber or space 77 to produce steam as well as the air and the fuel coming through the fuel feed 74 in either liquid or gaseous form. The parts of the generator or apparatus may be readily assembled after preliminary preparation and are of a durable character, the practical service of the several parts, and especially the combustion chamber, being materially prolonged in view of the operation of the thermal regulator which acts as a tempering means for the said combustion chamber.

What is claimed is:

1. In a pressure generator, the combination of a water chamber, a combustion chamber within the water chamber, means for feeding fuel and air to the combustion chamber, and a thermal regulator having a portion thereof depending into the combustion chamber for maintaining the uniformity of temperature in the latter.

2. In a pressure generator, the combination of a water chamber, a combustion chamber in the water chamber, means for feeding fuel and air to the combustion chamber and igniting the latter, and a thermal regulator having a portion thereof depending into the combustion chamber and operating to admit a tempering medium to the combustion chamber and preserve a predetermined temperature in the said latter chamber.

3. In a pressure generator, the combination of a water chamber, a combustion chamber exposed in the water chamber and provided with ignition means, means for feeding air and fuel under pressure to the combustion chamber and igniting the mixture of air and fuel, and a thermal regulator for admitting steam from the water chamber to the combustion chamber.

4. In a pressure generator, the combination of a water chamber, a combustion chamber exposed in the water chamber and provided with ignition means, means for feeding air and fuel under pressure to the combustion chamber and igniting the mixture of air and fuel, and a thermal regulator for admitting steam and hot water to the combustion chamber.

5. In a pressure generator, the combination of a combustion chamber provided with means for feeding a mixture of fuel and air thereto and for igniting the said mixture, a steam and hot water supplying means, and a thermal regulator for admitting steam to the combustion chamber.

6. In a pressure generator, the combination of a combustion chamber provided with means for feeding a mixture of fuel and air thereto and for igniting the said mixture, a steam and hot water supplying means, and a thermal regulator operating by expansion to admit steam and hot water to the combustion chamber.

7. In a pressure generator, the combination of a combustion chamber, a water chamber adjacent to the combustion chamber, means for supplying air and fuel under pressure to the combustion chamber and igniting the mixture, and a thermal regulator operating to open communication between the steam and hot water and the combustion chamber.

8. In a pressure generator, the combination of a water chamber, a combustion chamber within the water chamber having a lower reduced inlet and also provided with a bed of refractory material, means for feeding fuel and air to the said inlet of the combustion chamber, the fuel and air being ignited and the products of combustion passing upwardly into the combustion chamber above the bed of refractory material, and means for admitting steam into the upper portion of the combustion chamber.

9. In a pressure generator, the combination of a water chamber, a combustion chamber within the water chamber having a lower reduced inlet and also provided with ignition means, devices extending downwardly through the interior of the generator close to the inner portion of the combustion chamber for heating and feeding air and fuel to the lower reduced inlet of the combustion chamber, and means for admitting steam to the upper portion of the combustion chamber.

10. In a pressure generator, the combination of a water chamber, a combustion chamber within the water chamber having a lower reduced inlet, means for feeding fuel and air under pressure and in heated condition to the lower inlet of the combustion chamber, means for igniting the charge of fuel and air entering the lower portion of the combustion chamber and causing combustion to be effected and the products of combustion to rise in the combustion chamber, and means for admitting steam and a tempering medium into the upper portion of the combustion chamber, the admission of the tempering medium to the said combus-

tion chamber occurring when a maximum heated condition is reached and independently of the admission of the steam to said chamber.

11. In a pressure generator, the combination of a water chamber, a combustion chamber within the water chamber having a lower reduced inlet and an upper outlet, a bed of refractory material being disposed in the combustion chamber, means for feeding air and fuel to the lower inlet of the combustion chamber, the air and fuel being under pressure and preheated before entering the combustion chamber, means for preliminarily igniting the air and fuel adjacent to the inlet of the combustion chamber, the bed of refractory material igniting the air and fuel after the operation of the generator has started, and means for admitting steam into the upper portion of the combustion chamber and also for controlling the temperature of the latter chamber.

12. In a pressure generator, the combination of a water chamber, a combustion chamber within the water chamber, means for feeding air and fuel and igniting the latter at the lower portion of the combustion chamber, means for admitting steam into the combustion chamber, and means for preventing a rise of temperature in the combustion chamber above a predetermined degree.

13. In a pressure generator, the combination of a water chamber, a combustion chamber within the water chamber, means for feeding air and fuel to the lower portion of the combustion chamber, the combustion chamber having ignition means coöperating therewith, means for feeding steam into the combustion chamber, and means automatically operating to cut off a feed of fuel in the event of excessive pressure or back fire.

14. In a pressure generator, the combination of a water chamber, a combustion chamber within the water chamber, means for feeding air and fuel to the lower portion of the combustion chamber, means for igniting the air and fuel, and devices in the lower portion of the generator for blowing off and cleaning out the sediment that may collect therein.

In testimony whereof I have hereunto set my hand in presence of two subscribing witnesses.

LEE R. CAMP.

Witnesses:
CHAS. S. HYER,
CHAS. A. ROWE.