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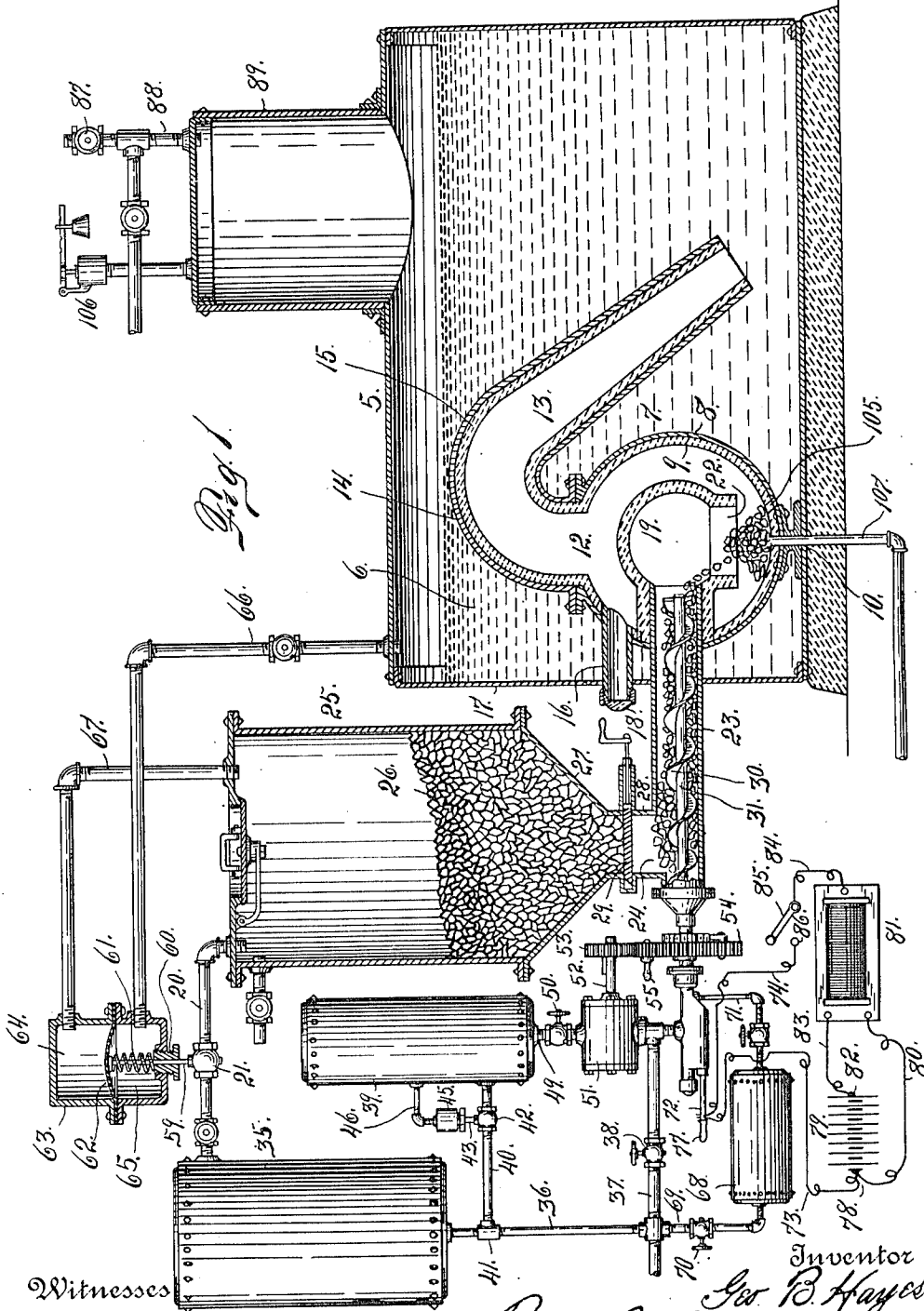
APPARATUS FOR GENERATING MOTIVE FLUID.

APPLICATION FILED OCT. 5, 1908.

Patented Aug. 22, 1911.

3 SHEETS-SHEET 1.

1,001,591.



Witnesses

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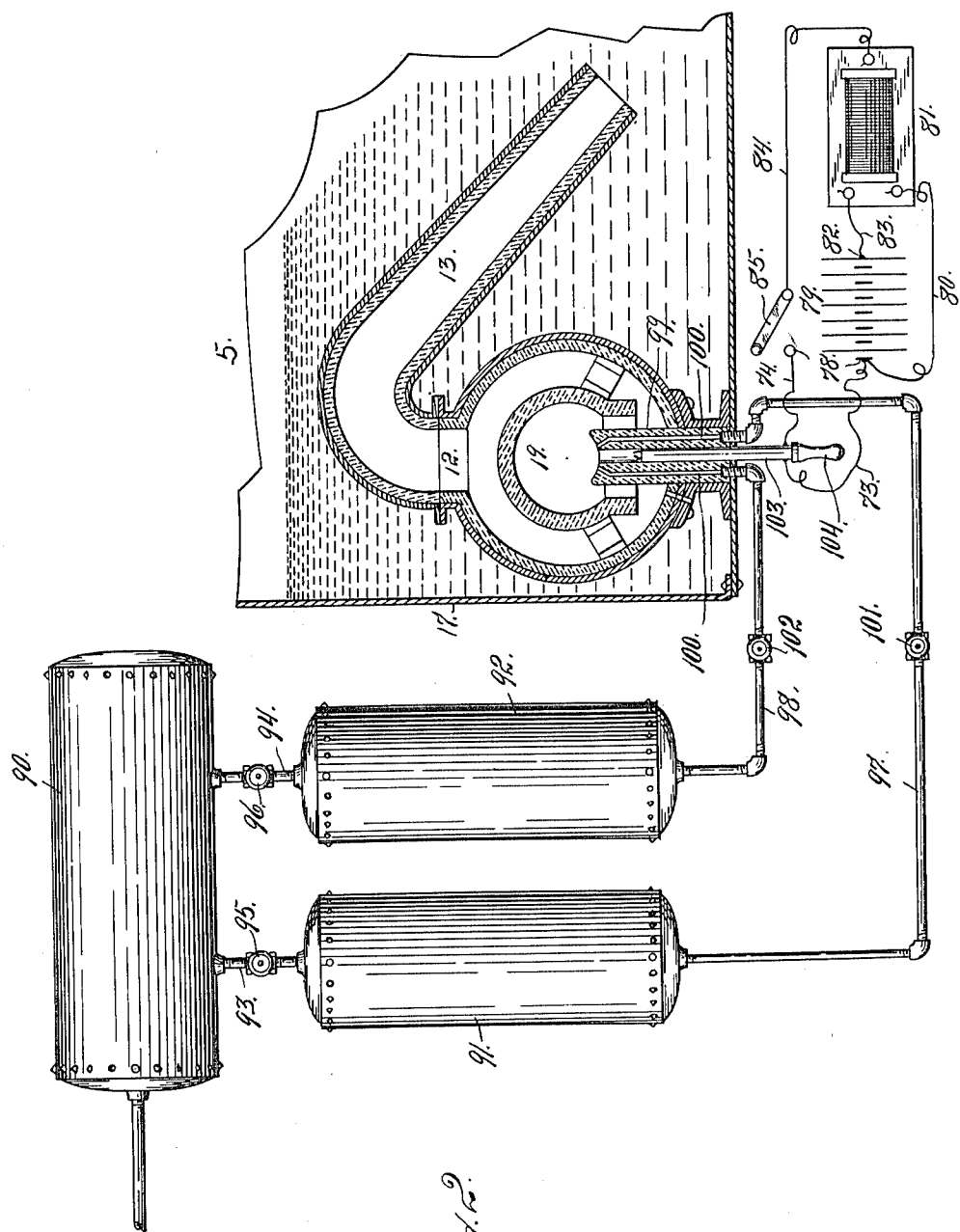


Fig. 2.

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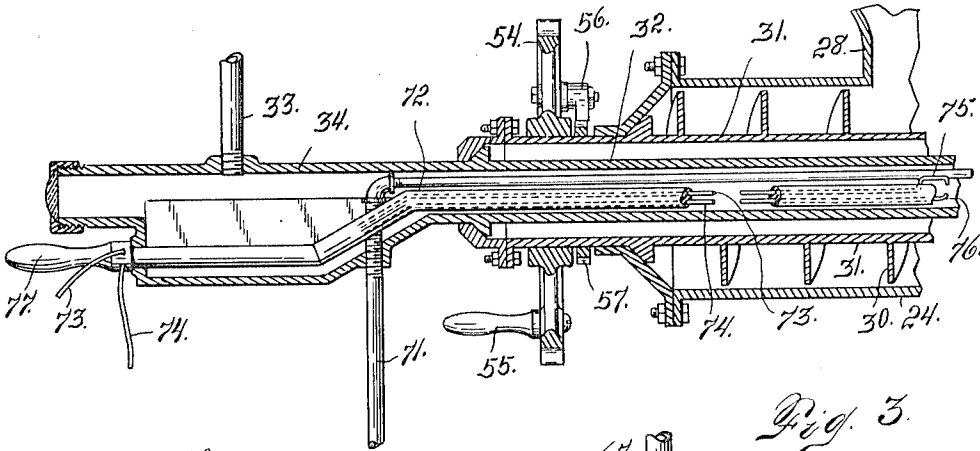


Fig. 3.

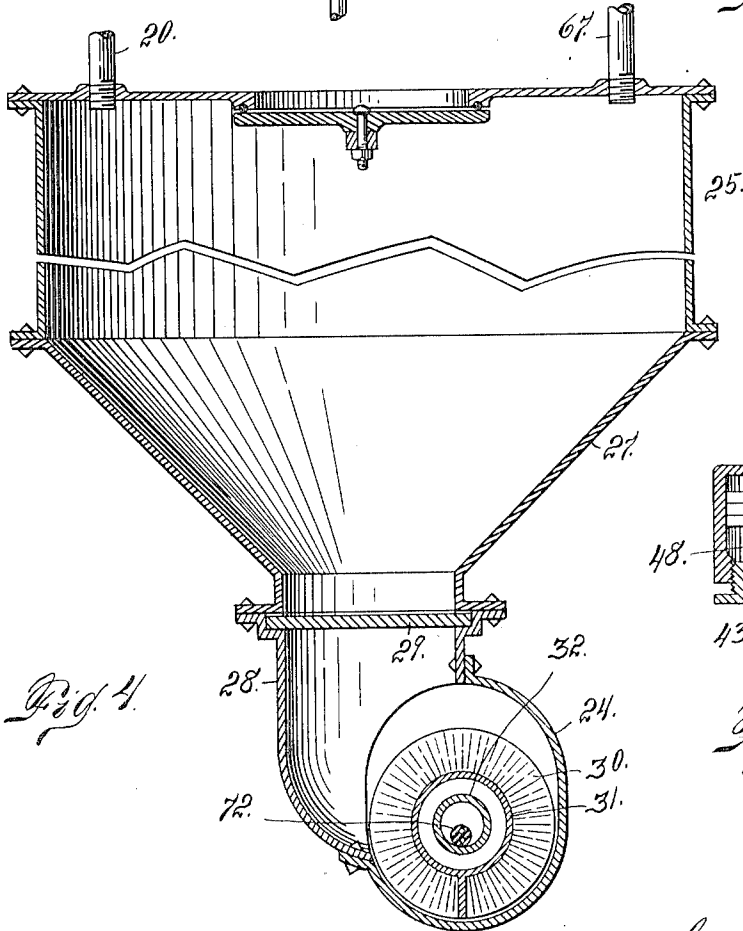


Fig. 4.

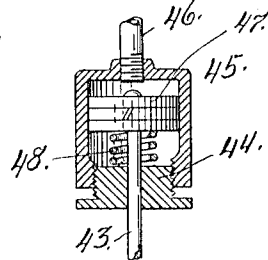


Fig. 5.

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UNITED STATES PATENT OFFICE.

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APPARATUS FOR GENERATING MOTIVE FLUID.

1,001,591.

Specification of Letters Patent. Patented Aug. 22, 1911.

Application filed October 5, 1908. Serial No. 456,132.

To all whom it may concern:

Be it known that I, GEORGE B. HAYES, a citizen of the United States, residing in the city and county of Denver and State of Colorado, have invented certain new and useful Improvements in Apparatus for Generating Motive Fluid; and I do 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, reference being had to the accompanying drawings, and to the letters and figures of reference marked thereon, which form a part of this specification.

My invention relates to improvements in apparatus for generating a motive fluid by the use of either solid or liquid fuel.

The general principles involved in the operation of my apparatus, consist in the introduction of the products of combustion into the liquid to be vaporized whereby all of the heat units are utilized for the purpose stated. The fuel and a suitable combustion supporting medium are simultaneously and separately delivered to a combustion chamber which is preferably located within the motive-fluid generator, being surrounded by the liquid of the generator. The combustion chamber is provided with a downwardly extending goose-neck shaped conduit, one extremity being in communication with the combustion chamber, while the other is open to the liquid. The pressure within the combustion chamber is uniformly somewhat greater than that within the generator, thus making it practicable to prevent the entrance of liquid to the combustion chamber from the generator when the apparatus is in use.

The apparatus herein described is suitable for use in the practice of the process set forth in my previous application, Serial No. 450011, filed August 24th 1908.

In my improved construction provision is made for initially igniting the fuel within the combustion chamber through the instrumentality of a sparking coil in combination with apparatus for carbureting gasoline, the latter being in suitable proximity to the spark-producing electrodes. The electric conductors with which the electrodes are connected, are embedded in a rod composed of insulating material the said rod being slidably mounted in a pipe passed through the hollow shaft to the feed screw.

This is the same pipe through which the combustion supporting medium is delivered to the combustion chamber. The carbureted gasoline is also passed through this pipe. The introduction of gasoline is continued until the fuel, if solid fuel, as coal, is employed, is well ignited, after which the introduction of gasoline may be discontinued, and the electrodes which are connected with an exteriorly located handle, withdrawn a sufficient distance to prevent their exposure to an undue degree of heat.

Having briefly outlined my improved construction, I will proceed to describe the same in detail, reference being made to the accompanying drawing in which is illustrated an embodiment thereof.

In this drawing, Figure 1 is a view partly in elevation and partly in section illustrating my improved apparatus. In this view the form of construction especially adapted for use with solid fuel is illustrated. Fig. 2 is a similar view illustrating a construction for using liquid fuel, or highly inflammable combustibles. In this view the generator, together with the combustion chamber located therein, is shown in section. Fig. 3 is a fragmentary detail view of the feed screw for introducing solid fuel to the combustion chamber together with means for initially igniting said fuel by the use of carbureted gasoline and electrodes. Fig. 4 is a fragmentary sectional view of the solid fuel receptacle, said view being taken at right angles to that shown in Fig. 1, but on a larger scale. Fig. 5 is a detail view of a governor interposed between the main air tank and an auxiliary tank, for maintaining the air within the latter constantly at the maximum pressure required in the generator.

The same reference characters indicate the same parts in all the views.

Referring first more especially to Figs. 1, 3 and 4, let the numeral 5 designate a generator containing liquid 6 to be evaporated. Within this generator is located a combustion chamber 7, having an outer shell 8 of metal and an inner lining 9 of fire-clay or other suitable material adapted to resist a high degree of heat. This chamber is provided with a suitable support 10 resting upon the bottom of the generator. The top of the chamber is open, as shown at 12, and communicates with a goose-neck shaped conduit 13 having an outer metal shell 14 and a lin-

ing 15 of fire-clay, the construction of the walls of the conduit being substantially the same as in the case of the chamber 7. This conduit 13 extends downwardly and its lower extremity is open. When the device is in use the liquid within the generator is prevented from entering the combustion chamber by the pressure within the latter which is somewhat greater than that within the generator. The combustion chamber is provided with a twyer 16 extending from its upper portion forwardly through the front shell 17 of the generator, its outer extremity being closed by a transparent disk or lens 18, providing means for viewing the interior of the combustion chamber from a position outside of the generator.

Within the main combustion chamber 7 is located an auxiliary combustion chamber 19 which is composed of fire-clay or other suitable refractory material. This auxiliary chamber is provided with a bottom opening 22 through which the products of combustion are delivered downwardly into the bottom of the main chamber before escaping into the liquid of the generator. By means of this interior chamber, more nearly perfect combustion may be obtained since the gases initially generated by the heat are caused to travel by a circuitous path before escaping. This path causes these gases to travel through the body of fuel, if any, which has accumulated in the said chamber.

A conduit 23 communicates at one extremity with the inner chamber; its opposite extremity being in communication with a mouth 24 of a receptacle 25 containing solid fuel 26, as coal. The bottom of this receptacle is funnel-shaped, as shown at 27, and terminates in a neck 28 in which is located a gate or slide valve 29. Within the conduit 23 which protrudes beyond the generator, is located a feed screw 30 containing a hollow stem 31 through which passes a pipe 32 for the introduction of air to the combustion chamber. A pipe 33 communicates with the outer extremity 34 of the said conduit.

The necessary air or other combustion supporting medium for supplying the combustion chamber, is taken from a tank 35 which may be connected with an air compressor (not shown), whereby the air within the tank 35 may be maintained at any suitable pressure. Leading downwardly from the tank 35 is a pipe 36 which communicates with a pipe 37 leading to the pipe 33. The pipe 37 is controlled by a valve 38. Hence, air may be introduced to the combustion chamber through the conduit 32 through the medium of the pipes 36, 37 and 33. In the drawing, however, I have shown means for regulating the pressure of the air delivered to the combustion chamber, which will now be described. Let the numeral 39 designate an auxiliary tank

which receives air through a pipe 40, one extremity of which communicates with the pipe 36, as shown at 41, while the other extremity communicates with the tank 39. Located within the pipe 40 is a valve 42 whose stem 43 passes upwardly through a screw-plug 44 inserted in the lower extremity of a casing 45, the upper extremity of the casing being in communication with the tank 39 by a pipe 46. The upper extremity of the valve stem 43 is provided with a piston 47 supported by a coil spring 48 resting upon the coil spring 44 which serves as a nut for regulating the tension of the spring 48. When the device is in use the plug 44 is screwed into the casing sufficiently to place the spring 48 under the desired tension for resisting a predetermined pressure upon the upper face of the piston 47, due to the pressure within the auxiliary tank 39. In other words, the spring 48 holds the valve 42 open by a predetermined resistance, the tension of the spring being so regulated as to keep the valve open until the pressure of the air within the tank 39 becomes greater than it is desired to deliver to the combustion chamber, and when this occurs, the piston 47 acted on from above will be moved downwardly against the tension of the spring 48 sufficiently to close the valve 42 and cut off the introduction of air from the tank 35 until the pressure in the tank 39 is reduced sufficiently to allow the spring to open the valve. When this auxiliary tank construction is employed the air from the tank 39 is delivered through a pipe 49 controlled by a valve 50 to a motor 51 which is in communication with the pipe 33, the exhaust from the motor entering the combustion chamber by way of the pipe 33 and the pipe 42 which passes through the hollow feed screw as heretofore explained. The motor 51 operates a shaft 52 on whose outer extremity is mounted a gear 53 meshing with a larger gear 54 provided with an operating handle 55 loose upon the hollow stem 31 of the feed screw. This wheel is connected in operative relation with the feed screw by virtue of a pawl 56 mounted upon the feed screw and engaging a ratchet wheel 57 fast on the stem of the feed screw. The pinion 53 may be slidably mounted upon the motor shaft 52 whereby the pinion may be thrust out of mesh with the gear 54 to allow the feed screw to be operated by hand without turning the motor. This may under some circumstances be necessary.

In my improved construction I provide means for maintaining the pressure within the fuel receptacle 25, at a somewhat greater degree than the pressure within the generator. The mechanism employed will now be described: Leading from the tank 35 to the fuel receptacle is a pipe 20 provided with a valve 21 having a stem 59 which

passes through a screw-plug 60 serving as a tension nut which engages a coil spring 61 surrounding the valve stem and interposed between the nut and a diaphragm 62 which separates a casing 63 into two compartments 64 and 65. A pipe 66 leads from the top of the generator to the compartment 65 of the casing 63; while a pipe 67 leads from the top of the fuel receptacle 25 to the compartment 64 of the casing 63, above the diaphragm.

In adjusting the tension of the spring 61 by the use of the nut 60 the tension of the spring is so regulated that the valve 58 will remain open when the pressure in the fuel receptacle or that bearing upon the upper surface of the diaphragm is a few pounds greater than the pressure upon the generator which acts upon the lower surface of the diaphragm. When, however, the pressure within the fuel receptacle becomes greater than the predetermined excess, the valve 58 will be closed and the air from the tank 35 cut off until the pressure within the fuel receptacle is reduced to the desired degree.

For the purpose of igniting the fuel within the combustion chamber, I introduce a quantity of properly carbureted gasolene which is taken from a tank 68, one extremity of which is connected with an air pipe 69 having a valve 70. This air pipe is in communication with the pipe 37, whereby air may be introduced into the tank 68 for the purpose of carbureting air which is carried under pressure through a pipe 71 which leads from the gasolene tank 68 and passes through the conduit 32 located within the hollow feed screw, the said combustible mixture being delivered at the inner extremity of the said screw where it enters the combustion chamber.

Mounted within the conduit 32 is a rod 72 composed of insulating material in which are embedded electrical conductors 73 and 74 terminating in electrodes 75 and 76 sufficiently separated to produce a spark resulting from the arcing of the current when the circuit is closed through the said conductors. This rod 72 is slidably mounted within the conduit 32 and has an exposed handle 77 for convenience of manipulation. After the ignition of the gasolene mixture the rod may be moved longitudinally within the conduit 32 sufficiently to withdraw the electrodes from the fierce heat of the combustion chamber.

The conductor 73 leads to a pole 78 of an electrical source 79. From the same pole 78 leads a conductor 80 to a sparking coil 81. From the opposite pole 82 of the said source leads a conductor 83 to the spark coil. From this coil also leads a conductor 84 to a switch arm 85 adapted to engage a contact 86 with which is connected the conductor 74.

When the switch arm 85 is closed or placed in engagement with the contact 86 the spark coil circuit is closed for the purpose of igniting the gasolene mixture in the combustion chamber for the purpose of burning the fuel delivered thereto in the manner heretofore explained.

In starting the apparatus, the water level should be as low as practicable in the generator, preferably so as to cover only about one-half of the combustion chamber. At this time the valve 87 located in a pipe 88 connected with a dome 89 of the generator will be open. After the contents of the generator have arrived at the boiling point the valve 87 is closed. It is assumed that the fuel is initially fed to the combustion chamber by hand; also that the necessary air or the combustion supporting medium, is supplied by the use of a hand pump. After the liquid within the generator has been raised to the boiling point, sufficient steam is generated for operating the compressor (not shown) which supplies the air tank 35. The compressed air is then used both for supplying the combustion chamber, and also for operating the feed screw through the movement of the motor, when solid fuel is used.

The construction disclosed in Fig. 2 of the drawing will now be described. This apparatus is suitable for burning highly inflammable combustibles such as hydro-carbons, with any suitable combustion supporting medium containing a large percentage of the combustion supporting element, such as liquid air containing a high percentage of oxygen, liquid oxygen itself, or compounds of nitrogen and oxygen, such as nitric acid. The combustion is started by an electrical device comprising a spark coil construction, the same as disclosed in Fig. 1, and the corresponding parts are, therefore given like reference characters. The apparatus disclosed in Fig. 2 consists of a reservoir 90 having a pressure greater than the pressure of the generator. Two tanks 91 and 92 are connected with the reservoir 90 by pipes 93 and 94 which are provided with valves 95 and 96 respectively. The tank 91 is the fuel tank and the tank 92 the tank containing the combustion supporting medium. These tanks are respectively connected by means of pipes 97 and 98 with a fire-clay burner 99 passing upwardly from the base of the generator and protruding into the combustion chamber, its upper extremity entering the inner or auxiliary chamber. This burner is provided with passages 100, with which the said pipes communicate, the pipes being threaded into the wall of the generator and entering the fire-clay burner at the outer extremity of the said passages. The pipes 97 and 98 are provided with valves 101 and 102, respectively. The electrical conductors 73 and 74

are connected with a movable rod 103 whose body portion is composed of insulating material in which the continuations of the said conductors are embedded. The inner extremities of the conductors are provided with electrodes 75 and 76. The same reference characters are applied to these electrodes as to those illustrated in Fig. 3, since the two constructions are substantially similar. In other respects, the combustion chamber of the construction illustrated in Fig. 2 is substantially the same as disclosed in Fig. 1. The insulating rod is provided at its outer extremity with a handle 104, the rod being slidably mounted in the burner to permit the withdrawal of the electrodes from the fierce heat of the chamber after the fuel has been originally ignited. The valves 101 and 102 should be so constructed that the combustible agents can be perfectly controlled and delivered in as small quantities as desirable.

It may be well to further explain that the governor valve interposed between the pipe 40 and the auxiliary tank 39, is used for maintaining the air within the auxiliary reservoir constantly at the maximum pressure required within the generator, so that any fluctuation of pressure in the generator from the auxiliary reservoir pressure, causes the flow of air and fuel to be increased or diminished, as the case may be.

The fuel feed device is designed to automatically control or regulate, and automatically proportion the supply of combustibles and insure a fuel feed at all times.

The bottom of the combustion chamber (see Fig. 1) is provided with a small opening 105 for draining the chamber of water when necessary, by subjecting the same to air pressure and also for the discharge of any incombustible matter that may be liquefied but which cannot be volatilized, when the apparatus is in use.

If desired, air may be supplied to the combustion chamber in addition to the regular supply heretofore explained, through a pipe 107 entering the bottom of the combustion chamber.

It may be stated that the safety valve 106 connected with the generator should be set at a somewhat lower pressure than the pressure of air supply whereby a flow of combustibles is always insured.

Having thus described my invention, what I claim is:

1. The combination of a liquid containing generator, of a combustion chamber, said combustion chamber having a fuel supply tank in communication therewith by means of a conduit, a tank containing a combustion supply medium communicating with the said combustion chamber through the fuel supply medium, and means for automatically igniting said combustion medium with-

in the combustion chamber, substantially as described.

2. The combination with a liquid containing generator, of a combustion chamber communicating with the volume of liquid in said generator, the said combustion chamber having a fuel supply receptacle, and a tank containing a combustion supporting medium in communication therewith, a governor mechanism in communication with the generator, the fuel receptacle and the said tank for automatically regulating the pressure within the fuel receptacle, and means for maintaining a predetermined relation between the pressure within the fuel receptacle and the pressure within the generator, substantially as described.

3. The combination with a liquid containing generator, of a combustion chamber having a single outlet for the products of combustion, the said outlet being in communication with the volume of liquid in the generator, a fuel receptacle, an operative connection between the said receptacle and the combustion chamber for delivering fuel from the one to the other, a tank containing a combustion supporting medium, also in communication with the combustion chamber, the fuel receptacle being in communication with the said tank, a governor mechanism in communication with the generator, the fuel receptacle and the said tank, for automatically regulating the pressure within the fuel receptacle, whereby a predetermined relation may be maintained between the pressure of the fuel receptacle and the pressure within the generator, substantially as described.

4. The combination with a liquid-containing generator, consisting of a combustion chamber, a fuel supply tank in communication therewith, a fluid storage tank communicating with the said combustion chamber, means for automatically regulating the flow of fluid from the storage tank to the combustion chamber, a fluid motor operated by the fluid contained in the fluid storage tank, and a screw conveyer operated by the motor for conveying fuel to the combustion chamber.

5. The combination with a liquid containing generator, of a combustion chamber located within the liquid-containing generator and in communication with the liquid of the generator, a fuel-containing tank, a screw conveyer for supplying fuel from the tank to the combustion chamber, a tank containing combustion-supporting medium in communication with the combustion chamber and the fuel-containing tank, means for automatically regulating the supply of combustion-supporting medium to the fuel receptacle, and means for maintaining a predetermined relation between the pressure within the fuel receptacle and the pressure

within the generator, substantially as described.

6. The combination with a liquid containing generator, consisting of a combustion chamber, a fuel supply tank in communication therewith, a fuel storage tank in communication with the said combustion chamber and with the fuel supply tank, a conveyer for supplying fuel to the said combustion chamber from the fuel supply tank, means for automatically regulating the flow of fluid to the combustion chamber, means for also regulating the supply of fluid to the receptacle, and a fluid motor for operating the conveyer, the said motor being operated by the fluid passing from the fluid storage tank to the combustion chamber, substantially as described.

7. The combination with a liquid containing generator, of a combustion chamber communicating with the volume of liquid in the said generator, a fuel supply receptacle in communication with the combustion chamber, a tank containing a combustion supporting medium in communication with the fuel receptacle, and a governor mechanism in communication with the generator, the fuel receptacle and the said tank for automatically regulating the pressure within the fuel receptacle, and means for conveying the fuel from the fuel receptacle to the combustion chamber, substantially as described.

8. The combination with a liquid containing generator, of a combustion chamber, having an outlet for the products of combustion into the liquid containing generator, a fuel receptacle, means for delivering fuel from the said receptacle to the combustion chamber, a tank containing a combustion-supporting medium in communication with the combustion chamber and the fuel receptacle, a governor mechanism in communication with the fuel receptacle in said tank for regulating the pressure within the fuel receptacle, whereby a predetermined relation may be maintained between the pressure in the fuel receptacle and the pressure within the chamber, and means for controlling the supply of combustion-supporting medium to the combustion chamber, in relation to the supply of fuel therein, substantially as described.

9. The combination with a liquid containing generator, of a combustion chamber in

communication with the volume of liquid in the generator, a fuel supply receptacle, a conduit leading from the fuel supply receptacle to the combustion chamber, a hollow screw conveyer located therein, a tank containing a combustion supporting medium, the said tank communicating with the fuel receptacle and the combustion chamber through the medium of the hollow of the screw conveyer, means for automatically regulating the flow of liquid from the combustion chamber, means for automatically regulating the flow of fluid to the fuel receptacle, a motor in operative relation with the screw conveyer, the said motor being in communication with the combustion supporting medium and the tank, and operated by the fluid in its passage to the combustion chamber, substantially as described.

10. In an apparatus of the class described, the combination with a liquid containing receptacle, of a combustion chamber located therein, and having an outlet extending downwardly and outwardly from the top of the chamber and in communication with the volume of liquid within the generator, and an inverted auxiliary chamber located within the first named chamber and communicating with the latter substantially as described.

11. The combination with a liquid containing generator, of a combustion chamber located within the liquid containing generator, the said combustion chamber being in communication with the liquid within the generator for delivering the products of combustion thereto, and an inverted auxiliary chamber located within the first named chamber and in communication with the latter, substantially as described.

12. In an apparatus of the class described, the combination with a liquid containing generator, of a main combustion chamber having a twyer extending downwardly and outwardly from the top of the main combustion chamber, and an inverted auxiliary chamber located within the main chamber and communicating with the latter, substantially as described.

In testimony whereof I affix my signature in presence of two witnesses.

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Witnesses:

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