(No Model.) 2 Sheets—Sheet 1.

V. KARAVODIN.

BOILER.

No. 569,287. Patented Oct. 13, 1896.

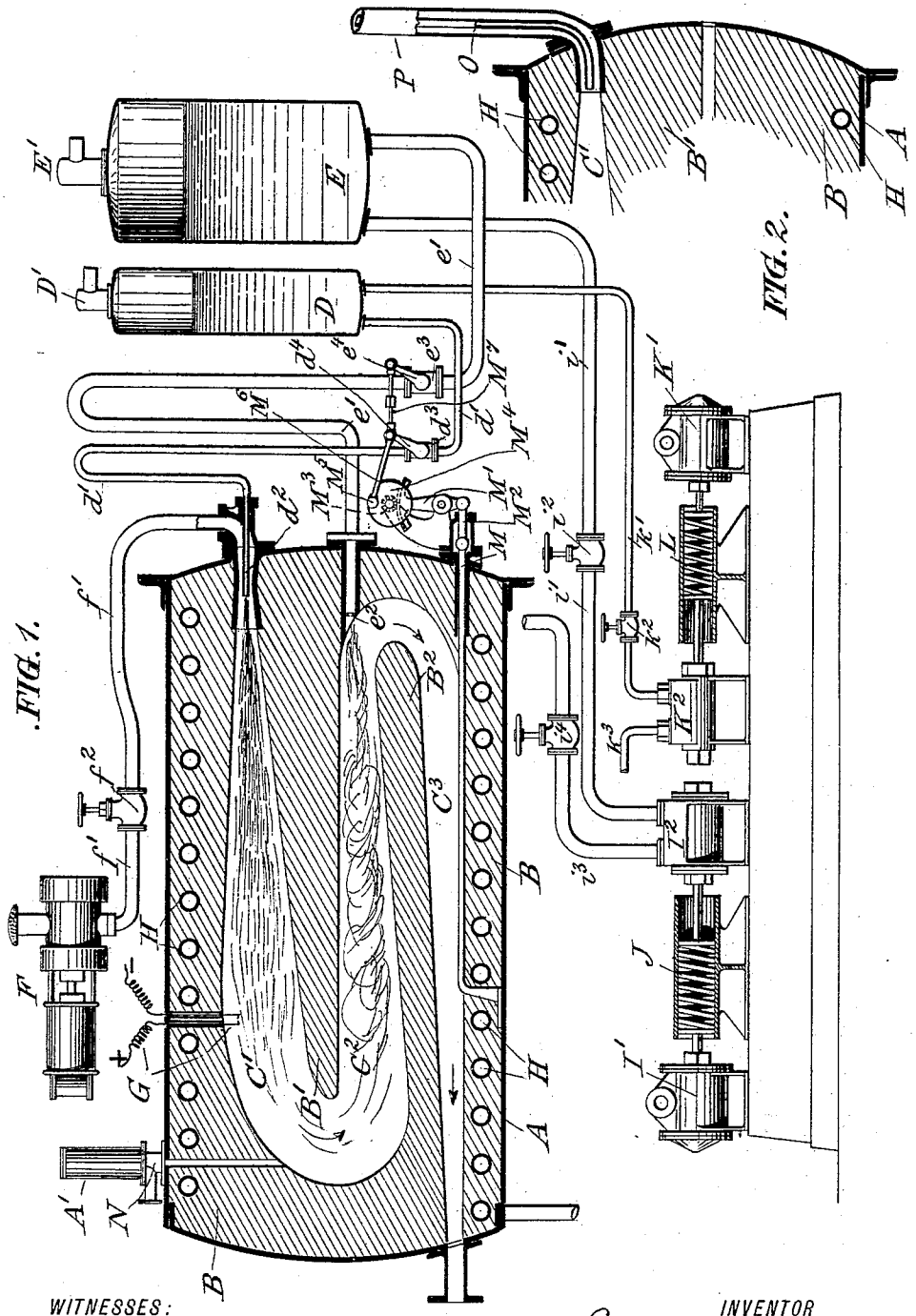

FIG. 1.

FIG. 2.

WITNESSES:
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(No Model.) 2 Sheets—Sheet 2.

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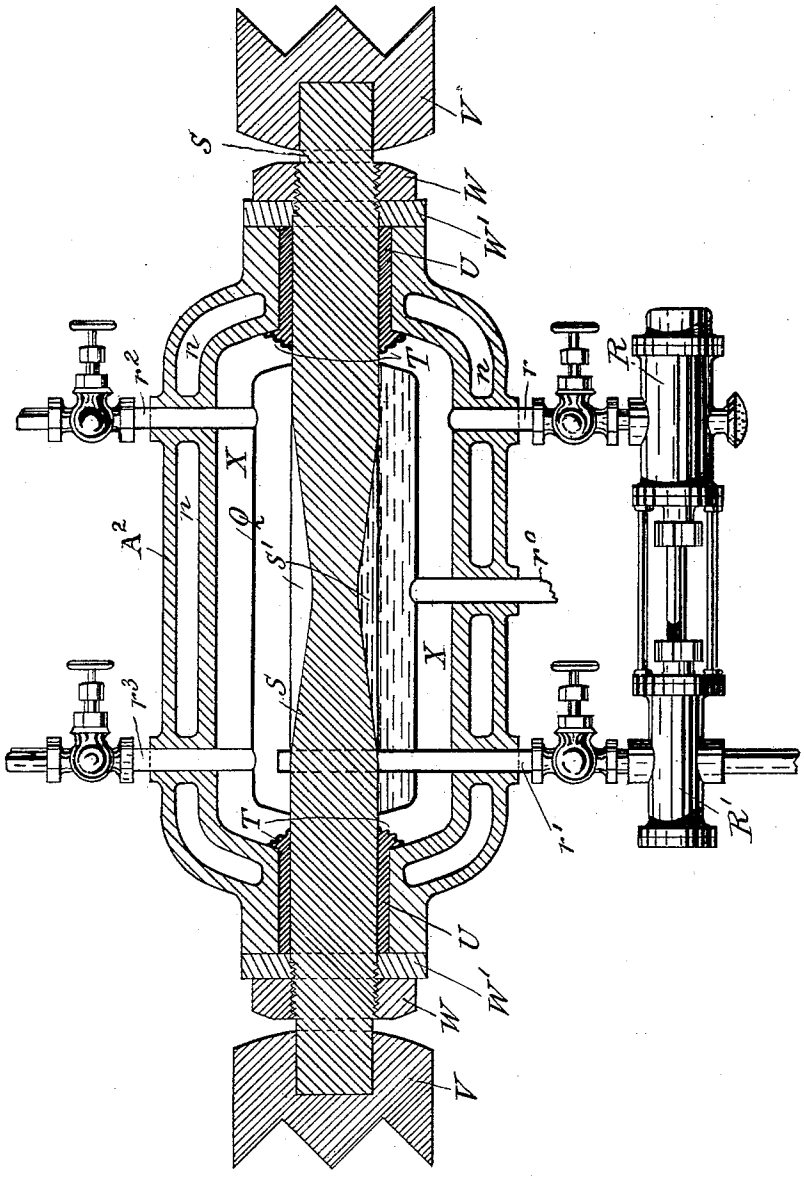

FIG. 3.

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VICTOR KARAVODIN, OF ST. PETERSBURG, RUSSIA.

BOILER.

SPECIFICATION forming part of Letters Patent No. 569,287, dated October 13, 1896.

Application filed February 16, 1895. Serial No. 538,657. (No model.)

To all whom it may concern:

Be it known that I, VICTOR KARAVODIN, a subject of the Emperor of Russia, residing at St. Petersburg, Russia, have invented certain new and useful Improvements in Appliances for Generating Vapors and Steam, of which the following is a specification.

My invention relates to improvements in the construction of boilers or retorts for generating vapor or steam, and appliances connecting therewith; and the principal objects of my invention are to provide suitable means for protecting and cooling their shells and for regulating the supply of fuel and of water to the interiors of such generators.

In the accompanying drawings, forming part of this specification, Figure 1 shows a longitudinal vertical section of a generator adapted for the development of a mixture of oil and water and their gases of combustion in accordance with my invention, while Fig. 2 shows a similar section of the rear portion of a like generator adapted for the utilization of finely-divided particles of solid carbonaceous fuel in place of water. Fig. 3 is a longitudinal vertical section of a steam-generator embodying certain features of my invention.

Referring first to Figs. 1 and 2, A is a metallic shell constructed in the form usually employed in boiler-shells. The same is provided with an interior lining B, made of refractory material which is a poor conductor of heat.

B′ B^2 are horizontal partitions made of like material and extending from opposite ends of the generator for nearly its entire length, so as to form, together with the outer walls of the generator, an **S**-shaped conduit C′ C^2 C^3, wherein the gases of combustion above referred to are produced, as more fully described hereinafter.

D is a vessel containing petroleum under pressure and having its liquid-space connected by means of a pipe d' with a jet d^2, discharging into the upper compartment C′ of the generator.

E is a vessel containing water under pressure, and having its liquid-space connected by a pipe e' with a spraying-outlet e^2, discharging into compartment C^2 of said generator.

F is an air-pump for forcing compressed air through a pipe f' and regulating cock or valve f^2 therein into compartment C′, the discharge end of pipe f' being made to so surround nozzle d^2 as to there create an induced current, whereby the petroleum is converted into a spray.

G is an electric igniter whereby the finely-divided petroleum may be ignited. The gases of combustion so created will then flow in the direction of the arrow into compartment C^2, where they meet the water discharged in the form of a spray from outlet e^2 and convert it into steam, and together with such steam flow through compartment C^3 to an engine, where they are employed in producing motive power, or to any other apparatus where they may be utilized.

H H are pipes embedded in the refractory lining B of the generator-shell, through which cooling-water is made to circulate for the purpose of protecting said lining and said shell and to thus make the latter more capable of resisting heavy pressures and avoiding the uneven strains usually resulting in such shells from uneven expansion and contraction caused by different degrees of temperature produced and existing in different parts thereof.

The supply of petroleum and water to vessels D and E and through the same to the generator is maintained by means of the following appliances:

I′ is the steam-cylinder of a pump I^2 by which water is pumped through pipe i' and valve i^2 into vessel E, i^3 being the suction-pipe of said pump, provided with valve i^4. J is a spiral spring inserted in and forming part of the main piston-rod of such pump. The tension of said spring is so adjusted that when the desired limit of pressure is reached within vessel E said spring will thereby become compressed sufficiently to keep the piston in pump-cylinder I^2 out of action until such pressure has again been reduced in vessel E by the discharge of water into the generator, when the pump will again come into action. In a like manner an oil-pump K^2 will force petroleum through pipe k' and valve k^2 into vessel D, k^3 being its suction-pipe, and a spring L, inserted in its piston-rod between the pistons in steam-cylinder K′ and oil-cylinder K^2, acting in a manner analogous to

spring J. Thus petroleum as well as water will at all times be injected into the generator under predetermined maximum pressures, and the quantities so discharged will be proportionate to the differences between the pressures in vessels D and E and the pressure in generator A.

I regulate the temperature of the combined gases within the generator by varying the proportions of the petroleum, which acts as heating agent, and of the water discharged into the generator in such a manner that the supply of petroleum will be decreased and that of the water increased as the temperature rises in the generator, and vice versa. I accomplish this by the following means: M is a thermostat extending from the interior of the generator, where it is exposed within compartment C^3 to the heat of the combined gases, to the exterior, where it actuates a toothed segment M′ through a connecting-rod M^2. Said segment engages with a pinion M^3 (shown in dotted lines) on the axis of a disk M^4. Near the periphery of said disk a stud M^5 is provided. d^3 and e^3 are valves in pipes d' and e', respectively, and d^4 and e^4 arms so attached to spindles on said valves that the movement toward the right of arm d^4 will partly close valve d^3, thereby reducing the flow of oil through the same, while a movement to the right of arm e^4 will further open valve e^3, thereby increasing the flow of water through the same. Movements of said arms to the left of the positions shown in the drawings will produce opposite results. Simultaneous movements of said arms in the same directions will be produced by means of rod M^6, connecting stud M^5 with the outer end of arm d^4, and connecting-rod M^7, connecting the outer ends of arms d^4 and d^5.

N is a connection through which steam may be introduced into the generator, which steam meeting the gases of combustion would unite with the same, becoming superheated and decomposed under the influence of the additional heat so imparted to it. When steam is so employed, the supply of water through pipe e' may be dispensed with. A′ is a safety-valve on generator, and D′ and E′ are safety-valves on vessels D and E, respectively.

In Fig. 2 a pipe O, conveying compressed air and inclosed by a pipe P, conveying pulverized carbonaceous fuel, is shown to be introduced into compartment C′ in such a manner that the force of the air will tend to draw such carbonaceous fuel into the generator.

In the apparatus illustrated in Fig. 3, A^2 represents a strong vessel, provided in its walls with water-passages n for cooling it. Within the said vessel a metallic shell Q, partly filled with water, is located, and a poor conductor of heat is introduced into the space X between it and the outer vessel N and maintained there under substantially the same pressure as exists within shell Q. The poor conductor employed in this case is atmospheric air supplied by an air-pump R, through a pipe r, the steam-cylinder R′ of which obtains its supply of steam from the steam-space of shell Q through a pipe r'. r^0 is a pipe for supplying water to the boiler, r^2 the steam-outlet pipe, and r^3 a pipe for supplying to it steam in case it be proposed to superheat therein steam generated in another boiler instead of developing steam from water introduced into said generator. All the aforesaid pipes are provided with suitable cocks and are protected by the walls of vessel A^2 and are kept cool by the same cooling-water which circulates through the passages n. Said pipes may likewise be surrounded by air under approximately the same pressure as exists within said pipes. Instead of air any other suitable non-conductor of heat may be maintained under pressure within space X. S is a thick body of metal, such as copper. T represents corrugated sheet-metal diaphragms connected with said body of metal and with the inner walls of vessel A^2, thus forming tight joints. U represents a non-conducting packing between vessel A^2, bar S, shell Q, and diaphragms T. V V are large bodies of metal adapted to be heated and to impart their heat through bar S to the contents of shell Q. Ribs S′ S′ may be added to bar S within shell Q, so as to increase the heating or radiating surface of the same. W W are nuts on bar S, and W′ W′ washers for adjusting it in its position with reference to vessel A^2 and shell Q.

I claim as new and desire to secure by Letters Patent—

1. In a generator for vapor or gases, in combination with an outer vessel having a suitable lining or interior shell and cooling-passages, appliances for introducing steam into said interior shell, and an independent water-pipe leading into said interior shell, and means for increasing the temperature of the steam within said shell without heating the outer vessel exteriorly, substantially as set forth.

2. In a generator for vapor or gases, in combination with its casing, a fuel-supply pipe entering said casing and means for automatically maintaining said fuel under pressure exceeding that in the generator and for increasing and decreasing the supply of fuel, as the temperature within the casing is decreased or increased, substantially as set forth.

3. In a generator for vapor or gases, in combination with its casing, an oil-supply pump and a water-supply pump, and automatic means for limiting the pressure applied to the oil and to the water by said pumps, substantially as set forth.

4. In a generator for vapor or gases, in combination with its casing, a fuel-supply pipe and a water-pipe entering said casing, and joint mechanical means for automatically and simultaneously increasing the supply of fuel and decreasing the supply of water, and vice versa, in accordance with the tempera-

ture within the generator, and comprising suitable valves in the pipes supplying the fuel and the water, coupled together, and a thermostat for actuating the coupling device, substantially as set forth.

5. In a generator for vapor or gases, in combination with its casing, a fuel-supply pipe and a water-pipe entering said casing, proper valves within said pipes, a thermostat, and a connection between the thermostat and said valves, whereby the operative opening in one valve is increased, while the other is reduced, substantially as set forth.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

VICTOR KARAVODIN.

Witnesses:

N. TSCHEKALOFF,

ED. WANSCHEIDT.