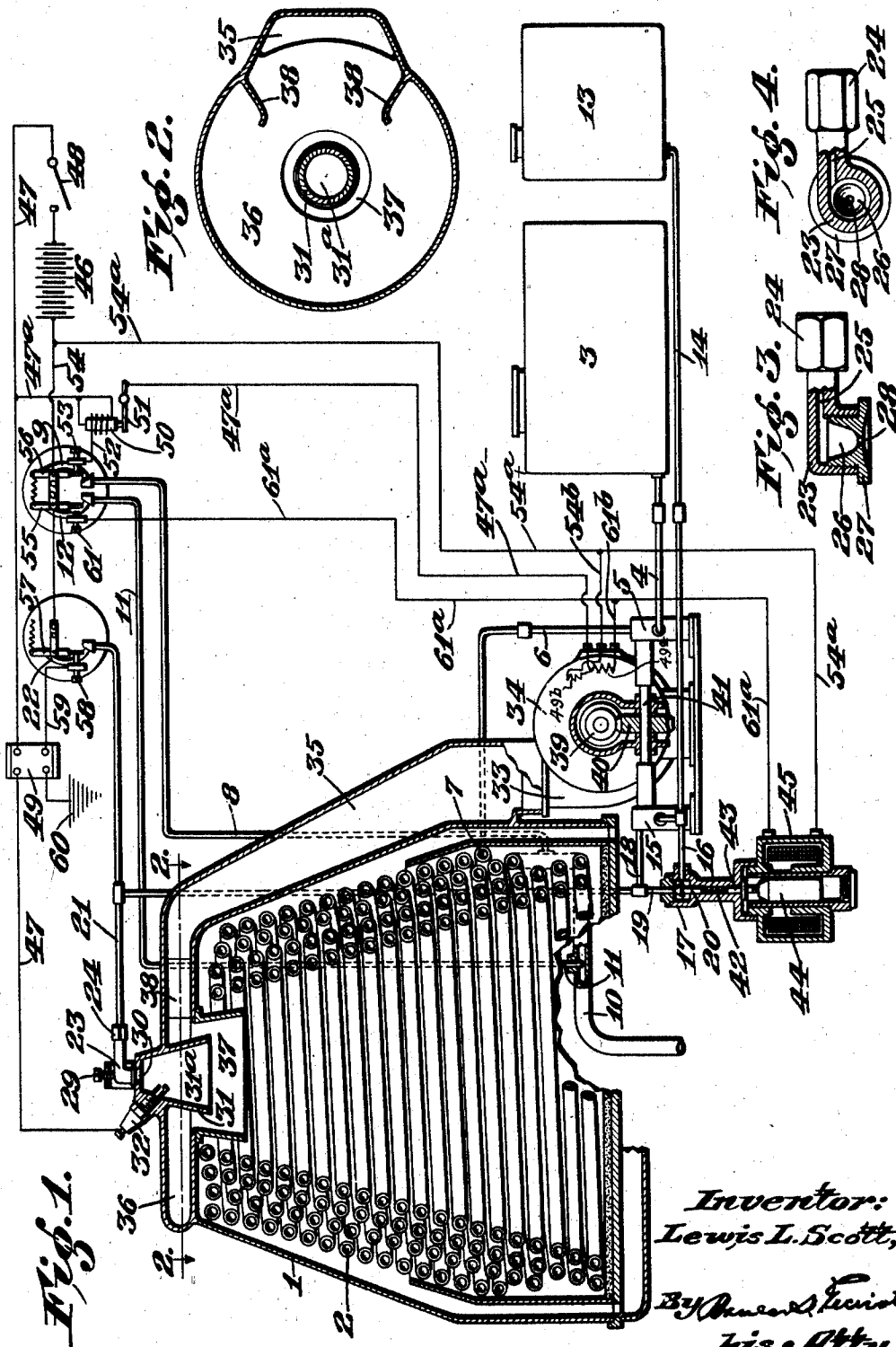


L. L. SCOTT.
COMBUSTION SYSTEM.
APPLICATION FILED JUNE 24, 1918.

1,334,560.

Patented Mar. 23, 1920.



Inventor:
Lewis L. Scott,

By *James L. Scott*
his Atty.

UNITED STATES PATENT OFFICE.

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COMBUSTION SYSTEM.

1,334,560.

Specification of Letters Patent. Patented Mar. 23, 1920.

Application filed June 24, 1918. Serial No. 241,590.

To all whom it may concern:

Be it known that I, LEWIS L. SCOTT, a citizen of the United States, residing in the city of St. Louis and State of Missouri, have invented new and useful Improvements in Combustion Systems, of which the following is a specification.

This invention relates to a novel apparatus for use in burning heavy oils, which are practically non-volatile at normal temperature, and in the operation of which I utilize the method set forth in my pending application, Serial No. 217,263, filed Feb. 14, 1918.

The invention is designed more particularly for use in steam automobiles, although not limited to such application, and the leading characteristics thereof are, that by means of the apparatus herein described, I am enabled to secure instantaneous ignition of the oil, and a very rapid and almost instantaneous generation of steam by simply closing an electrical switch, and thereafter automatic control of fuel combustion and steam generation.

In practice, starting initially with no previous preheating of the water, steam may be generated and the automobile placed in motion in about the same time as is required to put in motion an automobile actuated by the ordinary gasoline motor.

One of the objects of my invention is to provide means for automatically maintaining a constant pressure of kerosene on a nozzle for spraying the oil. A further object relates to the provision of means for automatically controlling the supply of current to an electric ignition device by variations of pressure in the fuel line above or below a predetermined amount, the device being cut out at the fixed, or normal, pressure, and placed in operation at sub-normal pressure. A still further object relates to the provision of means for automatically cutting off the supply of oil to the spray nozzle when the temperature in the boiler exceeds a pre-determined maximum, say 800° F. A still further object relates to the provision of means for automatically cutting out, or stopping, the operation of the entire generating system when the steam pressure exceeds a predetermined maximum, say 600 lbs. A still further object relates to means for mechanically spraying the oil

by means of pressure, whereby I am enabled to save the considerable expenditure of power involved in following the usual course of aspirating the oil by high-pressure air. A still further object relates to the provision of automatic means for maintaining a constant pressure on the delivery side of the pump that forces the oil to the spraying nozzle. A still further object relates to means for controlling the course of the air supplied to the combustion chamber, whereby I am enabled to secure a uniform distribution of the air.

Still further objects of the invention relate to certain novel details of construction and to combinations and operations of parts, involved in attaining the general objects of the invention above designated, all of which will more clearly appear from the detailed description to follow.

The invention is illustrated in the accompanying drawing, in which,—

Figure 1 is a vertical sectional view through the generator and parts immediately associated therewith, and more or less diagrammatic as to the remaining part of the system involved;

Fig. 2 is a section on the line 2—2 of Fig. 1;

Fig. 3 is a partial longitudinal sectional view through the spray nozzle employed; and

Fig. 4 is a partial, horizontal, sectional view, viewed from the top of the spray nozzle.

Referring now to the drawing, the numeral 1 indicates, generally, a steam generator, which has a boiler 2 of the flash type. This boiler is supplied with water from a water-tank 3. Leading from this tank is a pipe 4, which is connected with pump 5. The numeral 6 indicates the discharge pipe from the water-pump 5, said pipe communicating with the continuous tube of the boiler 2, as indicated at 7. A pipe 8 communicates at its lower end with the tubes of the boiler and at its upper end is connected with the Bourdon tube 9 of a steam pressure gage. The numeral 10 indicates the steam outlet pipe of the boiler, and located in the length of this pipe is one end of a mercury tube of a vapor tension thermostat, the opposite end of which tube is connected with the Bourdon tube 12, of a steam temperature

gage. The crude oil or kerosene is supplied to the generator from a tank 13, from which tank a pipe 14 leads to an oil-pump 15. An extension 16 of said pipe 14 communicates with a by-pass 17. The numeral 18 indicates the oil discharge pipe from the pump 15, which pipe communicates with a pipe 19 intermediate the ends of the latter. The lower open end of the pipe 19 enters the by-pass and is controlled by a spring-pressed valve 20, which normally closes it. The pipe 19 is continued upward to a point above the generator, where it connects with a pipe 21 intermediate the ends of the latter. One end of the pipe 21 is connected with the Bourdon tube 22 of a kerosene pressure gage, and the other end is connected to a spray nozzle 23 through the medium of a connecting nut 24. The nozzle 23 is of a well-known type, and is characterized by a tangential inlet 25, a tapered whirling-chamber 26 provided in a plug 27, and a small orifice 28, located centrally of said plug and at the bottom of the chamber 26. The spraying nozzle is secured, as by a binding screw 29, with the orifice 28 thereof, located centrally of an opening 30 provided in the upper end of a bell-shaped device 31, having a chamber 31^a, into which chamber project the terminals of a spark-plug 32.

The air for insuring complete combustion of the oil is supplied from a blower 33 operated by a motor 34, the air passing through a duct 35 into a distributing chamber 36 located on top of the generator 1. In the bottom of the distributing chamber 36, which is also the top of the generator 1, is an opening surrounded by a spout 37, into which spout the lower end of the bell-shaped device 31 extends for a short distance. Located in the chamber 36, on opposite sides thereof, as shown in Fig. 2, and adjacent to the point of connection of the duct 35 with said chamber, are deflecting-plates 38, which serve to properly direct the course of the air to insure that it will be evenly distributed as regards its passage through the spout 37. Without these deflecting-plates, it has been found that the air tends to pass to the farther side of the distributing chamber and down into the generator only through one portion of the spout 37, which tends to cause unequal heating of the boiler and an objectionable whirl of the flame of combustion. The axle of the motor 34 is provided with a worm 39 which is in mesh with a worm gear 40 mounted on a shaft 41, which shaft, as shown only conventionally, operates the water-pump 5 and the oil-pump 15.

The valve 20 in the by-pass 17 is operated directly by a coiled spring 42, which is interposed between the bottom of said valve and a plunger 43, which latter is adjustably mounted in the core 44 of the solenoid valve 45.

The electrical system by means of which the operations hereinafter set forth are secured will now be briefly described;

The numeral 46 indicates a battery, the current from which is employed for energizing the various electrical devices to be referred to. From one side of this battery leads a line wire 47 in the length of which is introduced the main operating switch 48. The wire 47 is connected to a spark coil 49 and a secondary wire 47^b continuing therefrom has its extremity connected to the spark plug 32. A branch wire 47^a leads from the wire 47 to a shunt coil 49^a of the compound wound motor 34, and has interposed in its length a magnetic switch 50 involving a make-and-break contact device 51. The switch 50 is connected by a wire 52 with a contact screw 53. From the other side of the battery 46 a wire 54 leads to and is connected with a contact member 55, of the steam temperature gage, a contact member 56 of the steam pressure gage, and a contact member 57 of the kerosene pressure gage. The numeral 58 indicates the contact-screw of the kerosene pressure gage, which screw is normally engaged by the contact-member 57. From the contact screw 58 a wire 59 leads to the spark-coil 49 and a secondary wire 60 leads thence and is grounded in the frame. A branch wire 54^a leads from the wire 54 to the coil of the solenoid valve 45 and is connected by a branch wire 54^b to one terminal of the motor from which the circuit passes through the series winding 49^b to the other motor terminal, which is also the terminal of the wire 47^a and of one end of the shunt winding 49^a. The contact-member 56 is normally in contact with the screw 53. The contact-member 55, on the other hand, is normally out of contact with the contact-screw 61. From this latter contact-screw a wire 61^a leads to the coil 45 and is connected by a branch wire 61^b with the other terminal of the shunt coil 49^a. Contact members 55 and 56 are electrically connected to provide a complete circuit. The operation is as follows:

Upon closing the switch 48 the motor 34 will be started and thus actuate the water pump 5, the kerosene pump 15 and the blower 33. Water will thereupon be forced into circulation through the tube of the boiler 2 and kerosene, or other heavy, or even crude oil will be forced upward through the pipes described into the spraying nozzle 23, whence it issues in the form of a fine spray into chamber 31^a of the bell-shaped device 31. The closing of the switch 48 will also operate, as will be seen, to place the spark plug 32 into the circuit of the battery 46 thereby, through the spark produced, causing the ignition of the kerosene spray. This, however, as is well known, will not result in producing complete combustion of

the kerosene, and hence the provision of the blower 33 for providing the requisite amount of air to cause complete combustion. It will readily be seen, in this regard, that the air
 5 passes up the duct 35 and out through the spout 37, through the opening surrounding the bell-shaped device 31, and this additional air causes complete combustion of the fuel in the combustion chamber, which, of
 10 course, is the central space surrounded by the tubes 2.

A highly important feature of my invention is the fact that the spray of the kerosene is produced mechanically, that is to say, by
 15 forcing it under pressure through the nozzle shown in Figs. 3 and 4. This is not only a highly efficient means of spraying the kerosene, but it is at the same time a very economical method, as compared with accom-
 20 plishing this result by an aspiration of the kerosene, which requires a very considerable amount of power to maintain the current of high-pressure air necessary for the purpose. It will be readily appreciated by those
 25 skilled in the art that the kerosene may be placed under the requisite amount of pressure to cause it to spray, say 25 lbs., by means of a pump operated from the motor with an expenditure of power that is so
 30 small as scarcely to be reckoned as an item of expense, inasmuch as the additional load placed upon the motor is very small. Aside from the question of expense, however, the diminution in power required permits of the
 35 use of a much smaller power plant than would otherwise be required.

The spark plug 32 is automatically cut out after ignition of the kerosene spray through the medium of the kerosene pressure gage,
 40 the ignition occurring in the brief interval required to raise the pressure on the kerosene. The pressure required on the kerosene will ordinarily be about 25 lbs. The kerosene gage will, therefore, be set at, say, 20
 45 lbs., and as soon as this pressure is reached the Bourdon tube 22 will be actuated to break the contact between the screw 58 and the member 57, and thus open-circuit the spark-plug. The pressure will continue to
 50 build up to the required amount, but as it is highly desirable, and a feature of my invention, to maintain the pressure of the kerosene constant, I provide additional means for controlling such pressure, the operation
 55 of which I will now describe.

It will be seen from the description of the circuits heretofore given that the solenoid valve 45 is normally in the circuit of the battery 46, being connected in series with
 60 the shunt coil of the motor, so that its core 44 is maintained in the raised position shown in the drawing. In this position its plunger 43 presses against the spring 42, which in turn presses the valve 20 upward and closes
 65 the opening in the pipe 19. In this position

of the parts, the kerosene forced by the pump 15 through the pipes 18, 19 and 21 passes direct to the spray nozzle. Should now the pressure upon the kerosene exceed the maximum of 25 lbs., which, of course, 70
 would mean the combustion of a greater amount of kerosene than necessary, the spring 42, the tension of which is regulated by adjusting the height of the plunger 43 to withstand a pressure of only 25 lbs., will 75
 yield, permitting the valve 20 to be forced from its seat, so that the kerosene may now take the course of least resistance and return, by way of pipe 19, by-pass 17, and pipes 16 and 14 to the inlet of pump 15. 80
 When the pressure has been thereby restored to normal, the spring 42 will act to force the valve 20 to its seat, and restore the direct circulation of the oil to the spray nozzle.

I further provide means for shutting off 85 the spray of kerosene should the temperature in the boiler exceed the maximum of 800°. As such high temperature is produced, it will be effective to operate the steam temperature gage through the 90
 medium of the mercury tube 11 and the Bourdon tube 12, which will result in making contact between the contact member 55 and the contact screw 61. By following the circuits described it will be seen 95
 that the closing of the contact in the temperature gage will operate to cut out the solenoid valve 45, and its coil being no longer energized, the core 44 will fall. This removes the pressure from the spring 42, 100
 and consequently from the valve 20, which latter will thereupon drop from the end of the pipe 19, so that the kerosene will now go through the by-pass and be returned to the inlet of pump 15, instead of passing to 105
 the spray nozzle. When the temperature has been restored to normal by the cessation of combustion, the Bourdon tube 12 will be actuated by the mercury tube 11 to break the contact between the member 55 110
 and the screw 61, the coil of the solenoid valve will again be energized and the core 44 raised, and the spring 42 will be caused to press valve 20 to its seat, whereby to close the by-pass and cause the oil to pass 115
 direct to the spray nozzle again.

A further factor of control consists in the provision of means for cutting out the motor 34 and thus stopping the operation 120
 of the entire combustion and generating system when the pressure of steam in the boiler tube exceeds the maximum of 600 lbs. Such excessive pressure will actuate the Bourdon tube 9, which is in constant communication with the boiler through the 125
 medium of the pipe 8, and cause the contact between the member 56 and the screw 53 to be broken. This, as will be seen from an inspection of the circuits indicated on the drawing embracing wires 47, 47^a and 52, 130

the magnet switch 50, the continuation of wire 47^a to the shunt coil 49^a and the wires 54^b, 54^a and 54, will operate to break the circuit of the motor 34, and the latter will
 5 cease to operate, so that neither air nor kerosene will be supplied to the generator, nor water to the boiler, and hence the whole steam generating operation will cease. When pressure is restored to normal, contact between the member 56 and screw 53
 10 will be automatically restored, the motor placed in operation and the combustion and steam generator processes resumed. The provision of the magnet switch 50 is
 15 for the purpose of enabling the main motor circuit to be opened and closed in a rapid and positive manner and for avoiding the arcing which would occur if this circuit were controlled by the steam switch, comprising the points 53, and 56. That is to
 20 say, the motor will take quite an amount of current as compared with the magnet switch, say, for example, about 45 amperes as compared with $\frac{1}{2}$ an ampere. The movement of the contact member 56 under the
 25 influence of steam is relatively slow, and, owing to variations in pressure, there will often occur a vibratory, instead of a unidirectional, movement of said contact member. If the contacts 53 and 56 were included
 30 in the main circuit to the motor, it will be at once seen that as they would have to handle the total current, the contact points would arc and soon be destroyed. Under the arrangement described, however, by having
 35 the steam operated switch handle a very small quantity of current, which current is used solely for energizing the magnet, which magnet in turn operates the main
 40 switch 51, I obtain an instantaneous action of the switch in either direction, as will be understood by those skilled in the art, and also avoid the objection of arcing at the switch terminals. It will be understood,
 45 of course, that when the motor 34 is cut out, the pressure on the kerosene will fall, as no more kerosene is then being pumped, and the member 57 is automatically restored to contact with the screw 58 by the action
 50 of the Bourdon tube 22. As the cutting out of the motor occurs automatically, the switch 48 will be closed, as the increase in pressure of the steam will only occur while the car is in operation; and hence, when the
 55 motor is again automatically placed in operation, the spark plug 32 will be in the circuit of battery 46, and will cause the ignition of the kerosene as soon as it is delivered through the spray nozzle; and, in the manner heretofore described, said spark plug
 60 will cut out as soon as the pressure on the kerosene reaches 20 lbs.

The steam generator which I employ is of the type shown in the patent to E. C. Newcomb No. 780,955, dated January 24, 1905,

but the combustion system and the location of the same is different. The Newcomb patent employs a fire produced from vaporized gas, and the burner is located at the bottom of the generator. In my arrangement
 70 the combustion system is located at the top of the generator and the oil is sprayed by pressure through a suitable nozzle. Owing to the character and length of the flame produced by this spraying method, a relatively
 75 long combustion chamber and a surrounding wall of generator tubes with openings between them, such as the Newcomb generator provides, is an ideal construction, if not a virtual necessity, in the use of my system. That is to say, the Newcomb construction of
 80 generator readily lends itself to the provision of a chamber which will accommodate the length of flame produced by the mechanical spraying device which I employ, and as the only outlet for the products of
 85 combustion is through the spaces provided between the coils, substantially all of the heat will be absorbed by the coils and utilized in the production of steam.

I claim:—

1. Combustion apparatus for burning heavy oils at approximately normal temperature comprising a mechanical oil spraying device, an electric device positioned to
 95 directly ignite the sprayed oil, means for supplying air to the ignited spray to complete combustion, and means for preventing access of the entire volume of supplied air to the sprayed fuel before ignition thereof.

2. In combustion apparatus for burning heavy oils at approximately normal temperature, in combination with a spray nozzle for finely dividing liquid fuel, means for forcing fuel under pressure through said
 105 spray nozzle and thereby mechanically spraying it, an electric device for directly igniting said sprayed fuel, and means for supplying air to the spray to complete combustion, said electric device being positioned in the direct path of said spray and located at a point where the spray reaches said electric device before said spray is completely mixed with air.

3. In combustion apparatus for burning heavy oils at approximately normal temperature, in combination with a spray nozzle for finely dividing liquid fuel, means for forcing fuel under pressure through said
 120 nozzle, and thereby mechanically spraying it, a by-pass in the fuel line for automatically maintaining a constant pressure of fuel at the spray nozzle, an electric device positioned to directly ignite the sprayed fuel, and means for supplying air to the ignited
 125 spray to complete combustion.

4. In combustion apparatus for burning heavy oils at approximately normal temperature, in combination with a spray nozzle for finely dividing liquid fuel, means for

forcing fuel under pressure through the spray nozzle, and thereby mechanically spraying it, means for igniting the sprayed fuel, means for supplying air to the ignited spray to complete combustion, a by-pass in the fuel line, and a valve therein seated against a given pressure of fuel, and adapted to be opened by an increase of such pressure to permit the passage of the fuel through the by-pass and thereby reduce the pressure at the nozzle.

5. In combustion apparatus for burning heavy oils, in combination with a mechanical oil spraying device, an electric device for igniting the sprayed oil, means for supplying air to the ignited spray to complete combustion, means for forcing oil under pressure to said oil spraying device, an oil pressure gage, and a cut-out device in the circuit of said igniting device adapted to be actuated by said pressure gage to break the circuit of the ignition device when the pressure on the oil has reached a pre-determined degree.

6. In combination with a heat absorbing medium, a combustion system comprising a fuel spraying device, an electric device positioned to directly ignite the sprayed fuel, an air blower for furnishing air to the ignited spray to complete combustion, a pump for forcing oil under pressure through the spraying device and thereby mechanically spraying it, a motor for driving said blower and said pump, and means responsive to changes in conditions in the heat-absorbing medium for controlling the motor.

7. In combination with a heat absorbing medium, a combustion system comprising a fuel spraying device, an electric device for igniting said sprayed fuel, an air blower for furnishing air to the ignited spray to complete combustion, a pump for forcing oil through the spraying device and thereby mechanically spraying it, a motor for driving said blower and said pump, means responsive to changes in the heat absorbing medium produced by combustion for breaking the circuit of said motor, a by-pass in the fuel line, and a solenoid valve controlling said by-pass and located in the circuit of said motor, whereby, when said motor is cut out, said solenoid will be instantly operated to open the by-pass and prevent further oil being supplied to the spraying device.

8. In combustion apparatus for burning heavy oils, in combination with a mechanical oil spraying device, means for forcing oil under pressure to said device, an electric device for igniting the sprayed oil, means for supplying air to the ignited spray to complete combustion, and means responsive to a pre-determined pressure in the fuel line for controlling the time of operation of the electric ignition device.

9. In combination with a heat absorbing

medium, a combustion system comprising a fuel spraying device, means for forcing fuel under pressure through the spraying device and thereby mechanically spraying it, an electrical device positioned to directly ignite said sprayed fuel, means for supplying air to the ignited spray to complete combustion, and means responsive to changes in temperature of the heat absorbing medium for controlling the supply of fuel to the spraying device.

10. In combination with a heat absorbing medium, a combustion system comprising a fuel spraying device, a pump for forcing oil through the spraying device and thereby mechanically spraying it, an electrical device positioned to directly ignite said sprayed fuel, an air blower for furnishing air to the ignited spray to complete combustion, a motor for driving said pump and said blower, and means responsive to changes in pressure in the heat absorbing medium for controlling the motor.

11. In combination with a heat absorbing medium, a combustion system comprising a fuel spraying device, a pump for forcing oil to the spraying device, an electrical device positioned to directly ignite the sprayed fuel, an air blower for furnishing air to the ignited spray to complete combustion, a motor for driving said pump and said blower, a source of current-supply for said motor, a by-pass in the fuel line, a solenoid valve controlling said by-pass and in the circuit of said source of current-supply, and means responsive to changes in temperature in the heat absorbing medium for controlling the supply of current to said solenoid valve without correspondingly affecting the motor, whereby to open or close the by-pass according as the temperature in the heat absorbing medium rises above or falls below a pre-determined degree.

12. In combination with a heat absorbing medium, a combustion system comprising means located at the top of the heat-absorbing medium for finely dividing liquid fuel and projecting it in the form of a spray, means positioned to directly ignite said spray, means for furnishing air to the ignited spray to complete combustion, and an air reservoir located at the top of the heat absorbing medium for receiving the air and directing it around the ignited fuel spray.

13. In combination with a generator surrounding a central combustion chamber and providing a plurality of heating members affording spaces between them constituting the only means of escape for the products of combustion from said chamber, whereby substantially all of the heat will be absorbed by the heating members and utilized in the production of steam and the walls of said steam generator will be kept at approximately the temperature of the steam con-

tained therein, a combustion system comprising means for finely dividing liquid fuel and projecting it in the form of an atomized spray into said combustion chamber, means positioned to directly ignite said spray, and means for furnishing air to the ignited spray to complete combustion.

14. In combination with a generator comprising a series of superimposed pipe coils surrounding a central combustion chamber, and having between the coils spaces affording the only means of escape for the products of combustion from said chamber, whereby substantially all of the heat will be absorbed by the coils and utilized in the production of steam, and the walls of said coils adjacent to said chamber will be kept at approximately the temperature of the steam within said coils, a combustion system comprising means for finely dividing liquid fuel and projecting it in the form of an atomized spray into said combustion chamber, means positioned to directly ignite said spray, and means for furnishing air to the ignited spray to complete combustion.

15. In combination with a generator surrounding a central chamber, a combustion system comprising means located in the top of said chamber for finely dividing liquid fuel and projecting it in the form of a spray downward into said chamber, means positioned to directly ignite said spray, means for furnishing air to the ignited spray to complete combustion, and an air reservoir located at the top of said generator for receiving the air and directing it around the ignited fuel spray.

16. In combination with a generator comprising a series of superimposed pipe coils surrounding a central combustion chamber, a combustion system comprising means located in the top of said chamber for finely dividing liquid fuel and directing it in the form of a spray downward into said chamber, means positioned to directly ignite said spray, and means for furnishing air to the ignited spray to complete combustion.

17. In combination with a heat absorbing medium, a combustion system comprising means for finely dividing fuel and projecting it in the form of a spray, means for igniting said spray, means for furnishing air to said ignited spray to complete combustion, an air reservoir located at the top of said medium for receiving said air and having an outlet surrounding the fuel spray, and deflecting plates located in said reservoir for dividing the air current and producing a uniform distribution of the air around said ignited fuel spray.

18. In combustion apparatus for burning heavy oils, a mechanical oil spraying device for atomizing the oil, a casing surrounding said device and having an outlet in the direction the spray is moving, an electric device

located in said casing for igniting said fuel spray at normal temperature, a combustion chamber, an air chamber surrounding said casing and having an outlet into said combustion chamber, and means for furnishing air to said air chamber.

19. In combustion apparatus for burning heavy oils, a mechanical oil spraying device for atomizing the oil, a casing surrounding said device and having an outlet in the direction the spray is moving, an electric device located in said casing for igniting said fuel spray at normal temperature, a combustion chamber, an air chamber surrounding said casing, a blower for furnishing air to said air chamber, and a funneled outlet from said air chamber surrounding said casing and opening into said combustion chamber.

20. In combustion apparatus for burning heavy oils, a spray nozzle for finely dividing liquid fuel, a casing surrounding said nozzle and having an outlet in the direction the spray is moving, an electric device located in said casing for igniting said fuel spray at normal temperature, an air chamber surrounding said casing, a blower for furnishing air to said chamber, a funneled outlet from said air chamber surrounding said casing, and deflecting plates located in said air chamber for causing an even distribution of the air around said casing and through said outlet.

21. In combination with a heat absorbing medium, a combustion system comprising a fuel spraying device, an electric device for igniting said sprayed fuel, an air blower for furnishing air to the ignited spray to complete combustion, a pump for forcing oil to the spraying device, a motor for driving said blower and said pump, means responsive to changes in the heat absorbing medium produced by combustion for breaking the circuit of said motor, a by-pass in the fuel line, and automatic means for maintaining a constant pressure on the delivery side of the pump.

22. A combustion system comprising a fuel burning device, a pump for forcing oil to said burning device, means for igniting the oil at the burner, means for driving said pump, a by-pass in the fuel line of the pump, an electrically operated pressure valve in the by-pass, an electric circuit including said valve, and automatic means controlled by the operation of the system for opening and closing said circuit, said valve being automatically set to by-pass fuel at a certain pressure when said circuit is closed, and operating to open said by-pass when said circuit is opened, and thereby prevent further flow of fuel to the burning device.

23. In combination with a heat-absorbing medium, a combustion system comprising a fuel-burning device, a pump for forcing oil to said burning device, means for igniting

the oil at the burner, a motor for driving said pump, a by-pass in the fuel line of the pump, an electrically operated pressure valve in the by-pass, and an electric circuit including said motor and valve, said valve
5 being automatically set to by-pass fuel at a certain pressure when said circuit is closed, and operating to open said by-pass when said circuit is opened, thereby preventing further flow of fuel to the burning device. 10

In testimony whereof I have hereunto set my hand.

LEWIS L. SCOTT.