UNITED STATES PATENT OFFICE.

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SYSTEM FOR OPERATING BURNERS BY MEANS OF LIQUID FUEL.

1,160,371.


Application filed November 22, 1913. Serial No. 802,441.

To all whom it may concern:

Be it known that I, CHARLES A. BROWN, a citizen of the United States, residing at Hinsdale, in the county of DuPage and State of Illinois, have invented a certain new and useful Improvement in Systems for Operating Burners by Means of Liquid Fuel, of which the following is a full, clear, concise, and exact description, reference being had to the accompanying drawings, forming a part of this specification.

My invention relates to an improved system for operating burners by means of liquid fuel and the control of such systems so that the amount of fuel supplied at any time may be regulated automatically according to the demand made upon the burner.

My invention has particular application to burners for boilers and it is intended to utilize liquid fuel requiring special means for vaporizing it, so that it may be burned in the burner. Difficulty has been experienced in the past in providing a reliable means for vaporizing the heavier fuel oils and it is an object of my invention to provide improved devices for heating the fuel oil so that it may be supplied to the burner in a gaseous condition and projected into the burner by a suitable blast, if desired, so as to produce the desired intensity of heat.

My invention further provides means for regulating the operation of the heating mechanism employed to vaporize the liquid fuel and to also control the amount of fuel supplied to the burner according to the demands made upon the boiler heated by the burner.

The several drawings illustrating my invention are as follows:

Figure 1 illustrates diagrammatically a system in accordance with my invention, in which the fuel is heated initially electrically and the electrical devices are automatically controlled to be rendered inoperative when the burner supplied with the fuel is in normal operation. Fig. 2 is a view of some of the parts shown in Fig. 1, taken along the line 2—2 in Fig. 1. Fig. 3 shows a modified embodiment of my invention, in which the heating and vaporizing of the liquid fuel is at all times accomplished by means of a burner auxiliary to the main burner. Fig. 4 shows in cross-section a form of burner that may be employed in carrying out my invention. Similar numerals refer to similar parts throughout the several views.

As shown in Fig. 1, a boiler 1 is provided with a burner 2 of any desired form, to which the fuel is supplied in gaseous condition through a pipe 3 provided with a control cock 4. The other end of the pipe 3 extends to a heating chamber 5, surrounded by a heating coil 6 insulated from the chamber 5 so that it may heat the same by the passage of electricity therethrough. The heating chamber 5 has connected with it a supply pipe 7 controlled by a cock 8 to determine the amount of liquid fuel which may be supplied from the tank 9 through the pipe 7 to the heating chamber 5. The heating chamber 5 is surrounded by a casing 10, communicating by means of a pipe 11 with the casing 12 surrounding the boiler 1.

The burner 2 is supplied at starting with air delivered to it through a pipe 13, communicating with the pipe 3 so that the air and vaporized fuel may be thoroughly mixed when they pass into the burner 2 and the pipe 13 is enlarged at its lower end to contain a fan 14, driven by an electric motor 15, which, when it is run in the direction indicated by the arrow, forces air upward through the enlarged lower end of the pipe 13 and into the burner 2. The motor 15 is provided with a commutator 16, upon which suitable brushes rest, which brushes are connected by wires 17 and 18 with one terminal of the storage battery 19 and one terminal of the heating coil 6, respectively. The other terminal of the coil 6 is connected by wire 20 with the other terminal of the battery 19. The shaft 21 of the motor 15 is rigidly connected with the cylindrical shell 22 of a roller clutch, the inner element 23 of which is rigidly secured to the shaft 24 of a generator 25, provided with a commutator 26, the brushes of which are connected by wires 27 and 28 with the wires 17 and 20, respectively, and thus with the terminals of the storage battery 19. The construction
of the roller clutch is indicated more clearly in Fig. 2. When the speed of the generator 25 exceeds that of the motor 15 obviously the speed of the disk 23 exceeds that of the cylindrical shell or flange 22. Consequently the rollers 23* become wedged between the disk 23 and the flange 22, thus locking said disk and said flange together. The shaft 34 has rigidly secured to it a pulley 29 for receiving a belt 30 driven by the pulley 31 carried by the crank shaft 32 of an engine 33 provided for the purpose of driving the generator 25. The engine 33 is provided with steam by a pipe 34 controlled by a cock 35, said pipe 34 extending to the steam main 36 communicating with the boiler 1. The steam main 36 also supplies a steam jet 37, through a pipe 38 and controlling cock 39, so that the steam jet may be employed to produce a blast in the burner 2, when desired.

As a result of the construction described, when it is desired to heat the boiler 1, the switch 40 in the wire 18 is closed, as is the switch 41 in the wire 28, with the result that current from the battery 19 is caused to flow through the motor 15 and the heating coil 6. The cocks 8 and 4 are opened so that a proper amount of liquid fuel is supplied from the tank 9 to the heating chamber 5. The fuel thus supplied to the pipe 13 of the burner 2 is mixed with air projecting into the pipe 13 by the fan 14, which condition continues until the steam generated by the boiler 1 is of sufficient pressure to operate the engine 33, at which time the cock 35 is opened and the generator 25 is started. With the increase of pressure in the boiler 1, the speed of operation of the engine 33 and generator 25 is increased until the shaft 21 is rotating at the speed of the shaft 21. When the speed of the generator is increased above this point, the roller clutch comes into operation and drives the shaft 21 and the fan 14 somewhat faster than the voltage impressed upon the commutator 16 would drive the motor 15, as a result of which the counter-electromotive force in the motor is increased and the current flowing from the battery 19 into the motor is nearly or quite reduced to zero. This condition constitutes the operating condition of the mechanism and it will be observed that, with the decrease of current flow through the motor for the reason described, the current flowing through the heating coil 6 is also decreased nearly or quite to zero. The heating of the chamber 5 is taken care of at this time by the exhaust gases from the boiler casing 12, conducted by the pipe 11, to the casing 10 surrounding the heating chamber and, therefore, there is no need for the heating coil 6 to operate at this time. It will be understood that the battery 19 may be employed for any desired purposes, such as operating electric lights 42, and that when the demand made upon it reduces its pressure somewhat below the pressure developed by the generator 25, the generator will at once serve to charge the battery 19 so that at all times the battery 19 is maintained in a practically charged condition.

It will be understood that the burner 2 may be of any desired construction and that the burner may be used either with or without forced draft resulting from the operation of the steam jet 37. For example, with a burner of the surface combustion type, as indicated in section in Fig. 4, it is for many conditions desirable that the pressure developed in the burner shall not exceed atmospheric pressure, whereas, for other types of burner, in which the body of the burner is closed and provided with outlet openings in one way or another, a forced draft may be used to advantage.

The system which is described provides, therefore, a means for preheating the liquid fuel supplied to the burner during the starting of the boiler, which preheating means is rendered inoperative automatically by the pressure developed in the boiler by the burner. If for any reason the steam demand upon the steam main 36 becomes excessive so as to considerably reduce the steam pressure in the boiler so that the engine 33 can not drive the generator 25 up to normal speed, the motor 15 and heating coil 6 are again automatically placed in operation, since the counter-electromotive force in the motor 15 drops somewhat and current again flows therethrough, as well as through the heating coil 6, which results in a greater heating of the fuel and the production of a larger amount of heat at the burner 2 so that a greater pressure will be produced in the boiler 1. In other words, the engine 33, the motor 15, the generator 25 and the heating coil 6 cooperate to automatically control the amount of heating of the chamber 5 and the amount of heat that is produced by the burner 2 so as to maintain the pressure developed in the boiler 1 as nearly as possible at a predetermined working value.

The switches 40 and 41, as well as the switch 43 in the lamp circuit, are provided to prevent draining current from the storage battery when the system is not in operation, but it will be understood that it is not necessary to operate the switches 40 and 41 after starting the motor 15 in order to secure the control of the system just described.

In the modified arrangement shown in Fig. 3, the boiler 1* is provided with a burner 2* supplied with vapor fuel through a pipe 3* through a control cock 4* from a heating chamber 5*. The heating chamber 5* is supplied with liquid fuel through 121...
a pipe 7 having a control cock 8, said pipe 7 being connected with a fuel tank 9. In this construction, the boiler casing 12 incloses not only the boiler 1 but also the heating chamber 5, the heating chamber being separated from the boiler by a partition 44 and a baffle plate 45. The boiler shown in this construction is of the sectional type, so that each section generates steam from water supplied by a common water header 45 and delivers the steam thus produced to a common steam header 46. An additional section or unit of the boiler is located at 47 between the partition 44 and the heating chamber 5, this additional or auxiliary unit being for the purpose of supplying steam through a pipe 48 to the pipe 13 extending downward from the burner 2.

An auxiliary burner 49 is located inside of the casing 12 beneath the heating chamber 5 and this burner is supplied with gaseous fuel through a pipe 50, having located therein a control cock 51. The pipe 50 extends upward to the top of a compressed gas tank 52 provided for starting the burner 49. A three-way cock 53, located in the pipe 50, is connected by a pipe 54 with the upper portion of the heating chamber 5 and when the handle of the three-way cock 53 is in the position indicated in dotted lines, communication between the tank 52 and the control cock 51 is interrupted and communication is established between the pipe 54 and the control cock 51. By this means, provision is made for using the gas from the compressed gas tank 52 only at starting and for running the burner 49 during the operation of the boiler 1 by fuel supplied by the heating tank 5.

The operating levers of the control cocks 4 and 51 are connected by means of a link 55, pivotally connected to one arm of a bell crank lever 56, the other end of which is connected by a link 57 with one arm of a bell crank lever 58, the other arm of which is pivotally connected with an operating rod 59 secured to the piston 60 contained in the regulating cylinder 61 connected with the steam header 46. A spring 62 is disposed in the cylinder 61 to exert an initial tension upon the piston 60 to hold it in the position indicated against the stops in the cylinder so that a predetermined pressure must be developed in the boiler before the piston is operated by the pressure developed. The rod 59 is also connected with the operating lever of the control cock 8. As a result of the connections described, when the pressure in the boiler reaches a predetermined amount, determined by the adjustment of the spring 62, the cocks 8, 51 and 4, are operated so as to decrease the amount of liquid fuel supplied to the heating chamber 5, to reduce the amount of fuel supplied to the burner 49 and to reduce the amount of fuel supplied to the burner 2, which condition continues until the steam pressure developed in the boiler decreases to permit the spring 62 to move the piston 60 back again to its normal position opening the various cocks referred to.

The pipe 48, supplied with steam from the auxiliary boiler section 47, is provided for the purpose of projecting a steam jet 75 into the lower end of the burner tube 13 so as to maintain a blast upon the burner 2. This pipe 48, however, is smaller than the tube 13 so that air may pass around it to mix with the gas projected by the pipe 8 into the burner, as a result of which the burner will operate before the steam pressure is developed to a point sufficient to produce the blast by means of the pipe 48.

The relation of the partition 44 and the baffle plate 45 is such that the burner 49, during the starting condition, serves to heat not only the heating chamber 5, but also the auxiliary boiler unit 47, thus heating this auxiliary unit nearly or quite to the temperature required to send a steam blast into the burner 2. When the burner 2 is brought into operation, a part of the heat from it finds its way to the left of the partition 44 to assist somewhat in heating the auxiliary unit 47 of the boiler and the heating chamber 5, although this effect is not large in amount, owing to the fact that the burner 2 is disposed preferably wholly to the right of the partition 44.

The steam jet provided in both constructions for putting a blast upon the burner, it will be understood, secures the added advantage of producing an increased intensity of combustion owing to the decomposition of the steam and the combustion of the gases resulting therefrom, so that the use of such a steam blast is particularly desirable where intense heat is required.

It will be observed that, while I secure the regulation referred to in connection with Fig. 1 by means of the electrical devices employed, that I secure a similar regulation by means of mechanical devices in connection with the construction shown in Fig. 3, for the spring 62 may be regulated if desired so that it is compressed for a considerable range of operating pressures in the steam header 46, which range extends much below the normal working pressure of the steam in the header and that, for such adjustment, the regulating devices will operate as a controlling means, not only for an excessive increase in steam pressure, but also for a decrease in the steam pressure below its normal working value which, for the latter condition, will serve to increase the amount of fuel supplied to the burner, as well as the temperature of the fuel thus supplied.

I do not limit myself to the particular de-
4. In a fuel supply system for burners, the combination of a fuel supply tank, a vaporizing receptacle connected with the tank, a burner connected with the vaporizing receptacle, means independent of said burner for heating the vaporizing receptacle, and automatic means for decreasing the degree of heating of the vaporizing receptacle when the fire produced by the burner exceeds a desired amount.

5. In a system for burning liquid fuel, the combination of a fuel tank, a vaporizing receptacle connected with the fuel tank, a burner connected with the vaporizing receptacle, independent means for initially heating the vaporizing receptacle to start the operation of the burner, means for interrupting the operation of said heating means when the main burner is placed in operation, a second heating mechanism for heating the vaporizing receptacle during the operating condition of the burner and automatic means governing the heating of said vaporizer.

6. In a fuel supply system for burners, the combination of a fuel supply tank, a vaporizing receptacle connected with the tank, a burner connected with the vaporizing receptacle, independent means for heating the vaporizing receptacle, automatic means for decreasing the degree of heating of the vaporizing receptacle when the fire produced by the burner exceeds a desired amount, and a blast jet for forcing the draft in the burner.

7. In a system for burning liquid fuel, the combination of a fuel tank, a vaporizing receptacle connected with the fuel tank, a burner connected with the vaporizing receptacle, independent means for initially heating the vaporizing receptacle to start the operation of the burner, means for interrupting the operation of said heating means when the burner is placed in operation, a second heating mechanism for heating the vaporizing receptacle during the operating condition of the burner, a blast jet for forcing the draft in the burner and automatic means governing said independent means.

8. In a system for burning liquid fuel, the combination of a fuel tank, a burner, independent mechanism between the tank and burner for heating and vaporizing the fuel, a boiler associated with the burner, and mechanism operated by the pressure produced in the boiler for reducing the effect of the independent heating mechanism.

9. In a system for burning liquid fuel, the combination of a fuel tank, a boiler, independent mechanism between the tank and burner for heating and vaporizing the fuel, the boiler associated with the burner, mechanism for heating and vaporizing the fuel by the gases of combustion during the operating condition of the burner and automatic means for reducing the effect of said independent mechanism.

10. In a system for burning liquid fuel, the combination of a fuel tank, a burner, a vaporizing chamber located between the fuel tank and the burner, a boiler adapted to be heated by the burner, an electric heating coil associated with the vaporizing chamber, a source of current for operating said coil, an electric motor driven from said source of current, a fan carried by the motor shaft for producing a blast in the burner, an engine driven by the boiler, an electric generator having its terminals connected with the source of current and driven by the engine, and clutch mechanism between the motor and generator for increasing the speed of the motor when the generator is brought up to its normal running speed.

11. In a system for burning liquid fuel, the combination of a fuel tank, a burner, a vaporizing chamber located between the fuel tank and the boiler, a burner adapted to be heated by the burner, an electric heating coil associated with the vaporizing chamber, a source of current for operating said coil, an electric motor driven from said source of current, a fan carried by the motor shaft for producing a blast in the burner, an engine driven by the boiler, an electric generator having its terminals connected with the source of current and driven by the engine, and clutch mechanism between the motor and generator for increasing the speed of the motor when the generator is brought up to its normal running speed.

said heating mechanism comprising a first means for initially heating the fuel to start the operation of the burner, and a second means for heating the fuel during the operation of the burner, and means for automatically reducing the effect of the initial heating means when the burner is placed in operating condition.

What I claim is:

1. In a fuel supply system for burners, the combination of a fuel supply tank, a vaporizing receptacle connected with the tank, a burner connected with the vaporizing receptacle, means independent of said burner for heating the vaporizing receptacle, and automatic means for decreasing the degree of heating of the vaporizing receptacle when the fire produced by the burner exceeds a desired amount.

2. In a system for burning liquid fuel, the combination of a fuel tank, a vaporizing receptacle connected with the fuel tank, a burner connected with the vaporizing receptacle, independent means for initially heating the vaporizing receptacle to start the operation of the burner, means for interrupting the operation of said heating means when the main burner is placed in operation, a second heating mechanism for heating the vaporizing receptacle during the operating condition of the burner and automatic means governing the heating of said vaporizer.

3. In a fuel supply system for burners, the combination of a fuel supply tank, a vaporizing receptacle connected with the tank, a burner connected with the vaporizing receptacle, independent means for heating the vaporizing receptacle, automatic means for decreasing the degree of heating of the vaporizing receptacle when the fire produced by the burner exceeds a desired amount, and a blast jet for forcing the draft in the burner.

4. In a system for burning liquid fuel, the combination of a fuel tank, a vaporizing receptacle connected with the fuel tank, a burner connected with the vaporizing receptacle, independent means for initially heating the vaporizing receptacle to start the operation of the burner, means for interrupting the operation of said heating means when the burner is placed in operation, a second heating mechanism for heating the vaporizing receptacle during the operating condition of the burner, a blast jet for forcing the draft in the burner and automatic means governing said independent means.

5. In a system for burning liquid fuel, the combination of a fuel tank, a burner, mechanism independent of said burner between the fuel tank and burner for heating and vaporizing the fuel, and devices for automatically reducing the effect of the heating mechanism when the burner is brought to its operating condition.

6. In a system for burning liquid fuel, the combination of a fuel tank, a burner, independent mechanism between the tank and burner for heating and vaporizing the fuel,
and generator for increasing the speed of the motor when the generator is brought up to its normal running speed, said motor and said coil being connected in series with each other whereby the increased speed of the motor resulting from the operation of the generator stops the flow of current through the motor and coil.

12. In a system for burning liquid fuel, the combination of a fuel tank, a burner, a vaporizing chamber located between the fuel tank and the burner, a boiler adapted to be heated by the burner, an electric heating coil associated with the vaporizing chamber, a source of current for operating said coil, an electric motor driven from said source of current, a fan carried by the motor shaft for producing a blast in the burner, an engine driven by the boiler, an electric generator having its terminals connected with the source of current and driven by the engine, clutch mechanism between the motor and generator for increasing the speed of the motor when the generator is brought up to its normal running speed, said motor and said coil being connected in series with each other whereby the increased speed of the motor resulting from the operation of the generator stops the flow of current through the motor and coil, and devices for heating the vaporizing chamber by gases of combustion from said burner.

13. In combination, a burner, a boiler associated with the burner, a fan for producing a blast in the burner, an electric motor for operating the fan, a source of current connected with the motor, an engine driven from the boiler, an electric generator driven from the engine, said generator being connected with the source of current, and clutch mechanism between the generator and motor for increasing the speed of the motor when the generator is brought up to its normal running speed, whereby the current flowing through the motor is reduced nearly or quite to zero.

14. In combination, a burner, a boiler associated with the burner, a fan for producing a blast in the burner, an electric motor for operating the fan, a storage battery for driving the motor, an engine driven by steam from the boiler, a generator driven by the engine, circuit connections extending from the generator to the storage battery, and clutch mechanism between the motor and generator for increasing the speed of the motor when the generator is brought up to its normal running speed to reduce the flow of current through the motor and deliver current from the generator to the storage battery to charge the same.

15. In a system for burning liquid fuel, the combination of a fuel tank, a main burner, a boiler associated with the main burner, a vaporizing chamber between the fuel tank and the main burner, an independent auxiliary burner associated with the vaporizing chamber, and automatic controlling devices operated by the pressure of the steam produced in the boiler for changing the amount of fuel vaporized and supplied to the main burner according to the pressure of the steam developed in the boiler.

16. In a system for burning liquid fuel, the combination of a fuel tank, a main burner, a boiler associated with the main burner, a vaporizing chamber between the fuel tank and the main burner, an independent auxiliary burner associated with the vaporizing chamber, and controlling devices operated by the pressure of the steam produced in the boiler for varying the quantity of liquid fuel supplied to the vaporizing chamber, the quantity of fuel supplied to the auxiliary burner, and the quantity of fuel supplied to the main burner, according to the pressure of the steam developed in the boiler.

17. In a system for burning liquid fuel, the combination of a fuel tank, a main burner, a boiler associated with the main burner, a vaporizing chamber between the fuel tank and the main burner, an independent auxiliary burner associated with the vaporizing chamber, controlling devices operated by the pressure of the steam produced in the boiler for changing the amount of vaporized fuel supplied to the main burner according to the pressure of the steam developed in the boiler, and a compressed gas tank for supplying the auxiliary burner with fuel to initially heat the vaporizing chamber.

18. In a system for burning liquid fuel, the combination of a fuel tank, a main burner, a vaporizing chamber located between the fuel tank and the main burner, a burner for said chamber, a boiler associated with the main burner, and a common casing inclosing the boiler, the main burner and the vaporizing chamber.

19. In a system for burning liquid fuel, the combination of a fuel tank, a main burner, a vaporizing chamber located between the fuel tank and the main burner, a boiler associated with the main burner, a common casing inclosing the boiler, the main burner and the vaporizing chamber, and a normally active auxiliary burner located in the casing for heating the vaporizing chamber.

20. In a system for burning liquid fuel, the combination of a fuel tank, a main burner, a vaporizing chamber located between the fuel tank and the main burner, an auxiliary burner for said vaporizing chamber, a boiler associated with the main burner, a common casing inclosing the boiler, the main burner and the vaporizing chamber, and deflecting walls in the casing for
directing a part of the products of combustion of the main burner against the vaporizing chamber.

21. In a system for burning liquid fuel, the combination of a fuel tank, a main burner, a vaporizing chamber located between the fuel tank and the main burner, a boiler associated with the main burner, a common casing inclosing the boiler, the main burner and the vaporizing chamber, a normally active auxiliary burner located in the casing for heating the vaporizing chamber, and devices for controlling the auxiliary burner and for controlling the quantity of fuel supplied to the main burner by the pressure of steam developed in the boiler.

22. In a system for burning liquid fuel, the combination of a fuel tank, a main burner, a vaporizing chamber located between the fuel tank and the main burner, a boiler associated with the main burner, a common casing inclosing the boiler, the main burner and the vaporizing chamber, a normally active auxiliary burner located in the casing for heating the vaporizing chamber, and devices for controlling the quantity of fuel supplied to the vaporizing chamber, the quantity of fuel supplied to the main burner and the quantity of fuel supplied to the auxiliary burner by the pressure of steam developed in the boiler.

23. In a system for burning liquid fuel, the combination of a fuel tank, a main burner, a vaporizing chamber independent of said main burner and located between the fuel tank and the main burner, a boiler associated with the main burner, a common casing inclosing the boiler, the main burner and the vaporizing chamber, a normally active auxiliary burner located in the casing for heating the vaporizing chamber, a compressed gas tank, and mechanism for supplying the auxiliary burner with fuel from said compressed gas tank.

24. In a system for burning liquid fuel, the combination of a fuel tank, a main burner, a vaporizing chamber independent of said main burner and located between the fuel tank and the main burner, a boiler associated with the main burner, a common casing inclosing the boiler, the main burner and the vaporizing chamber, a normally active auxiliary burner located in the casing for heating the vaporizing chamber, a compressed gas tank, and devices for supplying the auxiliary burner with fuel from said compressed gas tank or from said vaporizing chamber, as desired.

25. In a system for burning liquid fuel or the like, the combination of a fuel supply tank, a burner, independent means between the tank and the burner for heating and vaporizing the fuel, a boiler associated with the burner and heated thereby, said boiler adapted automatically to control the said independent heating and vaporizing means.

26. In combination a fuel supply tank for supplying liquid fuel, a boiler, a burner for heating said boiler, independent vaporizing means for heating and vaporizing the liquid fuel prior to feeding the same to said burner, said vaporizing means being controlled by the steam generated in said boiler.

In witness whereof, I hereunto subscribe my name this 20th day of November, A. D. 1913.

CHARLES A. BROWN.

Witnesses:
A. G. McCa ele,

August H. L. Arndt.