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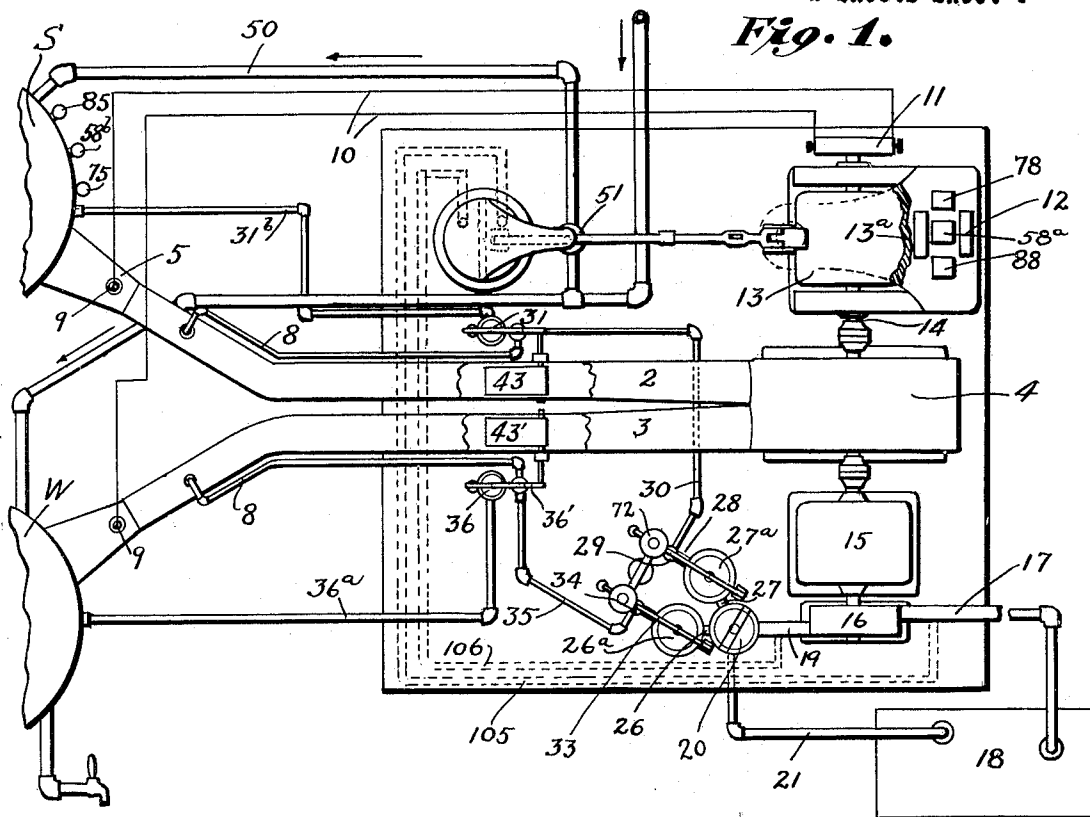
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R. S. CUNNINGHAM

AUTOMATIC OIL BURNING SYSTEM

Filed June 9 1922

2 Sheets-Sheet 1



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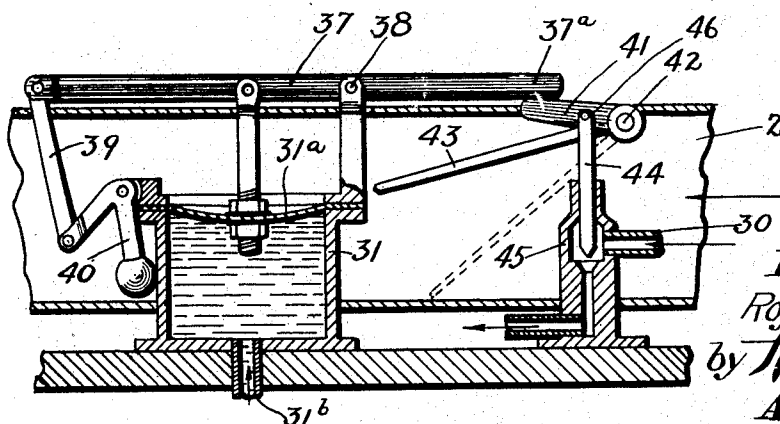
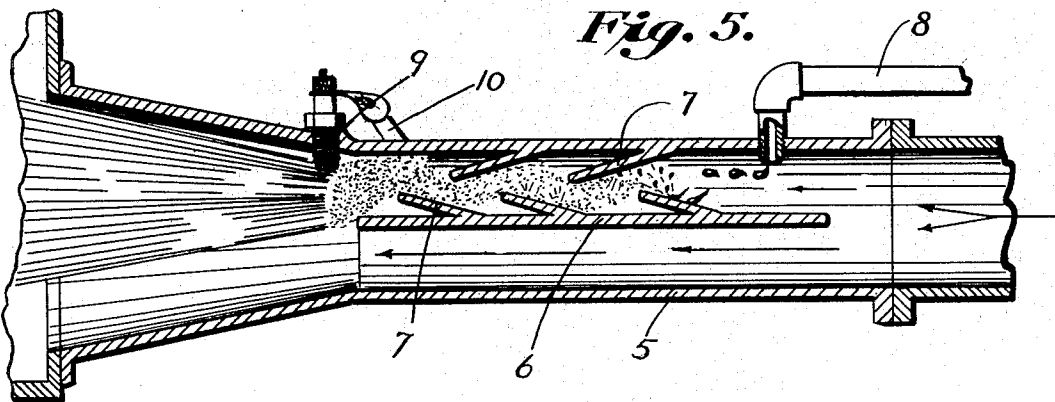
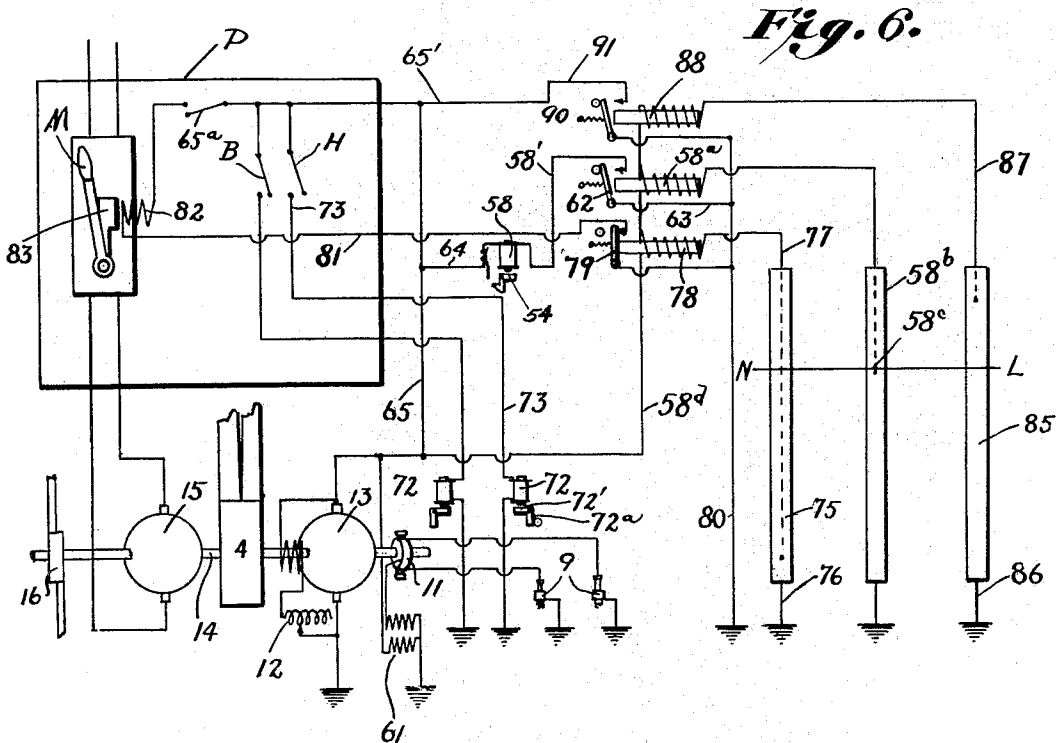


Fig. 4.

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UNITED STATES PATENT OFFICE.

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AUTOMATIC OIL-BURNING SYSTEM.

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To all whom it may concern:

Be it known that I, ROY S. CUNNINGHAM, a citizen of the United States, residing at Los Angeles, in the county of Los Angeles and State of California, have invented new and useful Improvements in Automatic Oil-Burning Systems, of which the following is a specification.

This invention relates to steam and hot water apparatus, and the invention has for its object to provide means for automatically controlling the supply of air and oil to oil burners of which a set is applied to each of the separate steam generators and water heaters. An object is to provide a compact and reliable organization whereby one blower may be utilized to serve either or both a water heater and a steam generator.

Another object is to provide means for automatically regulating the supply of air and oil in given proportions to the water heater and to the steam generator as determined by the temperature of the water in the water heater on the one hand, and the pressure of steam in the steam generator on the other hand.

An important object is to provide an electrically operative remote control for a steam generating and water heating means.

Means are also provided for automatically interrupting the operation of the apparatus when water in the steam generator falls below a predetermined minimum; to provide means for automatically interrupting the operation of the apparatus when the water rises above a predetermined maximum; and further to provide means for automatically cutting off the supply of water running into the steam boiler when the supply reaches a given mean or normal level.

A further object of the invention is to provide electrically controlled lock means for preventing the flow of oil from a supply means to either the water heater or to the steam generator, and which lock means includes circuit closing switches which must be closed before the apparatus becomes operative.

Another object is to provide a combined air blower and sparking current generator for ignition purposes, and which generator is utilized to feed automatic electric means.

Other objects will be made manifest in the following specification of an embodiment of the invention illustrated in the accompanying drawings, in which—

Figure 1 is a plan showing the mechanical apparatus of the improved system, certain of the parts being broken away and certain parts being shown in diagrammatic arrangement.

Fig. 2 is a vertical section through one of the automatic liquid fuel control means and its electrically controlled lock.

Fig. 3 is a vertical section showing the main water supply control device and showing also a safety by-pass for fuel oil.

Fig. 4 is a vertical longitudinal section of means for automatically regulating the flow of oil and air to a mixing device and burner, and which indicates a steam pressure actuated control for the air and oil device.

Fig. 5 is a longitudinal section of a form of air and oil mixer and burner.

Fig. 6 is a diagram illustrating the electrical wiring of the various controls and elements of the device.

The present invention is designed especially for enabling the control by a person at a remote station, of a steam plant and a water heating plant, each of which is independently and individually served with a supply of fuel oil and with a supply of fresh air or other atomizing means preferably from a unitary mechanical organization.

The mechanical organization will first be described.

A steam generator of any suitable type S and a water heater of any suitable type W are conveniently arranged in the plant room of an institution, such for instance as an office, flat, apartment, or dwelling, and to each is led a respective air pipe 2 and 3; these being connected to a blower 4 serving the steam generator and the water heater at one time or individually as may be required, as for instance for the heating of water only, or for the generation of steam only. The air pipes 2 and 3 are each provided with an air and oil mixer and burner which may consist of a shell 5 having a longitudinal partition or shelf 6 above which there is provided in the upper passageway a series of baffle plate 7 against which fuel oil is blown as the oil is discharged onto the shelf 6 from an oil supply pipe 8. The stream of air coming from the blower 4 divides above and below the shelf 6, and the oil fed in from the oil pipe is picked up and atomized as it passes the baffles 7. The air passing through the unobstructed lower

passage accelerates in its rate of movement, and this facilitates the atomization of the mixture leaving the baffle chamber.

For igniting the combustible mixture, there is provided in each oil burner 5 an ignition device which may consist of a spark plug 9, one terminal of which is grounded, while the other terminal 10, one for each spark plug, is electrically connected to a distributor 11 which in turn is supplied with current from any suitable source, as for instance an induction coil 12 combined with a generator 13.

The generator 13 includes a rotary central member secured on a shaft 14 passing through and carrying the fan in the blower 4 and which shaft is also connected to the shaft of a driving motor 15. Therefore, the one motor 15 serves to drive the blower and the generator 13 which latter is utilized for providing current to serve the ignition spark plugs 9.

The motor shaft is also connected to the impeller of a suitable pump 16 which has the supply connection 17 leading to a preferably sunken supply tank 18. The pump is connected by a discharge pipe 19 to an automatically operating oil returning device. This device is shown in Fig. 2, and consists of a shell 20 having in its bottom a return pipe 21 leading to the supply tank 18. Return flow through the pipe 21 is controlled by a needle or other suitable valve 22 having connection with a diaphragm 23 forming the top of the pressure chamber or shell 20. The valve 22 may be held to its seat by a spring 24, the pressure of which may be readily varied as by an adjusting device 25. This device enables the automatic return of oil coming from the pump to the tank 18 in the event of backing up of oil under predetermined pressure in the chamber 20.

From the return device 20 there leads separate outlets 26 and 27, the former leading into a receiver 26^a and the latter into a receiver 27^a. These receivers are respectively connected to the oil supply pipes 8 of the burners by means as will now be described.

The receiver 27^a is provided with a discharge pipe 28 connected to a lock valve body 29 having a pipe 30 leading to a pressure regulating device including a diaphragm chamber 31, Figs. 1 and 4. The chamber 26^a is provided with an outlet pipe 33 leading to a lock valve shell 34, Fig. 2, and from the valve shell leads a connection 35 to a thermostatic device 36, Fig. 1.

The automatic steam pressure device is shown in detail in Fig. 4 and includes a diaphragm 31^a below which pressure of steam is provided by the steam pipe 31^b leading to the steam boiler S. The diaphragm 31^a is connected to a regulating lever 37 mounted on a fulcrum 38 suitably provided, and one arm of the regulating lever 37 is attached

by a link 39 to an overbalancing lever arm 40, the function of which is to swing the outer end 37^a of the lever upwardly and to press the diaphragm 31^a down as pressure in the regulating chamber 31 falls. The swinging end 37^a of the lever operatively engages a finger 41 on a rock shaft 42 mounted transversely and in the upper portion of the air pipe 2 leading from the blower to the boiler S. Within the air pipe 2 is arranged a gate or valve member 43 which is secured to the rock shaft 42, so that in normal operation the pressure of the air moving in the direction of the arrow, Fig. 4, through the air pipe tends to raise the wing gate 43. This action of the gate 43 under air pressure is utilized for the opening and closing of a needle valve 44 operating in a valve body 45, and to which is connected the oil supply pipe 30. Thus, under increased flow of air against the wing valve 43, this latter is moved upwardly to permit a greater volume of air to pass, and at the same time the oil needle valve 44 is lifted by virtue of a pivotal connection 46 with the finger 41. As air pressure decreases against the gate 43, this latter falls and the flow of oil through the pipe 30 is correspondingly reduced in suitable proportion by the downward movement of the needle valve 44.

A somewhat similar automatic arrangement for the control of air and oil leading to the burner for the water heater W includes the thermostatic element 36 which operates a regulating lever 36' for the respective air valve 43' in the air pipe 3. The thermostatic device 36 is supplied with water through the pipe connection 36^a leading to the water heater W so that water of the temperature contained in the heater is conducted to the thermostatic device 36, and as the temperature of the water increases and falls, the flow of air and oil is accordingly decreased or increased. From this it will be seen that the apparatus provides pressure operated means for controlling the combustion of fuel at the steam boiler burner, and a thermostatically operative means for regulating the supply of oil and air to the water heater burner.

To supply water to the boiler, there is attached to the latter a supply pipe 50 which leads to an automatic valve 51 having connection to the water main as indicated at 52. This automatic valve 51 has a stem connected to an operating lever 53, the swinging end of which is designed to engage a latch member 54 which is disposed in the housing 13^a of the generator 13. This latch is pivotally mounted upon the swinging end of a carrying bar 55 which with the lever 53 is hung on a common pivot pin as 56. The generator includes a rotor 13^b secured on the shaft 14, and rotatably mounted about the rotor for a limited swinging movement is an

exterior annulus 13^c which, when the rotor 13^b is rotated by the driven shaft 14 and when electrical connections provide for the generation of electricity in the generator, tends to swing in the direction of the arrow *a*, Fig. 3. This swinging movement is utilized by means of a connecting link 57 to push the carrying arm 55 upwardly and with it the valve lever 53 which is connected to the arm by the latch 54.

During the operation of the apparatus after the valve stem 51 and the lever 53 have been actuated to open the valve 51, the valve lever 53 is maintained in open position until the water has been accumulated in the steam boiler *S* to about a normal or given level indicated on the line marked *N—L*, Fig. 6. When such level is reached, an electrical circuit is completed through an electro-magnet 58, and the latch 54 is retracted so as to disengage the lever 53 of the valve stem. This lever carries a circuit closing brush 59 engaging a contact 60 electrically connected to the windings of the electro-magnet 58 and, as soon as the latch 54 is released, the descending lever arm 53 retracts the brush 59 from the contact 60 and the circuit of the magnet is broken.

In the diagram shown in Fig. 6, the magnet 58 is shown as having a wire connection 58' to a contact to be engaged by an armature of the electro-magnet 58^a which is connected by a conductor to a vertical water gauge 58^b having a contact 58^c arranged at about the normal water level line *N—L*. Thus, when water rises in the gauge tube 58^b, the circuit of the magnet 58^a will be closed as through the ground connections and through its connection 58^c with an induction coil 61 in the generator combination 13. From the excitation of the magnet 58^a the armature 62 thereof is attracted and the circuit of the coil 58 is closed. This circuit includes a ground line 63 leading from the armature to a ground connection, and a connection 64 to a main feed wire 65 forming a portion of the generator circuit.

The remote control apparatus includes a main switch *M* connected to the main circuit wires supplying current to the motor 15. Also at the remote station, there is provided a steam boiler controlling switch *B*, and a hot water controlling switch *H*; these switches respectively controlling the operation of a lock mechanism which control respective valves in the oil supply connections.

Referring to Fig. 2, such a lock mechanism is indicated as including a needle or other suitable valve 34' operating in the valve body 34 and being pivotally connected to a lever 34^a which has connection to a stem 34^b of a diaphragm 34^c which, in Fig. 2, is arranged in the top of the oil chamber 26^a. The lever 34^a is also pivotally connected to

an overbalance weight arm 70 having a pivot support 71 and which also is connected to the needle valve 34'; the function of the overbalance arm 70 being to normally close the valve 34'. This valve cannot be opened for the flow of liquid oil through the respective pipe 35, or as the case may be, through the oil pipe 30, until the respective locking arm 34^a is released, and this is secured through the energization of an electro-magnet 72, one end of the coil of which is connected to the ground (Fig. 6), while the other end is connected by a wire 73 which is connected to one of the poles of a switch *H*, for instance of the hot water heater. The opposite pole of the switch *H* is connected to a main wire 65' of the generator circuit. The excitation of the electro-magnet 72 serves to attract a contiguous armature 72' of a latch member or dog 72^a which has a downwardly extending arm forming an abutment disposed above the contiguous end of the locking lever 34^a as of the oil supply pipe 35 leading to the oil burner of the water heater. A substantially similar electrical control is shown in Fig. 6 as attached to the steam boiler switch *B* so that the oil pipe 31^b—30 is only opened for flow of oil after the boiler switch has been closed. A master switch 65^a is provided at the operator's panel *P* at the remote station so as to break the generator circuit when necessary.

It may be in some cases that the water in the steam boiler has been evaporated down to a minimum low water mark, and this condition is indicated by a low water vertical gauge 75 having electrical connection 76 to the generator ground connection and having a conductor 77, the terminal of which is located well down on the gauge tube 75, and which conductor is connected to an electro-magnet coil 78 tapped into the contact 58^c.

In the event that the main switch *M* of the motor 15 is thrown to closing position at a time when the circuit of the electro-magnet 78 is broken by low water in the gauge 75, then it will be necessary to hold the main switch manually in circuit closing position to energize the motor for a period of time until the water in the gauge 75 rises and causes the closing of the circuit of the electro-magnet 78, whereupon the magnet attracts its armature 79 which is connected to a ground line 80 and engages a contact at the terminal of a wire 81 connected to an electro-magnet 82 designed to attract an armature 83 of the main switch *M*, so that the main switch will be held in circuit closing position during such time that the water in the gauge 75 is in circuit closing position. The electro-magnet 82 of the main switch is connected to the circuit wire 65'.

It is desirable further to provide means for automatically cutting off the supply of water to the steam boiler, and this is accom-

plished by the utilization of a circuit closing, high water level gauge 85 having an electrical ground connection 86 and a wire connection 87 to an electro-magnet 88 which is tapped into the service wire 58^d. The electro-magnet has an armature 90 electrically connected to the ground wire 80. The armature is designed to engage a contact terminal of a wire 91 connected to the circuit line 65.

When the armature 90 is attracted by its electro-magnet 88 it shorts the generator circuit from wire 65 to wire 91, and thence to the ground 80, and the generator being shunt wound, this automatically interrupts the electro-magnet circuits which are served by the generator circuit and cuts out the main switch M which causes the stopping of the motor 15 and the stopping of the oil pump and the air blower and stops the generator.

This automatic interruption of the system requires an inspection of the apparatus to ascertain the cause of the automatic cut out and facilitates in the location of the leak which initiated the cutting out operation by the closing of the cut out circuit in the high tube water level 85.

When the circuits are interrupted, the rotor 13^b of the generator may continue to rotate without producing mechanical torque upon the annulus 13^c, and this, therefore, being freed, is enabled to reverse itself and swing back under the downward pressure imposed by the arm 55 which will fall when the circuit in the electro-magnet 58 is broken.

In such an event the arm 55 is utilized to interrupt the oil circulation by the pump into the discharge pipe. Therefore, upon the arm 55 there bears the foot of a lever 100 which is pivoted on a bracket 101 overhanging the arm 55, and to the opposite end of the lever 100 is attached a plunger 102 which operates a valve 103 provided in the overhanging bracket. The bracket has a chamber 104 connected by a pipe 105 to the suction side or pipe 17 of the pump, while the discharge pipe 19 of the pump is connected by a pipe 106 to a chamber or passageway 107 in the bracket. The vacuum on the motor side of the pump is broken when the valve 103 opens.

Various modifications and changes may be resorted to within the spirit of the invention as claimed.

What is claimed is:

1. In a steam generating and hot water plant, a steam boiler and a water heater each having its own liquid fuel burner, a blower and an oil pump common to the boiler and the heater, a motor for driving the pump and the blower, separately remotely controlled locking means for said boiler and said heater and a main power switch for the motor.

2. In a steam generating and hot water plant, a steam boiler and a water heater each

having its own liquid fuel burner, a blower and an oil pump common to the boiler and the heater, a motor for driving the pump and the blower, separately remotely controlled locking means for said boiler and said heater and a main power switch for the motor at a station remote from the plant.

3. In a steam generating and hot water plant, a steam boiler and a water heater each having its own liquid fuel burner, a blower and an oil pump common to the boiler and the heater, a motor for driving the pump and the blower, a main power switch for the motor, and individual lock means for each oil burner supply from the pump, whereby the heater or the boiler may be separately cut-in for service from a remote point.

4. In a steam generating and hot water plant, a steam boiler and a water heater each having its own liquid fuel burner, a blower and an oil pump common to the boiler and the heater, a motor for driving the pump and the blower, a main power switch for the motor, individual lock means for each oil burner supply from the pump, whereby the heater or the boiler may be separately cut in for service, and means at a remote control station for releasing the said lock means.

5. In a steam generating and hot water plant, a steam boiler and a water heater each having its own liquid fuel burner, a blower and an oil pump common to the boiler and the heater, a motor for driving the pump and the blower, a main power switch for the motor at a station remote from the plant, and individual means at the remote station for cutting-in the supply to the respective burners.

6. In a steam generating and hot water plant, a steam boiler and a water heater each having its own liquid fuel burner, a blower and an oil pump common to the boiler and the heater, a motor for driving the pump and the blower, a main power switch for the motor at a station remote from the plant, and means at the remote station for selectively cutting-in the supply to the burners.

7. In a steam generating and hot water plant, a steam boiler and a water heater each having its own liquid fuel burner, a blower and an oil pump common to the boiler and the heater, a motor for driving the pump and the blower, a main power switch for the motor, supply connections between the pump and the burners, and independent controls for opening said connections from a remote point.

8. In a steam generating and hot water plant, a steam boiler and a water heater each having its own liquid fuel burner, a blower and an oil pump common to the boiler and the heater, a motor for driving the pump and the blower, a main power

switch for the motor, supply connections between the pump and the burners, and remote controls for opening said connections.

5 9. In a steam generating and hot water plant, a steam boiler and a water heater each having its own liquid fuel burner, a blower and an oil pump common to the boiler and the heater, a motor for driving
10 the pump and the blower, a main power switch for the motor, separate supply connections between the pump and the burners, controls for opening said connections, and independent automatic means in said
15 separate connections for returning the oil from either of said connections to a supply source under predetermined back pressure in said connections.

10. In a steam generating and hot water
20 plant, a steam boiler and a water heater each having its own liquid fuel burner, a blower and an oil pump common to the boiler and the heater, a motor for driving the pump and the blower, a main power
25 switch for the motor, separate supply connections between the pump and the burners, controls for opening said connections, and independent automatic devices operative respectively by temperature and by pressure
30 to regulate oil flow to the burners.

11. In a steam generating and hot water
plant, a steam boiler and a water heater each having its own liquid fuel burner, a blower and an oil pump common to the
35 boiler and the heater, a motor for driving the pump and the blower, a main power switch for the motor, separate supply connections between the pump and the burners, controls for opening said connections, and
40 independent automatic devices operative respectively by temperature and by pressure to regulate oil and air flow to the burners.

12. In a steam generating and hot water
plant, a steam boiler and a water heater
45 each having its own liquid fuel burner, a blower and an oil pump common to the boiler and the heater, a motor for driving the pump and the blower, a main power
50 switch for the motor, separate supply connections between the pump and the burners, independent controls for opening said connections, and a combined air and fuel proportioning means for each burner.

13. In a steam generating and hot water
55 plant, a steam boiler and a water heater each having its own liquid fuel burner, a blower and an oil pump common to the boiler and the heater, a motor for driving the pump and the blower, a main power
60 switch for the motor, separate supply connections between the pump and the burners, independent controls for opening said connections, a combined air and fuel propor-

tioning means for each burner, and means for automatically actuating said proportion- 65
ing means.

14. In a steam generating and hot water
plant, a steam boiler and a water heater each having its own liquid fuel burner, a blower and an oil pump common to the boiler and
70 the heater, a motor for driving the pump and the blower, a main power switch for the motor, separate supply connections between the pump and the burners, independent controls for opening said connections, a combined air and fuel proportion-
75 ing means for each burner, and respective temperature and pressure operated means for controlling the proportioning means.

15. A steam generator, a pump having
80 a connection to an oil burner for the generator, an electric motor for the pump, a main power switch for the motor, an electric generator, a high water level gauge, and an electric control for the main switch
85 including a circuit from said generator closed by high water in the gauge and an electro-magnetic device for holding the main switch in closed position until said
90 circuit is closed, whereupon the main switch is released and the motor stopped.

16. A steam generator, a pump having a
connection to an oil burner for the generator, an electric motor for the pump, a main
95 power switch for the motor, an electric generator connected to the motor, a high water level gauge, and an electric control for the main switch including a circuit from said
100 generator closed by high water in the gauge and an electro-magnetic device for holding the main switch in closed position until said circuit is closed, whereupon the main switch is released and the motor stopped.

17. A steam generator, a water connection to a main for supplying the generator
105 with water, a self-closing valve in said connection, and electrical control means for releasing said valve when water fills the generator to a normal level.

18. A steam generator, an oil pump hav-
110 ing a connection to an oil burner for the same, an electric motor for the pump, a water connection to a main for supplying the generator with water, a self-closing valve in said connection, electrical control means
115 for releasing said valve when water fills the generator to a normal level, and electrically controlled means for by-passing the oil flow in the pump.

19. A steam generator including a boiler
120 and a low-level water gauge, a motor driven pump for feeding oil to a burner for the boiler, a main current switch for the motor of the pump, and an electrical controlling device for holding the switch closed and
125 including a low level circuit breaker, where-

by the switch is released and the motor is stopped at a predetermined low level of water in the boiler.

20. In a water heating apparatus, an oil
5 pump having supply connection to a burner
thereof, electric ignition means for fuel at
the burner, a motor for driving the pump,
and a generator for supplying current to
the ignition means, said generator being
10 driven by the motor.

21. In a water heating apparatus, a motor,

a pump, a blower and an electric generator
all combined with a single drive shaft, a
burner device having a sparking means to
ignite fuel oil from the pump, said means 15
being energized by the generator, and the
oil being atomized in the burner by air
from the blower.

In testimony whereof I have signed my
name to this specification.

ROY S. CUNNINGHAM.