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LIQUID FUEL BURNING INSTALLATIONS

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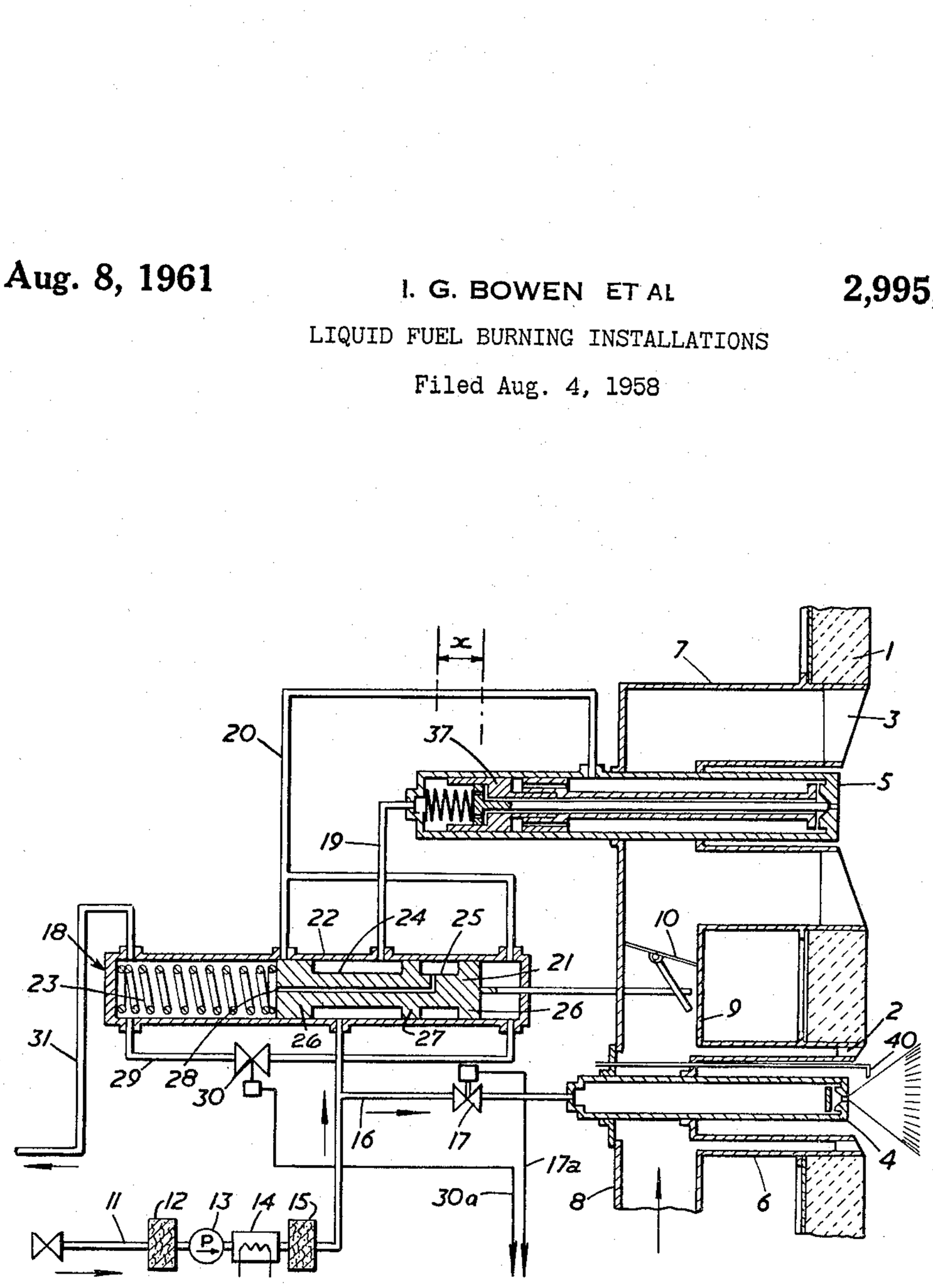

FIG. 1.

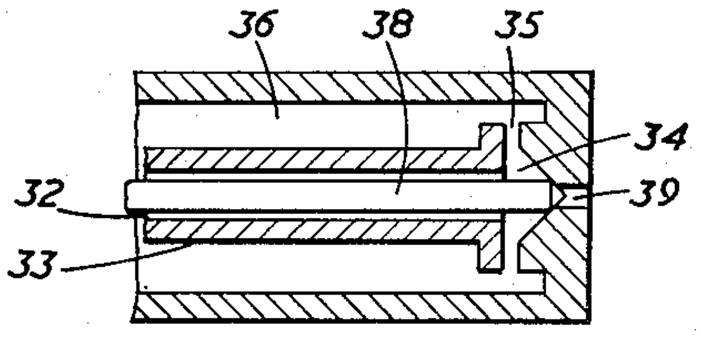

FIG. 2.

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LIQUID FUEL BURNING INSTALLATIONS

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This invention relates to liquid fuel burning installations and has particular although not exclusive reference to oil fired industrial boiler plants.

In industrial boiler plants, variations of load necessitate control over burner heat output and where the liquid fuel flow rates exceed about 10 gallons per hour it is desirable that the control should be such that frequent lighting-up and shutting-down of large burners is avoided. It has been proposed to employ burners whose output can be varied from a maximum down to about 40% of maximum. It has also been proposed to use a burner capable of providing a high output for heavy load conditions and a low output for low load conditions with suitable control apparatus for selecting the required output. Burners of the latter sort may employ a single, wide range atomiser with a single air register or twin atomisers again with a single air register. In both cases there is the disadvantage that combustion conditions under low output are not as favourable as those for high output.

It is an object of the present invention to provide a liquid fuel burning installation capable of high and low heat outputs under efficient combustion conditions.

Accordingly the present invention provides a liquid fuel burning installation comprising a first burner provided with an air register, a second burner provided with a separate air register, cooling means for said second burner, and control means responsive to the load on the installation for controlling said second burner, said control means also controlling the supply of air to the separate air register and the operation of the cooling means.

The first burner has a heat output sufficient for light load conditions while the second burner has a heat output which, taken together with that of the first burner, is sufficient to meet the full load demand of the installation. The provision of separate air registers for the two burners enables each burner to function under optimum combustion conditions and the means for cooling the second burner when it is not operating avoids overheating of the second burner which might otherwise occur when the first burner only is operating.

The second burner and cooling means may comprise a burner of the spill and/or recirculating type wherein the control means reverses the flow of fuel through the second burner as the latter is brought into or taken out of operation thereby ensuring the cooling of the burner when it is not operating. The control means may include a shut-off valve for the second burner operated by the pressure difference between a fuel feed line to this burner and a fuel spill line therefrom. The control means may also include a valve for controlling the direction of fuel feed flow to the second burner and having a movable element for controlling the supply of air to the air register of the second burner.

The installation may further comprise further control means responsive to the load on the installation for starting up and cutting out the first burner.

The installation may consist of several pairs of first and second burners with cooling means; alternatively, there may be a number of first burners and the same number of second burners with cooling means and having common control means, including the valve with the movable element referred to above.

By way of example only, an oil burning installation according to the invention and suitable for an industrial boiler plant will now be described in greater detail with reference to the accompanying drawings of which:

FIGURE 1 shows the lay-out of the installation in diagrammatic form only, and,

FIGURE 2 shows a detail of FIGURE 1 on an enlarged scale.

The drawing shows part of a furnace wall **1** having apertures **2**, **3** for receiving first and second burners **4**, **5** respectively and their air registers **6**, **7**. The registers are supplied with air under pressure via a common conduit **8** and are interconnected by a conduit **9** containing an adjustable damper **10**.

Oil is fed to the burners **4** and **5** from a feed line **11** via low pressure filter **12**, pump **13**, heater **14** and high pressure filter **15**. On the output side of the filter **15**, the feed line **11** divides and a branch line **16** is connected to the burner **4** via a thermostatically controlled isolating valve **17**. Line **11** is, on the output side of filter **15**, connected to a control valve **18** for controlling the flow of oil to the second burner **5**. Flow lines **19** and **20** connect the valve **18** with the burner **5**.

The control valve **18** comprises a piston-like member **21** movable in a cylinder **22** against a helical spring **23**. The member **21** has peripheral channels **24**, **25** located between end flanges **26** and separated by flange **27**. Channel **25** is connected by a drilling **28** with the space in the cylinder at one end of the member **21**. Connections are made to the valve **18** in the positions shown in the drawing so that with the member **21** in the position shown, oil from line **11** passes via channel **24** to flow line **19** and the burner **5** and thence via flow line **20** back to the valve **18**. It will be seen that the flow line **20** is connected at two points to the valve **18** and in the left-hand drawing one of these points is closed by the flange **26**. A by-pass line **29** connects together spaces at each end of the cylinder and flow along the line **29** is controlled by a thermostatically operated isolating valve **30**. Oil is finally returned to a low pressure source via line **31**.

Valve **17** is controlled by means of a thermostat (not shown) situated in the waterways of a boiler (not shown) fired by the installation. The thermostat is connected to valve **17** by means of line **17***a*.

Valve **30** is controlled by means of a second thermostat (not shown) situated immediately below the first mentioned thermostat in the boiler waterways. The second thermostat is set to operate at a lower temperature than the first mentioned thermostat and is connected to valve **30** by means of a line **30***a*.

Burner **5** is of the spill or recirculating type and oil from line **19** passes via a central passageway **32** in an inner tube **33** to a swirl chamber **34** and from thence through spill apertures **35** and an annular passage **36** to the flow line **20**. With oil flow in the direction just described, a movable piston **37** in the burner **5** is held in the position shown in the drawing by the pressure difference between the lines **19** and **20** acting across the piston **37**. Connected for movement with the piston **37** is a lance cut-off valve **38** whose tip closes the outlet orifice **39** of the burner **5**.

The movable member **21** is connected by a suitable linkage to the damper **10** positioned in the interconnecting conduit **9** referred to above.

Automatically operating ignition means indicated at **40** are provided adjacent burner **4** and their operation is initiated each time valve **17** is opened.

In use, the installation operates on low load conditions with burner **4** only firing. The first mentioned thermostat operates to open or close valve **17** as the waterway temperature respectively falls below or exceeds that set for the operation of the thermostat, ignition means

40 being initiated with the opening of valve 17. The moving parts are in the positions shown, the orifice 39 being closed also the damper 10. Isolating valve 30 is open and oil from the spill line of burner 5 circulates freely to the low pressure source of oil.

Burner 5 is brought into operation when the waterway temperature drops below that governing the second thermostat; the isolating valve 30 closes causing pressure to build up which forces the element 21 to the left as seen in FIG. 1 a distance x against the compression of helical spring 23. Oil from the feed line 11 now passes via channel 24 to flow line 20 and the reversal of the differential pressure across piston 37 withdraws the tip of the lance cut-off valve 38 from the orifice 39 of burner 5. Oil can now pass from the swirl chamber 34 through the orifice 39 where it is ignited by the flame already issuing from burner 4. At the same time damper 10 is moved to an open position thus permitting air flow to air register 7.

The reverse procedure occurs when the waterway temperature exceeds that set to control the second thermostat, and burner 5 is shut down.

By suitable choice of the heat outputs of the burners 4 and 5 it is possible to operate the installation for long periods without extinguishing burner 4. Burner 4 is shut down by valve 17 only after burner 5 has been shut down by valve 30, which is closed by its controlling thermostat at a lower temperature.

The separate air registers 6 and 7 enable both burners to operate under optimum combustion conditions. The use of high atomising pressures and air turbulence enables the flames of the burners to be smaller than in existing installations.

If this installation is used to burn heavy oils, the small burner 4 may be warmed before ignition, that is, during the start-up period, by the circulation of oil passing to or from the isolation valve 30 from an oil heater (not shown).

The thermostats controlling the operation of the installation can be replaced by any suitable control devices which are responsive to changes in temperature or pressure.

We claim:

1. A liquid fuel burning installation comprising a low thermal output liquid fuel burner, a first air register surrounding said low output burner, a liquid fuel igniter with ignition electrodes located adjacent said low thermal output burner only, a supplementary high thermal output liquid fuel burner of the spill recirculating type, a second air register surrounding said high output burner, said high thermal output burner being adjacent said low thermal output burner, liquid fuel flow and return pipes connected to said burners, a liquid fuel flow control valve in the flow pipe to said high output burner only whereby the flow to the latter is controllable between cooling and operative conditions, a conduit joining said first and second air registers, an air flow control element in said conduit, a linkage joining said liquid flow control valve to said air flow control element closing the latter when the fuel flow to said high output burner is in said cooling condition and means responsive to the load on the installation for controlling the operation of said high thermal output burner only lighting of which is by means of said low thermal output burner.

2. A liquid fuel burning installation comprising a low thermal output liquid fuel burner, a first air register surrounding said low output burner, liquid fuel igniter with ignition electrodes located adjacent said low thermal output burner only, a supplementary high thermal output liquid fuel burner of the spill recirculating type, a second air register surrounding said high output burner, said high thermal output burner being adjacent said low thermal output burner, fuel flow and return pipes connected to said burners, a liquid fuel flow control valve in the fuel flow pipe to said high output burner only whereby the flow to the latter is controllable between cooling and operative conditions, air flow control means located in said second air register, a linkage interconnecting said control valve and said air flow control means, and a device responsive to the thermal load on the installation for operating said control valve to control the operation of said high thermal output burner only.

3. A liquid fuel burning installation comprising in combination a low thermal output liquid fuel burner, a first air register for said low output burner, a liquid fuel igniter with ignition electrodes located adjacent said low thermal output burner only, a supplementary high thermal output liquid fuel burner of the spill recirculating type, a second air register for said high output burner, said high thermal output burner being adjacent said low thermal output burner, fuel flow and return pipes connected to said burners, a liquid fuel flow control valve in the fuel flow pipe to said high output burner whereby the flow to the latter is controllable between cooling and operative conditions, air flow control means located in said second air register, a linkage interconnecting said control valve and said air flow control means, and a device responsive to the thermal load on the installation for operating said control valve to control the operation of said high thermal output burner only.

4. A liquid fuel burning installation comprising a low thermal output liquid fuel burner, a first air register surrounding said low output burner, a liquid fuel igniter with ignition electrodes located adjacent said low thermal output burner only, a supplementary high thermal output liquid fuel burner of the spill recirculating type, a second air register surrounding said high output burner, said high thermal output burner being adjacent said low thermal output burner, liquid fuel flow and return pipes connected to said burners, a liquid fuel flow control valve in the flow pipe to said high output burner, said valve comprising a cylinder and a flow controlling piston movable within said cylinder, bias means for urging said piston into a position in which fuel flow to said second burner flows therethrough in a cooling circuit, a liquid fuel by-pass passage connected in parallel with said piston, a liquid fuel flow control valve in said by-pass passage, a device responsive to the thermal load on the installation for operating said control valve in said by-pass passage whereby said piston is movable against said bias means into a position in which fuel flow to said second burner flows therethrough in a fuel burning circuit, an air flow control element in said second air register and a linkage joining said piston to said air control element.

References Cited in the file of this patent

UNITED STATES PATENTS

1,637,820	Hawkins	Aug. 2, 1927
2,150,113	Wunsch et al.	Mar. 7, 1939
2,743,137	Wilson	Aug. 24, 1956
2,519,240	Fellows	Aug. 15, 1950