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SYSTEM OF FLUID FUEL SUPPLY FOR MULTIPLE BURNERS OPERATION

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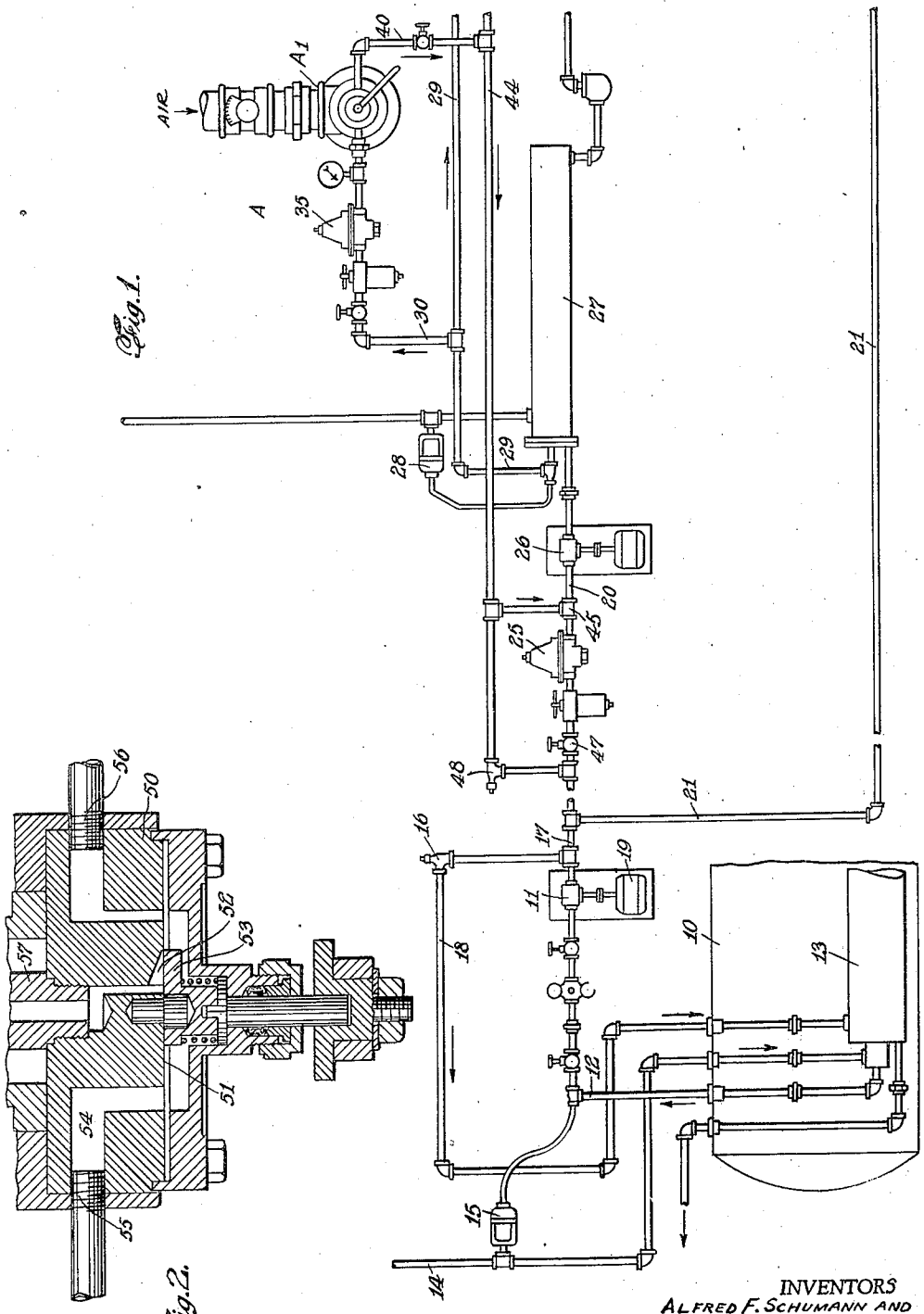


Fig. 1.

Fig. 2.

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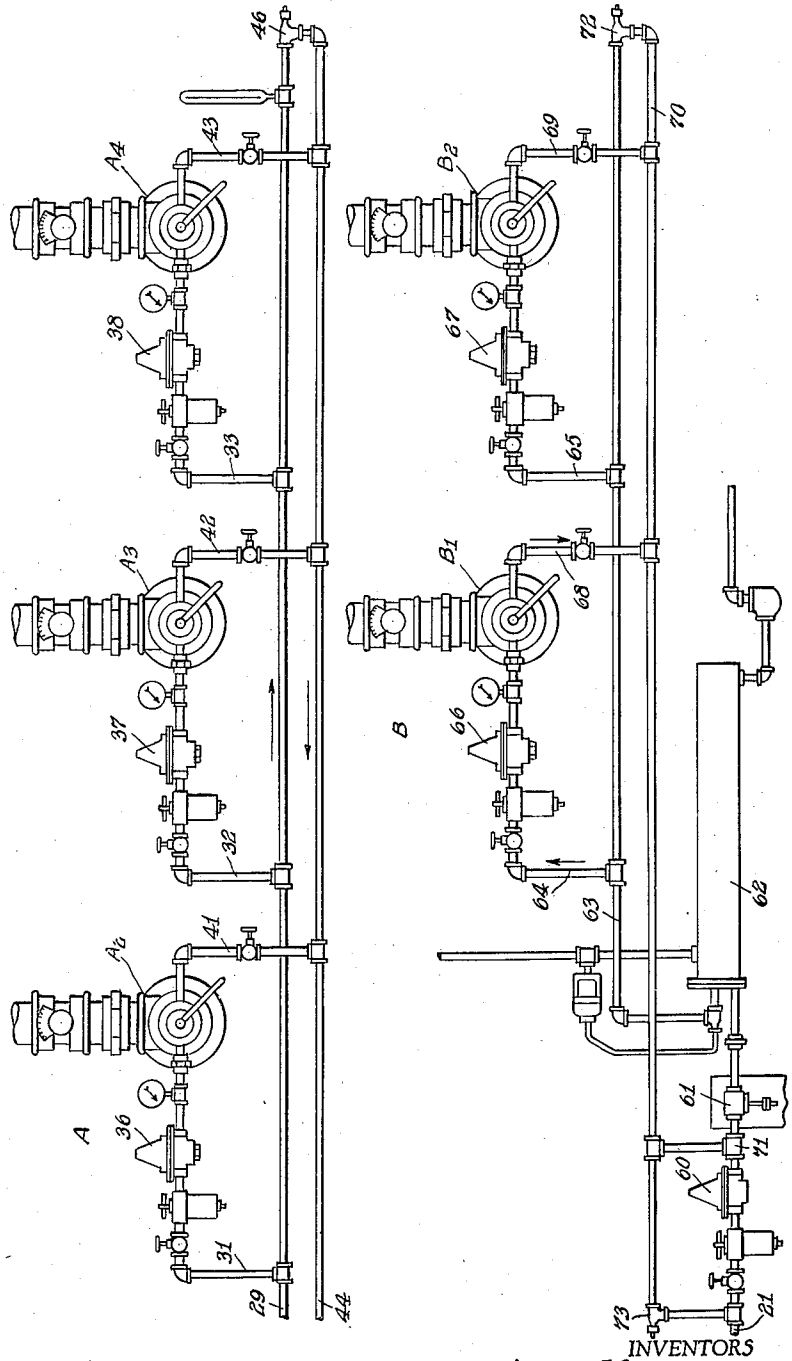
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Fig. 1a.



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SYSTEM OF FLUID FUEL SUPPLY FOR MULTIPLE BURNERS OPERATION

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5 Claims. (Cl. 158—36.3)

The invention relates to the operation of industrial burner installations embodying generally a plurality of burners in one or more groups and utilizing a liquid fuel such as heavy oil. In order to reduce the fire hazard and to eliminate wide temperature fluctuations, the fuel utilized with these burners is generally stored in suitable tanks located under ground and at a point more or less remote from the actual burners. A suction pump, which is located above ground, withdraws the fuel from the tank as required and under a substantial vacuum in view of the considerable lift necessitated by thus burying the tank. Heating of the oil in the tank to any substantial degree, say above 150° F., is therefore not practicable since above this temperature vapor would be produced to an extent to interfere with the vacuum so that the pump would not deliver the requisite volume of fuel. Moreover, when this heavy oil is to be delivered at an appreciable distance from the place of storage with an initial temperature of only 150° F., considerable loss in temperature and variation in pressure is experienced by the time it reaches the burner means, and constant satisfactory combustion cannot be had unless the oil temperature is maintained substantially constant at the burners.

The present invention has for an object to provide a novel method of operation and to an installation wherein these objections are overcome so that effective oil temperatures and pressure are maintained at the burners.

A further object of the invention is to maintain substantially constant the pressure on the fuel as delivered to a burner or burners.

Another object of the invention is to maintain substantially constant the temperature of the oil at the valve-metering opening for a burner.

Still another object of the invention is to make it possible to use fuel supplied to a burner at relatively low pressures and to provide controlling openings in the fuel-supply valve for the burner which are of a size sufficient to pass the usual amount of dirt and other foreign matter present in heavy-grade oils and render the system thus less subject to clogging.

The invention has for an object, also, to provide an installation wherein substantially as much fuel passes through the valve associated with a burner as may be required by the burner itself, whereby more satisfactory operation of the regulator in the supply of the fuel to the burner is attained, due to the fact that the variation of flow is reduced to about one-half the variation if only the oil consumed by the burner were controlled.

The invention has for another object to provide a system operable under comparatively low fuel pressures.

In carrying out the invention, the various burner units which may be arranged in one or more batteries of units are all connected to one common source of fuel supply. This may be contained in a tank or other suitable receptacle buried generally under ground and located more or less remotely with respect to the burner units. The fuel is pumped from the storage tank and delivered to a fuel supply line at a temperature of approximately 150° F., suitable provision being made for preliminarily heating the fuel in its tank. A substantial pressure is maintained in the supply line by the said pump approximately to the batteries of burners where a reducing valve or the like lowers the supply pressure. Beyond such reducing valve or the like auxiliary pumping means are installed to advance the fuel to the burners, said fuel first being passed through additional heater means to heat the fuel and to elevate its temperature to the requisite degree, for example, 250° F., or to a temperature at which the viscosity of the oil is not materially altered by slight temperature variations.

Connections are then made to the respective burner units for the fuel at this elevated temperature and under a moderate pressure which is maintained substantially constant by a reducing valve located immediately in advance of each of the burners. Moreover, the supply of fuel to a burner is arranged to be in excess of the burner requirements, being substantially double the normal requirements, and the excess is returned to the supply line on the intake side of the auxiliary pump beyond the pressure-reducing valve which is located in advance of the same. Respective by-pass connections are thus provided for each of the burners of a battery, the control valve for a burner being modified to admit of delivery of the excess fuel not required by a burner therethrough into the corresponding by-pass.

The nature of the invention, however, will best be understood when described in connection with the accompanying drawings, in which:

Figs. 1 and 1a, Sheets 1 and 2, respectively, illustrate more or less diagramatically the novel burner installation embodying by way of example two groups of burner units.

Fig. 2 is a fragmentary horizontal section through a portion of the control valve for a burner.

Referring to the drawings, the fuel to be utilized in the operation of the burners, and which may be a heavy oil, is contained in a suitable storage tank 10 or the like generally buried under ground. This fuel is to be heated as highly as is consistent with its removal by a suction pump 11 connected through pipe 12 to the tank for the fuel, or rather to a heater 13 therein. The heater 13 is operated from a steam line 14 through a temperature regulator 15, the fuel being maintained at a temperature of substantially 150° F. A relief valve 16 is included in the fuel supply line 17 to return any excess fuel to the heater as through the pipe connection 18, the pump 11 being a constant volume pump operated, for example, by a motor 19.

One or more batteries of burner units are connected to the supply line 17; and this connection may be made through a pressure-reducing valve which lowers its pressure somewhat below that at which the oil is supplied to the burner units by an auxiliary pumping means as well as through an additional heater means, all located immediately in advance of a battery. Thus, as indicated in the drawings, two batteries of burners A and B, respectively, are connected to the supply line 17, the former through the branch supply line 20 and the latter through the branch supply line 21, both connected directly to the supply line 17. The battery A comprises four burner units, A_1, A_2, A_3, and A_4, and the battery B two burner units, B_1 and B_2. These burners may be of any suitable design and are preferably of the proportional type, for example, of the nature set forth in U. S. Letters Patent #2,219,118 and #2,219,119 granted applicants' assignee, but slightly modified for the purpose hereinafter set forth. Thus, the intake for air from any suitable source such as a blower (not shown) is at the top of a burner, as indicated by the arrow, Fig. 1, while the burner delivery nozzle (not shown) is at right angles thereto, for example, in the axis of oscillation of the operating handle of a burner.

As hereinbefore noted, the supply of fuel to each battery of burners is preceded by a pressure-reducing valve, an auxiliary pumping means, and a heating means. For example, there is introduced in the branch line 20 the pressure-reducing valve 25 which reduces the supply pressure to approximately 5 pounds per square inch for the purpose hereinafter set forth, whereupon the flow is to the intake of an auxiliary pump 26 which delivers the fuel at a pressure of approximately 20 pounds per square inch to the heater 27 where it is reheated to a temperature of substantially 250° F. under control of a temperature-regulator 28. Connections are made from the heater outlet pipe 29 to the respective burners A_1, A_2, A_3, and A_4, as through pipes 30, 31, 32, and 33, respectively.

There is interposed in each of these connections a further pressure-reducing means and beyond each burner a return or by-pass connection. Thus, a pressure-reducing means 35 is connected immediately in advance of the burner unit A_1; a pressure-reducing means 36 immediately in advance of the burner unit A_2; a pressure-reducing means 37 immediately in advance of the burner unit A_3; and a pressure-reducing means 38 immediately in advance of the burner unit A_4, with by-pass connections 40, 41, 42, and 43 from each of the respective burner units to a common return 44. This enters the branch supply pipe at a point 45 located between the pressure-reducing valve 25 and the auxiliary pump 26 where the pressure of the fuel has been sufficiently reduced, thereby establishing a continuous circulation through the battery of burners of fuel at a proper temperature for most effective combustion and at the requisite pressure.

In addition, it will be noted that there is thus supplied to each burner of a battery fuel considerably in excess of its normal requirement which enables a much more satisfactory regulation to be attained in the flow of fuel through the burner nozzle in accordance with the demands made upon a unit. The feature of control of the fuel supply to a burner unit is well understood and forms no particular part of our invention, and is set forth in considerable detail in the aforesaid Letters Patent #2,219,118.

A pressure relief valve 46 is also included at the end of the supply line 29 for return of any surplus fuel into the said return 44; and beyond the entrance of said return 44 at the point 45 and in advance of a shut-off valve 47 a further return connection is made through a relief valve 48 so that if pressure should build up in the said return line, it would be properly relieved.

As hereinbefore set forth, the valve for controlling the flow of fluid through the burner orifice may be of the nature set forth in the aforesaid Letters Patent #2,219,119. Reference being had to Fig. 2 of the drawings, the valve-burner unit comprises a casing 50 in which is provided a valve seat 51 having therein a triangular port 52 over which is designed to be moved a cam-shaped valve piece 53 to control the area of port opening. Fuel is delivered into the interior 54 of the valve body of casing 50 as through an inlet 55 for communication with a corresponding one of the connections 30, 31, 32, and 33; while an outlet 56 is also made in this instance to allow of the by-passing of the fuel and is adapted for communication with a corresponding one of the connections 40, 41, 42, and 43. The fuel for the burner use passes through the hollow spindle 57 of the burner under control of the said valve piece 53.

In a similar manner, the other branch pipe 21 for the battery B of burners includes a pressure-reducing valve 60, auxiliary pumping means 61, and a heater 62, and from the latter extends the outlet or supply pipe 63. Pipes 64 and 65 connect this supply pipe to the respective burners B_1 and B_2 of the group through corresponding pressure-reducing valves 66 and 67, respectively, while by-pass connections 68 and 69, respectively, connect the said burners to a common return 70 entering the branch pipe 21 at the point 71 intermediate the pressure-reducing means 60 and auxiliary pumping means 61 where the fuel pressure has been sufficiently reduced. Pressure relief connections are made to the return 70 and to the supply pipe 21, respectively through relief valves 72 and 73 as in the case of the battery A.

Of course, under conditions wherein the main supply line pressure is not reduced, as by omitting a reducing valve 25 or 60, it will be necessary for an auxiliary pump 26 or 61 to step up the pressure of the fuel, as supplied to a burner, either through or with the elimination of the associated pressure-reducing valve, to a degree such that the fuel in the return line therefrom will exceed the main supply line pressure.

We claim:

1. A liquid fuel burner installation, comprising a battery of independent low-pressure burner units of variable inlet orifice, means to vary individually the orifices of the respective units to regulate the discharge therefrom, a source of

liquid fuel common to all of the burner units, a fuel supply line between the source and the battery, together with connections from said line to the respective burner units, pumping means in the fuel supply line to supply fuel from the fuel source to the battery of burners, pressure-reducing means included in the supply line immediately in advance of the battery of burner units, auxiliary pumping means beyond said pressure-reducing means for advancing fuel in excess of the respective burner requirements through the burner units, together with means for reducing the pressure of the circulated fluid in advance of said individual burner units to a degree suited for the burner operation and slightly above the intake pressure of the said auxiliary pumping means, and respective continuously open by-pass connections from each of the burner units of a battery for the excess fuel to a point of the said fuel supply line on the intake side of the auxiliary pumping means between said auxiliary pumping means and the first-named pressure-reducing means.

2. A liquid fuel burner installation, comprising a battery of independent low-pressure burner units of variable inlet orifice, means to vary individually the orifices of the respective units to regulate the discharge therefrom, a source of liquid fuel common to all of the burner units, a fuel supply line between the source and the battery, together with connections from said line to the respective burner units, pumping means in the fuel supply line to supply fuel from the fuel source to the battery of burners, pressure-reducing means included in the supply line immediately in advance of the battery of burner units, auxiliary pumping means beyond said pressure-reducing means for advancing fuel in excess of the respective burner requirements through the burner units, respective continuously open by-pass connections from each of the burner units of a battery for the excess fuel to a point of the said fuel supply line on the intake side of the auxiliary pumping means between said auxiliary pumping means and said pressure-reducing means, and a plurality of additional pressure-reducing means for the respective burner units and included immediately in advance of the corresponding burners in the respective supply connections thereto for reducing the pressure of the circulated fluid to a degree suited for the burner operation and slightly above the intake pressure of the said auxiliary pumping means.

3. A liquid fuel burner installation, comprising a battery of independent low-pressure burner units of variable inlet orifice, means to vary individually the orifices of the respective units to regulate the discharge therefrom, a source of liquid fuel common to all of the burner units, a fuel supply line between the source and the battery, together with connections from said line to the respective burner units, pumping means in the fuel supply line to supply fuel from the fuel source to the battery of burners at a substantial pressure, pressure-reducing means included in the supply line immediately in advance of the battery of burner units to reduce the pressure of the fuel substantially below that in the fuel supply line, auxiliary pumping means beyond said pressure-reducing means for advancing at an intermediate pressure fuel in excess of the respective burner requirements through the burner units, respective continuously open by-pass connections from each of the burner units of a battery for the excess fuel to a point of the said fuel supply line on the intake side of the auxiliary pumping means between said auxiliary pumping means and said pressure-reducing means and beyond the said pressure-reducing means, and a plurality of additional pressure-reducing means for the respective burner units and included immediately in advance of the corresponding burners in the respective supply connections thereto for reducing the pressure of the circulated fluid to a degree suited for the burner operation and slightly above the intake pressure of the said auxiliary pumping means.

4. A liquid fuel burner installation, comprising a battery of independent low-pressure burner units of variable inlet orifice, means to vary individually the orifices of the respective units to regulate the discharge therefrom, a source of liquid fuel common to all of the burner units, a fuel supply line between the source and the battery, together with connections from said line to the respective burner units, pumping means in the fuel supply line, respective continuously open by-pass connections to the intake side of the pumping means from each of the burner units of the battery for the excess fuel therefrom, the said pumping means being adapted to circulate fuel from the fuel source to the battery of burners in excess of the respective burner requirements through the individual burner units, and means for reducing the pressure of the circulated fluid in advance of said individual burner units to a degree suited for the burner operation and slightly above the intake pressure of the said pumping means.

5. The method of operating a variable inlet orifice burner unit, of an installation comprising a battery of such units, with liquid fuel from a storage supply thereof common to all of the units, which comprises advancing the liquid fuel substantially to the point of use, reducing the pressure on said liquid fuel, forcibly advancing it continuously and in excess of the capacity of a burner unit to a second pressure reduction, reducing the pressure on said liquid fuel to a degree suited for the burner unit, but slightly above the first-named pressure reduction, prior to passing the liquid fuel through the burner unit, bypassing to the point of first-named pressure reduction excess liquid fuel from the respective burner units, and regulating the discharge of a unit by varying the area of its inlet orifice.

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