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GAS PRESSURE STABILIZER

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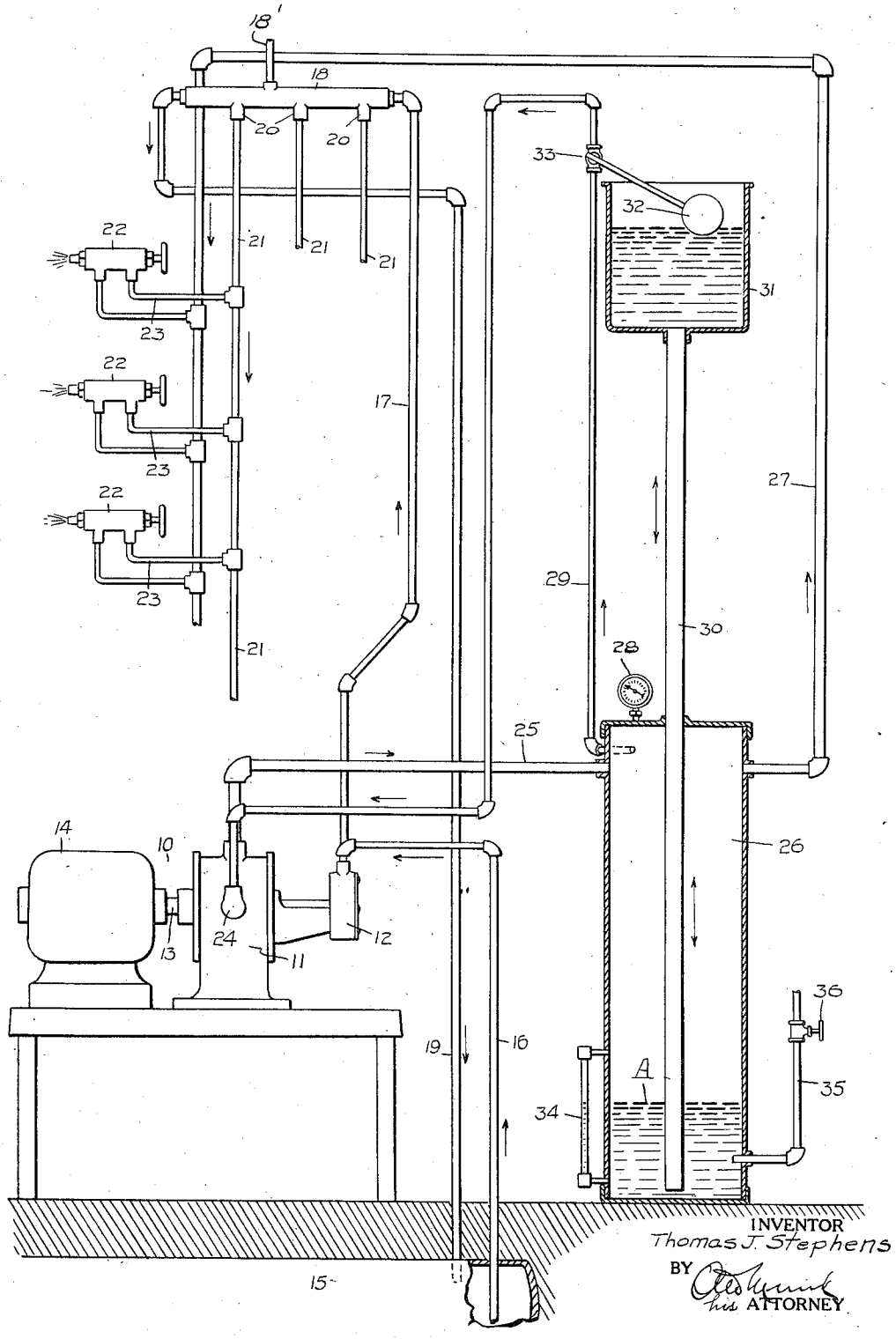

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GAS PRESSURE STABILIZER

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8 Claims. (Cl. 230—22)

My invention relates to method and apparatus for burning hydrocarbon fuel and has particular reference to a general system whereby a plurality of fires can be operated from a common source of supply of an atomizing agent coupled with a common source of fuel oil supply.

The present invention comprises a system of the character hereinafter described in which a plurality of burners are supplied with fuel from a single fuel supply manifold and with compressed air from a single air supply manifold; and the invention has for its principal object the provision of means whereby constant pressure can be independently maintained in each of said manifolds regardless of any fluctuations in the respective loads thereupon caused by an increase or a decrease in the number of burners being supplied simultaneously, or from other causes.

It is common practice to supply one or more burners with fuel oil under pressure from a single source of supply such for example, as a pump and to use compressed air as an atomizing agent also from a single source of supply such as an air compressor but always under conditions which are preductive of variations in the pressure of the atomizing agent. These variations of pressure may arise from any one of several causes, even when a single burner is being supplied. Among these causes may be enumerated variations or pulsations in the functioning of the compressor itself to which all compressors are subject in some degree; variations in the speed of the prime mover actuating the compressor due to fluctuations in the power supplied to the prime mover whether steam or electricity; variations in atmospheric conditions at the compressor.

In cases where a plurality of burners are operated from a single source, the stability of the pressure of the atomizing agent is affected by the number of burners being operated simultaneously, for example, if ten burners are being supplied with compressed air from a common source and some of these are suddenly discontinued, the pressure in the source of supply will be increased unless provision is made for simultaneously stabilizing same; and vice versa if only a few of the burners are being supplied and some of the others are suddenly started, the pressure of the atomizing agent will be lowered unless stabilizing provision is made.

Any variation of pressure in the atomizing agent or in the oil supply to a burner will cause a corresponding variation in the quality of the resulting fire calling for attention and regulation to meet the newly established pressures.

Stability of pressure is extremely important where purity of the products of combustion is desirable as for example in connection with the baking of food products in directly fired ovens.

Heretofore pressures in fuel oil burning systems have not been automatically controlled to the exactitude required for producing a plurality of fires from a common source of supply under conditions such that the stability of each fire can be continuously maintained independently of the others to a degree such as to produce by each fire a uniform quality of flame, uniform heat production and uniform consistency of the products of combustion.

An object of my invention is to provide a method and an apparatus for stabilizing the pressure of the atomizing medium as well as that of the fuel oil supply in a manner such as to maintain uniformly and automatically a pre-determined stabilized pressure at all burner nozzles of a system under all conditions of service.

One embodiment of my invention, whereby these advantages in the operation of liquid fuel burners have been completely realized, is described in the following specification, set forth in the appended claims and illustratively exemplified in the accompanying drawing showing a view of a system in a more or less diagrammatic form.

The method involved in the present invention contemplates the use of fuel and air pipe lines operating under pressure, the fuel being pumped, in a much greater volume than is necessary for use, into a manifold conduit disposed at an elevation above that of any of the burners so that the fuel lines feeding the burners will always be supplied by a source of much greater capacity than their own aggregate requirement and as a consequence, the static head of fuel in each line will remain constant whether all or only one of the burners may be operating.

The method of automatically controlling the air pressure is somewhat different from that of the fuel oil and comprehends an air reservoir into which air is being pumped and maintained at a constant pressure. The air utilized in the operation of several burners is forced through air conduits to the latter by the reservoir pressure in a quantity consistent with the number of burners in operation. The automatic control of the air pressure is accomplished by balancing the air pressure in the reservoir against a head of liquid comprising a column which supports a float operating a valve in an air discharge line leading from the reservoir. The valve is normally closed,

but when the pressure in the reservoir increases because less air is being used in the burner line, the water in the column raises in response to the increase in pressure, and with it the float, to open the discharge line whereupon the excess air pressure in the reservoir is relieved. The response of this operation is practically instantaneous because the very first effect of any appreciable increase or decrease in air pressure in the reservoir is simultaneously registered in the rise or fall of the water column supported by the air head; and any rise or fall in the water column actuates the float to either partially open or partially close the relief valve. Thus an exactitude of balance between the air head and the column supported by it is established; the head of the column providing the resistance against which the air head is maintained and the elevation of the column above a pre-determined level actuating the means which releases the air pressure head.

The body of compressed gas in the reservoir also provides means for the absorption of pulsations and other irregularities of delivery of the compressor.

Referring to the drawing of the apparatus embodying the system by means of which I carry out the several steps of my invention, 10 denotes a combination fuel oil and air pump comprising an air unit 11 and oil unit 12 operating on a single shaft 13 of a motor 14. Fuel is pumped from a tank or reservoir 15 through a pipe line 16 to the intake port of the oil pump 12. Oil is forced from the pump through a conduit 17 to a manifold fixture 18 which is vented to the atmosphere through the vertical riser 18'. The usual practice of pumping considerably more fuel than is actually used is followed in the present instance and the excess fuel passing into the fixture 18 is conducted by a return line 19 directly into the reservoir 15. The fixture comprises a cylindrical fitting having an inlet and an outlet port at opposite ends, respectively, and intermediate take-off ports 20. In practice the fitting 18 is disposed on an elevation above that occupied by any of the burners so that each take-off port 20 and its depending conduit 21 will receive a constant supply of fuel. The conduits 21 supply any number of burner units 22 through branch pipe connections 23.

Referring now to the air supply, the air pump 11 receives its initial air through an intake port 24 and discharges the air through a conduit 25 into a closed tank or air reservoir 26 to establish pressure in said reservoir. This tank may be a cylindrical casing disposed in upright position, also in communication with said reservoir is the air feed line 27 to the burners 22. A pressure gauge 28 is positioned at the head of the tank and at a point in the side thereof adjacent the inlet port of the conduit 25 is an opening to an outlet pipe line 29, which projects upwardly from the tank and then back again to enter the air intake port 24 of the air pump 11.

Automatic stability of the air pressure maintained in the tank 26 is accomplished, regardless of any irregularities of delivery thereto or withdrawal therefrom not exceeding the capacity of the pump, by means of a pipe or tube 30 mounted upright in the tank, the pipe projecting from a point therein short of the bottom and then through the upper head and terminating at an elevation above that of the upper head of the tank in a relatively large open cup shaped tank or fixture 31. The tube 30 provides an open way communicating between the lower portion of the tank 26 and that of the cup 31.

Water or other liquid is admitted to the tank 26 from a feed pipe 35 and valve 36 to fill same up to a certain level A. When air pressure is exerted upon the water surface in the tank 26, the water will rise to fill the tube 30 and the cup 31. A float 32 is disposed in the cup 31 and connected to operate the valve 33 so as to gradually open said valve as the float is raised and gradually closes same when the float is lowered.

As the column of water, actuated by the air pressure in the tank 26 fills the cup 31 the float 32 rides upon the surface of the rising column gradually opening the valve 33 which controls escape of compressed air from the tank 26.

Since the escape valve 33 is controlled by the elevation of the surface of the column and in turn controls the pressure which elevates the column, it follows that for any delivery of compressed air to the tank and any lesser withdrawal of air therefrom a stabilized balance will be established between the head of the column and the air pressure head in the tank.

In the operation of the system, according to the invention, the air pump 11 continues to force air under pressure through the conduit 25 into the tank 26 where a constant pressure must be maintained under any load. That is to say, if the most efficient air pressure for a burner is five pounds per square inch, the pressure of air in the feed line must be maintained at five pounds, whether one or all of the burners are in operation. Let it be assumed that under ordinary running conditions the column of water in the cup 31 reaches a certain elevation when all burners are in operation and the float 32 holds the valve 33 almost closed so that only one percent of the air is escaping through the valve 33. Now let one of the burners be discontinued. The air which has been supplying that burner no longer finding passage to it must accumulate in the tank 26 and consequently raises the pressure therein. At the very beginning of this increase in pressure, the surface of the column will rise a fraction of an inch but sufficient to open the valve 33 only enough to allow escape of the exact amount of air which tends to accumulate because of the burner having been closed to air passage. Likewise, if any number of burners up to the full number are discontinued, the same results will ensue, maintaining stability of air pressure in the tank 26.

On the other hand let it be assumed that all burners are shut off and the full delivery of the pump is being wasted through the escape valve 33. One burner is now opened. The air requirement of that one burner will now pass through it instead of through the escape valve 33. This will tend to lower the air pressure in the tank 26, the immediate result of weakening of the air pressure in the tank 26 will be the proportionate fall of the column supported by that pressure. This fall closes the escape valve proportionate and simultaneously balances between the air pressure in the tank and the column supported upon it is immediately established. Likewise if any and all of the remaining burners are opened, the escape valve 33 will immediately cease to waste their quota of air through settling of the float riding upon the surface of the column.

By the method and apparatus herein described, it is to be observed that not only do I maintain constantly a perfectly balanced head of fuel and

air in the system but that because of the particular arrangement and automatic control I am able to effect from a single point, operations in a plant where the burners may be widely separated and used for different purposes.

Having now described my invention and the manner in which the same is utilized, what I claim and desire to secure by Letters Patent is:—

1. A gas pressure stabilizer comprising a reservoir partially filled with liquid, a pump for delivering gas under pressure to continuously fill the remainder of said reservoir, means for intermittently releasing gas from said reservoir, a conduit establishing communication with the liquid content of said reservoir for confining a vertical column of said liquid raised by the pressure of said gas upon said liquid, and means for balancing the resultant coacting gas and liquid pressures at a pre-determined degree.

2. A gas pressure stabilizer comprising a reservoir partially filled with liquid, a pump for delivering gas under pressure to continuously fill the remainder of said reservoir, means for intermittently releasing gas from said reservoir, a conduit establishing communication with the liquid content of said reservoir for confining a vertical column of said liquid raised by the pressure of said gas upon said liquid, and means for balancing the resultant coacting gas and liquid pressures at a pre-determined degree by actuating gas relief means in communication with said reservoir by the rise or the fall of the upper surface of said liquid column.

3. A gas pressure stabilizer comprising a reservoir partially filled with liquid and a pump for continuously filling the remainder of said reservoir with gas under pressure, a conduit, said gas pressure causing said liquid to rise in a confined column in said conduit, and means for balancing the pressure head of said column against the pressure head of said gas at a predetermined degree.

4. A gas pressure stabilizer comprising a reservoir partially filled with liquid and a pump for continuously filling the remainder of said reservoir with gas under pressure, a conduit, said gas pressure causing said liquid to rise in a column in said conduit, and control means associated with the column and reservoir whereby the rise of said column above a pre-determined level causes relief of said gas pressure.

5. A gas pressure stabilizer comprising a reservoir partially filled with liquid and a pump for continuously filling the remainder of said reservoir with gas under pressure, a conduit, said gas pressure causing said liquid to rise in a column in said conduit, and control means associated with the column and reservoir whereby the rise of said column above a pre-determined level causing relief of said gas pressure; said reilef being proportioned to the degree of elevation of said column surface above said pre-determined level.

6. A gas pressure stabilizer comprising a reservoir partially filled with liquid and a pump for continuously filling the remainder of said reservoir with gas under pressure, a conduit, said gas pressure causing said liquid to rise in a column confined by said conduit, a gas reliefway and a valve normally closing same leading from said reservoir and means whereby said valve is gradually opened in response to the rise of the upper surface of said column above a pre-determined level, and is gradually closed in response to the fall of said surface below said level.

7. A gas pressure stabilizer, comprising a reservoir partially filled with liquid, means for continuously filling the remainder of said reservoir with gas under pressure, an upright conduit disposed in said reservoir and projecting from a point short of the bottom thereof to an elevation substantially above the top of the reservoir, said conduit maintaining a column of liquid by the pressure of gas, a return line from the reservoir to carry excess gas back to the means for filling the reservoir, and a float valve in said line operated by the rise and fall of the column of liquid.

8. A gas pressure stabilizer, comprising a closed tank partially filled with liquid, a pump for continuously filling the remainder of said reservoir with gas under pressure, an upright pipe supported in and projected above the tank, the pipe being open at its lower end below the level of the liquid and provided with an open end above the top of the tank, a return gas line opening into the tank at one end and into the intake of the pump at the other end, and a float valve arranged in the return line and provided with a float supported on the head of liquid in the open end of the pipe, said valve being responsive to the rise and fall of the liquid head to maintain a constant gas pressure in the tank.

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