SYSTEM FOR STABILIZING THE SUPPLY OF AIR TO AN IGNITOR

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BY

AGENT

FIG. 1

FIG. 3

FIG. 4

FIG. 2
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ABSTRACT OF THE DISCLOSURE

An air supply booster system for taking air from a source at a pressure varying over a wide range and for delivering the air to a point of use at a pressure subject to but limited minor variations, with the system including an air supply duct, containing a high pressure booster fan for increasing the air pressure to an initial amount, followed by an orifice for decreasing the pressure such as to reduce the air pressure fluctuations at the air source to the limited minor pressure fluctuations at the point of use.

Background of the invention

The invention is related to a fuel burning system equipped with a device for reducing the flow rate of air, and more specifically to such a system in which the air supply for the operation of the ignitor is taken from an air source which is subject to widely fluctuating pressure.

A description of the type of ignitor to which the invention may apply may be found in the U.S. Patent 3,123,527 issued to W. L. Livingston on Mar. 5, 1964.

Fuel burning systems of the above description are commonly used in connection with steam boilers which operate under widely fluctuating load conditions such as within a range of 100% down to 20% of maximum load. The pressure in the system supplying combustion air to the furnace generally follows the fluctuations of the load, so that the difference of pressure between a point in the main air duct upstream of the air heater and the furnace interior may, for example, vary between a low of 1 inch wg. (water gauge) and a high of 6 inch wg. It is desirable, however, in the operation of the ignitor that the variations in pressure at the air inlet or windbox of the ignitor not exceed a fraction, such as 1/2, of the minimum pressure at the ignitor air inlet, under all boiler load conditions. Accordingly, if the preferable minimum pressure at low load at the ignitor is set at 3 inch wg., for example, the maximum pressure should preferably not exceed 4 inch wg.

The ignitor air is generally taken from a point in the main air supply duct. To assure the necessary minimum air pressure at the ignitor, a booster fan must be employed to raise the air pressure to the minimum required at low load operation. Furthermore, control equipment must be furnished to control the pressure so as not to exceed the permissible maximum pressure at the ignitor during maximum load operation of the steam generator. Accordingly, the above control equipment represents a large outlay in original cost and maintenance cost.

Summary of the invention

The invention eliminates the need for control equipment for the ignitors and also provides automatic reduction of the wide variations of the main air duct pressure due to load swings, to the very limited fluctuations that can be tolerated at the air inlet of the ignitors. This, in contrast to present usage, is accomplished by employing a high pressure booster fan in the air supply line leading from the main air duct to the ignitors, which is followed by a flow restricting device such as an orifice to reduce the boosted pressure to the desired pressure at the ignitor windbox.

In accordance with the invention, the size of the booster fan determines the degree by which the wide pressure fluctuation in the main air duct is reduced to obtain in a completely automatic manner suitable pressure variations at the ignitor air inlet at all steam generating loads. The size of the flow restricting device determines the pressure drop necessary to reduce the boosted pressure to the pressure level demanded at the ignitor inlet.

Brief description of the drawing

FIG. 1 is a diagrammatic view of a steam generator equipped with the herein disclosed ignitor air supply system;

FIG. 2 is a diagram showing total head available in the ignitor air supply system and total flow resistance and ignitor flow resistance plotted against flow of air; and

FIGS. 3 and 4, respectively, are detail representations of an orifice and a fixed damper installed in the air supply duct.

Description of the preferred embodiment

Referring now to the drawing wherein like reference characters are used throughout to designate like elements, FIG. 1 shows a steam boiler furnace 10 equipped with burners 12, for discharging fuel and air into the furnace for burning. The combustion air is delivered to furnace 10 by way of forced air fan 14, main air duct 16, air heater 17, and burner windbox 18. An ignitor 20 is provided with each burner 12 to ignite the fuel such as pulverized coal when starting the steam boiler and to provide stable flame conditions during low load operation and during other emergency operating conditions. Air for the ignitors is supplied from the main air duct 16 by way of supply duct 22 which includes a high pressure booster fan 24 and a flow restricting device 26. This device preferably takes the form of a fixed orifice 27 as shown in FIG. 3. Under certain conditions flow restricting device 26 may take the form of a damper 28 as shown in FIG. 4. These conditions may require that during initial operating procedure of the steam boiler, damper 28 may be manually set at a specific location to cause a suitable pressure drop therethrough. This, in addition to the pressure drop through the supply duct 22, will enable the operator to fix the total pressure drop through the air supply system at a value most suitable for the operation of the ignitor 20 at all boiler loads.

With respect to the static pressure prevailing in the furnace, steam boilers may be operated as so-called pressurized units or as so-called suction units. In a pressurized unit the entire boiler and furnace setting is subject to superatmospheric pressure produced by the forced draft fan. In a suction unit a balanced draft is maintained in the top of the furnace with a burner pressure maintained in the windbox, and the remainder of the boiler interior being maintained under suction by the induced draft fan and stack.

The present invention can equally well apply to both boiler types with great benefit.

A critical feature in the operation of the air supply system in accordance with the invention is the pressure differential between the pressure maintained in the interior of the furnace such as at point 30 and the pressure prevailing in the main air duct 16 such as at point 32. These pressure points may be connected to a pressure differential gauge 34 by way of pressure lines 35 and 36 to indicate the pressure difference 40. This difference represents an approximation of the total value of the flow resistance through main duct 16, air heater 17, windbox 18, and burners 12.
Experience indicates that for successful operation of the herein disclosed ignitor air supply system the pressure at point 32 in the main duct must be boosted by the high pressure fan 24 at least by a value which equals the pressure differential 40. The boosted air pressure thereupon is reduced by flow restricting device 26 by a substantial amount to bring the pressure down to a level suitable for the operation of ignitor 20 at all boiler loads.

FIG. 2 illustrates the operating conditions preferable in a representative installation. Curves 42 and 44, respectively, show the ignitor resistance and the ignitor resistance plus orifice resistance when plotted against air flow. Curve 44 intersects curves 46 and 48 which represent the total head at the pressure side of fan 24 at high load and at low load, respectively. The intersection points a and b indicate a high and low load pressure head of 26 and 21 inch wg., at corresponding air flow quantities. These air flow quantities when projected on curve 42 intersect at points c and d and indicate a maximum and minimum value of the air pressure at the ignitor windbox of 3.7 and 3.0 inch wg., respectively. The above operating conditions are based on the operation of a typical industrial steam boiler pressure-fired through burners equipped with gas fired; pipe type, so-called delta P ignitors. In this particular case the backup pressure differential 40 from the forced draft fan 14 varies from 1 inch wg. at low load to 6 inch wg. at high load. A booster fan 24 with a 20 inch wg. head together with an orifice 26 minimizes the variation in the ignitor air pressure differential to a range of 3 inch wg. at low load to 3.7 inch wg. at high load. This is well within the required limits for satisfactory ignitor operation.

From the above it can readily be seen that the invention provides an air supply system for ignitors which eliminates the need for additional control equipment and the maintenance associated therewith. Instead, the invention provides a system which automatically and without special attention by the operator supplies air to the ignitor at a suitable pressure regardless of the load swings to which the boiler may be subjected.

While I have illustrated and described a preferred embodiment of my invention, it is to be understood that such is merely illustrative and not restrictive and that variations and modifications may be made therein without departing from the spirit and scope of the invention. I therefore do not wish to be limited to the precise details set forth but desire to avail myself of such changes as fall within the scope of my invention.

I claim:

1. The method of stabilizing the pressure of the air supplied to an ignitor at a desired ignitor pressure for burning fuel in a furnace under widely fluctuating load conditions and at an established furnace pressure, and received from an air source at a pressure fluctuating with said load between minimum and maximum values, comprising the step of establishing a stream of air from the air source to the ignitor, and the additional improvement steps of boosting the maximum pressure of the stream of air as taken from said air source by at least the difference between said maximum air source pressure and said furnace pressure, and thereafter reducing the boosted air pressure to the desired stabilized pressure at the ignitor air inlet.

2. In a steam generator operating under widely fluctuating load conditions and having a furnace including a burner and ignitor for burning fuel at an established furnace pressure and being supplied with combustion air from a source at a pressure fluctuating with said load between minimum and maximum values, the method of stabilizing the pressure of the air supply to the ignitor at a desired ignitor pressure, comprising the step of establishing a stream of air from the air source to the ignitor, and the additional improvement steps of boosting the maximum pressure of the stream of air as taken from said air source by at least the difference between said maximum air source pressure and said furnace pressure, and thereafter reducing the boosted air pressure to the desired stabilized pressure at the ignitor air inlet.

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JAMES W. WESTHAVER, Primary Examiner.