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(54) **FUEL AND EMISSIONS REDUCTION  
POWER PLANT DESIGN USING OXYGEN  
FOR COMBUSTION AND FLUE GAS  
RECIRCULATION TO MINIMIZE CARBON  
DIOXIDE AND NOX EMISSIONS**

**Related U.S. Application Data**

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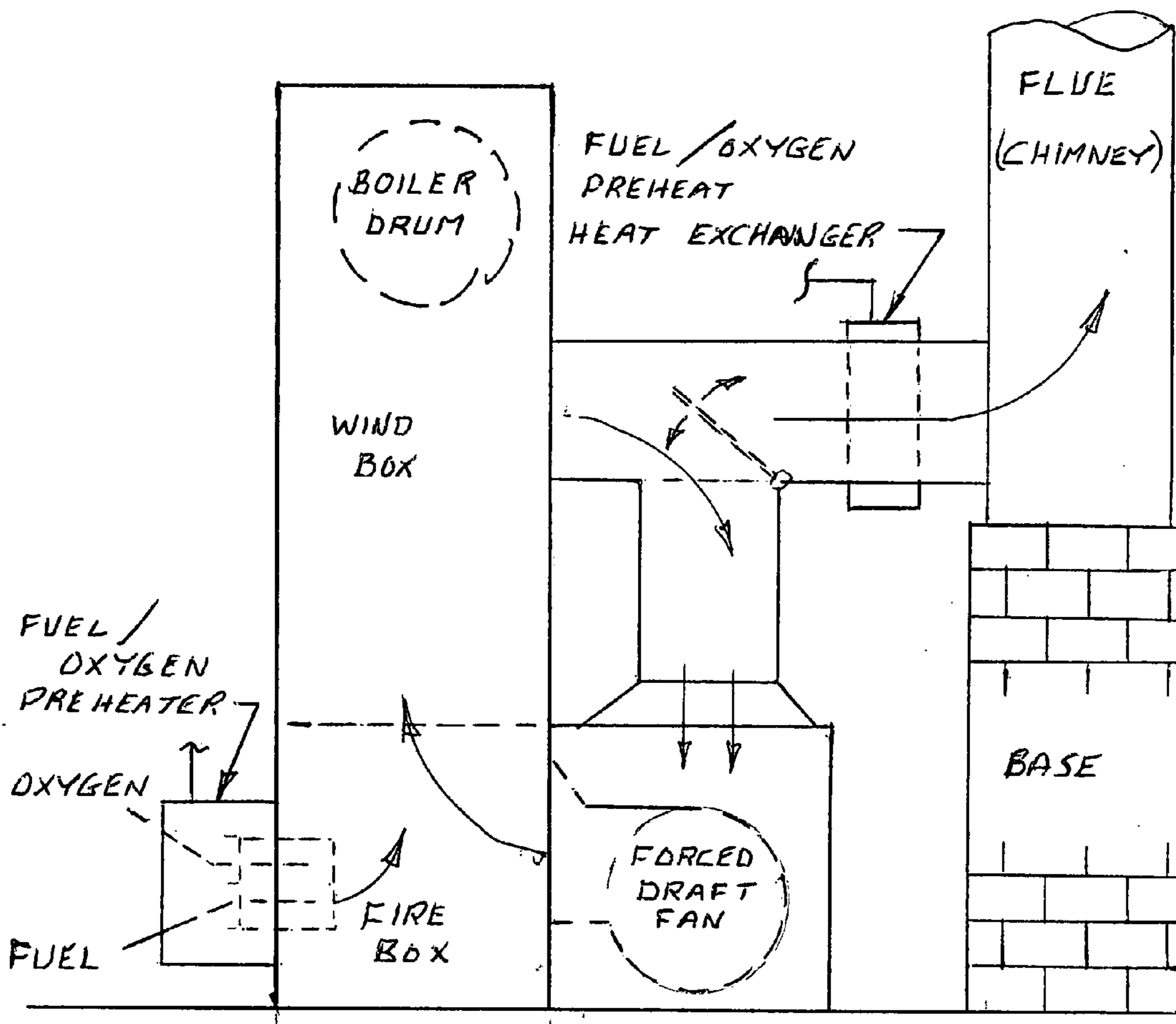
(57) **ABSTRACT**

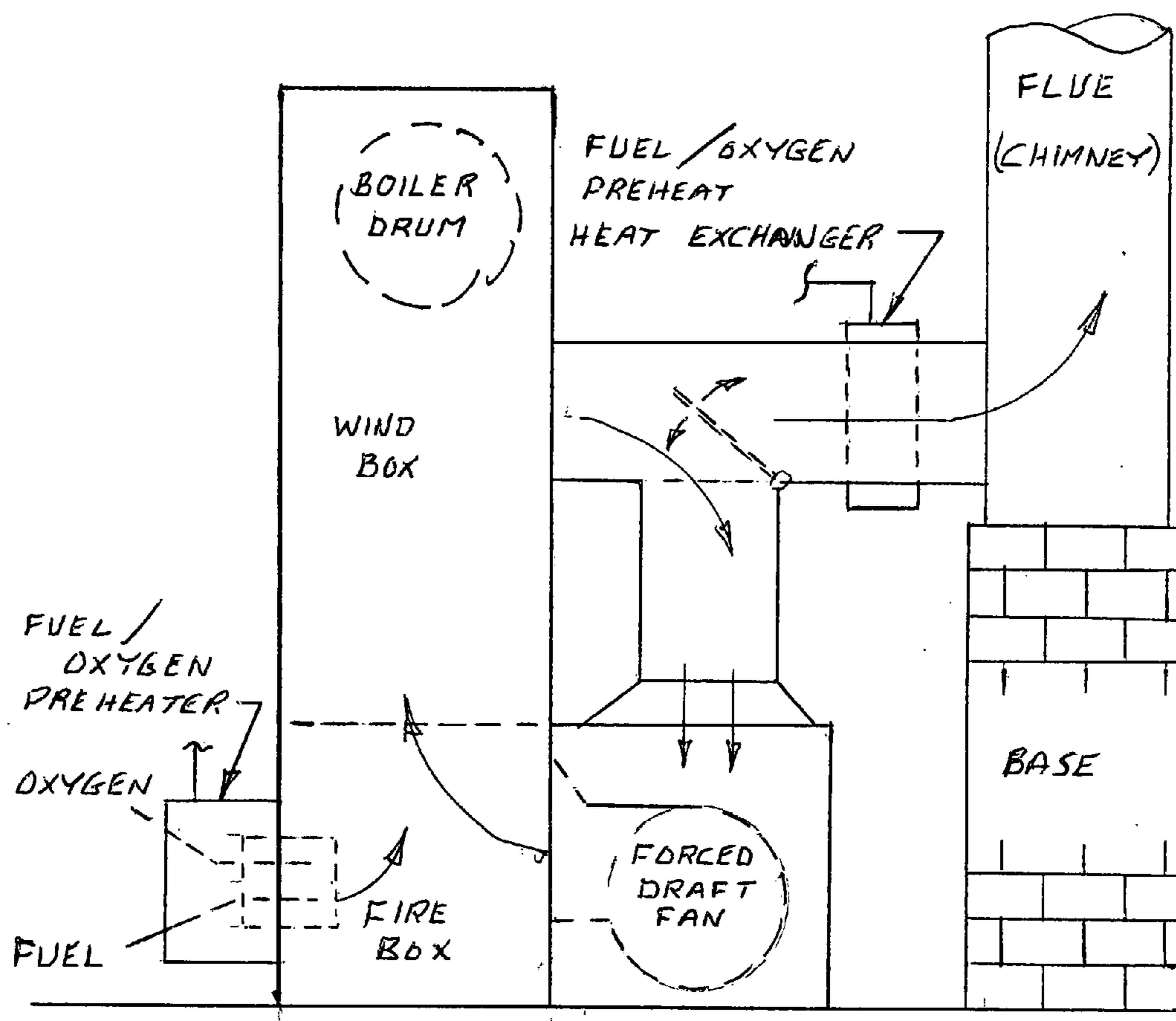
Power/process boiler modifications to use direct Oxygen input to burn the Carbon based fuel in a Nitrogen deficient atmosphere created by flue gas recirculation. This will result in a substantial reduction in fuel consumption and less Carbon Dioxide plus a near elimination of NOx in the flue exhaust released to the atmosphere. Both substances contribute to the Greenhouse effect and Global Warming and widespread use of his concept would help to reduce Global Warming and also reduce the usage and depletion of Carbon based fuels.

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TITLE: FUEL AND EMISSIONS REDUCTION POWER PLANT DESIGN USING OXYGEN FOR COMBUSTION AND FLUE GAS RECIRCULATION TO MINIMIZE CARBON DIOXIDE AND NOX EMISSIONS

**FUEL AND EMISSIONS REDUCTION POWER  
PLANT DESIGN USING OXYGEN FOR  
COMBUSTION AND FLUE GAS RECIRCULATION  
TO MINIMIZE CARBON DIOXIDE AND NOX  
EMISSIONS**

[0001] This application claims the benefit of PPA Ser. No. 60/796,124. confirmation NO. 2274 filed Apr. 27, 2006 by the present inventor.

FEDERALLY SPONSORED RESEARCH

[0002] Not applicable

BACKGROUND OF THE INVENTION

[0003] Conventional and existing fuel fired boilers and process heating devices typically use atmospheric air as the source of Oxygen necessary for the combustion. Approximately 19 percent of the atmospheric air is elemental Oxygen and the major portion of the rest is elemental Nitrogen. The part of the atmospheric air we really need for the combustion process is the Oxygen. The rest of the air is basically parasitic in that it goes along for the ride with the heating process and requires a considerable portion of the heat output from the fuel combustion to raise the Nitrogen to the same temperature as the rest of the gases in the boiler.

[0004] After the combined hot gases have imported a portion of their energy to the steam or other process, the gases exit the boiler and enter the flue or chimney where it is generally released to the atmosphere. Thus a substantial portion of the fuel combustion energy is thrown away after converting perhaps 50 percent of its energy to making steam.

[0005] Some furnaces or boiler designs install an air to air heat exchanger and pass this flue gas thru one side of it and outside air is drawn thru the cross tubing to preheat the new batch of combustion air which will supply the Oxygen necessary for the fuel/Oxygen heating cycle to continue.

[0006] The use of pure oxygen is not a new process and is sometimes used to reduce the amount of Carbon fuel used and to reduce the formations of Nitrous Oxides, but this modified process will use direct recirculation of the flue gases instead of using a gas to gas heat exchanger to preheat the Oxygen/Nitrogen combustion air. The regulated quantity of the recirculated flue gases that are returned to the boiler inlet will provide the additional mass of heated gases necessary to transfer their heat energy to the boiler/heater tubes or drum where the steam or other heated fluids are generated and subsequently put to use in electrical power generation or other manufacturing process.

DESCRIPTION OF THE INVENTION

[0007] The primary difference with this patent proposal is to return a regulated portion of the hot flue gas to the combustion air inlet where new fuel and commercially concentrated Oxygen are inputted thru separate pipes and burned, bringing the mixture up to the needed temperature to transfer more heat energy in to the steam or process generating system.

[0008] Enhanced combustion efficiency and reduction in NOx and Carbon Dioxide emissions thru a combined process of direct Oxygen feed for the combustion of the Carbon based fuel in place of the conventional atmospheric air supplied as the source of Oxygen, recirculation of the boiler or other heat/power generation device flue or discharge gases to provide a reheat capability volume and eliminate the introduction of atmospheric air which contains nearly 78 percent Nitrogen.

[0009] The presence of the large amount of Nitrogen that comes with air breathing furnaces combined with the high temperatures of the boiler or other heating device normally results in the formation of NOx compounds which are undesirable emissions which are typically regulated to a low level. The quantity of Nitrogen in the conventionally fed atmospheric air is also parasitic to the combustion process in that it must also be heated up to the boiler temperature where it also releases a portion of its heat energy to the steam generating process but is then discharged from the boiler where much of it is released to the atmosphere and that heat is lost. Direct recirculation of this flue gas would reduce the quantity of Carbon fuel/Oxygen needed for the combustion process and to preheat the incoming new fuel and Oxygen.

[0010] When the furnace is initially started up, the combustion chamber and gas flow area would be charged with an inert gas so as to preclude the presence of substantial amounts of Nitrogen.

DRAWING

[0011] The attached drawing identifies the typical components of a power boiler system and the uses of new or modified components to effect the improved emissions saving system.

1. Original design or modifications to existing power systems to incorporate this patent application will have the following benefits:

Direct Oxygen feed to provide the combustion of the Carbon based fuel will result in a higher flame temperature than using atmospheric air for the source of Oxygen. For a given quantity of fuel, the necessary BTU output can be achieved with a reduced quantity of fuel. This higher temperature will further heat the bypassed flue gases to bring the resultant mixture to the desired temperature needed to transfer heat energy to the production of steam or other process heating. The reduced quantity of Carbon based fuel will also result in the release of considerably less Carbon Dioxide, an undesirable Greenhouse gas.

2. The process of initially charging the boiler/heater combustion chamber with a non-Nitrogen atmosphere will preclude the formation of significant quantities of NOx compounds. NOx gases are an undesirable Greenhouse stimulating gas. Power producers and manufacturers are generally charged or monitored by the EPA to limit their release to the atmosphere.

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