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(54) **Title:** REGENERATIVE THERMAL OXIDIZER ASSEMBLY

(57) **Abstract:** An apparatus of the present invention includes plurality of modules each having a combustion chamber, a pair of heat exchanger disposed therein. An inlet line and an outlet line are fluidly communicated with each of the heat exchangers thereby forming a first circulation loop and a second circulation loop separable from the first circulation loop. A plurality of inlet and outlet valves are disposed on each of the inlet and outlet lines and are adaptable to manipulate between opened and closed modes. A controller is operatively communicated with each of the inlet and outlet valves and is adaptable to selectively manipulate the aforementioned closed and opened modes as any of the modules need to be serviced without diminishing oxidizing process.

REGENERATIVE THERMAL OXIDIZER ASSEMBLY

RELATED APPLICATION

[00001] The subject patent application claims priority to and all the benefits of United States Provisional Patent Application Serial No. 60/663,697 filed on March 21, 2005.

FIELD OF THE INVENTION

[00002] The subject invention relates to regenerative thermal oxidizers of the type having a plurality of heat exchangers leading into a common combustion chamber and designed for oxidizing pollutants and converting the pollutants into carbon dioxide and water vapor.

BACKGROUND OF THE INVENTION

[00003] The two most common methods of reclaiming heat are regeneration and recuperation. Regeneration refers to regenerating the heat of a large thermal mass; thermal oxidizers employing this method are called "Regenerative Thermal Oxidizers". Recuperation refers to transferring heat directly from the outgoing air stream to the incoming air stream; thermal oxidizers employing this method are called "Recuperative Thermal Oxidizers".

[00004] The typical regenerative thermal oxidizer is known in the art for oxidizing pollutants, such as hydrocarbon vapors in air, and converting the pollutants into carbon dioxide and water vapor. The regenerative thermal oxidizer is used to destroy air toxics and Volatile Organic Compounds (VOCs) that are discharged in industrial process exhausts and achieves VOC destruction through the process of high temperature thermal oxidation, converting the VOCs to carbon dioxide and water vapor, recycling released energy to reduce operating costs. The regenerative thermal oxidizer is a direct-fired oxidizer that employs integral primary heat recovery. The regenerative thermal oxidizer's operation is a periodic, repetitive cycle rather than a steady state. The nature of the heat recovery process requires it to have a least two beds, i.e. heat exchangers of appropriate heat recovery media. The primary advantage of the regenerative thermal oxidizer is lower operating costs due to high heat recovery and low fuel consumption. Typically, a pollutant laden "dirty" gas to be cleaned is directed into a combustion chamber of a tower of the regenerative thermal oxidizer and through a previously heated regenerative heat exchanger. At the same time, a previously combusted hot "clean" gas is directed out of the combustion chamber and into a second heat exchanger. The gas to be cleaned leading into the combustion chamber is heated as it passes through the previously heated heat exchanger, while the gas which has been combusted is passing out through the second heat exchanger, heating the second heat exchanger. In this way, the typical regenerative thermal oxidizers continuously operate to combust or oxidize a gas to be cleaned. By alternating the flow of cool gas to be cleaned through a hot heat exchanger, then moving hot gas from the combustion chamber outwardly through a heat exchanger, each heat exchanger is periodically and alternatively heated and cooled. Another common method of reclaiming heat is recuperation, which refers to transferring heat directly from the outgoing air stream to the incoming air stream.

[00005] The art is replete with various methods and apparatuses for oxidizing pollutants, which are disclosed in the United States Patent Nos. 5,531,593 to Klobucar; 5,578,276 to Klobucar; 5,730,945 to Klobucar; 5,967,771 to Chen et al.; 6,228,329 to Garvey; 6,261,092 to Cash; and 6,576,198 to Cash and widely used today in the automotive and other industries that oxidize pollutants.

[00006] Hence practicable, the prior art designs are non-effective in reduction of operational costs during "normal" operation of the prior art regenerative thermal oxidizer. But even with the aforementioned technique, to the extent it is effective, there is always need for improvements system for effectively oxidizing, i.e. "cleaning" the pollutant at a low cost and in efficient manner.

SUMMARY OF THE INVENTION

[00007] An apparatus of the present invention is designed for oxidizing pollutants and converting the pollutants into carbon dioxide and water vapor. The apparatus includes a plurality of modules, i.e. towers, adjacently located with respect to one and the other. Preferably, the apparatus includes seven modules. Each module presents a combustion chamber, a first heat exchanger, and a second heat exchanger disposed therein with each of the first and second heat exchangers having an inlet port and an outlet port defined by each of the modules.

[00008] A fluid circulation system, defined by an inlet manifold or inlet line and an outlet manifold or outlet line is fluidly communicated with the source of pollutant, i.e. gas or air to be oxidized before evaporating oxidized gas into atmosphere. The inlet line is fluidly communicated with each of the inlet ports of each first and second heat exchangers to form a first circulation loop. The outlet line is fluidly communicated with each of the outlet ports of each of the first and second heat exchangers to form a second circulation loop separable from the first circulation loop. A plurality of inlet valves interconnect each of the inlet ports and the inlet line and are operable between the opened mode and a closed mode. Similarly, a plurality of outlet valves interconnect each of the outlet ports and the outlet line and are operable between the opened mode and a closed mode. A controller is operatively communicated with each of the inlet and outlet valves and is adaptable to selectively manipulate the aforementioned closed and opened modes. A purge system is fluidly incorporated into each module.

[00009] The unique design of the present apparatus provides a customized application for an industry that expects high up-time and depends on unmanned, fault tolerant operation. The apparatus is further designed to handle the exhaust volume of the aforementioned separate pieces of process equipment (OSB Dryers). Those skilled in the art will appreciate that six of the aforementioned modules at a minimum are required to completely treat the full process exhaust volume. The additional module has several distinct operating features and benefits, not disclosed in the prior art designs. The unique design of the present invention having seven modules oxidizing the pollutant instead of six of the modules provides for at least 10% lower operational costs during "normal" operational mode of the apparatus. Addition of the seventh module allows for continuous dryer production in the event of any single module failed to perform or is required to be serviced. The present inventive concept enables the user (not shown) to maintain, wash-out and/or bake-out a single module during production thereby avoiding the time consuming and non-cost effective Preventive Maintenance of the module.

[00010] The apparatus also utilizes a trio of exhaust fans, arranged symmetrically around a common exhaust stack and a common fan inlet chamber, to provide the necessary air flow through the apparatus of the present invention. Each fan provides 1/3 of the total horsepower needed to process the full process airflow though the minimum of six modules as an "upset" condition. "Normal" RTO operation on seven modules reduces the Horsepower load to 2/3 of the maximum required horsepower. While each fan is controlled by a variable frequency drive and will reduce its speed to match the reduced horsepower requirement, the fan trio design allows for any two of the three fans to move the full process airflow through all seven modules as a "normal condition".

[00011] Alluding to the above, the apparatus of the present invention presents several other advantages over the prior art designs. One of the advantages of the present invention is to provide a regenerative thermal oxidizer assembly that is flexible and provides greater destruction performance.

[00012] Another advantage of the present invention is to provide a regenerative thermal oxidizer assembly that is cost effective, durable, and adaptable to be installed in various manufacturing environments.

BRIEF DESCRIPTION OF THE DRAWINGS

[00013] Other advantages of the present invention will be readily appreciated as the same becomes better understood by reference to the following detailed description when considered in connection with the accompanying drawings wherein:

[00014] Figure 1 is a schematic view of a regenerative thermal oxidizer assembly of the present invention;

[00015] Figure 2 is an elevational view of the inventive regenerative thermal oxidizer assembly;

[00016] Figure 3 is a cross sectional view of a module of the inventive regenerative thermal oxidizer assembly having a first heat exchanger and a second heat exchanger disposed in a combustion chamber of the module;

[00017] Figure 4 is a cross sectional view of two adjacent modules of the inventive regenerative thermal oxidizer assembly in a first oxidizing mode;

[00018] Figure 5 is a cross sectional view of the modules of Figure 4 in a second, i. e. reversed oxidizing mode; and

[00019] Figure 6 is a graph illustrating the level of destruction performance of the inventive regenerative thermal oxidizer system.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

[00020] Referring to the Figure 1, wherein like numerals indicate like or corresponding parts, an apparatus of the present invention, i.e regenerative thermal oxidizer assembly (the assembly) for oxidizing pollutants and converting the pollutants into carbon dioxide and water vapor, is generally shown at **10.** Preferably, the assembly **10** includes seven individual modules, generally indicated at **12, 14, 16, 18, 20, 22,** and **24** in Figure 1. Each of the modules **12, 14, 16, 18, 20, 22,** and **24,** as best illustrated in Figures 2 and 3 is further defined by a standard combustion chamber **26,** and two regenerative heat exchangers, i.e. a first heat transfer bed or heat exchanger **30** and a second heat transfer bed or heat exchanger **32.** The assembly **10** includes odd number of the modules **12, 14, 16, 18, 20, 22,** and **24,** such as, for example, seven modules. All seven modules **12, 14, 16, 18, 20, 22,** and **24** are utilized by the assembly with any of the modules **12, 14, 16, 18, 20, 22,** and **24** adaptable to be serviced at any time during the oxidizing cycle without interfering the oxidizing or "cleaning" process of the assembly **10.** The unique design of the assembly **10** having seven instead of six modules **12, 14, 16, 18, 20, 22,** and **24** adaptable to oxidize the pollutant provides for approximately 10% lower operational costs during "normal" operational mode of the apparatus **10.** Addition of the seventh module allows for continuous dryer production in the event of any single module failed to perform or is required to be serviced. The present inventive concept of the assembly **10** enables the user (not shown) to maintain, wash-out and/or bake-out a single module during production thereby avoiding the time consuming and non-cost effective Preventive Maintenance of the module.

[00021] The modules **12, 14, 16, 18, 20, 22,** and **24,** as best illustrated in Figure 1, are connected in parallel relationship with a common inlet line, i.e. inlet manifold **34** selectively communicating with each of the first heat exchanger **30** and a second heat exchanger **32.** An inlet manifold **34** is connected to a source of the pollutant, i.e. "dirty gas" to be oxidized, i.e. "cleaned". The inlet manifold **34** is fluidly and selectively communicated with each of the first and second exchangers **30** and **32** to form a first circulation loop to provide the pollutant to be cleaned by the first and the second heat exchangers **30** and **32** exposed to the combustion chamber **26** which includes a burner **38**. A common outlet line, i.e. outlet manifold **36** is selectively and fluidly communicated with each of the first and second exchangers **30** and **32** form a second circulation loop separable from the first circulation loop thereby evacuating **39** the oxidized or "clean" air from the assembly **10** without interfering with circulation process of the assembly **10**.

[00022] Alluding to the above, a fan assembly, generally shown at **40** in Figure 2, is fluidly communicated with the modules **12, 14, 16, 18, 20, 22,** and **24** to provide positive pressure to the common inlet line **34** thereby forcing gas containing the aforementioned pollutants through the assembly **10**. The fan assembly **40** includes three fans **42, 44,** and **46,** two fans of which provide requisite positive pressure in the common inlet line **34**. The fans **42, 44,** and **46** are arranged symmetrically around a common exhaust stack and a common fan inlet chamber adaptable to provide predetermined air flow through the assembly **10**. Each fan **42, 44,** and **46** provides 1/3 of the total horsepower needed to process the full process airflow though the minimum of six modules **12, 14, 16, 18, 20, 22** as an "upset" condition. "Normal" assembly **10** operation on seven modules **12, 14, 16, 18, 20, 22** and **24** reduces the Horsepower load to 2/3 of the maximum required horsepower. While each fan **42, 44,** and **46** is controlled by a variable frequency drive and will reduce its speed to match the reduced horsepower requirement, the fan assembly or fan trio **40** design allows for any two of the three fans **42, 44,** and **46** to move the full process airflow through all seven modules **12, 14, 16, 18, 20, 22** and **24** as a "normal condition".

[00023] Those skilled in the art will appreciate that the modules **12, 14, 16, 18, 20, 22,** and **24** are identically structured. As such, the module **12** will be discussed for exemplary purposes. The first heat exchanger **30** and the second heat exchanger **32** present an inlet port **50**, an outlet port **52**, and a purge port **54** each being fluidly communicated with an inlet line **56**, an outlet line **58**, and a purge line **60**, respectively, as illustrated in Figures 1 and 3 through 5. The inlet line **56**, the outlet line **58**, and the purge line **60** extend from the first exchangers **30** and the second heat exchangers **32** in a paparallel relationship for selectively introducing the pollutant therein and evacuating clean air from the second of the first and second heat exchangers **30** and **32**. Each of the inlet lines **56** and the outlet lines **58** is fluidly communicated with the respective common inlet manifold **34** and the outlet manifold **36**. The purge line **60** is fluidly communicated with a purge retention device **62**. The purge retention device **62** has an upstream end and a downstream end and a purge valve **66** received in each of the purge lines **60** to allow flow of clean purge gas from a purge chamber (not shown) and into the first and second heat exchangers **30** and **32** of each of the modules **12**, **14**, **16**, **18**, **20**, **22**, and **24** during a purge cycle. The purge retention device **62** and functional characteristics thereof are disclosed in the Unites Stated Patent No. 5,578,279 to Klobucar, which assigned to the Assignee of the present invention and incorporated herewith by reference in its entirety.

[00024] Alluding to the above, each of the inlet lines **56** includes a first or inlet valve **70** and each of the outlet lines **58** includes a second or outlet valve **72**. The inlet valves **70** and the outlet valves **72** are disposed on the respective inlet lines **56** and the outlet lines **58** between the inlet ports **50** and the outlet port **52** and the common inlet manifold **34** and the outlet manifolds **36**, respectively. The valves **70** are utilized to regulate supply of the pollutant from the source of pollutant supply. The valves **72** are utilized to regulate evacuation of the oxidized air from the assembly **10**. The valves **70** and **72** may include a ball valve. An actuating device (not shown) is cooperable with each of the first and second valves **70** and **72** for activating the first and second valves **70** and **72** when signaled by a controller **74**. The controller **74** is operatively communicated with each of said first and second valves **70** and **72** for regulating operational modes of each of the first and second valves **70** and **72** as each of the modules **12**, **14**, **16**, **18**, **20**, **22**, and **24** is selectively serviced. The controller **74** is operatively communicated with each of the purge valves **66** thereby regulating purging cycle. Each actuating device has an actuator (not shown) for pneumatically opening and closing the first and second valves **70** and **72** and a solenoid valve (not shown) for energizing the actuator. The solenoid valve and the actuator present an operative communication with the controller **74**. Alternatively, each module **12**, **14**, **16**, **18**, **20**, **22**, and **24** may include back up inlet and outlet valves (not shown) for selectively sealing any of the modules **12**, **14**, **16**, **18**, **20**, **22**, and **24** from the common inlet manifold **34** and the common outlet manifold **36** for cleaning and maintenance.

The back up inlet and outlet valves are operatively communicated with the controller **74**. Those skilled in the art will appreciate that other types and designs of valves may be utilized with the assembly **10**. The aforementioned first and second valves **70** and **72** are not intended to limit the scope of the present invention.

[00025] Figures 4 and 5 illustrate oxidizing, i.e. "cleaning" mode of the assembly **10** with two modules **12** and **14** being illustrated for exemplary purposes. The pollutant, i.e. "dirty air", illustrated by dots, passes through the inlet manifold **34** into the inlet lines **56** exposed to the first and second heat exchangers **30** and **32** as the inlet valve **70** is in opened mode. The pollutant is then enters the first heat exchanger **30** and then into the combustion chamber **26**. After being heated, "clean" gas enters the second heat exchanger **32** and then through the outlet valve **72** and evacuates into the outlet manifold **36**. "Clean" gas in outlet manifold **36** is then delivered to atmosphere. It is desirable after a period of time of operating the assembly **10** to shift or reverse the operational modes, i.e. inlet and outlet modes of the heat exchangers **30** and **32** thereby increasing oxidizing or cleaning cycle and efficiency of the assembly **10**. As such, one of the first and second exchangers **30** and **32** is now beginning its inlet mode while the other of the first and second exchangers **30** and **32** has begun its outlet mode.

[00026] Alluding to the above, the apparatus **10** of the present invention is customized to an application for an industry that expects high up-time and depends on unmanned, fault tolerant operation. The apparatus **10** is further designed to handle the exhaust volume of the aforementioned separate pieces of process equipment (OSB Dryers). Those skilled in the art will appreciate that six of the aforementioned modules at a minimum are required to completely treat the full process exhaust volume. The additional module has several distinct operating features and benefits, not disclosed in the prior art designs.

[00027] While the invention has been described with reference to an exemplary embodiment, it will be understood by those skilled in the art that various changes may be made and equivalents may be substituted for elements thereof without departing from the scope of the invention. In addition, many modifications may be made to adapt a particular situation or material to the teachings of the invention without departing from the essential scope thereof. Therefore, it is intended that the invention not be limited to the particular embodiment disclosed as the best mode contemplated for carrying out this invention, but that the invention will include all embodiments falling within the scope of the appended claims.

CLAIMS

What is claimed is:

1. A regenerative thermal oxidizer assembly fluidly communicating with a source of pollutant for cleaning the pollutant, said regenerative thermal oxidizer assembly comprising:

a plurality of modules adjacent one and the other with each of said modules presenting a combustion chamber and a pair of heat exchangers disposed therein with each of said heat exchangers an inlet port and an outlet port; and

an inlet line for fluidly communicating with said inlet ports to form a first circulation loop for delivering the pollutant into each of said heat exchangers and an outlet line separable from said inlet line and fluidly communicating with each of said outlet ports to form a second circulation loop for exhausting the oxidized pollutant from said assembly with each of said lines adaptable to selectively prevent circulation of pollutant and oxidized fluid through at least one of said modules without interfering with circulation process of said first and second circulation loops.

2. A regenerative thermal oxidizer assembly as set forth in claim 1 wherein said inlet line includes a plurality of first valves with each said first valve disposed between said inlet line and each of said inlet ports for regulating supply of the pollutant from the source of pollutant supply.

3. A regenerative thermal oxidizer assembly as set forth in claim 2 wherein said outlet line includes a plurality of second valves with each of said second valve disposed between said outlet line and each of said outlet ports for regulating supply of

the oxidized pollutant from each of said heaters from said assembly.

4. A regenerative thermal oxidizer assembly as set forth in claim 3, including a controller operatively communicating with each of said first and second valves for regulating operational modes of each of said first and second valves as each of said modules is serviced.

5. A regenerative thermal oxidizer assembly as set forth in claim 4 having seven of said modules.

6. A regenerative thermal oxidizer assembly as set forth in claim 5 wherein each of said first and second valves is a ball valve.

7. A regenerative thermal oxidizer assembly as set forth in claim 6, including an actuating device cooperable with each of said first and second valves for activating said first and second valves when signaled by said controller, said actuating device having an actuator for pneumatically opening and closing said first and second valves and a solenoid valve for energizing said actuator, said solenoid valve and said actuator presenting an operative communication with said controller.

8. A regenerative thermal oxidizer assembly as set forth in claim 7, including a purge retention device fluidly communicated with each of said heat exchangers, said purge retention device having an upstream end and a downstream end, and a valve

system for selectively delivering clean purge air from said purge retention device into said heat exchangers during a purge cycle.

9. A regenerative thermal oxidizer assembly as set forth in claim 8, wherein said purge retention device is further defined by a purge chamber and a purge line fluidly communicating said purge chamber with each of said heat exchangers such that a portion of pollutant gas to be oxidized is allowed to enter to each of said heat exchangers through said purge line, a purge valve received in each of said purge line to allow flow of clean purge gas from said purge chamber and into said heat exchangers.

10. A regenerative thermal oxidizer assembly as recited in claim 1, including at least two exhaust fans fluidly communicated with the exhaust outlet, said exhaust fans being arranged symmetrically around a common exhaust stack and a common fan inlet chamber adaptable to provide predetermined air flow through said assembly.

11. A method for oxidizing pollutant fluid delivered from a source of pollutant in a regenerative thermal oxidizer assembly fluidly communicating with the source of the pollutant, said method comprising the steps of:

connecting a plurality of modules each presenting a combustion chamber and an inlet port and an outlet port;

disposing a pair of heat exchangers in each of the modules and fluidly communicating the heat exchangers with the inlet ports and the outlet ports;

connecting an inlet line to each inlet ports thereby forming a first circulation loop to deliver the pollutant into each of the heat exchangers and connecting an outlet line separable from the inlet line and fluidly communicating with each of the outlet ports thereby forming a second circulation loop to exhaust oxidized pollutant out of the assembly; and

selectively closing each of the inlet and outlet port of at least one module to prevent circulation of the pollutant and the oxidized pollutant therethrough without interfering with oxidizing process of the assembly.

12. A method as set forth in claim 11 including a step of disposing a plurality of first valves between the inlet line and each of the inlet ports to regulate supply of the pollutant.

13. A method as set forth in claim 12 including a step of disposing a plurality of second valves between the outlet line and each of the outlet ports to regulate supply of oxidized pollutant.

14. A method as set forth in claim 13 including a step of connecting a controller to each of the first and second valves to regulating operational modes of each of the first and second valves as each of the modules is serviced.

15. A method as set forth in claim 14 wherein the step of connecting the plurality of modules is further defined by connecting seven of the modules.

16. A method as set forth in claim 15 including a step of connecting an actuating

device to each of the first and second valves to activate the first and second valves when signaled by the controller to pneumatically open and close the first and second valves with respect to different oxidizing modes of the assembly.

17. A method as set forth in claim 16 including a step of connecting a purge retention device to each of the heat exchangers and installing a valve system to selectively deliver clean purge air from the purge retention device into the heat exchangers during a purge cycle.

18. A method as set forth in claim 17 wherein the step of connecting the purge retention device to each of the heat exchangers is further defined by forming a purge chamber and a purge line to fluidly communicate the purge chamber with each of the heat exchangers such that a portion of the pollutant to be oxidized is allowed to enter to each of the heat exchangers through said purge line, a purge valve received in each of said purge line to allow flow of clean purge gas from said purge chamber and into said heat exchangers.

19. A method as set forth in claim 18 including a step of connecting at least two exhaust fans fluidly communicated with the exhaust outlet, said exhaust fans being arranged symmetrically around a common exhaust stack and a common fan inlet chamber adaptable to provide predetermined air flow through said assembly.

20. A regenerative thermal oxidizer assembly for removing pollutants from a gas stream, comprising:

a plurality of modules each having first and second heat exchangers with a combustion chamber being cooperable with said first and second heat exchangers, each of said heat exchangers being connected with parallel inlet lines for selectively introducing polluted gas to said first of said first and said second heat exchangers and being connected with parallel outlet lines for selectively evacuating clean air from said second of said first and second heat exchangers; and

said plurality of modules being connected in parallel relationship with a common inlet line selectively communicating with each of said heat exchanger inlet lines and a common outlet line selectively communicating with each of said heat exchanger outlet lines, thereby enabling selective activation of each of said plurality of modules and said first and second heat exchangers for continuously removing pollutants from the gas stream.

21. An assembly as set forth in claim 20, wherein said plurality of modules comprises an odd number of modules.

22. An assembly as set forth in claim 20, wherein said plurality of modules comprises seven modules.

23. An assembly as set forth in claim 20, wherein said parallel inlet lines of said plurality of modules each include an inlet valve operable for selecting which of said first and said second heat exchanger receives the gas stream.

24. An assembly as set forth in claim 20, wherein said parallel outlet lines of said

plurality of modules each include an outlet valve operable for selecting which of said first and said second heat exchanger evacuates clean gas from said module.

25. An assembly as set forth in claim 20, wherein each of said plurality of modules includes an inlet valve and an outlet valve for selectively sealing any of said modules from said common inlet line and said common outlet line for cleaning and maintenance.

26. An assembly as set forth in claim 26, including a controller electronically connected with each of said inlet valves and said outlet valves for sequentially actuating each of said inlet and said outlet valves.

27. An assembly as set forth in claim 20, including a fan assembly for providing positive pressure to said common inlet thereby forcing gas containing pollutants through said regenerative thermal oxidizer assembly.

28. An assembly as set forth in claim 27, wherein said fan assembly includes three fans, two fans of which provide requisite positive pressure in said common inlet line for forcing gas containing pollutants through said regenerative thermal oxidizer assembly.

1/5

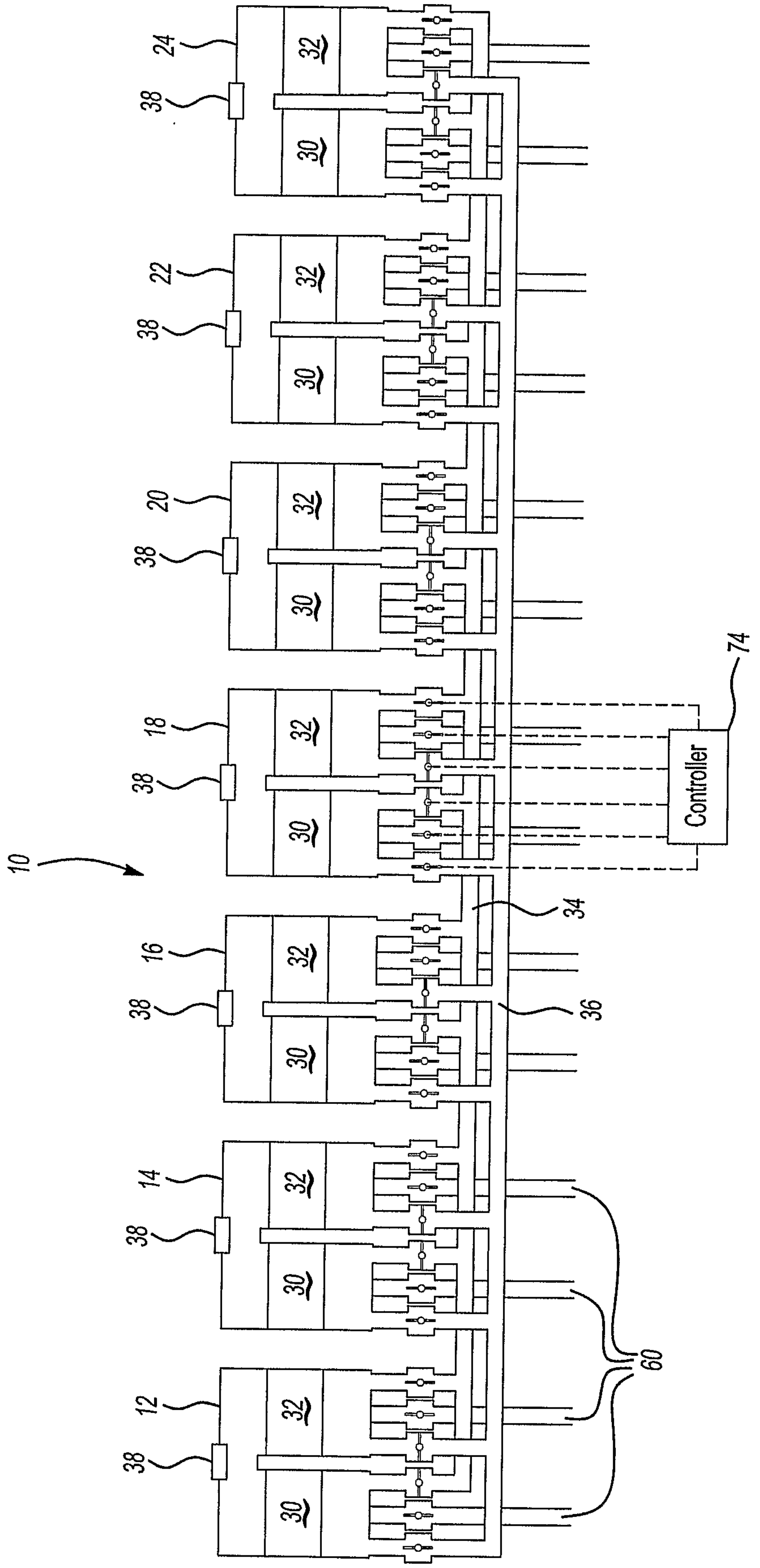


Fig-1

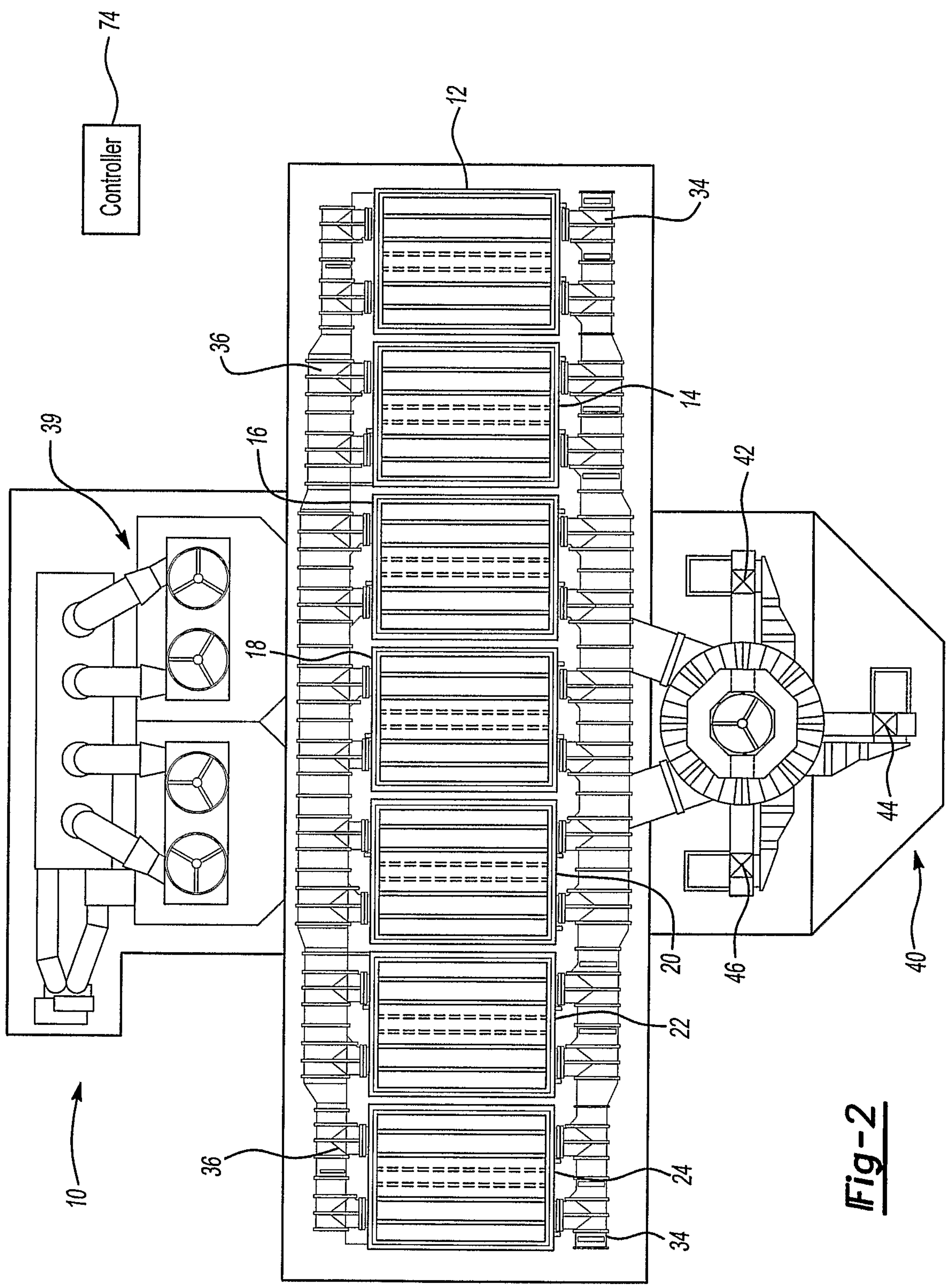
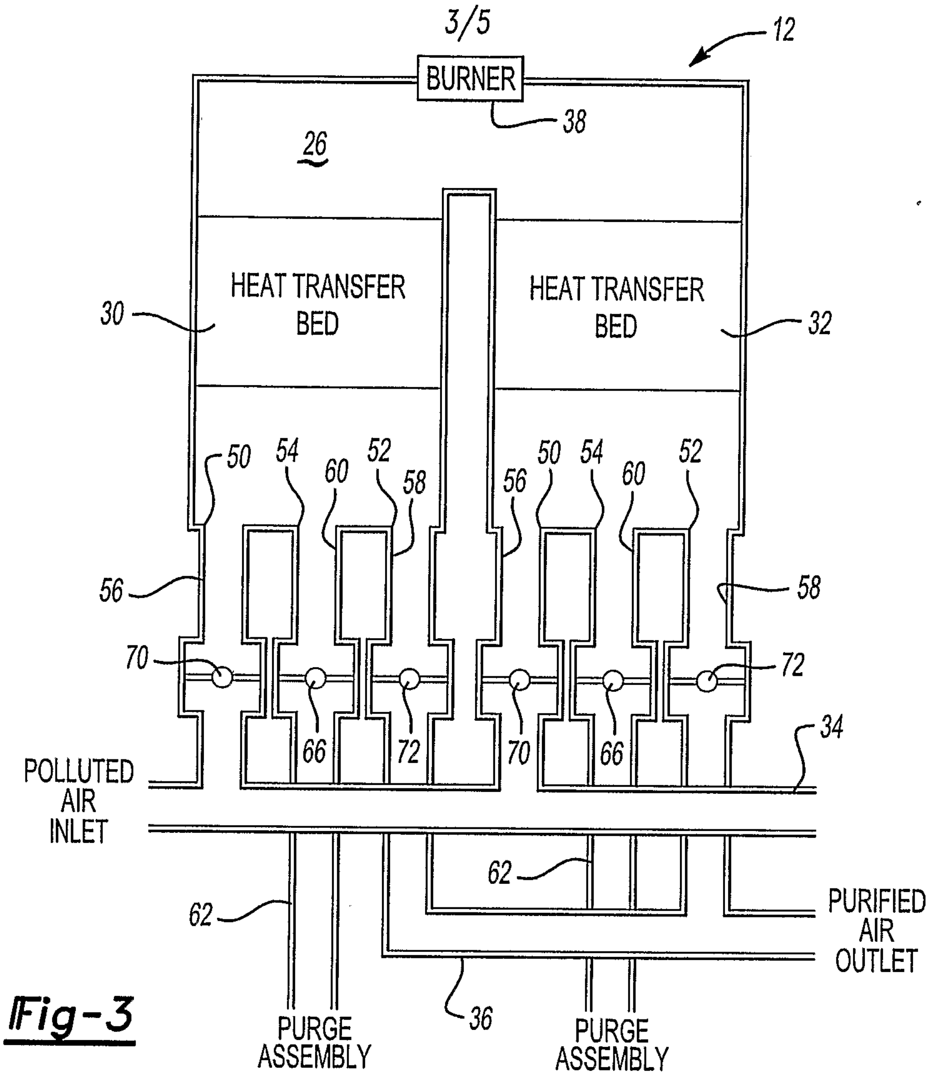


Fig-2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62
62
PURIFIED AIR OUTLET
36
PURGE ASSEMBLY
PURGE ASSEMBLY

Fig-3

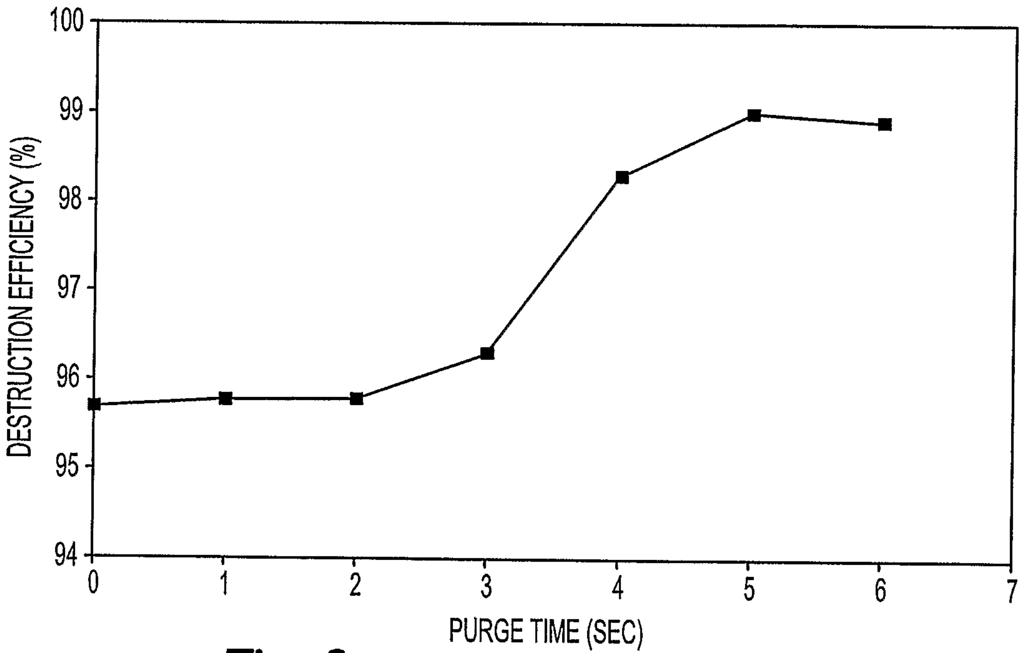
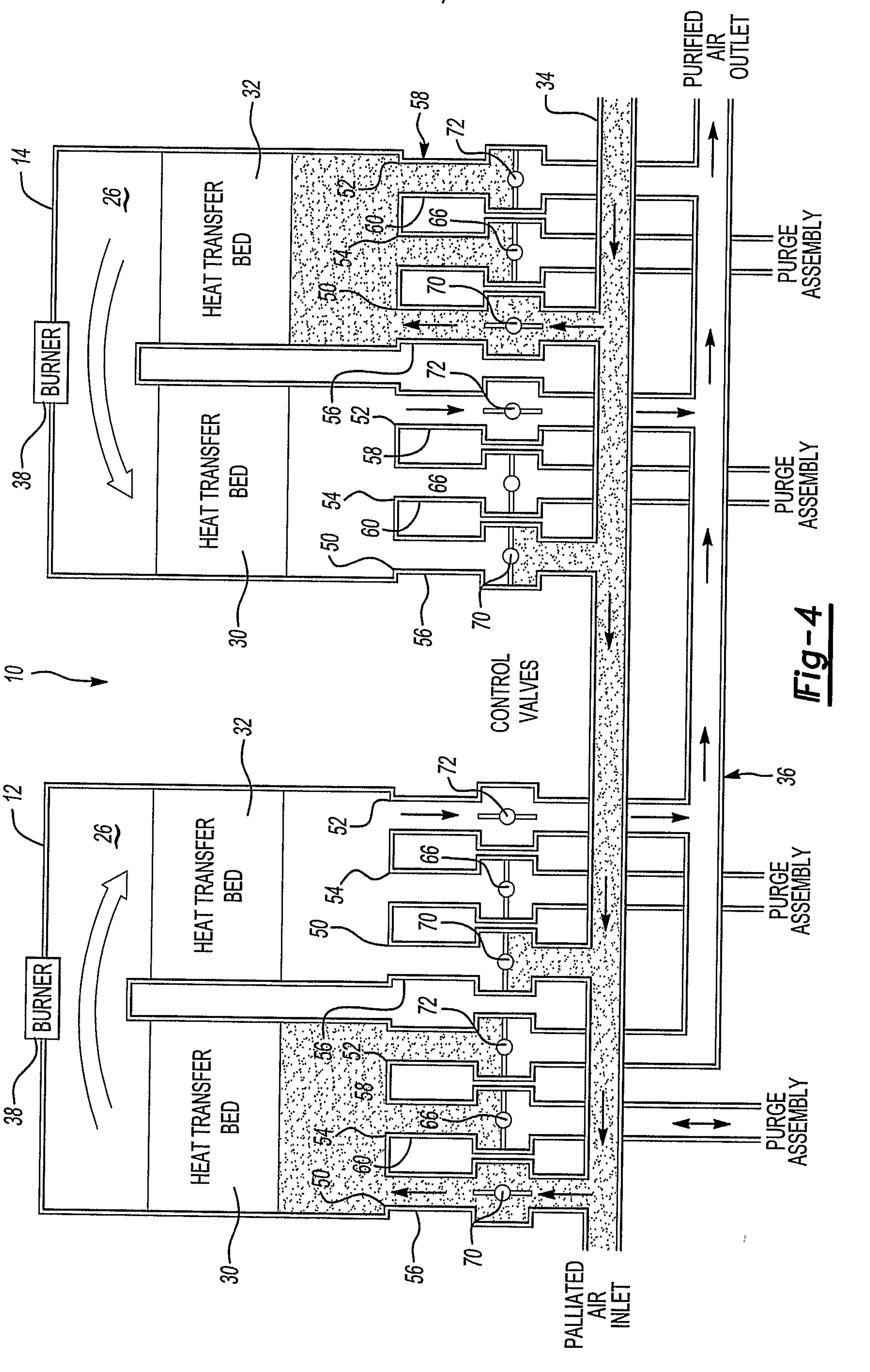

DESTRUCTION EFFICIENCY (%)
100
99
98
97
96
95
94
0
1
2
3
4
5
6
7
PURGE TIME (SEC)

Fig-6


PURIFIED AIR OUTLET
PALLIATED AIR INLET
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BURNER
BURNER
PURGE ASSEMBLY
PURGE ASSEMBLY
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PURGE ASSEMBLY
CONTROL VALVES
10
12
14
26
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34
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72

Fig-4

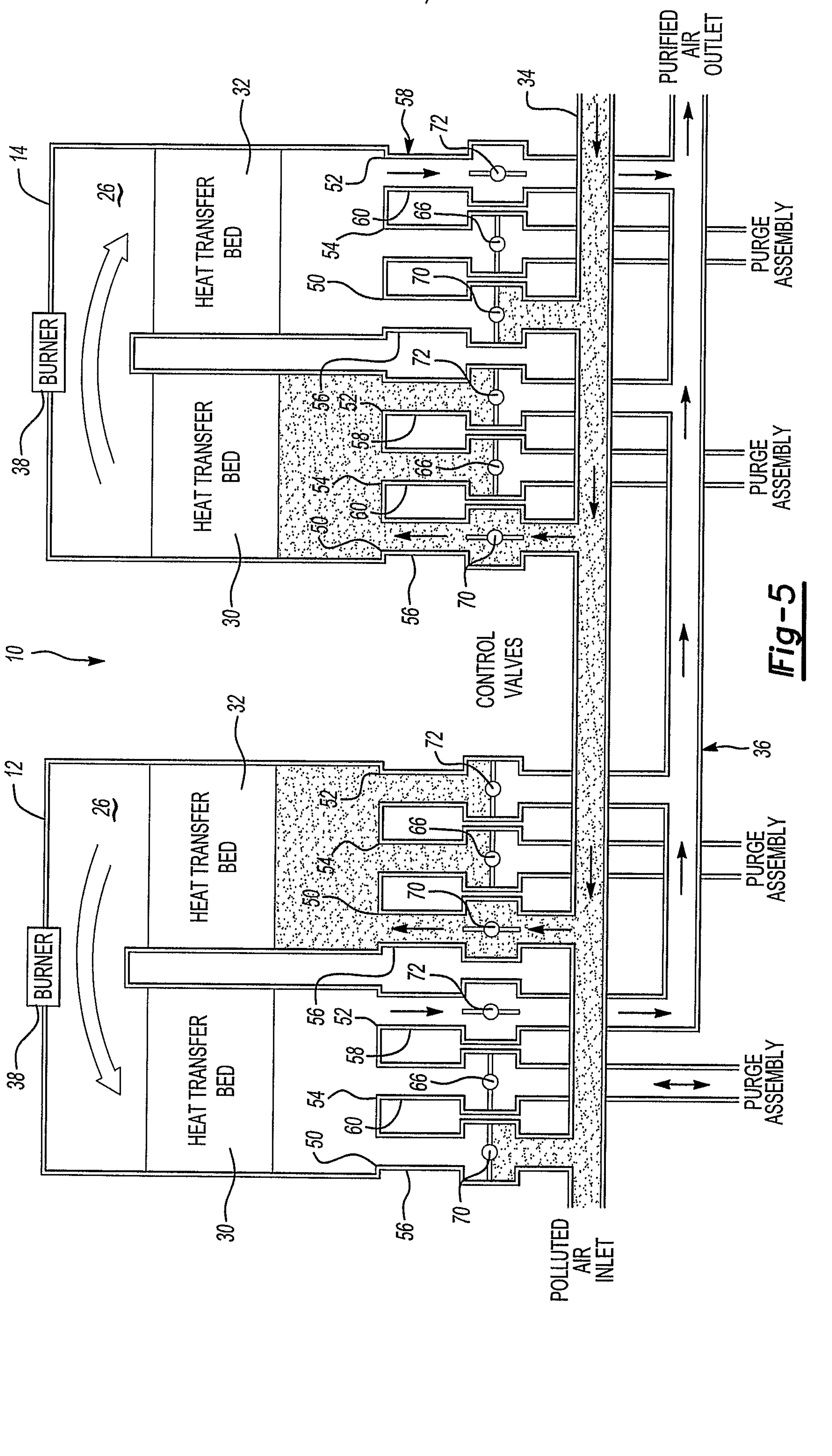
BURNER
HEAT TRANSFER BED
CONTROL VALVES
PURGE ASSEMBLY
PURIFIED AIR OUTLET
POLLUTED AIR INLET
10
12
14
26
30
32
34
36
38
50
52
54
56
58
60
66
70
72

Fig-5