(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau

PCT

(43) International Publication Date
28 June 2007 (28.06.2007)

(10) International Publication Number
WO 2007/073531 A1

(51) International Patent Classification:
F01N 7/08 (2006.01)

(21) International Application Number:
PCT/US2006/061798

(22) International Filing Date:
8 December 2006 (08.12.2006)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
60/751,459 19 December 2005 (19.12.2005) US
11/307,712 17 February 2006 (17.02.2006) US

(71) Applicant *(for all designated States except US)*: **L.C. ELDRIDGE SALES CO., LTD.** [US/US]; 9800 Richmond Avenue, Suite 325, Houston, TX 77042 (US).

(72) Inventors; and
(75) Inventors/Applicants *(for US only)*: **LESEMAN, Gary, Thelen** [US/US]; 9800 Richmond Avenue, Suite 325, Houston, TX 77042 (US). **DAVIS, Joseph, Byron** [US/US]; 9800 Richmond Avenue, Suite 325, Houston, TX 77042 (US).

(74) Agent: **DEAVER, Albert, B. JR.,**; 3400 JPMorgan Chase Tower, 600 Travis Street, Houston, TX 77002 (US).

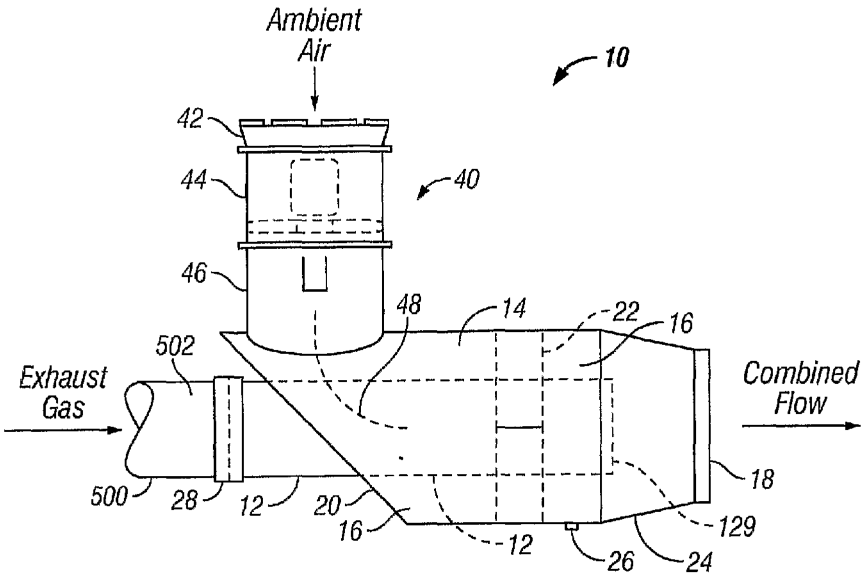
(81) Designated States *(unless otherwise indicated, for every kind of national protection available)*: AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BW, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IS, JP, KE, KG, KM, KN, KP, KR, KZ, LA, LC, LK, LR, LS, LT, LU, LV, LY, MA, MD, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PG, PH, PL, PT, RO, RS, RU, SC, SD, SE, SG, SK, SL, SM, SV, SY, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

(84) Designated States *(unless otherwise indicated, for every kind of regional protection available)*: ARIPO (BW, GH, GM, KE, LS, MW, MZ, NA, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HU, IE, IS, IT, LT, LU, LV, MC, NL, PL, PT, RO, SE, SI, SK, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

Published:
— *with international search report*

[Continued on next page]

(54) Title: METHOD AND APPARATUS FOR MANIPULATING AND DILUTING INTERNAL COMBUSTION EXHAUST GASES



(57) Abstract: A system for manipulating engine exhaust gases away from inhabited areas comprises an air pressurization system (40) coupled in fluid communication to a housing (14) . The housing is adapted to reside adjacent a terminal portion of an exhaust pipe (12) so that pressurized air injected into the housing entrains the exhaust gases and disperses them from the housing.

WO 2007/073531 A1

— *before the expiration of the time limit for amending the claims and to be republished in the event of receipt of amendments*

For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

TITLE: METHOD AND APPARATUS FOR MANIPULATING AND DILUTING INTERNAL COMBUSTION EXHAUST GASES

INVENTORS: GARY THELEN LESEMAN AND JOSEPH BYRON DAVIS

CROSS-REFERENCE TO RELATED APPLICATIONS

This application claims benefit of and priority of U.S. Application No. 11/307,712, filed on February 17, 2006, which claims benefit to and priority of U.S. Provisional Application No. 60/751,459, filed on December 9, 2005.

BACKGROUND

This disclosure is directed to manipulating the flow of exhaust gas from an internal combustion engine and, more specifically, to a method and apparatus for creating a high volume, high velocity air stream to direct an engine's exhaust gas away from a specific area and to dilute the exhaust gas.

Internal combustion engines are used as energy sources in a variety of industries. The exhaust gases from such engines are typically noxious and otherwise unpleasant for humans, fauna, and flora. In those environments where workers are adjacent the internal combustion energy source, contact with the exhaust gases creates an unpleasant and potentially unhealthy working environment. By way of example and not limitation, offshore structures such as oil well drilling rigs or production platforms, seem particularly susceptible to contamination of working and other inhabited areas with internal combustion exhaust gases. Perhaps because usable square footage is at such a premium on offshore structures, stationary internal combustion engines are by necessity relatively near inhabited spaces. Disposing of the exhaust gases in a manner that minimizes contamination of inhabited areas is or should be a major concern. Factors such as exhaust exit placement and wind and weather conditions affect exhaust gas dispersion and dilution. In other words, low exhaust gas velocity may allow wind and other weather conditions to redirect exhaust gas back toward the exhaust discharge and/or inhabited areas.

Conventional efforts to prevent exhaust gases from contaminating inhabited areas usually involved increasing the exhaust gas pipe height, length, and/or location. However, increasing the exhaust pipe length does not increase the exhaust gas exit velocity or improve the dilution of the exhaust gas. Oftentimes, increasing the length also increases engine backpressure, which decreases engine efficiency. This is especially true for diesel engines, which are notoriously sensitive to exhaust backpressure. In some circumstances, it may have been necessary to move the stationary energy source to another location farther away from the inhabited areas.

The inventions disclosed and taught herein are directed to improved systems and methods for creating a higher fluid velocity adjacent the engine exhaust gas discharge and, thereby, improving dispersal and dilution of the engine exhaust gas to reduce or prevent contamination of inhabited areas.

SUMMARY

In accordance with certain teachings of the present disclosure, one aspect of the invention includes an engine exhaust system comprising a housing adapted to surround a terminal portion of an engine exhaust pipe, the housing has an exit portion and an ambient air pressurization system coupled to the housing, such that ambient air is injected into the housing by the air pressurization system and the injected air entrains exhaust gases exiting the exhaust pipe and the combined fluid flows out the exit portion at a higher velocity than the exhaust gas alone.

Another aspect of the invention includes a method of manipulating engine exhaust gases, which comprises providing a housing having a converging nozzle at one end; locating the housing adjacent a terminal portion of an engine exhaust pipe; injecting air into the annular region at a velocity greater than a velocity of exhaust gases exiting the pipe; entraining the exhaust gases with the injected air; and propelling the combined fluid through the nozzle.

BRIEF DESCRIPTION OF THE DRAWINGS

Other objects and advantages of the invention will become apparent upon reading the following detailed description and upon reference to the drawings in which:

Figure 1 illustrates a side view of a first embodiment incorporating aspects of the invention.

Figure 2 illustrates a plan view of the embodiment illustrated in FIG. 1.

Figure 3 illustrates an end view of the embodiment illustrated in FIG. 2.

Figure 4 illustrates a side view of a second embodiment of the invention incorporating aspects of the invention.

Figure 5 illustrates a plan view of the embodiment illustrated in FIG. 4.

Figure 6 illustrates an end view of the embodiment illustrated in FIG. 5.

Figure 7 illustrates another embodiment of the invention.

Figure 8 illustrates another embodiment of the invention having a directable exit nozzle.

Figure 9 illustrates another embodiment of the invention receiving exhausts from multiple sources.

Figure 10 illustrates another embodiment of the invention interfaced with a computer control system.

While the invention is susceptible to various modifications and alternative forms, specific embodiments thereof have been shown by way of example in the drawings and are herein described in detail. It should be understood, however, that the description herein of specific embodiments is not intended to limit the invention to the particular forms disclosed, but on the contrary, the intention is to cover all modifications, equivalents, and alternatives falling within the spirit and scope of the invention as defined by the appended claims.

DETAILED DESCRIPTION

The Figures described above and the written description of specific structures and processes below shall not limit the scope of what Applicants have invented or the scope of protection sought for those inventions. The Figures and written description are provided to teach a person skilled in the art to make and use the inventions for which patent protection is sought. Those skilled in the art will appreciate that not all features of a commercial implementation of the inventions are described or shown for the sake of clarity and understanding. Persons of skill in this art also appreciate that the development of an actual commercial embodiment incorporating aspects of the present inventions will require numerous implementation-specific decisions to achieve the developer's ultimate goal for the commercial embodiment. Such implementation-specific decisions may include, and likely are not limited to, compliance with system-related, business-related, government-related, and other constraints, which may vary by specific implementation, location, and from time to time. While a developer's efforts might be complex and time-consuming in an absolute sense, such efforts would be, nevertheless, a routine undertaking for those of skill in this art having benefit of this disclosure. The inventions disclosed and taught herein are susceptible to numerous and various modifications and alternative forms.

The use of a singular term is not intended as limiting of the number of items. Also, the use of relational terms in this written description, such as, but not limited to, "top," "bottom," "left," "right," "upper," "lower," "down," "up," "side," and the like are used herein for clarity in reference to the Figures and are not intended to limit the invention or the embodiments that come within the scope of the appended claims.

Applicants have created an apparatus and method for manipulating engine exhaust gas with ambient air to direct and/or dilute the exhaust gas so that the exhaust gas does not recirculate to inhabited areas, such as workspaces, or, if recirculated, is diluted to an acceptable level. In general terms, a plenum may be formed about a terminal portion of a conventional exhaust pipe or system. Ambient air is pressurized into the plenum to entrain or otherwise increase the velocity of the exhaust gases exiting the housing for increased direction, dispersion and/or dilution. An annular region may be formed between an inside surface of the housing and an outside surface of the pipe. The exit portion may comprise a converging nozzle. The air pressurization system may comprise an air inlet, a pressurization device, and a housing transition. The air pressurization device may comprise, among other things, an axial fan, an axial blower, a ducted axial blower, a centrifugal fan, a centrifugal blower, a non-overloading fan or blower, or a non-stalling fan or blower. Turning and straightening vanes may be utilized in the housing. An adjustable pressurization system also may be used. The air pressurization system also may be computer controlled.

A method of dispersing engine exhaust gases may comprise providing a housing having a converging nozzle at one end locating the housing adjacent a terminal portion of an engine exhaust pipe; injecting air into the annular region at a velocity greater than a velocity of exhaust gases exiting the pipe; entraining the exhaust gases with the injected air; and propelling the combined fluid through the nozzle. An annular region may be created between the housing and the pipe. The housing may be located substantially cylindrically about the pipe. An air inlet hood may be provided for the air pressurization system. Determining how much pressurization from the air pressurization may be needed to adequately disperse the exhaust gases may also be done, as well as determining the current speed of an engine, and/or determining one or more weather conditions. In addition, adjusting the pressurization based on at least the engine speed and one or more transduced conditions may be done. In addition, increasing the operating efficiency of an engine may be achieved.

A first embodiment 10 incorporating aspects of the present invention is illustrated in FIGS: 1, 2 and 3. The embodiment 10 may comprise an exhaust sleeve 12 and an outer housing 14, which is adapted to encase at least a portion of the sleeve 12. FIG. 1 illustrates that the outer housing 14 may be concentrically disposed about the sleeve 12, thereby forming an annular plenum 16 between the outside of the sleeve 12 and the inside of the housing 14. The housing 14 comprises an exit portion 18 and a back portion 20, such as the back plate illustrated in FIG. 1. The outer housing 14 may be, and preferably is, sealed to the sleeve 12 at the back portion 20, such as by welding. The outer housing 14 may be supported concentrically about the sleeve 12 in any number of well-known ways, including the back portion 20 and/or straightening vanes 22. Straightening vanes 22 also function to reduce turbulence in the plenum 16 and to convert the kinetic energy of the pressurized air within the annular plenum 16 to static energy, which is sometimes referred to as static pressure regain. The exit portion 18 of the outer housing 14 may comprise a converging nozzle 24 adapted to increase the velocity of fluid flowing there through. It is preferred that the nozzle 24 be designed and constructed using conventional techniques to accelerate the fluid discharge velocity and to maintain a tight, fairly cylindrical, high velocity fluid flow away from the exit portion 18 at a velocity significantly greater than that of the prevailing wind velocity. It is preferred to have a drain port 26 located in the bottom portion of the outer housing 14, to facilitate draining liquids that may accumulate in the outer housing, such as by condensation, weather, or cleaning.

The sleeve 12 is adapted, such as by collar 28, to connect with existing exhaust system 500. Exhaust system 500 may be an existing exhaust pipe from the stationary engine or an exhaust pipe especially prepared for the present invention. It will be appreciated that the collar 28 may be a welded or un-welded connection, a removable joint, or a flexible connection. In some embodiments of the invention, not shown in FIG. 1, the exhaust pipe 500 may replace the sleeve 12 and/or the exhaust pipe 500 may be considered the sleeve 12.

Communicating with the plenum 16 is an ambient air pressurization system 40, which may comprise an air inlet 42, a pressurization device 44, and a transition 46. As illustrated in FIG. 1, the transition 46 is adapted to interface with the outer housing 14 so that fluid communication is established between the system 40 and the plenum 16. It is preferred that the transition 46 be sealed to the outer housing 14, such as by welding. Outer housing 14 may also include one or more turning vanes 48 to direct at least a portion of the pressurized ambient air toward the exit portion 18. Turning vanes 48 help to distribute the pressurized air more evenly through the annular plenum 16. It will be appreciated that the back portion 20 as illustrated in FIG. 1 also aids the redirection of the pressurized ambient air.

The air pressurization device 44 may be coupled to or integral with the transition 46, and the inlet 42 may be coupled to or integral with the pressurization device 44. For the embodiment illustrated in FIG. 1, the preferred pressurization device is a duct-mounted axial blower, such as are available from a wide variety of sources. Other pressurization devices, such as centrifugal blowers may also be used. As illustrated in FIG. 1, it is preferred that the pressurization system 40, or at least the pressurization device 44, is not subjected to the flow of hot engine exhaust gas. In some applications, however, it may be desired or required to subject the pressurization device 44 to the exhaust gases.

It will be appreciated at this point that the pressurization device 44 causes ambient air to be drawn into the air inlet 42 and injected into the plenum 16 through transition 46. The pressurized air injected into the plenum 16 by the pressurization device 44 creates an inductor effect within the plenum 16 at the discharge end 12a of the sleeve 12 and entrains or otherwise mixes with and dilutes the exhaust gases that are exiting the sleeve 12 and the combined fluid volume is accelerated through the nozzle 24 for dispersion. The injection of pressurized air may be used to create a pressure reduction in the exhaust gases in exhaust system 500 (and sleeve 12) thereby increasing engine efficiency.

It is preferred that the pressurization device 40 be designed to overcome the internal airflow resistance pressure imposed by the transition 46, internal turning vanes 48, plenum 16, sleeve 12, straightening vanes 22, and discharge nozzle 24, and create an exit velocity to counteract any prevailing wind speed. It is preferred that the system 10 be designed such that the engine exhaust can be propelled from the end of the nozzle 18 some 50 feet to 100 feet, or more, depending on prevailing wind speed, in a tight substantially cylindrical air pattern or column for maximum manipulation and dilution into the ambient air.

A presently preferred embodiment 110 incorporating aspects of the present invention is shown in FIGS: 4, 5 and 6. Similar to the embodiment 10 shown in FIGS: 1, 2 and 3, this presently preferred embodiment 110 comprises an exhaust sleeve 112 and an outer housing

114 that encases a portion of the sleeve 112. An annular plenum 116 is formed between the outside of the sleeve 112 and the inside of the housing 114. The housing 114 comprises an exit nozzle 118 and a back plate 120. The outer housing 114 is sealed to the sleeve 112 at the back plate 120 by welding and helps to support the outer housing 114 concentrically about the sleeve 112. Straightening vanes 122 also support the outer housing 114 and may function to reduce turbulence in the plenum 116 and to convert the kinetic energy of the pressurized air within the annular plenum 116 to static energy. The exit nozzle 118 comprises a 30° converging nozzle designed and constructed using conventional techniques to accelerate the fluid discharge velocity and to maintain a tight, fairly cylindrical, high velocity fluid flow away from the system 110 at a velocity significantly greater than that of the prevailing wind velocity. While FIG. 4 shows the exhaust sleeve 112 terminating within the nozzle 118, it will be appreciated that the exhaust sleeve 112 may also terminate within the housing 114 as required or desired by design criteria.

The ambient air pressurization system 140 comprises an air inlet 142, a pressurization device 144, a mounting spool or vane section 145, and a transition 146. As illustrated in FIGS: 4 and 6, the transition 146 is adapted to interface with the outer housing 114 adjacent the back plate 120 so that fluid communication is established between the system 140 and the plenum 116. The transition 146 is sealed to the outer housing 114 such as by welding. The outer housing 114 and/or the transition 146 may also include turning vane 148 that extends 180 degrees along the outer surface of the sleeve 112 to direct approximately one-half of the pressurized ambient air toward the exit nozzle 118. It will be appreciated that the back plate 120, primarily portion 120a, redirects the other portion of the pressurized ambient air.

The air pressurization device 144 is coupled to an inlet 142 and a transition 146. The pressurization device 144 may also include a mounting spool or vane section 145, as may be desired, to provide a uniform velocity profile across the pressurization device 144 diameter. The pressurization device 144 and mounting spool/vane section 145 may be considered a single device or as separate devices for purposes of this disclosure. In this preferred embodiment, the pressurization device 144 may be a Series 44 ducted axial fan available from Hartzell Fan, Inc., Piqua, Ohio. As illustrated in FIG. 6, air inlet 142 comprises a hood 150 having one or more elements 152 adapted to prevent water and other contaminants from entering or contacting the air pressurization device 144. As shown in FIG. 4, it is presently preferred that the nozzle 118 be spaced a distance "L" from the centerline of the pressurization device 144, where L ranges between about 1.5 to about 2.5 times the nominal diameter of the pressurization device 144, inclusive, and most preferably about 2 times the nominal diameter. Further, it is preferred that the area of the annular region created between the housing 114 and the sleeve 112 is substantially the same as the discharge area of the pressurization device 144 (or mounting spool/vane section 145), and most preferably, equal to or greater than the discharge area.

It is preferred that the embodiment 110 be fabricated from stainless steel, such as a series 300 stainless steel, and most preferably series 316 stainless steel. However, it will be appreciated that the embodiment 110 and other embodiments incorporating aspects of the inventions described herein may be fabricated from many other materials and combination of materials, including, but not limited to, carbon steel, galvanized steel, or other suitable heat and/or corrosion resistant material including metallic alloys, and non-metallic materials, such as fiberglass and composites. Such materials may be coated with a corrosion resistant and/or heat resistant coating and/or be insulated with heat resistant thermal barrier material or acoustical material.

One specific example of an implementation based on the preferred embodiment illustrated in FIGS: 4 – 6, a system was designed for an internal combustion diesel engine (EMD 16-645-E9) having a 22 inch exhaust pipe (nominal OD). According to the engine manufacturer, at full load, this particular engine created about 15,400 cubic feet per minute of exhaust gas, or an exit velocity of about 6,400 feet per minute (about 72 miles per hour). Exhaust volume for this engine at idle was estimated at about 25% of full load or about 3,850 fpm (about 44 mph). It has been found that unwanted recirculation or redirection of exhaust gases rarely, if ever occurs, at full engine load conditions. Therefore, the design criteria for this implementation were set for an air pressurization device 144 sufficient to move a volume of ambient air equal to or greater than the full load engine exhaust volume when the engine is at idle. In other words, the combined fluid flow out of the system 110 when the engine is at idle was desired to be at least equal to and preferably greater than about 19,250 cfm. In addition, it was desired for this implementation that the pressurization device 144 be able to move a volume of ambient air substantially equal to the volume of exhaust gases at full engine load at a static pressure greater than the combined full load fluid flow pressure loss at the nozzle 118 exit.

For this particular implementation, a Hartzell Series 44 ducted axial fan was selected having an output of about 15,000 cfm and about 17,700 cfm at a static pressures of about 3 and about 2 inches of water, respectively. The nominal diameter of this fan was about 33 inches resulting in a discharge area of about 5.94 square feet. Therefore, the nominal diameter of the outer housing 114 was set at about 40 inches to create an annular area between the exhaust sleeve 112 and the housing 114 of about 5.94 ft^{2,} and the dimension "L" was set at about 66 inches. A 30° nozzle 118 having an entrance diameter of about 40 inches and an exit diameter of about 29 inches was used, and the exhaust sleeve 112 extended into the nozzle entrance about 2 inches.

At full engine load, the system 110 will eject diluted exhaust gases at about 30,000 cfm, or about 6,800 fpm (~77 mph). At fifty percent load, the engine will produce about 7,700 cfm of exhaust gases and the axial fan 144 would inject something above 15,000 cfm of ambient air into the system 110 because of the decreased load on the fan. Even at engine idle, the system 110 would eject diluted exhaust gases at about 21,500 cfm (~55 mph).

The inventions described herein may be used at locations in the exhaust system other than at the end of the exhaust system 500. For example, as illustrated in FIG. 7, a system 200 may be placed in the exhaust system 500, such that combined exhaust/ambient air pipe 230 will continue past the system 200 before final termination. Space, design, and routing requirements may dictate this type of installation. For example, those of skill in the art may want to place the system 200 at a point in the exhaust system where the engine exhaust back pressure becomes an engine efficiency issue. Also, more than one system 200 may be placed in an exhaust system in series as needed, and may be combined with silencers or other exhaust equipment as desired.

FIG. 8 illustrates another embodiment 300. In this system, housing 314 has two ambient air pressurization systems 340a, 340b. Each pressurization system 340 comprises an inlet 342, a pressurization device 344 (with or without a mounting spool or vane section), and a transition 346. As mentioned before, when the internal combustion engine is being run at full load, the exhaust gas exit velocity may be sufficiently high to effect adequate direction or dispersal of the gases under certain weather conditions. In such cases, having two or more air pressurization systems 340 allows multiple systems to be run when needed, such as at idle or when weather conditions, such as wind speed or direction, have changed and to run fewer systems when conditions do not require as much injection velocity. Although the embodiment shown in FIG. 8 utilizes two air pressurization systems, it will be appreciated that a plurality of pressurization device may be utilized, as desired or required. In addition, it will be appreciated that equivalent control and functionality may be achieved by having the capability to run the air pressurization device at various levels of pressurization, such as speeds or loads. For example, the embodiment shown and described with reference to FIGS: 4 – 6 may utilize or have a variable speed air pressurization device. Although not shown in FIG. 8, those persons of skill will appreciate that implementations utilizing multiple pressurization devices, one or more of which may not used form time to time, may benefit from back flow restrictors, such as dampers, to prevent the pressurized fluid from escaping through the inactive pressurization device.

FIG. 8 also illustrates a directable exit nozzle 380. Exit nozzle 380 may be rotatably mounted to system nozzle 318 so that the direction of the combined exhaust gas and air exit in a direction that promotes the most efficient dispersion of exhaust gases. The nozzle 380 may be manually rotatable or may be automatically rotated by any number of well known devices 382, such as, but not limited to, pneumatic, electronic/electrical, and mechanical.

As will be discussed in more detail below, automatic or semi-automatic operation of the system may be desired for numerous reasons. One method of operation comprises an air pressurization device control signal 404 that instructs the air pressurization device 340 to start under certain defined conditions. For example, as shown in FIG. 8, a temperature sensor 402 may be thermally coupled to the exhaust pipe 500 or some other component of the exhaust-conveying system. When the temperature sensor 402 transduces a temperature above a certain level, for example 300 F°, a control circuit 406, preferably adjacent the air pressurization device 340, causes the air pressurization device 340 to start. It will be appreciated that a variable speed air pressurization device 340 may be controlled based on the transduced temperature with the output of the device 340 being a function of the transduced temperature, such as an inverse relationship.

FIG. 9 illustrates a partial embodiment that illustrates the broad applicability of the present invention. FIG. 9 teaches that a single dispersion system, 114, 314, may handle exhaust from multiple sources. For example and without limitation, a dispersion system 314 may accept multiple exhaust pipes 500a, 500b from a single engine or exhaust pipes 500a, 500b, & 500c from multiple engines. Those of skill in the art having the benefit of this disclosure will appreciate how to design a dispersion system to handle such increased exhaust loads.

Sophisticated implementations of the inventions disclosed herein may compromise computer or expert systems that control the system in response to one or more inputs or conditions. For example, FIG. 10 illustrates a dispersion system 800 in which a programmed logic controller, computer, or other such system 600 may monitor or detect, for example, engine speed 602, engine load 604, wind speed 606, wind direction 608, exhaust temperature 610, or exit velocity 684. At low engine speeds, an appropriately constructed or programmed computer 600 may instruct 682 the air pressurization device 644 to run at or near maximum pressure. Alternately, the PLC 600 may instruct a second or third air pressurization device (not shown) to start up or increase or decrease output. As weather conditions change and/or as engine speed or exhaust temperature increases, the expert system 600 may instruct or allow the air pressurization device 644 to slow down because of the increase in exhaust gas velocity. Alternately, the computer 600 may slow down or turn off one or more air pressurization devices. In other embodiments, a workspace or inhabited area, such as the moon pool on a drilling rig, may have one or more carbon monoxide detectors 650 or other transducers for detecting when engine exhaust gases are being circulated to the area. In response to such information from the inputs, the PLC 600 may increase the output of the air pressurization system 644 or systems by increasing blower speed or bringing more systems online, and/or may rotate 686 a directable nozzle (See FIG. 8) to a desired orientation.

Other and further embodiments can be devised without departing from the general disclosure thereof. For example, embodiments incorporating one or more aspects of the inventions disclosed herein may be used in any orientation vertical, horizontal, or otherwise without affecting the function and purpose. Although the descriptions above were directed to single engine exhaust, it will be appreciated that the systems can be modified and utilized to accommodate combined multiple internal combustion engine exhaust pipes arrangements. Further, the various methods and embodiments of the improved completion system can be included in combination with each other to produce variations of the disclosed methods and embodiments. Discussion of singular elements can include plural elements and vice-versa. Some elements of the invention have been described functionally and can be embodied as separate components or can be combined into components having multiple functions.

The inventions have been described in the context of preferred and other embodiments and not every embodiment of the invention has been described. Obvious modifications and alterations to the described embodiments are available to those of ordinary skill in the art. The disclosed and undisclosed embodiments are not intended to limit or restrict the scope or applicability of the invention conceived of by the Applicants, but rather, in conformity with the patent laws, Applicants intend to fully protect all such modifications and improvements that come within the scope or range of equivalents of the following claims.

CLAIMS

WHAT IS CLAIMED IS:

1. A system for manipulating engine exhaust comprising:

a housing adapted to surround a terminal portion of an exhaust pipe, the housing having an exit portion;

an ambient air pressurization system coupled to the housing in fluid communication therewith; and

whereby ambient air is injected into the housing by the air pressurization system and the injected air entrains exhaust gases exiting the exhaust pipe and the combined fluid flows out the exit portion.

2. The system of claim 1, wherein an annular region is formed between an inside surface of the housing and an outside surface of the pipe.

3. The system of claim 2, wherein the exit portion comprises a converging nozzle.

4. The system of claim 3, wherein the annular region has an area substantially equal to a discharge area of the pressurization system.

5. The system of claim 4, wherein the air pressurization system comprises an air inlet, a pressurization device, and a housing transition.

6. The system of claim 5, wherein the air pressurization device is selected from the group consisting of: an axial fan, an axial blower, a centrifugal fan, a centrifugal blower, a non-overloading fan, and a non-overloading blower.

7. The system of claim 5, further comprising turning and straightening vanes in the housing.

8. The system of claim 7, further comprising a mounting spool or vane section coupled to the pressurization device.

9. The system of claim 1, wherein the pressurization created by the pressurization system is adjustable.

10. The system of claim 1, wherein the pressurization system comprises a ducted axial blower.

11. The system of claim 10, wherein the pressurization system comprises a non-overloading axial blower.

12. The system of claim 10, wherein the pressurization system comprises a non-stalling axial blower.

13. The system of claim 9, wherein the air pressurization system is computer controlled.

14. A method of manipulating engine exhaust gases, comprising:

providing a housing having a converging nozzle at one end;

locating the housing adjacent and about a terminal portion of an engine exhaust pipe;

injecting air between the housing and the pipe;

entraining the exhaust gases with the injected air; and

propelling the combined fluid through the nozzle at a velocity greater than the exhaust gas alone.

15. The method of claim 14 further comprising creating an annular region between the housing and the pipe.

16. The method of claim 15, further comprising injecting the air at a velocity substantially equal to or greater than a velocity of exhaust gases exiting the pipe.

17. The method of claim 16, further comprising locating the housing substantially cylindrically about the pipe.

18. The method of claim 17, further comprising providing an air inlet hood for the air pressurization system.

19. The method of claim 14 further comprising determining how much pressurization from the air pressurization is needed to adequately manipulate the exhaust gases.

20. The method of claim 14, further comprising determining the current speed of the engine.

21. The method of claim 14, further comprising determining one or more weather conditions.

22. The method of claim 20, further comprising adjusting the pressurization based on at least the engine speed and one or more conditions.

23. The method of claim 14, further comprising adjusting the amount of air injected.

24. The method of claim 23, further comprising adjusting the amount of air injected based one or more conditions.

25. The method of claim 24, wherein the condition for adjusting the amount of injected air is selected from the group consisting of: engine speed, exhaust temperature, presence of exhaust gas, presence of personnel, and weather conditions.

26. The method of claim 14, further comprising increasing the operating efficiency of an engine.

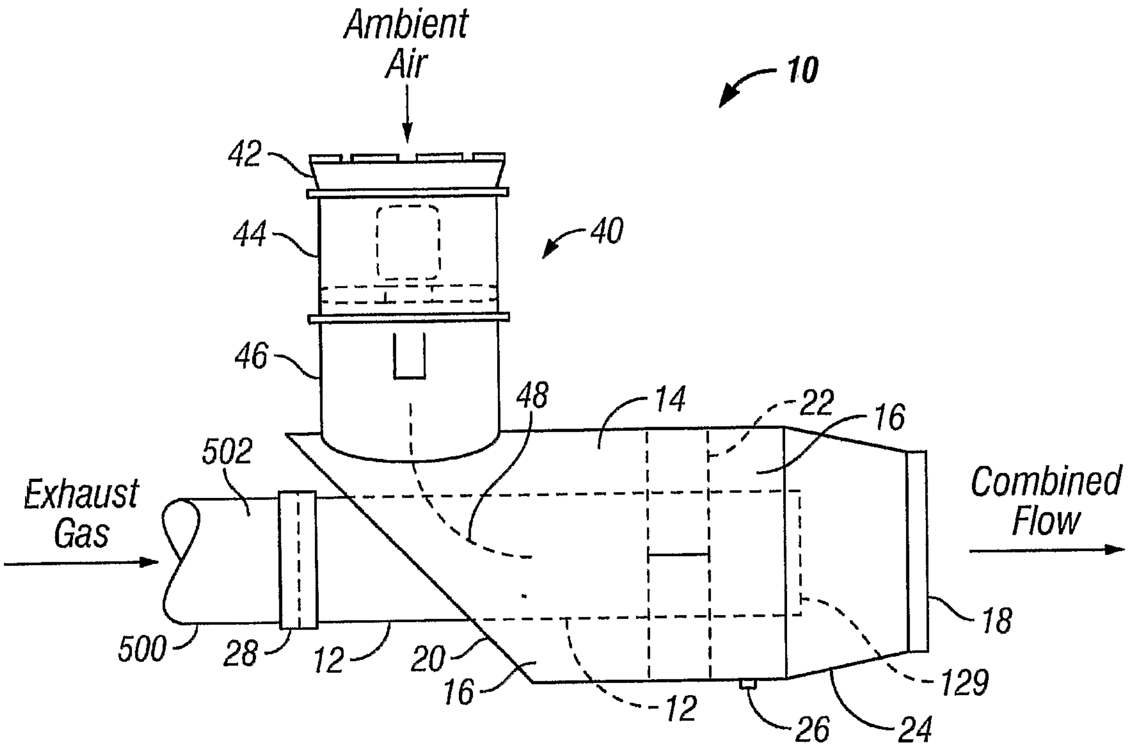

Ambient
Air
10
42
44
40
46
48
14
22
16
502
Exhaust
Gas
Combined
Flow
18
500
28
12
20
16
12
26
24
129

FIG. 1

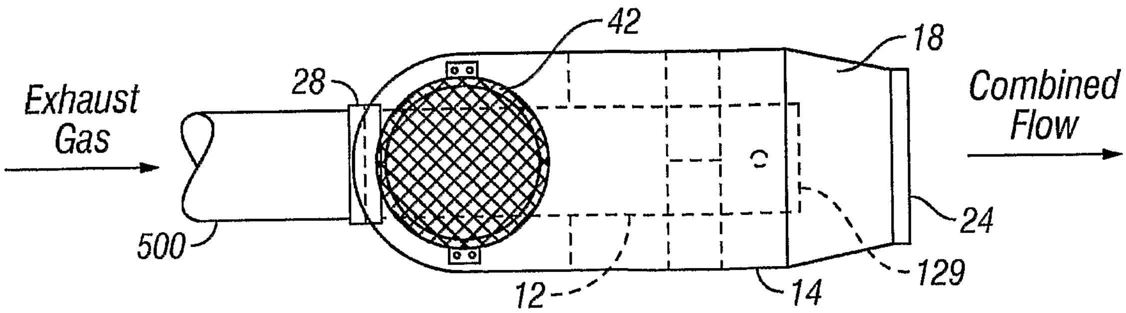

42
18
28
Exhaust
Gas
Combined
Flow
24
500
129
12
14

FIG. 2

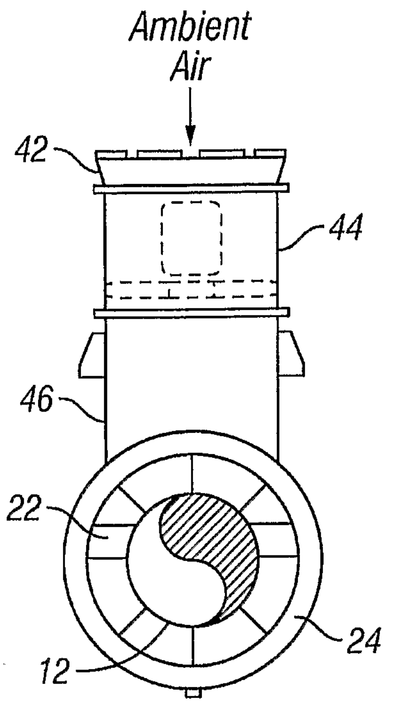

Ambient
Air
42
44
46
22
24
12

FIG. 3

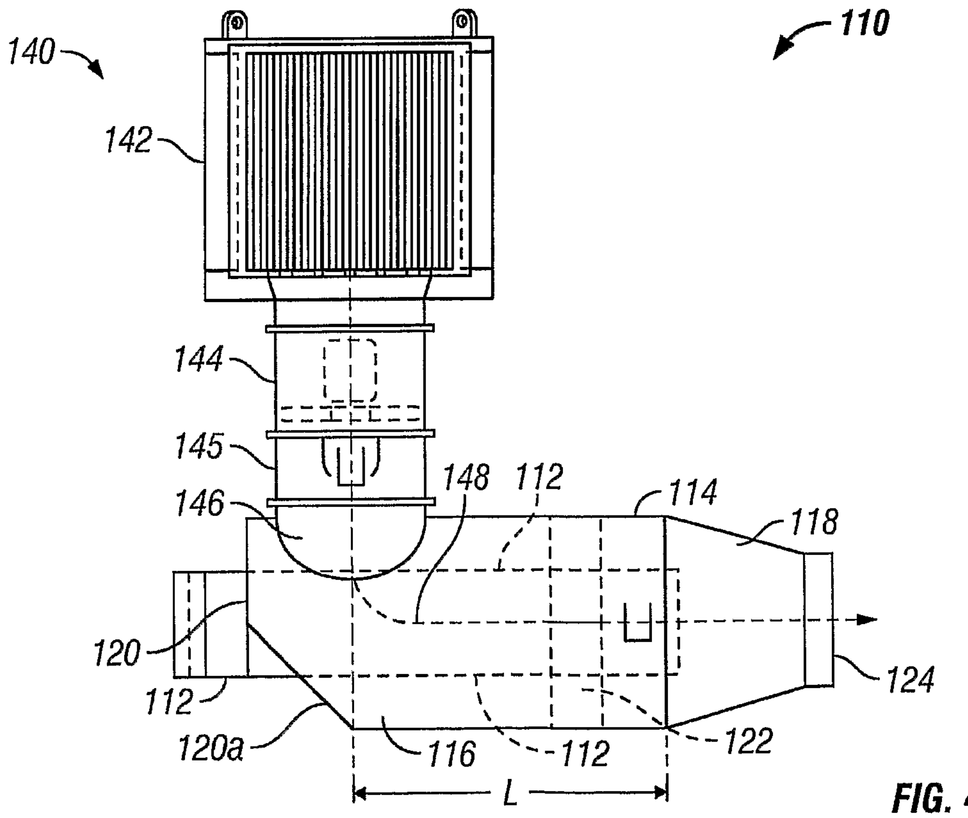

110
140
142
144
145
146
148
112
114
118
120
112
120a
116
112
122
124
L

FIG. 4

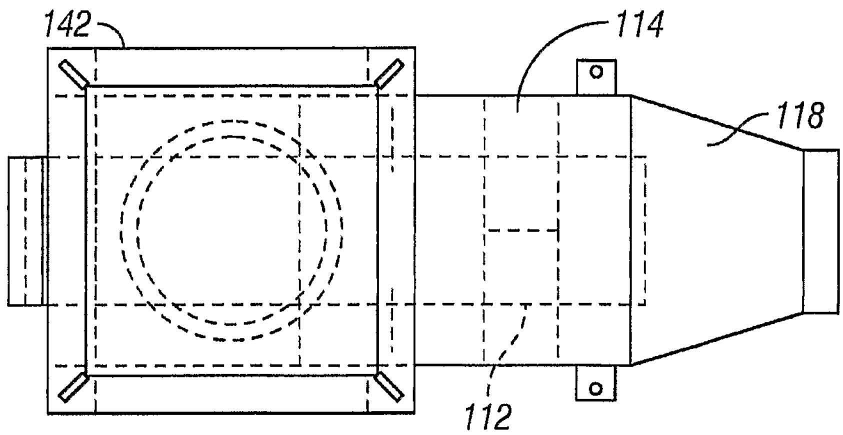


FIG. 5

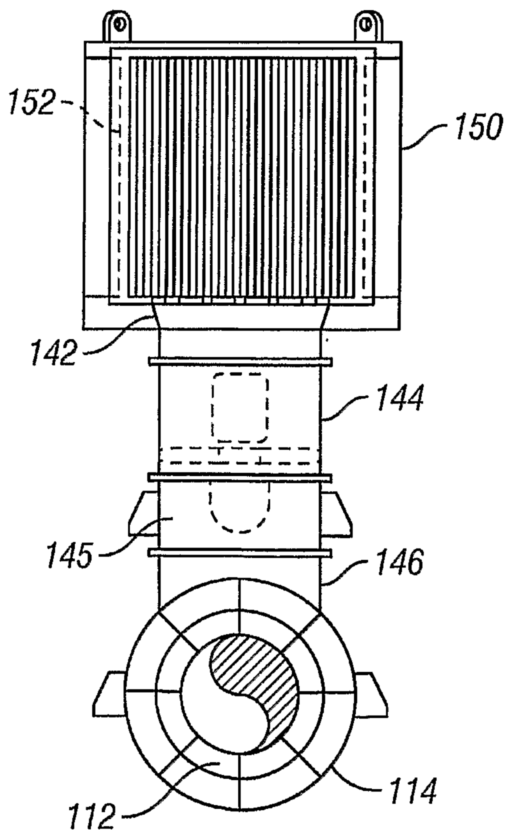


FIG. 6

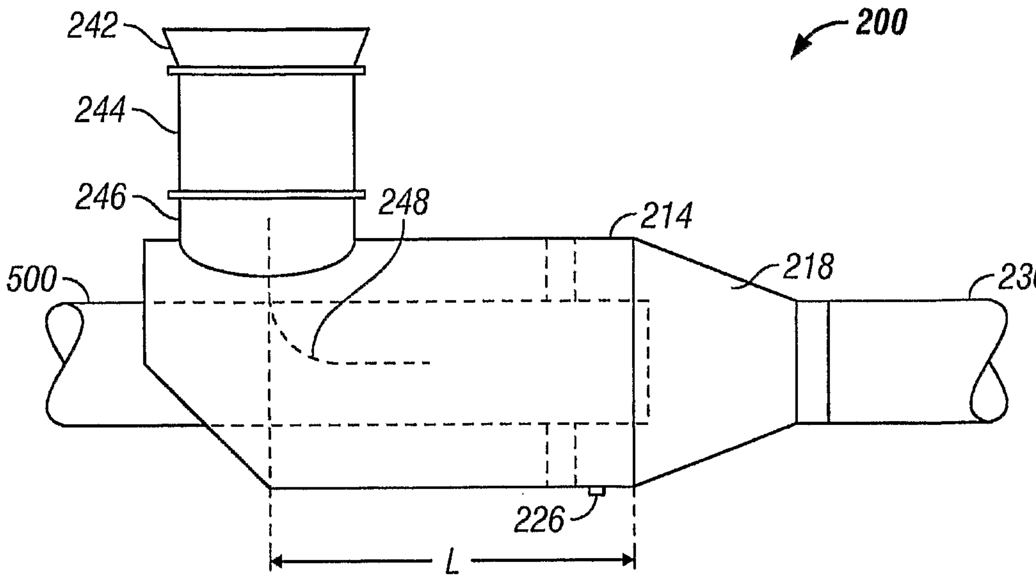

200
242
244
246
248
214
218
230
500
226
L

FIG. 7

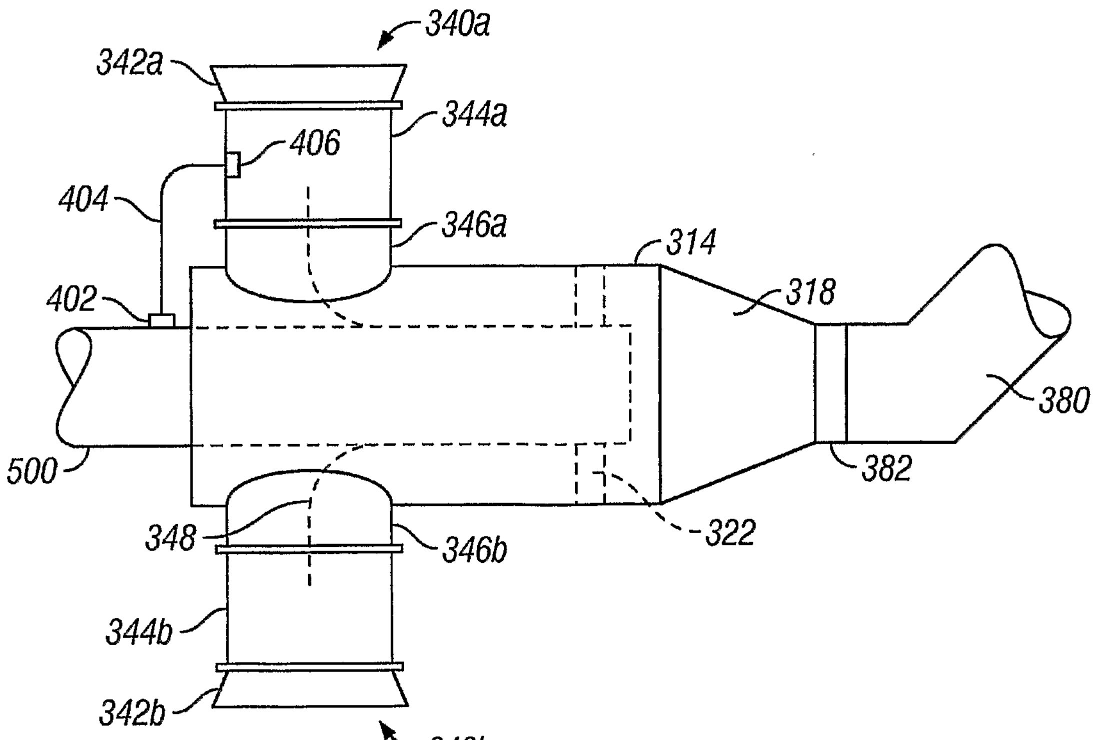

340a
342a
344a
406
404
346a
314
402
318
380
500
382
322
348
346b
344b
342b
340b

FIG. 8

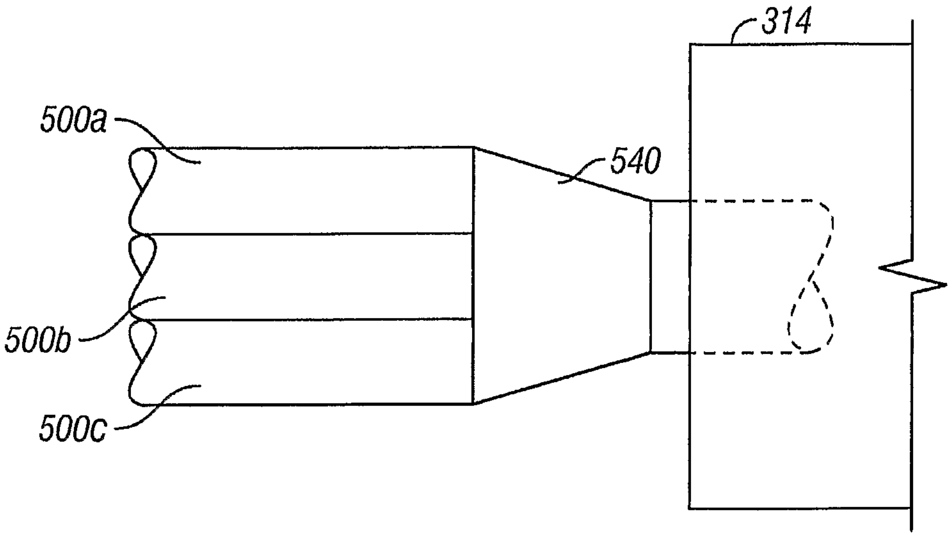

314
500a
540
500b
500c

FIG. 9

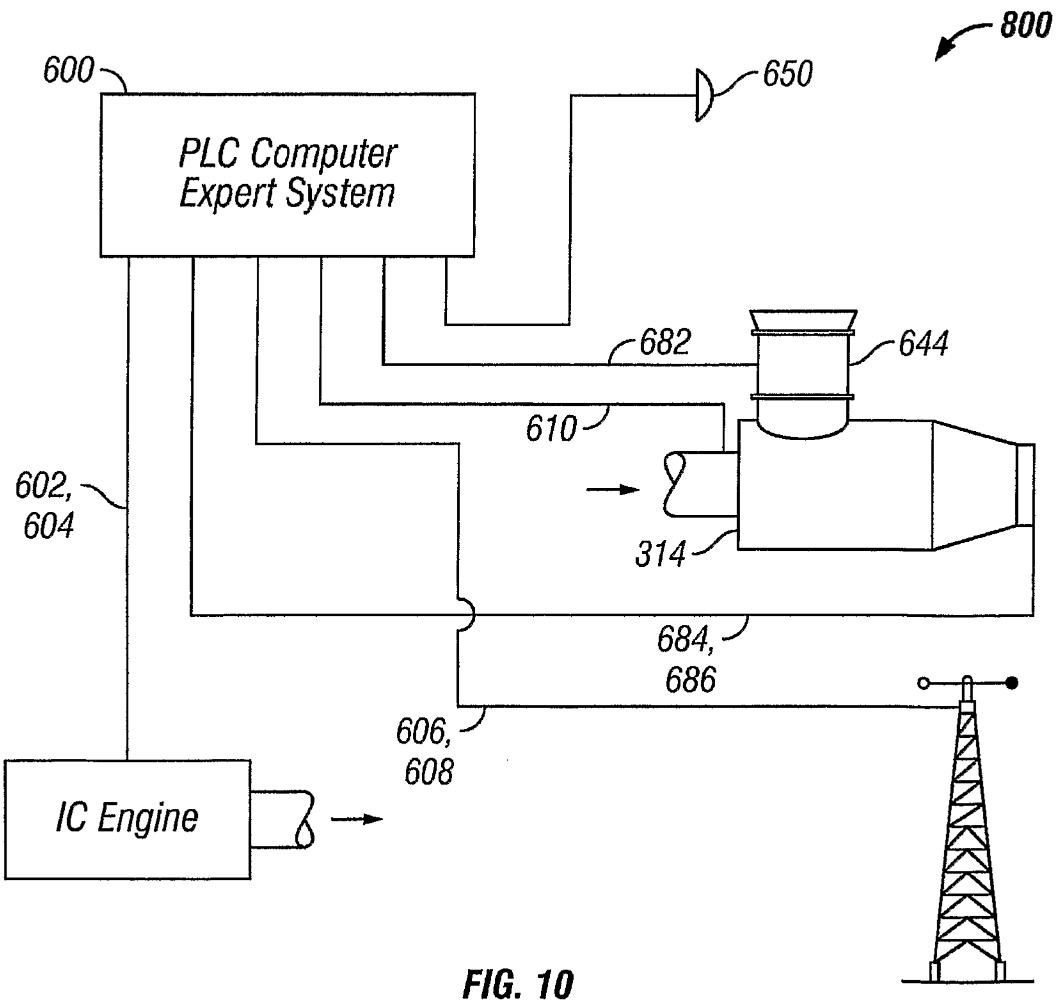

800
600
650
PLC Computer
Expert System
682
644
610
602,
604
314
684,
686
606,
608
IC Engine

FIG. 10

INTERNATIONAL SEARCH REPORT

International application No
PCT/US2006/061798

A. CLASSIFICATION OF SUBJECT MATTER
INV. F01N7/08

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
F01N

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EPO-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X Y	DE 10 99 799 B (DAIMLER BENZ AG) 16 February 1961 (1961-02-16) column 2, line 22 - column 3, line 8; figures	1,2,9-26 3-8
X	US 2004/088968 A1 (KOELM MARK D [US] ET AL) 13 May 2004 (2004-05-13) paragraph [0020]; figures	1,2, 14-18,21
X Y	WO 99/01649 A (DEPPE VOLKER [DE]) 14 January 1999 (1999-01-14) page 5, last paragraph - page 7, paragraph 1; figure 1	14-17, 20-26 3-8
X	JP 59 122718 A (FUJI HEAVY IND LTD) 16 July 1984 (1984-07-16) abstract	14,15, 20-26

☐ Further documents are listed in the continuation of Box C.

☒ See patent family annex.

* Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
11 April 2007	20/04/2007

Name and mailing address of the ISA/	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL – 2280 HV Rijswijk Tel. (+31-70) 340-2040, Tx. 31 651 epo nl, Fax: (+31-70) 340-3016	Torle, Erik

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No
PCT/US2006/061798

Patent document cited in search report		Publication date	Patent family member(s)		Publication date
DE 1099799	B	16-02-1961	NONE		
US 2004088968	A1	13-05-2004	AU 2003291479	A1	03-06-2004
			CN 1735733	A	15-02-2006
			EP 1573135	A1	14-09-2005
			WO 2004044331	A1	27-05-2004
WO 9901649	A	14-01-1999	AU 8854398	A	25-01-1999
JP 59122718	A	16-07-1984	NONE		