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(54) Titre : SYSTEME THERMOGENERATEUR A MOTEUR

(54) Title: SYSTEM TO PROVIDE HEAT USING AN ENGINE

(57) **Abrégé/Abstract:**

Portable heating systems for certain applications cannot use flame-type heating devices but will accept heaters based on reclaiming heat from diesel engines. These systems are designed for heating water or air used in these special zones. Other inventors have devised various ways to convert the mechanical shaft power of the engine to heat. The heating energy then, is the sum of the scavenged heat from the engine plus the conversion of mechanical power to heat.

My invention utilizes a common electrical generator to convert mechanical shaft power to electric power, which is in turn converted to heat.



Abstract

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Background Description and Prior Art:

Using a diesel engine as the device for converting chemical energy from fuel requires several key components. These would naturally include heat reclaim components such as an engine exhaust heat exchanger, engine coolant heat reclaim, turbo-charge cooler heat reclaim, and an radiated engine-heat reclaim system. The load on the engine's mechanical shaft creates a proportional amount of energy to be reclaimed from these components. Typical engines for this application will burn about 11 US gallons per hour of fuel, which will convert into about 1,500,000 btu/hr. This whole system requires that the device used to convert mechanical shaft power to heat becomes the controlling component in how much heat is produced. This device must be able to be controlled so that just the right amount of load is applied so that the sum of all the reclaimed sources plus the converted heat will just meet the heat demand.

Other inventors have devised devices for this purpose. These devices are connected to the engine shaft and convert the rotating shaft power to heat. The heart of the conversion devices are usually forms of fluid shear devices and at least one utilizes magnetic fields to create heat directly in a heating fluid. All of these devices have fluids operating at high temperatures. These fluids are, in turn, passed through heat exchangers to heat the air.

These fluid devices have a number of serious limitations. The fluids are prone to leak because there are rotating mechanical elements with seals, pumps with seals, and control valves that can also leak. The durability of the seals is weakened by the fact that the fluid temperature is high. Since discharge temperatures of the air are desired to be above 200 degF, the fluids will operate above 250 degF and under some process interruptions, can rise much higher. Another limitation is the foaming and breakdown of the fluid. Foaming causes sensors to be misread and interrupts the steady flow to transport heat away from the converting device. Yet another limitation is cavitation that erodes the shear device surfaces resulting in lack of reliability and the cause of much maintenance expense. The limited operating life typically requires that complete overhauls be performed after a few months of use. The methods used to control the amount of engine load are themselves a maintenance issue and result in reduced reliability. These systems also require that the engine be run at full speed regardless of load, thus adding more wear to the engine.

These other systems, when heating air, bring the air into the system through the radiator of the engine first. After the air has been heated through this first process, the air is then passed through an engine exhaust heat reclaim heat exchanger. Passing the warmer air through the exhaust heat exchanger lowers the effectiveness of the heat reclaim process.

Summary of the Invention:

My invention utilizes an ordinary AC electrical generator to convert mechanical shaft power to electric power, which is in turn, converted to heat. There are a number of important benefits of this invention. Electric generators and the electric heater elements used with it are highly reliable. The mean time between failures is more than 10 times the maintenance requirements associated with these existing methods. The generator has no wear items, no leaks, no seals, and no fluids as are commonly used on current state-of-the-art machines. Using the generator, the control of the heating process is easily done by switching on and off heater elements as the need for heat changes. The nature of generators is such that when there is no electrical load, the generator spins freely with almost no load other than bearing friction. As heating elements are switched on, the load to the motor correspondingly increases up to full load as needed. Rather than controlling heat output by switching heaters alone, the engine-generator is slowed down which produces a lower frequency, lower voltage output which lowers the heat generated per heater. The control system adjusts the speed and the number of heaters that are powered. The control will endeavor to operate with as many heaters on that it can while reducing heat output with engine speed. The engine wear is thereby reduced. Pure resistive heat elements do not care if the voltage or frequency changes. The power output is the result of the current times voltage. In resistive elements, the current falls proportionately with the voltage resulting in the power dropping by the square of the speed reduction.

In similar fashion to other state of the art systems, the engine, heat reclaim equipment, fuel tank, heat conversion device, and controls are all mounted on a trailer. In my system, the generator is close-coupled to the engine, as normal engine generator sets would be done. The output of the generator is wired through fuses and into the relays. When a relay is fired, power is supplied to the heater element, which begins to provide heat into the air or water stream. There is no wiring brought to the outside world. There are no other special electrical components needed. The function of the controller is to measure the temperature just before the electric heaters and flow of the stream to be heated wherein an amount of heat required is calculated. From this amount of heat needed, the correct engine operating speed and number of heaters is determined. Engine speed is automatically controlled using the Engine ECM interfaces available and the electronic controller switches relays using the 12 vdc power available from the engine battery. The control itself is powered from the engine's battery.

Additionally, a much higher percent of the exhaust heat is recovered by bringing the fluid to be heated (liquid or air) into the exhaust heat exchanger first where the difference in temperature is greatest. By providing additional heat exchange surfaces 100% of the other engine heat "losses" can still be recovered without overheating the engine.

Claims:

The embodiments of the invention in which an exclusive property or privilege is claimed are defined as follows:

1. In the case of the apparatus:

- A self-contained portable heating system, where all the components of the system are mounted on a trailer such that local air or water is heated by this system.
- Said system utilizes an engine as a source of heat where heat is reclaimed from the engine in addition to converting the mechanical power of the engine to heat.
- Said system utilizes an ac electric generator and electric heater elements to convert the mechanical power to heat.

2. In the case of the process:

- A self-contained portable heating system that brings the fluid (liquid or air) to be heated, into the exhaust heat exchanger first where the fluid is coldest so that a greater percent of heat is reclaimed from the engine exhaust stream. Heat from the engine coolant, charge cooler, and engine-generator compartment radiation losses are typically 100% reclaimed by ordinary means.
- Said system utilizes a control system where the speed of the engine and the electrical load of the generator are set based on current energy required as calculated from the temperature and mass flow of the fluid stream to be heated.