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PORTABLE HEATER

Filed Aug. 19, 1957

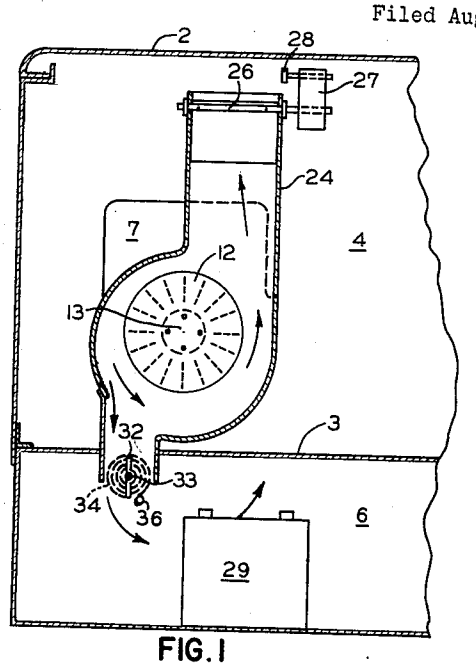


FIG. 1

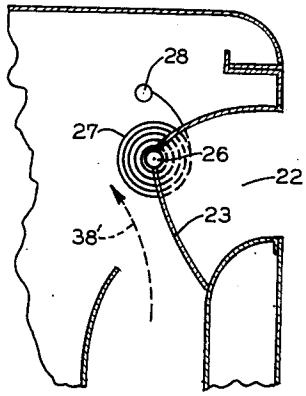


FIG. 3

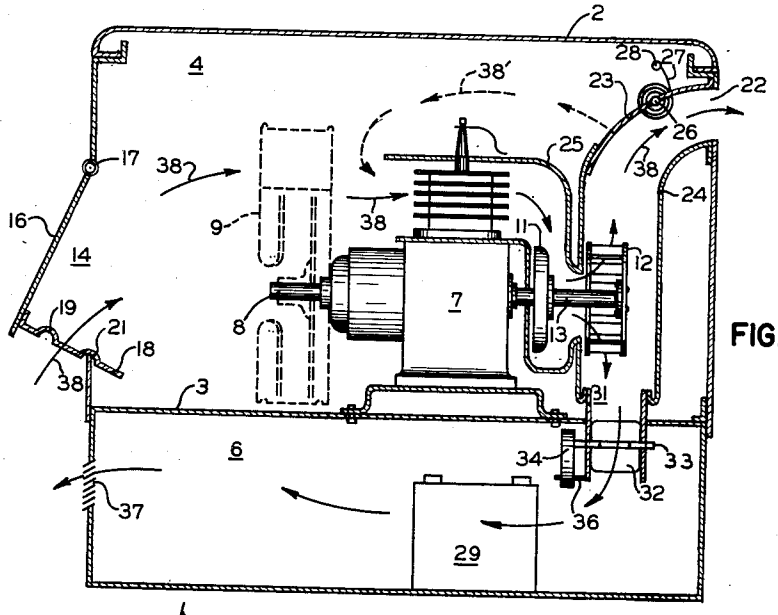


FIG. 2

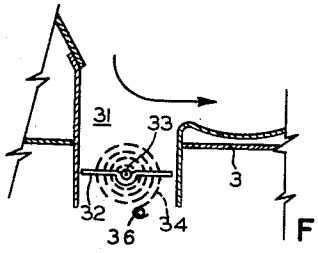


FIG. 4

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PORTABLE HEATER

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This invention relates to an improvement for portable heaters and more particularly to a temperature control system for the prime mover and other select parts of portable heaters of the type used for aircraft ground support.

In operating the prime mover of a portable ground support heater in extremely low temperatures, such as those encountered under arctic conditions, carburetor troubles occur due to the accumulation of rime ice in the carburetor, such ice accumulation being brought about by the low ambient temperatures and by the refrigerating effect of evaporating gasoline. In addition, frozen moisture accumulates in the crankcase lubricating oil, resulting in lubrication difficulties. To avoid these difficulties in the carburetor and crankcase lubrication system, complex and elaborate means requiring specially designed structure have been employed in the past. Such structure has been expensive in construction and maintenance and has increased further the weight of the portable heaters.

The present invention provides a straightforward, economical structure for controlling the temperature of the air surrounding the prime mover to thereby avoid the aforementioned carburetor and lubricating system difficulties of the past and to reduce the overall weight and maintenance problems concomitant with past structures. In addition, the present invention provides an economical and straightforward structure for sustaining the temperature level of other select parts of portable ground heaters, such as the storage battery which aids in the initial start of the prime mover.

Various other features of the present invention will become obvious to one skilled in the art upon reading the disclosure set forth hereinafter.

More particularly, the present invention provides, in a portable ground heater having a ventilating air blower, an engine-generator prime mover therefor and a storage battery for initially starting such prime mover, a temperature control system for the prime mover and battery comprising a housing means forming a first compartment for the prime mover and a second compartment communicating with the first compartment for the battery, spaced air inlet and outlet means in the housing, fan means to induce air flow through the compartment between the air inlet and the air outlet means, air flow control means to control air flow through each of the first and second compartments, and temperature responsive regulating means connected to the air flow control means and responsive to the temperatures within the compartments to regulate the air flow control means.

It is to be understood that various modifications and changes can be made by one skilled in the art in the several parts of the structure disclosed herein without departing from the scope or spirit of this invention.

Referring to the drawings:

FIGURE 1 is a schematic end elevational view of the inventive temperature control system for a prime mover and battery of a portable ground heater;

FIGURE 2 is a schematic side elevational view of the control system of FIGURE 1;

FIGURE 3 is an enlarged schematic view of the air outlet structure in the system of FIGURE 2, the damper being in a modified position;

FIGURE 4 is a schematic view of the damper structure of FIGURE 2 positioned between the first and second compartments of the housing, the damper being in closed position.

As is conventional in portable ground support heaters, the heater unit is provided with an engine-generator which is used to drive a large ventilating air blower and which serves to furnish auxiliary power to a variety of units. Since the units which the engine-generator serves are conventional in the art and do not comprise an essential part of the present invention, only the large ventilating air blower is set forth schematically in the present disclosure.

Referring to the drawings, a housing 2 is disclosed, the housing having positioned across its lower portion a transverse partition 3. This partition 3 separates the housing into an upper compartment 4 and a lower compartment 6.

Positioned in the upper compartment 4, is the engine-generator 7. Engine-generator 7 serves as the prime mover for the overall heater unit and has connected to its engine drive shaft 8 a large ventilating air blower 9. It is to be noted that the air blower 9 is disclosed in the drawings (FIGURE 2) by broken lines since it is not generally positioned in the upper compartment 4, but is advantageously positioned in a separate compartment not shown in detail in the drawings. Connected to the other end of the engine drive shaft 8 is the flywheel 11, which flywheel is located in compartment 4. Flywheel 11 has a conventional induction fan 12 secured thereto by means of a spool piece 13, the fan 12 being disposed in a duct 24 described hereinafter.

The housing 2 is provided with an air inlet 14 which opens into the upper compartment 4. Air inlet 14 is of sufficient size to permit free entrance of the proper amount of cooling air into the compartment 4 when the heater unit is operated at high ambient temperatures; however, when operating the heater unit at low ambient temperatures, inlet 14 is excessive and the amount of air which would enter through inlet 14 would cause some dilution of the compartment heating air. Therefore, inlet 14 is provided with inlet regulating means in the form of a movable door 16 hinged at its upper end to housing 2 by hinge member 17. At the lower end of door 16, a hold-open latch 18 is provided. Hold-open latch 18 is provided with two spaced notches 19 and 21 to permit regulation of the size of inlet 14. Thus, when operating the heater unit at extremely low ambient temperatures, it is only necessary to open door 16 to the position described by notch 19. When operating the unit at higher ambient temperatures, door 16 can be opened to the position indicated by notch 21.

As above mentioned, an engine-generator if designed to operate under arctic conditions, would have had rather elaborate means in the past for sustaining carburetor air inlet temperatures well above the freezing point and for heating the engine lubricant to prevent the lubricant from reaching temperatures low enough to freeze the condensation appearing therein. The present invention, recognizing that a major portion of the heat dissipated from a gasoline engine appears in the engine cooling air, utilizes such air which has been raised in temperature by such dissipated heat to accomplish the same purpose accomplished by the complex structure of the past. The present invention accomplishes this by altering the amount of air surrounding the engine-generator or, more specifically, by recirculating air through a compartment surrounding the engine-generator which air cannot be discharged from such compartment.

This is accomplished by positioning a damper unit 23 adjacent an air outlet 22, which outlet is spaced from air inlet 14 in the wall of housing 2 so as to also communicate with compartment 4. Specifically, damper unit 23 is positioned in the elbowed wall portion of a discharge duct 24. The discharge duct 24 has one end communicating

with a shroud 25, which shroud surrounds the engine cylinder of engine-generator 7, and the other end of the duct communicates with air outlet 22. Damper 23 is secured to a simple rotatable axle 26 which projects beyond the wall of the aforementioned elbow in duct 24. A bi-metal actuator 27 is fastened to axle 26, the outer end of the bi-metal actuator 27 being secured to the housing structure and prevented from movement by a pin 28. It is to be understood that the actuator can be of the conventional metal type made up of two helically disposed metals welded together, the metals having substantially dissimilar rates of thermo-expansion so that when heat is applied thereto the metal will warp. Since the bi-metal actuator is in the form of a jelly-roll type of helix, the inner end can be caused to impart a rotating motion to axle 26 and to damper 23 secured thereto. It also is to be understood that actuator 27 can be secured to axle 26 in such a manner as to cause damper 23 to remain in a "duct open" position at temperatures between 60° F. and 70° F., or at any other preselected temperature range desired, to permit free passage of air through duct 24 and outlet 22. As the temperature within compartment 4 in which the actuaor 27 is positioned falls below a specific temperature range selected, the diverting damper 23 in duct 24 progressively rotates counterclockwise toward a "duct closed" position, increasing the amount of air to be diverted, or recirculated, back into engine compartment 4. At temperatures above 60° to 70° F. the damper remains in a "duct open" position so as to be held tightly against the wall of duct 24 and all the engine cooling air is ejected through air outlet 22.

In order to aid the initial starting of engine-generator 7, a storage battery 29 is provided. Since portable ground support heaters are designed to be as compact as possible, space does not always permit the location of the storage battery in the compartment 4 as would be the most desirable. Therefore, it has been found advantageous to have a separate battery compartment 6. With the battery positioned outside of compartment 4, however, the problem arises as to how to maintain the battery temperature at a level which will produce current therefrom during low ambient temperature operation, it being well known that batteries fail rapidly in their ability to generate electricity at temperatures much below −20° F. Therefore, in order to sustain a proper operating temperature level of the air surrounding the storage battery, the present invention provides for a structure which diverts air from the compartment 4 for the engine-generator into the compartment 6 in which storage battery 29 is positioned. To accomplish this, a passage 31 is provided in the partition 3, passage 31 communicating with compartment 6 and duct 24 aforedescribed. In an arrangement similar to that used with damper 23, a damper 32 is positioned in passage 31 to control the air volume into compartment 6. More specifically, damper 32 is secured to rotatable axle 33, the outer end of which axle is rotated by a bi-metal actuator 34. Actuator 34 is secured to the housing structure at its outer end by support pin 36. Simple exhaust vents 37 are provided in the wall of battery compartment 6 to dissipate the air entering the compartment.

In a typical operation of the abovedescribed structure, air enters the engine-generator compartment 4 through air inlet 14, movable door 16 being adjusted on one of two notches 19 or 21 of the hold-open latch 18 depending upon the prevailing ambient temperature. In this connection, it is to be noted that solid line arrows 38 of FIGURE 2 describe the path of flow of the incoming air. Referring to these arrows, it can be seen that fan 12 draws the air across the engine cylinder which is surrounded by shroud 25. The air is confined by the shroud, raised in temperature by the dissipated heat from the engine-generator, and directed to the fan 12. From there it proceeds through duct 24 and out of the cabinet through discharge opening 22 if damper 23 is in "duct open" position. In this connection, it is to be noted that some of the air passes down into the lower compartment 6 through passage 31 if damper 32 is in "duct open" position. The amount of air passing through discharge opening 22 and through passage 31 is dependent upon the position of the dampers 23 and 32, respectively, in these openings and the position of these dampers is dependent upon the ambient temperatures surrounding their respective bi-metal actuators. In this connection, it is to be noted that when damper 23 is in "duct closed" position, as shown in FIGURE 3, the air is recirculated as indicated by the broken line arrows 38' (FIGURES 2 and 3) to pass into the shroud 25 and around the engine cylinder.

With the arrangement described above, it is now possible to utilize the warm air passing over the engine to sustain proper carburetor induction air temperatures and crank case oil temperatures for portable heater units operating at extremely low ambient temperatures. Thus, past problems which have required complex and detailed structure now have been avoided in a simple and straightforward manner by structure which operates efficiently and effectively with a minimum of cost and maintenance.

The invention claimed is:

1. In portable housing apparatus having an engine-generator prime mover and a storage battery for initially starting said prime mover, an improved housing arrangement to permit selected temperature control for said prime mover and said battery comprising a first compartment in said housing for said prime mover, a second compartment in said housing communicating with said first compartment for said battery, spaced air inlet and outlet means in said housing, fan means to induce air to flow through said compartments between said air inlet and said air outlet means, air flow control means to control air flow through each of said first and second compartments, and temperature responsive regulating means connected to said air flow control means and responsive to the temperatures within said compartments to regulate said air flow control means.

2. In portable housing apparatus having a prime mover, an improved housing arrangement to permit selected temperature control for said prime mover comprising a separate compartment for said prime mover, said compartment having spaced air inlet and outlet means, fan means to induce air to flow through said compartment between said air inlet and said air outlet means, air flow control means including recirculating means to control air flow through said compartment, and temperature responsive regulating means connected to said air flow control means and responsive to the temperature within said compartment to regulate said air flow control means and thus the temperature within said compartment.

3. In portable housing apparatus having a prime mover disposed therein, an improved housing arrangement comprising a separate compartment surrounding said prime mover, said compartment having spaced air inlet and outlet means, fan means positioned within said compartment between said air inlet and said air outlet means to induce air to flow therebetween, air flow control means including recirculating means cooperating with said outlet means in said compartment to control air flow through said compartment, and temperature responsive regulating means connected to said air flow control means and responsive to the temperature within said compartment to regulate said air flow control means and thus the temperature within said compartment.

4. In portable housing apparatus having a prime mover disposed therein, an improved housing arrangement comprising a separate compartment surrounding said prime mover, said compartment having an air inlet and an air outlet spaced therefrom, an open end shroud member disposed within said compartment and surrounding a portion of said prime mover, one end of said shroud member communicating with said air inlet of said compartment, a duct connecting the other end of said shroud member to said air outlet, an induction fan positioned in said duct,

said induction fan being connected to said prime mover for power, a rotatable damper member in said duct between said fan and said air outlet, and a temperature responsive bi-metal actuator connected to said damper to rotate said damper in accordance with temperatures in said compartment.

5. In portable housing apparatus having an engine-generator prime mover and a storage battery for initially starting said prime mover, an improved housing arrangement comprising a first compartment for said prime mover and a second compartment for said battery, a passage for communicably connecting said first and second compartments, an adjustable air inlet and an air outlet spaced therefrom in said first compartment, a second air outlet in said second compartment, an open end shroud member disposed within said first compartment and surrounding a portion of said engine-generator, one end of said shroud communicating with said adjustable air inlet of said first compartment, a duct connecting the other end of said shroud to said air outlet of said first compartment and to said passage between said first and second compartments, an induction fan positioned in said duct, said fan being connected to said engine for power, a first rotatable damper in said duct between said fan and said air outlet of said first compartment, a first temperature responsive

bi-metal actuator positioned in said first compartment and connected to said first damper to rotate said damper in accordance with temperatures in said first compartment, a second rotatable damper positioned in said passage between said first and second compartments, and a second temperature responsive bi-metal actuator positioned in said second compartment and connected to said second damper to rotate said second damper in accordance with temperatures in said second compartment.

References Cited in the file of this patent

UNITED STATES PATENTS

1,778,036	Noble et al.	Oct. 14, 1930
1,834,958	Martin	Dec. 8, 1931
2,273,502	Couse	Feb. 17, 1942
2,355,208	Devol et al.	Aug. 8, 1944
2,396,657	Holthouse	Mar. 19, 1946
2,405,145	Holthouse	Aug. 6, 1946
2,410,353	McCollum	Oct. 29, 1946
2,630,537	Wiegman et al.	Mar. 3, 1953
2,789,234	Lambert et al.	Apr. 16, 1957
2,799,782	Armstrong et al.	July 16, 1957

FOREIGN PATENTS

678,343	Great Britain	Sept. 3, 1952