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(54) INTEGRATED TRANSPORT REFRIGERATION UNIT

INTEGRIERTE TRANSPORTKÜHLEINHEIT

GROUPE FRIGORIFIQUE DE TRANSPORT INTÉGRÉ

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US-A- 5 857 348

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Description

BACKGROUND OF THE INVENTION

[0001] In today's world, a wide variety of goods are transported via trucks, trailers and other mobile containers. Often, it is necessary to control the environment within such mobile containers. For example, it is often desirable to control the temperature and or humidity within a container. It may also be advantageous to provide for circulation the air within a container, to exchange air within a container with ambient air from outside, or to introduce other gases such as ozone, carbon dioxide, or nitrogen into a shipping container so as to maintain a desired environment within the container.

[0002] To meet these desires, mobile containers typically make use of a transport refrigeration unit, which may be attached to a mobile container. Typically transport refrigeration units include a power source, such as a diesel engine. They also include a refrigerant loop that includes a compressor for circulating refrigerant through an evaporator and a condenser and one or more blowers for circulating air into and within the container and for facilitating exchange of heat with the refrigerant loop. A generator is often included to produce electricity to power the fans, and in some cases, a battery is also included for storing energy to enable the fans to operate when the diesel engine is not operating.

[0003] There is a need for a transport refrigeration unit with reduced fuel consumption, reduced ownership cost, and decreased size.

BRIEF DESCRIPTION OF THE INVENTION

[0004] An integrated transport refrigeration unit comprises an engine providing power to drive a shaft. The shaft drives a refrigerant compressor and a generator, both of which are encased within a housing, and the generator is immersed in refrigerant. In an exemplary embodiment, an integrated transport refrigeration unit also includes an auxiliary generator driven by the shaft and disposed externally from the housing. In this embodiment, the auxiliary generator produces current for charging a battery and for operating a fan.

[0005] EP 1 834 818 A2 shows a transport refrigeration unit of the type configured to be mounted on the front wall of a transport trailer, comprising a compressor, a condenser heat exchanger, an evaporator heat exchanger, at least one fan assembly having at least one electric fan motor configured to provide air flow over one of the heat exchangers, and an integrally mounted unitary engine driven generator assembly configured to selectively produce at least one A.C. voltage at one or more frequencies. The generator assembly is capable of producing sufficient power to operate the compressor drive motor and the at least one fan motor. In a preferred embodiment, the generator assembly is a synchronous generator and the compressor drive motor and the at least one

fan motor are configured to be directly coupled to the generator and to operate at a voltage and frequency produced by the synchronous generator.

[0006] Further embodiments of the invention are disclosed in the following, numbered paragraphs:

1. An integrated transport refrigeration unit comprising an engine providing power to drive a shaft, a refrigerant compressor driven by the shaft, and an integrated generator driven by the shaft, wherein both the compressor and the integrated generator are encased within a housing, and wherein the integrated generator is immersed in refrigerant.

2. An integrated transport refrigeration unit as described in paragraph 1, further comprising an auxiliary generator driven by the shaft and positioned externally from said housing, the auxiliary generator producing current for charging a battery and for operating a fan.

3. An integrated transport refrigeration unit as described in paragraph 1, wherein the integrated generator is disposed between the engine and the compressor.

4. An integrated transport refrigeration unit as described in paragraph 1, wherein the compressor is disposed between the engine and the integrated generator.

5. An integrated transport refrigeration unit as described in paragraph 1, wherein the engine is an internal combustion engine.

6. An integrated transport refrigeration unit as described in paragraph 1, wherein the compressor is directly coupled to the shaft.

7. An integrated transport refrigeration unit as described in paragraph 1, wherein the shaft is magnetically driven.

8. An integrated transport refrigeration unit as described in paragraph 1, further comprising a plurality of permanent magnets fixed to the shaft within the housing and windings disposed around the permanent magnets so as to generate an electrical current when the shaft rotates.

9. An integrated transport refrigeration unit as described in paragraph 1, further comprising an induction generator disposed on the drive shaft, wherein an alternating current is induced as a consequence of the rotation of the shaft.

10. An integrated transport refrigeration unit as described in paragraph 1, further comprising an auxil-

ary generator that is positioned externally from said housing and that is driven by a belt driven by the shaft.

11. An integrated transport refrigeration unit as described in paragraph 10, wherein the auxiliary generator produces current for charging a battery, wherein the battery is coupled to a control box, wherein the control box is configured to provide power to drive a fan.

12. An integrated transport refrigeration unit as described in paragraph 11, wherein the control box comprises an inverter for converting direct current to alternating current at a voltage suitable for operating the fan.

13. An integrated transport refrigeration unit as described in paragraph 11, wherein the control box is configured to receive a signal from a transportable container and to operate the fan based on the signal.

14. An integrated transport refrigeration unit as described in paragraph 11, wherein the control box is configured to command the engine to operate so as to cause the auxiliary generator to provide power to charge the battery.

15. An integrated transport refrigeration unit as described in paragraph 11, wherein the control box is configured to command the engine to operate so as to cause the compressor to provide cooling by pumping refrigerant through a set of refrigeration cycle components.

16. An integrated transport refrigeration unit as described in paragraph 1, wherein the integrated generator is configured to produce power to operate a fan.

17. An integrated transport refrigeration unit as described in paragraph 1, further comprising one or more direct-current fans and one or more alternating-current fans.

18. An integrated transport refrigeration unit as described in paragraph 11, wherein the control box provides power to a power converter, and wherein the power converter provides a direct current at a voltage suitable for operating an evaporator fan.

19. An integrated transport refrigeration unit as described in paragraph 1, wherein the integrated generator is configured to produce a high-voltage current suitable to charge a high-voltage battery pack.

BRIEF DESCRIPTION OF THE DRAWINGS

[0007] The subject matter which is regarded as the invention is particularly pointed out and distinctly claimed in the claims at the conclusion of the specification. The foregoing and other features, and advantages of the invention are apparent from the following detailed description taken in conjunction with the accompanying drawings in which:

FIG. 1 is a perspective drawing of an integrated transport refrigeration unit with an immersed generator disposed between the engine and the compressor;

FIG. 2 is a perspective drawing of an integrated transport refrigeration unit with a compressor disposed between the engine and the immersed generator;

FIG. 3 is a schematic diagram showing an exemplary integrated transport refrigeration unit with a high-voltage, alternating-current fan;

FIG. 4 is a schematic diagram showing an exemplary integrated transport refrigeration unit with a combination of direct-current and alternating-current fans; and

FIG. 5 is a schematic diagram showing an exemplary integrated transport refrigeration unit with a combination of direct-current and alternating-current fans and an integrated, high-voltage battery pack.

DETAILED DESCRIPTION OF THE INVENTION

[0008] With reference to the drawings, FIG. 1 is a perspective drawing of an integrated transport refrigeration unit 100 with an immersed generator 110 disposed between an engine 120 and a compressor 130. In accordance with this embodiment, engine 120 is an internal combustion engine, such as a diesel or gasoline engine, and drives an output shaft (not shown), to which immersed generator 110 and compressor 130 are directly coupled. The drive shaft may be open to the atmosphere or it may be magnetically driven. Housing 140 encases both compressor 130 and immersed generator 110 and seals a volume of refrigerant within housing 140. Refrigerant inlet 150 carries refrigerant to housing 140 for uptake and re-compression by compressor 130, and refrigerant outlet 160 delivers re-compressed refrigerant to a high pressure coolant line for expansion in an evaporator (not shown).

[0009] Within housing 140, both compressor 130 and generator 110 are immersed in low-pressure refrigerant that has been returned to housing 140 via refrigerant inlet 150. Being immersed, compressor 130 and generator 110 are cooled by the refrigerant. It should be noted that

housing 140 is sealed so as to retain refrigerant, and generator 110 is constructed using magnet wire or another wire suitable for immersion in refrigerant. In an exemplary embodiment, a single shaft is driven by engine 120, and permanent magnets are fixed to the shaft. Windings are disposed within housing 140 and around the permanent magnets. As the shaft is rotated by the engine, current is generated in the windings. In another exemplary embodiment, an induction generator is disposed on the drive shaft wherein an alternating current is induced as a consequence of the rotation of the shaft. In both cases, compressor 130 is also driven by the shaft, and comprises a series of pistons cycled by the rotation of the shaft. As a result of the incorporation of the generator within the housing, the transport refrigeration unit may be made more compact as space is no longer required to position a generator on an auxiliary shaft. In addition, the generator can be made smaller due to decreased need to entrain air to cool the generator.

[0010] FIG. 2 is a perspective drawing of an integrated transport refrigeration unit 200 with a compressor 230 disposed between the engine 220 and the immersed generator 210. Accordingly, generator 210 is outboard of compressor 230. As with the transport refrigeration unit of FIG. 1, generator 210 and compressor 230 are directly coupled to the output of engine 220. Housing 240 surrounds compressor 230 and immersed generator 210 and seals a volume of refrigerant within housing 240. Refrigerant is reserved within housing 240 for uptake and re-compression by compressor 230, and both compressor 230 and generator 210 are immersed in low-pressure refrigerant that has been returned to housing 240. Thus, compressor 230 and generator 210 are cooled by the refrigerant. Also, housing 240 is sealed to retain refrigerant, and generator 210 is constructed for immersion in refrigerant. As with the embodiment shown in FIG. 1, the incorporation of the generator within the housing enables the transport refrigeration unit to be made more compact as space is no longer required to position a generator on an auxiliary shaft. In addition, the generator can be made

relatively smaller due to decreased need to entrain air to cool the generator.

[0011] FIG. 3 is a schematic diagram showing an integrated transport refrigeration unit 300 according to the present invention. In this embodiment, engine 320 drives integrated compressor/generator unit 310 with a single shaft 330. Integrated compressor/generator unit 310 is sealed within a single housing (not shown in FIG. 3) that also serves as a low pressure reservoir for refrigerant that is returned to the compressor after the refrigerant has flowed through a typical refrigeration cycle such as having passed through a condenser and an evaporator for extracting heat from a cooled space. In this embodiment, shaft 330 also drives an auxiliary generator 340 using belt 350 or other means for extracting power from shaft 330. The auxiliary generator 340 is disposed externally from the single housing that serves as a low pressure reservoir for refrigerant returned to the compressor.

In an exemplary embodiment, auxiliary generator 340 is an alternator coupled with a rectifier (i.e., a DC alternator) so as to produce DC current for charging unit battery 360 and current may also be made directly available to control box 370. Control box 370 may draw electrical current directly from battery 360 when engine 320 is not operating or may draw power from auxiliary generator 340 when engine 320 is operating. Control box 370 includes an inverter (not shown) for converting DC current to alternating current at a voltage suitable for operating at least one fan 380, which provides ventilation, circulation, heat transfer for a transportable container.

[0012] In operation, control box 370 may receive indications from the transportable container to determine whether and how to operate fan 380 and/or compressor 310. When it is desirable to operate fan 380, control box 370 may draw power from battery 360 so long as it retains adequate charge. When a state of charge in battery 360 is insufficient to operate fan 380, control box 370 may command engine 320 to operate so as to provide power via compressor/generator 310 and to re-charge unit battery 360. Similarly, when it is desirable to provide cooling to the transportable container, control box 370 may command engine 320 to operate so as to provide cooling by pumping refrigerant through its refrigeration cycle components. While engine 320 is operating, compressor/generator 310 produces power to operate fan 380, and alternator 340 produces power to charge battery 360.

[0013] FIG. 4 is a schematic diagram showing an exemplary integrated transport refrigeration unit 400 with a combination of direct-current and alternating-current fans. In this embodiment, engine 420 drives integrated compressor/generator unit 410 with a single shaft 430. Integrated compressor/generator unit 410 is sealed within a single housing (not shown) that also serves as a low pressure reservoir for refrigerant that is returned to the compressor after the refrigerant has flowed through a typical refrigeration cycle such as having passed through a condenser and an evaporator for extracting heat from a cooled space. In this embodiment, shaft 430 also drives auxiliary generator 440 using belt 450 or other means for extracting power from shaft 430. Auxiliary generator 440 may include an alternator coupled to a rectifier for producing DC current (i.e., a DC alternator) for charging unit battery 460 and current may also be made directly available to control box 470. Control box 470 may draw electrical current directly from battery 460 when engine 420 is not operating or may draw power from auxiliary generator 440 when engine 420 is operating. Control box 470 includes an inverter (not shown) for converting DC current to alternating current at a voltage suitable for operating condenser fans 480, which provide heat transfer for a transportable container. Control box 470 also provides power to converter 490 for providing DC current at a voltage suitable for operating evaporator fans 495, which provide heat transfer for a transportable container.

[0014] Accordingly, this embodiment enables power to be delivered in various forms to drive different compo-

nents. This can be useful in mobile refrigeration applications such as where it may be advantageous to employ direct current power to drive evaporator components, while it may be preferable to employ alternating current power to drive condenser components. Alternating current produced by the compressor/generator can be used to drive the condenser fan, while the auxiliary generator may be configured to provide DC power to drive the evaporator fan. Accordingly, this embodiment may be configured so as to eliminate any need for a separate rectifier device, thereby saving unit volume, weight, and cost.

[0015] FIG. 5 is a schematic diagram showing an exemplary integrated transport refrigeration unit 500 with a combination of direct-current and alternating-current fans and an integrated high voltage battery pack. In this embodiment, engine 520 drives integrated compressor/generator unit 510 with a single shaft 530. Integrated compressor/generator unit 510 is sealed within a single housing (not shown) that also serves as a low pressure reservoir for refrigerant that is returned to the compressor following its having flowed through a typical refrigeration cycle such as having passed through a condenser and an evaporator for extracting heat from a cooled space. In this embodiment, shaft 530 also drives auxiliary generator 540 using belt 550 or other means for extracting power from shaft 530. Auxiliary generator 540 produces DC current for charging unit battery 560 and current may also be made directly available to control box 570. In addition, compressor/generator 510 produces high voltage current for use by a battery pack charger 512 to charge high voltage battery pack 514. Power stored in high voltage battery pack 514 can then be used by control box 570.

[0016] Control box 570 may draw electrical current directly from battery 560 or from high voltage battery pack 514 when engine 520 is not operating. In an exemplary embodiment, high voltage battery pack may be a commercial battery pack that generates approximately 600 volts. When engine 520 is driving the system, control box 570 may also draw power from auxiliary generator 540 or from compressor/generator 510, which is configured to produce high voltage current. Control box 570 provides power to AC/DC converter 580, which produces power or current at a sufficiently high voltage to drive high-voltage, direct-current fans 590. When engine 520 is not operating, power from high voltage battery pack 514 may be used to drive compressor 510.

[0017] While the invention has been described in detail in connection with only a limited number of embodiments, it should be readily understood that the invention is not limited to such disclosed embodiments. Rather, the invention can be modified to incorporate any number of variations, alterations, substitutions or equivalent arrangements not heretofore described, but which are commensurate with the spirit and scope of the invention. Additionally, while various embodiments of the invention have been described, it is to be understood that aspects of the invention may include only some of the described

embodiments. Accordingly, the invention is not to be seen as limited by the foregoing description, but is only limited by the scope of the appended claims.

Claims

1. An integrated transport refrigeration unit (100) comprising an engine (120) providing power to drive a shaft, a refrigerant compressor (130) driven by the shaft, and an integrated generator (110) driven by the shaft, wherein both the compressor (130) and the integrated generator (110) are encased within a housing (140), and **characterized in that** the integrated generator (110) is immersed in refrigerant; and an auxiliary generator (340) is provided that is positioned externally from said housing and that is driven by a belt driven (350) by the shaft (330).
2. An integrated transport refrigeration unit (100) as described in claim 1, further comprising an auxiliary generator (440) driven by the shaft (430) and positioned externally from said housing, the auxiliary generator (440) producing current for charging a battery (460) and for operating a fan (495).
3. An integrated transport refrigeration unit (100) as described in claim 1, wherein the integrated generator (110) is disposed between the engine (120) and the compressor (130).
4. An integrated transport refrigeration unit as described in claim 1, wherein the compressor is disposed between the engine and the integrated generator.
5. An integrated transport refrigeration unit (100) as described in claim 1, wherein the engine (120) is an internal combustion engine.
6. An integrated transport refrigeration unit (100) as described in claim 1, wherein the compressor is directly coupled to the shaft.
7. An integrated transport refrigeration unit (100) as described in claim 1, wherein the shaft is magnetically driven.
8. An integrated transport refrigeration unit (100) as described in claim 1, further comprising a plurality of permanent magnets fixed to the shaft within the housing and windings disposed around the permanent magnets so as to generate an electrical current when the shaft rotates,

9. An integrated transport refrigeration unit (100) as described in claim 1, further comprising an induction generator disposed on the drive shaft, wherein an alternating current is induced as a consequence of the rotation of the shaft (430). 5
10. An integrated transport refrigeration unit (100) as described in claim 1, wherein the auxiliary generator (440) produces current for charging a battery, wherein the battery is coupled to a control box, wherein the control box is configured to provide power to drive a fan. 10
11. An integrated transport refrigeration unit (100) as described in claim 10, wherein the control box (470) comprises an inverter for converting direct current to alternating current at a voltage suitable for operating the fan; or 15
wherein the control box (470) is configured to receive a signal from a transportable container and to operate the fan based on the signal or to command the engine to operate so as to cause the auxiliary generator (440) to provide power to charge the battery. 20
12. An integrated transport refrigeration unit (100) as described in claim 10, wherein the control box (470) is configured to command the engine to operate so as to cause the compressor to provide cooling by pumping refrigerant through a set of refrigeration cycle components. 25
13. An integrated transport refrigeration unit (100) as described in claim 1, wherein the integrated generator (120) is configured to produce power to operate a fan; or 30
wherein the integrated generator (120) is configured to produce a high-voltage current suitable to charge a high-voltage battery pack. 35
14. An integrated transport refrigeration unit (100) as described in claim 1, further comprising one or more direct-current fans and one or more alternating-current fans. 40
15. An integrated transport refrigeration unit (100) as described in claim 10, wherein the control box (470) provides power to a power converter, and wherein the power converter provides a direct current at a voltage suitable for operating an evaporator fan. 45

Patentansprüche

1. Integrierte Transportkühleinheit (100), umfassend einen Motor (120), der Leistung zum Antrieb einer Welle bereitstellt, 55
einen Kältemittelverdichter (130), der von der Welle angetrieben wird, und

einen integrierten Generator (110), der von der Welle angetrieben wird, wobei sowohl der Verdichter (130) als auch der integrierte Generator (110) in einem Gehäuse (140) aufgenommen sind, und

dadurch gekennzeichnet, dass

der integrierte Generator (110) in Kältemittel getaucht ist; und
ein Hilfsgenerator (340) vorgesehen ist, der außerhalb des Gehäuses positioniert ist und von einem Riemen (350) angetrieben wird, der von der Welle (330) angetrieben wird.

2. Integrierte Transportkühleinheit (100) nach Anspruch 1, ferner umfassend einen Hilfsgenerator (440), der von der Welle (430) angetrieben wird und außerhalb des Gehäuses positioniert ist, wobei der Hilfsgenerator (440) Strom für das Aufladen einer Batterie (460) und für das Betreiben eines Lüfters (495) produziert.
3. Integrierte Transportkühleinheit (100) nach Anspruch 1, wobei der integrierte Generator (110) zwischen dem Motor (120) und dem Verdichter (130) angeordnet ist.
4. Integrierte Transportkühleinheit nach Anspruch 1, wobei der Verdichter zwischen dem Motor und dem integrierten Generator angeordnet ist.
5. Integrierte Transportkühleinheit (100) nach Anspruch 1, wobei der Motor (120) ein interner Verbrennungsmotor ist.
6. Integrierte Transportkühleinheit (100) nach Anspruch 1, wobei der Verdichter direkt an die Welle gekoppelt ist.
7. Integrierte Transportkühleinheit (100) nach Anspruch 1, wobei die Welle magnetisch angetrieben ist.
8. Integrierte Transportkühleinheit (100) nach Anspruch 1, ferner umfassend eine Vielzahl von Permanentmagneten, die an der Welle innerhalb des Gehäuses befestigt sind, und Wicklungen, die um die Permanentmagnete herum angeordnet sind, so dass sie einen elektrischen Strom erzeugen, wenn die Welle rotiert.
9. Integrierte Transportkühleinheit (100) nach Anspruch 1, ferner umfassend einen Induktionsgenerator, der an der Antriebswelle angeordnet ist, wobei infolge der Rotation der Welle (430) ein Wechselstrom induziert wird.
10. Integrierte Transportkühleinheit (100) nach Anspruch 1, wobei der Hilfsgenerator (440) Strom für das Aufladen einer Batterie produziert, wobei die

Batterie an ein Steuergerät gekoppelt ist, wobei das Steuergerät konfiguriert ist, um Leistung zum Antreiben eines Lüfters bereitzustellen.

11. Integrierte Transportkühleinheit (100) nach Anspruch 10, wobei das Steuergerät (470) einen Wechselrichter zur Umwandlung von Gleichstrom in Wechselstrom bei einer Spannung, die zum Betrieb des Lüfters geeignet ist, umfasst; oder wobei das Steuergerät (470) konfiguriert ist, um ein Signal von einem transportablen Behälter zu empfangen und um den Lüfter basierend auf dem Signal zu betreiben oder um dem Motor zu befehlen, so zu arbeiten, dass er den Hilfsgenerator (440) veranlasst, Leistung zum Aufladen der Batterie bereitzustellen.
12. Integrierte Transportkühleinheit (100) nach Anspruch 10, wobei das Steuergerät (470) konfiguriert ist, um dem Motor zu befehlen, so zu arbeiten, dass er den Verdichter veranlasst, Kühlung bereitzustellen, indem er Kältemittel durch einen Satz von Kühlkreislaufkomponenten pumpt.
13. Integrierte Transportkühleinheit (100) nach Anspruch 1, wobei der integrierte Generator (120) konfiguriert ist, um Leistung zum Betreiben eines Lüfters zu produzieren; oder wobei der integrierte Generator (120) konfiguriert ist, um einen Hochspannungsstrom zu produzieren, der geeignet ist, ein Hochspannungsbatteriepaket aufzuladen.
14. Integrierte Transportkühleinheit (100) nach Anspruch 1, ferner umfassend einen oder mehrere Gleichstromlüfter und einen oder mehrere Wechselstromlüfter.
15. Integrierte Transportkühleinheit (100) nach Anspruch 10, wobei das Steuergerät (470) einem Stromrichter Leistung bereitstellt, und wobei der Stromrichter einen Gleichstrom bei einer Spannung, die zum Betreiben eines Verdampferlüfters geeignet ist, bereitstellt.

Revendications

1. Groupe frigorifique de transport intégré (100) comprenant
un moteur (120) alimentant un arbre de transmission,
un compresseur de réfrigérant (130) entraîné par l'arbre, et
un générateur intégré (110) entraîné par l'arbre, dans lequel à la fois le compresseur (130) et le générateur intégré (110) sont enfermés à l'inté-

rieur d'un boîtier (140), et

caractérisé en ce que

le générateur intégré (110) est immergé dans le réfrigérant ; et

un générateur auxiliaire (340) est fourni qui est positionné à l'extérieur par rapport audit boîtier et qui est entraîné par une courroie (350) entraînée par l'arbre (330).

2. Groupe frigorifique de transport intégré (100) selon la revendication 1, comprenant également un générateur auxiliaire (440) entraîné par l'arbre (430) et positionné à l'extérieur par rapport audit boîtier, le générateur auxiliaire (440) produisant un courant pour charger une batterie (460) et pour faire fonctionner un ventilateur (495).
3. Groupe frigorifique de transport intégré (100) selon la revendication 1, dans lequel le générateur intégré (110) est placé entre le moteur (120) et le compresseur (130).
4. Groupe frigorifique de transport intégré selon la revendication 1, dans lequel le compresseur est placé entre le moteur et le générateur intégré.
5. Groupe frigorifique de transport intégré (100) selon la revendication 1, dans lequel le moteur (120) est un moteur à combustion interne.
6. Groupe frigorifique de transport intégré (100) selon la revendication 1, dans lequel le compresseur est directement couplé à l'arbre.
7. Groupe frigorifique de transport intégré (100) selon la revendication 1, dans lequel l'arbre est à entraînement magnétique.
8. Groupe frigorifique de transport intégré (100) selon la revendication 1, comprenant également une pluralité d'aimants permanents fixés à l'arbre à l'intérieur du boîtier et des enroulements placés autour des aimants permanents de sorte à générer un courant électrique lorsque l'arbre pivote.
9. Groupe frigorifique de transport intégré (100) selon la revendication 1, comprenant également un générateur d'induction placé sur l'arbre de transmission, dans lequel un courant alternatif est induit suite à la rotation de l'arbre (430).
10. Groupe frigorifique de transport intégré (100) selon la revendication 1, dans lequel le générateur auxiliaire (440) produit un courant pour charger la batterie, dans lequel la batterie est couplée à un boîtier de commande, dans lequel le boîtier de commande est configuré pour fournir du courant pour entraîner un arbre.

11. Groupe frigorifique de transport intégré (100) selon la revendication 10, dans lequel le boîtier de commande (470) comprend un onduleur pour transformer un courant continu en courant alternatif à une tension appropriée pour faire fonctionner le ventilateur ; ou
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dans lequel le boîtier de commande (470) est conçu pour recevoir un signal à partir d'un contenant transportable et pour faire fonctionner le ventilateur en se basant sur le signal ou pour commander le fonctionnement du moteur afin d'amener le générateur auxiliaire (440) à fournir du courant pour charger la batterie.
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12. Groupe frigorifique de transport intégré (100) selon la revendication 10, dans lequel le boîtier de commande (470) est configuré pour commander le moteur pour fonctionner afin d'amener le compresseur à fournir un refroidissement en pompant du réfrigérant à travers un jeu de composants de cycle de réfrigération.
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13. Groupe frigorifique de transport intégré (100) selon la revendication 1, dans lequel le générateur intégré (120) est conçu pour produire un courant pour faire fonctionner un ventilateur ; ou
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dans lequel le générateur intégré (120) est conçu pour produire un courant à haute tension apte à charger un bloc-batterie à haute tension.
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14. Groupe frigorifique de transport intégré (100) selon la revendication 1, comprenant également un ou plusieurs ventilateurs à courant continu et un ou plusieurs ventilateurs à courant alternatif.
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15. Groupe frigorifique de transport intégré (100) selon la revendication 10, dans lequel le boîtier de commande (470) fournit du courant à un convertisseur de courant, et dans lequel le convertisseur de courant fournit un courant continu à une tension appropriée pour faire fonctionner un ventilateur d'évaporation.
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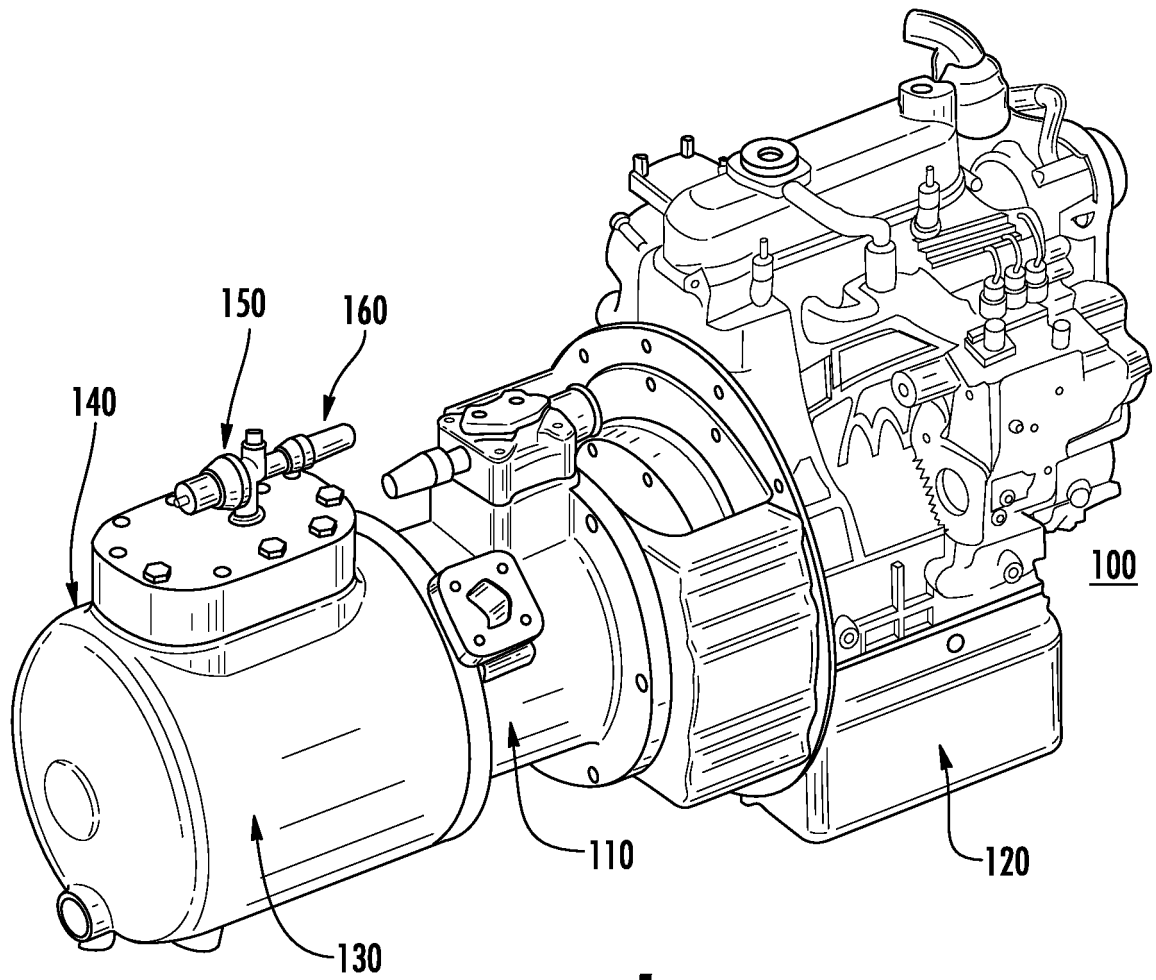


FIG. 1

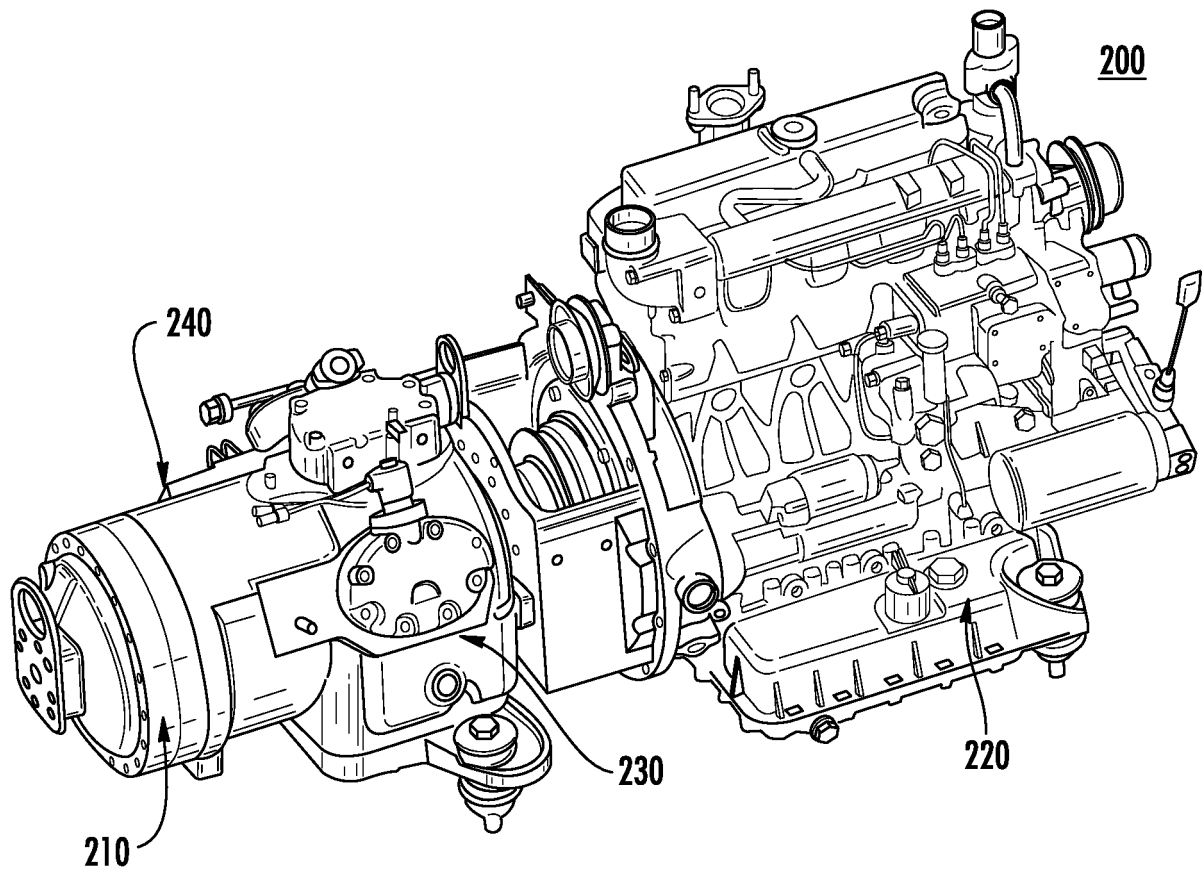


FIG. 2

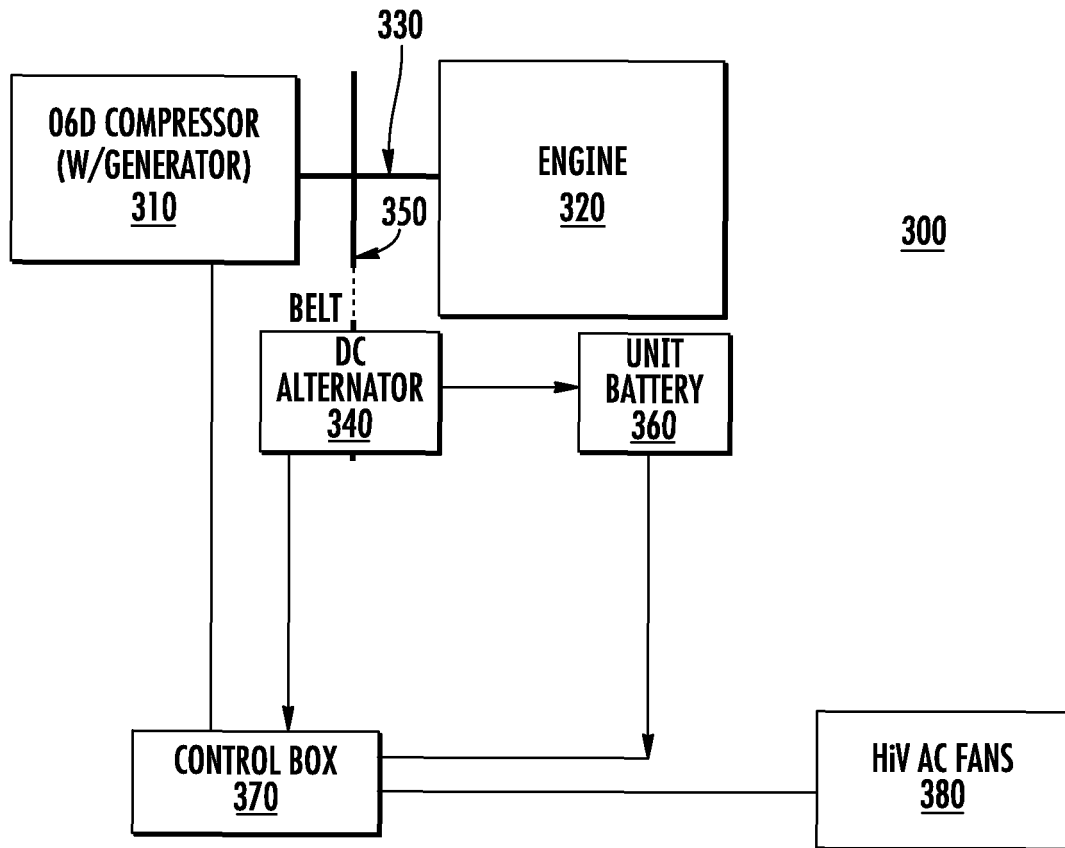


FIG. 3

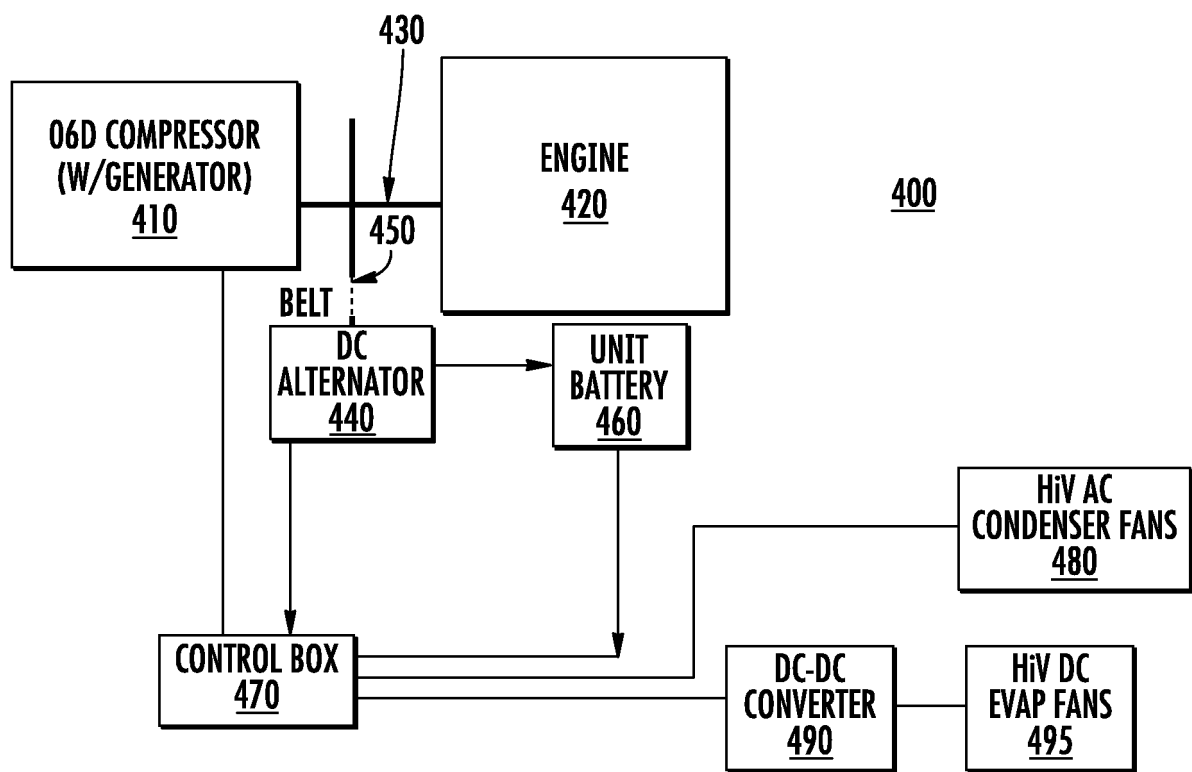


FIG. 4

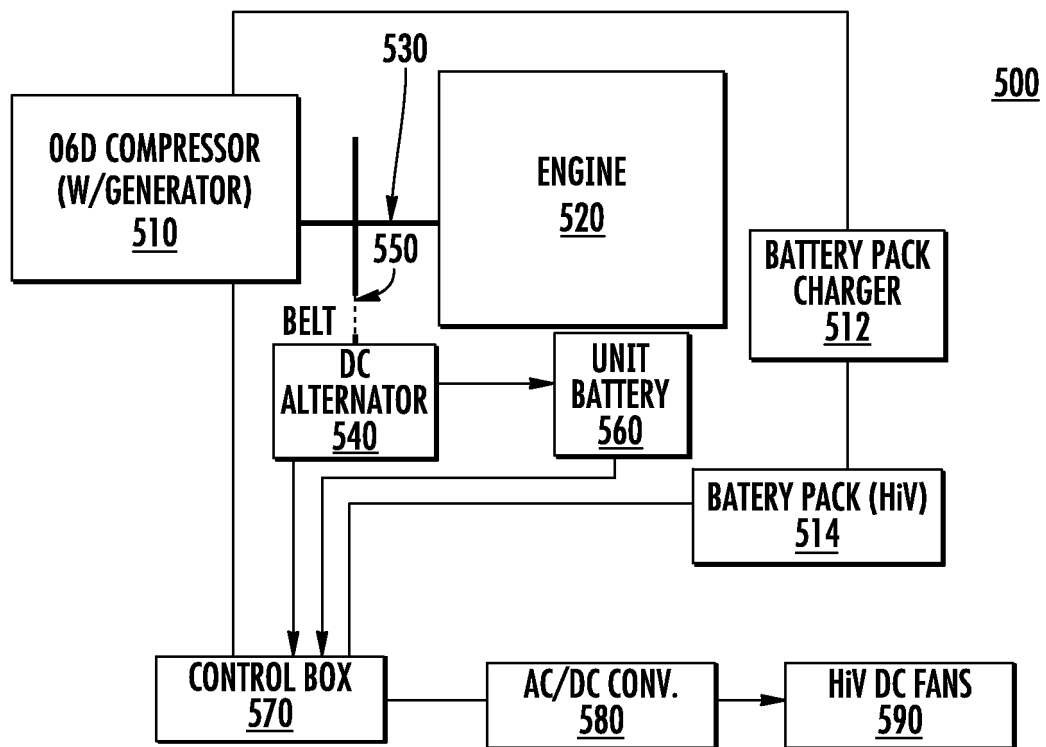


FIG. 5

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- EP 1834818 A2 [0005]