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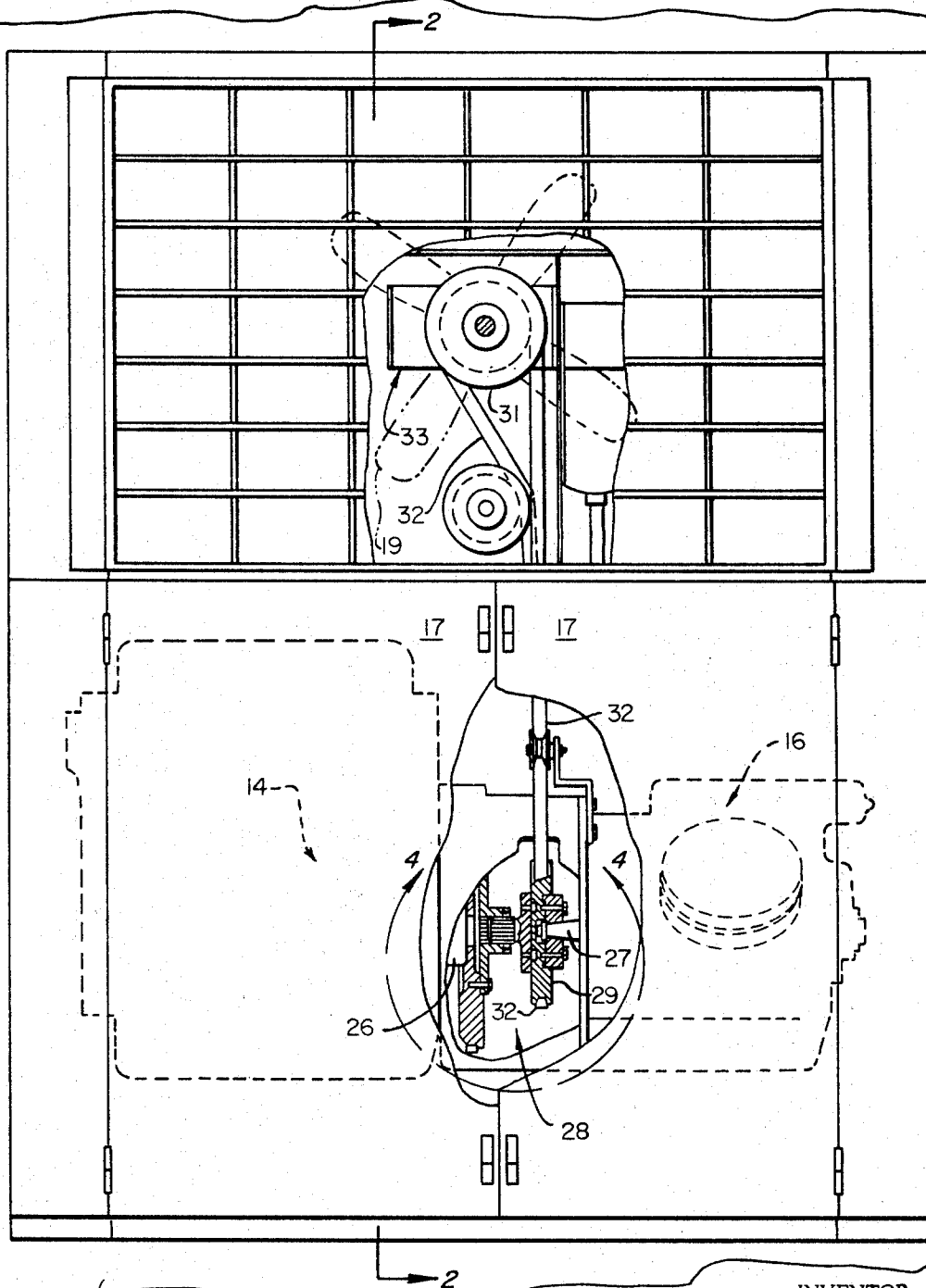
J. H. WHITE

3,415,072

DRIVE UNIT FOR TRANSPORT REFRIGERATION SYSTEM

Filed April 18, 1967

4 Sheets-Sheet 1



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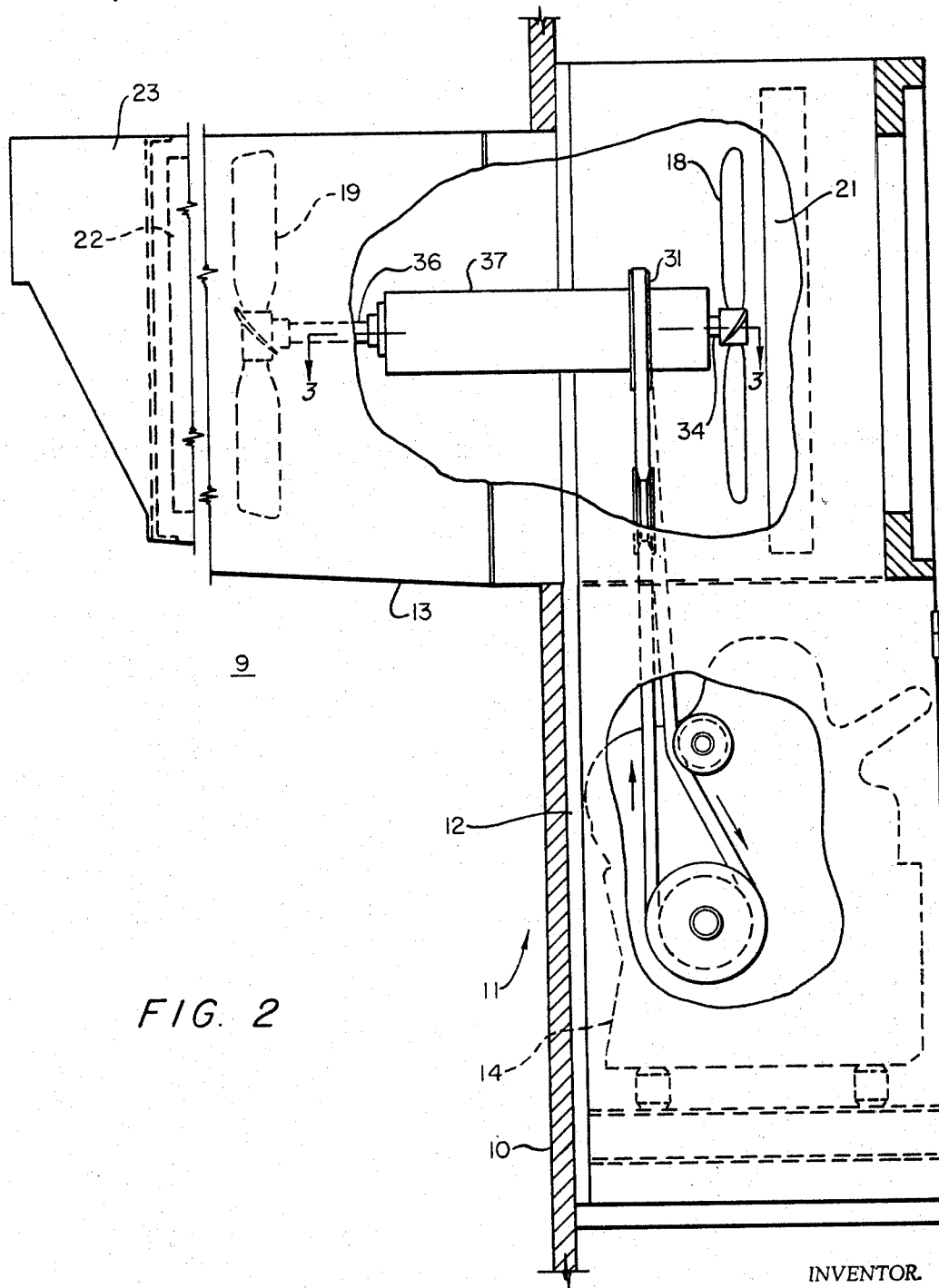


FIG. 2

INVENTOR.
JACK H. WHITE

BY *F. Lehn, Rodback, Keat,
Albritton & Herbert*

ATTORNEYS

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J. H. WHITE

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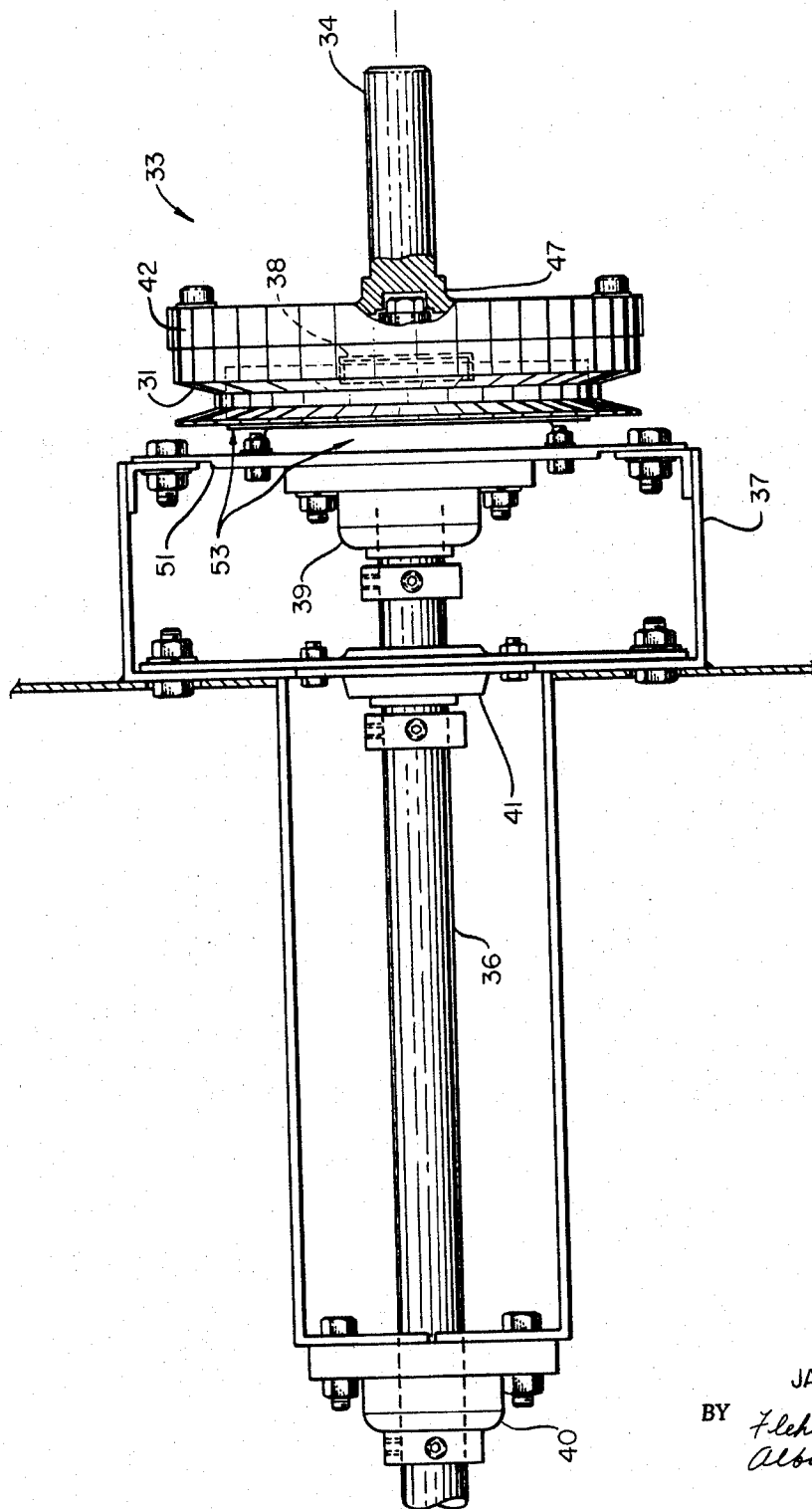


FIG. 3

INVENTOR.

JACK H. WHITE

BY

*Fleish, Hobbach, Vest,
Albritton & Herbert*

ATTORNEYS

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J. H. WHITE

3,415,072

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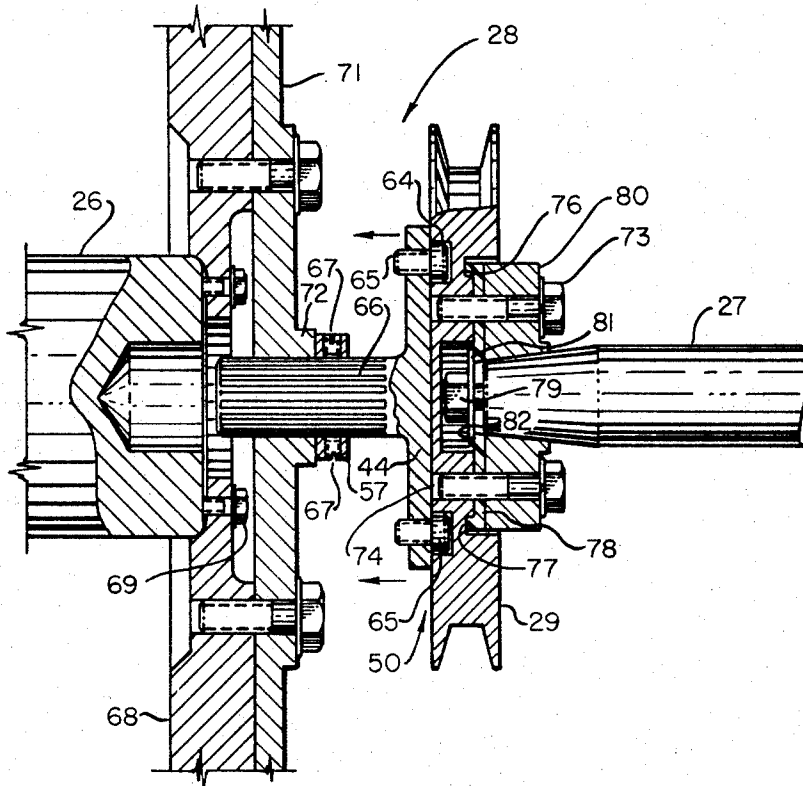


FIG. 4

INVENTOR
JACK H. WHITE
BY *Flehm, Hohbach, Post,
Albiston & Herbert*
ATTORNEYS

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3,415,072

DRIVE UNIT FOR TRANSPORT REFRIGERATION SYSTEM

Jack H. White, Huntington Beach, Calif., assignor to
Transicold Corporation, Montebello, Calif., a corporation of California

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2 Claims. (Cl. 62-239)

ABSTRACT OF THE DISCLOSURE

A drive unit for a nose mount refrigeration system wherein fans are located inside and outside a commodity space to be refrigerated. The outer fan is adapted to be associated with a condenser unit of the system, and the inner fan cooperates with a cooling evaporator in the commodity space. A clutch serves to decouple the inner fan so as to preclude rotation thereof during selected periods, such as during a defrost cycle. An endless drive belt is interposed both between the two fans, and between the compressor and the compressor's prime mover in a manner which permits the drive belt to be readily replaced. The shaft which couples the compressor to its prime mover is readily demounted or separated for longitudinal relative movement to provide a gap in the drive shaft between the compressor and its prime mover. The gap serves to pass the endless belt therethrough when replacing worn or defective belts.

This invention relates to a drive unit for a transport refrigeration system of the type adapted to be mounted to extend through the wall of a vehicle wherein a portion of the refrigeration system is carried for cooling a commodity space while other units of the system are disposed outside the commodity space. More particularly, the invention relates to such a drive unit arranged in a manner whereby that fan for circulating air in the commodity space directs a stream of air across the evaporator coils during a cooling operation but may be selectively decoupled so that during certain operations, such as during a defrost cycle of operation, the circulation of air will be discontinued. At the same time, however, the operation of that fan associated in conjunction with a condenser unit, for example, mounted outside the commodity space, may be continued.

It is a general object of the present invention to provide an improved drive unit for transport refrigeration systems of a type adapted to be mounted on the front end of a van or other transport refrigeration vehicle.

Another object of the invention is to provide a transport refrigeration system wherein during a defrost cycle of operation, the normal flow of air across the then heated evaporator coils will be discontinued while continuing operation of the condenser fan.

A further object of the invention is to provide apparatus of the kind described above, arranged whereby a single relatively short endless drive belt forms the driving connection between the prime mover and the evaporator and condenser fans.

These and other objects of the invention will become more readily apparent from the following detailed

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description of a preferred embodiment according to the invention.

In general, according to the invention, there is provided, in a refrigeration system of the type above described, the arrangement of a compressor, an engine or prime mover for driving the compressor, an endless belt power take-off interposed between the compressor and the prime mover. The power take-off forms a readily demountable driving connection between the output shaft of the prime mover and the input shaft of the compressor whereby upon merely releasing two set screws, the two shafts may be decoupled and one of them longitudinally moved relative to the other sufficiently to accommodate passage of a belt through the gap thus formed. Further, a magnetic clutch serves to selectively couple and decouple the shaft of the evaporator fan whereby the stream of circulated air directed to the evaporator coils can be selectively terminated while continuing operation of the condenser fan.

The foregoing general summary of the apparatus is embodied more particularly in the following detailed description which will be more readily understood when considered in conjunction with the accompanying drawings in which:

FIGURE 1 is a front elevation view, partially broken away, according to the invention;

FIGURE 2 is a side elevation view, partially broken away, taken along the line 2-2 of FIGURE 1;

FIGURE 3 is a plan view, partially broken away, of the apparatus of FIGURE 2; and

FIGURE 4 is an enlarged elevation detail view in section of the detail of FIGURE 1 within line 4-4 thereof.

Referring to the drawings, in FIGURES 1 and 2, a so-called "nose-mount" refrigeration system is shown, as typically carried on the leading wall 10 of a commodity space in the van portion of a refrigerated truck, or other vehicle. The refrigeration unit 11 includes a lower housing portion 12 and an upper housing portion 13. Portion 12 contains a prime mover 14 and a compressor 16. Doors 17 serve to enclose the apparatus within housing portion 12.

Upper housing portion 13 contains, in general, a pair of fans 18, 19 respectively associated with a condenser unit 21 and an evaporator unit 22 which form components of the refrigeration system.

In general, during a cooling operation, fan 18 serves to cool the coils of condenser unit 21 whereas fan 19 serves to direct a stream of air across the coils of evaporator unit 22 whereby the stream of air circulates in the commodity space 9 within the vehicle as represented by wall 10. For fan 19, upper housing portion 13 includes a hooded portion 23.

The unit 11 is secured in any suitable manner to the wall 10 of the vehicle. Air is circulated by fan 19 through the coils of evaporator 22 within the commodity space 9.

In apparatus of the above kind, during a cooling operation, the coils of evaporator 22 will be quite cold. The cold coils of evaporator 22, from time to time, must be defrosted. In certain apparatus this defrosting operation is accomplished by temporarily reversing the refrigeration cycle so as to heat the coils of evaporator 22. Obviously, any heating of coils in evaporator 22 will serve to warm air within the commodity space, which, if maintained for any length of time, is undesirable.

For the foregoing reasons, in typical installations of the above kind, shutters are employed to preclude circulation within the commodity space of warmed air during defrost operations.

A common problem with the use of shutters as employed to protect a commodity space against loss of its previously established cooled condition, is found in their tendency to become frozen open so as to warm the space during defrost operation. Should operation of the fans be arrested during such defrost operations so as to restrict circulation of warm air, it would ordinarily serve to impair efficient operation of condenser unit 21 inasmuch as fans 18 and 19 usually rotate together.

Means, as described in detail below, have been provided which serve to selectively decouple fan 19 from fan 18 whereby the stream of air circulated via the evaporator can be selectively terminated during defrost operation while continuing to operate the fan 18 of condenser unit 21.

Fans 18, 19 are driven by apparatus now to be described. Prime mover 14 includes an output shaft 26 adapted to be coupled to drive an input shaft 27 of compressor 16. A belt drive power take-off assembly 28 characterized by a sheave 29 is interposed between compressor 16 and prime mover 14. Rotation of shaft 26 serves to rotate sheave 29. Pulley 31 (for fans 18, 19), when coupled by an endless belt 32 to sheave 29, rotates both fans 18, 19 through connections formed by the coupling assembly 33.

Fan 18 is driven by rotation of shaft 34 and fan 19 by shaft 36. Coupling assembly 33 is characterized by a clutch or brake arrangement forming means which serves to selectively decouple one shaft 36 relative to the other 34 whereby the stream of air directed to the evaporator coils shall be selectively terminated while continuing to permit rotation of shaft 34 for operating condenser fan 18.

Shafts 34, 36 are disposed at opposite sides of a journal box construction 37 which also supports coupling assembly 33. Each of shafts 34, 36 is independently rotatable as supported in rotatable bearings 38, 39 respectively and, for shaft 36 by the additional bearings 40, 41.

Shaft 34 rotates with pulley 31 as a portion of the clutch adaptor plate 42 coupled to pulley 31.

Replacement of worn or defective belts 32 can be readily applied to sheave 31 by passing the belt over fan 18.

Sheave 31 accommodates an electromagnetic clutch assembly 53 carried on the armature mounting plate 51 transversely of journal box 37. Accordingly, shaft 36 can be rotated with respect to pulley 31 by operating clutch assembly 53.

As endless belt 32 is cyclically driven by prime mover 14, pulley 31 rotates shaft 34 (and its fan 18).

As explained below, the two shafts 26, 27 are readily disconnected or separated by longitudinal relative movement so as to provide a gap therebetween whereby defective or worn belts 32 may be replaced, while at the same time retaining all of the advantages of being able to drive the upper apparatus from the lower apparatus by means of a belt located substantially midway between the two units, as now to be described.

Prime mover 14 is readily decoupled from compressor 16 merely by release of two set screws so that the shafts can be sufficiently separated longitudinally to provide a gap at 50 sufficient to accommodate passage of belt 32 therethrough.

Referring to FIGURE 4, for example, the means forming a driving connection between shaft 26 and shaft 27 and generally forming power take-off assembly 28 includes sheave 29 formed with six circular pockets 64 for receiving the heads of studs 65. Studs 65 are carried by a connector plate 44 formed to include a splined axial portion 66 held longitudinally in place by set screws 67 of a retaining collar 57. The end of shaft 26 carries a fly wheel 68 bolted thereto by bolts 69. Fly wheel 68

further carries an adaptor plate 71 bolted thereto and formed for receiving the splined axial portion 66.

Portion 66, thus, forms a shaft extension portion carried by shaft 26 in a manner permitting the shaft to be readily foreshortened merely by releasing set screws 67.

Accordingly, portion 66 is adapted to slide longitudinally relative to the end of shaft 26. The end of shaft 26 is counterbored in order to accommodate entry of portion 66 thereto in order to permit full longitudinal movement thereof.

Several bolts 73 are adapted to be carried for rotation with shaft 27 and to protrude into cooperating threaded holes 74 of sheave 29. For purposes of alignment and for forming a somewhat flexible connection, a groove 76 cooperates with a rim 77 of an annular nylon gear plate 78 fitted over a steel gear 80 snugly wedged onto the end of shaft 27 by means of bolt 79. Bolt 79, accordingly, bears on a washer 81 which in turn is disposed upon a seat 82 formed on plate 78. In this manner, plate 78 rotates as though it were a part of shaft 27. Thus, the output shaft 26 of prime mover 14 will be drivingly coupled to input shaft 27 of compressor 16 via studs 65 while sheave 29 and endless belt 32 serve to operate fans 18 and 19 by the means described above.

In the event that belt 32 requires replacement, all that needs to be done to mount a new belt is to pass the belt over fan 18 and onto sheave 31. Then, to mount the lower end of belt 32, set screws 67 are released and plate 44 is moved axially until the heads of studs 65 are sufficiently withdrawn to form enough of a gap with the side face of sheave 29 to accommodate the passage of a new belt therethrough.

What is claimed is:

1. In a refrigeration system of a type adapted to be mounted to a vehicle for cooling a commodity space therein, apparatus comprising a compressor having an input drive shaft, a prime mover for driving the compressor and having an output shaft adapted to be coupled to drive said input shaft, a belt drive power take-off interposed between said compressor and said prime mover and operated by rotation of one of said shafts, first and second fans mounted respectively on first and second shafts for rotation therewith, said first fan being adapted to direct a stream of air through a condenser unit, said second fan being adapted to direct a stream of air relative to an evaporator unit, a drive pulley interposed between said fans for rotating same, an endless belt trained about said pulley and said power take-off for driving said fans, clutch means serving to selectively decouple said second shaft relative to said first shaft whereby the stream of air relative to the evaporator shall be selectively terminated while continuing to direct an air stream through the condenser to permit heating of said evaporator unit without circulating air heated by the evaporator unit into the commodity space, means forming a driving connection between said input and output shafts, the last named means serving to readily decouple said input and output shafts relative to each other, said driving connection being carried by one of said input or output shafts and including a shaft extension portion, readily releasable to move to provide a gap between the input and output shafts serving to permit passage of said belt via said gap.

2. In a refrigeration system of a type adapted to be mounted to a vehicle for cooling a commodity space therein, apparatus comprising a compressor having an input drive shaft, a prime mover for driving the compressor and having an output shaft adapted to be coupled to drive said input shaft, a belt-drive power take-off interposed between said compressor and said prime mover and operated by rotation of one of said shafts, first and second fans mounted respectively on first and second shafts for rotation therewith, said first fan being adapted to direct a stream of air to a condenser unit, and said second fan being adapted to direct a stream of air to an evaporator

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unit, a drive pulley interposed between said fans for rotating same, an endless belt trained about said pulley and said power take-off for driving said fans, means forming a driving connection between said input and output shafts, and means serving to readily decouple said input and output shafts, said means including a shaft extension portion carried by one of said input and output shafts, readily releasable and movable to foreshorten one of the shafts relative to the other to form a gap between said input and output shafts serving to accommodate passage of said endless belt therethrough.

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WILLIAM J. WYE, *Primary Examiner*.

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62—323, 408, 429; 165—43