United States Patent

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[72] Inventors **Thomas H. Boyce, Jr.;**
Robert W. Mitchell, Houston, Texas

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[73] Assignee **Stewart & Stevenson Services, Inc.**
Houston, Texas
a corporation of Texas

[54] **APPARATUS FOR INCREASING BLOWER AIR PRESSURE IN SCAVENGING DIESEL ENGINES**
3 Claims, 2 Drawing Figs.

[52] **U.S. Cl.** **123/65,** 123/55, 123/119
[51] **Int. Cl.** **F02b 75/22,** F02b 75/02
[50] **Field of Search** 123/65B1, 55V4, 55V6, 55V8, 55VX, 119C1, 119C

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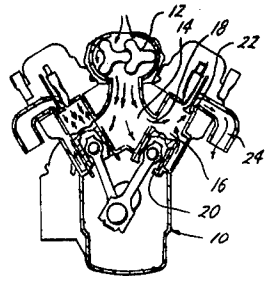
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Primary Examiner—Wendell E. Burns
Attorneys—James F. Weiler, Jefferson D. Giller, William A. Stout, Paul L. De Verter, II, Dudley R. Dobie, Jr. and Henry W. Hope

ABSTRACT: An apparatus for allowing operation at low speeds of a two-cycle uniflow scavenged type compression ignition diesel engine by providing a speed step up for increasing the blower speed. A shaft extension connected to the blower rotor gear connected to speed increasing means for increasing the blower speed. A first hollow shaft gear having a hollow shaft coupling connected to the blower drive gear and meshing with a second smaller gear to provide a first stage step up speed with a third gear larger than the second gear connected to the shaft of the second gear and a fourth gear smaller and meshing with the third gear to provide the second stage speed up with a blower drive shaft connected to the fourth gear and through the hollow first gear shaft and coupling to the blower rotor gear.



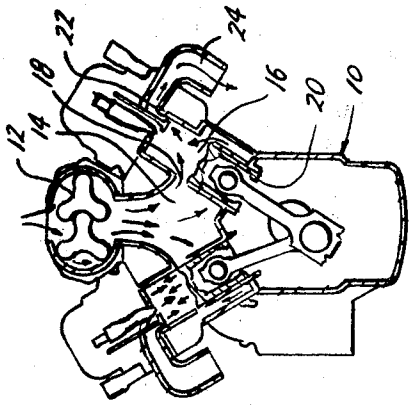


Fig. 1

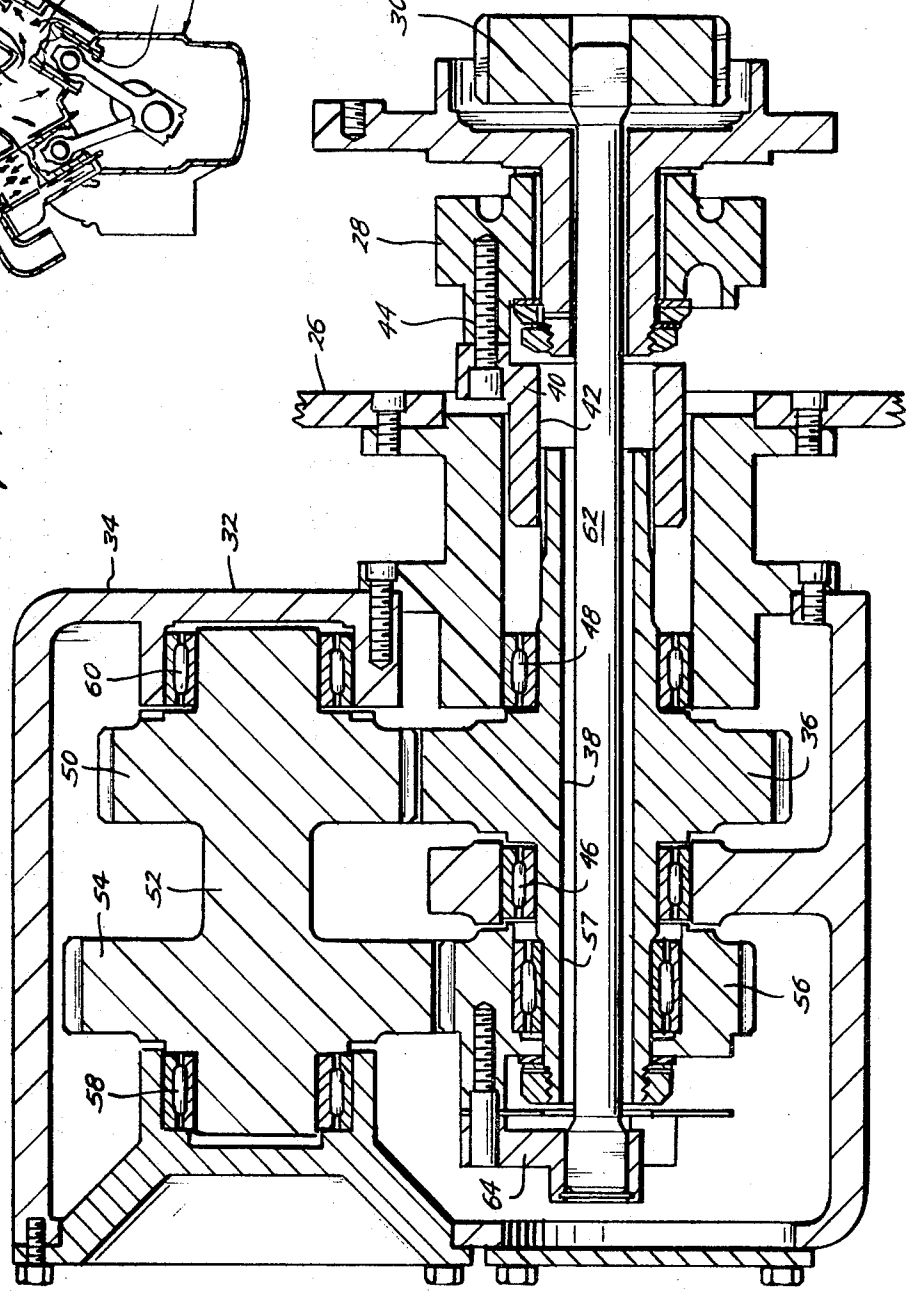


Fig. 2

Thomas H. Boyce, Jr.
Robert W. Mitchell
INVENTORS

BY James F. Weiler
William A. Stout

ATTORNEYS

APPARATUS FOR INCREASING BLOWER AIR PRESSURE IN SCAVENGING DIESEL ENGINES

BACKGROUND OF THE INVENTION

Diesel engines such as the V-type series **71** of the Detroit Diesel Engine Division of General Motors are normally designed for operations at rotative speeds in excess of 1,200 r.p.m. While it is desirable in some applications to operate such an engine at slower than the minimum designed speed, operation at such lower speeds can cause excess carboning, sludging and horse power loss. In addition, the inherent design of these particular engines is such that their internal configuration and dimensions do not allow changing the gear ratio of the blower sufficiently to overcome the low operating speed problem.

SUMMARY OF THE INVENTION

The present invention is directed to providing an increase in the scavenging blower speed to increase air manifold pressure.

The invention provides for blower speed increase by providing a blower rotor gear extension connected to a speed step-up means driven from the blower drive gear.

The present invention is further directed to providing an apparatus for increasing the scavenging air pressure in the air manifold at speeds below 1,200 r.p.m. in a two-cycle uniflow scavenge type V-compression ingnition diesel engine having a scavenging blower by providing a first hollow shaft gear having a hollow shaft coupling connected to the blower drive gear with a second smaller gear connecting with the first gear and a third gear larger than the second gear connected to the shaft of the second gear with a fourth gear smaller than the third gear meshing with the third gear, and connecting the blower drive shaft to the fourth gear and passing it through the hollow shaft first gear and coupling and connecting it to the blower rotor gear to provide a two stage speedup for the blower.

The invention further includes providing the fourth gear with a hollow shaft whereby the blower drive shaft passes through the fourth gear hollow shaft and is connected to the fourth gear on the side remote from the blower rotor gear for balancing the forces on the shaft and wherein a housing is provided surrounding the gears and connected to the diesel engine lube oil system for providing lubrication.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a schematic elevational view of a two-cycle blower scavenged diesel engine, and

FIG. **2** is an enlarged cross-sectional view of the blower speed up gear box of the present invention.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring now to the drawings, particularly to FIG. **1**, the reference numeral **10** generally indicates a conventional two-cycle diesel engine having a blower **12** which blows air into an air box or manifold **14** and in turn into the cylinders such as **16** for expelling exhaust gases therefrom and to supply the cylinders with fresh air for combustion. The cylinder wall contains a row of ports **18** which are above the piston **20** when the piston is at the bottom of its stroke. These ports **18** admit the air from the blower air box **14** into the cylinders **16** as soon as the piston **20** uncovers the ports **18**. The unidirectional flow of air towards the exhaust valves **22** produces a scavenging effect leaving the cylinders **16** free of clean air when the pistons **20** again cover the inlet ports **18**. As each piston **20** continues its upward stroke, the exhaust valves **22** close, the air is subject to compression so that as the fuel is sprayed into the cylinders **16** the fuel is ignited and the resulting pressure forces the piston **20** downwardly on the power stroke. The exhaust valves **22** are again opened when the piston **20** is down below the inlet ports **18** allowing the burned gases to escape into the exhaust manifold **24**. Thereafter, the downward moving piston uncovers the inlet ports **18** and the cylinders are again swept with clean scavenging air and the cycle continued.

However, the inherent design of the V-type diesel engine designed for operation in excess of 1,200 r.p.m. is that when they are operated at speeds of lower than 1,200 r.p.m. the scavenging air pressure in the air box **14** on the outlet side of the blower **12** is so reduced as to impair proper scavenging of the exhaust gas and is insufficient to provide enough combustion air to maintain clean and satisfactory operation over sustained periods under some operating conditions. Because of the insufficient air volume and pressure in the air box **14**, with resulting poor combustion and insufficient differential pressure between the air box **14** and the inside of the cylinder adjacent the ports **18**, carbon particles and contaminated air can be emitted into the air box **14** of the engine from the cylinders **16**. That is, the pressure and volume of air in the air box **14** at low rotative engine speeds can be lower than the pressure in the cylinders **16** at the ports **18** slightly after the ports are opened on the downward power stroke of the engine. This condition tends to carbon up the intake ports **18**, fill the air box **14** with carbon formation and the lack of sufficient clean air in the air box **14** further impairs clean combustion thereby aggravating the carboning conditions and shortening the intervals between necessary repair and maintenance as well as reducing horse power output.

Therefore, one way to overcome these problems is to increase the blower speed at lower rotative engine speeds, but the internal configuration and dimensions of the engine are such that the r.p.m. of the blower **12** cannot be increased by changing the gear ratio sufficiently to overcome the low pressure conditions.

Therefore, the present invention is directed to providing any suitable speedup means such as gear, chains, belts and pulleys connected between the blower drive gear and the blower rotor gear to step up the rotor speed.

Referring now to FIG. **2**, a portion of the engine housing is indicated by the numeral **26** which encloses the blower drive gear **28** and the blower rotor gear **30** which turns the blower **12**. One type of speed increaser of the present invention is generally indicated by the reference numeral **32** and includes a housing **34** which is externally connected to the engine housing **30**. A two stage gear step-up train may be provided which includes a first gear **36** having a hollow shaft **38** and a coupling **40** also having a hollow shaft **42**. The coupling **40** is connected to the blower drive gear **28** such as by **44**. The first gear **36** is suitably supported on bearings **46** and **48**.

A second gear **50** being smaller in diameter and has fewer teeth than the first gear **36** and is provided meshing with the first gear **36** to provide a first stage step-up speed. The second gear **50** is connected by a shaft **52** to a third gear **54**. Gear **54** is larger than the second gear and has more teeth and is in turn connected to the fourth gear **56** having a hollow shaft **57**, which gear **46** is a smaller gear thereby providing the second stage of a step-up speed. Shaft **52** of gears **50** and **54** is suitably supported from bearings **58** and **60**.

A blower drive shaft **62** is provided connected to the fourth gear **56** by a coupling **64** and extends through the hollow shaft **57** of the fourth gear **56**, through the hollow shaft **58** of the first gear **36** and through the hollow shaft **42** of the coupling **40** and is connected to the blower rotor gear **30**. Thus, the manner of connections insures no unbalanced loads will be exerted on shaft **62** and the gear train.

It is noted that the speed increaser **32** makes no internal modifications to the engine and does not impose any additional settings on the engine gear train or require any modifications to the existing engine. Since the housing **34** is externally connected to the engine housing **26** the gear box will derive its lubrication from the engine lube oil system. The speed increaser **32** requires no special tools or skills and any time that it becomes desirable to convert the engine back to standard speed operation, the speed increaser **32** may be simply removed.

In operation, the blower drive gear **28** rotates from the engine conventionally and in turn rotates coupling **40**, first gear **36** which in turn drives second gear **50** at a faster speed and

third gear **54** is driven through shaft **52** by a second gear **50** and in turn provides a second stage step-up speed by driving fourth gear **56**. Fourth gear **56** is connected to coupling **64** and rotates the blower drive shaft **62** which is connected to and in turn drives blower rotor gear **30** which drives the blower **12** to provide an increased air pressure in the manifold or air box **14** to overcome the problems previously mentioned.

The present invention, therefore, is well adapted to carry out the objects and attain the ends and advantages mentioned as well as others inherent therein. While a presently preferred embodiment of the invention has been given for the purpose of disclosure, numerous changes in the detail of construction and arrangement of parts may be made which will readily suggest themselves to those skilled in the art and which are encompassed within the spirit of the invention and the scope of the appended claims.

We claim:

1. An apparatus for providing increased scavenging air pressure in the air manifold at speeds below 1,200 r.p.m. in a two-cycle uniflow scavenged type V-Compression ignition diesel engine having a scavenging blower having a blower drive gear driving the blower rotor gear by increasing the blower speed comprising:

a first hollow shaft gear having a hollow shaft coupling connected to the side of the blower drive gear;

a second gear smaller than said first gear and meshing with the first gear providing a first stage step-up speed;

a third gear larger than the second gear connected to the second gear by an axial shaft;

a fourth gear smaller than the third gear and meshing with the third gear providing a second stage step-up speed, the axis of the fourth gear aligned with the axis of the first gear and hollow shaft coupling;

a blower drive shaft connected to the fourth gear and passing through the hollow shaft first gear and coupling and connected to the blower rotor gear; and

the fourth gear having a hollow shaft and the blower drive shaft passing through said fourth gear hollow shaft and connected to the fourth gear on the side remote from the blower rotor gear.

2. The apparatus of claim **1** wherein said first, second, third and fourth gears are positioned on the side of the drive gear remote from the rotor gear for converting said engine to a low speed operation.

3. An apparatus for providing operation at low speeds of a two-cycle uniflow scavenged type compression ignition diesel engine having a scavenging blower having a blower drive gear for driving the blower rotor gear, said drive gear and said rotor gear being mounted coaxially and side to side inside the engine housing, by increasing the scavenging air pressure in the air manifold of said engine by increasing the blower speed comprising:

a first hollow shaft gear having a hollow shaft coupling connected to the side of the blower drive gear;

a second gear smaller than said first gear and meshing with the first gear providing a first stage step-up speed;

a third gear larger than the second gear connected to the second gear by an axial shaft;

a fourth gear smaller than the third gear and meshing with the third gear providing a second stage step-up speed, the axis of the fourth gear aligned with the axis of the first gear, hollow shaft coupling and drive and rotor gear;

a blower drive shaft connected to the fourth gear and passing through the hollow shaft first gear and coupling and drive gear and connected to the blower rotor gear; and

said first, second, third and fourth gears are positioned on the side of the drive gear remote from the rotor gear for converting said engine to a low speed operation.