United States Patent [19]

Bulkley et al.

[11] **3,844,688**

[45] **Oct. 29, 1974**

[54] **COMPRESSOR CRANK CASE VENTING ARRANGEMENT FOR ELIMINATING LUBE OIL CARRYOVER**

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[22] Filed: **May 8, 1973**

[21] Appl. No.: **358,443**

[52] **U.S. Cl.** **417/313,** 92/79

[51] **Int. Cl.** **F15b 21/04,** F04b 21/06

[58] **Field of Search** 417/437, 313; 92/79

[56] **References Cited**

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[57] **ABSTRACT**

A reciprocating air compressor is provided with a modified valve plate to block the crank case from direct access to the intake manifold and a crank case vent tube coupled to the intake manifold opens to the crank case on the side of a coalescent separator opposite that having access to the reciprocating piston, thus preventing the oil-air mist, resulting from blowby in the crank case, to mix with the suction air being compressed by the compressor, prior to removal of the entrained oil.

3 Claims, 2 Drawing Figures

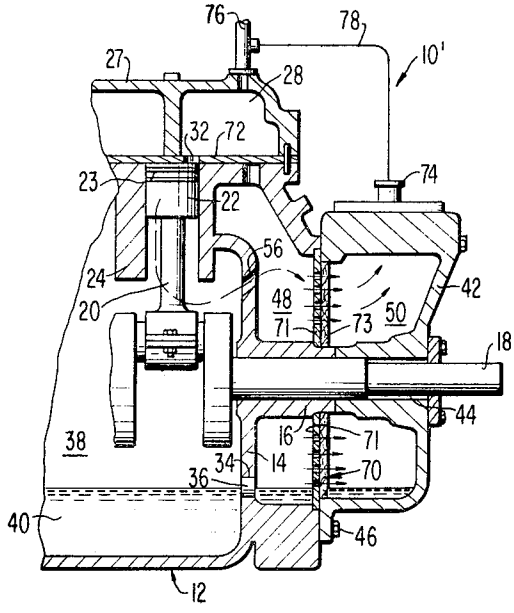


FIG. 1
PRIOR ART

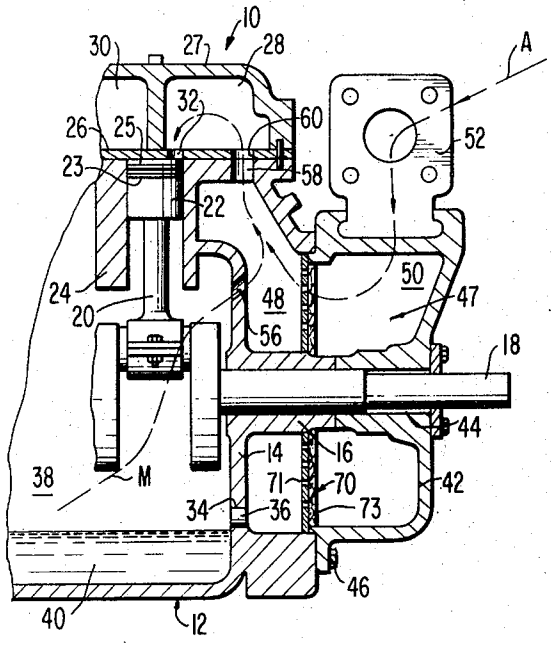
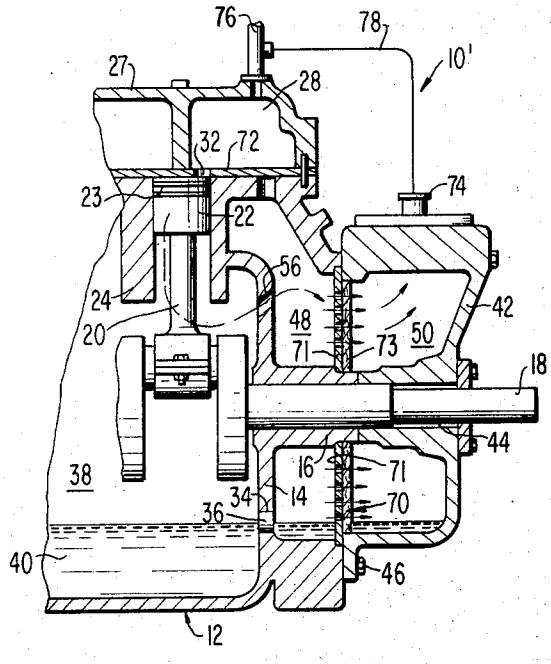


FIG. 2



COMPRESSOR CRANK CASE VENTING ARRANGEMENT FOR ELIMINATING LUBE OIL CARRYOVER

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention relates to reciprocating gas compressors, and more particularly to air compressors in which the crank case is vented to the intake manifold to reduce crank case pressure produced by gas blowby.

2. Description of the Prior Art

In self-contained motor compressor units for compressing air and other gases, it is conventional to collect lubricating oil within the crank case of the compressor, which is then fed under pressure to portions of the compressor for proper lubrication of the moving parts during compressor operation. In reciprocating compressors, the piston which normally reciprocates along the axis of its fixed cylinder and carries one or more piston rings which tend to retain a given amount of lubricating oil between the stationary cylinder walls and the reciprocating piston. During compression of the air, by reciprocation of the piston, the developed air pressure, regardless of the fit between the piston or rings and the compressor result in a certain amount of gas blowby which increases gas pressure within the crank case in the absence of venting means.

One method of venting the crank case, in the past, consists of porting the crank case to the air intake manifold of the compressor head. Reference to FIG. **1** illustrates one specific prior art arrangement for venting the crank case to the incoming gas to be compressed. Referring to this FIG., the gas compressor identified generally at **10,** which is only partially shown, comprises a housing **12,** including an end wall **14** at its right hand end, which supports by means of journal bearing **16,** a compressor crank shaft **18** mounted for rotation about a horizontal axis. Crankshaft **18** is supplied with one or more connecting rods **20,** each of which supports a piston **22** mounted for reciprocation within a stationary cylinder **24** formed integrally with the housing **12.** Each piston **22** carries oil ring **23.** The head of piston **22** defines a working chamber **25** between the head of the piston and a valve plate **26** which lies intermediate of the housing **12** and the head **27** of the compressor. In this respect, the head **27** defines for each piston and cylinder separate fluid passages in the form of an intake manifold **28** and an exhaust manifold **30.** Communication between manifolds **28** and **30** and the working chamber **25** is controlled by valves (not shown) associated with the valve plate **26** for each cylinder. In this respect, however, a port or opening **32** permits fluid communication between intake manifold **28** for instance, and the chamber **25.** Oil **40** generally accumulates to the level shown within crank case **38** beneath the crank shaft **18.** Housing **12** is further provided with an attached end plate **42** which further carries a journal bearing **44** for additionally supporting the crank shaft **18.** Plate **42** is bolted to the housing **12** by means of a number of bolts **46** as shown and effects a fluid sealed connection therewith. Plate **42** defines with end wall **14,** an air intake passage **47.** The end plate **42** effectively further acts to maintain a vertical suction screen **49** in position so as to separate a passage **47** formed by housing **12** and end plate **42** into inner and outer chambers **48** and **50** respectively. In this respect, assuming that the gas being compressed is air, air enters the air compressor through an air inlet fitting **52** into the outer chamber **50** and passes through the suction screen **49** to enter the inner chamber **48.** A coalescent separator **70** consisting of a perforated annular plate **71** and a felt annulus **73** separates oil and other liquids carried by the incoming gas stream A. End wall **14** of housing **12** is provided with an opening **34** at the bottom which carries a check valve **36** which permits oil to drain into the bottom of the crank case **38.** The end wall **14** of housing **12** is further provided with port **56** lying well above the level of the lube oil **40.** Port **46** permits the oil-air mist M within crank case **38** to merge with the incoming air stream A, within inner chamber **48.** Further, in the illustrated prior art arrangement, aligned openings **58** and **60** of housing **12** and the valve plate **26** respectively permit the incoming air and the oil-air mist emanating from port **56** to enter the intake manifold **28** for compression due to the reciprocation of piston **22.** Unless the oil is recovered after compression exterior of the compressor, the available oil supply to the compressor is rapidly reduced.

SUMMARY OF THE INVENTION

The invention is directed to modification of such reciprocating gas compressors such that the intake manifold is shut off from direct access to the crank case and the gas such as air being compressed is ported directly to the intake manifold while the crank case vent line fluid connects the air inlet upstream of the intake manifold or the manifold itself to the crank case to one side of a coalescent oil separator opposite that having access to the developed oil mist within the crank case. Thus, the oil-air mist resulting from gas blowby to the crank case impinges on the coalescent separator, the oil is separated and returned to the crank case, permitting only the crank case air minus the oil to enter the intake manifold after oil removal, and eliminating any possibility of lube oil carryover to the compressor discharge.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a sectional elevational view of a portion of a prior art air compressor employing crank case venting.

FIG. **2** is a sectional, elevational view of the air compressor of FIG. **1** modified in terms of the present invention.

DESCRIPTION OF THE PREFERRED EMBODIMENT

In FIG. **2,** like elements to those illustrated in the prior art compressor of FIG. **1** carry like numerical designations. In this respect, compressor **10'** of the present invention includes a housing **12** having an end wall **14** which defines in conjunction with head **27** a crank case **38** within which oil **40** rises to a given level. Again, the end wall **14** carries a journal bearing **16** supporting crank shaft **18** for rotation about a horizontal axis, the crank shaft being connected via connecting rod **20** to a piston **22** which reciprocates in similar manner to the arrangement of the compressor of FIG. **1** along its vertical axis within cylinder **24.** The compressor may include two or more reciprocating pistons **22,** as desired. An end plate **42** defines with end wall **14** of the housing **12** dual chambers **48** and **50** separated by coalescent separator **70.**

Coalescent separator **70** in the compressor of FIG. **2** is identically arranged and as such comprises a perforated annular plate **71** which is sandwiched between casing **12** and end plate **42** and supports on the side of chamber **50** a felt annulus **73** permitting oil to be removed from the oil mist during passage from chamber **48** to chamber **50** which oil drains through check valve **36** to the crank case **38.**

Further, the end plate **42** is provided with a journal bearing **44** further supporting the outer end of the crank shaft **18,** the end plate **42** being coupled to the housing **12** by a series of bolts as at **46** in a fluid sealed manner.

The modification of the compressor in terms of the present invention further takes the form of a modified valve plate **72,** which effectively covers the passage or opening **58** within housing **12** normally leading to intake manifold **28** although plate **72** is provided with a port at **32** permitting fluid connection between intake manifold **28** and the working chamber defined by the head of piston **22,** the wall of cylinder **24** and the modified valve plate **72.** The intake and exhaust valves for the compressor are not shown. Further, in conjunction with the present invention, a fitting **74** fluid couples the chamber **50** to tube **76** which ports directly to the intake manifold **28.** Tube **76** acts as the air inlet to the compressor (assuming air is the working fluid of the compressor). The crank case vent line indicated schematically at **78** constitutes in turn a small diameter tube leading from fitting **74** to the air inlet tube **76.** Thus, essentially, the modified valve plate **72** effectively blocks the chamber **48** from direct access to the intake manifold except via chamber **50,** and tube **78.** The modified head **27** without communicating with the crank case in the fashion of the prior art arrangement is therefore not contaminated by the oil-air mist emanating from the crank case through check valve **36** leading into the inner chamber **48.** The air leakage past the piston ring **23** and conventionally termed "gas blowby" creates an oil-gas mist which vents to the head **27** only after passage through the inner chamber **48,** depositing the oil from the mist on the coalescent separator **70,** whereupon the oil drains into the bottom of these chambers and passes through check valve **36** back into the crank case **38.** Further, the air in passing from inner chamber **48** to outer chamber **50** moves through the coalescent separator **70** under very low velocity insuring the full removal of the oil prior to passing via fitting **74** and tube **78** to the air inlet tube **76** leading into the intake manifold **28.** This results in the maintaining of a suitable oil supply **40** within the crank case **38** permitting the compressor to be efficiently lubricated and without the necessity of an external oil separator downstream of the compressor.

While the invention has been particularly shown and described with reference to a preferred embodiment thereof, it will be understood by those skilled in the art that various changes in form and details may be made therein without departing from the spirit and scope of the invention.

What is claimed is:

1. In a reciprocating gas compressor comprising:

a compressor housing including a crank case for housing the compressor crank shaft and having at least one piston supported by said crank shaft and reciprocating within a fixed cylinder and defining with said cylinder a working chamber,

a vertical housing end wall defining a crank case vent passage separate from and to the side of said crank case,

an intake manifold overlying said compressor housing and being ported to said working chamber,

a coalescent separator vertically mounted within said crank case vent passage and spaced from said end wall to separate said crank case vent passage into a first chamber underlying said intake manifold and a second chamber,

a first vertical opening within said first chamber leading directly from said crank case vent passage first chamber into said intake manifold, and

a second opening within said housing second chamber for normally introducing the gas to be compressed to said second chamber for passage through said coalescent separator to remove oil carried thereby,

a first opening within the bottom of said end wall and carrying a check valve to permit oil flow from said first chamber into said crank case, and

a second opening within said end wall above said check valve opening for permitting oil-air mist within said crank case to vent from said crank case into said crank case vent passage first chamber, the improvement comprising:

means for blocking said first opening within said first chamber,

means for directing the intake gas to said compressor directly to said intake manifold, bypassing said first and second chambers, and

means for fluid coupling said second housing opening directly to said intake manifold,

whereby; the oil-air mist within the crank case entering said first chamber from said crank case, passes through said coalescent separator to remove the oil therefrom to permit venting of the crank case gas resulting from blow-by to the intake manifold, and returns the removed oil back to the crank case through said check valve to eliminate compressor lube oil carryover.

2. The compressor as claimed in claim **1,** wherein said working chamber is defined by said at least one cylinder, the piston reciprocating therein, a valve plate overlies the cylinder and separates said head from said compressor housing, and defines with said cylinder and the head of said piston the working chamber, and said first opening comprises aligned openings within said valve plate and said compressor housing, and said means for blocking said first opening comprises a solid portion of said valve plate which overlies the opening within said compressor housing normally leading to said head.

3. The compressor as claimed in claim **2,** wherein said working chamber is defined by said at least one cylinder, the piston reciprocating therein, a valve plate overlies the cylinder and separates said head from said compressor housing, and defines with said cylinder and the head of said piston the working chamber, and said first passage means comprises aligned openings within said valve plate and said compressor housing, and said means for blocking said first passage means comprises a solid portion of said valve plate which overlies the opening within said compressor housing normally leading to said head.

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