



Europäisches Patentamt
European Patent Office
Office européen des brevets



Publication number:

0 242 044 B1

(12)

EUROPEAN PATENT SPECIFICATION

(45) Date of publication of patent specification: **30.10.91** (51) Int. Cl.⁵: **F04B 39/02, F01M 11/06**

(21) Application number: **87302032.5**

(22) Date of filing: **10.03.87**

(54) **Gas compressors.**

(30) Priority: **14.03.86 GB 8606381**

(43) Date of publication of application:
21.10.87 Bulletin 87/43

(45) Publication of the grant of the patent:
30.10.91 Bulletin 91/44

(64) Designated Contracting States:
BE DE ES FR IT NL SE

(56) References cited:
AT-B- 380 541
DE-A- 3 401 998
DE-C- 1 055 743
US-A- 2 983 334

(73) Proprietor: **BENDIX LIMITED**
Douglas Road
Kingswood, Bristol BS15 2NL(GB)

(72) Inventor: **Durrant, Jeremy James**
15, Isley's Court
Longwell Green Bristol BS15 7DR(GB)
Inventor: **Oliver, Patrick Ronald**
84 Pearsall Road
Longwell Green Bristol BS15 6BE(GB)
Inventor: **Carver, Nigel James**
23, Bloomfield Close
Timsbury Bath. BA3 1LP(GB)

(74) Representative: **Turner, Alan Reginald**
c/o Bendix Limited Douglas Road
Kingswood, Bristol BS15 2NL(GB)

EP 0 242 044 B1

Note: Within nine months from the publication of the mention of the grant of the European patent, any person may give notice to the European Patent Office of opposition to the European patent granted. Notice of opposition shall be filed in a written reasoned statement. It shall not be deemed to have been filed until the opposition fee has been paid (Art. 99(1) European patent convention).

Description

This invention relates to gas compressors and relates more particularly to gas compressors which utilise a reciprocating piston in a cylinder, according to the preamble of claim 1.

A common form of gas compressor relies upon one or more reciprocating pistons in cylinders. Such gas compressors are used to charge reservoirs of compressed air braking systems of heavy road vehicles. The bearings of such a compressor are usually lubricated by oil under pressure from the lubrication system of a vehicle engine upon which it is drivingly mounted. One problem encountered is that accumulation of oil drained into the compressor crankcase from the bearings can cause over-lubrication of the cylinder bores and resultant oil carry-over into the system can be excessive. Such oil carry-over can be detrimental to the brake system and is preferably to be removed or prevented. One obvious way to reduce such oil carry-over is to limit the flow of oil to the compressor bearings but this can seriously impair the working life of the compressor.

In the Specification of DE-A-3401998 there is described a single cylinder and piston air compressor drivingly mounted on the crankcase of an internal combustion engine in which bearings of the crankshaft of the compressor are lubricated by oil-mist from the engine crankcase itself. The oil-mist is introduced and returned via inlet and return passages through one-way reed valves by virtue of crankcase pumping action of the compressor piston. In such an arrangement the compressor bearings can easily be starved of lubrication when starting up from cold and this can result in reduced compressor bearing life. Moreover, as explained in the above document, normal breathing of the compressor crankcase is preferably eliminated to maximise the crankcase pressure fluctuation for the pumping action. Accordingly, since substantial crankcase pressure elevations can occur during induction strokes of the piston the tendency for oil-mist to travel past the piston and appear as oil carry-over is enhanced. This is disadvantageous as referred to above and the present invention has as an object to reduce these shortcomings.

The present invention thus seeks to provide an improved gas compressor wherein oil carry-over can be substantially reduced without undesirably reducing the oil-flow to the bearings.

According to the present invention there is provided a gas compressor comprising a crankcase and cylinder assembly having a rotatable crankshaft with a crankpin connected to a piston to reciprocate the piston in the cylinder for alternatively effecting induction and compression strokes said crankshaft rotating in a bearing sup-

plied with lubrication by a source of lubricant and said crankcase being provided with a sump into which lubricant can drain from said bearing a sump outflow passage for lubricant in the sump and a breather passage having valve means which restricts said breather passage creating crankcase pressure during induction strokes to scavenge lubricant therefrom via said outflow passage characterised in that said outflow passage is a free passage and the inner end thereof is below a predetermined level of lubricant in the sump and said valve means (19, 21; 23) is timed by cooperation of an outer surface (20) of a crank web (21) with the inner end of the breather passage (19) to restrict said breather passage during predetermined portions of said induction strokes to create sufficient crankcase pressure elevations to scavenge lubricant via said outflow passage.

In order that the invention may be more clearly understood and readily carried into effect the same will be further described by way of example with reference to the accompanying drawings of which:-

Fig. 1 illustrates a part-sectional view of a piston and cylinder air compressor in accordance with the invention, and

Fig. 2 illustrates a side view thereof.

Referring to Fig. 1 a single cylinder piston compressor shown in sectional form therein comprises a cylinder and crankcase casting 1 provided with a valve plate 2 and a cylinder head 3. The casting 1 has a cylinder bore 4 within which a piston 5 is reciprocated by means of a crankshaft 6 connected to the piston via a connecting rod 7 and a gudgeon pin 8. The crankshaft is rotatable in respective bearings 9 and 10 which are pressure fed from the right-hand end of the crankcase wherein an oil pressure chamber 11 is provided. This chamber is pressure fed with oil from an engine to which the compressor is mounted by a suitable flange 12. The inner end 13 of the crankshaft is provided with a drive pinion (not shown) engageable with a gear train in the crankcase of the engine.

The oil-ways providing connection between the oil chamber 11 and the big-end bearing and the left hand main bearing, are denoted by broken outlines 14 and 15 and it will be appreciated that in operation, oil flow leakage will run down into the lower part of the crankcase which is shown to be closed by a suitable cover plate 16 and as shown in Fig. 1 and Fig. 2, there is provided a small upwardly directed oil flow passage 18 communicating below a predetermined level with the sump in the lower part of the crankcase. Furthermore, at an appreciably higher point in the crankcase there is provided a somewhat larger air breather passage denoted by reference 19 (Fig. 2) and shown dotted in

Fig. 1. The angular position of this air passage 19 in relation to the crankshaft rotation is chosen so that it is substantially obscured by close proximity of an outer face 20 of the crankweb counterweight 21 during predetermined portions of induction strokes of the crankshaft and piston assembly. Since passages 18 and 19 are the only breathing passages for the crankcase, the inner end of the passage 19 and outer face 20 of the crankweb 21 comprise a timed valve which can impede the breathing of the crankcase over a predetermined portion of the compressor induction stroke during the crankshaft rotation cycle.

As shown in Fig. 2 the direction of rotation of the crankshaft is denoted by an arrow 22, the crankweb 21 being shown in dotted outline. It is seen moreover that at a suitable angular position, moving away from top dead centre after completion of a compression stroke, the surface 20 of the counterweight of the crankweb is about to obscure the inner end of the passage 19. The effect of this is to immediately impede the formerly free flow of air into and out of the crankcase through passage 19 so that the further downward movement of the piston is now able to create a suitable pressure elevation which acts in a sense to drive oil above the plate 16 out into the gear housing upwards via the small passage 18. By such means, the level of drained-out oil in the crankcase of the compressor is effectively limited to a level determined by the position of the passage 18.

The sizes of the passage 18 and the larger passage 19 are selected, along with the range of angular position of the crankshaft for which the passage 19 is closed during induction strokes, to ensure that any tendency for oil build-up in the crankcase is prevented. On the other hand pressure elevations in the crankcase are minimised. This is advantageous as it is undesirable to create more than minimal cyclic pressure elevations in the crankcase. Such elevations may not only reduce the efficiency of the compressor but as discussed earlier they can tend to drive lubricant upwards past the piston into the compression chamber of the compressor and result in oil carry-over in the compressor output.

It will be appreciated that the present invention relies upon the production of acceptable crankcase pressure elevations to drive out surplus oil from pressure fed bearings. In the case of a single cylinder compressor this is effected by closing a valve during an induction stroke but in the case of multiple cylinders with a common crankcase volume it may be necessary to arrange the relative cyclic positions of the pistons such that there is an interval of net reducing crankcase volume and to arrange for the valve device to close during that particular interval. This will inevitably still occur

during an induction stroke of at least one such cylinder.

Claims

1. A gas compressor comprising a crankcase and cylinder assembly (1) having a rotatable crankshaft (6) with a crankpin connected to a piston (5) to reciprocate the piston in the cylinder for alternatively effecting induction and compression strokes said crankshaft (6) rotating in a bearing (9, 10) supplied with lubrication by a source of lubricant and said crankcase being provided with a sump into which lubricant can drain from said bearing a sump outflow passage (18) for lubricant in the sump and a breather passage (19) having valve means which restricts said breather passage creating crankcase pressure during induction strokes to scavenge lubricant therefrom via said outflow passage characterised in that said outflow passage (18) is a free passage and the inner end thereof is below a predetermined level of lubricant in the sump and said valve means (19, 21; 23) is timed by cooperation of an outer surface (20) of a crank web (21) with the inner end of the breather passage (19) to restrict said breather passage during predetermined portions of said induction strokes to create sufficient crankcase pressure elevations to scavenge lubricant via said outflow passage.
2. A gas compressor as claimed in claim 1 characterised by said sump outflow passage (18) being directed upwardly from said predetermined level.

Revendications

1. Compresseur de gaz comprenant un ensemble carter-cylindre (1) comportant un vilebrequin rotatif (6) avec un maneton relié à un piston (5) afin de déplacer celui-ci dans le cylindre à va-et-vient pour effectuer alternativement des courses d'aspiration et de compression, le vilebrequin (6) tournant dans un roulement (9, 10) alimenté pour lubrification par une source de lubrifiant, et le carter comportant un puisard dans lequel peut s'égoutter le lubrifiant provenant dudit roulement, un conduit d'écoulement (18) pour le lubrifiant se trouvant dans le puisard, et un reniflard (19) comportant un dispositif d'obturation qui ferme ledit reniflard, créant une pression dans le carter pendant la course d'aspiration pour chasser du lubrifiant de celui-ci par ledit conduit d'écoulement, caractérisé en ce que le conduit d'écoulement (18) est un passage libre et son extrémité

interne est située au dessous d'un niveau prédéterminé de lubrifiant dans le puisard, et en ce que le fonctionnement du dispositif d'obturation (19, 21) est rythmé par la coopération d'une surface externe (20) d'un flasque de manivelle (21) avec l'extrémité interne du reniflard (19) afin d'obturer celui-ci pendant des parties prédéterminées desdites courses d'aspiration pour produire dans le carter des élévations de pression suffisantes pour chasser le lubrifiant par ledit conduit d'écoulement.

gerichtet ist.

2. Compresseur suivant la revendication 1, caractérisé en ce que le conduit d'écoulement (18) est orienté vers le haut à partir dudit niveau prédéterminé.

Patentansprüche

1. Gaskompressor, umfassend ein Gebilde (1) aus Kurbelgehäuse und Zylinder, welches eine drehbare Kurbelwelle (6) hat mit einem Kurbelzapfen, der mit einem Kolben (5) verbunden ist zum Hin- und Herbewegen des Kolbens in dem Zylinder zum abwechselnden Hervorrufen von Einlaß- und Kompressionshüben, wobei die Kurbelwelle (6) sich in einem Lager (9,10) dreht, welchem Schmiermittel von einer Schmiermittelquelle zugeführt wird, das Kurbelgehäuse mit einem Sumpf, in welchen Schmiermittel von dem Lager abfließen kann, einem Sumpfauslaßdurchgang (18) für Schmiermittel in dem Sumpf, und einem Entlüftungsdurchgang (19) versehen ist, der eine Ventileinrichtung hat, welche den Entlüftungsdurchgang verengt bzw. versperrt, wodurch in dem Kurbelgehäuse Druck während der Einlaßhübe erzeugt wird, um Schmiermittel aus dem Kurbelgehäuse über den Auslaßdurchgang auszuspülen, **dadurch gekennzeichnet**, daß der Auslaßdurchgang (18) ein freier Durchgang ist und sein Innenende sich unterhalb einer vorbestimmten Schmiermittelhöhe in dem Sumpf befindet, und die Ventileinrichtung (19,21;23) zeitgesteuert ist durch Zusammenarbeiten einer Außenfläche (20) eines Kurbelsteges (21) mit dem Innenende des Entlüftungsdurchganges (19), um den Entlüftungsdurchgang während vorbestimmter Abschnitte der Einlaßhübe zu verengen bzw. zu versperren, um ausreichende Erhöhung des Drucks im Kurbelgehäuse zu erzeugen, um Schmiermittel über den Auslaßdurchgang auszuspülen.
2. Gaskompressor nach Anspruch 1, dadurch gekennzeichnet, daß der Sumpfauslaßdurchgang (18) von der vorbestimmten Höhe nach oben



