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(54) COMPRESSOR UNIT WITH AN OIL SLINGER DEVICE.

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(73) Proprietor : **TECUMSEH PRODUCTS COMPANY**
100 East Patterson Street
Tecumseh Michigan 49286 (US)

(72) Inventor : **HANNIBAL, Billy B.**
1109 North River Court
Tecumseh, MI 49286 (US)

(74) Representative : **Brunner, Michael John et al**
GILL JENNINGS & EVERY 53-64 Chancery Lane
London WC2A 1HN (GB)

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Description

This invention relates to a compressor oil cooling device, and more particularly to an oil slinger device wherein an elongated hollow body is adapted to receive a portion of the oil pumped upwardly and sling it radially outwardly against the cooler interior surfaces of the compressor in order to conduct heat energy from the oil to the compressor housing.

The crankshaft of a compressor conducts heat from the motor which drives it, the crankshaft bearings in which it rotates, and other associated parts connected or in close proximity thereto. The crankshaft is machined with an oil passage axially extending therein and has an oil pump connected to its bottom portion, which extends into an oil sump in the bottom of the compressor to pump oil upwardly through the oil passage for distribution to the motor, bearings, and the like in order to cool and lubricate them and the crankshaft. Naturally the oil is heated to high temperatures, and if not cooled may result in the premature deterioration or complete breakdown of the lubricating properties of the oil, thereby causing premature failure of bearings, wrist pins and the like.

Attempts to cool the oil include machining the oil passage completely through the upper portion of the crankshaft so that a portion of the oil may be sprayed upwardly against the cooler top surface of the compressor housing. However, an oil pump of large capacity is required to do this and such pumps may not be adaptable to small compressors. Additionally, most compressors utilize a centrifugal type oil pump, which in most cases may not be capable of generating the force required to spray the oil upwardly against the compressor housing top surface. Nevertheless, should any oil be sprayed against the compressor housing top surface, it tends not to flow along the top and side surfaces of the housing, but rather to drip downwardly over the hot compressor parts, thereby preventing cooling of the oil.

Other attempts have been made wherein the oil passage machined in the upper part of the crankshaft is disposed angularly in relation to the crankshaft longitudinal axis. This is an attempt to take advantage of the rotational motion of the crankshaft to impart greater force to the oil exiting the oil passage to direct the oil away from the compressor top housing surfaces. Although an improvement over the method mentioned in the above paragraph, several problems still exist, among which is the absence of centrifugal force great enough to throw the oil against the compressor upper side surfaces. Another cause contributing to the improper cooling of the oil is the existence of compressor parts which are above or over the crankshaft top end that obstruct the path between the oil passage opening in the crankshaft and the compressor housing surfaces. To overcome this problem, the compressor would need to be constructed with the compressor

parts below the crankshaft top end, which may not be possible due to the curvature of the compressor housing, or the crankshaft would have to be extended to elevate the top end above the compressor parts, which again may not be possible due to the compressor housing, or not desirable due to the increase in weight of the crankshaft.

Of interest relative to the present invention is US-A-2628016 which shows a small bent pipe or tube inserted in the oil passage in the crankshaft. The pipe or tube is bent radially outwards to throw oil onto the wall of the compressor for cooling the oil.

The Ashrae Journal of September 1975, page 34 and Figure 1, discloses a compressor including a hermetically sealed housing having a crankcase with a cylinder head and a reciprocating piston therein, a sump in a bottom portion and a vertically arranged crankshaft including an eccentric portion and having a pump connected to its bottom portion disposed in the sump for pumping lubricant from the pump upwardly through an oil passage in the crankshaft; and an oil slinging device comprising a generally elongate hollow body connected at one end to the crankshaft in communication with the oil passage; an upper portion of the generally elongate hollow body being disposed above the cylinder head and angularly disposed relative to the axis of rotation of the crankshaft so that the other end of the elongate hollow body is disposed upwardly and radially outwardly from the crankshaft whereby a portion of oil delivered upwardly through the oil passage to the generally elongate hollow body by the pump is slung radially outwardly from the crankshaft through an opening in the end of the crankshaft, to cool the oil against interior surfaces of the compressor housing, the crankcase being located in an upper portion of the housing, the crankshaft eccentric being connected to the upper portion of the crankshaft and including a bore open at its lower end to the oil passage and directed angularly upwardly and outwardly relative to the crankshaft axis so that the upper end of the bore is eccentric with respect to the axis of rotation of the crankshaft, one end of the hollow body being received into the upper end of the bore in axial alignment therewith and upwardly and outwardly inclined relative to the crankshaft axis.

According to the invention there is provided, in a radially outer side of the hollow body, an opening for propelling lubricant radially outwardly therefrom and towards the cylinder head to cool the cylinder head.

Whereas the prior art provides a very simple but effective oil cooling arrangement for a compressor and one in which the upwardly slanting bore provides additional centrifugal velocity to the oil thus causing more effective slinging of the oil onto the inner surface of the compressor casing and thus enhancing cooling of the oil, the invention provides also cooling of the cylinder head. The oil is a convenient medium for

transferring heat from the compressor components to the housing of the compressor, as the oil can be used to contact all of the components inside the housing. Heat is transferred from the hot components to the oil, and then transferred from the oil to the compressor housing.

The invention itself will be better understood by reference to the following description of an embodiment of the invention taken in conjunction with the accompanying drawings, wherein :

Figure 1 is a sectional view of Figure 2 along line 1-1 and viewed in the direction of the arrows ;

Figure 2 is a broken-away top plan view of Figure 1 ;

Figure 3 is a broken-away, elevational view of the upper portion of the compressor viewed from the left side of Figure 1 ;

Figure 4 is an internal view of the cylinder head of the compressor ;

Figure 5 is a sectional view of Fig. 4 along line 5-5 and viewed in the direction of the arrows ; and

Figure 6 is a side elevational view of an oil tube disposed in the oil passage of the crankshaft.

Referring to the drawings, and particularly Figure 1, conventional compressor 8 comprises lower housing 10 and upper housing 12, which may be welded or brazed at seam 14. Mounted within compressor 8 is crankcase 16 having crankshaft 18 rotatably received therethrough, and a motor 20 comprising rotor 22 secured to crankshaft 18 and stator 24 with field winding 26.

The upper portion of crankshaft 18 has closed-loop end 28 of connecting rod 30 connected thereto and which has its opposite end connected by wrist pin 32 and spring clip 34 to piston 36 disposed in cylinder 38 of crankcase 16. Cylinder 38 has connected thereto gasket 40, leaf plate 42, valve plate 44, gasket 46, and cylinder head 48, by four bolts 50. The piston-cylinder arrangement is dynamically balanced by counterweight 52 connected to crankshaft 18.

Disposed in lower housing 10, along with refrigerant tubing 54, is oil pump 56 which is connected to the bottom end portion of crankshaft 18 in oil sump 58. Crankshaft 18 has axially disposed therein oil passage 60 and upper oil passage 62 for delivering oil to lubricate typical points, such as main bearing 64 and bearing 66.

During operation, very high temperatures exist within compressor 8 causing the components therein, for example, motor 20, crankcase main bearing 64, crankshaft bearing 66, and most particularly cylinder head 48 to become extremely hot, thereby requiring cooling.

Generally, the cooling of the above mentioned parts is accomplished by oil pump 56 pumping oil from oil sump 58 upwardly through oil passage 60 to not only lubricate points, such as crankcase main bearing 64 and crankshaft bearing 66, but also to conduct heat

energy from motor 20, crankcase main bearing 64, crankshaft bearing 66, and other parts connected or in close proximity to crankshaft 18. Upon termination of its upward travel through oil passage 60 or upper oil passage 62, the oil is returned to oil sump 58 at very high temperatures, and, if not properly cooled, may prematurely lose its lubricating properties, thereby possibly resulting in the early failure of wrist pins, bearings and the like.

A unique means of cooling the oil is provided by oil slinger tube 68, which is fitted in opening 63 of upper oil passage 62 in the top end of crankshaft 18. In the present embodiment, slinger 68 is angularly disposed relative to the rotational axis of crankshaft 18. Slinger 68 is of a predetermined length for reasons which will be discussed below and has opening 70 disposed therein, which, as measured from the rotational axis of crankshaft 18, has an effective radius longer than the effective radius of crankshaft 18.

The cooling of the oil takes place upon motor 20 being energized through conventional multi-pin terminal 72, which causes rotor 22 to rotate crankshaft 18 and oil pump 56. As the oil is pumped upwardly by oil pump 56 through oil passage 60 and upper oil passage 62, a portion of the oil will be urged upwardly through slinger 68 and opening 70 to be slung generally upwardly and radially outwardly against side surfaces 73 of upper housing 12. Because both lower housing 10 and upper housing 12 are cooler than the oil, heat energy will be conducted from the oil to housings 10 and 12 thereby cooling the oil as it flows downwardly to oil sump 58. To insure the oil being slung by slinger 68 does not impact top surface 75 of upper housing 12, and consequently drip downwardly upon compressor parts, such as discharge muffler cover 74, suction muffler cover 76, and the other above mentioned parts, slinger 68 is angularly oriented from the vertical to direct the spray of oil away from top surface 75 and toward side surfaces 73 of upper housing 12. Furthermore, should certain compressor parts be disposed above the top end of crankshaft 18, as illustrated in Figure 1, slinger 68 may be manufactured having a predetermined length which will insure opening 70 being above such parts, thereby preventing the existence of any obstruction in the path of the oil being slung by slinger 68.

To reiterate, slinger 68, due to its angular orientation relative to the rotational axis of crankshaft 18 and the increased effective radius of opening 70, is able to sling the oil against surfaces 73 of upper housing 12. In addition, slinger 68 can be bent to allow directional control of the spray path of the oil exiting opening 70 for various compressor models.

It was earlier mentioned that cylinder head 48 experiences extremely high temperatures during the operation of compressor 8. This is primarily due to the temperature existing within the interior space of com-

pressor 8 and the high temperatures produced within cylinder 38 upon compression of gaseous refrigerant. Conventional means to alleviate the extremely high temperatures experienced by cylinder head 48 include disposing a plurality of fins 78 on cylinder head 40 to conduct the heat energy therefrom to the interior space of compressor 8. In spite of this, cylinder head 48 may still remain at undesirable temperatures during the operation of compressor 8.

To reduce the temperatures of cylinder head 48, bleed holes 80 and 81 are disposed in the side of oil slinger tubes 68, with bleed hole 80 facing radially outwardly therefrom. Because slinger 68 rotates with crankshaft 18, bleed hole 80 will always rotate facing towards upper housing 12. This permits a portion of the oil traveling upwardly through slinger 68 to be slung generally horizontally, radially outwardly through bleed hole 80. As slinger 68 rotates past cylinder head 48, a spray of oil is slung from bleed hole 80 onto cylinder head 48 for cooling purposes. Little oil is slung from hole 81 since it faces radially inwardly towards the rotational axis of crankshaft 18. Hole 81 is present only because of manufacturing expediency.

To insure that a portion of the oil slung from bleed hole 80 flows over end portion 49 of cylinder head 48 and ribs 78 disposed thereon, a deflector and heat sink 82 having slots 84 disposed therein is transversely disposed on the top surface of cylinder head 48. Consequently, upon slinger 68 rotating past cylinder head 48 a portion of oil is caught by deflector 82 and caused to flow over the surfaces of cylinder head 48 adjacent valve plate 44, while at the same time allowing a remaining portion of the oil to pass through slots 84 and to flow over end portion 49 of cylinder head 48 and ribs 78.

As illustrated in Figures 1 and 5, deflector 82 is transversely disposed on the top surface portion of cylinder head 48 adjacent gasket 46. Deflector 82 could be disposed on the top surface of cylinder head 48 adjacent end portion 49, however, due to the small confines generally existing between cylinder head 48 and upper housing 12, it has been found that deflector 82 performs its desired function most efficiently when disposed adjacent gasket 46. Furthermore, deflector 82 is of a predetermined height and desirably disposed away from housing 10 to allow for production tolerances.

Claims

1. A compressor (8) including a hermetically sealed housing (10,12) having a crankcase (16) with a cylinder head (38) and a reciprocating piston therein, a sump (58) in a bottom portion and a vertically arranged crankshaft (18) including an eccentric portion and having a pump (56) connected to its bottom portion disposed in the sump (58) for pumping lubric-

ant from the pump upwardly through an oil passage (60) in the crankshaft (18); and an oil slinging device (68) comprising a generally elongate hollow body (68) connected at one end to the crankshaft (18) in communication with the oil passage (60); an upper portion of the generally elongate hollow body (68) being disposed above the cylinder head (38) and angularly disposed relative to the axis of rotation of the crankshaft (18) so that the other end of the elongate hollow body is disposed upwardly and radially outwardly from the crankshaft (18) whereby a portion of oil delivered upwardly through the oil passage (60) to the generally elongate hollow body (68) by the pump (56) is slung radially outwardly from the crankshaft through an opening in the end of the crankshaft, to cool the oil against interior surfaces of the compressor housing, the crankcase (16) being located in an upper portion of the housing (10,12), the crankshaft eccentric being connected to the upper portion of the crankshaft (18) and including a bore (62) open at its lower end to the oil passage (60) and directed angularly upwardly and outwardly relative to the crankshaft axis so that the upper end of the bore (62) is eccentric with respect to the axis of rotation of the crankshaft (18), one end of the hollow body (68) being received into the upper end of the bore (62) in axial alignment therewith and upwardly and outwardly inclined relative to the crankshaft axis, characterised in that: there is provided in a radially outer side of the hollow body (68), an opening (80) for propelling lubricant radially outwardly therefrom and towards the cylinder head (38) to cool the cylinder head.

35 Ansprüche

1. Ein Verdichter (8), welcher ein hermetisch abgedichtetes Gehäuse (10, 12), das ein Kurbelgehäuse (16) mit einem Zylinder (38) und einem sich darin hinund herbewegenden Kolben aufweist, einen Sumpf (58) in einem unteren Teil und eine vertikal angeordnete Kurbelwelle (18), welche einen exzentrischen Teil enthält und eine Pumpe (56) aufweist, die mit ihrem unteren, in dem Sumpf (58) angeordneten Bereich zum Pumpen von Schmiermittel von der Pumpe nach oben durch einen Öldurchgang (60) in der Kurbelwelle (18) verbunden ist; und eine Öl-Schleudereinrichtung (68) enthält, die einen im wesentlichen länglichen hohlen Körper (68) umfaßt, der an einem Ende mit der Kurbelwelle (18) in Verbindung mit dem Öldurchgang (60) stehend verbunden ist, wobei ein oberer Teil des im wesentlichen länglichen hohlen Körpers (68) oberhalb des Zylinders (38) angeordnet und im Winkel relativ zu der Drehachse der Kurbelwelle so angeordnet ist, daß das andere Ende des länglichen hohlen Körpers nach oben und radial nach außen von der Kurbelwelle (18) aus angeordnet ist, wodurch ein Teil des nach oben

durch den Öldurchgang (60) dem im wesentlichen länglichen hohlen Körper (68) durch die Pumpe (56) zugelieferten Öls von der Kurbelwelle radial nach außen durch eine Öffnung in dem Ende der Kurbelwelle geschleudert wird, um das Öl gegen innere Oberflächen des Kompressorgehäuses zum Kühlen zu schleudern, wobei die Kurbelwelle (16) in einem oberen Bereich des Gehäuses (10, 12) angeordnet ist, der Kurbelwellenexzenter mit dem oberen Bereich der Kurbelwelle (18) verbunden ist und eine Bohrung (62) enthält, die an ihrem unteren Ende zu dem Öldurchgang (60) hin offen und im Winkel nach oben und nach außen relativ zu der Kurbelwellenachse gerichtet ist, so daß das obere Ende der Bohrung (62) exzentrisch in bezug auf die Drehachse der Kurbelwelle (18) ist, wobei ein Ende des hohlen Körpers (68) in dem oberen Ende der Bohrung (62) in axialer Ausrichtung damit aufgenommen und nach oben und nach außen relativ zu der Kurbelwellenachse geneigt ist, **dadurch gekennzeichnet**, daß in einer radial äußeren Seite des hohlen Körpers (68) eine Öffnung (80) zum Treiben von Schmiermittel radial nach außen davon und in Richtung zu dem Zylinderkopf (38), um den Zylinderkopf zu kühlen, vorgesehen ist.

Revendications

1. Compresseur (8) comprenant un carter (10, 12) hermétiquement fermé, contenant un carter de vilebrequin (16) avec une culasse (38) et un piston alternatif à l'intérieur, une cuvette (58) dans la partie basse et un vilebrequin (18) disposé verticalement, qui comprend une partie excentrique et qui est relié à sa partie inférieure à une pompe (56) disposée dans la cuvette (58) pour refouler le lubrifiant de la pompe vers le haut à travers un passage d'huile (60) ménagé dans le vilebrequin (18) ; et un dispositif de projection d'huile (68) comprenant un corps creux (68) de forme générale allongée relié par une première extrémité au vilebrequin (18), en communication avec le passage d'huile (60) ; une partie supérieure du corps creux (68) de forme générale allongée étant disposée au-dessus de la culasse (38) et inclinée par rapport à l'axe de rotation du vilebrequin (18), de sorte que l'autre extrémité du corps creux de forme allongée est disposée vers le haut et radialement vers l'extérieur par rapport au vilebrequin (18), de sorte qu'une partie de l'huile débitée vers le haut par la pompe (56) à travers le passage d'huile (60) vers le corps creux (68) de forme générale allongée est projetée radialement vers l'extérieur à partir du vilebrequin par une ouverture à l'extrémité du vilebrequin, pour refroidir l'huile contre les surfaces intérieures du carter du compresseur, le carter de vilebrequin (16) étant placé dans une partie supérieure du carter (10, 12), l'excentrique du vilebrequin étant relié à la partie supérieure du vilebrequin (18) et comprenant un perçage (62) ouvert à

son extrémité inférieure sur le passage d'huile (60) et dirigé dans une position inclinée vers le haut et vers l'extérieur par rapport à l'axe du vilebrequin, de sorte que l'extrémité supérieure ou perçage (62) est excentrique par rapport à l'axe de rotation du vilebrequin (18), une extrémité du corps creux (68) étant reçue dans l'extrémité supérieure du perçage (62), dans l'alignement axial de celui-ci, et inclinée vers le haut et vers l'extérieur par rapport à l'axe du vilebrequin, caractérisé en ce qu'il est prévu, dans un côté radialement externe du corps creux (68), une ouverture (80) pour projeter le lubrifiant radialement à l'extérieur de celui-ci et en direction de la culasse (38) pour refroidir la culasse.

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