PCT

WORLD INTELLECTUAL PROPERTY ORGANIZATION
International Bureau

INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification 3 : F04B 17/00

A1

(11) International Publication Number: WO 83/ 03877

(43) International Publication Date: 10 November 1983 (10.11.83)

(21) International Application Number: PCT/US83/00659

(22) International Filing Date: 3 May 1983 (03.05.83)

(31) Priority Application Number: 374,050

(32) Priority Date: 3 May 1982 (03.05.82)

(33) Priority Country: US

(71) Applicant: TECUMSEH PRODUCTS COMPANY [US/US]; 100 East Patterson Street, Tecumseh, MI 49286 (US).

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

(74) Agents: HOFFMAN, John, F. et al.; Gust, Irish, Jeffers & Hoffman, 1006 Anthony Wayne Bank Building, Fort Wayne, IN 46802 (US).

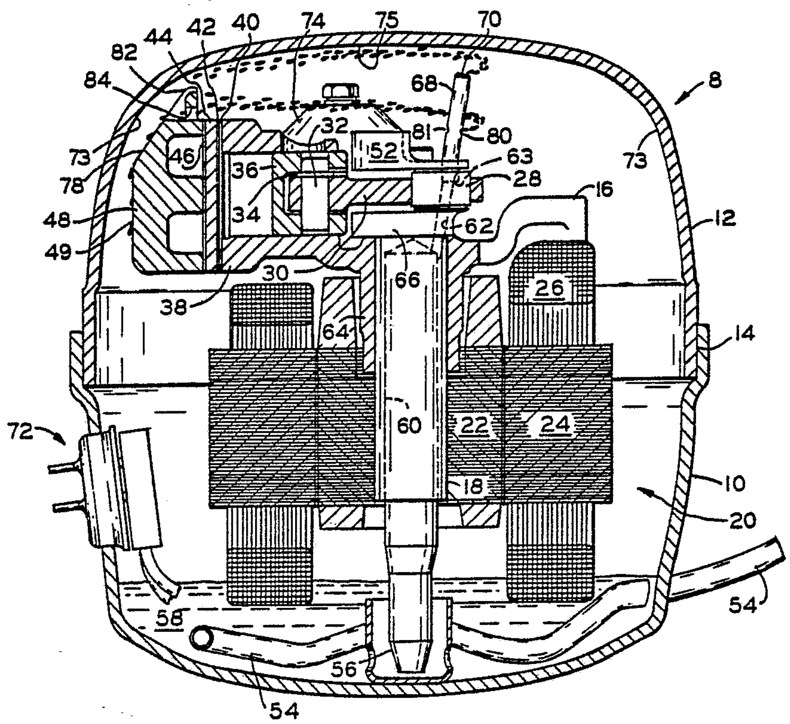
(81) Designated States: AT (European patent), AU, BE (European patent), BR, CH (European patent), DE (European patent), DK, FR (European patent), GB (European patent), JP, LU (European patent), NL (European patent), SE (European patent), SU.

Published
With international search report.

(54) Title: OIL SLINGER DEVICE

(57) Abstract

An oil slinging device is provided in a compressor utilizing a centrifugal oil pump (50) to pump oil from a sump (58) in the bottom of the compressor upwardly through an axially disposed oil passage (60) in the crankshaft (18). The device is an elongated, rigid tube (68) connected to the upper end of the crankshaft and in communication with the oil passage, and is angularly disposed outwrdly in relation to the rotational axis of the crankshaft to dispose its remote upper end (70) upwardly and radially outwardly from the periphery of the rotating crankshaft. Oil pumped through the device by the oil pump is slung radially outwardly against the interior surfaces (73) of the compressor housing (12) in order to allow the oil to flow downwardly along the compressor housing inner surfaces, thereby cooling the oil by conducting heat energy therefrom to the compressor housing (12).



FOR THE PURPOSES OF INFORMATION ONLY

Codes used to identify States party to the PCT on the front pages of pamphlets publishing international applications under the PCT.

AT	Austria	LI	Liechtenstein
AU	Australia	LK	Sri Lanka
BE	Belgium	LU	Luxembourg
BR	Brazil	MC	Monaco
CF	Central African Republic	MG	Madagascar
CG	Congo	MR	Mauritania
CH	Switzerland	MW	Malawi
CM	Cameroon	NL	Netherlands
DE	Germany, Federal Republic of	NO	Norway
DK	Denmark	RO	Romania
FI	Finland	SE	Sweden
FR	France	SN	Senegal
GA	Gabon	SU	Soviet Union
GB	United Kingdom	TD	Chad
HU	Hungary	TG	Togo
JP	Japan	US	United States of America
KP	Democratic People's Republic of Korea		

OIL SLINGER DEVICE

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 U.S. Patent No. 2,125,645 issued to Money on August 2, 1938. Money has provided a small pipe or tube to be inserted in the oil passage in the crankshaft. The pipe or tube is vertically disposed with its top opening just slightly above the top surface of the crankshaft to throw oil onto the compressor parts for lubrication. It bears noting that the pipe or tube is nonadjustable, is vertically disposed relative to the compressor housing, and extends only a slight distance above the crankshaft top surface. Analogically, the pipe or tube acts similarly to a lawn sprinkler in that it distributes the oil upon the top surfaces of the compressor parts.

The present invention overcomes the earlier described problems and disadvantages associated with the prior art by providing an elongated, rigid tube to be fitted to the oil passage in the crankshaft. The tube is angularly disposed relative to the rotational axis of the crankshaft so that the tube remote upper end is spaced upwardly and radially outwardly from the periphery of the crankshaft top end. The effect of this is to increase the radius of the remote upper end of the tube from the rotational axis of the crankshaft, thereby increasing its angular velocity. This results in a greater centrifugal force being imparted to the oil to throw it against the compressor housing upper surfaces so that it may be cooled as it flows downwardly along the surfaces to the oil sump.

Another advantage of the present invention is the length of the tube which allows it to be adjusted to an optimum angular position that will direct the oil against the upper side surfaces of the compressor housing, thereby avoiding any possible obstructions.

Furthermore, since the tube may be of variable length, there is no requirement to build the compressor with its internal components disposed below the crankshaft top end, or to extend the crankshaft above these components to eliminate any obstructions in the path of the oil.

The present invention is concerned with protecting the bearings, valves, motor insulation and the oil from damage, as well as to improve the efficiency of the compressor by preventing these components from overheating. 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 present invention makes it possible to efficiently utilize the housing as a heat conductor by optimally spraying oil on the housing.

Broadly stated, the present invention provides an oil slinging device comprising a generally elongated hollow body having opposing ends and being connected to a rotatable crankshaft having an oil passage axially disposed therein and with which the body is in communication through one of its ends. The upper end of the generally elongated hollow body is angularly disposed relative to the axis of rotation of the crankshaft in order to place the end upwardly and radially outwardly from the crankshaft to increase its effective radius, whereby oil delivered upwardly through the tube is radially slung outwardly from the crankshaft and against the interior surfaces of the compressor housing.

It is an object of the present invention to provide an oil slinging device which slings oil against the compressor housing upper surfaces.

Another object of the present invention is to provide an oil slinging device which is in communication with a crankshaft oil passage and which is elongated to permit it to be angularly adjusted relative to the rotational axis of the crankshaft, thereby permitting directional control of the oil relative to the compressor housing upper surfaces for various compressor models.

The above mentioned and other features and objects of this invention, and the manner of obtaining them will become more apparent and 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:

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

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

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

Fig. 4 is an internal view of the cylinder head of the compressor;

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

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

Referring to the drawings, and particularly Fig. 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 windings 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 loose its lubricating properties, thereby possibly resulting in the early failure of writs 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 Fig. 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 compressor 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 temperature of cylinder head 48, bleed holes 80 and 81 are disposed in the side of oil slinger tube 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 Figs. 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.

While this invention has been described as having a specific embodiment, it will be understood that it is capable of further modification. This application is therefore intended to cover any variations, uses, or adaptations of the invention following general principles thereof, and including such departures from the present disclosure as come within known or customary practice in the art to which this invention pertains and fall within the limits of the appended claims.

CLAIMS

1. In combination with a compressor including a hermetically sealed housing having a crankcase therein with a cylinder disposed in said crankcase and a sump in a bottom portion thereof, a crankshaft rotatably received in said crankcase and having a piston operably connected thereto and disposed in said cylinder, said crankshaft having centrifugal pump means connected to its bottom portion and disposed in said sump for pumping lubricant from said sump upwardly through an oil passage in said crankshaft, an oil slinging device comprising:

a generally elongated hollow body having opposite ends and being connected to said rotatable crankshaft and in communication with said oil passage through a first one of said ends,

an upper portion of said generally elongated hollow body being angularly disposed relative to the axis of rotation of said crankshaft to dispose an opposite end of said elongated hollow body upwardly and radially outwardly from said crankshaft, whereby a portion of oil delivered upwardly through said oil passage to said generally elongated hollow body opposite end by said centrifugal pump means is radially slung outwardly from said crankshaft and against interior surfaces of said compressor housing.

2. The compressor of Claim 1 wherein said body is substantially linear and said first end is connected to said oil passage at its opening in the upper end of said crankshaft.

3. The compressor of Claim 2 wherein said body is a bent tube.

4. In combination with a compressor including a hermetically sealed housing having a crankcase therein with a cylinder disposed in said crankcase and a sump in a bottom portion thereof, a rotatable crankshaft having an oil passage axially disposed therein and received in said crankcase and having a piston operably connected thereto and disposed in said cylinder, an oil slinging apparatus comprising:

a generally elongated hollow body having opposite ends and connected to said rotatable crankshaft,

a first one of said ends being disposed in said oil passage to provide communication between said oil passage and said generally elongated hollow body,

an opposite end of said generally elongated hollow body being disposed axially upwardly and radially outwardly from the upper end of said crank-shaft, and

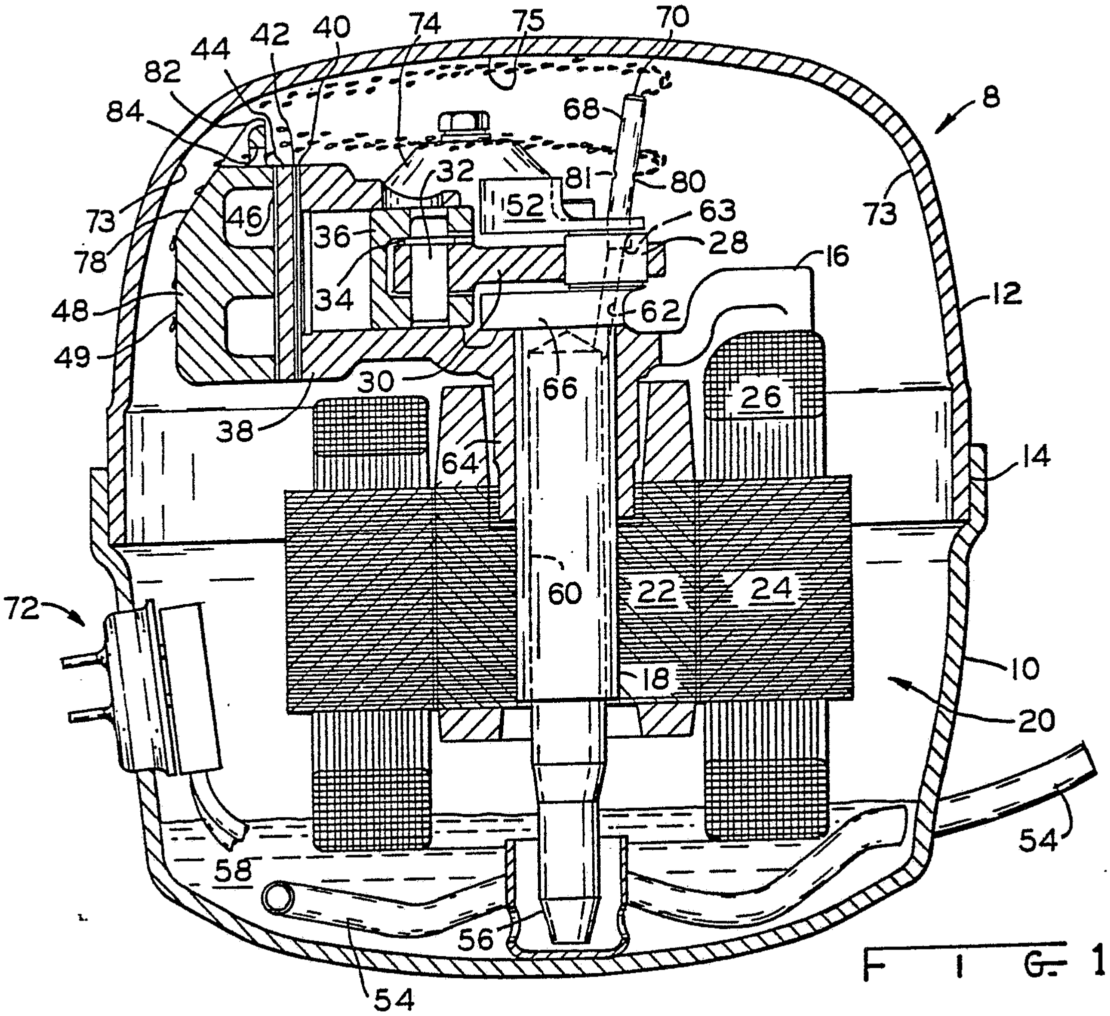
means connected to a bottom portion of said crankshaft and disposed in said sump for pumping oil from said sump upwardly through said oil passage, whereby a portion of the oil is pumped through said generally elongated hollow body and slung radially outwardly therefrom and against the interior surfaces of said housing, thereby cooling the oil as it flows downwardly to said sump.

5. The compressor of Claim 4 wherein said body is substantially straight and said first end is fitted in the opening of said oil passage in the upper end of said crankshaft.

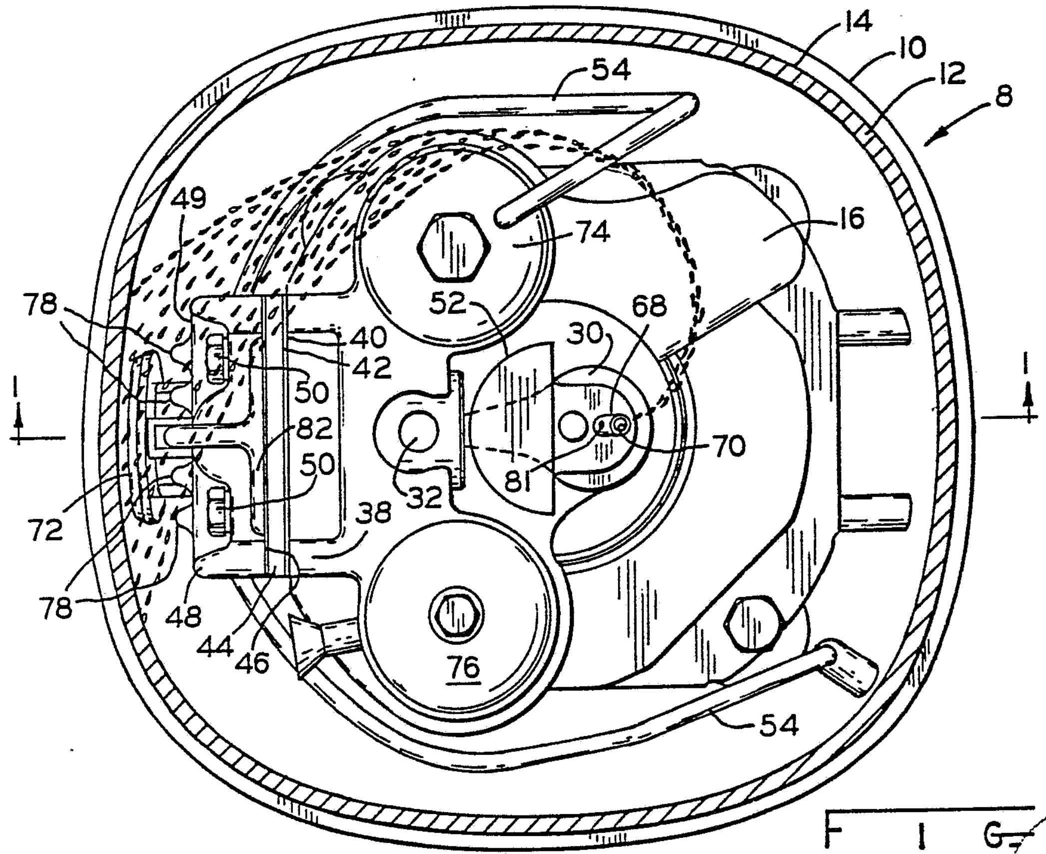
6. The compressor of Claim 5 wherein said body opposite end is disposed above said cylinder.

7. The compressor of Claim 4 wherein said body is a bent tube having a first portion parallel to the axis of rotation of said crankshaft and a second, distal end angularly disposed relative to the crankshaft axis of rotation.

1/2


70
75
74
40
42
44
82
84
73
78
48
49
46
36
34
32
52
81
80
68
63
28
16
62
66
30
38
64
26
12
73
8
14
60
22
24
10
20
18
72
58
56
54
54

F I G. 1


14
10
12
8
54
49
74
16
78
52
68
40
30
42
50
82
70
32
81
50
38
72
78
48
44
46
76
54

F I G. 2

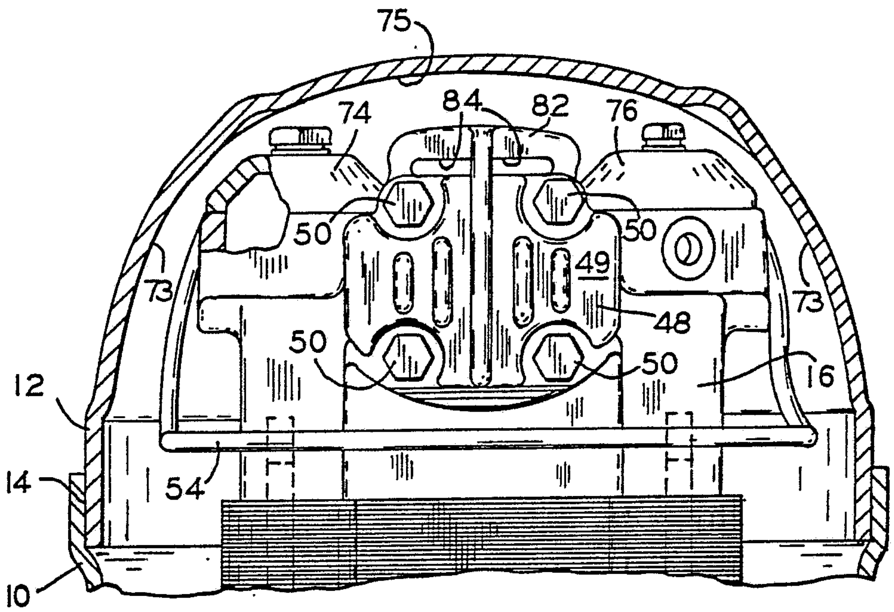


FIG 3

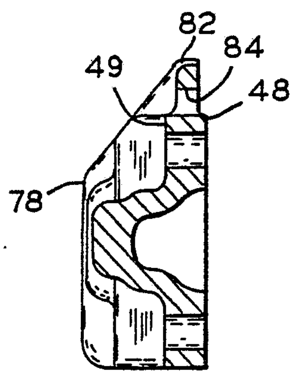


FIG 5

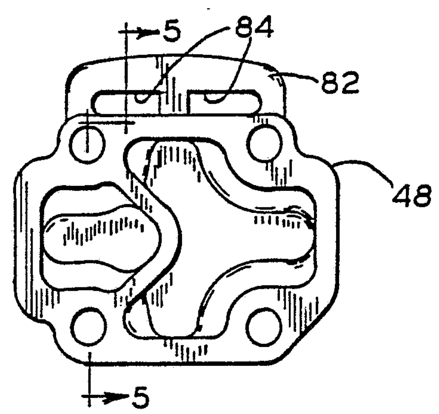


FIG 4

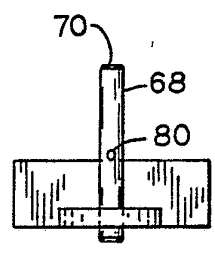


FIG 6

INTERNATIONAL SEARCH REPORT

International Application No PCT/US 83/00659

I. CLASSIFICATION OF SUBJECT MATTER (if several classification symbols apply, indicate all) [3]

According to International Patent Classification (IPC) or to both National Classification and IPC

INT. CL.[3] F04B 17/00
U.S. CL. 417/368

II. FIELDS SEARCHED

Minimum Documentation Searched [4]

Classification System	Classification Symbols
U.S.	417/368, 372, 902 418/85 184/6.16, 6.18

Documentation Searched other than Minimum Documentation to the Extent that such Documents are Included in the Fields Searched [5]

III. DOCUMENTS CONSIDERED TO BE RELEVANT [14]

Category *	Citation of Document, [16] with indication, where appropriate, of the relevant passages [17]	Relevant to Claim No. [18]
A	US,A, 3,285,504, (SMITH) 15 November 1966	1-7
A	US,A, 2,504,528, (HUME) 18 April 1950	1-7
Y	US,A, 2,500,751, (HALFVARSON) 14 March 1950	1-7
Y	US,A, 2,125,645, (MONEY) 2 August 1938	1-7
A	US,A, 2,050,385, (SCHMIDT) 11 August 1936	1-7
A	DE,C, 938,313, (BACH) 26 January 1956	1-7
A	FR,A, 871,115, (BEAU) 9 April 1942	1-7

* Special categories of cited documents: [15]

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

IV. CERTIFICATION

Date of the Actual Completion of the International Search [2] 18 July 1983	Date of Mailing of this International Search Report [2] 09 AUG 1983
International Searching Authority [1] ISA/US	Signature of Authorized Officer [20] D. E. Stout D. E. Stout/rb

Form PCT/ISA/210 (second sheet) (October 1981)