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(54) **OIL DISTRIBUTION SYSTEM FOR A COMPRESSOR.**

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Description

The invention relates to hermetically sealed refrigeration compressors, and more particularly to an oil distribution system for such compressors adapted to conduct heat energy from the cylinder heads within the compressor housings.

In those refrigeration compressors utilizing a piston-cylinder arrangement for compression, the gaseous refrigerant becomes extremely hot upon compression and conducts heat energy to the cylinder and cylinder head, thereby increasing temperatures of the cylinder and cylinder head. These higher temperatures may cause lubricant to boil and lose its lubricating properties, which eventually results in carbon deposits forming on valves, valve seats, leaf plates and the like. The steady accumulation of such deposits will eventually destroy the integrity of the valve arrangement requiring shutdown of the compressor and replacement of the defective parts.

Generally, the cooling of the cylinder head is left to the suction inlet refrigerant that is delivered directly into the compressor housing. Although adequate to acceptably cool the cylinder head, higher compressor efficiencies are obtainable if the cylinder head is cooled even further.

The most relevant prior art of which applicants are aware is U.S. Patent No. 2,125,645 issued to Money on August 2, 1938. Money has a short tube extending upwardly from the top opening of the oil passage in the crankshaft that serves to spray oil upon the top surfaces of compressor components. To insure that some of the oil will fall upon the outer surfaces of the pistons and cylinder to lubricate them, a baffle is connected to the top of the cylinder to deflect some of the sprayed oil so that it may drip downwardly onto the outer surfaces of the piston. It appears that the majority of the oil which is sprayed over the baffle impacts the compressor housing to return to the oil sump in the bottom of the compressor. It should be noted that the baffle in the Money patent is disposed on the most axially inwardly portion of the cylinder to insure deflection of oil to lubricate the piston.

US—A—2198258 similarly discloses cooling the cylinder head of a compressor by passing oil over it, the oil being dripped from stationary parts onto the cylinder head to provide the cooling. In US—A—2628016 oil is sprayed against the wall of the housing and the outside of the stator body so that the oil runs down the side walls and is cooled by contact therewith. There is no teaching in the specification of the cooling of the cylinder head by the oil and further it is noted that the location of the cylinder head is such that oil sprayed outwardly cannot reach the cylinder head itself.

Other devices have been used to decrease the extremely high temperatures of the cylinder head, for example, heat radiation fins disposed on the cylinder head, which have been effective in various degrees in lowering the cylinder head temperature. However, further cylinder head temperature reduction is desirable in order to increase compressor efficiency, prevent accumulation of carbon deposits on the valve arrangements, and prolong the life of parts such as bearings, insulation and the like.

The Ashrae Journal, Sept. 1975, pages 32 to 35, discloses a compressor including a hermetically sealed housing having a crankcase therein with a cylinder disposed in the crankcase and a sump in a bottom portion thereof; a substantially vertically disposed crankshaft rotatably received in the crankcase and having a piston operably connected thereto and disposed in the cylinder; a cylinder head, the crankshaft having pump means connected to its bottom portion and disposed in the sump for pumping lubricant from the sump upwardly through a lubricant passage in the crankshaft, and a lubricant distribution system having a generally elongate hollow body connected to the crankshaft and in communication with the lubricant passage and an end opening through which lubricant is thrown radially outwardly against the housing upon rotation of the crankshaft; an upper portion being of the hollow body angularly disposed relative to the axis of rotation of the crankshaft to dispose the opposite end upwardly and radially outwardly from the crankshaft.

One technique for maintaining the discharge valve temperature low enough to prevent an accumulation of carbon deposits is to transfer heat energy from the cylinder head expeditiously. This invention accomplishes such heat transfer by bathing the cylinder head with a flow of oil.

According to the present invention, there is provided a compressor including a hermetically sealed housing having a crankcase therein with a cylinder disposed in the crankcase and a sump in a bottom portion thereof; a substantially vertically disposed crankshaft rotatably received in the crankcase and having a piston operably connected thereto and disposed in the cylinder; a cylinder head, the crankshaft having pump means connected to its bottom portion and disposed in the sump for pumping lubricant from the sump upwardly through a lubricant passage in the crankshaft, and a lubricant distribution system having a generally elongate hollow body connected to the crankshaft and in communication with the lubricant passage and an end opening through which lubricant is thrown radially outwardly against the housing upon rotation of the crankshaft; an upper portion being of the hollow body angularly disposed relative to the axis of rotation of the crankshaft to dispose the opposite end upwardly and radially outwardly from the crankshaft; characterized by:

means substantially vertically upstanding from the cylinder head for directing a portion of the lubricant slung by the generally elongate hollow body to said cylinder head to conduct heat energy therefrom; and

in a radially outer side of the hollow body, an opening for propelling lubricant radially outwardly therefrom and against the directing means.

Upon rotation of the crankshaft, a portion of the oil pumped upwardly through the elongate body is slung generally radially outwardly through the opening in the side of the body, and, upon reaching the transversely disposed oil deflector on the cylinder head, deflected by the oil deflector to flow over the side and end exterior surfaces of the cylinder head to conduct heat therefrom.

The present invention provides significant additional cooling to the cylinder, and particularly to the cylinder head, of a refrigeration compressor, thereby increasing the compressor's efficiency, preventing the premature accumulation of carbon deposits on valve arrangements, and increasing the useful life of bearings, insulation and the like.

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:

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

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

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

Referring to the drawings, and particularly Fig. 1, conventional compressor 8 comprises a 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 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 thrust 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 pin, 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 surfaces 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 made of a rigid material that allows it to be 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 the surfaces 73 of upper housing 12. In addition, slinger 68 is 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 48 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 travelling upwardly through slinger 68 to be slung generally horizontally, radially outwardly through bleed hole 80. As slinger 68 rotates past cylinder head 48, a pray of oil is slung from bleed hole 80 onto cylinder head 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 caued 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 chould 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) therein with a cylinder (38) disposed in the crankcase and a sump (58) in a bottom portion (10) thereof; a substantially vertically disposed crankshaft (18) rotatably received in the crankcase and having a piston (36) operably connected thereto and disposed in the cylinder; a cylinder head (48), the crankshaft having pump means (56) connected to its bottom portion and disposed in the sump for pumping lubricant from the sump upwardly through a lubricant passage (60, 62) in the crankshaft, and a lubricant distribution system having a generally elongate hollow body (68) connected to the crankshaft and in communication with the lubricant passage and an end opening through which lubricant is thrown radially outwardly against the housing (10, 12) upon rotation of the crankshaft; an upper portion being of the hollow body (68) angularly disposed relative to the axis of rotation of the crankshaft to dispose the opposite end upwardly and radially outwardly from the crankshaft; characterized by:

means (82) substantially vertically upstanding from the cylinder head (48) for directing a portion of the lubricant slung by the generally elongate hollow body to said cylinder head to conduct heat energy therefrom; and,

in a radially outer side of the hollow body (68), an opening (80) for propelling lubricant radially outwardly therefrom and against the directing means (82).

2. A compressor according to claim 1, wherein the directing means (82) is a flange member (82) having at least one opening therein to allow passage therethrough of lubricant to conduct heat energy from the cylinder head.

3. A compressor according to claim 2, wherein the flange member is in direct thermal contact with the cylinder head.

Patentansprüche

1. Ein Verdichter (8) einschließlich eines hermetisch abgedichteten Gehäuses (10, 12) mit einem darin befindlichen Kurbelgehäuse (16) mit einem an dem Kurbelgehäuse angeordneten Zylinder (38) und einem Sumpf (58) in einem unteren Teil desselben; einer im wesentlichen vertikal angeordneten Kurbelwelle (18), die drehbar in dem Kurbelgehäuse aufgenommen ist und einen funktionsmäßig mit ihr verbundenen und in dem Zylinder angeordneten Kolben (36) aufweist; einem Zylinderkopf (48), wobei die Kurbelwelle eine Pumpeinrichtung (56) aufweist, die mit ihrem unteren Teil verbunden und in dem Sumpf angeordnet ist, um Schmiermittel von dem Sumpf aus durch einen Schmiermitteldurchgang (60, 62) in der Kurbelwelle nach oben zu pumpen, und einem Schmiermittel-Verteilungssystem, das einen im wesentlichen länglichen hohlen Körper (68), der mit der Kurbelwelle verbunden ist und mit dem Schmiermitteldurchgang in Verbindung steht, und eine Endöffnung aufweist, welche Schmiermittel radial nach außen gegen das Gehäuse (10, 12) durch Rotation der Kurbelwelle geschleudert wird; wobei ein oberer Teil des kohlen Körpers (68) winklig relativ zur Rotations-

achse der Kurbelwelle angeordnet ist, um das entsprechende Ende nach oben und radial nach außen von der Kurbelwelle gerichtet anzuordnen; gekennzeichnet durch eine Einrichtung (82), die im wesentlichen vertikal von dem Zylinderkopf (48) nach oben steht, um einen Teil des von dem im wesentlichen länglichen hohlen Körper weggeschleuderten Schmiermittels zu dem Zylinderkopf zu leiten, um Wärmenergie davon abzuführen; und eine öffnung (80) in einer radialen äußeren Seite des hohlen Körpers (68) um Schmiermittel davon radial nach außen und gegen die Leitungseinrichtung (82) zu treiben.

2. Ein Verdichter nach Anspruch 1, wobei die Leiteinrichtung (82) ein Flanschteil (82) ist, das wenigstens eine öffnung darin aufweist, um den Durchgang von Schmiermittel durch die öffnung hindurch zu ermöglichen, um Wärmeenergie von dem Zylinderkopf abzuführen.

3. Verdichter nach Anspruch 2, wobei das Flanschteil in direktem Wärmekontakt mit dem Zylinderkopf steht.

Revendications

1. Compresseur (8) comprenant un carter hermétiquement fermé (10, 12) présentant intérieurement un carter de vilebrequin (16) avec un cylindre (38) disposé dans le carter de vilebrequin et une cuvette (58) dans sa partie basse (10); un vilebrequin (18) disposé sensiblement verticalement, monté rotatif dans le carter de vilebrequin et portant un piston (36) qui lui est relié fonctionnellement et disposé dans le cylindre; une culasse (48), le vilebrequin ayant des moyens de pompage (56) reliés à sa partie inférieure et disposés dans la cuvette pour refouler du lubrifiant de la cuvette vers le haut à travers un passage de lubrifiant (60, 62) ménagé dans le vilebrequin et un dispositif de distribution de lubrifiant comprenant un corps creux (68) de forme générale allongée relié au vilebrequin et communiquant avec le passage de lubrifiant et une ouverture d'extrémité à travers laquelle du lubrifiant est projeté radialement vers l'extérieur contre le carter (10, 12) lors de la rotation du vilebrequin; une partie supérieure du corps creux étant disposée sous un angle par rapport à l'axe de rotation du vilebrequin, de manière que l'extrémité opposée soit dirigée vers le haut et radialement vers l'extérieur par rapport au vilebrequin, caractérisé par:

des moyens (82) qui font saillie sensiblement verticalement vers le haut sur la culasse (48) pour diriger une partie du lubrifiant projeté par le corps creux de forme générale allongée sur ladite culasse afin d'évacuer de l'énergie thermique de celle-ci; et

dans un côté radialement extérieur du corps creux (68), une ouverture (80) pour éjecter du lubrifiant radialement vers l'extérieur à partir d'elle et contre les moyens directeurs (82).

2. Compresseur selon la revendication 1, dans lequel les moyens directeurs (82) sont un élément nervure (82) présentant au moins une ouverture pour permettre au lubrifiant de le traverser pour évacuer l'énergie thermique de la culasse.

3. Compresseur selon la revendication 2, dans lequel l'élément nervure est en contact thermique direct avec la culasse.

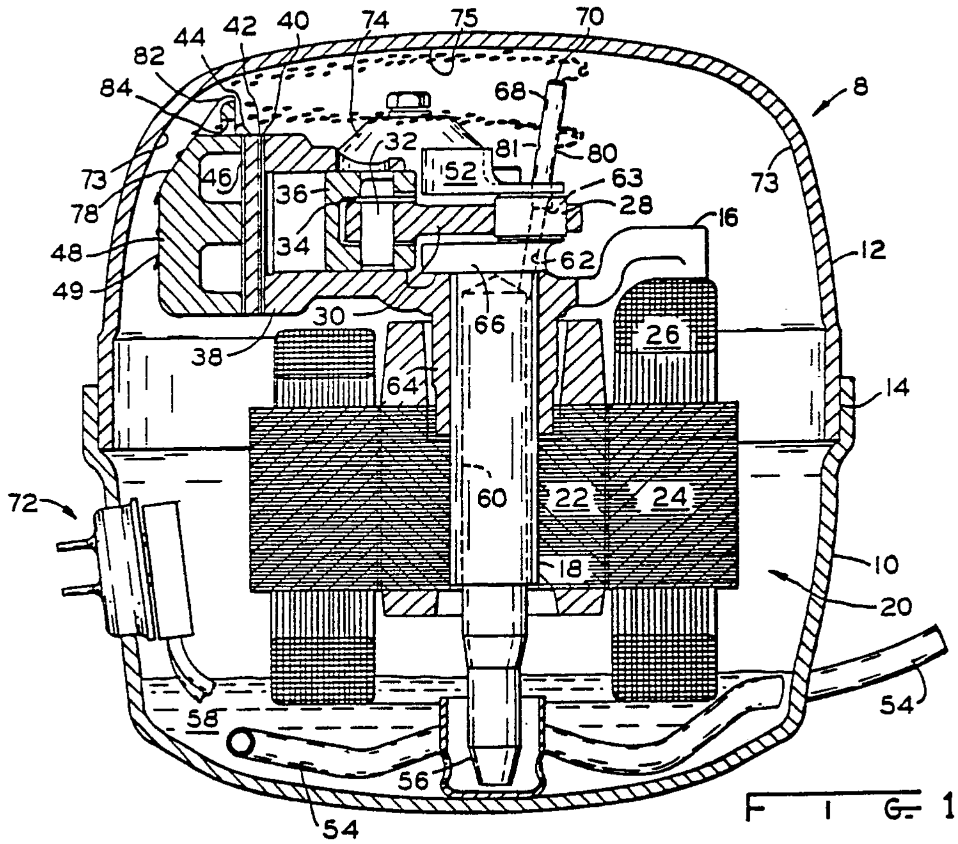
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FIG. 1

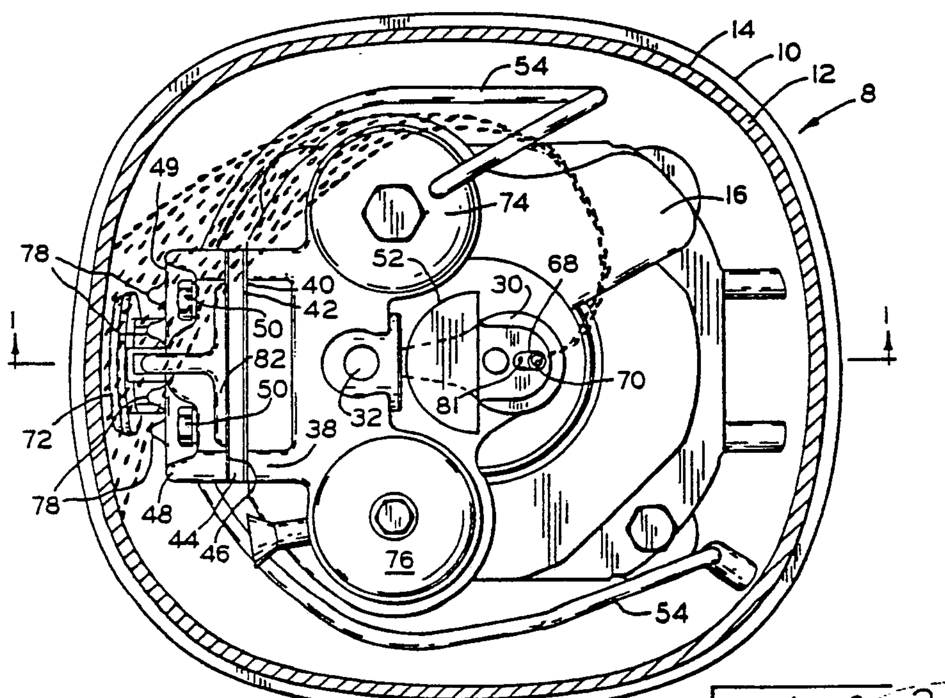
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FIG. 2

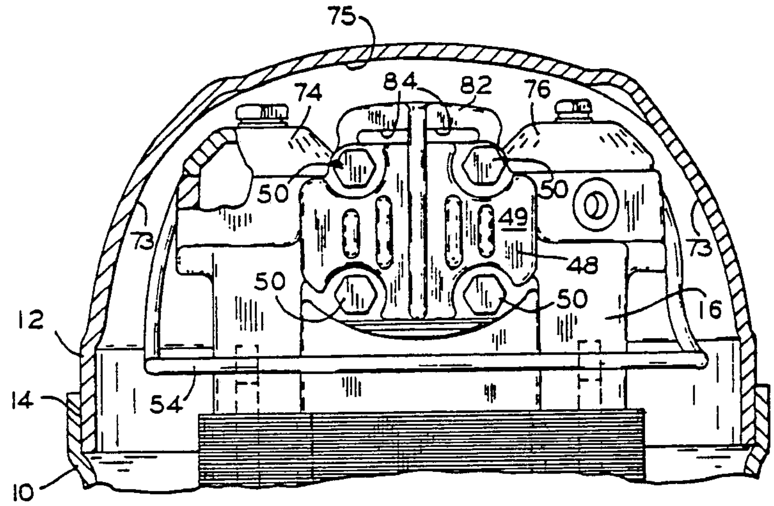

FIG. 3

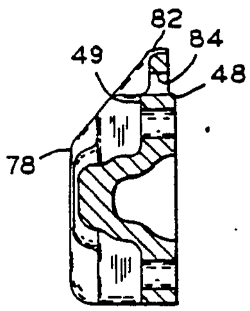

FIG. 5

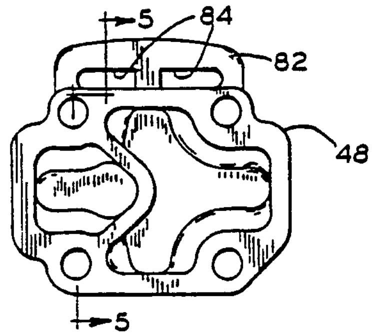

FIG. 4

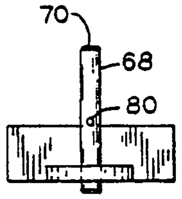

FIG. 6