United States Patent

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[54] **OIL EQUALIZATION SYSTEM**
5 Claims, 6 Drawing Figs.

[52] **U.S. Cl.** **62/468,** 230/206, 62/510, 62/84
[51] **Int. Cl.** **F25b 43/02**
[50] **Field of Search** 230/206; 62/468, 510, 192, 84

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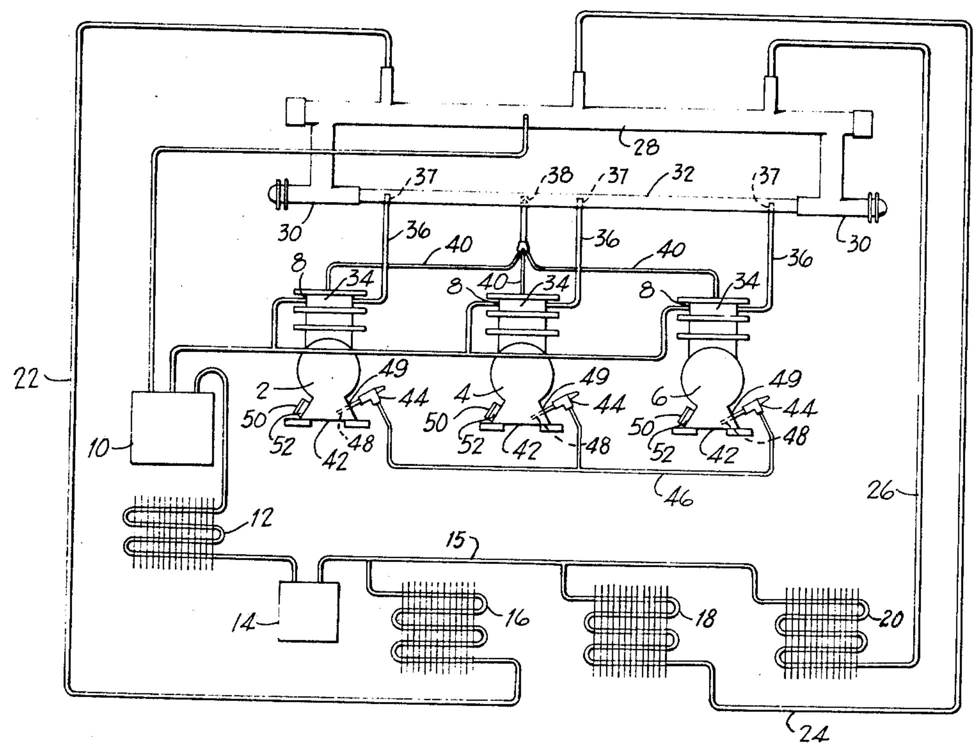
ABSTRACT: A system for equalizing the level of the oil in each of a plurality of compressors in a refrigeration system wherein each compressor is provided with an oil level equalizer connected to a common oil line and means are provided for substantially uniformly distributing oil returning from the system to each of the compressors.



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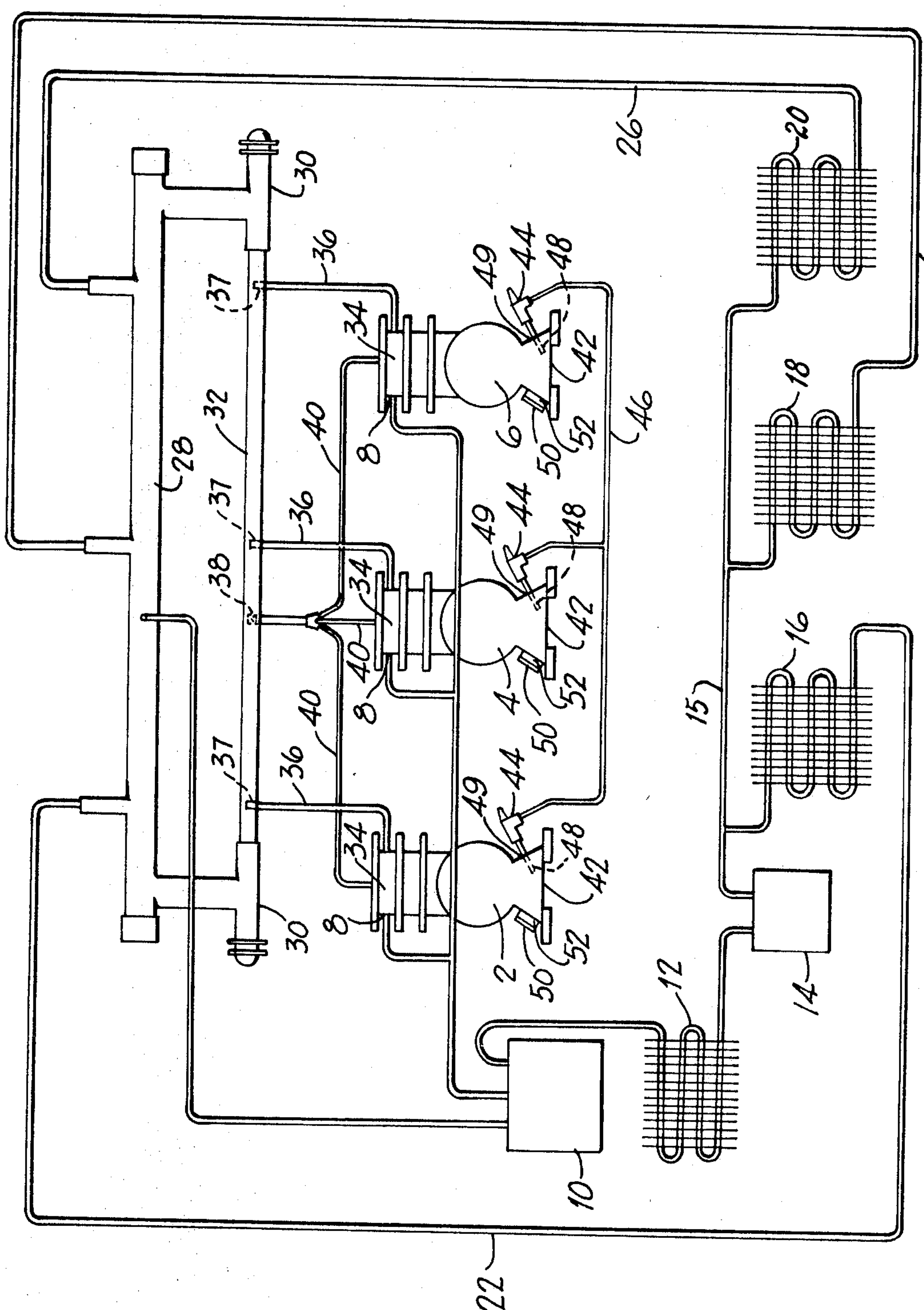

Fig. 1

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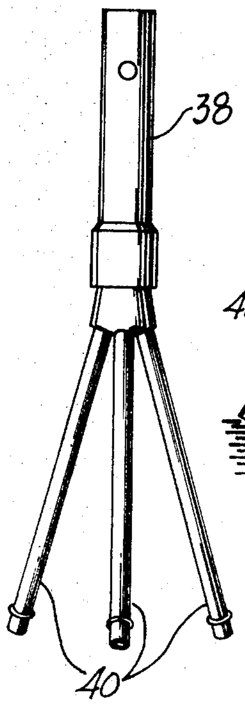

Fig. 2

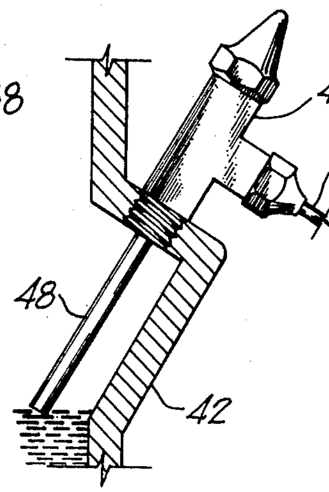

Fig. 6

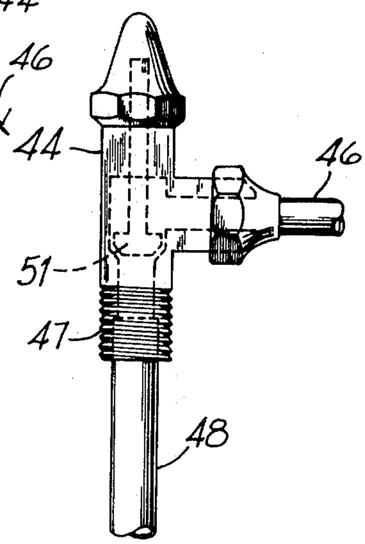

Fig. 3

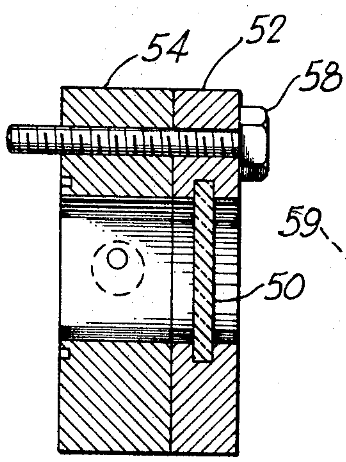

Fig. 5

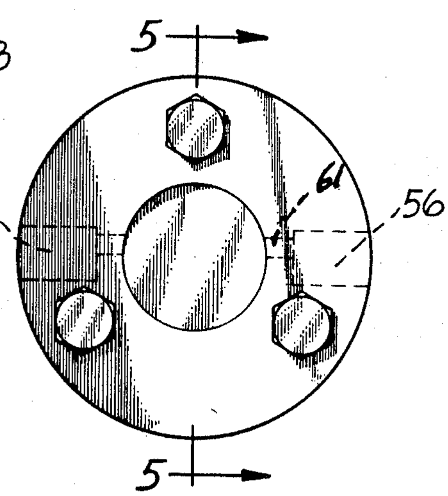

Fig. 4

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OIL EQUALIZATION SYSTEM

FIELD OF INVENTION

In order to supply refrigerant to each of a plurality of refrigerated fixtures, it is usual to provide a plurality of compressors which may be connected to a common header from which the refrigerant is returned to the compressors for recompression and recirculation. Such compressors may all have the same capacity but in some instances, one compressor may be larger than others. Furthermore, one or more of the compressors may remain idle while the others continue to operate. It is also found that the amount of oil which dissolves or is miscible in the refrigerant being circulated varies depending upon the temperature and suction pressure to which the refrigerant is subjected and also varies depending upon the type of the refrigerant being circulated.

As a result, the oil level developed in the various compressors tends to vary considerably. Thus, the oil which separates from the refrigerant in the common header may flow more readily back to one compressor than another due to the fact that some installations are not leveled and due to the fact that the piping associated with one compressor may be more favorable in length or arrangement for oil return than that of another compressor. Moreover, if one compressor operates at a lower pressure tan another, more oil may be drawn into that compressor than into those which operate at higher pressures. Furthermore, the amount of oil which is used and pumped out of any compressor with the refrigerant will vary depending upon wear or the closeness with which the operating members fit to one another.

When the oil chambers or sumps of the various compressors are connected together to permit oil flow from one to another, there is still a tendency for the oil to drain out of any idle compressor to other compressors in the assembly due to the differences in pressure existing in the oil chambers thereof. Under such circumstances, one compressor may be drained of oil while another is flooded with oil giving rise to improper operation of both compressors.

In accordance with the present invention, these difficulties and objections are overcome and the oil level in all of the compressors is maintained substantially the same. This result is preferably attained by providing each of the compressors with an oil-equalizing device communicating with the oil chamber thereof and with a common oil line. The system preferably also includes a single oil distributor communicating with the common refrigerant return manifold for receiving oil separated from the refrigerant returning to the compressors and provided with separate oil return lines through which the oil may be returned to each compressor in substantially equal amounts. In this way, all of the compressors are assured of an adequate supply of oil and the level of the oil in the oil chambers thereof can be maintained substantially uniform.

THE DRAWINGS

FIG. 1 is a diagrammatic illustration of a typical refrigeration system embodying the present invention,

FIG. 2 is an enlarged view of a typical oil distributor embodied in the system of FIG. 1,

FIG. 3 is a perspective view of one form of oil equalizer which may be utilized in the system of FIG. 1,

FIG. 4 is an end view of an alternative form of oil equalizer,

FIG. 5 is a sectional view of the type of oil equalizer illustrated in FIG. 4, and

FIG. 6 is a sectional view of a portion of a compressor housing illustrating the location of an oil equalizer of the type shown in FIG. 3.

PREFERRED EMBODIMENT OF THE INVENTION

In that form of the invention chosen for purposes of illustration in the drawings, the system is provided with a plurality of compressors, indicated at **2**, **4**, and **6**, each of which has a pressure side **8** from which compressed refrigerant and dissolved or entrained oil pass to an oil separator **10**. From the oil separator **10** the hot, compressed refrigerant gas containing some oil flows to the condenser **12** and receiver **14**. The resulting liquid refrigerant is then supplied from receiver **14** through a line **15** to evaporators **16**, **18** and **20**, located in the equipment to be refrigerated. The refrigerant is vaporized in the evaporators and thereafter returns through lines **22**, **24** and **26** respectively to the suction manifold **28** which also serves as an accumulator. The oil collecting in oil separator **10** is passed to the suction manifold or accumulator so as to be cooled by the returning vaporized refrigerant and by any liquid refrigerant therein. From the manifold **28** the refrigerant and the oil carried thereby pass through suction filters **30** to an additional return accumulator or manifold **32**. With the return manifolds **28** and **32** the refrigerant is fully vaporized and for the most part separated from the oil received from the oil separator **10** and the oil which was dissolved or entrained in the refrigerant. The oil then accumulates in the lower portion of the return manifold **32** whereas the refrigerant vapor returns to the suction side **34** of each compressor through return pipes **36** which project upwardly into the return manifold **32** as indicated at **37** to points above the level to which the oil may accumulate.

An oil distributor **38**, which may have the form shown in FIG. **2**, communicates with the lower portion of the return manifold **32** to receive oil accumulating therein and oil return lines **40** extend from the oil distributor **38** to the suction side **34** of each of the compressors. The oil distributor is common to all of the oil return lines **40** so that each line will of necessity receive oil from the same source, namely the distributor **38**, and, in practice, it is preferable to form the oil return lines of substantially the same length so as to assure substantially equal distribution of the oil to the various compressors.

In order further to assure equalization of the oil level in all of the compressors, it is desirable to provide the oil chamber or sump **42** of each compressor with an oil level maintaining device **48** and to connect such devices one to another by an interconnecting oil line **46** and valve **44**. In this way, the level of the oil maintained in the oil chambers of all the various compressors can be equalized at substantially the same level under substantially all operating conditions. Moreover the amount of oil pumped out of the compressors with the refrigerant being circulated will be rendered more nearly equal and the danger of drawing oil from the oil chamber of an idle compressor or from one compressor to another is eliminated.

The oil level equalizer illustrated in FIG. **3** is provided with threads **47** and is mounted in the oil filling opening **49** in the oil chamber of the compressor so that it can be easily removed for service or supplying the compressor with oil. As shown in FIG. **6** the oil-equalizing means includes a dip tube **48** held in an inclined position and located so that the lower end of the dip tube will be spaced a predetermined distance from the bottom of the oil chamber **42**. The lower end of the dip tube is preferably located at about the center line of the sight glass **50** provided in the oil chamber of the compressor. The upper end of the dip tube **48** is connected to the oil line **46** which leads to the oil equalizers of each of the other compressors. The dip tube thus serves to allow oil to enter the oil chamber **42** of any compressor from the oil chamber of any other compressor wherein the oil is at a higher level so that the level of the oil in all of the compressors will be equalized and maintained at the same height. At the same time, if the pressure developed in the oil chamber of any compressor should be reduced so as to cause oil to be drawn from the other compressors, the level of the oil cannot fall below that established by the open lower end of the dip tubes **48**. As a result, each compressor is sure to retain an adequate supply of oil in its oil chamber whether it is operating or not and despite the amount of oil used or pumped out with the refrigerant in any other compressor in the system. The oil equalizer may have a valve **51** therein for closing off the oil line **46** leading to that compressor in the event the compression is to be rendered inoperative while the remaining compressors are in use. Instead of employing the type of oil equalizer shown in FIG. 3, the oil equalizer of FIG. 4 may be used. As there shown, the oil equalizer is used in combination with the usual sight glass provided for each compressor. Accordingly, the sight glass unit 50 which was formerly mounted on a boss formed in the oil chamber of the compressor is removed. A unit 54 having an oil inlet opening 56 is then placed on the boss and connected to oil line 46. If desired the unit 54 may have an alternative inlet opening 59 on the opposite side thereof to permit the line 46 to be connected from either side. However, only one such inlet is used at any time, the inlet in use being filled by a suitable plug. The sight glass 50 is applied to the outer end of the unit 54 and bolts 58 are passed through the sight glass unit 54 into the bolt holes previously provided for securing the sight glass in place.

The oil inlet passage 61 through which oil flows from line 46 and inlet opening 56 into the sump 42 of the compressor is preferably centered with respect to the sight glass to establish the level to which the oil in the oil chamber is maintained. The unit 54 thus functions in much the same way as the dip tube 48 of the construction shown in FIGS. 3 and 6 to prevent the oil in the sump 42 of any compressor from being drawn off to other compressors to such an extent as to fall below a predetermined safe level. The valve 51 which is installed on the appropriate side of the unit 54 and interconnected with line 46 will then enable the oil to be equalized through the oil inlet openings 61 thereby maintaining an oil level at about center of the sight glass in all of the compressors.

The system described assures an adequate and substantially uniform supply of oil to all of the compressors under all conditions of operation by reason of the equalization of the supply of oil returning to each compressor and by preventing the pumping or transfer of oil from one compressor to another to such an extent as to flood one compressor with oil while draining oil from the other compressors to a point which might interfere with its operation. The system may be employed when using any number of compressors in combination and when using compressors operating at different capacities, pressures and temperatures.

We claim:

1. In a refrigeration system embodying a plurality of compressors, each having an oil chamber therein, an oil level maintaining device in each of said chambers, and a common oil line communicating with each of said devices, the improvement comprising:

said oil level equalizing device being associated with a sight glass through which the level of the oil in the oil chamber may be seen.

2. In a refrigeration system embodying a plurality of compressors, each having an oil chamber therein, an oil level maintaining device in each of said chambers, and a common oil line communicating with each of said devices, the improvement comprising:

said oil level maintaining device including a dip tube extending into the oil chamber at a point above the level of the oil in said chamber and extending downward to a point establishing the lowermost level of the oil to be maintained in the chamber of the compressor; and

said dip tube being mounted within a wall of said oil chamber by releasable fastening means;

whereby said dip tube may be easily removed from said oil chamber without substantial losses of oil during maintenance periods and the like.

3. An improvement according to claim 2, wherein said releasable fastening means comprises threaded fastening means formed on said dip tube and on a marginal edge of a surface adjacent adjacent said oil chamber defining an aperture through which said dip tube operationally extends.

4. An improvement according to claim 3, wherein said oil level equalizing device is associated with a sight glass through which the level of the oil in the oil chamber may be seen.

5. In a refrigerant system comprising a plurality of compressors for circulating refrigerant through such system, a common manifold to which refrigerant returning to the compressors is supplied and wherein oil is separated from the refrigerant, an oil distributor communicating with said manifold to receive oil therefrom, and oil return lines extending from said distributor to each of said compressor, the improvement comprising:

said plurality of compressors for circulating refrigerant consisting of at least three compressors;

said oil return lines extending from said distributor to each of said compressors comprising one oil return line for each of said at least three compressors; and

at least two of said return lines being substantially equal in length.