Dec. 29, 1942. R. E. KING 2,306,813

COMPRESSOR

Filed Sept. 16, 1941

Fig. 2.

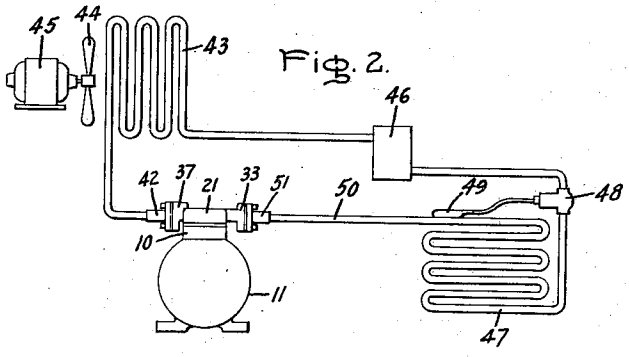
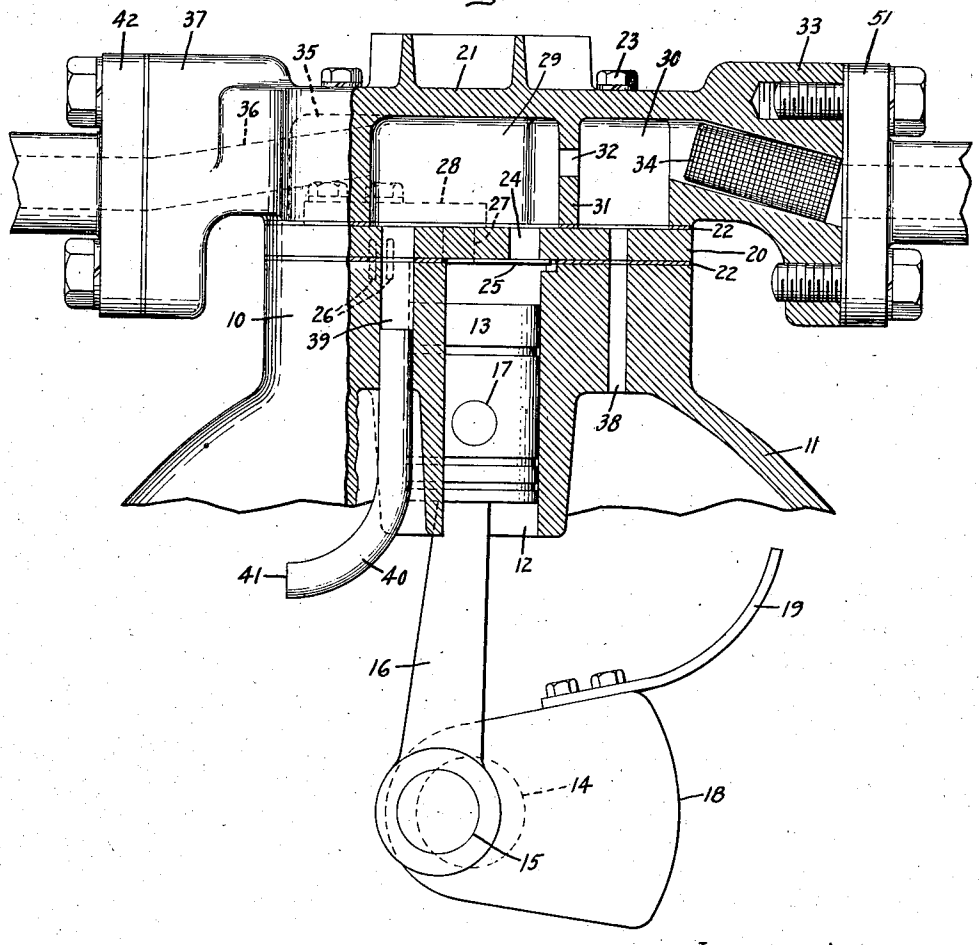


Fig. 1.



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COMPRESSOR

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6 Claims. (Cl. 230—206)

My invention relates to compressors and particularly to compressors provided with devices for separating oil from the working fluid admitted to the compressor.

Compressors operating in systems such as refrigerating machines which have closed circuits through which the working fluid is circulated unavoidably entrain small quantities of the lubricating oil in the working fluid. In order to maintain the desired quantity of lubricant in the compressor crankcase and also to prevent lowering of the effective capacity of the working fluid, it is necessary to separate the lubricant from the working fluid and return it to the crankcase. Many different arrangements have been provided for this purpose.

It is an object of my invention to provide a compressor having an improved arrangement for separating and returning to the crankcase lubricating oil which has become entrained in the working fluid returned to the compressor.

Another object of my invention is to provide a compressor having an improved oil return device of simple and rugged construction which may be arranged entirely within the compressor and is effective to return to the crankcase a high proportion of the lubricating oil entering the compressor intake with the working fluid.

Further objects and advantages of my invention will become apparent as the following description proceeds, and the features of novelty which characterize my invention will be pointed out with particularity in the claims annexed to and forming a part of this specification.

For a better understanding of my invention reference may be had to the accompanying drawing in which Fig. 1 shows a partial elevational view in section of a refrigerant compressor embodying my invention; and Fig. 2 is a diagrammatic view of the compressor of Fig. 1 arranged in a refrigerating system.

Briefly, the compressor shown in the drawing comprises a cylinder block having a reciprocating piston mounted therein and a crankcase for holding a quantity of lubricating oil. The compressor is provided with a valve plate and a head providing the intake and exhaust passages and valves for the compressor cylinder in which the piston is mounted. In order to separate oil from the working fluid drawn into the compressor two parallel paths are provided between the suction connection of the compressor and the intake port of the cylinder. An oil separating chamber is arranged at the entrance of the two chambers and one path leads directly to a chamber at the intake port of the compressor while the other leads through the crankcase. Most of the oil separated from the working fluid is directed so that it flows through the path leading through the crankcase and the oil is trapped and retained in the crankcase while the working fluid flows to the intake port.

Referring now to the drawing, the compressor shown in Fig. 1 comprises a block 10 having a crankcase 11 formed integrally therewith. Only a portion of the crankcase has been shown in Fig. 1. However, its outline is indicated in Fig. 2 and its construction is in accordance with well-known practice. A cylinder 12 is formed in the block 10 and a reciprocating piston or displacement member 13 is mounted therein. The piston is actuated by rotation of a shaft 14 driven by a suitable motor (not shown) through a crank pin 15 and a connecting rod 16 joined to the piston by means of a suitable wrist pin 17. A counterweight 18 is provided to balance the compressor and a splashing element or finger 19 is secured to the counterweight to dip into a body of oil in the bottom of the crankcase and splash oil to the working parts of the mechanism. The shaft 14, as shown in the drawing, is intended to be rotated in a counterclockwise direction. The counterweight 18 and the finger 19 are displaced axially to the rear of the connecting rod, as viewed in Fig. 1, so that they cannot strike the walls of the cylinder 12. The compressor is provided with a valve plate 20 and a head 21. Gaskets 22 are provided on either side of the valve plate, and the head and valve plate are secured to the block by a plurality of cap screws 23. The valve plate is provided with an intake port 24, and an intake valve 25 of the flexible reed type is securely held between the plate and the block to control the port 24. Suitable pins 26 may be employed to position the valve 25 securely. An exhaust port 27 is formed in the valve plate 20 in communication with the cylinder 13 and is controlled by a suitable exhaust valve indicated at 28. The head 21 has formed therein a chamber 29 about the intake port 24 and a second chamber 30 separated from the chamber 29 by a wall 31 and communicating with the chamber 29 through a restricted opening 32 in the wall 31. The chamber 30 is arranged to receive working fluid through a suction connection 33, the suction connection being provided with a suitable fine mesh wire screen or filter 34 to prevent foreign matter from entering the compressor. The head 21 is provided with an ex-

haust chamber 35 in communication with the exhaust port 27 and arranged to discharge working fluid from the compressor through an exhaust passage 36 in an exhaust or discharge connection 37.

The arrangement of the chamber 30 and the restricted opening 32 is such that considerable turbulence of the working fluid drawn into the compressor occurs in the chamber 30 and lubricating oil entrained in the working fluid is separated and falls to the bottom of the chamber. This lubricant may be returned to the crankcase through a suitable duct 38 formed in the block 10 and in the plate 20. In order to cause a positive flow downwardly through the duct 38, I provide a second duct 39 in the block 10 and valve plate 20 in communication with the chamber 29 at its upper end and with the crankcase at its lower end. A suitable tube 40 may be inserted in the lower end of the duct 39 and the end thereof bent toward the side of the crankcase so that its open end, indicated at 41, is in the same direction as the direction of movement of the splashing element 19, and the tendency of oil to be splashed into the opening 41 is minimized. The extension tube 40 is not, however, necessary to the satisfactory separation of the oil from the gaseous refrigerant entering the cylinder.

The duct 39 is preferably made of a larger cross-sectional area than the duct 38 to facilitate the drawing of working fluid through the duct 38 into the crankcase and thence into the duct 39 to the chamber 29. This provides a parallel path for the flow of gaseous working fluid from the suction connection 33 to the chamber 29. Most of the working fluid flows from the connection 33 to the chamber 29 through the chambers 29 and 30 and the opening 32 in series communication. The positive flow of fluid through the duct 38 draws into the crankcase the lubricant separated from the working fluid in the chamber 30. This lubricant is trapped in the crankcase 11 while the working fluid flows from the crankcase to the chamber 29 through the duct 39. This construction provides a simple and effective device for separating lubricant from the working fluid admitted to the compressor and for returning the lubricant to the crankcase. Since there is a positive flow of working fluid and lubricant downwardly through the duct 38, lubricant splashed by the finger 19 is prevented from flowing upwardly through the duct 38.

The compressor shown in Fig. 1 may be connected in the refrigerant circuit of a refrigerating system as indicated in Fig. 2. The discharge connection 37 is secured to a connector 42 of a discharge line by which the hot compressed refrigerant is conducted to a condenser 43. The refrigerant in the condenser 43 is cooled and liquefied by operation of a fan 44 driven by an electric motor 45, and the liquid refrigerant is delivered to a receiver 46. From the receiver 46 the refrigerant flows to an evaporator 47 under the control of a thermostatic expansion valve 48 having its thermal element 49 in heat exchange with the outlet or suction line 50 of the evaporator. The vaporized refrigerant is returned to the compressor through the suction line 50 which is secured by a suitable connector 51 to the suction connection 33 of the compressor.

During the operation of the refrigerating system shown in Fig. 2 a certain amount of the lubricant in the crankcase 11 unavoidably enters the cylinder of the compressor because of the pumping action of the piston which forces the oil or lubricant along the cylinder walls, and this lubricant is entrained with the refrigerant discharged to the condenser and finds its way to the evaporator and eventually is returned to the compressor intake through the suction line 50. The greater part of the lubricant which enters the compressor head with the refrigerant is separated from the vaporized refrigerant in the chamber 30 of the compressor and flows from the chamber 30 through the duct 38 to the crankcase. The greater portion of the vaporized refrigerant flows to the chamber 29 and the intake port 24 through the restricted opening 32, and the portion of the gaseous refrigerant flowing through the crankcase 11 reaches the chamber 29 and the intake port 24 through the duct 39.

From the foregoing it is readily apparent that I have provided a simple and effective arrangement for separating lubricating oil from the working fluid admitted to the compressor and for returning the oil to the crankcase. This arrangement requires no additional working parts and no complicated structure and may be built easily into the head of the compressor.

While I have described my invention in connection with a refrigerant compressor, other applications will readily be apparent to those skilled in the art. I do not therefore desire my invention to be limited to the particular construction shown and described, and I intend in the appended claims to cover all modifications within the spirit and scope of my invention.

What I claim as new and desire to secure by Letters Patent of the United States, is:

1. A compressor having a crankcase, working fluid suction and exhaust connections for said compressor, said compressor having a cylinder and a displacement member therein, means providing intake and exhaust ports and valves therefor, means providing two parallel paths for the flow of gaseous working fluid from said suction connection to said intake port, one of said paths including said crankcase, and means adjacent the inlet of said one of said parallel paths for separating lubricant from the working fluid flowing from said suction connection to said paths and for directing the lubricant into said one path whereby lubricant entrained in the working fluid entering said suction connection is returned to said crankcase.

2. A compressor having a crankcase, working fluid suction and exhaust connections for said compressor, said compressor having a cylinder and a displacement member therein, means providing an intake port and an exhaust port for said cylinder and valves therefor, means providing a first chamber adjacent and in communication with said intake port, means providing a second chamber between said first chamber and said suction connection and a restricted opening between said chambers, means providing ducts between said chambers and said crankcase, the duct between said first chamber and said crankcase having a larger cross-sectional area than the duct between said second chamber and said crankcase whereby a portion of the working fluid entering said second chamber flows to said first chamber through said crankcase and oil carried thereby is separated therefrom and retained in said crankcase.

3. A compressor comprising a block having a cylinder and a working fluid displacement member therein and a crankcase for holding a body of lubricating oil, said cylinder having intake

and exhaust ports, valves for said ports, intake and exhaust connections for said compressor, means providing two chambers connected in series communication between said intake connection and said intake port to provide a first path for gaseous working fluid flowing from said intake connection to said intake port, means providing ducts connecting both of said chambers with said crankcase to provide a second path for gaseous working fluid flowing from said intake connection to said intake port, said paths being so arranged that portions of the gaseous working fluid flow from said intake connection through said paths in parallel to said intake port whereby oil entrained in the portion of the working fluid flowing through said second path is retained in said crankcase.

4. A compressor comprising a block having a cylinder and a working fluid displacement member therein and a crankcase for holding a body of lubricating oil, said cylinder having intake and exhaust ports, valves for said ports, intake and exhaust connections for said compressor, a head for said compressor having a chamber formed therein about said intake port, means providing communication between said chamber and said crankcase, said head having a second chamber formed therein and arranged in communication with said intake connection and with said first mentioned chamber for separating oil from the gaseous working fluid flowing from said intake connection to said intake port, means providing communication between said second chamber and said crankcase whereby a portion of the gaseous working fluid flowing to said intake port passes to said first mentioned chamber through said crankcase and oil separated from the working fluid in said second chamber flows to said crankcase and is trapped therein.

5. A compressor comprising a cylinder block and a crankcase, said cylinder block having a cylinder and a reciprocating piston mounted therein, a valve plate having intake and exhaust ports for said cylinder, valves for said ports, a head for said compressor having intake and exhaust connections, said head having two chambers formed therein and having a restricted opening providing communication between said chambers, one of said chambers being in direct communication with said intake port and the other of said chambers being in direct communication with said intake connection, said block and said valve plate having a first duct formed therein providing communication between said crankcase and said other chamber and a second duct providing communication between said crankcase and said one chamber, said other chamber being so arranged and constructed as to facilitate the separation of oil from the refrigerant in the working fluid entering said compressor, the major portion of the working fluid flowing to said intake port passing through said restricted opening and the remaining portion passing through said ducts and said crankcase whereby oil separated from the working fluid in said other chamber is trapped in said crankcase.

6. A compressor comprising a cylinder block and a crankcase, said cylinder block having a cylinder and a reciprocating piston mounted therein, means including a rotating member having a crank pin thereon and a connecting rod between said crank pin and said piston for reciprocating said piston, an oil splashing element secured to said rotating member for directing oil to the working parts of said compressor, a valve plate having intake and exhaust ports for said cylinder, valves for said ports, a head for said compressor having intake and exhaust connections, said head having two chambers formed therein and having a restricted opening providing communication between said chambers, one of said chambers being in direct communication with said intake port and the other of said chambers being in direct communication with said intake connection, said block and said valve plate having a first duct formed therein providing communication between said crankcase and said other chamber and a second duct providing communication between said crankcase and said one chamber, an intake tube communicating with said second duct for conducting working fluid to said second duct from said crankcase, said tube having its open end turned toward one side of said crankcase in the same direction as that of the movement of said splashing element whereby the tendency to splash oil into said tube is minimized, said other chamber being so arranged and constructed as to facilitate the separation of oil from the refrigerant in the working fluid entering said compressor, the major portion of the working fluid flowing to said intake port passing through said restricted opening and the remaining portion passing through said ducts and said crankcase whereby oil separated from the working fluid in said other chamber is trapped in said crankcase.

RALPH E. KING.