Nov. 7, 1939. C. R. NEESON 2,179,268

TWO-CYLINDER COMPRESSOR

Filed Dec. 16, 1937 3 Sheets-Sheet 1

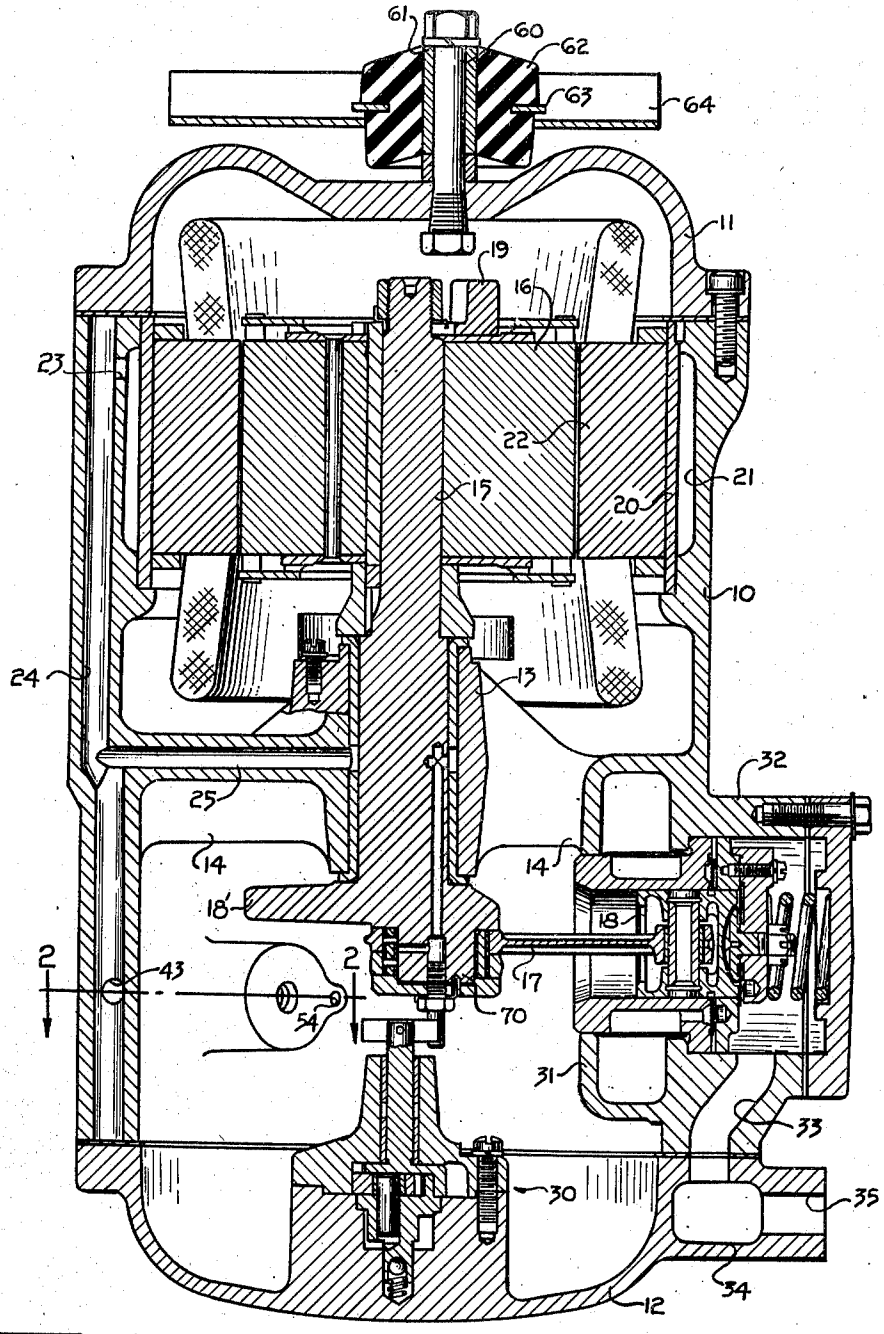


FIG 1

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FIG 2

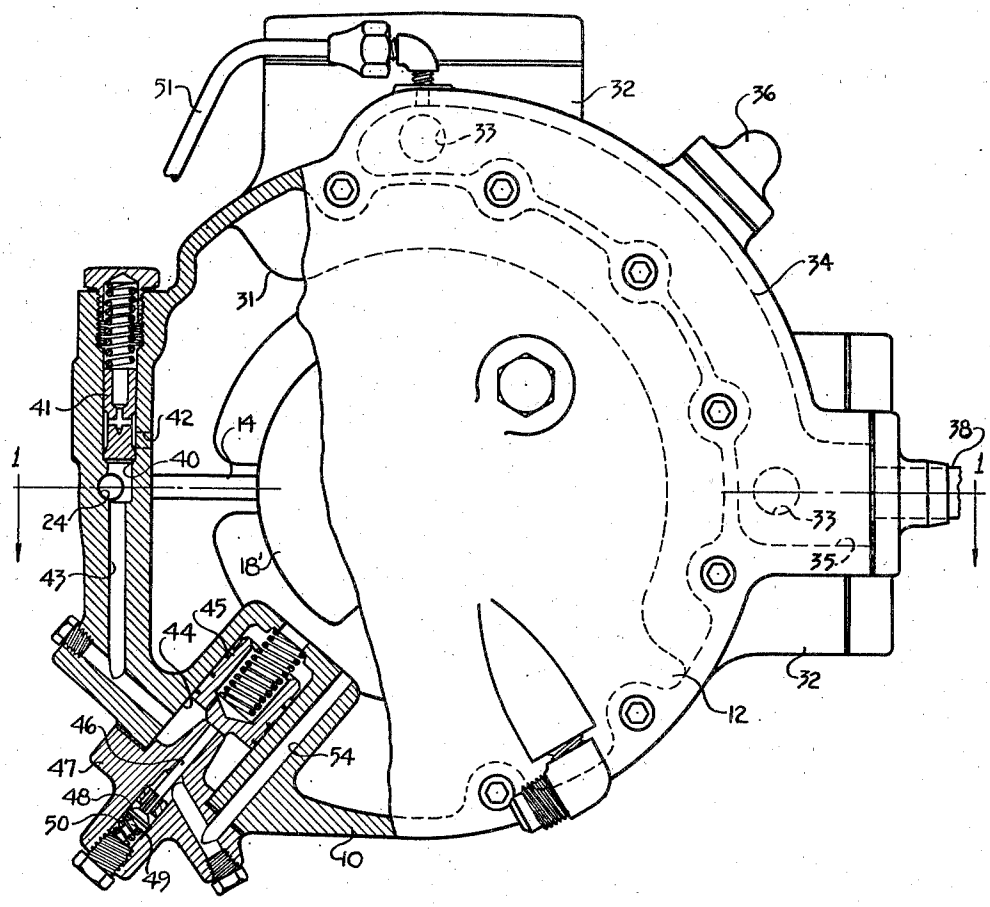
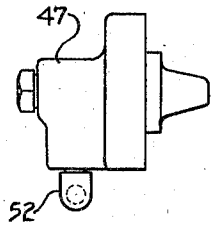


FIG 4



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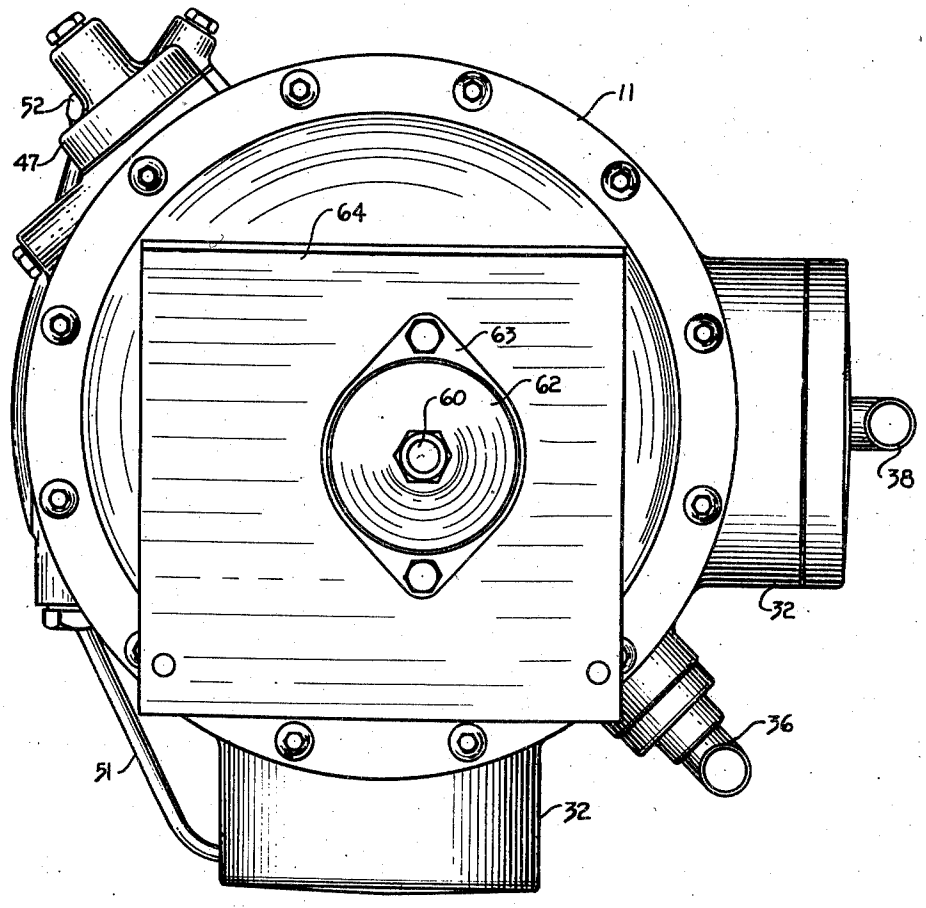


FIG 3

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UNITED STATES PATENT OFFICE

2,179,268

TWO-CYLINDER COMPRESSOR

Charles R. Neeson, Dayton, Ohio, assignor, by mesne assignments, to Chrysler Corporation, Highland Park, Mich., a corporation of Delaware

Application December 16, 1937, Serial No. 180,099

3 Claims. (Cl. 230—187)

My present invention relates to a compressing unit of the hermetically sealed type, comprising a casing within which is mounted a motor-compressor assembly. The particular invention is an improvement upon my application, Serial No. 145,585, filed May 29, 1937, co-pending herewith, and has to do with the arrangement and mounting of a two-cylinder radial compressor whereby the same may be suspended in balanced state both during operation and when the compressor is at rest. The objects and advantages of the invention will be apparent from the following specification taken in connection with the accompanying drawings wherein like numerals refer to like parts throughout. In the drawings Fig. 1 is a vertical cross-section taken along line 1—1 of Fig. 2 showing the arrangement of the various parts of the compressing unit; Fig. 2 is a bottom view of the compressing unit with a portion of the bottom broken away to line 2—2 of Fig. 1 in order to show certain parts of the compressor; Fig. 3 is a top plan view of the compressing unit and mounting thereof; and Fig. 4 is a side elevation of a portion of the unit.

The compressing unit comprises a substantially cylindrical casing 10 to which is bolted a top cover 11 and a bottom cover 12. A journal 13, supported by integrally cast arms 14 extending radially inward from the main casing 10, supports crank shaft 15 to the upper end of which is attached a motor rotor 16 and to the lower end of which is attached the piston rods 17 of a pair of pistons 18. The motor-piston assembly is properly balanced by counterbalances 18' and 19 as adequately described in my co-pending application, Serial No. 145,585. A ring 20 fitted into the inner wall of the casing 10 forms one side of a passage 21 surrounding the stator 22 of the motor. A cooling medium such as lubricating oil is caused to flow through the recess 21 in order to cool the motor, and emerges from the recess through an opening 23 into a vertical bore 24 extending downwardly through the wall of the casing. Oil which emerges from the recess 21 flows through a passage 25 in one of the radial arms 14 and lubricates the bearings and pistons as described in the aforementioned co-pending application. The oil drops into the sump provided by the bottom cover 12 and is ejected therefrom by means of the pump 30 driven by the crankshaft 15, the oil then traversing an oil cooler (not shown) and entering the recess 21 through an opening (not shown). The gas enters the cylinders by way of a suction manifold 31 integrally cast into the main casing, is compressed within the cylinders and ejected into a discharge head 32 projecting radially from the substantially cylindrical surface of the casing. The discharge head communicates through a discharge passage 33 with a discharge manifold 34 integrally cast with the bottom cover 12, the discharge manifold 34 communicating through pipe 38 with the high pressure side of a refrigerating system (by way of example) through the opening 35. The refrigerant or other gas to be compressed, enters the suction manifold through a connection 36. Further details of the piston and valve assembly, the lubricating system, the pump, the crankshaft and other portions of the mechanism may be ascertained from my co-pending applications Serial Nos. 145,585 to 145,589, inclusive, filed May 29, 1937.

Features of the aforesaid applications fully claimed in the application, Serial No. 145,587, is the means for regulating the oil pressure within the system, and the means for unloading the system when the compressor comes to rest. In the present application the same mechanism is included in slightly modified form. The oil in passage 24 may flow through a cross-bore 40, and if the pressure becomes excessive, will move the spring-loaded relief valve 41 in order that the relief passage 42 may be uncovered. Oil may then flow through the relief passage 42 to return to the interior of the compressor, thereby maintaining the oil pressure within the system at a constant value. Another cross-bore 43 leads to an unloader cylinder 44 within which is placed the unloader piston 45. The piston 45 bears against a plunger 46 mounted in a cap 47 and operates an unloader valve 48 against the pressure of a spring 49. The discharge manifold 34 is connected to the chamber 50, within which spring 49 is placed, by means of a tube 51 and connecting elbow 52. The valve 48, when lifted from its seat as shown in Fig. 2, places chamber 50 in communication with an unloading passage 54 leading to the interior of the crank case. When the oil pressure drops below a predetermined value, the unloader piston 45 is moved by its spring to cause plunger 46 to raise valve 48 from its seat thereby causing gas compressed into the manifold 34 to follow the path of least resistance through tube 51, valve 48 and unloading passage 54 into the interior of the compressor from whence it is again removed by the pistons as long as the crankshaft is operated. If the oil pressure should rise above a predetermined value, the piston 45 will be retracted against its spring, and spring 49 will cause valve 48 to close thereby

stopping gas from flowing through the unloaded cycle and forcing the gas to flow through the refrigerating system. The operation and other details of the unloading mechanism may be fully ascertained from the aforementioned co-pending application, Serial No. 145,587.

In the present invention it is to be noted that there are two cylinders and two piston and valve assemblies located in two discharge heads **32**. It is extremely difficult to balance a two-cylinder compression machine, and it is the object of this invention to create a balanced machine of this type. Accordingly the discharge heads **32** are placed at an angle of ninety degrees with respect to each other, and the angle of the discharge heads is bisected by a diameter extending substantially through the center of mass of the oil pressure regulating and unloader valve assemblies which are located at the opposite side of the compressor. It is to be noted that all other portions of the entire assembly are substantially in static equilibrium. Associated with the discharge heads and pistons is the suction manifold **31** which extends circumferentially about the main casting through the shortest arc between the discharge heads, and the bottom cover contains the discharge manifold **34** which likewise extends circumferentially through the shortest arc between the discharge heads. The discharge heads, pistons, suction manifold and discharge manifold therefore comprise a mass whose center is distributed substantially along the aforementioned diameter and spaced outwardly from the longitudinal centerline of the unit. The unloader valve and pressure regulating valve assemblies likewise create a mass whose center is distributed substantially along the same diameter and spaced outwardly along the same diameter but in the opposite direction in an attempt to counterbalance the first-mentioned mass.

Since the first-mentioned mass is obviously the greater mass, the compressor assembly would cant if suspended from a point comprising a continuation of the center line. The object of the type of the invention is to provide a compressor assembly which may be suspended substantially from a single point thereby permitting oscillation of the unit in all directions, vertically, laterally and rotatively about the center of mass. As described and claimed in my aforementioned application, Serial No. 145,585, the compressor is preferably suspended by means of a bolt **60** extending upwardly from the top cover **11** through a sleeve **61** bonded to a resilient block **62** which is in turn bonded to a collar **63** fastened to a supporting plate **64** which is attached to a suitable framework. The bolt **60** in this instance is placed along the aforementioned diameter at a point such as to balance the weights of the first-and second-mentioned masses. This point is spaced radially outward from the longitudinal center of the unit substantially in line with the center of the crank pin **70** to which the piston rods **17** are attached when the crank pin is between the two pistons; in other words, the point is spaced outwardly from the centerline a distance substantially equal to half of the piston stroke. It is obvious that the greatest reciprocating force at each cylinder will exist during the moment of greatest compression when the crank pin is closest to the discharge head **32**. The thrust, therefore, is distributed substantially below the point of suspension exemplified by bolt **60** thereby eliminating most of the sideward swinging which would otherwise be the case if the compressor were suspended along its center line. This thrust is followed a quarter of a revolution later by a thrust at right angles thereto which tends to dampen the first thrust, and the next three-quarters of a revolution is free from such thrusts during which time the compressor tends to regain its suspended equilibrium.

It should be obvious to those skilled in the art that I have created a compressing unit which may be suspended in such a manner as to reduce to a minimum oscillations created by the operation thereof and, having described the preferred form of my invention, it should be apparent to those skilled in the art that modification in arrangement and detail thereof may be achieved within the scope of the following claims.

I claim:

1. A two-cylinder compressing unit comprising a hermetically sealed motor-compressor assembly including a vertical crank shaft and two reciprocating pistons operated thereby, said pistons being located at a 90° angle to each other, and a resilient single-point suspension member for the unit laterally spaced from the centerline of the unit along a diameter substantially bisecting the angle between the pistons, said member being laterally spaced from the longitudinal centerline of the unit by a distance sufficient to cause said unit to hang substantially vertical when at rest.

2. A two-cylinder compressing unit comprising a hermetically sealed motor-compressor assembly including a vertical crank shaft and two reciprocating pistons operated thereby, said pistons being located at a 90° angle to each other, and a resilient single-point suspension member for the unit laterally spaced from the centerline of the unit along a diameter substantially bisecting the angle between the pistons, said member being laterally spaced from the longitudinal centerline of the unit by a distance sufficient to cause said unit to hang substantially vertical when at rest, the center of mass of all other statically unbalanced parts of the compressor being located substantially along the same diameter but on the same side of said suspension member as the longitudinal centerline.

3. A two-cylinder compressing unit comprising a casing hermetically sealing a motor and a compressor driven thereby, said compressor comprising a vertical crank shaft journaled at the longitudinal centerline of the casing and two horizontally reciprocating pistons operating in cylinders located at a 90° angle to each other thereby forming a mass whose center is laterally spaced from said centerline along a diameter substantially bisecting the angle between said cylinders, said compressor comprising other parts located on the opposite side of said casing from said cylinders and forming a substantial mass whose center is also located substantially along said diameter, and a resilient suspension member fastened to said casing at a point along said diameter between the two centers of mass.

CHARLES R. NEESON.