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R. GALIN

2,991,931

REFRIGERATING APPARATUS

Filed March 23, 1959

2 Sheets-Sheet 1

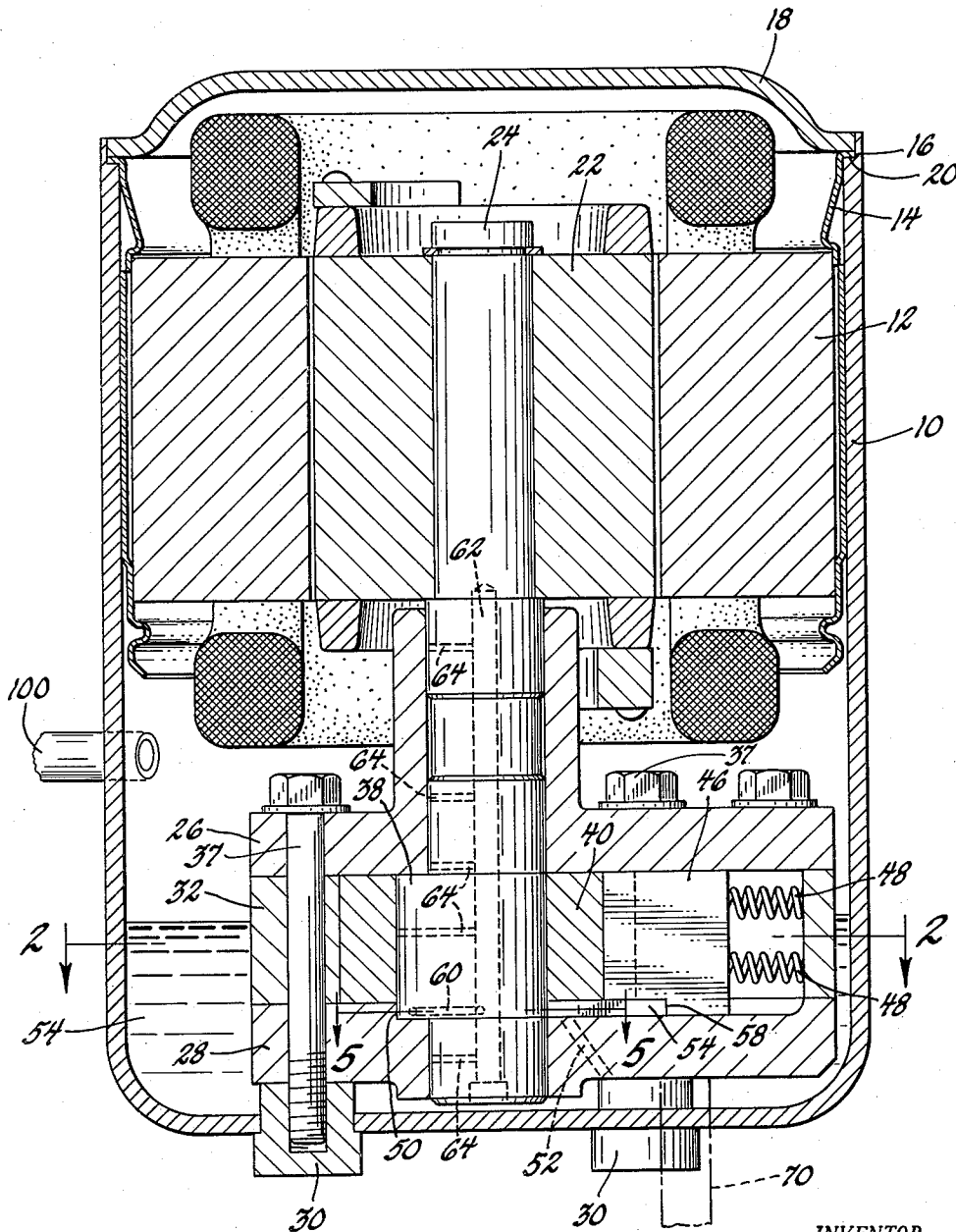


Fig. 1

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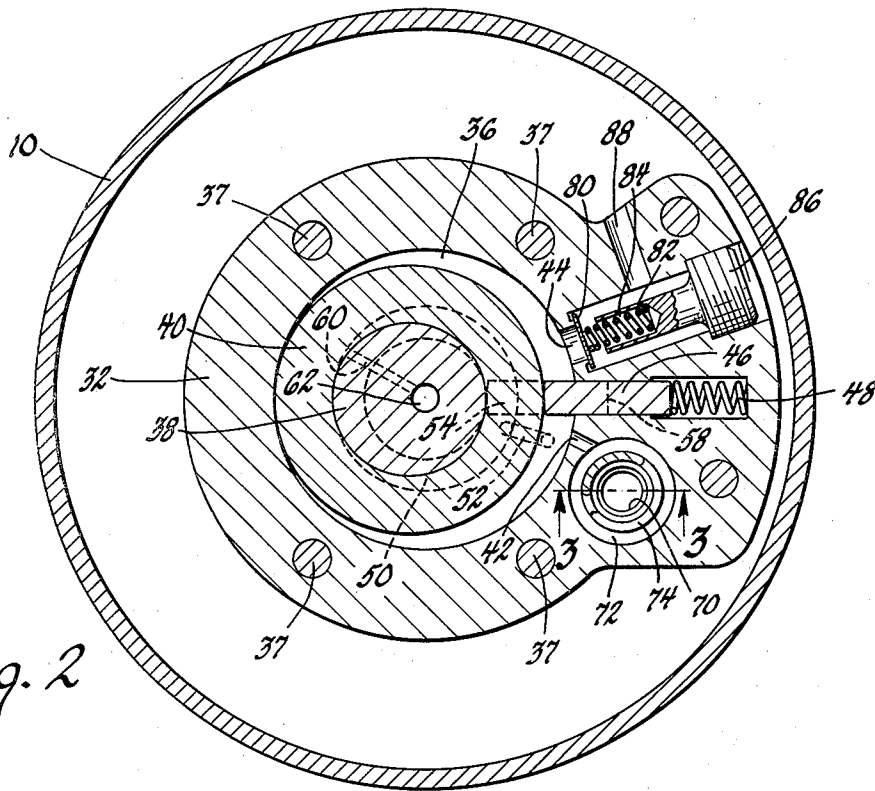
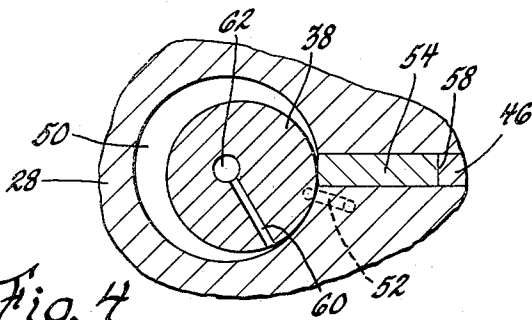
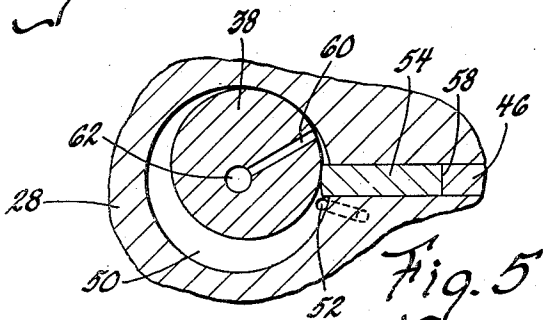
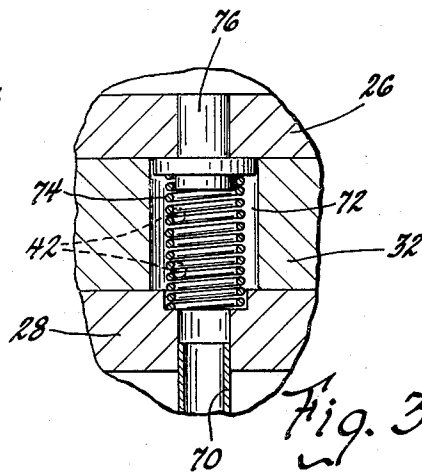
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2 Sheets-Sheet 2



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2,991,931

REFRIGERATING APPARATUS

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This invention relates to refrigerating apparatus and more particularly to a sealed rotary compressor unit.

It is an object of this invention to provide a low-cost rotary compressor which has incorporated therein an improved oil pump.

More particularly it is an object of this invention to provide a rotary compressor with a built-in oil pump which necessitates the addition of only one extra part.

Another object of this invention is to provide a simplified rotary compressor for use in refrigerating systems and the like having an improved valving arrangement including means for automatically limiting the load on the compressor.

Still another object of this invention is to provide a low-cost rotary compressor which lends itself to mass production methods.

Further objects and advantages of the present invention will be apparent from the following description, reference being had to the accompanying drawings, wherein a preferred form of the present invention is clearly shown.

In the drawings:

FIGURE 1 is a vertical sectional view showing a preferred embodiment of the invention;

FIGURE 2 is a sectional view taken substantially on line 2-2 of FIGURE 1;

FIGURE 3 is a fragmentary sectional view taken substantially on line 3-3 of FIGURE 2; and

FIGURES 4 and 5 are sectional views taken substantially on line 5-5 of FIGURE 1 showing various positions of the compressor eccentric within the oil pumping chamber.

Referring now to the drawings wherein a preferred embodiment of the invention has been shown, reference numeral 10 designates a cup-shaped sheet metal housing element which has its upper end closed by means of a plate-like element 18 which is welded or otherwise secured to the housing element 10. A motor-compressor unit disposed within the housing 10 includes a motor stator 12 supported in the upper end of the housing 10 by means of a corrugated stamped sheet metal sleeve 14 in accordance with standard practice. The upper end of the sleeve 14 is provided with a flange 16 which is clamped between the closure member 18 and a shoulder 20 formed adjacent the upper edge of the sheet metal casing 10. A motor rotor 22 cooperates with the motor stator 12 and is secured to the upper end of the compressor drive shaft 24.

The compressor drive shaft 24 is journaled in the upper and lower compressor end plates 26 and 28 respectively of the compressor as shown. The lower end plate 28 rests on a plurality of mounting lugs 30 carried by the bottom wall of the casing 10. A cylinder block element 32 is sandwiched between the end plates 26 and 28 and cooperates with the end plates to form a circular compression chamber 36. Bolts 37 hold the elements 26, 28 and 32 in place on the mounting lugs 30.

The compressor shaft 28 is provided with an eccentric portion 38 which has an axial length slightly in excess of the thickness of the cylinder block element 32 for a purpose to be described more fully hereinafter. A circular gas impeller 40 is arranged to cooperate with the eccentric portion 38 so as to serve as a piston or impeller operating within the compression chamber 36 formed in the cylinder block 32. As best shown in FIGURE 2 of the drawing, inlet and outlet ports 42 and 44 respectively are provided on opposite sides of a specially constructed divider

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block or blade 46 which is slidably disposed in the cylinder block 32. A pair of springs 48 urges the divider blade 46 into engagement with the impeller 40 so as to seal the inlet port from the outlet port in accordance with usual practice.

In order to provide force feed lubrication to the various bearing surfaces of the shaft 24 there is provided a novel oil pump which is unique in its simplicity. Thus, the bottom end plate 28 is provided with a circular recess 50 which has a radius equal to the maximum radius of the eccentric portion 38 whereby the lower end of the eccentric portion 38 can be used as an impeller for an oil pump. The end plate 28 is provided with an oil inlet passage 52 which has its lower end arranged in contact with a body of oil 54 provided in the lower portion of the casing 10. The upper end of the passage 52 enters the oil pumping recess 50 adjacent one side of an auxiliary divider block or vane 54 which is held in sealing engagement with the outer periphery of the lower end of the eccentric portion 38 by means of the main divider block 46. It will be noted that the main divider block 46 is provided with a notch 58 in its lower edge for receiving the divider blade 54.

The eccentric portion 38 is provided with a radial oil discharge passage 60 located slightly in front of the point of tangency between the eccentric portion 38 and the periphery of the oil pumping chamber 50. The passage 60 then serves as the outlet port for the oil pump and delivers the oil to an axially extending passage 62 provided in the central portion of the main drive shaft 24. The passage 62 in turn delivers oil to a plurality of radially extending oil feed passages 64 which feed lubricant to the various bearing surfaces of the main drive shaft so as to thereby lubricate the drive shaft. By virtue of the above described arrangement it is obvious that the divider blade 54 is the only additional element required for the oil pump as all of the other elements are required parts of the gas compressor.

The gas to be compressed enters the compressor through a suction line 70 which communicates with the lower end of a chamber 72 formed in the main cylinder block 32 as best shown in FIGURES 2 and 3. A specially constructed flow modulating spring 74 is arranged within the cavity 72 in such a manner that the incoming gas enters the lower end of the spring and is required to pass between the convolutions of the spring before passing through the inlet port passage means 42. The upper end of the spring abuts against a piston-like element 76 which has its upper end exposed to the compressed and relatively high pressure gas which surrounds the compressor assembly. Since the upper end of the piston 76 is subjected to the high pressure gas and the lower end thereof is subjected to the relatively low suction pressure of the gas it is obvious that as the head pressure exceeds the suction pressure by a predetermined amount, the spring 74 will become compressed and this results in restriction to the flow of gas to the compressor inlet passage means 42.

The compressed gas leaves the compression chamber 36 through the port 44 as best shown in FIGURE 2 of the drawing. A discharge valve plate 80 cooperates with the port 44. This valve plate 80 is biased to the closed position by means of a coil spring 82 arranged in a recess 84 formed in the adaptor 86 which is rigidly held in place relative to the cylinder block 32. It will be noted that in the arrangement shown, as the valve plate 80 moves away from its set, the spring 82 will be compressed and will have pocketed therein a body of gas which serves as a pneumatic cushion which reduces the severity of the opening movement of the valve plate 80. The compressed gas leaving the port 44 discharges into the main casing or housing 10 through the discharge passage 88 which is ar-

ranged as best shown in FIGURE 2 of the drawing. The compressed gas leaves the casing 10 through an outlet 100.

By virtue of the above described arrangement the divider blades and the flow modulating spring 74 are all held in place by the lower end plate of the compressor and a minimum number of parts is required for the assembly as shown.

While the form of embodiment of the invention as herein disclosed constitutes a preferred form, it is to be understood that other forms might be adopted, as may come within the scope of the claims which follow.

What is claimed is as follows:

1. In combination, a casing, a motor in said casing, a compressor in said casing, said motor and said compressor having a common shaft including an eccentric portion, said compressor having a compression chamber comprising a pair of end wall members and an outer peripheral wall member sandwiched between said end wall members, an impeller supported by said eccentric portion and disposed in said chamber, means forming inlet and outlet ports communicating with said compression chamber, means for discharging compressed gas leaving said compressor into the space between said casing and said compressor, means including a blade slidably mounted in a peripheral wall of said cylinder block intermediate said inlet and outlet ports and movable into contact with said rotor for causing fluid to be compressed in said chamber during operation of said motor, spring means holding said blade in contact with said rotor, one of said end walls having a circular oil pumping chamber surrounding one end of said eccentric portion whereby said one end serves as an oil impeller, means forming oil inlet and oil outlet ports for said oil pumping chamber, and a divider blade means between said oil inlet and said oil outlet ports in sliding engagement with said one end of said eccentric, said divider blade means being held in place by said one end wall.

2. In combination; a casing; a motor and a compressor unit disposed within said casing; said motor including a shaft projecting from one side thereof and having an eccentric portion; said compressor including means forming a compression chamber having end walls and a peripheral wall surrounding said shaft, a rotor disposed in said chamber on said eccentric portion of said shaft and serving as an impeller for gas to be compressed, means forming inlet and outlet ports communicating with said compression chamber, means including a blade slidably mounted in a peripheral wall of said cylinder block intermediate said inlet and outlet ports and movable into contact with said rotor for causing fluid to be compressed in said chamber during operation of said motor, spring means holding said blade in contact with said rotor; one of said end walls having a circular oil pumping chamber surrounding one end of said eccentric portion whereby said one end serves as an oil impeller; means forming oil inlet and oil outlet ports for said oil pumping chamber; and a divider blade means between said oil inlet and oil outlet ports in sliding engagement with said one end of said eccentric.

3. In combination; a casing; a motor disposed within said casing and including a drive shaft having an eccentric intermediate its ends, compressor cylinder block means forming a bearing for said shaft and also forming gas compressing and oil pumping chambers both surrounding said eccentric, a rotor disposed on a portion of said eccentric and serving as an impeller for gas to be compressed, means forming inlet and outlet ports communicating with said gas compressing chamber, a first divider blade slidably mounted in a peripheral wall of said cylinder block means intermediate said inlet and outlet ports and contacting said rotor for causing fluid to be compressed in said gas compressing chamber during operation of said motor, spring means holding said first divider blade in sliding contact with said rotor, a second divider blade slidably mounted in said cylinder block means and projecting into engagement with that portion of said eccentric

which is disposed within said oil pumping chamber, means forming inlet and outlet ports for said oil pumping chamber on opposite sides of said second divider blade, and means for feeding oil from said last named outlet port to said bearing.

4. In a rotary compressor, means forming a cylinder block having a compression chamber therein, means forming inlet and outlet ports for said chamber, said chamber comprising an outer peripheral wall and a pair of end walls, a shaft rotatably supported in said end walls and having an eccentric extending through said chamber, an oil feed passage in said shaft, an impeller supported on said eccentric portion and operating within said chamber to compress gas therein, said cylinder block having a blade slot therein, a divider blade in said slot, spring means urging said blade into sealing engagement with said impeller, an oil pumping chamber formed in the face of one of said end walls and cooperating with a portion of said eccentric, means forming oil inlet and oil outlet ports for said oil pumping chamber, and a second divider blade disposed between a portion of said first named divider blade and said eccentric and serving to prevent the passage of oil between said oil inlet and oil outlet ports.

5. In a rotary compressor, means forming a cylinder block having a compression chamber therein, means forming inlet and outlet ports for said chamber, said chamber comprising an outer peripheral wall and a pair of end walls, a shaft rotatably supported in said end walls and having an eccentric extending through said chamber, an oil feed passage in said shaft, an impeller supported on said eccentric portion and operating within said chamber to compress gas therein, said cylinder block having a blade slot therein, a divider blade in said slot, spring means urging said blade into sealing engagement with said impeller, an oil pumping chamber formed in the face of one of said end walls and cooperating with a portion of said eccentric, means forming oil inlet and oil outlet ports for said oil pumping chamber, and a second divider blade disposed between a portion of said first named divider blade and said eccentric and serving to prevent the passage of oil between said oil inlet and oil outlet ports, said oil outlet port comprising a substantially radially extending passage formed in said eccentric and communicating with said oil feed passage.

6. In a compressor, means forming a cylindrical gas pumping chamber, said means comprising an outer peripheral wall member and a pair of end members, at least one of said end members having a bearing aperture therein, a shaft journaled in said bearing aperture and projecting into said chamber, said shaft having a first eccentric portion within said chamber, a gas impeller disposed within said chamber and arranged in driving engagement with said eccentric portion, means forming inlet and outlet ports for said gas pumping chamber, divider block means slidably mounted in said peripheral wall, one of said end walls having a lubricant pumping recess formed therein surrounding said shaft, said eccentric portion of said shaft extending into said recess and serving as an oil impeller, means forming inlet and outlet ports for said lubricant pumping recess, and a divider blade slidably mounted in said one end member and cooperating with said eccentric portion to seal said last named inlet and outlet ports from one another.

7. In a compressor, means forming a cylindrical gas pumping chamber, said means comprising an outer peripheral wall member and a pair of end members, at least one of said end members having a bearing aperture therein, a shaft journaled in said bearing aperture and projecting into said chamber, said shaft having a first eccentric portion within said chamber, a gas impeller disposed within said chamber and arranged in driving engagement with said eccentric portion, means forming inlet and outlet ports for said gas pumping chamber, divider block means slidably mounted in said peripheral wall, one of said end members having a lubricant pump-

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ing recess formed therein surrounding said shaft, an oil inlet port leading to said recess, said eccentric portion of said shaft extending into said recess and serving as an oil impeller, an oil outlet port formed in said impeller, divider block means slidably supported in said one end member adjacent said oil inlet port and arranged to engage said oil impeller.

8. In a compressor, means including an outer peripheral wall member and a pair of end members forming a cylindrical gas pumping chamber, at least one of said end members having a bearing aperture therein, a shaft journaled in said bearing aperture and projecting into said chamber, means forming inlet and outlet ports for said chamber, said shaft having an eccentric portion within said chamber, a gas impeller disposed within said chamber and arranged in driving engagement with said eccentric portion, a divider block slidably mounted in said peripheral wall and biased into engagement with said impeller, one of said end walls having an oil pumping recess formed therein surrounding said shaft, said shaft having an eccentric portion extending into said re-

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cess and serving as an oil impeller, divider block means engaging said last named eccentric portion, means for supplying oil to said oil pumping recess, said last named eccentric portion having a radially extending oil passage provided therein with one end of said oil passage communicating with said oil pumping chamber, said shaft having an axial passage formed therein for supplying oil to said bearing aperture, said radial passage having its outlet end communicating with said axial passage.

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