Oct. 2, 1962 R. GALIN 3,056,542

REFRIGERATING APPARATUS

Original Filed March 23, 1959 2 Sheets-Sheet 1

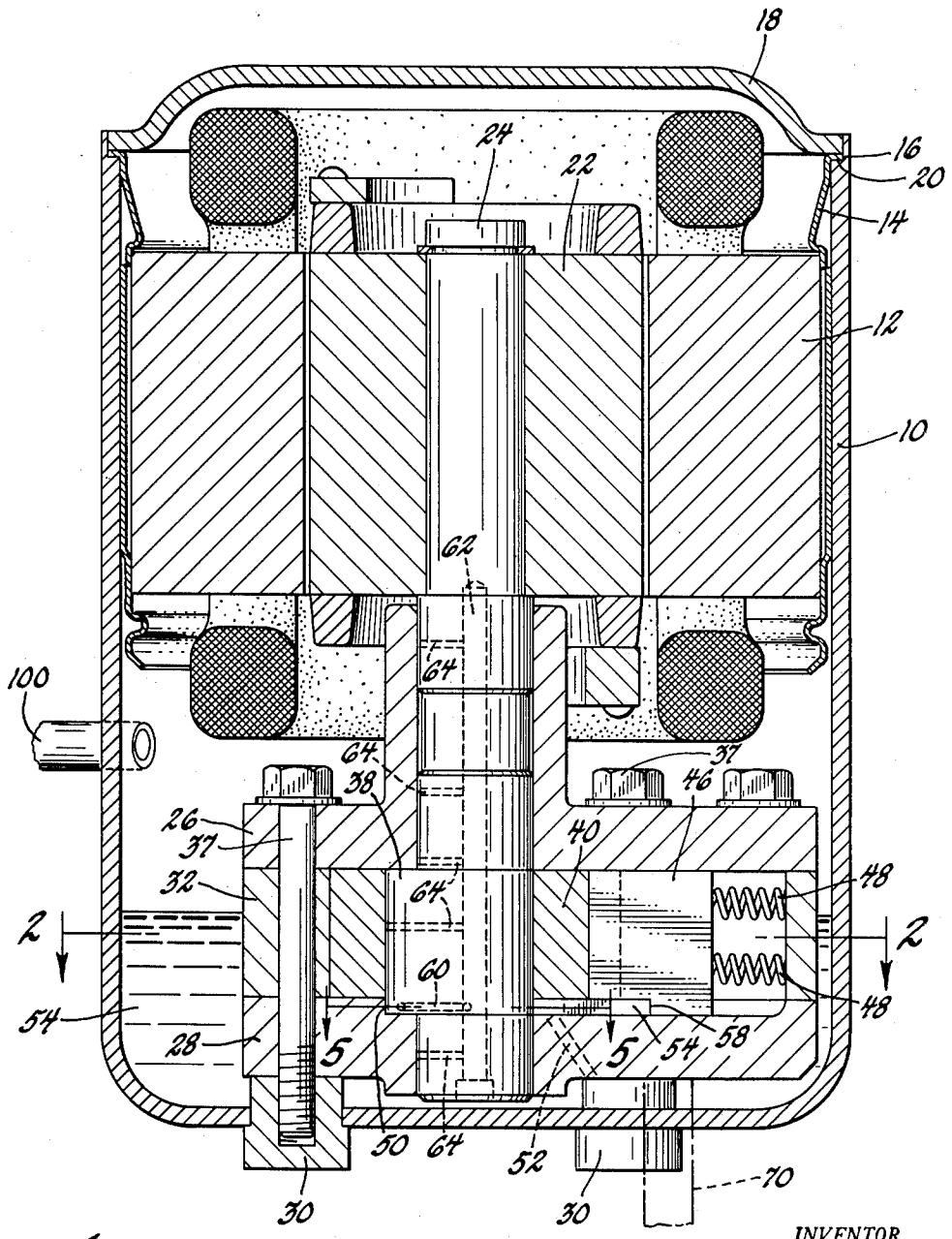


Fig. 1

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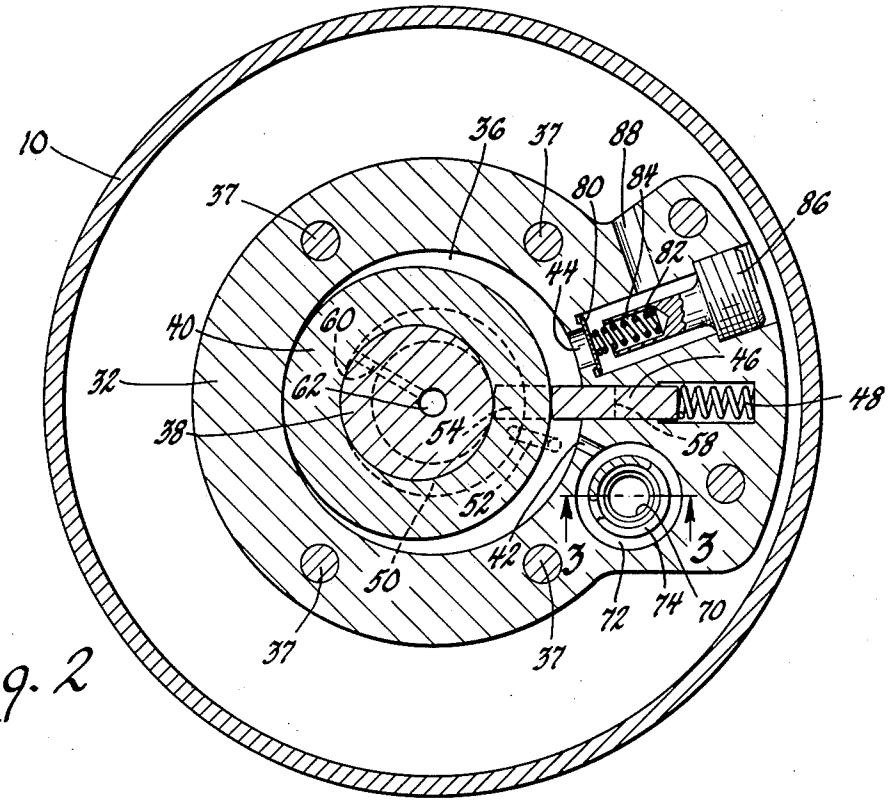


Fig. 2

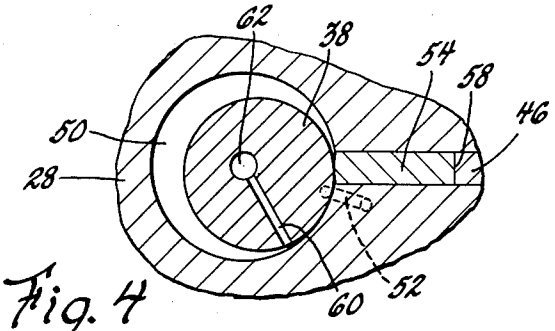


Fig. 4

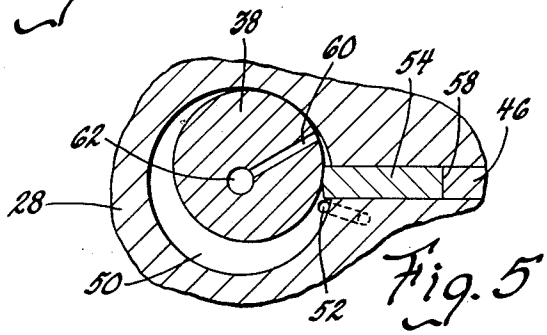


Fig. 5

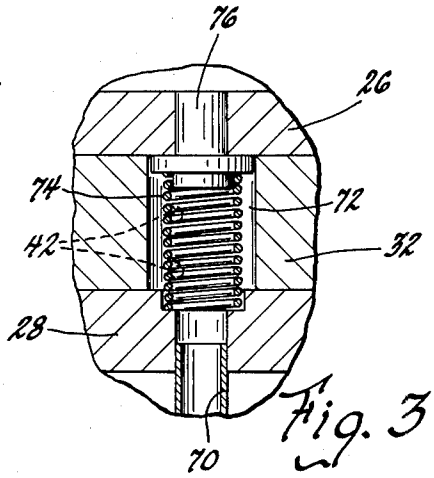


Fig. 3

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REFRIGERATING APPARATUS

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Original application Mar. 23, 1959, Ser. No. 801,202, now Patent No. 2,991,931, dated July 11, 1961. Divided and this application Nov. 10, 1960, Ser. No. 68,388

6 Claims. (Cl. 230—138)

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

This is a division of application Serial No. 801,202 filed March 23, 1959, and now Patent No. 2,991,931.

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.

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 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 or recess 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 is disposed in a passage formed in the end plate 26 as shown in FIGURE 3 and 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 adapter 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 arranged 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 compressor in said casing, said compressor having a drive shaft provided with an eccentric portion thereon, said compressor including means forming a compression chamber, an impeller driven by said eccentric portion and disposed to operate within said chamber, means forming inlet and outlet ports communicating with said compression chamber, means for discharging compressed gas leaving said compression chamber into the space between said casing and said compressor, means for regulating the flow of gas to said inlet port including means forming a recess, a coil spring having adjustable spaced convolutions disposed within said recess with at least portions of said convolutions spaced from the walls of said recess, means for supplying gas to be compressed to the interior of said convolutions, means for conveying gas passing between said convolutions to said inlet port, means forming a passage connecting the interior of said recess and the compressor discharge gas surrounding said compresor, a piston slidably disposed within said passage and having its one end exposed to the gas within said casing surrounding said compressor and having its other end arranged in abutting relationship to said coil spring whereby an increase in pressure in said gas surrounding said compressor above a predetermined value causes said piston to compress said coil spring so as to restrict the flow of gas from the interior of said spring to the inlet port of said compressor.

2. In combination, a casing, a compressor supported within said casing, said compressor having a shaft provided with an eccentric portion, said compressor including means forming a compression chamber, an impeller driven by said eccentric and disposed to compress gas in said chamber, means forming an outlet for said compression chamber, means forming a passage for conveying gas to be compressed into said compression chamber, said passage having an enlarged portion, a coil spring disposed within said enlarged portion and having convolutions between which gas flowing through said passage is required to pass, a piston element having one end arranged in abutting relationship to said spring for varying the spacing between said convolutions and means for continuously subjecting the one end of said piston to a pressure corresponding substantially to the pressure at the outlet of said compressor.

3. In combination, a casing, a compressor in said casing, said compressor having a drive shaft, said compressor including means forming a compression chamber, an impeller driven by said shaft, means forming inlet and outlet ports communicating with said compression chamber, means for discharging compressed gas leaving said compression chamber into the space between said casing and said compressor, means for regulating the flow of gas to said inlet port including means forming a recess, a coil spring having adjustable spaced convolutions disposed within said recess with at least portions of said convolutions spaced from the walls of said recess, means for supplying gas to be compressed to the interior of said convolutions, means for conveying gas passing between said convolutions to said inlet port, means forming a passage connecting the interior of said recess and the compressor discharge gas surrounding said compressor, pressure responsive means disposed within said passage and having its one side exposed to the gas within said casing surrounding said compressor and having its other side arranged in abutting relationship to said coil spring whereby an increase in pressure in said gas surrounding said compressor above a predetermined value causes said pressure responsive means to compress said coil spring so as to restrict the flow of gas from the interior of said spring to the inlet port of said compressor.

4. In combination, a casing, a compressor supported within said casing, said compressor including cylinder block means forming a compression chamber, an impeller disposed to compress gas in said chamber, means forming an outlet for said compression chamber, means in said cylinder block means forming a passage for conveying gas to be compressed into said compression chamber, said passage having an enlarged portion, a coil spring disposed within said enlarged portion and having convolutions between which gas flowing through said passage is required to pass, a pressure responsive element arranged in abutting relationship to said spring for varying the spacing between said convolutions and means for subjecting said pressure responsive means to a pressure corresponding substantially to the pressure at the outlet of said compressor.

5. In combination, a casing, a compressor within said casing including a base plate supported within said casing, a cylinder block mounted on said base plate and having a compression chamber therein, means including a suction passage in said cylinder block for conveying gas to be compressed into said compression chamber, an end plate secured to said cylinder block and closing one side of said compression chamber, a shaft journaled in one of said plates and having an eccentric portion in said compression chamber, an impeller on said eccentric and arranged in pumping relationship within said compression chamber, a divider block slidably supported by said cylinder block and arranged to engage the periphery of said impeller, a discharge port through which compressed gas leaves said compression chamber and flows into the space between said casing and said compressor, one portion of said suction passage traversing said cylinder block, a coil spring disposed within said one portion of said suction passage having convolutions between which the gas flowing through said passage is required to pass, one of said plates having a passage in alignment with said one portion, a piston element disposed within said last named passage and arranged to compress said spring in response to a predetermined increase in pressure within said casing so as to restrict the flow of gas into said compression chamber.

6. In combination a casing, a compressor supported within said casing and having a cylinder block provided with a suction port, suction passage means for conveying gas to be compressed through a wall of said casing into said suction port, said compressor including a pair of compressor end plates abutting opposite sides of said cylinder block, a discharge port through which compressed gas leaves said compressor and flows into the space between said casing and said compressor, a portion of said suction passage means comprising a passage traversing said cylinder block, a coil spring disposed within said passage means having convolutions between which the gas flowing through said passage is required to pass, one of said compressor end plates having a passage in alignment with said portion of said passage, a piston element disposed within said last named passage and ar-

ranged to have its one end subjected to the pressure in the space between said compressor and said casing and having its other end arranged to compress said spring in response to a predetermined increase in pressure within said casing so as to restrict the flow of gas into said compressor.

References Cited in the file of this patent

UNITED STATES PATENTS

125,937	Cowles	Apr. 23, 1872
342,275	Walters	May 18, 1886
1,547,324	Hiles	July 28, 1925
1,616,992	Ruckstuhl	Feb. 8, 1927
1,884,702	Hubacker	Oct. 25, 1932
1,948,907	Egli	Feb. 27, 1934
2,044,867	Woodard	June 23, 1936
2,415,011	Hubacker	Jan. 28, 1947

FOREIGN PATENTS

531,444	Great Britain	Jan. 3, 1941
873,949	France	Apr. 13, 1942