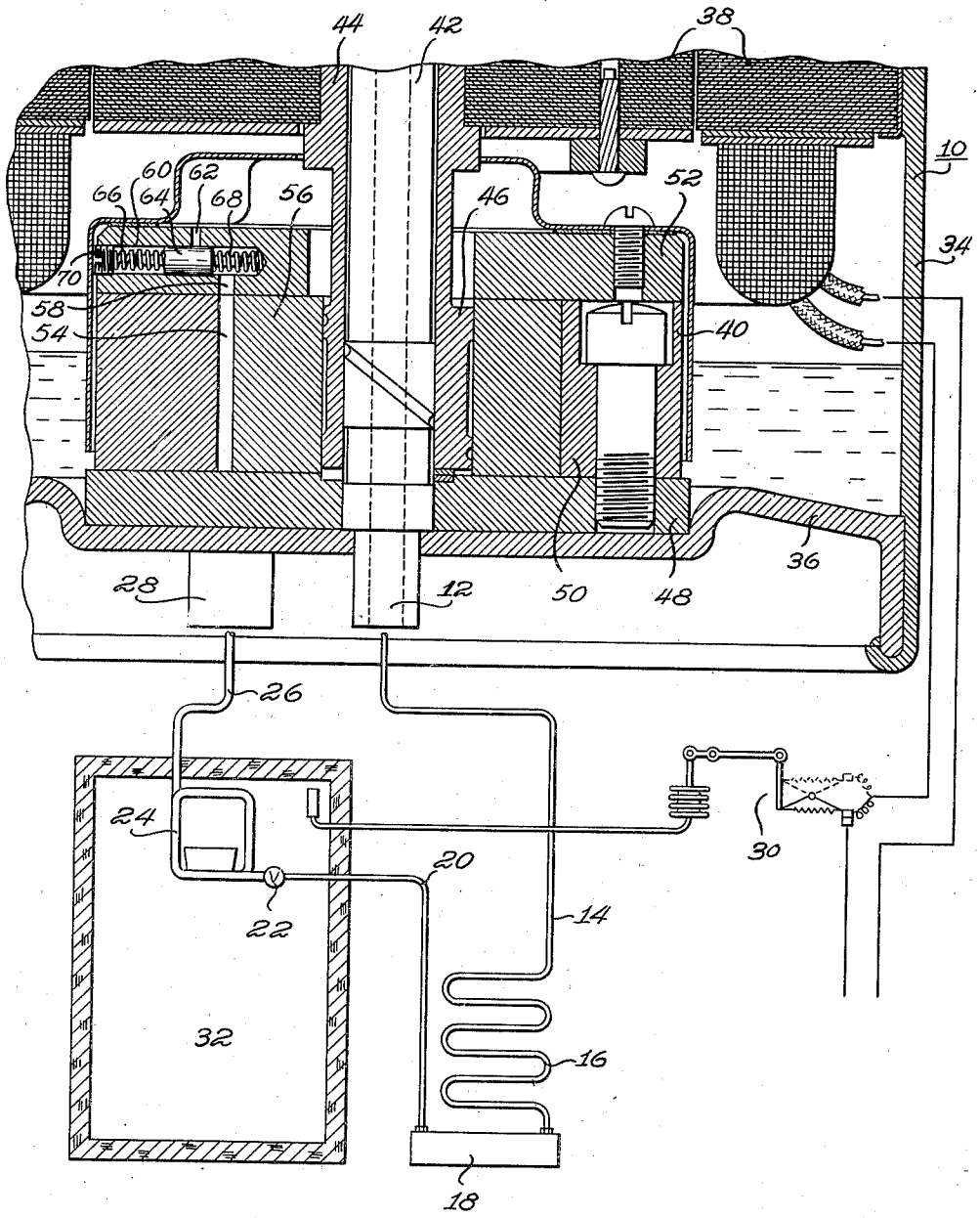
May 17, 1938. H. HUEY 2,117,424

REFRIGERATING APPARATUS

Filed March 29, 1935



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Patented May 17, 1938 2,117,424

UNITED STATES PATENT OFFICE

2,117,424

REFRIGERATING APPARATUS

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Application March 29, 1935, Serial No. 13,719

4 Claims. (Cl. 230—227)

This invention relates to refrigerating apparatus and particularly to compressors for refrigerating apparatus.

It is an object of the invention to provide a compressor in which the disagreeable noise produced by ordinary valves is eliminated.

It is a further object to provide a novel valve mechanism for compressors.

Another object of the invention is to provide a compressor discharge valve which is tuned as a vibrating body to the normal speed of operation of the compressor.

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

In the drawing:

The figure is a fragmentary cross section of a compressor embodying the present invention and showing the elements of a refrigerating system diagrammatically.

In the form of the invention illustrated in the drawing, a compressor generally indicated at 10 delivers compressed refrigerant to an outlet connection 12, whence it is delivered by conduit 14 to a condenser 16. The refrigerant liquefied in the condenser 16 is collected in a receiver 18 and delivered by a conduit 20 to an expansion valve or other liquid refrigerant control device 22, whence the refrigerant expands into the evaporator 24. The expanded refrigerant is withdrawn from the evaporator 24 through a conduit 26 to the inlet connection 28 of the compressor 10. The customary thermostatic control switch 30 is provided for opening and closing the circuit to the motor of the compressor unit in response to temperature conditions created in the compartment 32 within which the evaporator 24 is located.

The compressor unit 10 comprises a hermetically sealed housing 34 having a base 36 and within which is located an electric motor 38 and a rotary compressor 40. A stationary hollow shaft 42 is rigidly secured in the housing 34 centrally thereof to form a conduit for the compressed refrigerant collected at the top part of the housing 34 and to form a central support for the rotating parts of the motor-compressor unit. The latter comprise a sleeve 44 journaled on the shaft 42 and carrying the rotor of the motor 38 and an eccentric journal 46 at the lower end of the sleeve 44. The stationary body of the compressor 40 comprises a base plate 48 rigidly secured to the base 36 as by welding, a cylindrical body member 50 and a valve plate 52, both of which are suitably secured to the base plate 48. The members 48, 50, and 52 form a cylindrical chamber 54 within which an impeller member 56 is given a planetating movement by the rotation of the sleeve 44 carrying the eccentric 46. A divider block (not shown) is mounted in a radial slot in the cylindrical body member 40 to divide the chamber 54 into suction and discharge chambers. The inlet connection 28 communicates with the suction chamber on one side of the divider block, while on the opposite side of the divider block, a discharge passage 58 communicates with the discharge chamber.

A bore 60 is formed in the valve plate 52 perpendicular to the discharge passage 58, while a second discharge passage 62 communicates between the bore 60 and the top of the valve plate 52 in spaced relation to the discharge passage 58. Within the bore 60 there is mounted a cylindrical valve member 64 having a spring 66 urging the valve member toward the discharge passage 58 and a spring 68 resiliently cushioning the closing movement of the valve member 64. An adjustable plug 70 retains the parts in position in the bore 60 and provides for varying the pressure of the springs 66 and 68. The mass of the valve member 64 is preferably so proportioned in relation to the force-displacement rate of the springs 66 and 68 as to give the valve 64 a particular natural frequency of vibration. This frequency is preferably selected to correspond to the frequency of the discharge strokes of the compressor mechanism so that when the motor compressor unit is operating at normal running speed, the discharge impulses are produced at a rate corresponding to the natural rate of vibration of the valve 64.

In operation, whenever the switch 30 is closed, current is fed to the motor 38 causing the sleeve 44 to rotate, which in turn produces a planetary movement of the impeller 56 within the chamber 54. Refrigerant is alternately withdrawn through the inlet connection 28 and compressed and delivered through the discharge passage 58 to the valve member 64. Each pulsation of compressed gas causes the valve 64 to move to the left until the second discharge passage 62 is uncovered when the compressed refrigerant is discharged through the passage 62. It will be noted that upon the cessation of the discharge impulse within the discharge passage 58 the spring 66 together with the pressure of the gas trapped in the left hand end of bore 60 moves the valve 64 back to the right, closing the second discharge passage 62.

The closing movement of the valve is cushioned by the spring 68 and the movement of valve 64 to the right is thus brought to a gradual stop as distinguished from the action which takes place in poppet or leaf type valves wherein the valve member is abruptly stopped by coming in contact with a rigid seat. Furthermore, due to the tuning of the vibrating system comprising the valve 64 and springs 66 and 68 the succeeding impulses which are produced at normal running speed drive the valve member 64 at a rate corresponding to its natural frequency of vibration so that the valve 64 vibrates in the bore 60 through a considerable amplitude, thus insuring a minimum amount of restriction at the point where the valve 64 uncovers the second discharge passage 62.

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

What is claimed is as follows:

1. A compressor comprising in combination relatively movable elements forming an expansible chamber, a discharge passage leading from said chamber, means forming a bore disposed transversely to said discharge passage, a cylindrical valve member reciprocably mounted in said bore, a second discharge passage spaced along said bore from the first passage, resilient means urging said valve member toward the first passage to close the second passage, and resilient means for cushioning the closing movement of said valve, the mass of said valve and the rate of vibration of said resilient means being correlated to give the valve member a natural period of vibration in said bore coordinated with the period of operation of said elements through one cycle at normal running speed.

2. A compressor comprising in combination relatively movable elements forming an expansible chamber, a discharge passage leading from said chamber, a valve member for closing said passage, and resilient means for urging said valve to closed position, the mass of said valve and the rate of vibration of said resilient means being correlated to give the valve a natural period of vibration coordinated with the period of operation of said elements through one cycle at normal running speed.

3. In a pumping system, a discharge port therein, a valve therefor having a natural frequency of vibration in operation, and means including a pump for impelling a fluid with pressure pulsations against said valve at a frequency of said pulsations equal to the natural frequency of the valve whereby said pressure pulsations cause said valve to operate to open and close said port substantially without noise.

4. In a pumping system, a valve means having a natural frequency of vibration in operation, means for impelling a fluid with pressure pulsations against said valve means at a frequency of said pulsations so as to operate said valve means at its natural frequency, and a discharge passage leading from said valve means so constructed and arranged that the discharge passage is opened and closed by the valve means as the valve means vibrates back and forth.

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