Oct. 18, 1932. W. E. BIHL ET AL 1,883,328

COMPRESSOR

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Fig. 1.

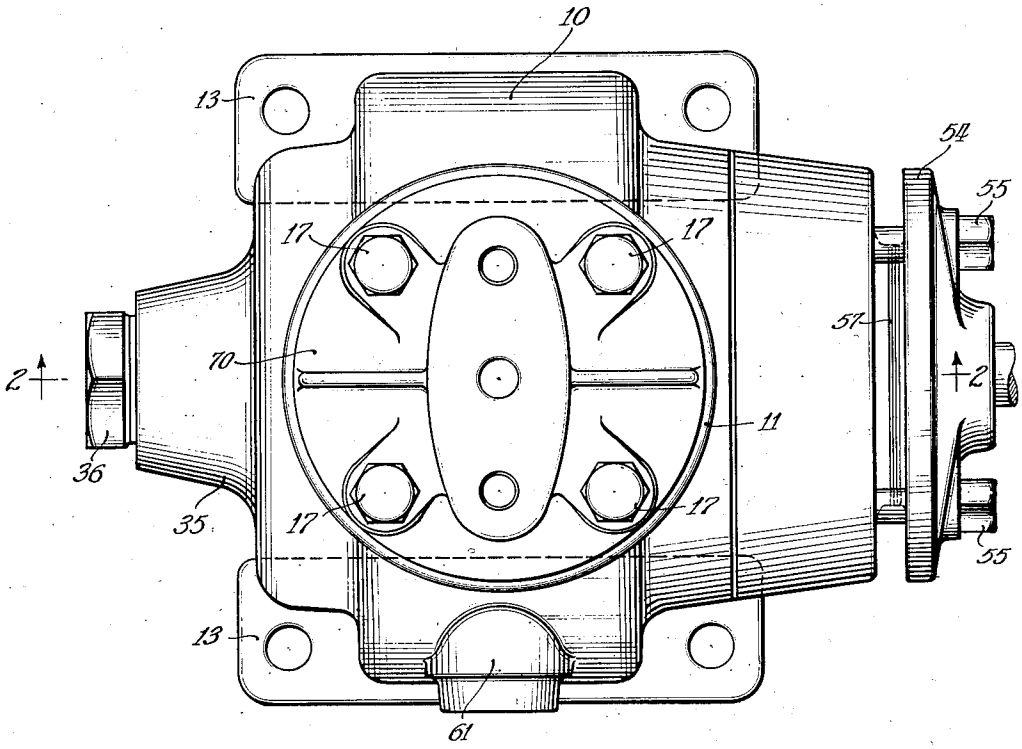


Fig. 4.

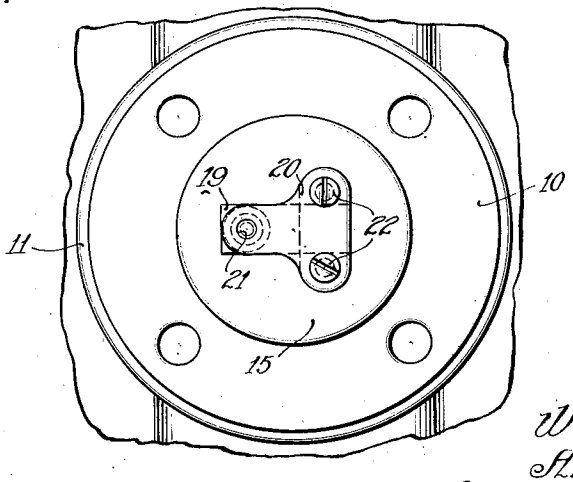
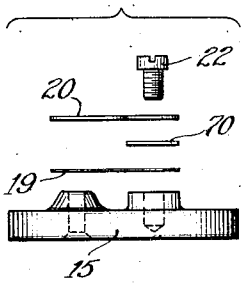


Fig. 5.



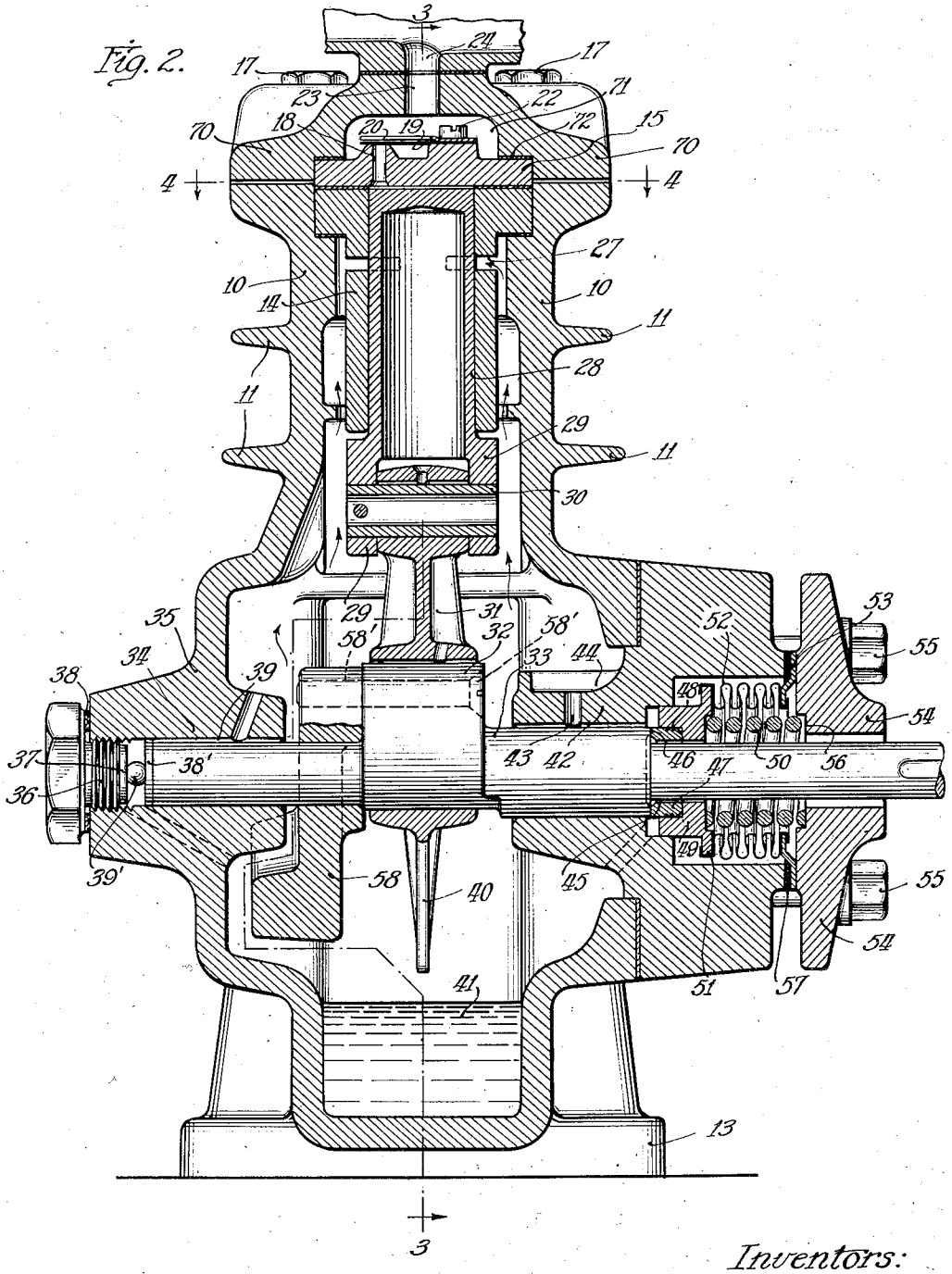
Inventors:
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Fig. 2.



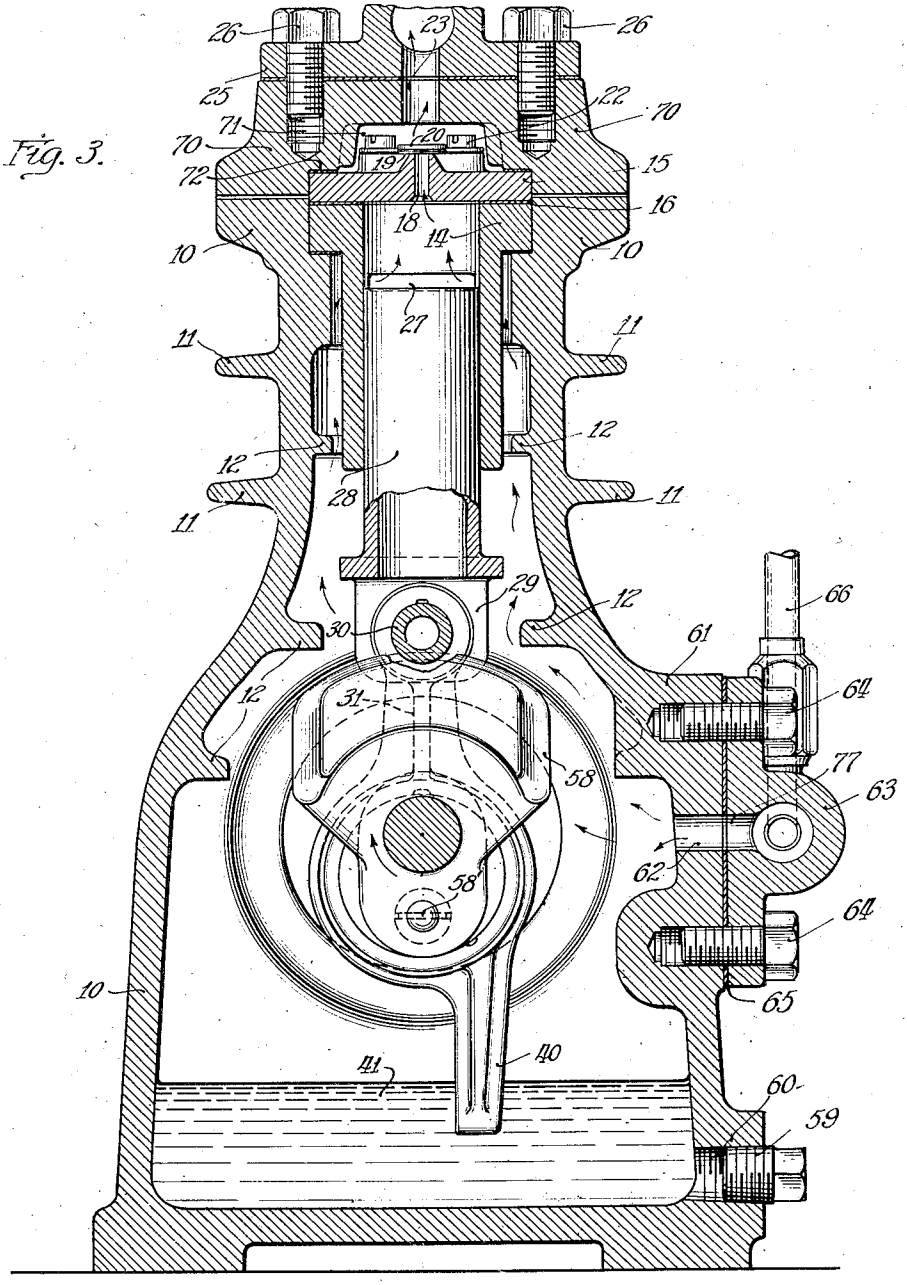
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COMPRESSOR

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Fig. 3.



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Patented Oct. 18, 1932

1,883,328

UNITED STATES PATENT OFFICE

WILLIAM E. BIHL AND AXEL RAMCLAW, OF CHICAGO, ILLINOIS, ASSIGNORS, BY MESNE ASSIGNMENTS, TO ZEROZONE, INCORPORATED, OF CHICAGO, ILLINOIS, A CORPORATION OF DELAWARE

COMPRESSOR

Application filed November 8, 1927. Serial No. 231,874.

Our invention relates in general to compressors for mechanical refrigerators and more particularly to small, compact and efficient compressors adapted to be operated by an electric motor for domestic or home use.

In mechanical refrigerators, and more particularly in mechanical refrigerators for domestic or home use it is highly desirable and advantageous to provide a cheap, compact, and highly efficient compressor unit that will operate indefinitely without attention. It is also desirable that the compressor unit be operated with as little vibration as possible in order to prevent objectionable noise. In addition it is highly advantageous to have the compressor unit coupled directly to the shaft of the driving motor, not only to reduce the cost of the speed reducing mechanism, but because if the compressor is run at a relatively high speed there is less tendency to produce objectionable sounds and noise. When the compressor unit is run at high speed, any noises that are present will occur at a relatively high speed and will be apparent by an audible hum, which is much less objectionable than a series of knockings and poundings. In order to further reduce the vibration and permit the compressor to run at high speed, it is desirable that the crank shaft carrying the piston be counterbalanced.

One of the objects of our invention is to provide a cheap, small, compact and highly efficient compressor unit which is adapted for domestic use.

Another object is to provide a compressor unit which may be operated at motor speed of commercial electric motors so as to reduce the noise and vibration, and so as to eliminate the cost of the usual speed reducing mechanism now employed.

Another object is to provide a cylinder for a compressor unit of this character which may be removed, either for replacement or adjustment.

Another object is to provide means for counterbalancing the crank shaft of the compressor unit.

There are other objects of our invention, which together with the foregoing, will be described in the detail specification, which is to follow, taken in conjunction with the accompanying drawings.

Referring now to the drawings:—

Fig. 1 is a top plan view of our improved compressor unit;

Fig. 2 is a vertical section along the line 2—2 of Fig. 1 looking in the direction of the arrows;

Fig. 3 is another vertical section at right angles to the one of Fig. 2 and taken along the line 3—3 of this figure;

Fig. 4 is a top plan view with the compressor head removed, taken along the line 4—4 of Fig. 2; and

Fig. 5 shows a modified view of the leaf valve in the top of the cylinder.

Referring now to the drawings, in which like reference characters in the various figures are applied to similar parts, the reference character 10 designates the cylinder block which has the exterior radiating fins 11 and the interior strengthening webs 12 formed or cast integrally with it. The cylinder block 10 is supported by a base 13 which is also formed integrally with it. A cylinder 14, which is cast separately, is adapted to fit within the upper end of the cylinder block 10. A cylinder head 15 is placed on the top of the cylinder 14, with a gasket 16 interposed between the top of the cylinder and the cylinder head. The head 15 of the cylinder 14 is held in place by the clamping action of the head 70 of the cylinder block 10. The head 70 is provided with a central recess 71 having an annular shoulder 72 fitting over the cylinder head 15 and is firmly secured to the cylinder block 10 by means of bolts 17.

The cylinder head 15 has a valve opening 18 therein. The valve comprises a thin spring metal strip 19 one end of which fits over the opening 18 and the other end is secured in place by the clamping action of the valve guard 20, which is held in place by the bolts 22. The valve guard 20 is slightly offset to permit the valve 19 to open. The offset portion of the valve guard is disposed parallel to the valve and in close proximity thereto, and is provided with a substantially flat under surface against which the valve strikes when it operates. The offset end of the valve

guard 20 is also provided with a small opening 21 therein to prevent the valve 19 from sticking thereto from air pressure when it is operated. The head 70 of the cylinder block 10 is provided with an opening 23 which coincides with an opening 24 in the compressor head cap 25 that is attached to the head of the cylinder block 70 by the bolts 26. The openings 23 and 24 constitute the outlet port of the compressor. The cylinder 14 is provided with openings 27 in the side wall thereof which serve to admit the refrigerating fluid to the cylinder. A hollow piston 28 is adapted to fit within the cylinder 14. The piston 28 is provided with two extensions 29 having an opening in each which form bearing surfaces for the piston pin 30 that serves to connect the piston 28 to a connecting rod 31. The connecting rod 31 is suitably fastened to an eccentric 32 on a crank shaft 33. The crank shaft 33 rides in a bearing 34 that is formed by a boss 35 on the cylinder block 10. An end plug 36 is threaded into the bearing 34 and serves to abut the end of the crankshaft 33 and to hold the crank shaft in place, through a bearing made up of a ball 39′ suitably held in place between two discs 37 and 38′. The disc 38′ may be pinned or otherwise attached to the shaft 39 to rotate with it. The discs 37 and 38′ are provided so that if the bearing wears it may be replaced. A gasket or washer 38 is interposed between the end plug 36 and the boss 35 to seal the bearing so that the refrigerator fluid will not escape. The bearing 34 is supplied with oil through an oil groove 39.

The end of the connecting rod 31 has a dipper or extension 40 which is adapted to plunge into the oil reservoir 41, formed in the base of the cylinder block and splash the oil therein to the various bearing surfaces. The other end of the crank shaft 33 rides in a bearing 42 having an oil port 43 for lubricating purposes. The bearing is supplied with oil from a small oil reservoir 44 formed on top of the bearing 42. A shoulder 46 is formed on the crankshaft 33 by reducing its diameter, and is ground so as to provide a very even surface. This shoulder is adapted to rest against a sealing ring 47, which is provided with a packing 48. The sealing ring 47 fits in a recess in an annular member 49 which is pressed tightly against it by means of a spring 50. The annular member 49 is provided with a flange 51. A bellows 52 is suitably attached to the flange 51. The other end of the bellows 52 is attached to a ring member 53 which is clamped between the cylinder block 10 and a flanged member 54. The flanged member 54 is clamped tightly to the cylinder block 10 by means of bolts 55. The flanged member is provided with a circular recess 56 on its inner side to provide a seat for the spring 50. A washer 57 is positioned between the ring member 52 and the cylinder block. The spring 50 serves to maintain the crank shaft properly positioned. The ring member 47 fits tightly against the shoulder of the crank shaft, both surfaces being ground and together with the packing 48, the annular member 49, the ring member 53 and the flanged member 54 forms a means for sealing the bearing 42 of the crank shaft to prevent escape of the refrigerating fluid.

A counterbalance 58 is suitably attached by a bolt 58′ to the crank shaft 33 adjacent the connecting rod bearing. The counterbalance 58 serves to balance the piston on the crank shaft 33. A plug 59 is adapted to fit within an opening 60 in the lower portion of the cylinder block 10. The openings 60 serve as a means of access to the oil reservoir 41.

The cylinder block 10 is provided with an extension or boss 61 which has an opening 62 therethrough. A cap member 63 is attached to the cylinder block by means of bolts 64. A gasket 65 is interposed between the cap member and the extension 61 to provide a tight fitting joint. The cap member 63 carries the pipe connection 66 and contains an opening 77 which coincides with the opening 62 in the cylinder block to form the inlet port, that is, the path by which the refrigerator fluid is conveyed to the compressor. The path of the refrigerating fluid is shown by the arrows. The crank shaft 33 is coupled directly to a small electric motor (not shown).

When the circuit of the electric motor, which operates the compressor, is closed by the operation of the thermostat switch in the refrigerator in a well known manner, the crank shaft of the compressor which is connected directly to the motor shaft is operated at motor speed. Assuming that the motor speed is 1800 revolutions per minute the piston 28 has 1800 compression strokes per minute. The dipper 40 attached to the end of the connecting rod 31 serves to spray the oil in the reservoir 41 to all the bearing surfaces of the compressor. The refrigerating fluid is admitted to the cylinder block through the inlet port 62 from the pipe 66 that leads to the refrigerating coil in the refrigerator. The refrigerating fluid passes through the ports 27 in the cylinder block when the piston is at the end of its charging stroke. The refrigerating fluid is then compressed by the compression stroke of the piston. At the end of this compression stroke the refrigerating fluid is forced through the leaf or feather valve 19 through the outlet port 24 and then to the condensing coil. From the condensing coil the refrigerating fluid is admitted through the usual expansion valve into the refrigerating coil in the refrigerator.

The ends of the crank shaft are ground in order to provide close spacing so that there is no leaking of the refrigerating fluid through the end plug 36 or through the ring

seal 47. The counterbalance 58 reduces the vibration of the crank shaft 33.

Referring now to Figure 5 we will describe a modified form of leaf or feather valve for the cylinder head 15. The only difference between this construction and that of the feather valve before described is that the valve guide 20 is not offset in this instance. A small spring member 70′ which is shorter than the spring member 19 constituting the feather valve, though of equal thickness is interposed between the valve guard 20 and the valve spring 19. The spring member 70 serves to space the valve 19 from the valve guide 20 so that there is no necessity for offsetting the valve guide as in the previous construction.

We contemplate as being included in these improvements such variations and modifications from what is herein specifically illustrated and described as fall within the scope of the appended claims.

We claim:—

1. In a compressor, a crank case, a base and a cylinder block all formed as integral parts of a unitary structure, the block having an inner annular shoulder adjacent its upper end, a cylinder having an outer annular flange at its upper end seating on said shoulder, a cylinder head seating on the upper end of the cylinder, a cylinder block head seating on the cylinder head and secured to the block, a piston operating in the cylinder, a crank shaft mounted in the crank case, and operating connections between said shaft and the piston.

2. In a compressor, a crank case, a cylinder block opening into the case, a cylinder suspended from its upper end and depending into the cylinder block in spaced relation to the surrounding wall thereof, the space between the cylinder and the block being open at its lower end, the crank case having an inlet opening and the cylinder having intake ports adjacent its upper end, a piston operating in the cylinder, a crank shaft mounted in the crank case, and operating connections between said shaft and the piston.

3. In a compressor, a crank case, a cylinder block opening into the crank case, a cylinder mounted in the block in spaced relation to the surrounding wall thereof, the space between the cylinder and the block being closed at its upper end and communicating at its lower end with the crank case, said case having an inlet opening and the cylinder having intake ports opening into said space, a piston operating in the cylinder, a crank shaft mounted in the crank case, and operating connections between said shaft and the piston.

4. In a compressor, a cylinder, a head for said cylinder having an opening therein, a spring member having an end fitting over said opening, a relatively thin flexible guard member fitting over said spring member and clamping it in place, said guard member having an offset portion with a substantially flat under surface disposed in close proximity to said spring member and adapted to be contacted thereby, and said offset portion having an opening therein to prevent said spring member from sticking thereto.

In witness whereof, we hereunto subscribe our names this 20th day of June, 1927.

WILLIAM E. BIHL.
AXEL RAMCLAW.