Jan. 30, 1951 J. TOUBORG 2,540,062

HERMETIC REFRIGERANT COMPRESSOR

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Fig. 1.

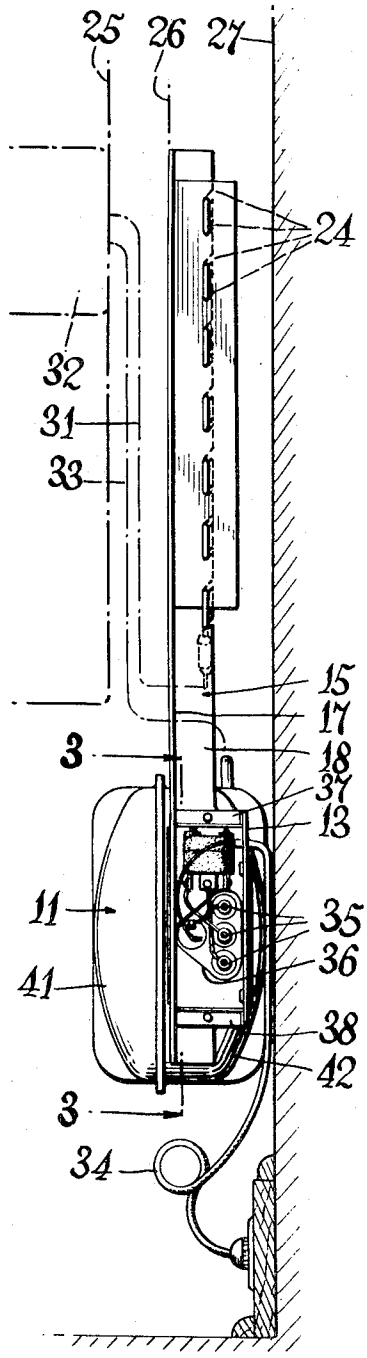
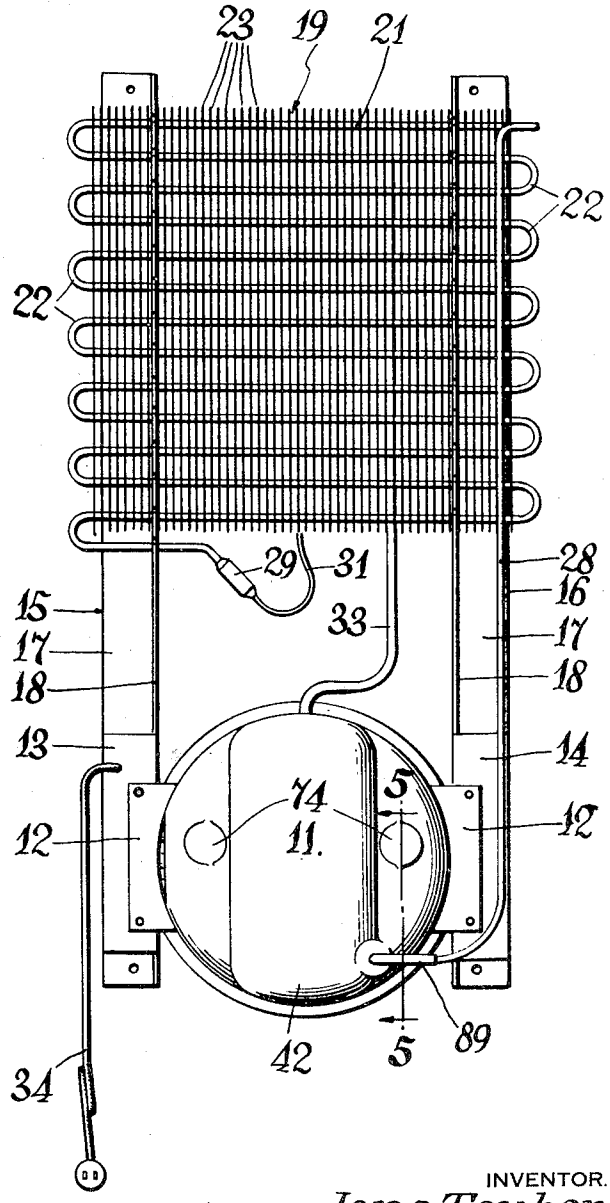


Fig. 2.



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Fig. 3.

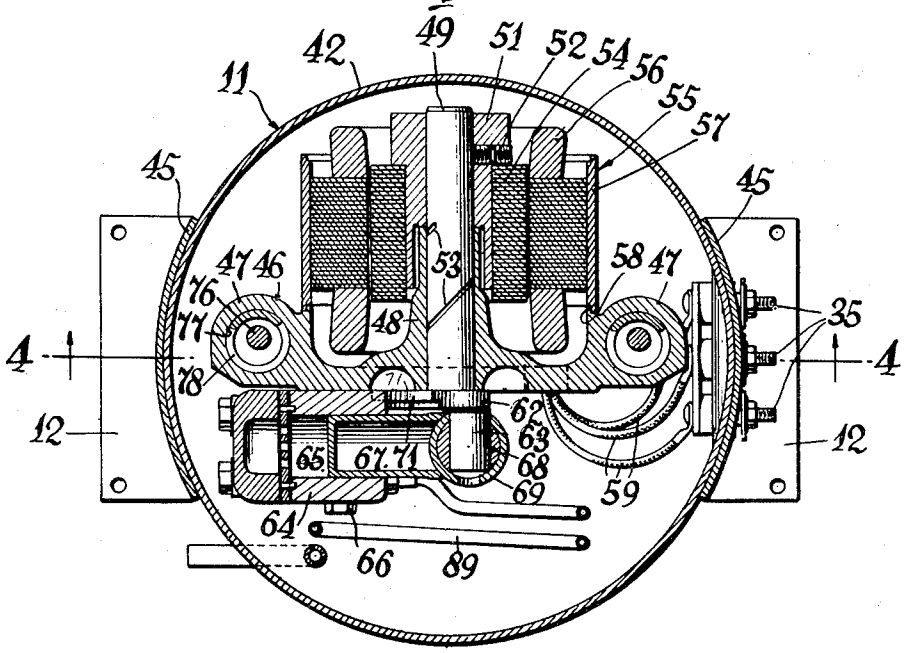
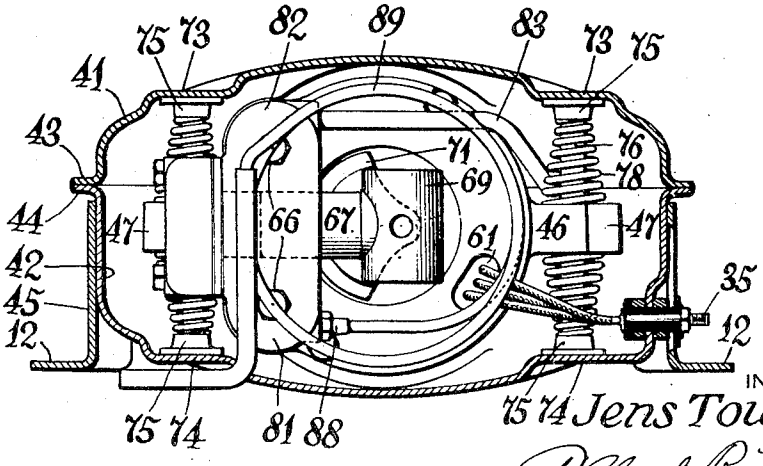


Fig. 4.



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Fig. 5.

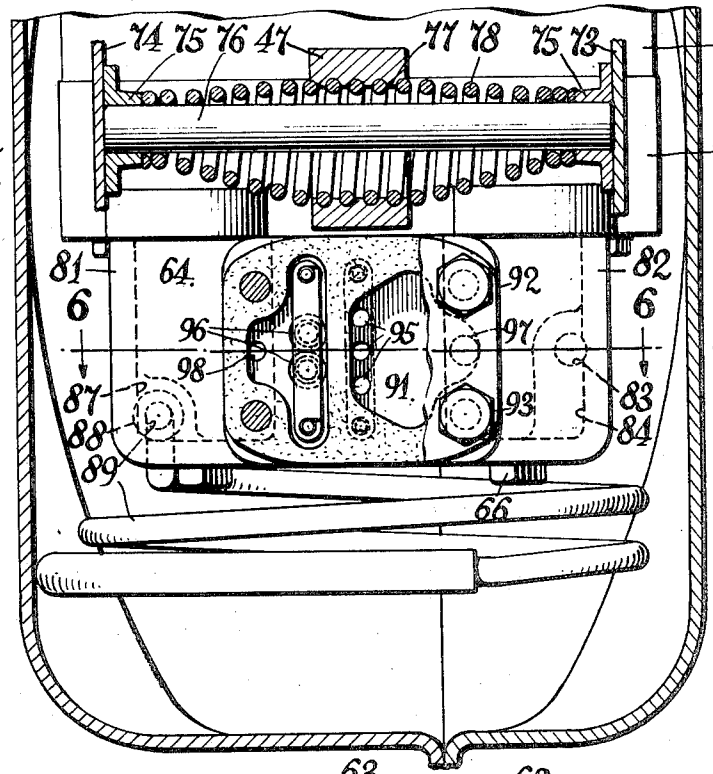
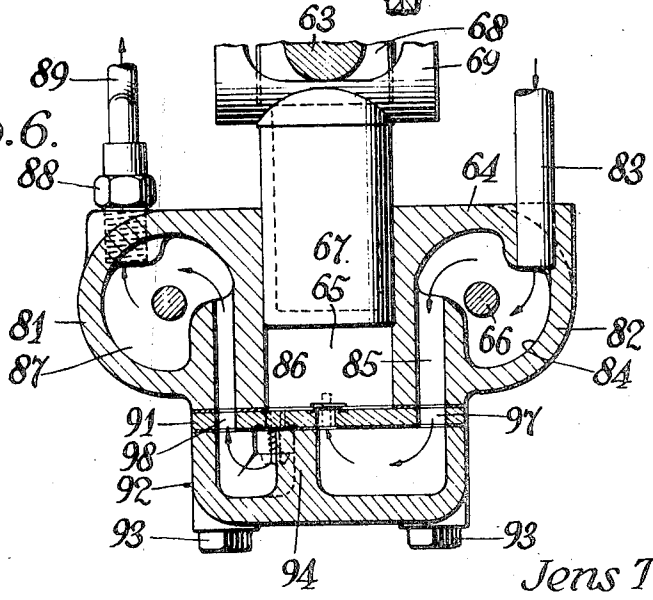


Fig. 6.



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UNITED STATES PATENT OFFICE

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HERMETIC REFRIGERANT COMPRESSOR

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5 Claims. (Cl. 230—58)

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This invention relates to a hermetically sealed compressor, and it has particular reference to a compressor suitable for use in a refrigeration system, and its coordination with the condenser employed therein.

One purpose of the invention is to provide a hermetic compressor, adapted to be driven by a fractional horsepower motor, which is extremely compact and of relatively small dimensions for its capacity, so that, when assembled in a domestic box, a greater percentage of the box volume may be given over to food storage. Another feature in providing such a compact unit is to decrease the space between the heat-generating elements of the compressor and the casing, whereby cooling may be more readily effected. Other aspects of the invention involve an improved internal resilient mounting for the compressor and motors; provision of built-in muffler chambers to minimize the development of noise; and simplifications of construction and assembly conducive to economies in manufacture. The invention also contemplates the combination of the compressor with a flue type condenser, whereby the high side of the refrigeration system may be fabricated as a unit.

The invention may be more readily understood by a perusal of the following description of a typical embodiment, illustrated in the accompanying drawings, wherein:

Fig. 1 is a side elevation of the compressor-condenser assembly, shown as it appears when mounted for service in a domestic refrigerator;

Fig. 2 is a rear elevation of the assembly of Fig. 1;

Fig. 3 is a vertical section through the compressor;

Fig. 4 is a bottom plan of the compressor and its internal mounting, the casing being shown in section as indicated by the line 4—4 of Fig. 3;

Fig. 5 is an enlarged fragmentary section taken substantially on the line 5—5 of Fig. 2; and

Fig. 6 is a fragmentary section taken on the line 6—6 of Fig. 5.

Referring first to Figs. 1 and 2, there is shown a hermetic compressor casing 11 provided with diametrically opposed outstanding flanges 12, which are bolted to short flange sections 13 and 14 respectively of upright columns 15 and 16. These columns are, except for the region of the short flange sections, of angular cross section, each having a flange 17 parallel to the short flange sections, and a flange 18 at right angles thereto. The two facing flanges 18 of the columns provide a support for a refrigerant condenser 19, herein shown as a fin and tube type

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having a continuous coil of tubing consisting of parallel transverse stretches 21 connected by return bends 22 and vertically disposed spaced fins 23. The flanges 18 may be formed with open end slots 24 to receive the several tube stretches 21 and thereby firmly support the condenser with outermost edges of the fins disposed between plumb lines passing through the front and back surfaces of the compressor casing 11.

The column flanges 17 provide means for mounting the assembly on the rear of a domestic refrigerator cabinet, as schematically indicated in Fig. 1. Herein, the dot and dash lines 25 and 26 represent the internal and external walls of the box, and the flanges 17 are connected to the external wall in any suitable manner. It will be seen that the compressor is suspended on the columns below the condenser, and when the box is positioned close to the room wall 27, an induced draft of cooling air will flow from the floor beneath the compressor and up the flue-like space between box and wall, thereby to extract heat from the high side portions of the refrigeration system.

The refrigerant circuit is also illustrated—in part schematically—in Figs. 1 and 2. Compressed refrigerant flows from the casing 11 through a discharge line 28 into the upper stretch 21 of the condenser 19, through the several convolutions, and thence through a liquid strainer 29 into a capillary feed tube 31 which may pass between the box walls 25 and 26 into the refrigerant evaporator 32, disposed in the food storage compartment. Expended refrigerant vapor returns to the compressor through a suction line 33. Automatic control of the cycle of operations is effected in the usual manner, current being supplied to the compressor motor through a conductor cord 34.

It will be seen that the short flange sections 13 and 14 not only provide pads for connecting the casing 11 to the columns 15 and 16, but that one of them also provides a housing for the various electrical connections and motor auxiliaries. In practice, the short flange sections may be formed by welding plates to standard angle irons, or they may be formed by cutting away excessive portions of one flange of channel irons. The motor lead terminals 35 are brought through the wall of the casing 11 adjacent one flange 12, to project through an opening 36 cut in the flange 18 of one column, as, for example, the column 15 provided with the short flange section 13. End closure members 37 and 38 are secured between the flanges 13 and 17 adjacent the ends of the flange 13, and a removable cover plate (not shown) may subsequently be positioned over the

open surface shown in Fig. 1. Provision is thereby made to locate the starting and overload relays, and points of service connections, exteriorly of the casing, where they are readily accessible, and withal to enclose them against dust and unauthorized tampering.

The casing 11 is formed from two sections 41 and 42, substantially circular in outline and relatively shallow, thus forming a generally cylindrical casing, wherein, in the embodiment shown, the diameter is greater than the axial length. These are welded together along abutting flanges 43 and 44, and these flanges, in the assembled unit, as shown in Figs. 1 and 2, are vertically disposed, rather than horizontally, as has heretofore been common practice. The mounting flanges 12 are each provided with arcuate webs 45 for connection to the casing section 42, the web adjacent the terminals 35 of course being slotted. The motor and compressor assembly is mounted within the casing, with the motor shaft disposed in an upright position, or at right angles to the casing axis, as is clearly shown in Fig. 3.

This assembly comprises a substantially circular and relatively thin main casting 46 provided at diametrically opposed points with outstanding lugs 47, each of which is transversely bored to accommodate mounting means, as will presently be described. The casting 46 is centrally formed with an upstanding bearing boss 48 which is axially bored to receive a main shaft 49. The upper end of the shaft 49 receives a bored and counterbored quill 51 whose internal shoulder seats on the upper end of the boss 48 to provide a thrust and supporting bearing. The quill is retained on the shaft by set screws 52. Lubricating oil is supplied to both the radial and thrust bearings by means of a spiral groove 53 cut in the shaft 49, which is fed by splashing from oil contained in the casing 11, or by other desired means. A drain hole 61 in the web of the casting 46 permits oil to return to the pool beneath.

The exterior cylindrical surface of the quill 51 serves as a supporting mandrel for the rotor 54 of an electric motor 55, the stator 56 of which is contained in a cylindrical sleeve 57 internally shouldered at its ends. One end of the sleeve is positioned on a cooperatively shouldered concentric rim 58 formed on the casting 46, thereby to retain the motor components in operative relationship. Lead wires 59 from the motor windings extend through a suitably located aperture 61 (Fig. 4) in the casting 46, for connection to the inner ends of the terminals 35.

The lower end of the motor shaft 49 extends through and below the casting 46, where it is offset to provide a crank arm 62 from which depends a crank pin 63. A cylinder block 64 formed with a cylinder 65 is secured to the lower side of the casting 46 by screws 66. The cylinder is fitted with a reciprocating piston 67 operatively connected to the pin 63. As shown in Figs. 3, 4, and 6, this connection is made by a crosshead 68 into which the pin 63 projects, and the crosshead is guided for transverse reciprocating motion in a slotted cylindrical yoke 69 secured to the end of the piston 67. The crank arm 62 is provided with a counterweight 71.

The motor and compressor assembly is internally mounted within the casing 11 by a resilient suspension cooperating with the previously referred to casting lugs 47. The casing sections 41 and 42 are each provided with spaced pad portions 73 and 74 respectively, located radially

equidistant from the longitudinal axis of the cylindrical dimension of the casing, and in an axial horizontal plane passing therethrough. Opposed pads may therefore be brought into alignment when the two casing sections are superimposed. As best shown in Figs. 4 and 5, each pad is provided, on its inner surface, with abutments or sockets 75 which may conveniently be welded thereto. The ends of transverse supporting rods 76 extend into and are retained by the aligned sockets, and these rods pass through the openings 77 in the casting lugs 47. Each rod is surrounded by a coiled spring 78, which may be of double conical shape, and the springs also pass through the openings 77, and abut the ends of the sockets 75.

Inasmuch as the springs 78 are helical, the openings 77 may be internally threaded, so that the springs may be screwed into them and bind when the major spring diameter reaches the center of the openings. In making the assembly, the casting 46, motor 55, and compressor are put together, and the springs are positioned in the lugs 47. The casing section 42 is then laid on its side, as shown in Fig. 4, and the rods 76 are placed in the sockets 75 to stand in a vertical position. The springs are then pushed over the ends of the rods until they abut the sockets, and then the casing section 41 is placed on the upper ends of the rods and pressed down until the flanges 43 and 44 abut. This will place the springs 78 under some compression, tending to expand the coils within the openings 77, and thereby preventing lateral displacement. The small ends of the springs grip the rods 76 adjacent the pads 75, but at the large diameter there is clearance, as is shown in Fig. 5. This provides a transverse resilient suspension of the motor and compressor, effectively supporting the assembly in all directions.

As best shown in Figs. 4 and 6, the cylinder block 64 is formed with laterally projecting portions 81 and 82, each of which is internally cored to provide muffler chambers for both incoming and discharged refrigerant. The suction vapors returning through the line 33 enter the top of the casing 11 and circulate around the motor, and then enter the block 64 through a suction pipe 83 extending from the portion 82 to a point in the casing above the casting 46, and therefore above the oil level. The pipe 83 communicates with the cored chamber 84, and through it with the inlet passage 85 which is drilled in the head end of the block 64. Compressed refrigerant finds its way to a drilled duct 86 communicating with a cored chamber 87 in the portion 81, which is also provided with an outlet fitting 88 leading to a discharge line 89. The line 89 is coiled in the oil bath, so that the heat of the compressed refrigerant will aid in eliminating refrigerant dissolved in the lubricant. The discharge line passes through the wall of the casing section 42 for connection to the condenser, as heretofore described. The provision of muffler chambers on both the inlet and discharge side of the cylinder, and the building of such chambers into the block, greatly reduces the tendency to develop noise, and also simplifies construction and assembly.

The ducts 85 and 86 are covered by a valve plate 91 and a cylinder head 92, conveniently secured by bolts 93 to the block 64. The head 92 is provided with an internal wall 94 abutting the plate 91 between its inlet and outlet ports 95 and 96. The plate is also provided with in-

wardly and outwardly opening valve leaves for the ports, and with openings 97 and 98 registering with the ducts 85 and 86.

It is believed that the operation will be readily apparent to those skilled in the art from the foregoing description. When current is supplied to the motor 55 in response to an increase in the low side pressure in the evaporator, the piston 67 is reciprocated to draw refrigerant vapor through the pipe 83 into the cylinder 65, where it is compressed and then discharged through the line 89, connected to the line 28 leading to the condenser 19. In passing through the casing 11, the refrigerant aids in cooling the motor, both by conduction with the motor parts and by convection to the casing wall. Vibrations caused by the motor and compressor motion are absorbed and dampened through the suspension on the transversely disposed springs 78, while compression noises or hisses are minimized by the two mufflers 84 and 87.

It will be seen that the springs 78 provide metallic heat paths directly to the walls of the casing 11, further to aid in compressor cooling, and that the external surface of the casing is directly disposed in the path of the induced cooling air flowing around the back of the cabinet and the condenser 19. An additional direct metallic heat dissipating path is provided between the flanges 12 and the columns 15 and 16. Due to the internal mounting of the compressor and motor, it is not necessary to provide resilient connections between these parts.

The casing 11 is so devised as to fit in close spaced relation to the compressor, thus minimizing space requirements and the internal heat path to the casing walls. It will further be seen that the components of the assembly are so organized as to lend themselves to simplified manufacturing operations and ease of assembly, thereby providing a highly efficient and economical unit.

While the invention has been described with reference to a single embodiment thereof, it is not intended to limit it to the precise details shown and described, but to encompass all such variations and modifications as fall within the scope of the appended claims.

I claim:

1. A hermetic compressor comprising a sealed casing formed of at least two sections each of which is internally provided with at least two spaced abutments, said abutments being aligned in opposed pairs when said casing is sealed, a substantially annular casting mounted in and transversely of said casing, a motor and compressor connected to said casting, hollow lugs formed on the casting at spaced portions thereof and in substantial alignment with said opposed pair of abutments, rods extending from said abutments and through said lugs, and coiled springs positioned around said rods and engaging the abutments at their ends and the internal walls of the lugs therebetween.

2. The hermetic compressor of claim 1, wherein said coiled springs are of double conical shape, the portions thereof of maximum diameter engage within the lugs, the end portions of smaller diameter engage the rods adjacent the abutments, and said springs are under compression.

3. Refrigeration apparatus comprising a hermetic compressor having a substantially cylindrical casing of less axial depth than the diameter thereof, a motor and compressor assembly resiliently mounted within the casing, motor lead terminals extending through the arcuate wall of the casing at one side thereof, diametrically opposed webs connected to said arcuate wall and having angularly disposed mounting flanges extending outwardly therefrom, one of said webs being perforated to receive said terminals, supporting columns connected to said web flanges, said column connected to said one perforated web also being perforated to receive said terminals, said perforated column being formed with outwardly extending spaced flanges partially enclosing said terminals, and cover means adapted to be positioned between said flanges further to enclose said terminals.

4. Refrigeration apparatus comprising a pair of spaced supporting columns adapted to be positioned in a vertical position, a hermetic compressor suspended from and between said columns adjacent the lower ends thereof, said compressor comprising a substantially cylindrical casing of less axial length than diameter, a motor, compressor, and supporting casting positioned in said casing, said casting being positioned in a substantially horizontal position, diametrically spaced mounting flanges connected to the arcuate wall of said casing and to said columns, spaced supporting springs for the casting extending in a horizontal direction between end walls of said cylindrical casing, thereby to mount the motor and compressor and casting within the casing with the major dimension of the casing extending vertically and the minor axial dimension extending horizontally with respect to the supporting columns.

5. A hermetic compressor comprising a two part sealed casing of generally cylindrical form, a plurality of pairs of opposed abutments formed on opposite walls of the casing, the abutments of said pairs being respectively positioned on each of the parts of the casing in spaced relation to the axis thereof, an interconnected motor, supporting casting, and compressor within the casing in spaced relation to the inner walls thereof, said motor having its shaft disposed normal to the axis of the casing, supporting lugs formed on the casting at spaced points and in line with the opposed abutments, and coiled springs extending from said abutments to said lugs, said springs extending transversely of the casting and motor shaft and substantially parallel to the axis of the casing and providing supporting and vibration damping means for the motor, casting, and compressor.

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