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F. H. KOLBE

COMPRESSOR FOR REFRIGERATING MACHINERY

Filed March 17, 1919

Fig-1

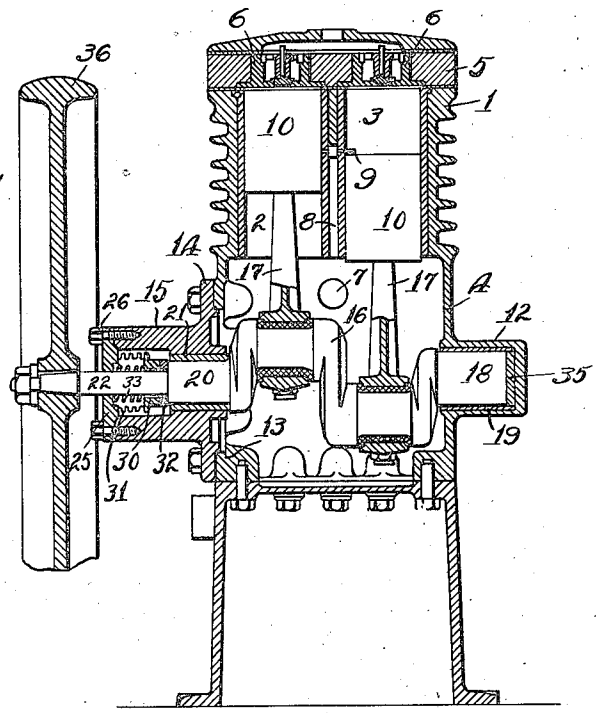
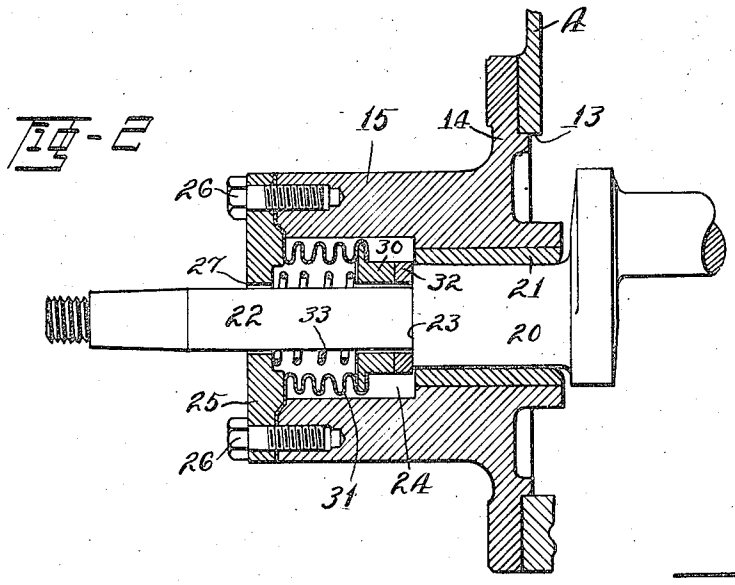


Fig-2



Inventor

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UNITED STATES PATENT OFFICE.

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COMPRESSOR FOR REFRIGERATING MACHINERY.

Application filed March 17, 1919. Serial No. 283,044.

To all whom it may concern:

Be it known that I, FREDERICK H. KOLBE, a citizen of the United States, residing at Detroit, in the county of Wayne and State of Michigan, have invented a certain new and useful Improvement in Compressors for Refrigerating Machinery, of which the following is a full, clear, and exact description, reference being had to the accompanying drawings.

This invention relates to compressors for gaseous fluid particularly such as are used in refrigerating apparatus, and has especial reference to refrigerating apparatus of the domestic type although not necessarily limited thereto. While it is well known that the requirements of all refrigerating machinery are severe, owing to the offensive and corrosive nature of the fluids employed, it is a fact that a device for domestic use has peculiarly severe requirements owing to the irregularity of its use, the lack of skilled or constant attention, and the high pressures to which it is occasionally subjected. Such a device is often left unused for long periods of time, such as during the winter months, yet the demand is made that it shall start instantly and operate perfectly at the end of that time; also owing to temporary vacation of premises, discontinuance of electric current, or for accidental reasons, such apparatus is frequently left idle for extended periods in hot weather as a result of which the refrigerant fluid, which under ordinary operating conditions exists largely in the liquefied state, becomes wholly gasified with the production of internal pressure far beyond those which would normally occur. Notwithstanding these extreme drawbacks no leakage must occur either of air inward or of refrigerant outward, and no corrosion must result for otherwise the machine might not run when called on.

One of the most fruitful sources of trouble in previous refrigerating systems has originated at the point where the main driving shaft of the compressor projects through the wall of the casing in which it revolves, since it is at this point that leakage of refrigerant or lubricant fluid, inlet of air, and corrosion of the parts has most frequently occurred. The objects of the present invention are the provision of a compressor of such construction as to overcome and avoid such leakage without such nicety of fit as will impede the operation of the compressor; the provision of a compressor of such nature and construction as always to remain tight under all conditions of temperature and pressure; the provision of a compressor of such design as to be more easily constructed and assembled than previous devices; the provision of a new and improved construction of sealing and bearing means; the provision of a new and improved expedient for maintaining contact between the parts of such a bearing; while further objects and advantages of my invention will become apparent as the description proceeds.

In the drawings accompanying and forming a part of this application I have shown one mechanical construction in which my inventive idea can be embodied, although it will be understood that this drawing is intended to be merely illustrative and not limiting upon me. In this drawing Fig. 1 represents a longitudinal, vertical sectional view through a preferred design of compressor embodying my improvements; and Fig. 2 is an enlarged detail view showing the bearing and sealing means.

The particular compressor shown is of the cylinder type and operates upon the two-cycle principle, although neither of these features is necessary to my invention. In the present embodiment the cylinder block 1 having therein the cylinders 2 and 3 is cast integral with the hollow crank case 4. The cylinders are shown as surmounted by the head block 5 having therein the outlet valve casings 6, 6, while one side of the crank casing is formed with the inlet aperture 7 from which the refrigerant vapor passes by means of a vertical duct 8 adjacent to the cylinders to the inlet ports 9 which open through the cylinder walls at such a point as to be alternately covered and uncovered by the pistons 10, 10. One end of the crank case is formed with a hollow integral boss 12 which supports the bearing for one end of the shaft, while the opposite end of the case is formed with an axial opening 13 receiving the cover plate 14 hermetically bolted thereto and carrying a boss 15 in which is mounted the other bearing together with my improved sealing means.

The crank shaft 16 is shown as of the two-throw type and has associated therewith the usual connecting rods 17, 17. At its rear-

ward end it is formed with an exteriorly cylindrical portion 18 journaled in a bushing 19 located in the boss 12; at the forward end it is formed with a cylindrical portion 20, rotatably journaled in a bushing 21 mounted in the boss 15. Forward of the portion 20 the crank shaft is formed with a reduced extension 22 surrounded by the abrupt shoulder 23, while the boss 15 is formed with an internal cavity 24 surrounding the reduced portion of the crank shaft. At the outer end of the boss 15 is a cover plate or cap 25, rigidly secured in place by any suitable means such as the bolts 26, and having an aperture 27 through which extends the portion 22 of the crank shaft. Inside the cavity 24 the reduced shaft portion 22 is surrounded by a freely fitting collar 30 to whose outer end is hermetically attached a longitudinally-expansible sheath 31 of circumferentially-corrugated flexible sheet metal, the opposite end of said sheath being hermetically attached to the wall of the boss 15 as by having its margin flared and clamped underneath the cover 25. While I do not limit myself in this regard, I have found the corrugated metal as manufactured by the Fulton Company of Knoxville, Tenn., to be very satisfactory for this purpose, although I do not limit myself to this or even to a cylindrical formation of flexible plate.

Between the collar 30 and the shoulder 23 I have shown a bearing and sealing ring 32 made of some composition which will maintain a tight joint at this point preferably without the necessity of lubrication and without corrosion or sticking; and between the collar 30 and plate 25, inside the sheath 31 I introduce a compression spring 33 tending to force the collar toward the shoulder 23. For withstanding the pressure of this spring I have illustrated the boss 12 as provided with a thrust bearing 35, which may take any desired form, against which the end of the shaft abuts; and I have also found it advisable that the shoulder 23 should project outwardly beyond the end of the bushing 21 so that neither the ring nor the shoulder can come in contact with this bushing. The projecting end of the shaft 22 is provided with driving means of any suitable or desired type, such for example as the drive wheel 36.

Within the scope of my invention the ring 32, when used, may be made of any material; contour, or arrangement, although I prefer to make the same of some soft and antifriction composition which may adhere to the one part and rub upon the other with sealing contact. The composition which I prefer is that described and claimed in the Letters Patent of Emery G. Gilson, No. 1,071,044, dated August 26, 1913, and No. 1,177,407 dated March 28, 1916, which composition is at present sold by the General Electric Company under the name "Genelite." This substance will run against certain bronzes and against hard steel without perceptible wear and without sticking, even at high temperatures. As an example of a composition of such metal which I have found very satisfactory, the following may be taken:—

	Per cent.
Copper	68 to 73
Tin	13 to 13
Lead	8 to 10
Graphite	6 to 4

although these proportions are not invariable, and a small amount of other substances, such as zinc, could also be employed. In use a sealing ring of this composition becomes coated on its wearing surface with a smooth, soft, adherent coating which looks and feels as though it might consist of graphite, and which offers little friction, is self-lubricating and permits no leakage even though run at a rather high temperature.

The collar 30 can likewise be of any desired metal within my invention, but in case of the use of a sealing ring such as I have described I prefer to make that collar of a kind of bronze, as for example:

	Per cent.
Copper	79 to 83
Tin	14 to 13
Zinc	2 to 1
Lead	2 to 1

With this arrangement it is immaterial whether the ring 32 rotates with the one member or stands still with the other member. The composition of the bronze collar will prevent this from cutting or scoring the shaft. This collar can also be lubricated upon the outside occasionally if desired, although it will be noted that it floats freely on the shaft and carries no load and hence does not offer much opportunity for friction.

It will be understood that lubricant may or may not be employed inside the compressor depending upon the metals used and the temperatures and friction-coefficient permitted, but that when used and of sufficient viscosity it may be considered as a part of the sealing means though not always a necessary part. It will also be understood that the embodiments here shown constitute only a small number out of the many constructions in which my inventive idea may be utilized, wherefore I do not limit myself to the details herein shown except as the same are specifically recited in the claims hereto annexed or rendered necessary by the prior state of the art.

Having thus described my invention, what I claim is:—

1. A compressor for refrigerating machinery comprising, in combination, a casing having an opening, a shaft projecting

through said opening and having an abrupt shoulder, a bearing surrounding the larger portion of said shaft, a collar surrounding the smaller portion of said shaft, a longitudinally expansible, circumferentially corrugated flexible metal member hermetically joined to said collar and casing, a sealing ring of self-lubricating metal separate from said collar and interposed between said shoulder and collar, and a spring forcing said collar toward said shoulder to compress said ring.

2. A compressor for refrigerating machinery comprising, in combination, a casing having a bearing, a shaft journaled in said bearing and having a shoulder, a collar surrounding said shaft facing said shoulder, a longitudinally expansible, circumferentially corrugated flexible metal member hermetically joined to said collar and casing, a sealing ring of graphite-containing bronze interposed between said shoulder and collar, and a spring forcing said collar toward said shoulder to compress said ring.

3. A compressor for refrigerating machinery comprising, in combination, a casing having a bearing and a cavity outside said bearing, a shaft journaled in said bearing and having a reduced portion projecting through said cavity, said shaft having a shoulder within said cavity, a collar surrounding the reduced portion of said shaft, a circumferentially-corrugated, longitudinally-expansible cylindrical, sheet metal sheath hermetically joined to said collar and to the wall of said cavity, a sealing ring between said collar and shoulder, and a compression spring inside said sheath forcing said collar toward said shoulder.

4. In a compressor for refrigerating apparatus, a closed casing having a bearing, a drive shaft journaled in said bearing and having formed thereon an integral shoulder, an endless annulus of anti-friction metal surrounding said shaft and facing said shoulder, a spring arranged to force said shoulder and annulus together, and an expansible cylindrical body of flexible sheet metal hermetically sealed to said casing and making a tight joint with said annulus.

5. In refrigerating apparatus, a casing having a bearing and a cavity into which said bearing opens, a shaft journaled in said bearing and having a shoulder, a collar surrounding said shaft and facing said shoulder, a spring interposed between said collar and a part of said casing and tending to move said collar toward said shoulder, and a longitudinally-expansible, cylindrical sheath located inside said cavity and hermetically joined to said collar and casing.

In testimony whereof, I hereunto affix my signature.

FREDERICK H. KOLBE.