

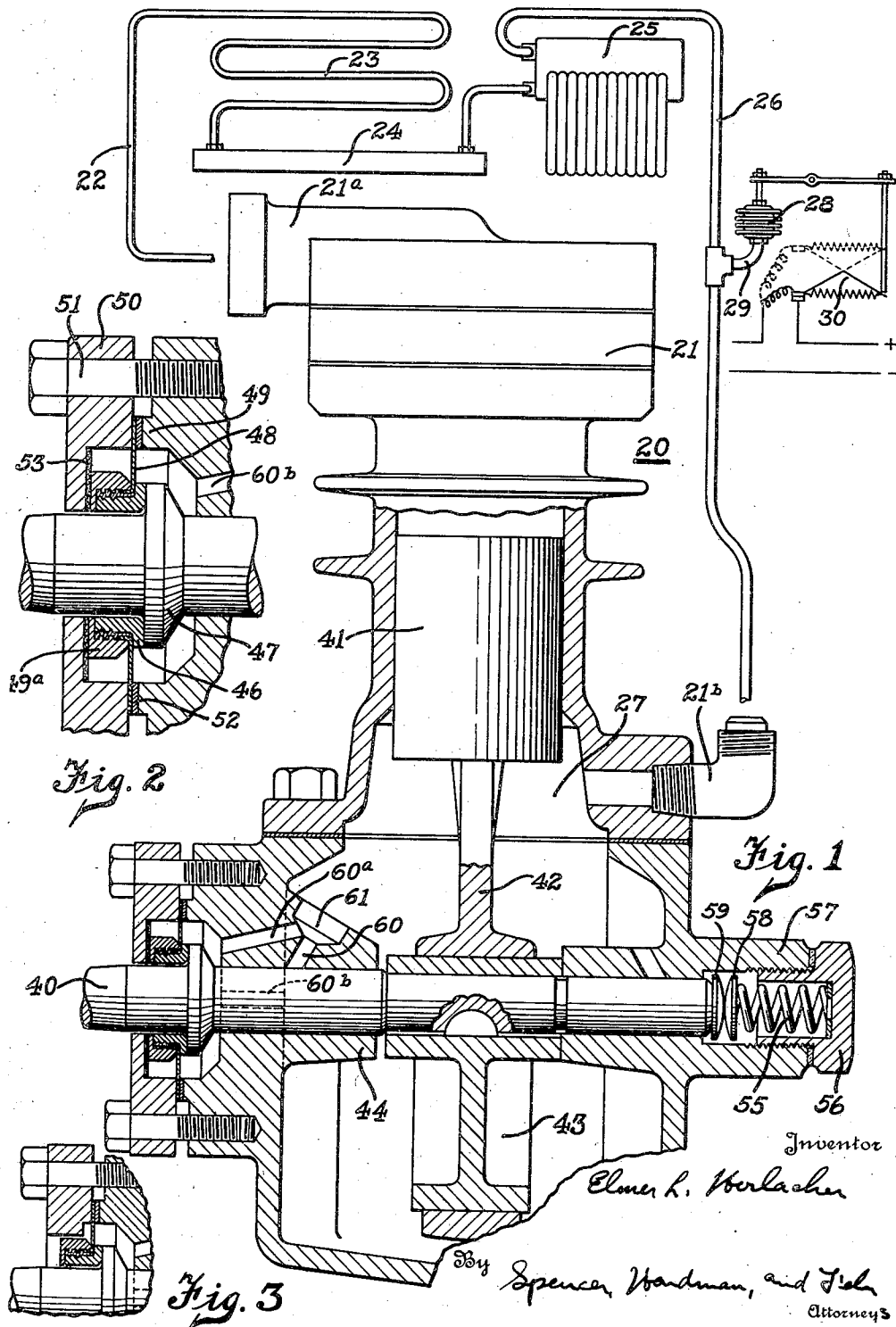
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REFRIGERATING APPARATUS

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REFRIGERATING APPARATUS

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This invention relates to refrigerating apparatus and more particularly to a seal for a shaft passing thru a casing of said apparatus.

An object of this invention is to provide a refrigerating apparatus having a shaft passing thru a casing of said apparatus provided with a seal for said shaft which seal is not liable to set up audible vibrations.

Another object of this invention is to provide a seal for refrigerating apparatus provided with a flexible metallic wall which seal is not liable to set up audible vibrations.

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

In the drawings:

Fig. 1 is a view partly in section, partly in elevation and partly diagrammatic of a refrigerating apparatus embodying features of my invention;

Fig. 2 is an enlarged detailed horizontal cross-sectional view of a portion of said apparatus;

Fig. 3 is a cross sectional view of a portion of an apparatus having a modified form of the invention.

A refrigerating apparatus of the household type in which features of my invention may be embodied is generally designated as 20. This type of apparatus is generally installed in places where there is no skilled attendant. Apparatus of this type must be automatic in its operation, and any parts which need practically constant adjustment must be of an automatically adjusted type. This type of apparatus necessarily must operate without any constant care from a skilled attendant. Apparatus of this type may comprise a compressor 21 discharging by a pipe 22 to a condenser 23 which delivers liquefied refrigerant to a receiver 24 from which the liquid refrigerant discharges to an evaporator 25, which may be of the type which controls by a float the admission of refrigerant from receiver 24. The evaporator 25 discharges evaporated refrigerant

thru the line 26 back to the compressor 21 preferably thru the crankcase 27. Means for controlling a motor which operates the compressor 21 may be provided. This means may comprise an expansible bellows 28 connected by line 29 with the line 26. The collapsible bellows 28 is adapted to operate a snap switch 30 which controls the starting and stopping of the electric motor which drives the compressor 21. A refrigerant which may be used in this apparatus is SO_2 . The compressor 21 may be drivingly connected thru the shaft 40 with the motor hereinbefore described preferably by a large wheel at the end of shaft 40 driven by a belt connected to a pulley on the motor. The compressor discharges into the pipe 22 thru the outlet 21a and receives the refrigerant from pipe 26 thru inlet 21b.

In a refrigerating apparatus of this type a shaft generally passes thru a wall of the apparatus in order to transmit power within the apparatus. In this embodiment such a shaft may be the crankshaft 40 of the compressor 21.

The shaft 40 is adapted to reciprocate the piston 41 thru the medium of a pitman 42 operated by the eccentric 43 keyed to the shaft 40.

Means is provided for preventing the passage of gas outwardly along the shaft 40 or for preventing the passage of air inwardly to the apparatus along said shaft. For this purpose, an axially flexible wall may be provided having hermetic connections with the shaft and with the casing of the apparatus. One of these connections may be a frictional sliding connection. In the embodiment shown, a ring 46 of relatively self-lubricating material is adapted to bear against a shoulder 47 of the shaft 40. The ring 46 is adapted to be connected hermetically with a flexible wall 48 the other edge of which is hermetically connected with the wall of the crankcase 27. In the modification herein shown, the edge of the flexible wall 48 is clamped between a shoulder 49 of the crankcase 27 and end plate 50 by means of bolts 51. A gasket 52 may be interposed between the shoulder 49 and the

flexible wall 48. A backing disc 53 of yielding material and which may comprise mainly manila rope fibre and rubber, may be interposed between the flexible wall 48 and the end plate 50.

The backing disc 53 need not touch the seal during normal operation of the machine. It may be spaced a minute distance from the seal and may be used merely to back up the seal during extended periods of idleness when pressure in the crankcase is liable to become excessive. The ring 46 may be attached to the flexible wall 48 by cementing the ring 46 to a bronze ring 49a. These two rings may be cemented together by some such cement as litharge cement. Prior to the cementing operation however the ring 49a may be soldered or brazed to the flexible wall 48.

Because of construction shown in which the bronze ring 49a is placed on the opposite side of the flexible wall 48 away from the bearing surfaces the bearing surface between the ring 46 and the shoulder 47 may be brought very close to the plane of the wall 48. This short axial distance between the wall 48 and the bearing surface prevents certain types of stresses in the wall 48 so that no audible vibrations are set up in the seal. In some manner the vibration is probably reduced so that the irregular friction stresses between the shaft and seal do not transmit audible vibrations to the seal.

In order to provide a suitable pressure between the shoulder 47 and the ring 46 a spring 55 may be placed at the other end of the shaft 40. One end of this spring is adapted to engage a cup-like nut 56 threaded in an extension 57 of the crankcase 27. The other end of the spring 55 is adapted to bear against a bearing 58 which engages the rounded end bearing 59 and the shaft 40. The backing disc 53 takes up excessive strains exerted upon the wall 48 by the refrigerant.

Lubrication may be provided at the bearing surface between the ring 46 and the shoulder 47. A means of obtaining this may be by providing lubricating passages 60, 60a and 60b in the bearing 44 and in the wall of the crankcase 27. These lubricating passages are adapted to receive oil splashed by the eccentric 43 and some of the oil thus received may work thru the passages 60 and 60a to the cavity 62 surrounding the sealing means heretofore described. The end of the passages 60 and 60a may have an enlarged oil catching cup 61.

The bearing ring 46 may be made of a substance somewhat like that described in the patent to Williams et al. 1,642,347. The frictional sliding connections between the ring 46 and the shoulder 47 may cause audible vibrations in the seal. Merely as a theory, the truth of which is unnecessary to

a complete disclosure it is suggested that these vibrations may be due to a slight axial movement of portions of the ring 46 away from the shoulder 47. It is believed that the bearing surface of the ring tends to vibrate radially, thus tending to bend the diaphragm. A relatively long axial displacement of this surface from the plane of the diaphragm gives the ring sufficient leverage to bend the diaphragm. However, with a short or substantially negligible displacement the ring does not have sufficient leverage to produce this bending of the diaphragm. Whatever the cause of these vibrations is, the vibrations are of a very disagreeable nature in a refrigerating apparatus of this type. Means for damping these vibrations into the inaudible range have been provided. The short axial distance between the diaphragm 48 and the bearing surface prevents audible vibrations.

There seems to be no exact measure for the permissible length of the axial displacement of the bearing or displacement of the bearing surface from the diaphragm. The length must not be sufficient to cause the vibrations. It is believed that such factors as the stiffness of the diaphragm and the character of the frictional surfaces vary the permissible axial length of the displacement. However, the length is substantially shorter than present standard practice in the refrigeration art.

Merely by way of example, in a small household refrigerating apparatus, after extensive experimentation, I have found the following dimensions to prevent squeaks: Many diaphragms .010 inch thick, made of phosphor bronze having an external diameter of $1\frac{3}{4}$ inches were each clamped between a casting shoulder and an end plate having an internal diameter of $1\frac{3}{8}$ inches. The external diameter of the Durex ring 46 was $1\frac{1}{16}$ inch and the internal diameter of its bearing surface was $2\frac{3}{32}$ inch. It was found that axial displacements of $1/16$ to $1/4$ inch produced no squeaks against a smooth steel shaft shoulder when installed in a refrigerating apparatus. However, an axial distance of $7/16$ inch in the axial displacement of the bearing surface from the plane of the diaphragm produced squeaks in a substantial percentage of installations.

The flexible wall 48 has a zone of relative rigidity. In this particular embodiment, the rigidity is in the plane of the wall. That is, the wall is substantially rigid radially, but flexible axially. The bearing surface of ring 46 has substantially no displacement from said zone. Thus no leverage is provided by the ring 46 for causing audible vibrations in the direction of flexibility of the wall 48.

The type of seal herein shown needs more or less adjustment because of periodic vari-

ations in the dimensions of the apparatus. Applicant's seal, however, automatically adjusts itself to these variations, and prevents the passage of gases into or from the refrigerating apparatus. This automatic adjustment is obtained by the flexibility of the wall 48. This flexibility does not produce the usual objectionable squeaks in applicant's embodiment because of the vibration damping construction.

In the modification shown in Fig. 3 the backing ring 53 may be omitted. When this ring is omitted the end plate 50 need not extend radially inwardly as far as shown in the other modification. It is therefore shown in this modification without any inwardly extending flange.

The bearing ring 46 is made of a relatively self lubricating material being of a porous nature and impregnated with oil, and this tends to reduce irregular frictional stresses between the shoulder 47 and the ring 46.

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 claim which follows.

What is claimed is as follows:

In refrigerating apparatus including a compressor casing, a shaft passing through said casing, a seal for said casing at the point where said shaft passes therethrough, said seal comprising a flexible diaphragm having hermetic connections with said casing and with said shaft, one of said connections being a sliding, frictional connection including a bearing surface of a porous, lubricant impregnated, metal member cemented to said diaphragm, and a ring member soldered to said diaphragm on the side away from said hermetic connection, substantially as described.

In testimony whereof I hereto affix my signature.

ELMER L. HORLACHER.