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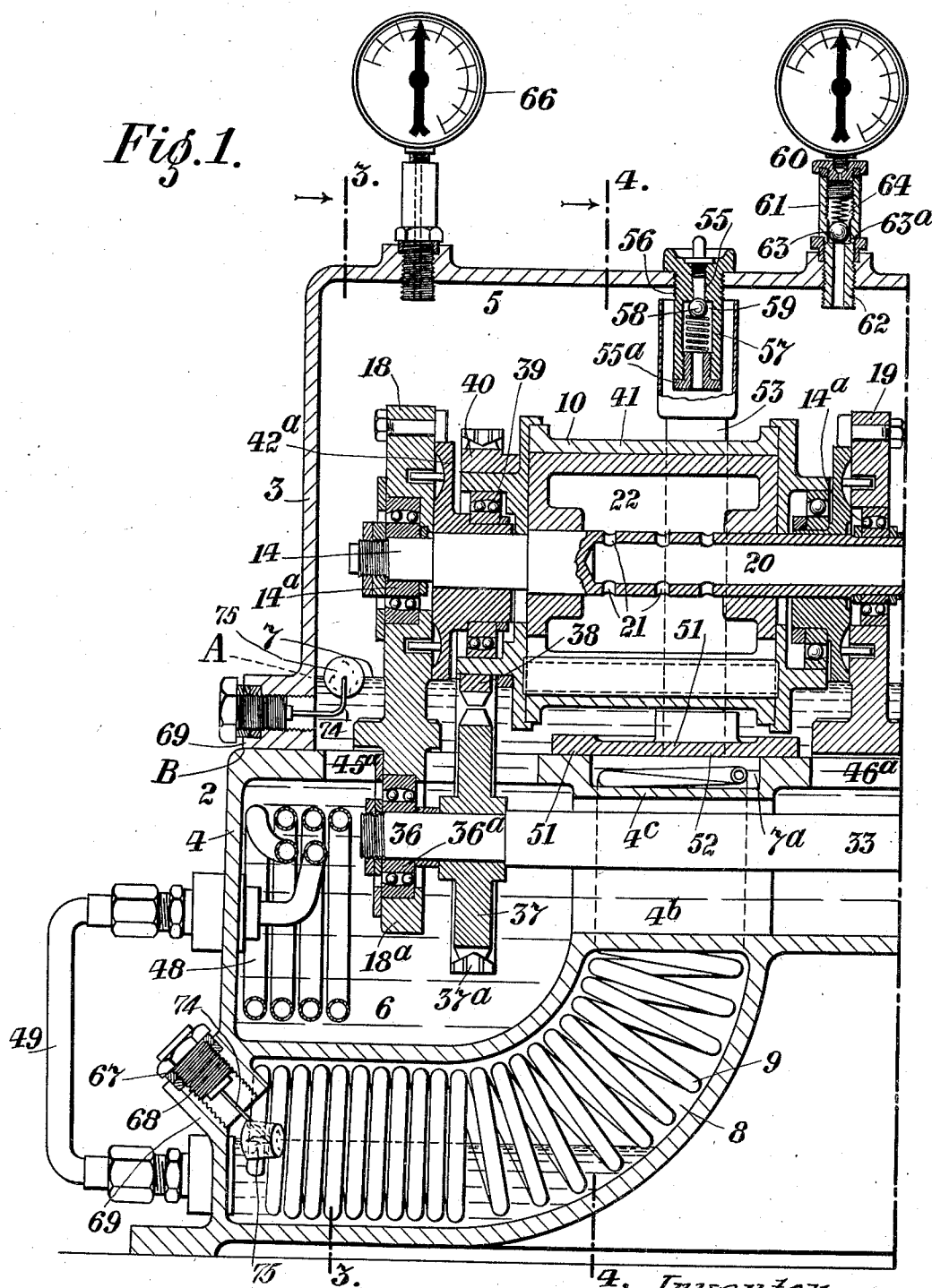
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REFRIGERATING SYSTEM OR APPARATUS

Filed Dec. 12, 1923

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Fig. 1.



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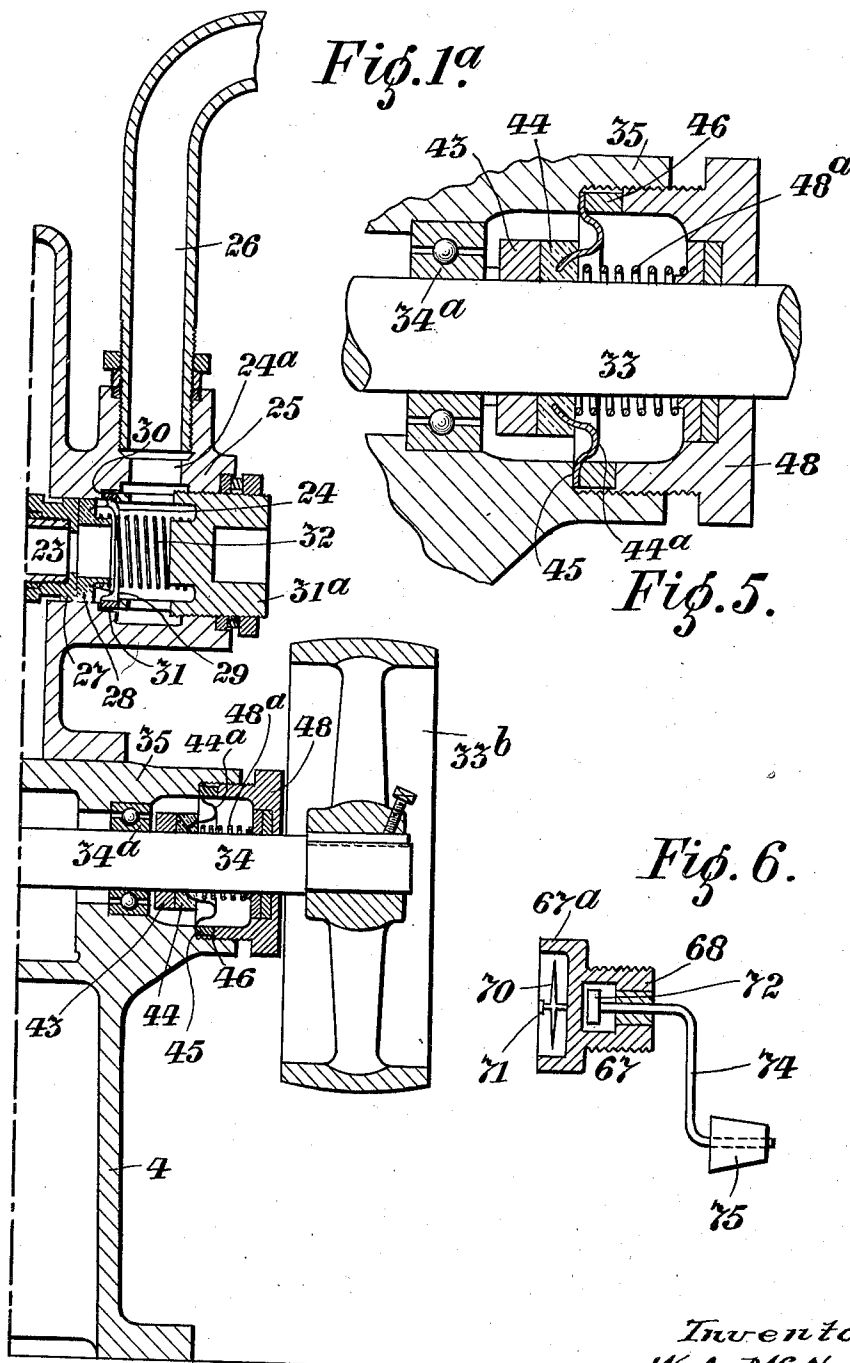
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REFRIGERATING SYSTEM OR APPARATUS

Filed Dec. 12, 1923

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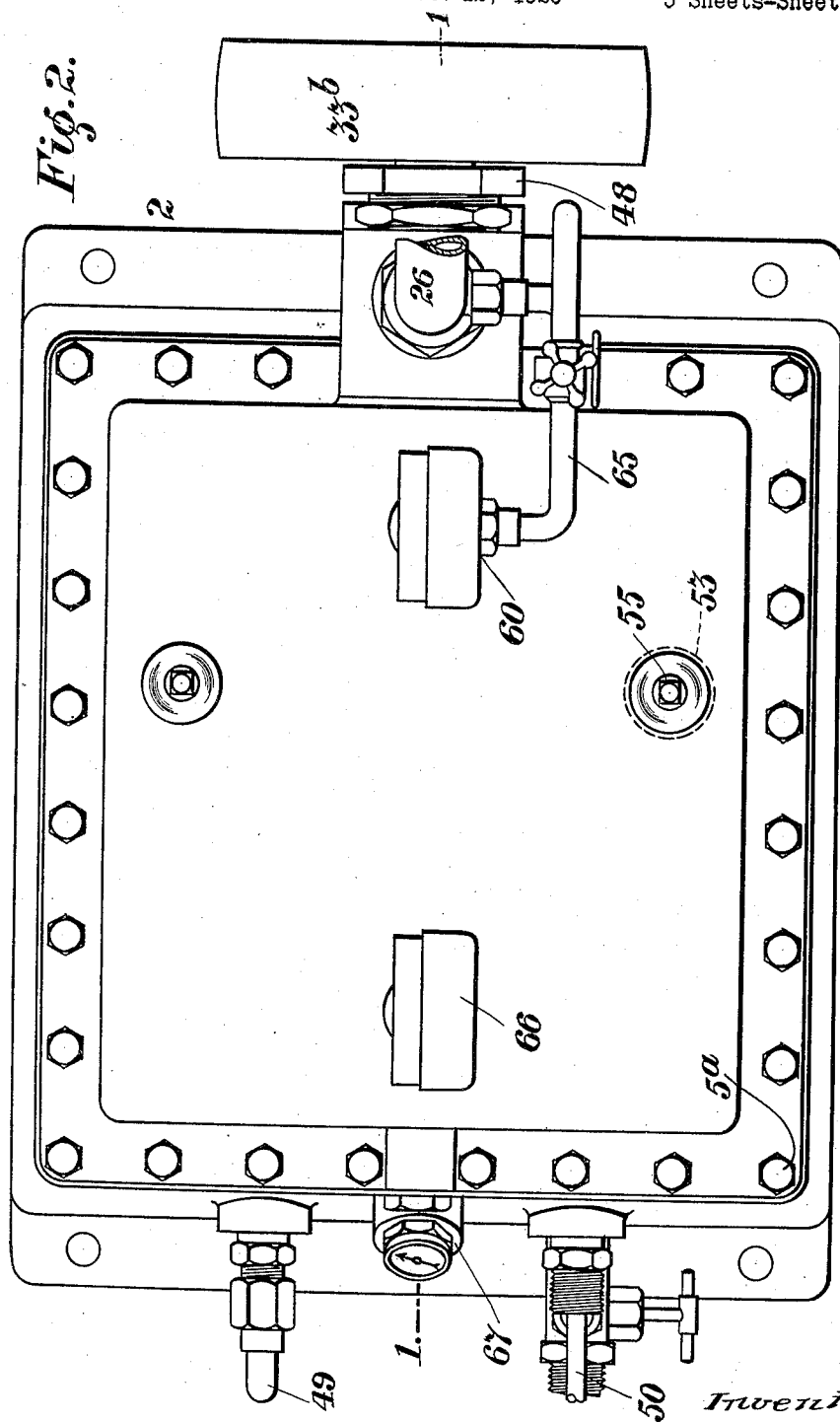
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1,571,633

REFRIGERATING SYSTEM OR APPARATUS

Filed Dec. 12, 1923

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Feb. 2, 1926.

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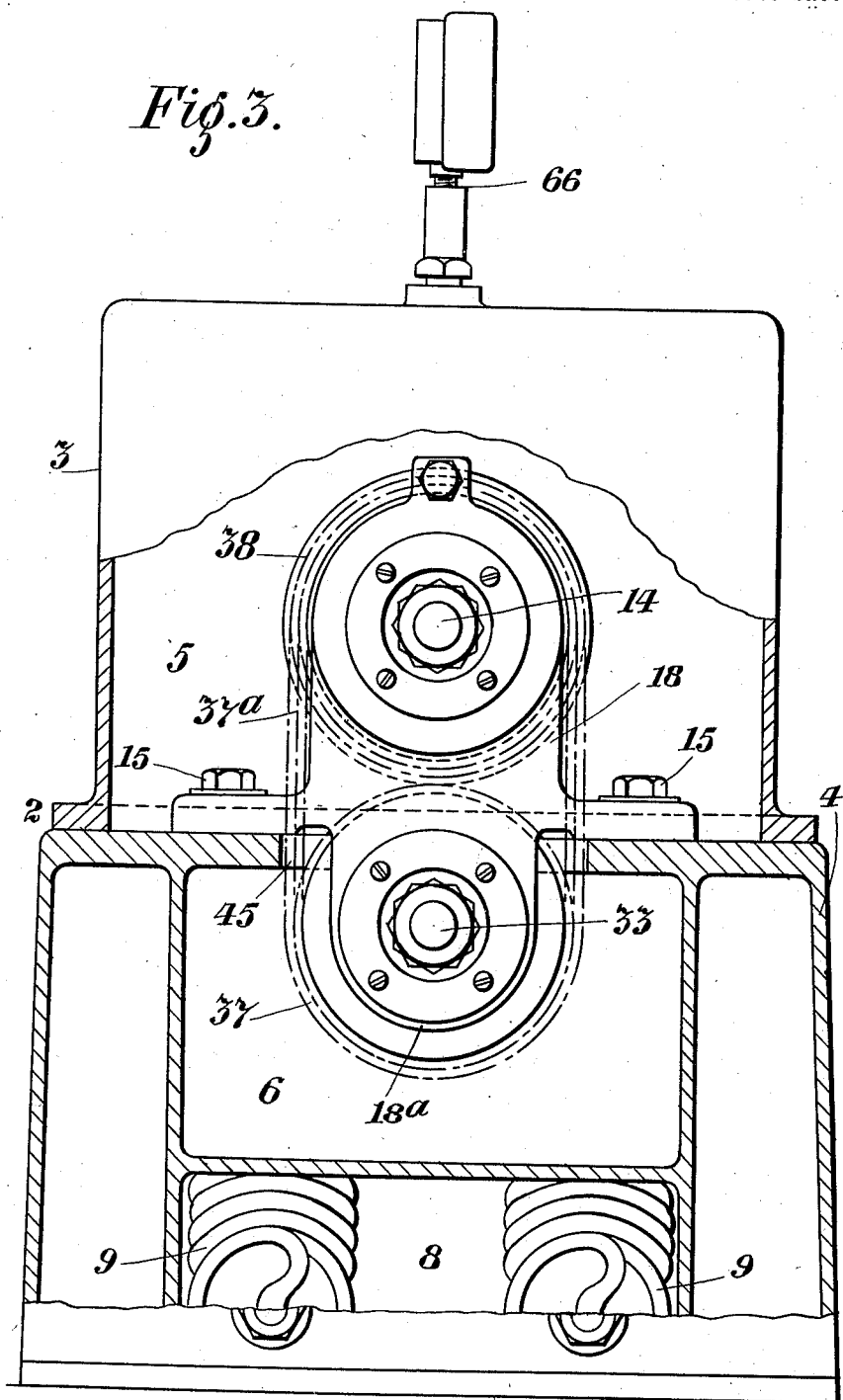
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REFRIGERATING SYSTEM OR APPARATUS

Filed Dec. 12, 1923

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Fig. 3.



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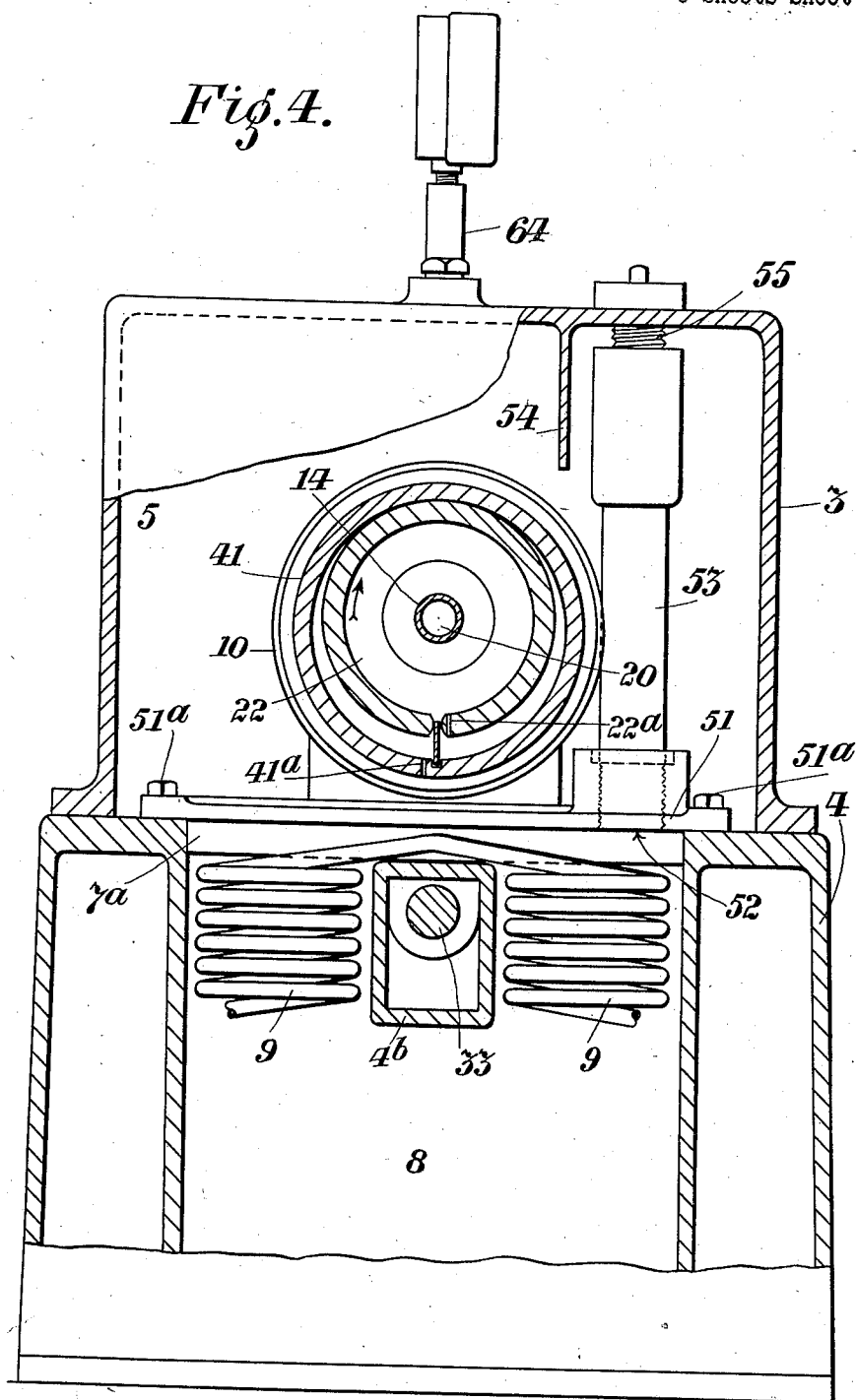
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REFRIGERATING SYSTEM OR APPARATUS

Filed Dec. 12, 1923

5 Sheets-Sheet 5



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UNITED STATES PATENT OFFICE.

WILLIAM ALEXANDER McNUTT, OF STAMFORD, ENGLAND, ASSIGNOR TO THE KITSON ENGINEERING COMPANY (LONDON) LIMITED, OF WESTMINSTER, LONDON, ENGLAND.

REFRIGERATING SYSTEM OR APPARATUS.

Application filed December 12, 1923. Serial No. 680,236.

To all whom it may concern:

Be it known that I, WILLIAM ALEXANDER McNUTT, Stamford, Lincolnshire, England, a subject of the King of Great Britain, have
5 invented certain new and useful Improvements Relating to Refrigerating Systems or Apparatus, of which the following is a specification.

This invention relates to refrigerating machines or apparatus employing a condensible fluid such as ethyl chloride as the refrigerating agent, and in which the compressor and the condenser are housed within a single casing, and particularly to the type of machines constructed with the body of the housing divided into two chambers, one for the condenser, and the other arranged to form a reservoir for a sealing liquid such as glycerine and to contain a rotary compressor
10 and the compressor shaft, said glycerine acting as a seal for the housing and as a lubricant for the compressor shaft. In these machines it is found that the refrigerant whilst passing to the condenser in the gaseous state mixes with the glycerine with the
15 result that glycerine is conveyed to the condenser and, after condensation of the gas, great difficulty is experienced in effecting a complete separation of the two liquids.

According to this invention, refrigerating machines or apparatus of the type aforesaid are so constructed that the refrigerant, as it passes from the compressor in a gaseous state, is conveyed to the condenser without
20 admixture with the sealing liquid.

The compressor and the condenser for the machine or apparatus are housed in a single casing which is sealed by a liquid surrounding the shaft for driving the compressor, said shaft being located in the lower portion of the casing and connected with the compressor, which is located in the upper part of the casing, through chain and sprocket or equivalent gearing. Hereinafter
25 the refrigerant will be referred to as ethyl chloride.

Where the condenser and compressor are contained in a single casing as aforesaid, communication is preferably established
30 between the upper portion of the compression chamber and the condenser chamber, by

means of a pipe opening into the compression chamber at or near the top thereof, and a baffle is associated with said pipe to prevent the sealing liquid being conveyed to the
35 condenser chamber with the refrigerant (hereinafter referred to as ethyl chloride). The condenser preferably comprises two intercommunicating coils in the condenser chamber and a third coil in the sealing
40 liquid.

In order to prevent the loss of gas, and the drawing in of air during re-charging with either liquid ethyl chloride, or with the sealing liquid, the casing may be provided
45 with removable charging plugs, each having a non-return valve adapted to be opened by a projection or spout on the refilling vessel.

The apparatus may be equipped with magnetic liquid level indicators as hereinafter more fully described.

In order that the invention may be clearly understood, reference is made to the accompanying drawings, which show, by way of
50 example, one construction of refrigerating machine in accordance with the invention.

Fig. 1 is a sectional elevation of the left hand portion of the machine taken on line 1—1 of Fig. 2.

Fig. 1^a is a continuation of Fig. 1 to the right.

Fig. 2 is a plan.

Fig. 3 is a sectional end elevation taken in a plane represented by the line 3—3 of
55 Fig. 1.

Fig. 4 is a sectional end elevation taken in a plane represented by the line 4—4 of Fig. 1.

Fig. 5 is a sectional detail view showing
60 the packing gland for the bearing of the compressor driving shaft.

Fig. 6 is a sectional detail view of a preferred form of indicator used for indicating the level of the liquid ethyl chloride.

On the drawings, 2 represents the machine casing, built up in two sections 3 and 4 secured together by bolts 5^a (see Fig. 2). The upper section 3 forms a compression chamber 5 and contains a compressor 10,
65 while the lower section 4 is sub-divided to provide two chambers 6 and 8 the former

constituting a reservoir for liquid (such as glycerine); the chamber 8 contains the condenser coils 9.

The compressor 10 enclosed within the compression chamber 5 is preferably of the type described in the specification of British Letters Patent No. 193,739 of 1922. The axle 14 of the compressor is supported in ball bearings 14^a, mounted in brackets 18, 19 secured to the top of the lower section 4 of the casing by bolts or studs 15. Said axle has an axial bore portion 20 and radial apertures 21 establishing communication between said bore and the interior of the rotor 22 of the compressor. The end 23 of the bore is in communication with a passage 24 in a bearing box 25 on the casing 2, which passage communicates in turn with the refrigerator coils (not shown) by means of a pipe 26 secured in a passage 24^a in the bearing box 25 leading from the passage 24.

In order to prevent the escape of ethyl chloride gas from the compression chamber 5, a special packing gland is provided comprising a collar 27 (Fig. 1^a) rigidly secured on the axle 14, and forming an abutment for a loose collar 28 which carries a diaphragm 29 of copper or other suitable material, the peripheral edge of which is nipped between a shoulder 30 in the passage 24 and a retaining ring 31, the latter being pressed in position by a retaining nut 31^a screwed into the bearing box 25. A spring 32 located between the retaining nut and the collar 28 holds the latter resiliently against the rigid collar 27.

Instead of the compressor axle 14 being directly coupled with the compressor driving means, it is arranged to be driven by a shaft 33 (Fig. 1) accommodated in the liquid reservoir 6, and mounted at one end 34 in a ball bearing 34^a, supported in a bearing box 35 formed integral with the lower section 4 of the casing, the other end 36 of the shaft being mounted in a ball bearing 36^a, carried by an extension 18^a of the supporting bracket 18. A chain 37^a and sprocket wheels 37, 38 operatively connect the compressor axle 14 and the main driving shaft 33. The wheel 38 is mounted in a ball bearing 39 carried between an extension 40 of the compressor cylinder 41, and a guide plate 42^a mounted on the axle 14.

The level A (Fig. 1) of the glycerine in the chamber 6 is kept above the main joints B of the two sections 3, 4 forming the machine housing or casing, and it will therefore be obvious that the joints between the two sections are only required to retain the liquid glycerine, as the gaseous ethyl chloride in the chamber 5 will not pass below the level of the glycerine and become admixed with it.

To prevent the escape of glycerine from

the chamber 6 a packing gland is arranged in the bearing box 35, in a manner similar to that described with reference to the packing gland for the compressor axle. In this gland, however, the collar or nut 43 (Fig. 1^a) is welded on the driving shaft 33 and forms an abutment for an adjustable collar 44 to which is secured a membrane 44^a of copper or other suitable material, whose peripheral edge is nipped between a shoulder 45 in the bearing box 35 and a retaining ring 46, pressed into engagement with the membrane by a retaining nut 48 screwed into the bearing box. A spring 48^a inserted between the nut and the collar 44 presses the latter resiliently into contact with the fixed collar 43 to effect a face joint therewith. With this arrangement glycerine from the chamber 6 is effectively prevented from creeping between the shaft and the bore of the collar 43 as the latter is fluid-tight on the shaft and it is prevented from passing the disc 44^a as the latter is cast in the adjusting collar 44 which is also joint tight. Furthermore, any leakage of liquid between the adjacent faces of the collars 43, 44 is opposed by centrifugal action set up by the revolving collar 43.

The glycerine chamber 6 is provided with openings 45^a, 46^a, (Fig. 1) which communicate with the interior of the compression chamber 5, and it is provided with a reduced portion 4^b through which the shaft 33 passes.

A cover plate 51 (Figs. 1 and 4) secured to the top of the lower section 4 of the casing by bolts or studs 51^a, Fig. 4 is provided for closing the upper end 7^a of the compressor chamber 8, being provided with an opening 52 in communication with the condenser chamber by means of a pipe 53 extending vertically in the compression chamber 5. A baffle plate 54, Fig. 4 depending from the top of the upper section 3 is located between the rotary compressor 10 and the pipe 53 in order to prevent glycerine thrown up by the action of the compressor from passing into the said pipe. Any glycerine which strikes the plate will be caught by the baffle plate and will flow back into the reservoir or glycerine chamber.

As already stated, the chamber 8 contains condenser coils 9. Said coils extend upwards, one at each side of the portion 4^b and are connected together over a bridge piece 4^c of said portion. They are also connected to coils 48 in the glycerine chamber 6 by a branch pipe 49. Water or other cooling medium is admitted to the condenser coils 9 through an inlet pipe 50, Fig. 2; after circulation through said coils and the glycerine cooling coils 48, it passes out by means of a pipe (not shown) connected to the latter.

In operation the driving shaft 33 is connected up to an electric motor, or a gas or

petrol engine, by means of a pulley 33^b or equivalent and the drive is transmitted through the chain gearing to the compressor axle. Under the action of the compressor, ethyl chloride gas is drawn from the refrigerating coils (not shown) through the pipe 26 into the hollow portion 20 of the axle 14, and through the apertures 21 into the interior of the rotor 22, passing then by way of the openings 22^a in the rotor (Fig. 4) to the compressor cylinder 41 in which it is compressed. The compressed gas passes into the compressor chamber 5 by way of openings 41^a in the cylinder and then passes down the pipe 53 into the condenser chamber where it is condensed into liquid ethyl chloride by contact with the condenser coils. From the condenser chamber the liquid ethyl chloride passes to the refrigerating coils where it is expanded again and absorbs heat in known manner.

Means are also provided on the compression side of the machine, whereby loss of gas and the drawing in of air is prevented during re-charging with either liquid ethyl chloride or glycerine. Said means comprise a hollow plug 55 extending into the pipe 53 and provided with a screwed body portion 56 adapted to be screw fitted into the top of the upper section 3; said plug has a passage 57 normally closed by a spring pressed ball 58 located between a plug 55^a and a valve seat 59 in the hollow plug. The valve is opened by forcing the ball valve from the valve seat by means of an extension forming a spout on the refilling vessel. A similar device may be provided for replenishing the glycerine supply.

For regulating the pressure of gas in the compression chamber a safety valve 60 is provided comprising a hollow plug 61, having a body portion 62 screw fitted and extending into the compression chamber 5. The valve passage is normally closed by a ball or equivalent 63, pressed onto a valve seating 63^a by a spring 64. The safety valve is connected to the compression suction pipe or conduit 26 (Fig. 2) for normal conditions by a pipe 65. A pressure gauge 66 is also provided at the top of the compression chamber 5.

To indicate the level of the glycerine and ethyl chloride in the respective compartments or chambers, indicator devices are provided each comprising a plug 67, (Fig. 6) having a screw threaded body portion 68, screw fitted into an internally screw threaded boss 69 (Fig. 1) of the casing, one end 67^a of the plug being recessed to receive a needle 70, pivoted at 71. This needle is controlled by a magnet 72 attached to a lever 74 on which a cork 75 is carried and which floats on the surface of the glycerine or the ethyl chloride as the case may be. The action of the device is such, that as the

levels of the glycerine and ethyl chloride rise and fall in the chambers 6, 8, the magnets will be turned and the needles will follow, thus indicating the prevailing levels.

What I claim and desire to secure by Letters Patent is:—

1. A refrigerating apparatus employing a condensible fluid as a refrigerant, comprising a casing made up of two parts, the lower part being divided to present an upper reservoir for a sealing liquid, and a lower chamber sealed against the reservoir and adapted to contain a condenser, the sealing liquid in the reservoir being adapted to seal the juncture between the two parts of the casing, a compressor arranged in the upper part of the casing, an operating shaft for the compressor working in said reservoir, and means to convey the refrigerant in a gaseous state from the compressor to the condenser without permitting it to mix with the sealing liquid.

2. For a refrigerating apparatus employing a condensible fluid as a refrigerant and having in combination a rotary compressor housed in an upper portion and a condenser housed in a lower portion of a single casing, a compressor driving shaft passing through said casing, a sealing liquid to surround the said shaft and seal the casing, a pipe to convey the refrigerant in a gaseous state from the compressor to the condenser without admixture with the sealing liquid, to said pipe opening into the compression chamber near the top thereof, and a baffle plate associated with said pipe to prevent the sealing liquid being conveyed to the condenser chamber with the refrigerant.

3. For a refrigerating apparatus employing a condensible fluid as a refrigerant and having in combination a rotary compressor housed in an upper portion and a condenser housed in a lower portion of a single casing, a compressor driving shaft passing through said casing, a sealing liquid to surround the said shaft and seal the casing, and a pipe to convey the refrigerant in a gaseous state from the compressor to the condenser without admixture with the sealing liquid, and removable charging plugs provided in the top of the casing for replenishing the supply of sealing liquid and refrigerant, said plugs being each provided with a non-return valve adapted to be opened by a projection on the re-filling vessel.

4. For a refrigerating apparatus employing a condensible fluid as a refrigerant and having in combination a rotary compressor housed in an upper portion and a condenser housed in a lower portion of a single casing, a compressor driving shaft passing through said casing, a sealing liquid to surround the said shaft and seal the casing, a pipe to convey the refrigerant in a gaseous state from the compressor to the condenser

without admixture with the sealing liquid, the said pipe opening into the compression chamber near the top, thereof, a baffle plate associated with said pipe to prevent the sealing liquid being conveyed to the condenser chamber with the refrigerant and removable charging plugs provided in the top of the casing for replenishing the supply of sealing liquid and refrigerant, said plugs being each provided with a non-return valve adapted to be opened by a projection on the re-filling vessel. 10

In testimony whereof I affix my signature.
WILLIAM ALEXANDER McNUTT.