Dec. 6, 1932. G. ANDRESEN 1,890,205

REFRIGERATING APPARATUS

Filed Jan. 31, 1931 5 Sheets-Sheet 1

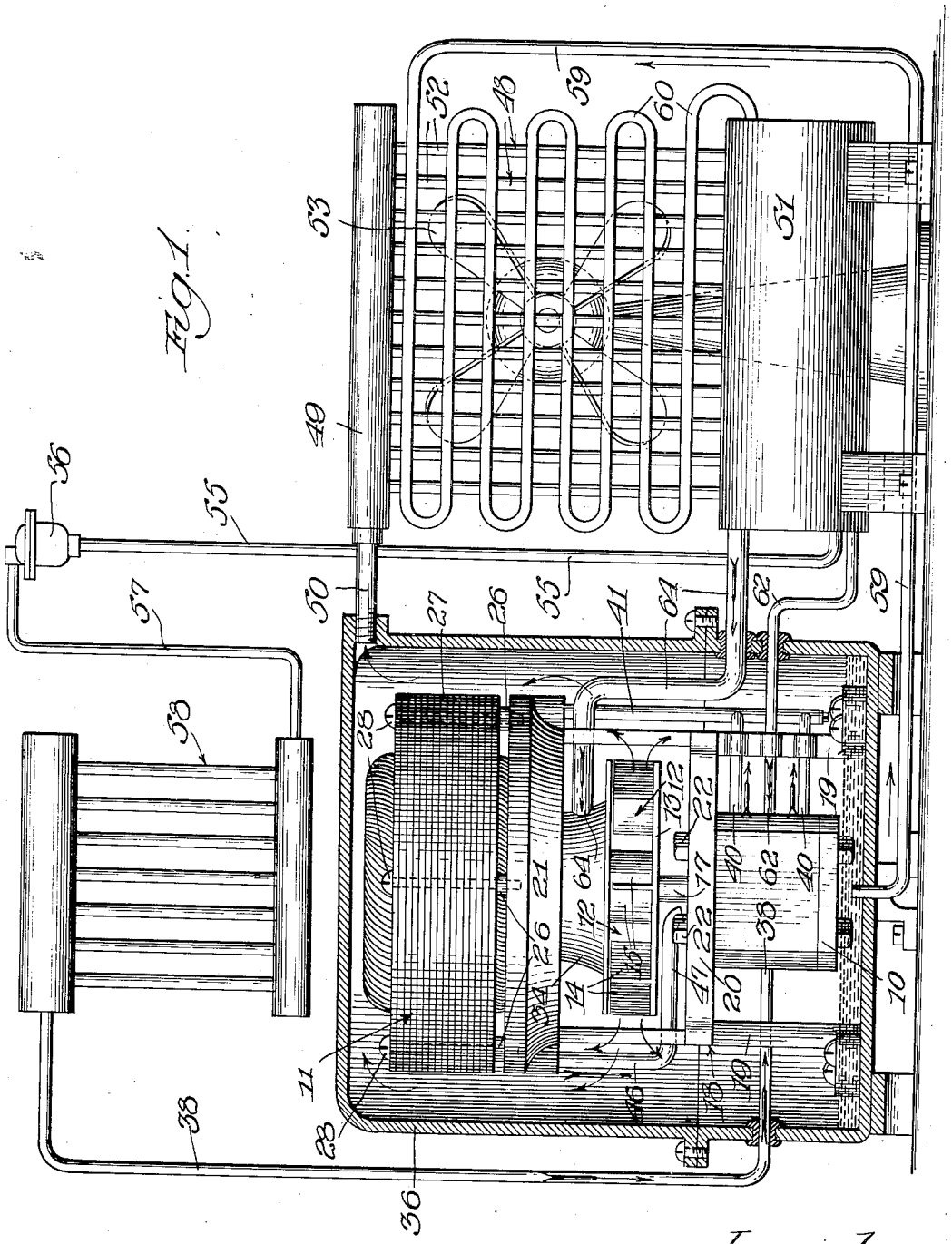


Fig. 1.

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Fig. 2.

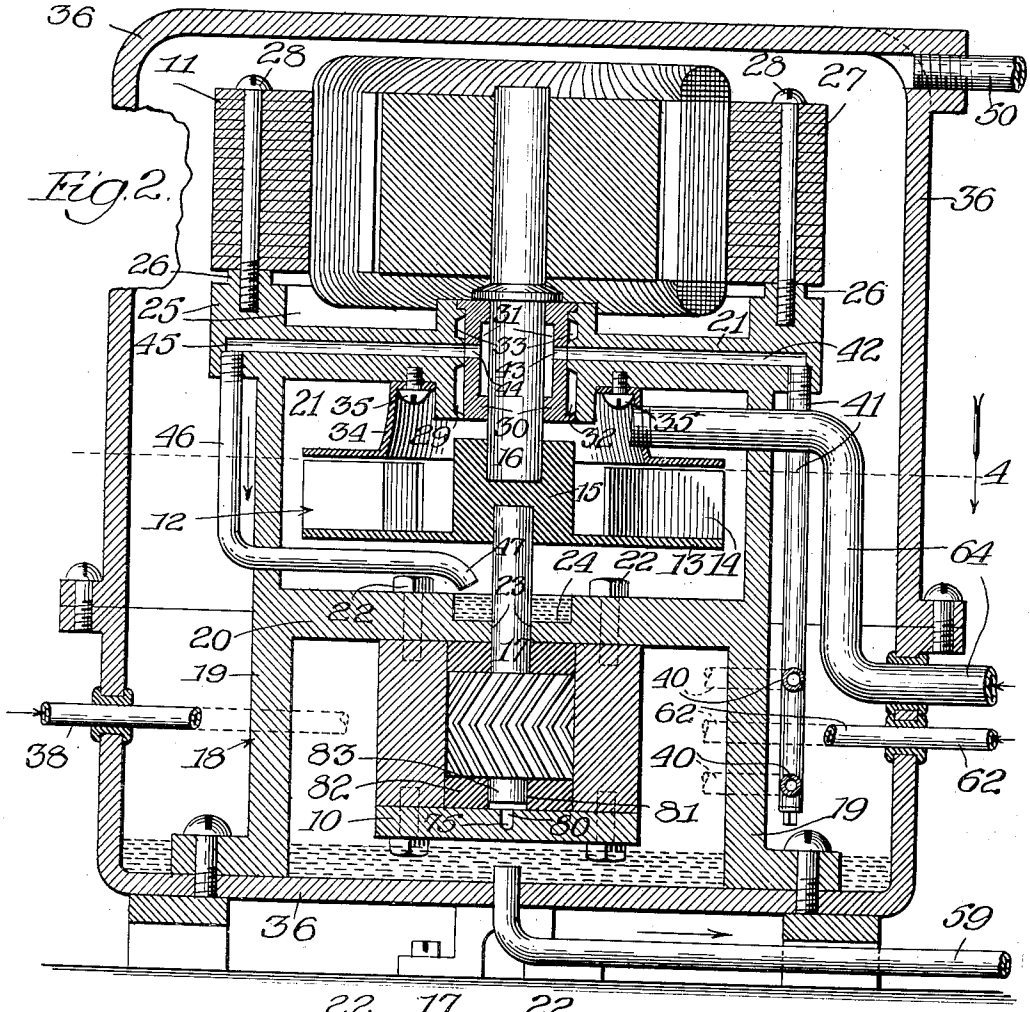
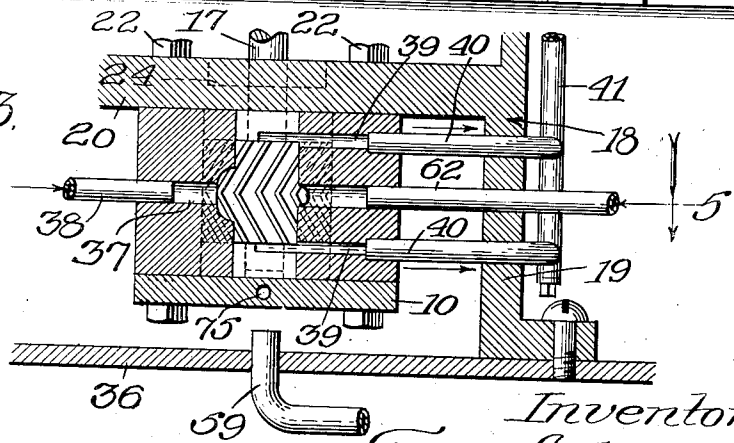


Fig. 3.



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Fig. 4.

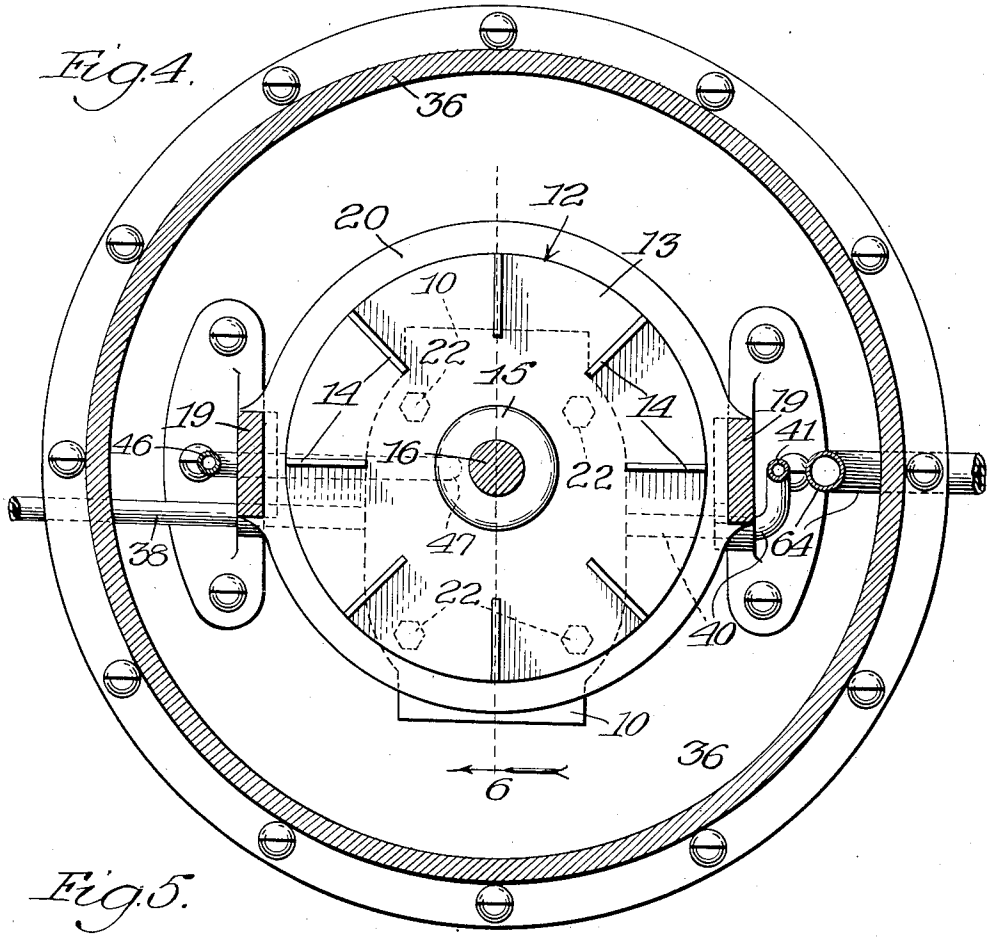
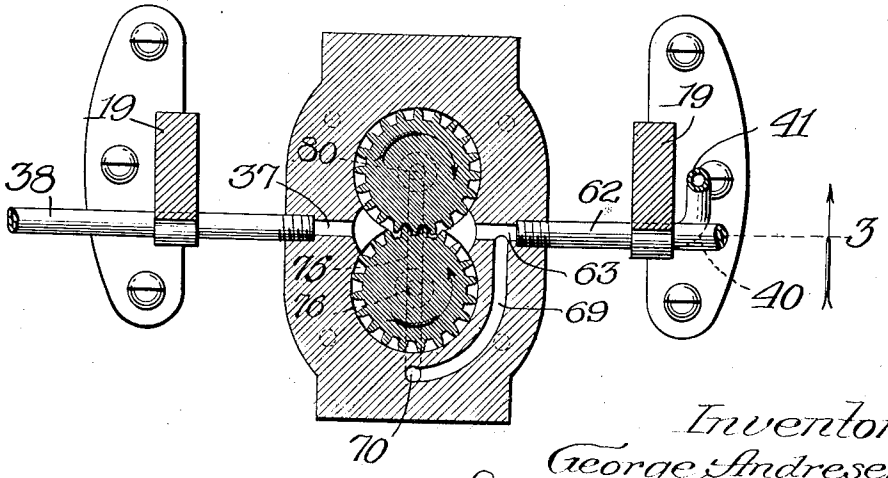


Fig. 5.



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REFRIGERATING APPARATUS

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Fig. 6.

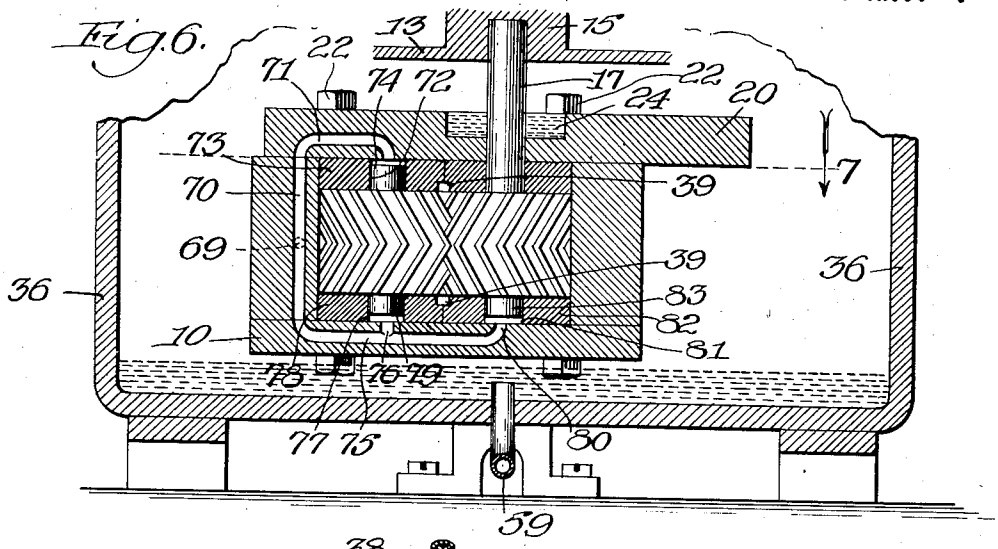


Fig. 7.

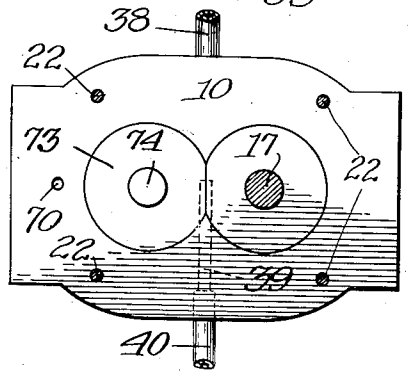
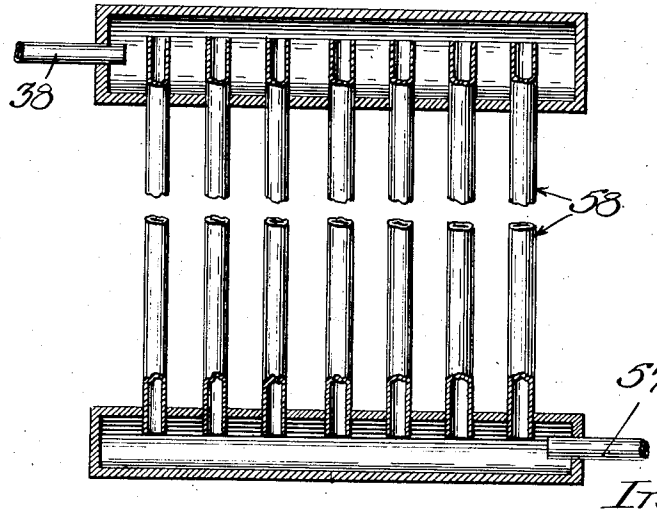


Fig. 8.



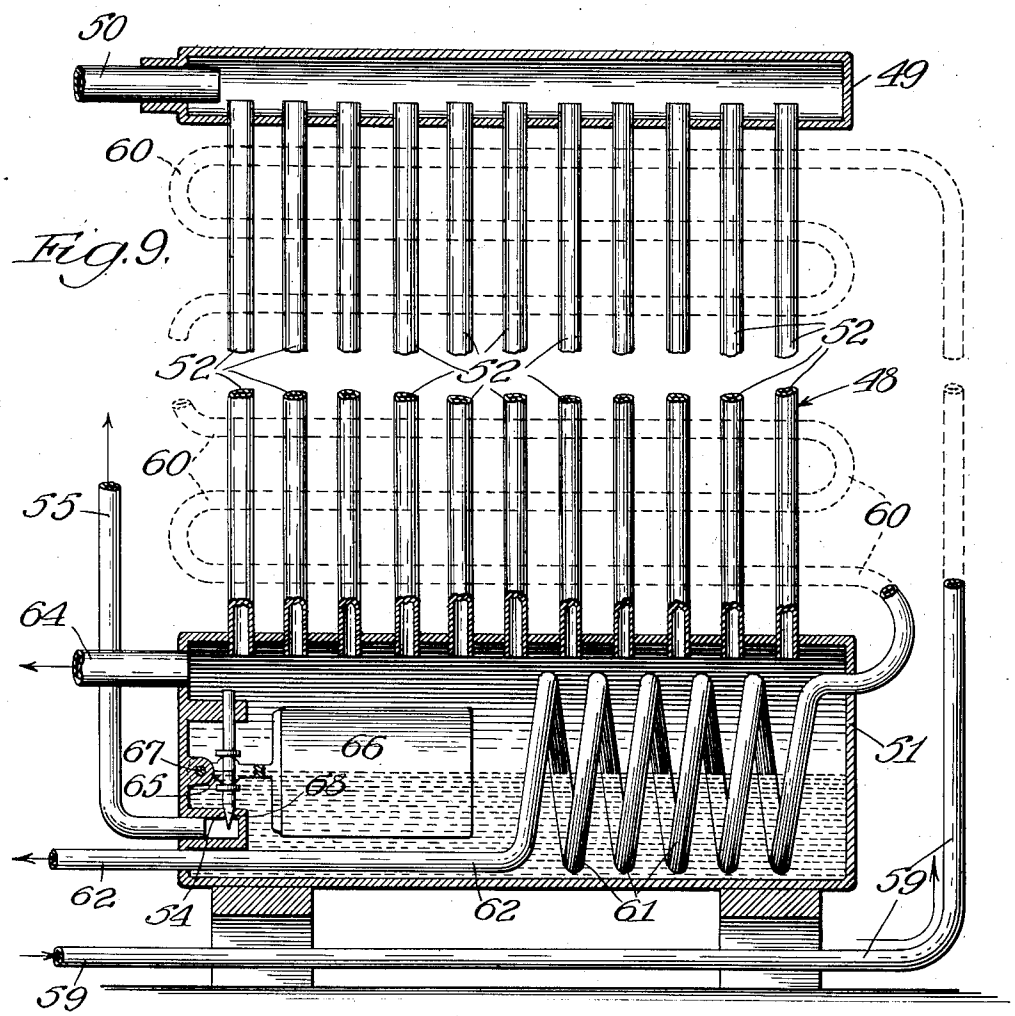
Inventor:
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REFRIGERATING APPARATUS

Filed Jan. 31, 1931 5 Sheets-Sheet 5

Fig. 9.



Inventor:
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Patented Dec. 6, 1932 1,890,205

UNITED STATES PATENT OFFICE

GEORGE ANDRESEN, OF CHICAGO, ILLINOIS, ASSIGNOR TO W. B. PARKYN, OF CHICAGO, ILLINOIS

REFRIGERATING APPARATUS

Application filed January 31, 1931. Serial No. 512,671.

My invention relates more particularly to refrigerating apparatus of the type in which the compressor discharges into a receptacle in which the sealing and/or lubricating liquid is separated from the gaseous refrigerant.

One of my objects is to provide improvements in apparatus of the type above referred to to the end that impedance to flow of the gaseous refrigerant from the receptacle into the condenser, and commonly resulting in apparatus as hitherto provided from stratification in the top portions of the receptacle and condenser of gaseous fluid non-condensible at the pressures produced by the apparatus, the effects of hydraulic friction and countercurrents within the condenser, shall be reduced to the minimum, whereby the apparatus operates at a lower temperature differential than hitherto required between the receptacle and the condenser, for effecting flow of the compressed refrigerant into the condenser, resulting in lower pressure in the receptacle and consequent decreased impregnation of the sealing and/or lubricating fluid with the gaseous refrigerant.

Another object is to provide for the minimizing of the transference of heat from the motor to the compressor and to the sealing and/or lubricating liquid and in connection therewith to produce and maintain, to as perfect a degree as possible, adiabatic compression.

Another object is to provide in a structure wherein the motor is cooled by contact with gaseous refrigerant discharged from the compressor, for the flowing in proximity to the motor of a sufficient volume of the gaseous refrigerant to produce adequate cooling of the motor and other objects as will be manifest from the following description:

Referring to the accompanying drawings:

Figure 1 is a view, somewhat diagrammatic in nature, of a refrigerating apparatus embodying my invention.

Figure 2 is a view in sectional elevation of the hermetically sealed compressor and motor unit of the apparatus.

Figure 3 is a view in sectional elevation through the center of the compressor, the section being taken at the line 3 of Fig. 5 and viewed in the direction of the arrow.

Figure 4 is a plan sectional view taken at the line 4 on Fig. 2 and viewed in the direction of the arrow.

Figure 5 is a plan sectional view taken at the line 5 on Fig. 3 and viewed in the direction of the arrow.

Figure 6 is a sectional view taken at the line 6 on Fig. 4 and viewed in the direction of the arrow.

Figure 7 is a sectional view taken at the line 7 on Fig. 6 and viewed in the direction of the arrow.

Figure 8 is a broken view in sectional elevation of the refrigerating element or evaporator forming a part of the apparatus of Fig. 1; and

Figure 9, a similar view of the refrigerating element or evaporator together with a liquid-refrigerant receptacle and a sealing and/or lubricating liquid conduit associated therewith.

Referring to the apparatus as disclosed and constituting one embodiment of my invention, it comprises a compressor 10 which may be of any desirable construction, as for example of the intermeshing herring-bone gear type as shown and to which a sealing and lubricating liquid is supplied, and a motor 11 shown as of the electrically driven type and located above the compressor 10 for driving the latter.

Located between the motor 11 and the compressor 10 is a fan 12 of the paddle type the lower end of the fan being formed of a disk-like plate 13 shown as extending to substantially the outer edges of the paddles of the fan and represented at 14.

The fan 12 which is actuated by the motor 11 is connected at its hub 15 with the lower end of the armature shaft 16 of the motor, the drive of the compressor by the motor being through the fan 13 by means of a shaft 17 connected with the fan.

The parts described are supported on a frame 18 comprising legs 19 and upper and lower spaced apart plate-like portions 20 and 21, respectively, united with the legs 19. The compressor 10 is bolted at 22 to the under-

side of the plate 20, through an opening 23 in which latter the shaft 17 passes, the top of the plate 20 being recessed around the shaft as represented at 24.

The plate 21 is provided on its upper surface at its marginal edge with an annular flange 25 from which rises a plurality of upwardly extending bosses 26 shown as four in number and equidistantly spaced apart about the flange 25, the motor 11 being supported at its field-core 27 on these bosses and held in place by screws 28 extending downwardly through holes in the core and screwed into the flange 25 thereby supporting the motor upon surfaces of the frame of relatively small area to minimize the transference by conduction from the motor through the frame 18 to the compressor and sealing and lubricating fluid, of heat generated by the motor. The shaft 16 extends downwardly through an opening 29 in the plate 21 between the wall of which and the shaft 16 a bushing 30 of thermal insulating material is interposed. The bushing 30 is preferably hollowed out internally between its upper and lower edges, as represented at 31 to minimize the area of contact with the shaft 16 and the wall of the opening 29 is likewise internally annularly recessed as represented at 32 and 33 also for the purpose of minimizing the area of contact of the bushing 30 with the wall of the opening 29.

A shroud member located above the paddles 14 and represented at 34 is provided for cooperation with the paddles 14 and is shown as secured, by the screws 35, to the underside of the plate portion 21.

It may be here stated that the unitary motor, fan and compressor assembly is located in a hermetically sealed container or housing represented at 36, the compressor discharging into the housing 36 from which the compressed gasified fluid passes to a condenser forming a part of the refrigerating apparatus and hereinafter referred to, the lubricating and sealing liquid discharged from the compressor gravitating to the bottom of the housing 36 and after conditioning, as hereinafter described, being returned to the inlet of the compressor.

The compressor 10, shown as of the well known intermeshing herring-bone gear type, communicates at its inlet 37 with a pipe 38 and at its outlets 39, located at opposite ends of the compressor, with pipes 40 which open into a pipe 41, the pipe 41 opening at its upper end into a passage 42 in the plate portion 21 and registering with a passage 43 in the bushing 30 and communicating with the recess 31, this recess also communicating with a passage 44 in the opposite side of the bushing 30 and which communicates with a passage 45 diametrically opposed to the passage 42 and opening at its outer end into a pipe 46 having a down-turned end 47 terminating directly above the recess 24, whereby the compressed gaseous refrigerant and the lubricating and sealing liquid discharged from the compressor traverses the passages and pipes just described finally discharging at a point above the recess 24, the liquid discharging from the pipe 46 maintaining a body of lubricating liquid around the shaft 17 and the excess liquid overflowing to the bottom of the housing, the compressed gaseous refrigerant rising in the housing 36.

The condenser above referred to and into which the gaseous refrigerant compressed by the compressor 10 is discharged, is represented at 48 and is shown as of the type comprising an upper header 49 in communication at one end with the top portion of the housing 36, through the medium of a pipe 50, a lower header 51 forming a receptacle, and a series of vertical pipes 52 opening at their upper and lower ends, respectively, into the headers 49 and 51. The condenser 48 may employ any desirable cooling means therefor, the condenser being shown as air-cooled, as for example by a motor-driven fan indicated at 53.

It may be here stated that in the operation of the apparatus the refrigerant liquefied in the condenser 48 discharges into the receptacle 51 wherein it accumulates and from which it passes through a valve-controlled port 54 into a pipe 55 and through a valve device 56 hereinafter referred to and thence through a pipe 57 into the refrigerating element, or evaporator, 58, which may be of any desirable construction that shown being of a common and well known form and in which the liquefied refrigerant supplied thereto, in evaporating, produces the refrigerating temperature in the chamber in which the refrigerating element 58 would be located in use. The top of the refrigerator element 58 is connected with the pipe 38 for leading the gasified refrigerant from the refrigerating element back to the compressor 10.

The apparatus shown incorporates means for conditioning the sealing liquid in accordance with the invention described in my pending application for United States Letters Patent Ser. No. 381,862, filed July 29, 1929, for improvement in refrigeration, the particular construction of these means illustrated herein comprising a pipe 59 which opens into the bottom of the container 36, a flat coil 60 shown as connected at its upper end with the pipe 59 and flatwise opposing, and in contact with, the series of pipes 52, and a cylindrical pipe coil 61 located in the tank 52, one end of which is connected with the lower end of the coil 60 and the opposite end of which is connected with a pipe 62 which communicates with a port 63 in the casing of the compressor and shown as located midway between the ends of the intermeshing gears of the compressor and so positioned as to com-

municate with the space between the gears at their points of initial intermesh. By the arrangement shown the lubricating and sealing liquid during the operation of the compressor, is continuously drawn from the body thereof in the bottom of the housing 36, thence passed through the coils 60 and 61 wherein it is subjected respectively to the cooling effect produced by the fan 53 and the temperature of the liquefied refrigerant and then introduced into the interior of the compressor for performing the sealing and lubricating functions.

In the operation of the apparatus a body of liquefied refrigerant is maintained in the receptable 51 as hereinafter described and in which body the coil 61 extends whereby the sealing and lubricating liquid in the coil 61 is caused to be in heat-interchange relationship with the liquefied refrigerant in the receptacle 51, whereby the temperature of the sealing and lubricating liquid, due to its subjection to the temperature of the condensed refrigerant, rises and falls substantially in step with the rise and fall of the temperature of the condensed refrigerant the temperature of which latter rises and falls responsive to the heat of the compressed gaseous refrigerant discharged from the compressor, regardless of variations in the relative quantities of gas and oil discharged from the compressor, with resultant high efficiency in the operation of the apparatus as fully set forth in my above referred to pending application for patent.

In accordance with the preferred illustrated embodiment of my invention, provision is made for continuously circulating the gaseous fluid from the housing 36 to the condenser and from the latter back to the housing, for the purpose of cooling the motor and producing flow of the compressed refrigerant from the housing to the condenser, the apparatus to this end being provided with a pipe 64 which connects at one end with the upper end of the liquefied refrigerant receptacle 51 and which opens at its other end into the housing 36 preferably through the shroud member 32 above the fan 12, the fan in operating producing suction in the pipe 64 with resultant circulation of the gaseous refrigerant. The fan 12 is of such capacity that it will circulate gases in a quantity sufficient to insure the proper cooling of the motor by convection currents regardless of the volumetric discharge of the compressor.

It is desired that there be maintained at all times a passage through which a portion of the compressed gaseous refrigerant discharged from the housing 36 is returned to the latter to thus effect the continuous circulation above described.

In the particular construction shown, means are provided for preventing the liquefied refrigerant from rising in the receptacle 51 to the pipe 64, these means comprising the system of valves disclosed in United States Letters Patent No. 1,759,534 granted to me May 20, 1930, the lower valve device which controls the port 54 and operates to open this port when the liquid refrigerant rises in the receptacle 51 above a predetermined level, being represented at 65, this valve device being shown as comprising a float 66 pivotally connected at 67 with the receptacle 51 and a reciprocable valve member 68 which is raised and lowered by the corresponding movement of the float 66.

The upper valve structure 56 corresponds with the upper valve structure 23 of the patent referred to and serves to prevent substantial evaporation of the liquefied refrigerant while in the pipe 55.

The valve structure 56 serves to maintain throughout the range of the temperatures of the condensing medium a substantially low and uniform differential pressure at opposite sides of the valve 65, resulting in the actuating of the discharge by a substantially constant-level of liquid refrigerant in the receptacle 51 which, as shown, is below the pipe 64.

In the construction shown, means are provided for leading portions of the sealing and lubricating liquid to the bearings for the rotating parts of the compressor, the means shown comprising a passage 69 communicating at one end with the port 63 and at its opposite end with a vertical passage 70 having a lateral branch 71 opening into the journal portion 72 provided in a disk 73 positioned in the compressor-casing and in which disk the stub shaft 74 of one of the gears is journalled. The lower end of the passage 70 connects with a lateral passage 75 which opens through a port 76 into the journal portion 77 of another disk 78 in the compressor casing for the other stub shaft 79 of this gear, the passage 75 opening through a port 80 into the journal portion 81 of another disk 82 in the compressor casing in which the stub shaft 83 carried by the gear to which the shaft 17 is connected, is journalled. Thus in the operation of the compressor temperature-conditioned lubricating liquid is supplied to the journal bearings for these several stub shafts, as well as to the journal bearing for the shaft 17 supplied with lubricating liquid by reason of the bath thereof maintained in the recess 24.

It will be understood from the foregoing that by providing means for effecting the flow of the compressed gaseous refrigerant from the receptacle (exemplified by the housing 36) into which the compressor discharges, into the condenser without the addition of heat and particularly by providing for the return of gaseous refrigerant from the condenser to the receptacle, stratification of the gases in the receptacle and which are non-

condensible at the pressures produced by the apparatus, the effects of hydraulic friction and of counter-currents produced in the condenser, with resultant impedance to the flow of the gaseous fluid to the condenser, are minimized. Furthermore, the apparatus functions at a lower differential temperature between the receptacle and the condenser than in the case of structures wherein thermal means are provided for inducing the flow of the compressed refrigerant to the condenser, resulting in consequent low pressure in the receptacle and decreased impregnation of the sealing and/or lubricating fluid with the gaseous refrigerant. In this connection it may be stated that this feature of the invention is of value not only in an arrangement wherein the compressor and motor are housed in a receptacle common to both and into which the compressor discharges, but also in an arrangement in which the compressor discharges into a receptacle in which either the compressor or motor are housed or in which neither is housed.

In the arrangement shown wherein the motor is located in the receptacle into which the compressor discharges the induced flow of gaseous fluid in the housing not only serves to effect the result just described but also serves to cool the motor by the convection currents produced without the supply of additional heat to the receptacle or its contents and, when the condenser is provided with a return connection to the housing as described, regardless of the volumetric displacement of the compressor.

Another feature of great advantage is that of reducing to the minimum the possibility of heat transference from the motor to the compressor and to the sealing and lubricating liquid, with a view to effecting substantially adiabatic compression which object is substantially accomplished in the arrangement shown and involving the sealing and lubricating liquid conditioning by subjection to the temperature controlling effect of the condensed refrigerant and the isolation of the motor from the compressor and the sealing and lubricating fluid from the compressor, so far as the matter of heat interchange is concerned.

While I have illustrated and described a particular construction embodying my invention, I do not wish to be understood as intending to limit it thereto as the same may be variously modified and altered without departing from the spirit of my invention.

What I claim as new, and desire to secure by Letters Patent, is:

1. In refrigerating apparatus the combination of a compressor, means for actuating said compressor, a receptacle into which said compressor discharges, a condenser in communication with said receptacle, and mechanical means for producing flow of the compressed gaseous refrigerant from said receptacle into said condenser.

2. In refrigerating apparatus the combination of a compressor, means for actuating said compressor, a receptacle into which said compressor discharges, a condenser in communication with said receptacle, and means for conducting compressed gaseous refrigerant, after entry into said condenser, back to said receptacle.

3. In refrigerating apparatus the combination of a compressor, means for actuating said compressor, a receptacle into which said compressor discharges, a condenser in communication with said receptacle, mechanical means for producing flow of the compressed gaseous refrigerant from said receptacle into said condenser, and means for conducting compressed gaseous refrigerant, after entry into said condenser, back to said receptacle.

4. In refrigerating apparatus the combination of a compressor, means for actuating said compressor, a receptacle into which said compressor discharges, a condenser in communication with said receptacle, and mechanical means in said receptacle for producing flow of the compressed gaseous refrigerant from said receptacle into said condenser.

5. In refrigerating apparatus the combination of a compressor, means for actuating said compressor, a receptacle into which said compressor discharges, a condenser in communication with said receptacle, and a fan in said receptacle for producing flow of the compressed gaseous refrigerant from said receptacle into said condenser.

6. In refrigerating apparatus the combination of a compressor, means for actuating said compressor, a receptacle into which said compressor discharges, a fan in said receptacle, a condenser, means for conducting the compressed gaseous refrigerant into said condenser, and means for conducting compressed gaseous refrigerant, after entry into said condenser, back to said receptacle into a position to be subjected to the suction action of said fan.

7. In refrigerating apparatus the combination of a compressor, means for actuating said compressor, a receptacle into which said compressor discharges, a condenser in communication with said receptacle, a second receptacle in communication with said condenser for receiving the condensed refrigerant, means for conducting the compressed gaseous refrigerant into said condenser, and means for conducting compressed gaseous refrigerant from a point between the entry of the compressed refrigerant into the condenser and the body of liquefied refrigerant in said second receptacle, into said first-named receptacle.

8. In refrigerating apparatus the combination of a compressor, means for actuating said compressor, a receptacle into which said

compressor discharges, a condenser in communication with said receptacle, a second receptacle in communication with said condenser for receiving the condensed refrigerant, means for conducting the compressed gaseous refrigerant into said condenser, and means for conducting compressed gaseous refrigerant from said second receptacle, above the body of liquefied refrigerant therein, into said first-named receptacle.

9. In refrigerating apparatus the combination of a compressor, means for actuating said compressor, a receptacle into which said compressor discharges, a condenser in communication with said receptacle, a second receptacle in communication with said condenser for receiving the condensed refrigerant, means for conducting the compressed gaseous refrigerant into said condenser, means for conducting compressed gaseous refrigerant from a point between the entry of the compressed refrigerant into the condenser and the body of liquefied refrigerant in said second receptacle, into said first-named receptacle, and means for producing flow of the compressed gaseous refrigerant from said first-named receptacle into said condenser.

10. In refrigerating apparatus the combination of a compressor, means for actuating said compressor, a receptacle into which said compressor discharges, a condenser in communication with said receptacle, a second receptacle in communication with said condenser for receiving the condensed refrigerant, means for conducting the compressed gaseous refrigerant into said condenser, means for conducting compressed gaseous refrigerant from a point between the entry of the compressed refrigerant into the condenser and the body of liquefied refrigerant in said second receptacle, into said first-named receptacle, and means controlling the height to which the liquefied refrigerant extends in said receptacle to maintain it below said second-named means.

11. In refrigerating apparatus, the combination of a compressor, a motor for actuating said compressor, a housing for said motor and into which said compressor discharges, a condenser in communication with said housing, and mechanical means for producing flow of the compressed gaseous refrigerant from said housing into said condenser.

12. In refrigerating apparatus, the combination of a compressor, a motor for actuating said compressor, a housing for said motor and into which said compressor discharges, a condenser in communication with said housing, and mechanical means in said housing for producing flow of the compressed gaseous refrigerant from said housing into said condenser.

13. In refrigerating apparatus, the combination of a compressor, a motor for actuating said compressor, a housing for said motor and into which said compressor discharges, a condenser in communication with said housing and a fan for producing flow of the compressed gaseous refrigerant from said housing into said condenser.

14. In refrigerating apparatus, the combination of a compressor, a motor for actuating said compressor, a housing for said motor and into which said compressor discharges, a condenser in communication with said housing and a fan in said housing for producing flow of the compressed gaseous refrigerant from said housing into said condenser.

15. In refrigerating apparatus, the combination of a compressor, a motor for actuating said compressor, a housing for said motor and into which said compressor discharges, a condenser in communication with said housing and a fan in said housing between said motor and compressor, for the purpose set forth.

16. In refrigerating apparatus, the combination of a compressor, a motor for actuating said compressor, a housing for said compressor and motor and into which said compressor discharges, a condenser in communication with said housing and a fan in said housing between said motor and compressor, for the purpose set forth.

17. In refrigerating apparatus, the combination of a compressor, a motor above said compressor for actuating the latter, a housing for said motor and into which said compressor discharges, a condenser in communication with the top of said housing and mechanical means for producing flow of the compressed gaseous refrigerant from said housing into said condenser.

18. In refrigerating apparatus, the combination of a compressor, a motor for actuating said compressor, a housing for said motor and into which said compressor discharges, a condenser, means for conducting the compressed gaseous refrigerant into said condenser, and means for conducting compressed gaseous refrigerant, after entry into said condenser, back to said housing.

19. In refrigerating apparatus, the combination of a compressor, a motor for actuating said compressor, a housing for said motor and into which said compressor discharges, a condenser, means for conducting the compressed gaseous refrigerant into said condenser, means for conducting gaseous refrigerant, after entry into said condenser, back to said housing, and means for producing flow of the compressed gaseous refrigerant from said housing into said condenser.

20. In refrigerating apparatus, the combination of a compressor, a motor for actuating said compressor, a housing for said motor and into which said compressor discharges, a condenser, means for conducting the com-

pressed gaseous refrigerant into said condenser, means for conducting gaseous refrigerant, after entry into said condenser, back to said housing, and mechanical means for producing flow of the compressed gaseous refrigerant from said housing into said condenser.

21. In refrigerating apparatus, the combination of a compressor, a motor for actuating said compressor, a housing for said motor and into which said compressor discharges, a fan in said housing, a condenser, means for conducting the compressed gaseous refrigerant into said condenser, and means for conducting compressed gaseous refrigerant, after entry into said condenser, back to said housing into a position to be subjected to the suction action of said fan.

22. In refrigerating apparatus, the combination of a compressor, a motor for actuating said compressor, a housing for said motor and into which said compressor discharges, a condenser, a receptacle in communication with said condenser for receiving the condensed refrigerant, means for conducting the compressed gaseous refrigerant into said condenser, and means for conducting compressed gaseous refrigerant from a point between the entry of the compressed refrigerant into the condenser and the body of liquefied refrigerant in said receptacle, into said housing.

23. In refrigerating apparatus, the combination of a compressor, a motor for actuating said compressor, a housing for said motor and into which said compressor discharges, a condenser, a receptacle in communication with said condenser for receiving the condensed refrigerant, means for conducting the compressed gaseous refrigerant into said condenser, and means for conducting compressed gaseous refrigerant from said receptacle, above the body of liquefied refrigerant therein, into said housing.

24. In refrigerating apparatus, the combination of a compressor, a motor for actuating said compressor, a housing for said motor and into which said compressor discharges, a condenser, a receptacle in communication with said condenser for receiving the condensed refrigerant, means for conducting the compressed gaseous refrigerant into said condenser, means for conducting compressed gaseous refrigerant from a point between the entry of the compressed refrigerant into the condenser and the body of liquefied refrigerant in said receptacle, into said housing, and means for producing flow of the compressed gaseous refrigerant from said housing into said condenser.

25. In refrigerating apparatus, the combination of a compressor, a motor for actuating said compressor, a housing for said motor and into which said compressor discharges, a condenser, a receptacle in communication with said condenser for receiving the condensed refrigerant, means for conducting the compressed gaseous refrigerant into said condenser, means for conducting compressed gaseous refrigerant from said receptacle above the body of liquefied refrigerant therein, into said housing, and means for producing flow of the compressed gaseous refrigerant from said housing into said condenser.

26. In refrigerating apparatus, the combination of a compressor, a motor for actuating said compressor, a housing for said motor and into which said compressor discharges, a condenser, a receptacle in communication with said condenser for receiving the condensed refrigerant, means for conducting the compressed gaseous refrigerant into said condenser, means for conducting compressed gaseous refrigerant from said receptacle, above the body of liquefied refrigerant therein, into said housing, and means for controlling the height to which the liquefied refrigerant extends in said receptacle to maintain it below said second-named means.

27. In refrigerating apparatus, the combination of a compressor, a motor for actuating said compressor, a housing for said motor and into which said compressor discharges, a condenser, a receptacle in communication with said condenser for receiving the condensed refrigerant, means for conducting the compressed gaseous refrigerant into said condenser, means for conducting compressed gaseous refrigerant from said receptacle, above the body of liquefied refrigerant therein, into said housing, means for controlling the height to which the liquefied refrigerant extends in said receptacle to maintain it below said second-named means, and means for producing flow of the compressed gaseous refrigerant from said housing into said condenser.

GEORGE ANDRESEN.

DISCLAIMER

1,890,205.—*George Andresen*, Chicago, Ill. REFRIGERATING APPARATUS. Patent dated December 6, 1932. Disclaimer filed July 8, 1935, by the assignee, *Winifred B. Parkyn*.

Hereby enters this disclaimer to that part of the claim in said specification which is in the following words, to wit, claim 1, reading as follows:

"1. In refrigerating apparatus the combination of a compressor, means for actuating said compressor, a receptacle into which said compressor discharges, a condenser in communication with said receptacle, and mechanical means for producing flow of the compressed gaseous refrigerant from said receptacle into said condenser."

[*Official Gazette July 30, 1935.*]