Feb. 14, 1933. L. A. PHILIPP 1,897,178

REFRIGERANT COMPRESSOR COOLING SYSTEM

Filed March 14, 1930 2 Sheets-Sheet 1

Fig. 1

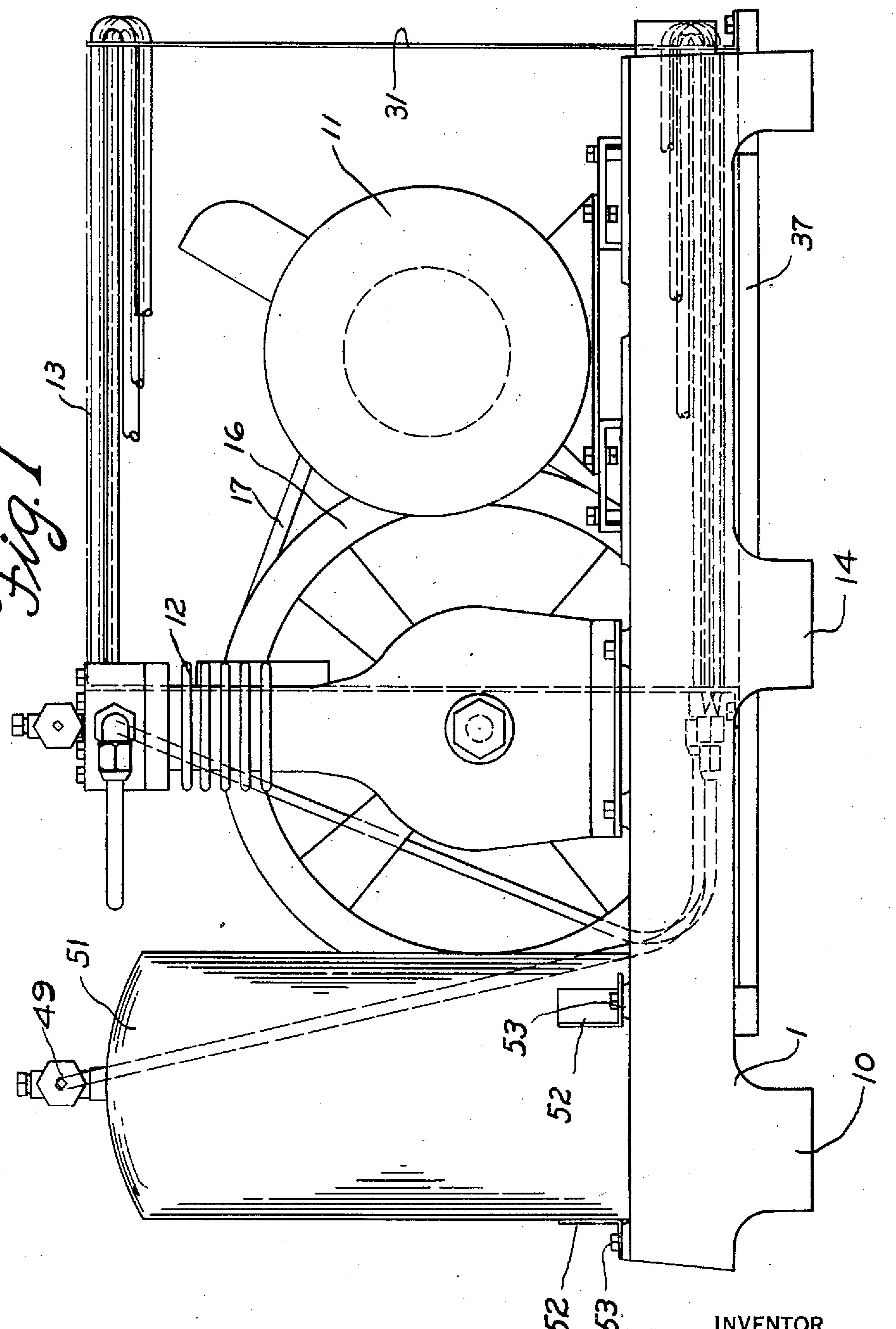

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Fig. 2

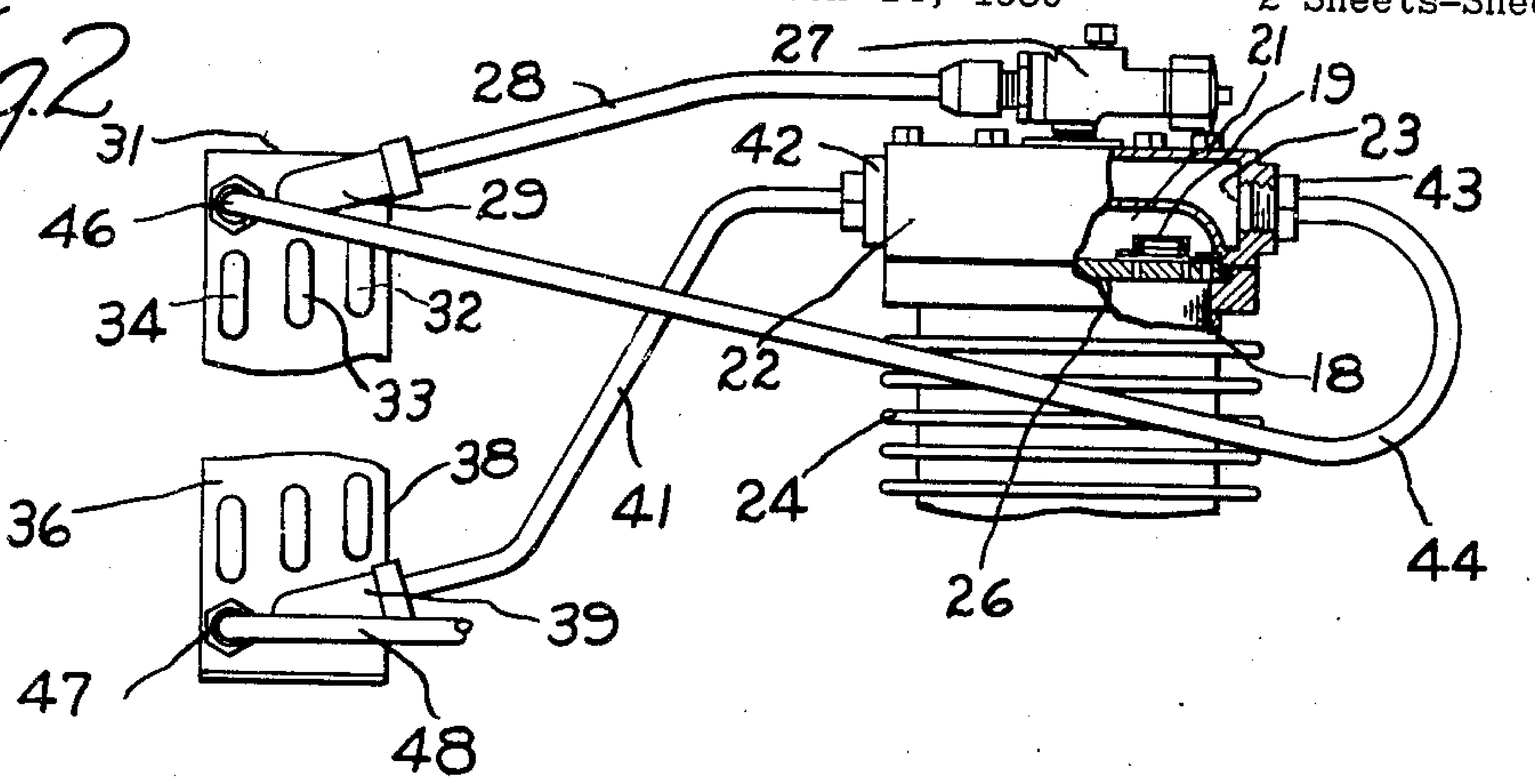
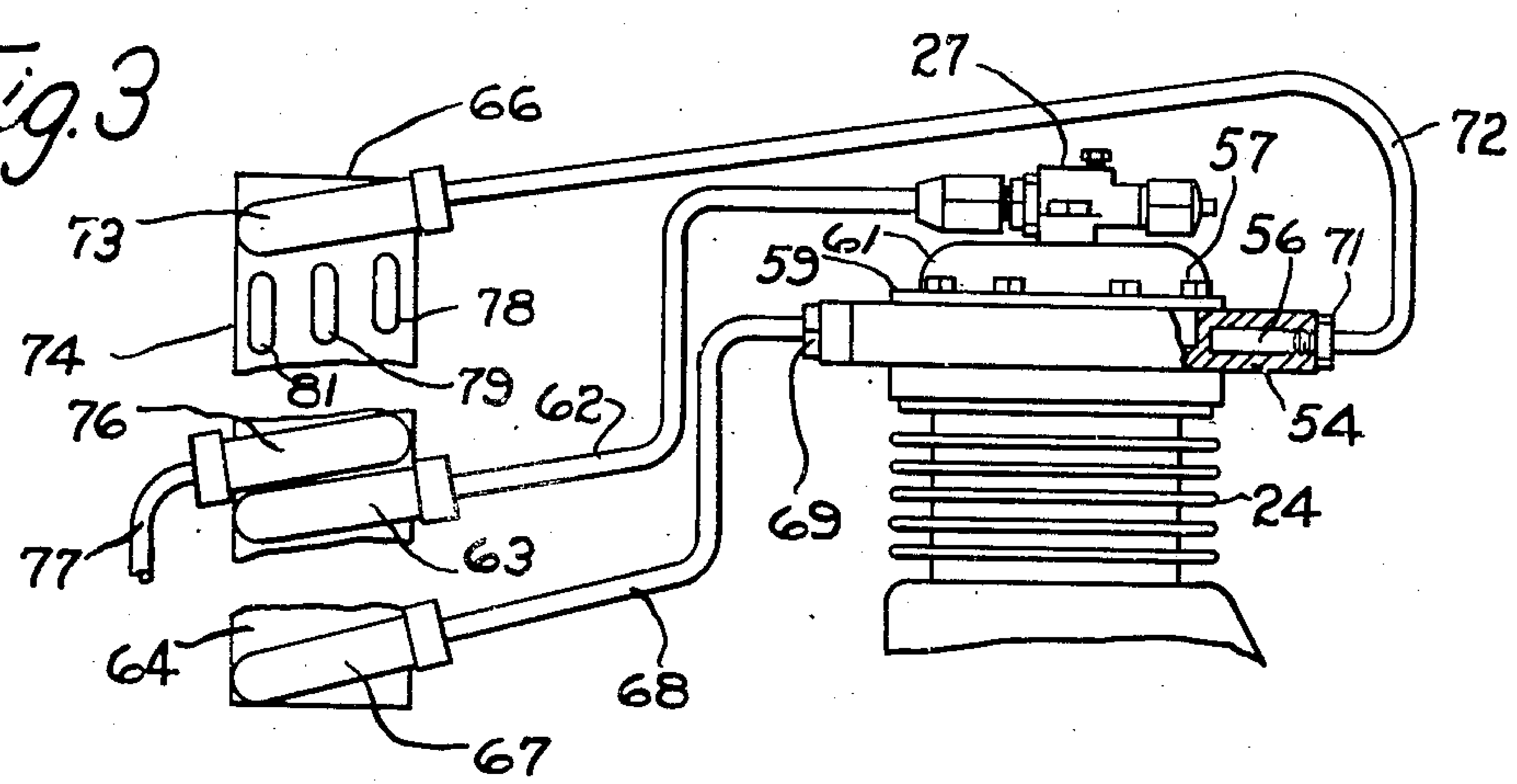


Fig. 3



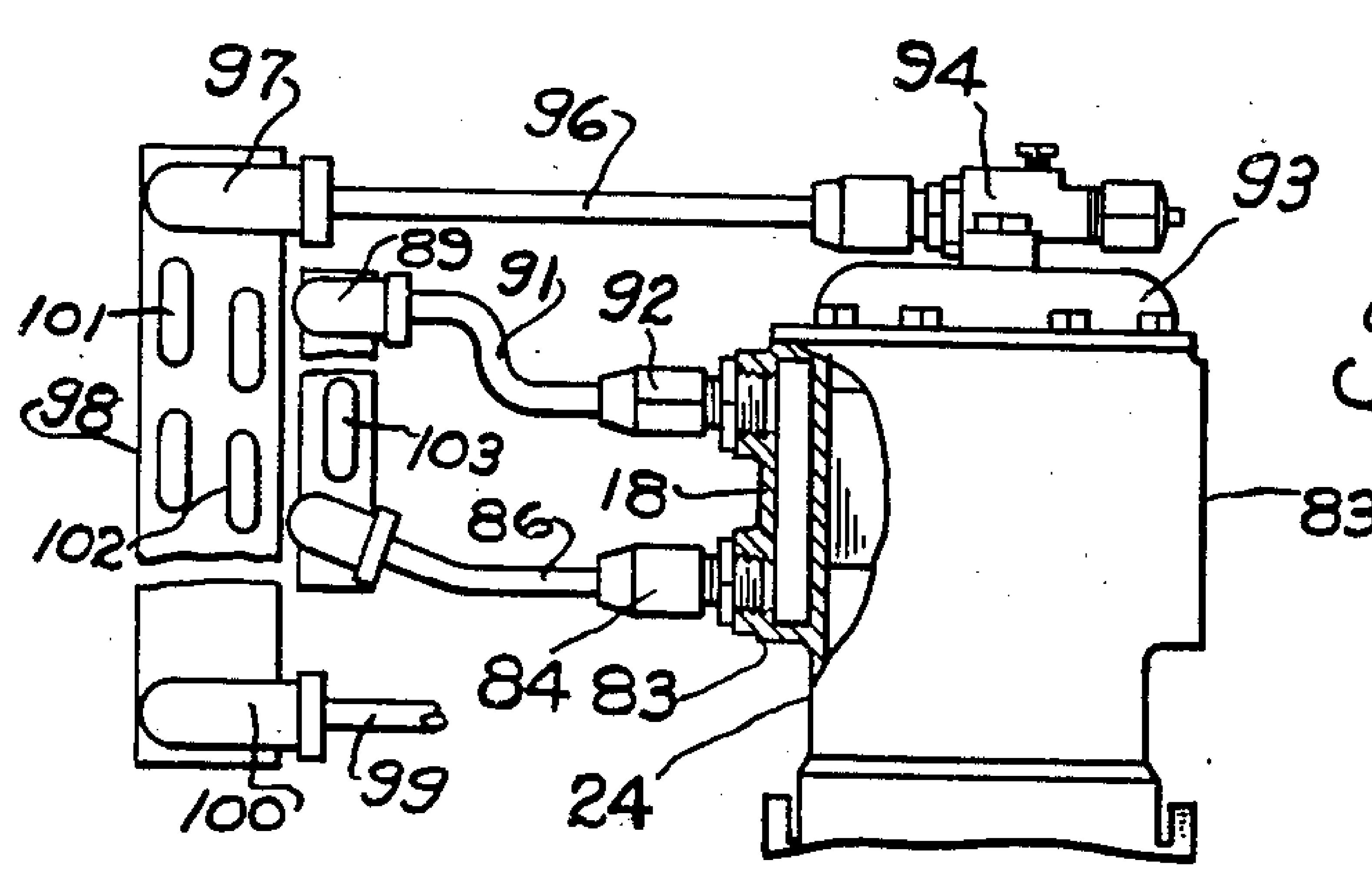


Fig. 4

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UNITED STATES PATENT OFFICE

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REFRIGERANT COMPRESSOR COOLING SYSTEM

Application filed March 14, 1930. Serial No. 435,938.

This invention relates to mechanical refrigeration, and has particular relation to the cooling of refrigerant compressors embodied in such apparatus.

An object of the invention is to prevent the decomposition of the oil employed in lubricating the parts of a refrigerant compressor, and hence to increase the efficiency of a refrigeration unit by maintaining a relatively high rate of dissipation of the heat generated.

Heretofore, in the operation of a refrigeration apparatus of relatively high capacity, for example, such as multiple unit installations in large apartment buildings, it has been observed that some of the apparatus did not perform efficient service after a relatively short period of operation. Upon examination of such apparatus it became apparent that the compressor discharge valves had not held properly, owing to the deformation of the surfaces and structure of the varicus valve elements. In almost every instance of this kind, it also was found that the interior surfaces of the high side of the compressor were coated with a gum-like carbonaceous substance.

This invention provides a solution for the aforesaid difficulty by preventing the formation of such carbonaceous deposit on the interior surfaces of the high side of the refrigerant compressor, and hence removes the cause responsible for the unsatisfactory discharge valve operation.

In a refrigerant compressor there are two sources of heat, namely, the heat in the refrigerant fluid, and the heat generated by friction. In the high side of the compressor the amount of heat per unit volume of fluid is high, and this heat flows into the various metallic parts of the compressor adjacent the compression chamber. When, in large units of apparatus, the heat generated by friction is added to the same parts of the compressor, the surrounding medium cannot absorb the heat at a rate that will prevent the occurrence of temperatures much higher than the temperature corresponding to the high side fluid pressure.

When the oil in suspension in the compressed fluid impinges against such metallic parts, the intense heat causes new combinations to form among the molecules of the oil and a sticky carbonaceous substance, formed by such chemical action, adheres to the interior walls of the compressor. This substance is a relatively poor conductor of heat and hence the greater its thickness the more it interferes with the dissipation of excess heat generated in the compressor, until finally the high temperature to which the various metallic parts are subjected, affects the operation of the compressor discharge valves.

If it were possible to conduct the heat away from certain parts of a compressor, at a rate that would prevent the formation of the initial coating of the sticky substance, it is apparent that the temperature of the parts would never rise to such a degree that the discharge valves would be affected.

In the preferred embodiment of the invention, a suitable liquid having a high coefficient of heat transfer, such as sulphur dioxide for example, is associated in thermal contact with some part of the compressor where a large amount of heat is available. The consequent re-evaporation of the liquid dissipates the heat from the compressor part with which it is associated, at a very high rate. Heat from adjacent parts of the apparatus flows into that in contact with the liquid and thus the accumulation of large quantities of heat in any part of the compressor, is prevented.

Since all of the heat generated by the compressor must be dissipated into the atmosphere eventually, it is apparent that no loss of energy is inherent in the practice of this invention.

For a better understanding of the invention reference may now be had to the accompanying drawings forming a part of this specification, in which:

Figure 1 is a side elevational view of a conventional air cooled refrigerant condensing unit.

Figure 2 is a diagrammatical view illustrating the method of circulating the refrigerant between the compressor and condenser elements embodied in the structure shown by Figure 1.

Figures 3 and 4 diagrammatically illustrate alternative methods of cooling a refrigerant compressor, which may be embraced in the structure shown by Figure 1.

Referring particularly to Figure 1, a refrigerant condensing unit 10, in which the invention is embodied, comprises an electric motor 11, a refrigerant compressor 12, and a refrigerant condenser 13, all of which are secured rigidly on a base or frame member 14. The motor 11 is provided with the usual electrical conductors, not shown, in which any suitable form of controlling mechanism is connected in series. A combination flywheel, pulley and fan 16, is driven by the motor 11 through a suitable belt or series of belts 17. The compressors illustrated in all of the figures of the drawings are of the two cylinder type, and one of the pistons therein is indicated in Figures 2 and 4 by the numeral 18. The pistons are connected by the usual connecting rods and crank shaft, not shown, to the flywheel 16.

As illustrated by Figure 2, the pistons 18 draw in the evaporated refrigerant fluid from an evaporating unit, not shown, and compress it through discharge valves 19 into a compression chamber 21, which is common to both of the cylinders. The compression chamber 21 is formed in one side of a head 22, having an interiorly disposed chamber 23 for the reception of cooling fluid. The head 22 is secured in any suitable manner, as by bolts, not shown, to the upper extremity of a block 24 in which the cylinders are formed. A valve plate 26, secured in a groove between the head 22 and the block 24, provides means for supporting the discharge valves 19 and for closing the space between the two cylinders formed in the block and the common compression chamber 21.

The compressed refrigerant fluid discharged from the compression chamber 21 passes through a discharge service valve 27, secured in the head 24, and a conduit 28 connecting the service valve with a manifold coupling 29 communicating with a refrigerant condenser 31. The condenser is composed of a plurality of parallel banks of sinuous tubes 32, 33 and 34, which are secured rigidly between the end plates 36 of a refrigerant condenser frame 37. The compressed fluid from the manifold coupling 29 is circulated by gravity through a section 38 of the condenser 31 comprising the banks of tubes 32 and 33. The discharge ends of the tubes of this section of the condenser communicate with another manifold coupling 39 which is connected by a conduit 41 to an inlet opening 42 communicating with the cooling chamber 23 formed in the interior of the head 22. From the head 22, the refrigerant fluid is discharged through a coupling 43 connected by a conduit 44 to an inlet terminal 46 which communicates with the single bank of tubes 34 comprising the remaining section of the condenser 31. From a terminal 47 at the lower end of the bank of tubes 34, the refrigerant fluid then is discharged through a conduit 48 and coupling 49 into the upper portion of a vertically disposed refrigerant liquid receiver 51. The receiver is secured rigidly to the frame 10 by angle brackets 52 bolted thereto as indicated at 53.

In the structure disclosed by Figure 3, the cylinder block 24 is provided with a valve plate 54 having a cooling chamber 56 formed interiorly thereof by which the compressor is cooled. The valve plate is secured against the cylinder block 24 by bolts 57 projecting through a securing flange 59 formed around the lower edge of a cylinder head 61. As in the structure disclosed by Figures 1 and 2, compressed refrigerant is discharged from the high side of the compressor through a discharge service valve 27, a conduit 62 and a manifold coupling 63 into a section 64 of a condenser 66.

After passing through the section 64 of the condenser, the refrigerant fluid is discharged through a manifold coupling 67, a conduit 68, and a coupling 69, into the cooling chamber 56 in the interior of the valve plate 54. From a coupling 71 at the opposite extremity of the cooling chamber 56, the refrigerant fluid again is discharged through a conduit 72 and manifold coupling 73 into the upper extremity of a section 74 of the condenser 66, which is disposed immediately above the section 64 and is constructed as a unit therewith. From a manifold coupling 76, at the lower extremity of the section 74, the refrigerant fluid is discharged through a conduit 77 into the liquid refrigerant receiver 51.

As in the condenser disclosed by Figure 2, the condenser 66 comprises a plurality of banks of parallel and sinuous tubes 78, 79 and 81, but these are broken intermediate the terminals at the opposite ends thereof, and the manifold sections 63 and 76 are connected therein.

In Figure 4, a jacket 83 is provided for the cylinder 24 instead of the hollow valve plate as shown by Figure 3 or the chambered head as shown by Figure 2.

As an alternative method of cooling the jacket, the cooling fluid may flow through a coupling 84 and a conduit 86 to a terminal 87 formed at the lower extremity of a condenser 88. The upper end of this condenser, instead of being connected with the fluid in the refrigerating system as disclosed by Figures 1 to 3, may be connected through a terminal 89, conduit 91 and coupling 92, to an upper portion of the interior of the cylinder jacket 83. In this structure the jacket is charged independently with a quantity of any suitable fluid capable of absorbing heat in such a system. Any suitable refrigerant fluid may be employed for this purpose, such, for example, as sulphur dioxide or even water may be employed if preferred.

The refrigerant fluid from the high side of the compressor is discharged from a compression chamber in the interior of the head 93 through a discharge service valve 94, a conduit 96 and a manifold coupling 97 into the interior of a condenser 98 disposed in parallel relation to the condenser 88. From the other extremity of the condenser the fluid is discharged through a manifold coupling 100 and a conduit 99 into the liquid receiver 51. The condenser 98 is constructed by employing a pair of parallel banks of sinuous tubes 101 and 102, while the condenser 88 employs only a single bank of tubes 103.

While, in the structure disclosed by Figure 4, the two condenser sections 88 and 98 are illustrated as separate and independent units disposed in close proximity to each other, they may be constructed as disclosed by Figures 2 and 3, as a single unit. Likewise, the several sections of the condensers 31 and 66, as disclosed by Figures 2 and 3, may consist of sections constructed independently of each other, as illustrated by Figure 4. It is further apparent, from Figures 2, 3 and 4, that while different portions of the cylinder 24 are provided with different chambered portions through which cooling fluid may be circulated, more than a single portion of any cylinder may be provided with a cooling fluid jacket if desired. The entire cylinder may, in fact, be surrounded with a jacket capable of connection to any of the condenser structures illustrated.

These and other variations and changes may be made in the preferred forms of the invention without departing from the spirit of the invention or from the scope of the appended claims.

I claim:

1. A refrigerant condensing unit comprising a compressor for increasing the pressure of refrigerant fluid exhausted from a refrigerant evaporating unit, a condenser for receiving the fluid discharged from the high side of said compressor, means associated with the compressor for retaining a quantity of cooling fluid in thermal contact therewith, and a heat radiating device connected to said means for radiating the heat absorbed thereby.

2. A refrigerant condensing unit comprising a compressor for increasing the pressure of refrigerant fluid exhausted from a refrigerant evaporating unit, a condenser for receiving the fluid discharged from the high side of said compressor, means associated with the compressor for retaining a quantity of cooling fluid in thermal contact therewith, a heat radiating device connected to said means for radiating the heat absorbed thereby, said condensers being located adjacent each other, and means for circulating a cooling fluid in thermal contact with said condensers.

3. A refrigerant condensing unit comprising a compressor for increasing the pressure of refrigerant fluid exhausted from a refrigerant evaporating unit, a condenser for receiving the fluid discharged from the high side of said compressor, means associated with the compressor for retaining a quantity of refrigerant in thermal contact therewith, a conduit connecting said means to the discharge side of the aforesaid condenser, and a second condenser connected to the discharge side of said means.

4. A refrigerant condensing unit comprising a refrigerant compressor having a chambered wall, a condenser connected at opposite ends to the high side of the compressor and to the interior of the chambered wall, and a second condenser connected to the interior of the chambered wall and through which the refrigerant fluid from the high side of the compressor eventually is discharged.

5. A refrigerant condensing unit comprising a condenser having a pair of independent sections, means for discharging a blast of cooling fluid against said sections, means for connecting the inlet of one of the sections of the condenser to the high side of a refrigerant compressor, means for connecting the discharge of said section to the inlet of said remaining section, said last mentioned means being associated in thermal contact with some portion of the refrigerant compressor cylinder.

6. A refrigerant condensing unit comprising a compressor having a condenser connected therewith, said condenser having an intermediate portion disposed in heat exchange relation with a portion of said compressor casing.

7. A refrigerant condensing unit comprising a condenser having a pair of vertically disposed and parallel sections, means for connecting an inlet to one of said sections to a refrigerant compressor, means for connecting a discharge from the same section to a chambered wall formed in the refrigerant compressor, and means for connecting the other refrigerant condenser section to said chambered wall.

8. A refrigerant condensing unit comprising a compressor having a compressor head formed to provide a cooling chamber, means for connecting a condenser between the high side of said compressor and said cooling chamber, and means for discharging refrigerant fluid from said cooling chamber.

9. A refrigerant condensing unit comprising a compressor having a condenser associated therewith to receive high pressure fluid therefrom, and means for discharging refrigerant fluid from said condenser, said last

mentioned means being disposed in thermal contact with said compressor.

10. A refrigerant condensing unit comprising a compressor for increasing the pressure of refrigerant fluid exhausted fom a refrigerant evaporating unit, a condenser for receiving the fluid discharged from the high side of said compressor, means associated with the compressor for retaining a quantity of refrigerant fluid in thermal contact therewith, and a heat radiating device connected to said means for radiating the heat absorbed thereby.

11. A refrigerant condensing unit comprising a compressor for increasing the pressure of refrigerant fluid exhausted from a refrigerant evaporating unit, a condenser for receiving the fluid discharged from the high side of said compressor, means associated with the compressor for circulating a cooling fluid in thermal contact therewith, and a heat radiating device connected to said means for radiating the heat absorbed thereby.

12. A refrigerant condensing unit comprising a compressor for increasing the pressure of refrigerant fluid exhausted from a refrigerant evaporating unit, a condenser for receiving the fluid discharged from the high side of said compressor, means associated with the compressor for circulating a cooling fluid in thermal contact therewith, said means being adapted to permit the circulation of the cooling fluid continuously in the same direction, and a condenser connected to said means for radiating the heat absorbed thereby.

13. A method of refrigeration which comprises reducing the vapor pressure of a refrigerant fluid until evaporation occurs, compressing the fluid in a mechanical device until its temperature is higher than the surrounding atmosphere, retaining the fluid in confinement at such temperature until a portion of the latent heat thereof flows into the surrounding atmosphere, bringing the fluid again in thermal association with the mechanical device and re-evaporating a portion of the fluid by employing the heat generated in such mechanical device, and again retaining the fluid in confinement until a portion of the heat taken up from the mechanical device flows into the surrounding atmosphere.

14. The refrigerating method which comprises, compressing a refrigerant within a compartment, condensing the compressed refrigerant, applying the heat of compression within the compartment to condensed refrigerant to vaporize at least a portion thereof to thereby remove the heat of compression from the compartment, recondensing the vaporized refrigerant, evaporating condensed refrigerant to produce a refrigerating effect and returning the evaporated refrigerant to be recompressed and recondensed.

15. A method of refrigeration which comprises reducing the vapor pressure of a refrigerant fluid until evaporation occurs, compressing the fluid by means of a mechanical device until its temperature is higher than the surrounding atmosphere, retaining the fluid in confinement at such temperature until a portion of the latent heat thereof flows into the surrounding atmosphere, bringing the fluid again in thermal association with the mechanical device and re-evaporating a portion of the fluid by employing the heat generated in such mechanical device, and again retaining the fluid in confinement until a portion of the heat taken up from the mechanical device flows into the surrounding atmosphere.

In testimony whereof I hereunto affix my signature.

LAWRENCE A. PHILIPP.