UNITED STATES PATENT OFFICE.

GEORGE F. MEYER, OF NEW YORK, N. Y., ASSIGNOR TO THE DE LA VERGNE REFRIGERATING MACHINE COMPANY, OF SAME PLACE.

ART OF REFRIGERATION BY COMPRESSION AND EXPANSION OF GASES.

SPECIFICATION forming part of Letters Patent No. 371,779, dated October 18, 1887.

Application filed April 12, 1887. Serial No. 234,533. (No model.)

To all whom it may concern:

Be it known that I, GEORGE F. MEYER, of the city, county, and State of New York, have invented a new and useful Improvement in the Art of Refrigeration by Compression and Expansion of Gases, or compressing and expanding gases for purposes of refrigeration when such gases are compressed in contact with or presence of lubricating-liquids.

In all of the known processes in which a lubricating liquid is employed the gas is compressed in some kind of a pump to which liquid is supplied, and this liquid, after being discharged from the pump in connection with the compressed gas, is separated mechanically from the gas or the liquefied gas and returned to the pump. In some of these processes the oil is cooled after leaving the pump and before it is returned to it. In others the oil is not cooled prior to its return to the pump. In some of these processes the oil is kept under substantially the pressure at which it left the pump until it returns to it. In others the oil is relieved to a greater or less extent from pressure after leaving and before it is returned to the pump. In some of these processes the oil is injected into the pump after the suction-stroke thereof is completed; in others during the suction-stroke; in still others during the compression-stroke, and in some instances during both the compression and the suction-stroke. The oil is also sometimes admitted or forced into the compression-pump in measured quantities, and sometimes through a simple pipe controlled by a cock. In some of these processes the oil is cooled in the presence of gas; in others after it has been separated mechanically from the gas.

My improvement is applicable to any of these processes, and requires, in order to work it out fully, first, a compressing-pump; second, a condenser; third, an expansion-coil or its equivalent; fourth, a separator or separating tank or tanks for separating oil from gas mechanically; fifth, necessary connections of these parts, so that expanded gas may be returned to the compressing-pump and that oil discharged from the pump may be returned thereto, all these parts being such as are well known and usually employed in refrigerating apparatus. In addition to these parts or subdivisions of a complete apparatus there is needed for carrying out my improvement some means—such as a jacketed kettle, or steam-coil, or their substitutes or equivalents—for heating the oil after it has been wholly or partially mechanically separated from the gas, and during its progress from the discharge-valves of the compressing-pump and before it returns or is returned to the pump again, and some proper connection from the cavity in which the oil is heated to the pressure side of the apparatus.

I use the word "oil" in this description and specification as including and defining any of the liquids and their equivalents now employed in refrigerating processes for the purpose of filling up clearances in compression-pumps and preventing leakage of pistons, piston-rods, valves, &c., and the word "gas" as including and defining all the various kinds of gas applicable for refrigerating purposes by compressing them and then permitting them to expand.

In such processes the oil takes up in the pump more or less of the gas which is being compressed and retains more or less of such gas after the oil has been expelled or discharged from the pump. If the oil during its progress from the discharge-valves of the pump until its return thereto has the pressure upon it relieved, the theory is that some gas then escapes from the oil, said gas escaping not to waste, but into the suction or expansion side of the apparatus, whence the gas is returned to the compressing-pump. If the oil be kept substantially under the pressure at which it left the compressing-pump and until its return thereto, the theory is that the gas in the oil escapes in the pump when the pressure in the pump is less than that of the entering oil, and that this gas thus escaping cools the pump and also enables it to deliver at each stroke more gas than it would if the oil contained no gas at all, or less gas than was due to the pressure under which the oil was discharged from the pump. In both these ways of working refrigerating apparatus, however, the gas which escapes from the oil either in the pump itself or into the suction or expansion side of the apparatus must be recompressed, because in all known forms of refrige-

rating apparatus the gas circulates throughout the whole apparatus and none of it is permitted to escape into the outer air to waste.

Now it is a well-known fact that the oil will, other things being equal, hold more gas at a high pressure than at a low one, and that it will, other things being equal, hold more gas at a low temperature than a high one—that is, if oil containing absorbed or mechanically-mixed therein a certain quantity of gas be heated, then the oil will part with a quantity, more or less, of this gas even if the pressure be not reduced. It is further known to those using the well-known processes, that the mechanical separation of the oil from the gas in separating-tanks, or their substitutes for the purpose, is by no means perfect, and that the oil usually contains gas mechanically mixed therewith. A consideration of these facts has led me to this invention, and it consists in an addition to the usual processes, whereby the oil, after being wholly or partially mechanically separated from the gas, as usual, is heated so that some of the absorbed and contained gas is to a greater or less extent expelled therefrom and delivered into the pressure side of the apparatus. This heating takes place after the oil has been ejected from the pump and prior to its return thereto, and after the oil has been wholly or partially mechanically separated, as usual, from the compressed gas, and I prefer to separate the oil mechanically from the gas soon after they leave the pump and before the gas is cooled in the condenser. I also prefer to cool the oil after it has been thus exposed to heat and before it is returned to the pump.

If there be in the apparatus as a whole, as is usual, a separating-tank, or its equivalent, into which the whole charge of gas and oil from the pump is discharged, and to the bottom of which the oil drops, I place in the bottom of such tank a coil heated by steam. The heat from this coil will expel some of the gas from the oil, and this gas will go off with the gas discharged from the pump into the pressure side of the apparatus and be cooled in the condenser, adding to the whole quantity of compressed gas that additional quantity which is driven off from the oil by heating the oil. The oil, after this heating and before it returns to the pump, is, by preference, cooled by water in the usual apparatus or in other suitable known manner; or I may heat the oil in a coil-pipe or kettle after it leaves the separating-tank, provided the cavity in which it is heated is not open to the air, and is in some way connected to the pressure side of the apparatus, so that the gas separated by heat will be introduced into the pressure side of the apparatus, the gas thus driven from the oil being subsequently cooled either in the usual or in a separate condenser. It will be apparent that this process economizes all the gas which is separated by heat, sending it to the pressure side of the apparatus, so that it may be used while expanding for refrigerating purposes. It is true that when this oil returns to the pump it must again be charged with gas, requiring some power to produce this charging; but as this gas so charged is again wholly or partially driven off by the subsequent heating of the oil my process appears to me to work, so far as effect is concerned, much to the same advantage that would follow from the use of an oil which would absorb no gas. Such an oil is not yet known; but my process is designed for securing advantages similar to those which would result from the use of such oil if it were known.

The oil may be heated to drive off the gas after the oil has been cooled in the presence of gas and separated mechanically therefrom, provided the gas thus driven off is conducted to the pressure side of the apparatus; but this is an inferior way of working my process.

I have throughout this description used the word "heating" without specifying any certain temperature, because different degrees of heat will be required for different oils, and because the degree of heat will be in some measure dependent upon the temperature at which the oil leaves the compressing-pump and also upon the boiling-point of the particular oil used; but I can define generally the degree of heat to be applied to the oil by stating that it must be greater than that at which the oil leaves the compressing-pump and less than that at which the oil boils.

I claim—

1. The improvement in the refrigerating process herein described, which consists in heating the oil after it has been expelled from the pump, and conducting the gas driven off by such heating into the pressure side of the apparatus, said heating being performed after the oil has been partially or wholly separated mechanically from the gas and before the oil is returned to the pump.

2. The improvement in the refrigerating process herein described, which consists in heating the oil after its expulsion from the pump and subsequent to mechanical separation from the gas, and the cooling of such oil after it has been heated, the gas driven off by the heating, and prior to the cooling of the oil being conducted to the pressure side of the apparatus.

GEO. F. MEYER.

Witnesses:
W. W. BAILEY,
H. W. GUERNSEY.