

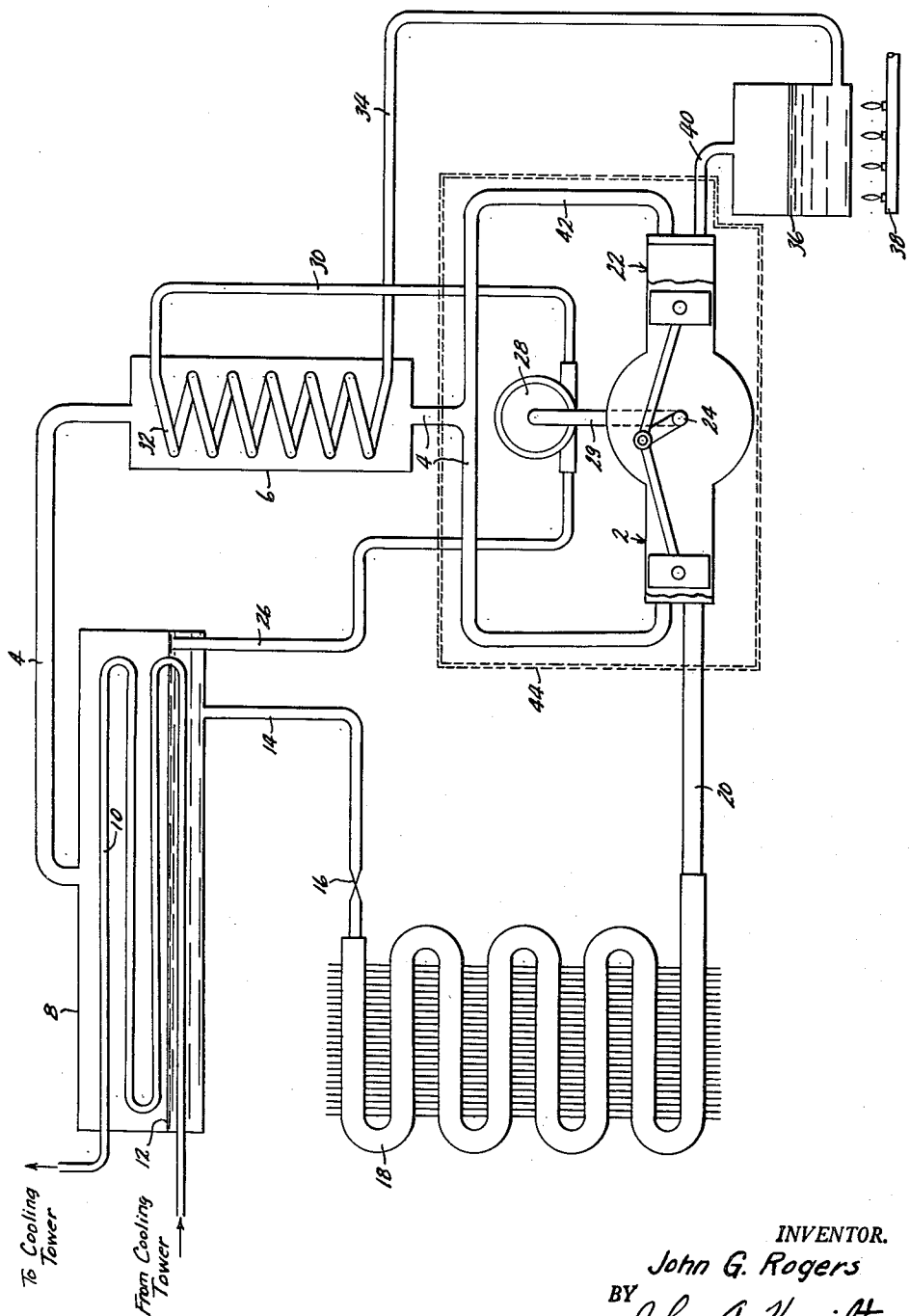
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J. G. ROGERS

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REFRIGERATION SYSTEM

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INVENTOR.
John G. Rogers
BY John A. Hamilton
Attorney.

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REFRIGERATION SYSTEM

John G. Rogers, 7200 Maple Lane NW., Parkville, Mo.

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This invention relates to new and useful improvements in refrigeration systems, and has particular reference to refrigeration systems of the compressor-condensor-expander type.

The principal object of the present invention is the provision of a compressor-condensor-expander type refrigeration system wherein the compressor is driven by the refrigerant gas itself. Generally, this object is accomplished by utilizing a compressor which is driven or powered by a gas or vapor under pressure, extracting a portion of the refrigerant from any suitable portion of the compressor-condensor-expander circuit, increasing the pressure of said extracted refrigerant by means of a pump and increasing the volume thereof by the application of heat thereto, and utilizing the expanded refrigerant as the power medium for driving said compressor, the refrigerant exhausted from the compressor being returned to the system for recycling. Since the only external power necessarily required by my system is a source of heat, my system greatly increases the flexibility of application of a compressor-type system, and is more economical in both construction and operation than other types of heat-actuated systems.

Another object is the provision of a refrigeration system of the character described wherein the pump embodied in the compressor driving portion of the circuit is also driven by the extracted and expanded portion of the refrigerant, whereby the system is rendered completely independent of any outside power except a source of heat.

A further object is the provision of a refrigeration system of the character described which is adapted to be completely sealed against the leakage of any of the refrigerant therefrom.

With these objects in view, as well as other objects which will appear in the course of the specification, reference will be had to the drawing, which is a schematic layout of a refrigeration system embodying the present invention.

In the drawing, the figure 2 indicates a compressor, the compressor illustrated being of the piston type, although as will appear various types of compressors may be utilized within the spirit of my invention. A refrigerant gas compressed by said compressor is delivered through a conduit 4, in which is interconnected a heat exchanger chamber 6 the purpose of which will be later described, to a condenser 8 comprising a closed vessel containing pipe coils 10 in which a cooling fluid is circulated from a cooling tower or the like. It will be apparent also that an air-cooled or other type of condenser could be used if desired. The compressed refrigerant gas is cooled to a liquid form in said condenser, the liquid level being indicated at 12. The liquid refrigerant then passes through a conduit 14 to an expansion valve 16, by which it is greatly expanded to gaseous form, and therefore greatly reduced in temperature. The cold refrigerant gas then passes through an evaporator coil 18, over which the air or other medium to be cooled is circulated. The refrigerant gas passes from the evaporator back to compressor 2 through a conduit 20, and the cycle is repeated.

The system thus far described, with the exception of heat exchanger 6 is common and well known, being an ordinary compressor-condensor-expander circuit. The present invention relates to the powering of the compressor by means of the refrigerant itself. To this end, there is shown a piston-type vapor or gas engine 22

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operable to drive compressor 2, the pistons of both the compressor and engine being operatively connected to a common crankshaft 24. Refrigerant for driving the engine is extracted from condenser 8 by means of a pipe 26 which extends upwardly into said condenser to a point just below the liquid level 12 therein. Refrigerant for this purpose could be extracted at other points in the system, but is in its densest state at this point, and therefore may be most greatly expanded to drive the compressor by the application of heat thereto, for greater efficiency of operation.

The refrigerant is drawn through pipe 26 to a pump 28, whereby the pressure is increased to a figure sufficiently higher than the delivery pressure of the compressor to provide an operating pressure differential for engine 22, since said engine must exhaust at compressor delivery pressure, as will appear. Pump 28 is driven by a shaft 29 connected to crankshaft 24 of the compressor-engine. Refrigerant is delivered from pump 28 through a conduit 30 to a pipe coil 32 in heat exchanger chamber 6 wherein said refrigerant derives a degree of heat from the compressed refrigerant being delivered by the compressor. The refrigerant passes from coil 32 through a conduit 34 to a vapor generator 36, wherein the refrigerant is gasified and tremendously expanded by the application of heat thereto. The heat source is indicated at 38, and could be a gas or oil burner, electric heater, or any other suitable heating device. In the case of an automobile installation, the exhaust manifold of the automobile engine could effectively be utilized as a source of heat. The expanded refrigerant gas or vapor then passes from generator 36 through a conduit 40 to engine 22 and drives said engine, and is exhausted from said engine through a conduit 42 which is interconnected into conduit 4 ahead of heat exchanger 6. It is desirable that compressor 2, engine 22 and pump 28 be constructed in a sealed unit, the casing of said unit being indicated at 44, in order to seal the system completely against the possible leakage of refrigerant therefrom.

While I have shown and described a specific embodiment of my invention, it will be readily apparent that many minor changes of structure and operation could be made without departing from the spirit of the invention as defined by the scope of the appended claims. For example, in addition to the alternatives already set forth in the course of the specification, it will be apparent that while heat exchanger 6 increases the efficiency of the system by pre-heating the refrigerant delivered to vapor generator 36, and by reducing the amount of heat to be extracted by condenser 8, it is not essential to the basic concept of my invention and could be dispensed with. Also, it is not essential that pump 28 be operated by engine 22 as shown, although this arrangement is deemed to possess advantages of economy, convenience, and the elimination of any fuel or power except for heat. The pump could be operated by a separate vapor engine also operated by generator 36, or could be operated by an electric motor, preferably built in a sealed unit therewith. Also, the engine-compressor unit need not be of the piston type as shown. It could, alternatively, be of the turbine type, or of the vane type, or a jet compressor may be used wherein the refrigerant from conduit 20 is compressed by high speed jets of refrigerant from generator 36, directed downstream to the direction of flow. The only essential requirement as to the compressor, insofar as the present invention is concerned, is that it be operable by a gas or vapor under pressure.

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

1. A refrigeration system comprising a compressor, a condenser and an expander in a closed operating circuit containing a compressible refrigerant; means operable to

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drive said compressor and adapted to be powered by a vapor under pressure; a driving circuit operable to extract refrigerant from said operating circuit in a compressed state and to return it to said operating circuit at a point intermediate said compressor and said condenser, said driving circuit including in series a pump operable to increase the pressure of said refrigerant, a heat exchanger operable to extract heat from said operating circuit intermediate said compressor and said condenser, whereby refrigerant in said driving circuit is preheated, a vapor generator operable to expand said refrigerant by the application of heat thereto, and said compressor driving means; means operable to drive said pump; and a heating device operable to apply heat to said vapor generator.

2. A refrigeration system as recited in claim 1 wherein said heat exchanger comprises a conduit extending be-

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tween said pump and said vapor generator in said driving circuit, and a chamber disposed in said operating circuit intermediate said compressor and said condenser, said conduit passing through said chamber, whereby refrigerant flowing through said conduit to said vapor generator is preheated.

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