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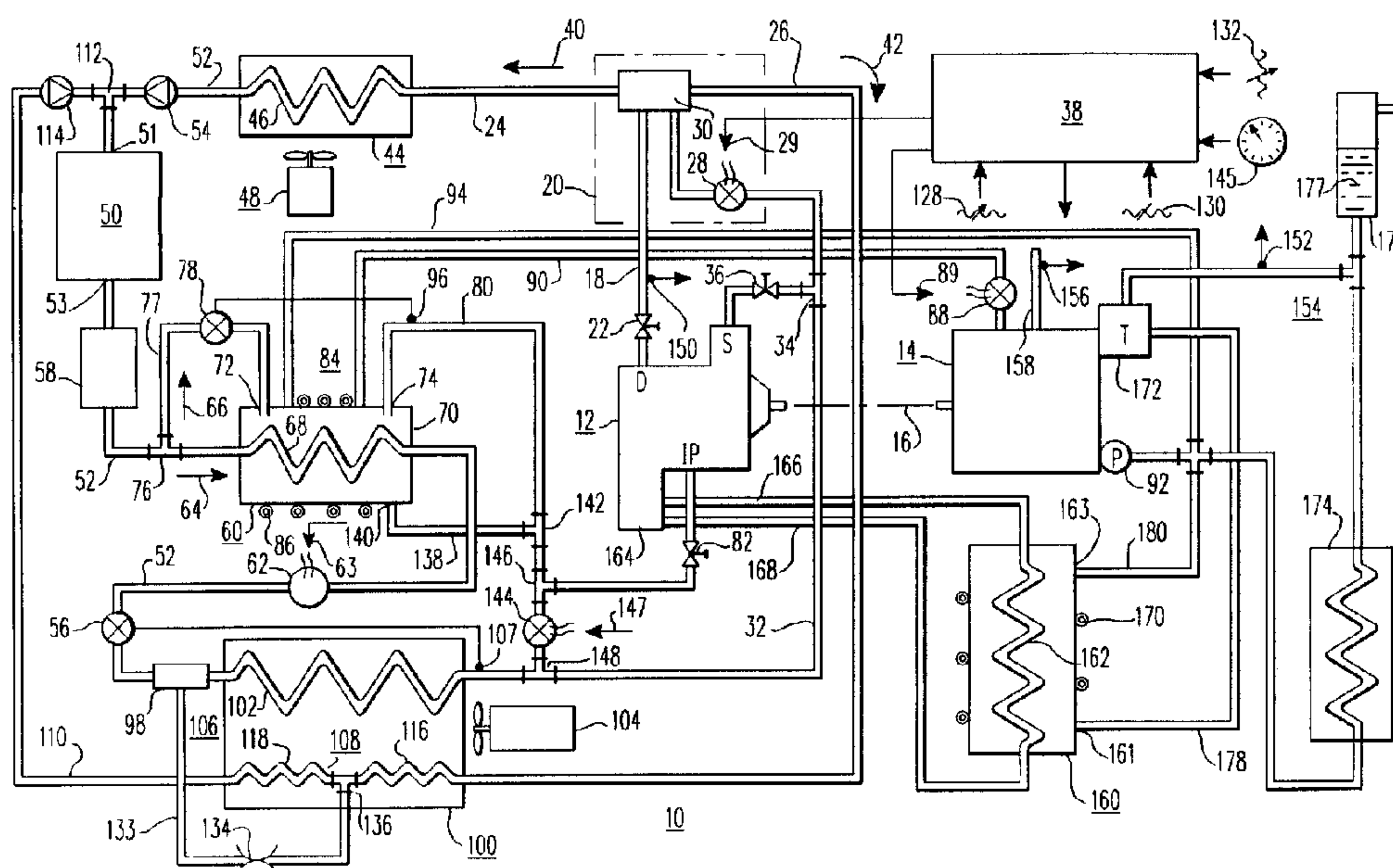
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(54) Titre : LIMITATION COMBINEE DU RETOUR D'HUILE ET DE LA TEMPERATURE DE REFOULEMENT A LA SORTIE DU COMPRESSEUR D'UN ECONOMISEUR DE TYPE NOYE

(54) Title: COMBINED OIL RETURN AND COMPRESSOR DISCHARGE TEMPERATURE LIMITATION REGARDING FLOODED ECONOMIZER HEAT EXCHANGER



(57) Abrégé/Abstract:

A refrigeration system of the type having an economizer cycle is provided with a null cycle, in addition to heating and cooling cycles, without shutting a compressor prime mover down, to preserve air flow in a conditioned space. First, second and third controllable valves respectively: (1) select main and auxiliary condensers, (2) open and close a liquid line, and (3) open and close a line which provides a warm liquid to an economizer heat exchanger. The valves are controlled in at least one predetermined open/close pattern during a null cycle, and preferably in a plurality of selectable predetermined open/close patterns, to provide a null cycle at any instant which substantially matches the net heat gain or loss taking place in the conditioned space. Thus, the temperature of the served space will be more apt to remain in a null temperature range close to set point, providing smoother and more accurate control over the temperature of the conditioned space for longer shelf life of perishables stored therein. The system achieves the latter by controlling cooling circulation in the compressor oil cooler.

ABSTRACT OF THE DISCLOSURE

5 A refrigeration system of the type having an economizer cycle is provided with a null cycle, in addition to heating and cooling cycles, without shutting a compressor prime mover down, to preserve air flow in a conditioned space. First, second and third controllable valves respectively: (1) select main and auxiliary condensers, (2) open and close a liquid line, and (3) open and close a line which provides a warm liquid to an economizer heat exchanger. The valves are controlled in at least one predetermined open/close pattern during a null cycle, and preferably in a plurality of selectable predetermined open/close patterns, to provide a null cycle at any instant which substantially matches the net heat gain or loss taking place in the conditioned space. Thus, the temperature of the served space will be more apt to remain in a null temperature range close to set point, providing smoother and more accurate control over the temperature of the conditioned space for longer shelf life of perishables stored therein. 10 The system achieves the latter by controlling cooling circulation in the compressor oil cooler. 15 20

METHODS AND APPARATUS FOR OPERATING
A REFRIGERATION SYSTEM CHARACTERIZED BY
CONTROLLING ENGINE COOLANT

TECHNICAL FIELD

The invention relates in general to refrigeration systems, and more specifically to refrigeration systems which utilize a compressor having an intermediate pressure port.

BACKGROUND ART

U.S. Patent 4,850,197, which is assigned to the same assignee as the present application, discloses a vapor compression refrigeration system based on an economizer cycle which utilizes a refrigerant compressor having an intermediate pressure port, in addition to suction and discharge ports. An economizer heat exchanger is used to enhance hot gas cooling and heating cycles which are initiated by associated electrical or electronic control to achieve and maintain a predetermined temperature range close to a selected set point temperature in a served space to be conditioned.

U.S. Patent 5,174,123 issued December 29, 1992 entitled Methods and Apparatus for Operating a Refrigeration System, which is assigned to the same assignee as the present application, discloses refrigeration methods and apparatus which utilize a flash tank in a refrigeration system which has an economizer cycle, in place of an economizer heat exchanger. The refrigeration arrangement disclosed in the aforesaid application eliminates the need

for a float valve in the flash tank, enabling the flash tank to be used in transport refrigeration applications.

It would be desirable, and it is an object of the present application, to improve the reliability and efficiency, as well as the control methods and arrangements, of refrigeration systems which have an economizer cycle, such as the refrigeration systems disclosed in the hereinbefore mentioned patent and patent application.

SUMMARY OF THE INVENTION

10 The invention includes methods and apparatus for operating a refrigeration system which achieves and holds a predetermined set point temperature in a conditioned space via cooling and heating cycles. The refrigeration system includes a refrigerant compressor having a suction
15 port, an intermediate pressure port, a discharge port, and a compressor prime mover. The refrigeration system further includes a hot gas compressor discharge line, first and second hot gas lines, and first controllable valve means having first and second positions which respectively
20 connect the hot gas compressor discharge line to the first and second hot gas lines. A main condenser is connected to the first hot gas line. An evaporator, which is associated with the conditioned space, includes an evaporator expansion valve. An auxiliary condenser is associated with the
25 conditioned space, with the auxiliary condenser being connected to the second hot gas line. Economizer heat exchanger means having first and second refrigerant flow paths is provided, including an economizer expansion valve which controls the rate of refrigerant flow through the
30 second refrigerant flow path. A main liquid line connects the main condenser to the evaporator expansion valve via the first refrigerant flow path of the economizer heat exchanger means, an auxiliary liquid line connects the auxiliary condenser to the economizer heat exchanger means,
35 a main suction line connects the evaporator to the suction port of the compressor, and an auxiliary suction line connects the second flow path of the economizer heat exchanger means to the intermediate pressure port of the

5 .375 inch (9.5 mm) OD tubing. The Figure 6 embodiment of drain line 138' also has the temperature control advantage of the Figure 1 embodiment, directly limiting the economizer suction temperature and indirectly limiting the discharge temperature.

APPENDIX I

Prior Art United States:

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| 1. | 4,178,769 | 12/1997 | Johnsen |
| 2. | 5,174,123 | 12/1992 | Erickson |

