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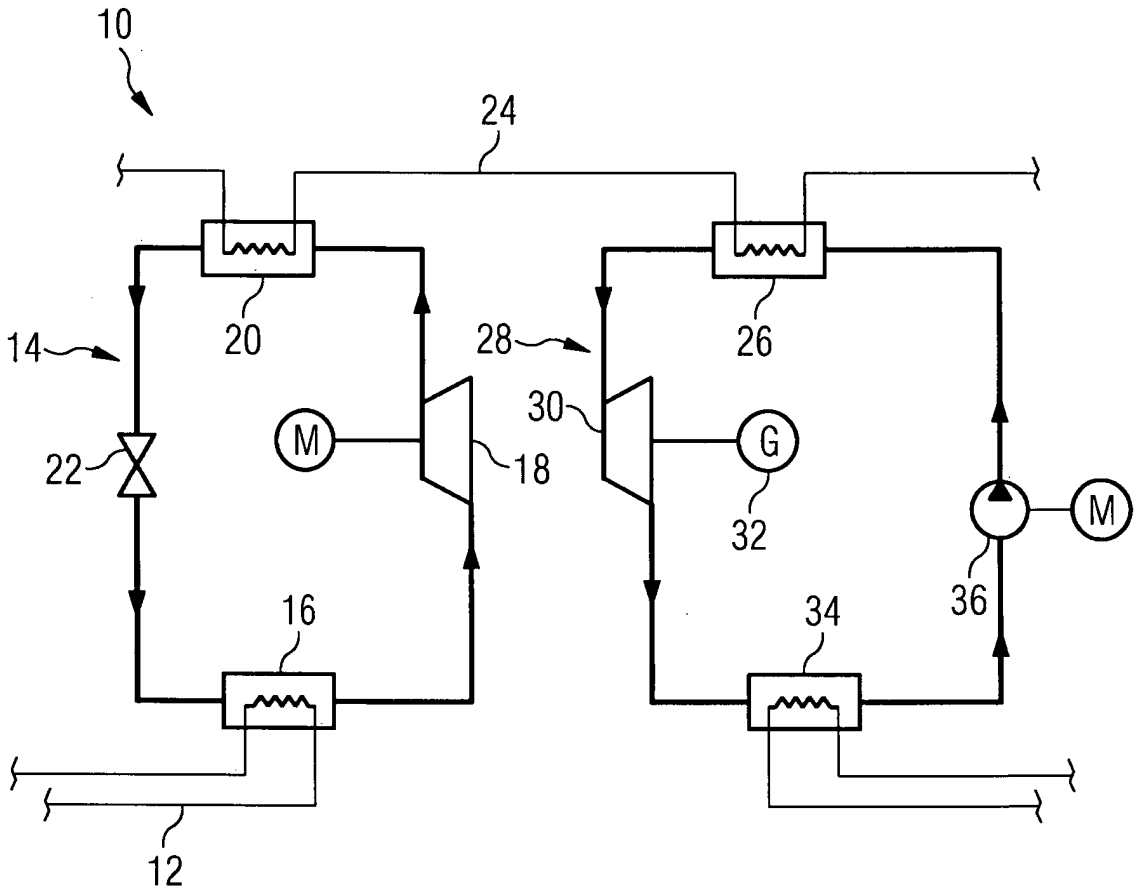
(54) System for using surplus heat energy

(57) A System (10) for using surplus heat energy, in particular from a district cooling (12), comprises a cycle (14) for circulation of a working fluid, the cycle (14) includes a vaporizing unit (16) for taking up the surplus heat energy and vaporizing the working fluid to become gaseous, a compressor unit (18) for compressing the gaseous working fluid, a condenser unit (20) for condensing the compressed gaseous working fluid to become liquid and releasing heat energy to a heat carrier (24), and an expansion unit (22) for reducing the pressure of the liquid working fluid. The system (10) further includes a second vaporizing unit (26) being connected to the cycle (14) via the condenser unit (20) for taking up heat energy from the heat carrier (24) and vaporizing a second working fluid to become gaseous, and a second expansion unit (30) for expanding the gaseous second working fluid.



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Description

[0001] The present invention relates to a system for using or refining surplus heat energy, in particular by utilizing waste heat energy from district cooling or other heat energy sources, comprising a cycle for circulation of a working fluid, the cycle including a vaporizing unit for taking up the surplus heat energy and vaporizing the working fluid to become gaseous, a compressor unit for compressing the gaseous working fluid, a condenser unit for condensing the compressed gaseous working fluid to become liquid and releasing heat energy to a heat carrier, and an expansion unit for reducing the pressure of the liquid working fluid.

[0002] Energy is becoming one of the most important goods. Nevertheless, large amounts of surplus heat energy of varying temperature are produced around the world. Accordingly, vast economical and environmental advantages could be reached by using waste or surplus heat energy. However, depending on the temperature of the surplus heat energy, there can be some limitations in the utilisation, such as temperature demand on a district heat energy network being connected with the surplus heat energy source. Thus, sometimes the surplus heat energy cannot be used and has to be disposed of as a waste heat energy to the surroundings, for example to rivers, lakes or to the sea.

[0003] From WO 2005/024189 A1 a system for heat energy refinement by utilizing waste heat energy in a conduct is known, comprising a first cycle, an evaporator in which the circulating working fluid is evaporated to gas, a compressor that compresses the gas, a condenser that condenses the gas to a condensate and releases heat energy to a passing heat carrier in the condenser, and an expansion valve that expands the condensate and brings back the working fluid to the evaporator. The system further comprising a second cycle being attached to the first cycle via the evaporator for supplying fluid from the evaporator to a turbine whereby an expansion occurs and whereby the condensate is brought back to the evaporator of the first cycle.

[0004] It is an object of the present invention to provide an alternative system for using surplus heat energy, the system taking care of surplus heat energy which in particular otherwise limits production of district cooling.

[0005] The object is solved according to the invention by a system according to claim 1. Preferred embodiments are defined in the dependent claims.

[0006] The system for using surplus heat energy, in particular from district cooling, according to the invention comprises a cycle for circulation of a working fluid, the cycle including a vaporizing unit for taking up the surplus heat energy and vaporizing the working fluid to become gaseous, a compressor unit for compressing the gaseous working fluid, a condenser unit for condensing the compressed gaseous working fluid to become liquid and releasing heat energy to a heat carrier, and an expansion unit for reducing the pressure of the liquid working fluid. The system further includes a second vaporizing unit being connected to the cycle via the condenser unit for taking up heat energy from the heat carrier and vaporizing a second working fluid to become gaseous, and a second expansion unit for expanding the gaseous second working fluid.

[0007] In other words, according to the invention heat energy in the state of waste heat energy or from other heat sources can be used for said circle of the system first, and can further be used for vaporizing a second working fluid which can be expanded and can thus deliver energy for further areas of application. The two evaporation processes of the system usually occur at different temperature levels, thus providing a wide range of application possibilities.

[0008] In a preferred embodiment of the invention, the second expansion unit of the system includes a turbine having a generator torque proof connected therewith. The turbine may drive a generator for the production of electricity. Thus, even more waste heat energy or more district cooling can be produced and be transformed into electrical power without dumping surplus energy.

[0009] Further, according to the invention, it is preferred to include a second condenser unit into the system for condensing the gaseous second working fluid to become liquid. Further preferred, a pump unit for pumping the liquid second working fluid from the second condenser unit to the second vaporizing unit is provided. The second condenser, the pump unit and said second vaporizing unit all together form a second circle in which said turbine works as a "refrigerant"-turbine for using nearly the entire temperature potential of the second working fluid and for generating electricity which can be distributed easily. The second condenser may be connected with a cooling conduct by which only a small amount of waste heat energy is dumped to the environment.

[0010] For connecting the second vaporizing unit to the condenser unit of the cycle, preferably, a heat carrier conduit for conducting a heat carrier fluid is provided. The heat carrier conduit makes it possible to position the first circle at the adequate distance of the second circle and the second vaporizing unit and second expansion unit provided therein.

[0011] Addition advantages and features according to the invention are evident in the following from the description of an embodiment according to the invention.

[0012] Hereinafter, a preferred embodiment of a system according to the invention is described more in detail by reference to the rather schematic drawings enclosed. Therein the Fig. shows a circuit diagram of an embodiment of a system for using surplus heat energy, in particular from district cooling, according to the invention.

[0013] A system 10 uses surplus heat energy which is delivered through a conduit 12 of a district cooling. The system 10 comprises a first cycle 14 for circulation of a working fluid through a vaporizing unit 16, a compressor unit 18, a condenser unit 20 and an expansion unit 22.

[0014] The vaporizing unit 16 takes up the surplus heat

energy from the conduct 12 and vaporizes the working fluid in the first circle 14 to become gaseous. The compressor unit 18 compresses the gaseous working fluid. The condenser unit 20 condenses the compressed gaseous working fluid to become liquid and releasing heat energy to a liquid heat carrier which runs through a conduit 24. Alternatively, a rigid or non-flexible heat carrier, e.g., in the form of an aluminium rib or web, may be provided.

[0015] The expansion unit 22 reduces the pressure of the liquid working fluid and delivers the working fluid back to the vaporizing unit 16.

[0016] The system 10 further includes a second vaporizing unit 26 which is connected to the first cycle 14 via the liquid heat carrier in the conduit 24 to the condenser unit 20 for taking up heat energy from the heat carrier and vaporizing a second working fluid to become gaseous.

[0017] The second working fluid runs through a second circle 28. In the second circle 28 a second expansion unit 30 in the form of a turbine is provided for expanding the gaseous second working fluid. The turbine drives a generator 32 which provides electricity. The second circle 28 further includes a second condenser unit 34 for condensing the gaseous second working fluid to become liquid and a pump unit 36 for pumping the liquid second working fluid from the second condenser unit 34 to the second vaporizing unit 26.

Reference signs

[0018]

10	system
12	conduit of a district cooling
14	first circle
16	vaporizing unit
18	compressor unit
20	condenser unit
22	expansion unit
24	conduit for a liquid heat carrier
26	second vaporizing unit
28	second circle
30	second expansion unit / turbine
32	generator
34	second condenser unit
36	pump unit

Claims

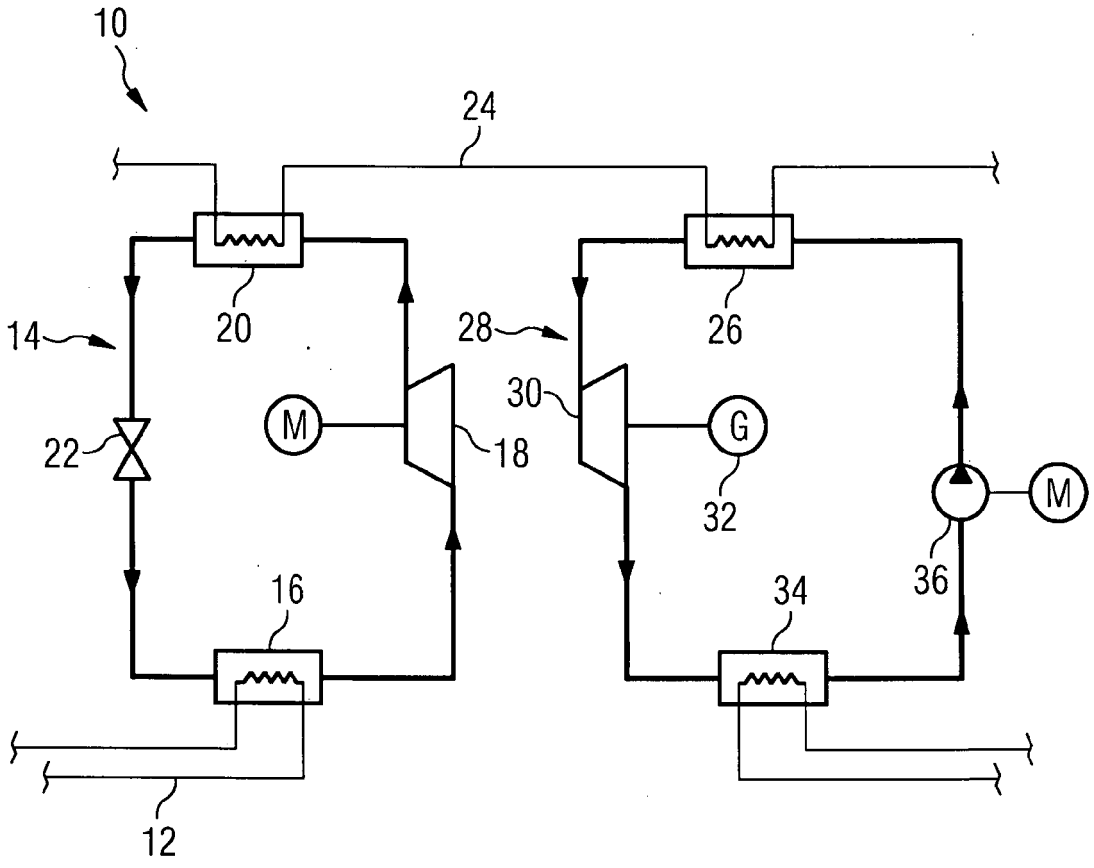
1. System (10) for using surplus heat energy, in particular from a district cooling (12), comprising a cycle (14) for circulation of a working fluid, the cycle (14) including
a vaporizing unit (16) for taking up the surplus heat energy and vaporizing the working fluid to become gaseous, a compressor unit (18) for compressing the gaseous working fluid,
a condenser unit (20) for condensing the compressed gaseous working fluid to become liquid and releasing heat energy to a heat carrier (24), and
an expansion unit (22) for reducing the pressure of the liquid working fluid,
the system (10) further including
a second vaporizing unit (26) being connected to the cycle (14) via the condenser unit (20) for taking up heat energy from the heat carrier (24) and vaporizing a second working fluid to become gaseous, and
a second expansion unit (30) for expanding the gaseous second working fluid.

2. System according to claim 1,
in which the second expansion unit (30) including a turbine having a generator (32) torque proof connected therewith.

3. System according to claim 1 or 2,
including a second condenser unit (34) for condensing the gaseous second working fluid to become liquid.

4. System according to any of claims 1 to 3,
including a pump unit (36) for pumping the liquid second working fluid from the second condenser unit (34) to the second vaporizing unit (26).

5. System according to any of claims 1 to 4,
in which the second vaporizing unit (26) is connected to the condenser unit (20) of the cycle (14) via a heat carrier conduit (24) for conducting a heat carrier fluid.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EUROPEAN SEARCH REPORT

Application Number
EP 06 02 4323

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Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
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D,A	WO 2005/024189 A (ETA ENTRANS AB [SE]; JOHANSSON AKE [SE]) 17 March 2005 (2005-03-17) * figure 5 *	1	

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F01K
F25B

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	27 November 2007	Lepers, Joachim

CATEGORY OF CITED DOCUMENTS

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EPO FORM 1503 03.82 (P04C01)

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For more details about this annex : see Official Journal of the European Patent Office, No. 12/82

REFERENCES CITED IN THE DESCRIPTION

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