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Thermodynamic conversion of heat into cooling.

Extract.
A method and derived Equipment, where a thermodynamic process, ie a so-called "left-folding," "Rankine" cycle, the cooling process is driven by a thermodynamic process, ie a so-called "right-folding, 'Rankine "-cycle, said heating process, wherein said actuator is effected by means of a forced draft of a" ejector ", which connects cycles, and wherein both circuits have a common condenser, from which, intermittent," top-ups "take place of (a) the water heater in said "right-folding," circuit and (b) the evaporator in said "left-folding," cycle. Named "reloads" are controlled using sensors, two valves and limited electrical circuit.

<u>Subject.</u>
A Method and Apparatus derived, where a "left-turning around" "Rankine" `recycle process, the cooling process is driven by a" right-turning around "Rankine" cycle process, the heating process, without neces-of compressor and electric power consumption is limited to the operation of several sensors and two control valves.

<u>Summary.</u>
Almost all cooling systems in use today, still show a compressor in the "Rankine" cycle, which has the following steps: compression, condensation and evaporation throttle valve.
The compressor takes a lot of energy. In the present invention, the compressor is replaced with a hot water heater, in which cooling liquid is heated and partially evaporated. The vapor in the tank above is under pressure and blows an "ejector" to; sucking vapor from this to an evaporator, in which low pressure and ambient temperature is maintained.
The vapor flows come together in the diffuser of said "eductor" and condense out in a common condenser, in which the vapor has a pressure which is in between that of the water heater and that of the evaporator.
As the liquid levels in both of them, the boiler and the evaporator, decrease during operation, be intermittend liquid "charges" is fed to this by means of the action of gravity. From the condenser The apparatus, of this invention is therefore carried out for it with the condenser vertically above the boiler, the latter is then inserted again. Vertically above the evaporator
The "re-load" of boiler and evaporator liquid requires at least two valves and simple limited instrumentation. The heating of the boiler can be done in several ways: eg gas heating or by heat exchange from a hot liquid, which by a tube-coil, which is arranged inside the water heater. The latter may be, e.g. liquid by solar energy or "loss" heat heated.
A fl iangende of the temperature of the heat energy, which can be provided to the water heater must be the type of cooling fluid, which flows through the said apparatus, for thermodynamic reasons, to be selected.
Outside of the cooling systems, which are based on the well-known "Rankine" cycle, there are also other systems, such as for example, The "Brayton" cycle, which are used under special circumstances. It is also known that the cooling system is based on the Peltier effect,
Inventor also in the laboratory a new exotic cooling system construction, where "Brownian motion" energy along with 'zero' energy into DC electrical energy to be converted (reducing the "Brownian motion" means energy reduction of temperature) .
The applications of the technology of the present invention are preferably in the area of higher cooling capacities: for example, the air conditioning of a house or larger, or bv the cooling of long refrigerated transport trailer, wherein the heat energy, by the exhaust of the engine of the tractor is

produced is used for heating the boiler described in the cooling system.

Description.

(a) Design.

The thermodynamic "loop" processes, which are specific to the method of this invention, two parts in common, namely those which take place in the "ejector" and that happen in the condenser. For the proper functioning of the technology must meet a number of conditions must be met:

(1) The type of cooling fluid must be in "generally be appropriate to the temperature of the heat energy source.

(2) in order to keep the "re-charge" times for the boiler and evaporator as low as possible, the volume of the condenser must be significantly larger than the volumes of each, the heater and the evaporator. The electrically operated valve between the boiler and condenser of relatively large size must be and a smaller liquid container, which is placed at the evaporator in the "re-load" line must communicating with the condenser and the height of crane set between boiler and condenser are disposed. Short "re-load" times in effect, there is no rnerkbare reduce the cooling intensity can be observed during the "reload, because of the" thermal inertia "of the evaporator.

(b) Operation and Figure description.

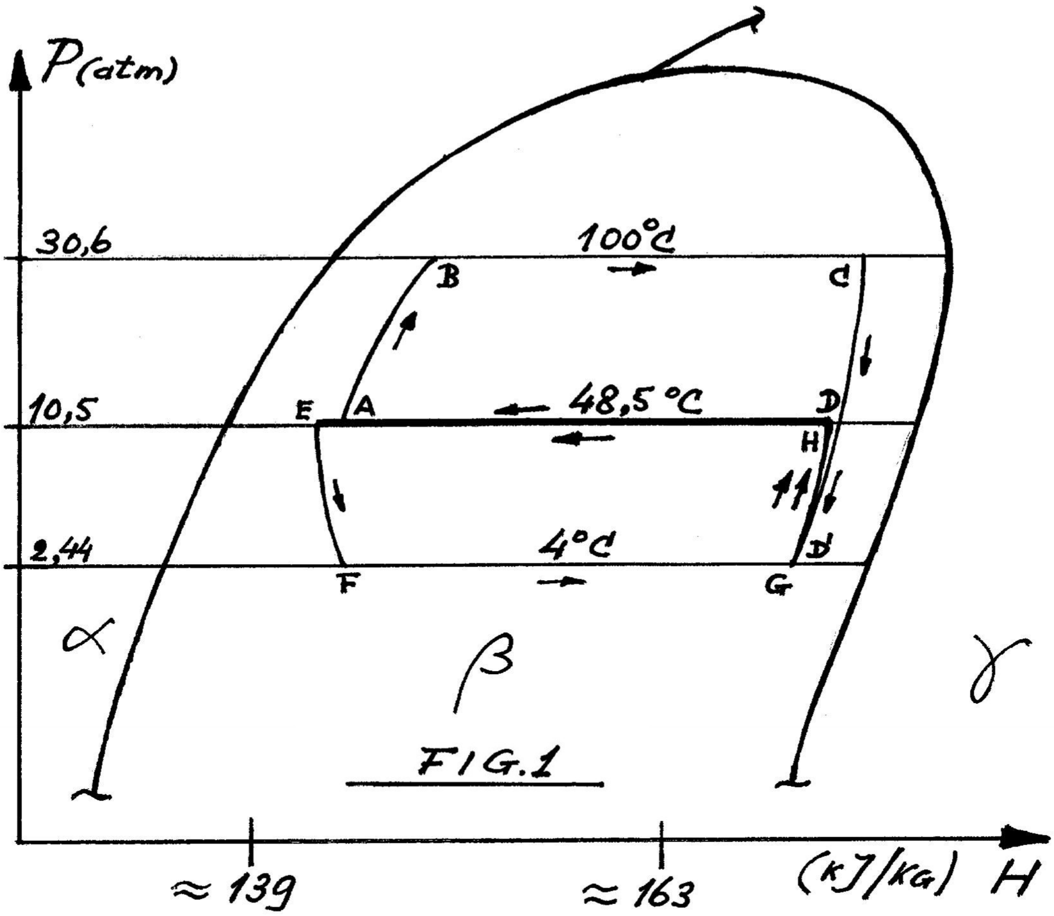

FIG.1

FREON-12

Figure 1 shows the approximate a "Pressure-Enthalpy 'diagram where each process" cycles "are shown. The driving circuit is: ABCD "-D and the refrigeration cycle is: EFGH.

The arrows indicate the process directions. B-C is the evaporation at high pressure in the boiler; FG is evaporating at low pressure and low temperature in the evaporator.
DAE gives condensing on both vapor streams that came together in the ejector CD "and GH. Areas: α , β and χ , respectively, indicate: '100% liquid, "bi-phase" and "100% vapor" to.
The numerical values, such as those shown in Figure 1, for the pressures and associated temperatures on the isobars, as well as the values for the Enthalpy at the X-axis, corresponding to a use of Freon-12 (Dupont, R-12) as a coolant.
The more recently developed coolants, eg type: 134-A, MP-39, MP-52, MP-66 show values, which are as much as 10% or more may be different from that of R-12.
Completely different coolants, the functioning of the technology of the present invention permit, may also be selected. (The example of F-12 and the naming of refrigerant 134-a herein, has direct relation to an application in the field of refrigerated transport, which applies as of today under development).
(The coolant type 134-A is permitted in N.America for automobile and road transport applications).

FIG. 2

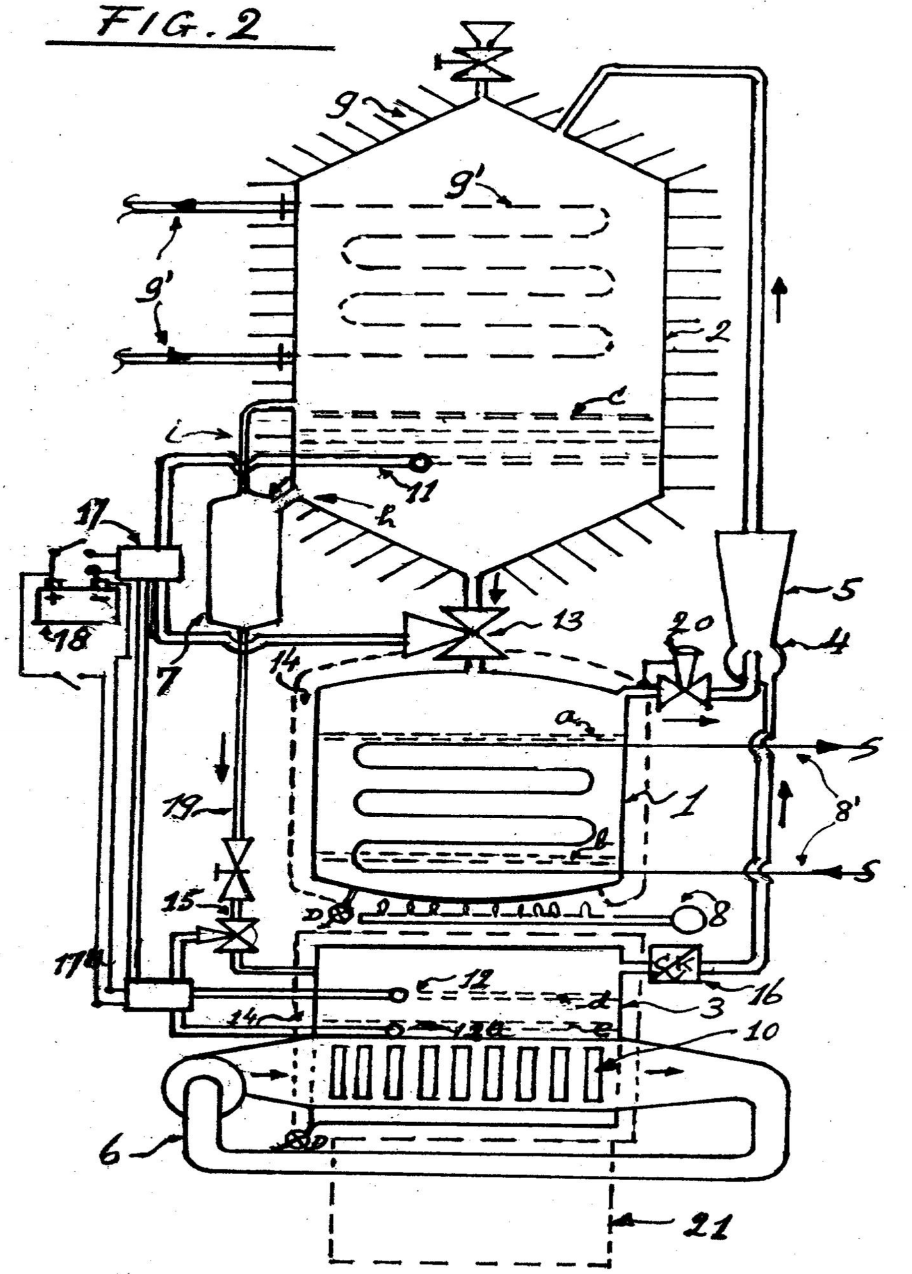

Figure 2 shows the schematic "layout" of the equipment of this invention.

Herein: (1) boiler; (2) Condenser; (3) evaporator; (4) "ejector" nozzle and venturi; (5) diffuser; (6) air-conditioning duct with fan; (7) communicating vessel with liquid to 'top up' of evaporator; (8) boiler heating; (8a) product heating heat exchanger inside tank; (9) cooling fins on condenser; (9a) any heat exchanger inside condenser; (10) channels within evaporator air passage; (11) low-level sensor; (12) high-level sensor; (12a) low-level sensor; (13) electrically operated "reload" tap, I; (14) insulation against heat transfer; (15) electrically operated "reload" crane, II; (16) check valve (check valve); (17) Control device for 'top-up' of boiler, (17a) Control Device "reloading" of evaporator, (18) battery, (19) led by communicating stock barrel to evaporator; (20) Adjustable pressure control valve , (21) cooling area; (d) drains, (a) high-level tank, (b) low-level boiler, (c) low-level condenser, (d) high-level evaporator, (e) low-level evaporator, (f) pipe evaporator "ejector", (g) leadership "ejector" condenser, (h, i) between (2) and (7).

Procedure:

1 Boiler (1) is sufficiently heated through (8) or (8a), eg coming from solar collectors, so that the vapor pressure in (1) becomes greater than adjusted by restriction (20).

As a result, vapor is at high speed from the nozzle into the venturi of the "ejector" (4); herein enters the vapor "co-rut effect" and evaporate by the relatively wide line (f), with easy working non-return valve (16), from evaporator (3) pulled away. In the diffuser (5) is converted back to pressure energy, a part of the kinetic energy ,(BernouiIli) which is the "mid-pressure" in condenser (2) is constituted; line (g) is relatively wide. The operation of "ejectors" depends on various parameters: size, molecular weight of gas / vapor drive - pressure / suction pressure ratio and temperature. Inventor (in equipment design) utilizes a diagram of DeFrate and Hoerl, Chem. Engineering, Progr. 55 Symp. Ser. 21, 46, (1959); This diagram is depicted in Periy's Chemical Engineer 's Handbook, Chapter 6-31.

The volume of the condenser (2) is greater (at least 5 times) than the volumes of boiler and evaporator together.

Reason for the volume ratio between the condenser on the one hand and the boiler and evaporator on the other hand, lies in minimizing the "reload" times for boiler and evaporator. Pursue

The process execution suing: low-level sensor (b) instructs control (17) to open the valve (13), a relatively large flow measure; occurs then immediate pressure equalization between (1) and (2), vapor from (l) shoot first upwards, then dumps liquid quickly (2) into (1) until the sensor (a) to (17) it divides crane (13) to close.

Due to the relatively large volume (2) is the final pressure after "reload" still close to the normal operating pressure (2) and the pressure it back quickly to the nonnaal operational level.

At the same time with the "re-charge of (1) the outflow stops by (20) and the" ejector "stops operation, there is increased pressure from (2), which is passed through the" ejector "in the direction of (3), which is prevented by non-return valve (16) and the pressure in the evaporator therefore almost not changed.

The volume Vande boiler Attn upper level (a) is designed such that the volumetric space above (a) is relatively low, which means that the relatively small volume of vapor after "reload" of (1) quickly comes to operating pressure, minirnalisering to the "top-up" period.

The "reload" of (3) takes place out of vessel (7) which has a volumetric size of roughly 1/3 - 1/5 of the liquid supply portion of (2).

Sensor (12a) instructs control (17a) to open valve (15) closes again when the sensor (12) which passes it on to (17a). Barrel (7) is outside, then the "reload" of (3), always full.

Location of the conduit (h) is very low to (2), and just above (13), thus filling (7) directly after the "top-ups" and (7) is filled rather than that level (c) is reached in (2) .

During the "reload" of (3) the evaporation therein and suction vapor "ejector" just keep going, if the "top-up" of (1) is not underway. Prevents both (1) and (3) simultaneously Would "reload". Using a relay circuit between (17) and (L7A) As a whole, is considered: This cooling system is volumetric 2-3 times as large as the conventional systems; construction costs of implementation are about the same (the expensive compressor is eliminated).

Operating costs, if heat loss or heat generated is used alternatively, are virtually nil.

Conclusions.

1 A method, in which a thermodynamic process, ie a so-called "left-folding," "Rankine" cycle, the cooling process is driven by a thermodynamic process, ie a so-called "right-folding," "Rankine." - cycle, said heating process, wherein said pulley is driven by means of a forced draft of a "ejector", which are circuit-walk connects and where both circuits have a common condenser, from which, intermittent, "top-ups" occur of (a) the water heater in said "right-folding," circuit and (b) the evaporator-mentioned 'left-folding, "cycle. Named "top-ups" are controlled using sensors, two control valves and limited electrical circuit.
2. A method, as in (1), whereby an adjustable pressure regulator is provided in the aanblaas line of said "eductor".
3. Method A, as in (1) and (2), wherein a non-return valve is arranged in the suction line of said "eductor".
4. A method, as in (1), (2) and (3), wherein said condenser level-wise above the said cylinder is mounted vertically.
5. Method A, as in (1) T / m (4), wherein said cylinder-wise level above said evaporator is mounted vertically.
6. One method, referred to as a boiler in any of the preceding claims, wherein heating means are provided below, or inside,.
7. A method, as in any of the preceding claims, wherein cooling means are arranged on the outside of, ofbinnen, said condenser.
8. Method A, if any of the preceding claims, wherein a high-and a low-level sensor being disposed within said water heater, to which "top-up" of the said boiler mentioned can effectuate. In
9. A method, as in any of the preceding claims, wherein a high-and a low-level sensor being disposed within said evaporator, which is 'top-up' of the said said evaporator can effectuate.
10. A method, as in any of the preceding claims, wherein an electrically operated valve is disposed between said condenser and said boiler.
11. A method, as in any of the preceding claims, wherein in addition to the lower part of said condenser a communicating vessel is placed so that the bottom of a pipe is connected with said lower part of said condenser and at the top has a conduit connection to the upper vapor part of said condenser.
12. A method, as in any of the preceding claims, wherein an electrically operated valve is disposed between said communicating vessel and said evaporator.
13. Method A, as in (6), wherein said product heating means below said one gas boiler ofbrandstof-heater is fed.
14. Method A, as in (6), wherein said product heating means within said boiler is made up of heat exchanger, which is connected to a hot fluid source of heat with two conduits through the outer wall of the said boiler to go.
15. Method A, as in (7), said cooling means, which are arranged on the outer surface of said condenser, cooling fins.
16. Method A, as in (7), said cooling means, which are arranged inside said condenser is a heat exchanger, with which two pipes are connected by the back wall of said condenser, with the coolant source.
17. A method, as in any of the preceding claims, wherein cooling fluids are used, which are substitutes for the fluorochlorohydrocarbonen.
18. Equipment as in any of the preceding claims, consisting of a number of main components:. (A), in which connection components: (b) are connected, which together with control components: (c) allow a process-liner, wherein a "right-turn-income" "Rankine" cycle a "left-folding, 'Rankine' cycle drives, namely
(a) a condenser with a liquid accumulation portion, level-wise mounted above, a boiler, which are level-wise positioned at the top, an evaporator.

(b) a pressure restrictor / regulator, an "ejector" with diffuser attached to them, a check valve, an electrically operated valve between the condenser and boiler, a communicating vessel to the lower portion of said condenser, an electrically operated valve between said communicating vessel and said evaporator, lines between all parts as mentioned above under (a) and (b).
(c) high-and low-level sensors in said boiler and evaporator said signal-activators (for ratification of electrically operated valves) associated with boiler and evaporator, an AC or DC voltage source.
19. Equipment, as in (18), wherein said pressure regulator between said boiler and said "eductor" is mounted.
20. Equipment, as in (18) and (19), wherein said diffuser of said "eductor" is connected to the top of said condenser.
21. Equipment, as (18), (19) and (20), wherein said non-return valve between the ejector "said", and said evaporator in the vapor suction line is mounted.
22. Equipment, as in (18) tfm (21), wherein said communicating vessel with two pipes connected to the lageer both upper portion of said condenser
23.Equipment, as in (18) T / m (22), wherein between the lower part of said condenser, and a boiler said electrically operated valve is mounted.
24.Equipment, as in (18) T / m (23), wherein between the lowest part of said communicating vessel and said evaporator an electrically-operated faucet is mounted
25.Equipment, as in (18) T / m (24), wherein a high and a low level sensor being disposed within said water heater.
26.Equipment, as in (18) T / m (25), wherein a high and a low level sensor being disposed within said evaporator.
27.Equipment, as in (23) and in (25), said electric valve and said level sensors are connected to a signal-to-activator.
28.Equipment, as in (24) and (26), said electric valve and said level sensors are connected to a signal-to-activator, unlike in claim (27).
29.Equipment, as in (27) and (28), wherein said signal-activators are energized continuously by a DC or AC power source.