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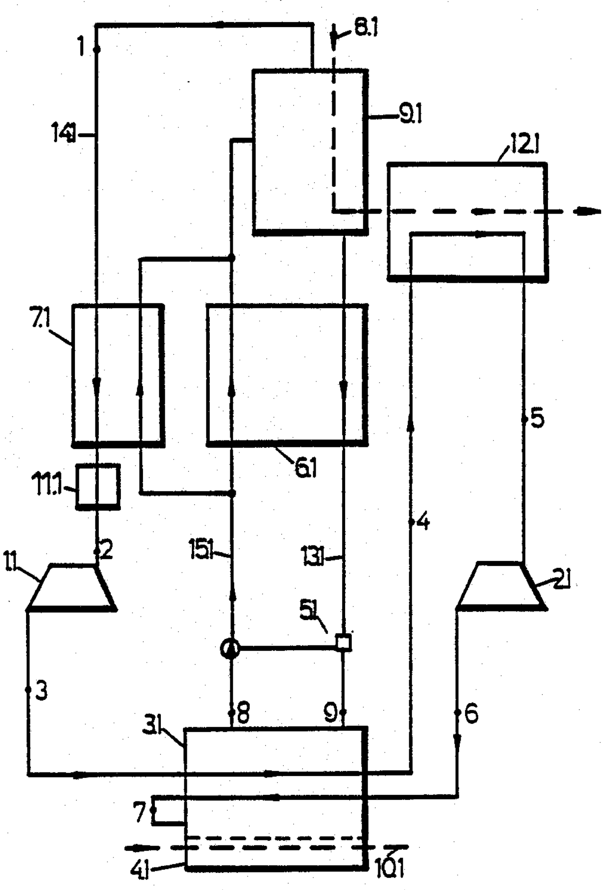
(57) Abstract

A multicomponent working fluid consisting of a lower boiling point component "solute" dissolved in higher boiling components "absorbant", is pumped as a liquid (15.1) to a high working pressure. The liquid is heated up in a steam generator (9.1) and is partially evaporated, splitted into a gaseous working fluid (14.1) consisted mainly from the lower boiling component and a lean solution (13.1) with respect to lower boiling component. After successive reheatings and expansions the gaseous working fluid is absorbed by the lean solution returning to absorber (14.1). The purpose of this procedure is to increase the thermal efficiency of the cycle by expanding the gaseous working fluid to a low temperature and by reducing the heat amount rejected to ambient.



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HEAT CONVERSION INTO MECHANICAL WORK THROUGH ABSORPTION- DESORPTION

DISCRIPTION

RELATED APPLICATION: The usual way of converting heat into mechanical work (and then electricity) is based on the Ranking cycle. A liquid (water) is heated up to s··per heated steam. Expanding the steam through a turbine, work is produced.The saturated steam at the turbine exit is condensed, at the same time rejecting heat to the ambient and subsequently compressed to a higher pressure level before being heated again.

In an improvment of Ranking cycle a system of multicomponent working fluid is utilized. This system operates on the principle that a binary working fluid is pumped as aliquid to a higher pressure level. It is heated in a steam generator to partially vaporize the working fluid. The vaporized working fluid is expanded through a turbine to transform its energy to usable form. The remaining liquid working fluid returns to an absorber where it is mixed with the expanded gaseous working fluid, to regenerate the initial multicomponent working fluid.

Applicant has improved the above system mainly by adding the following processes:

Preheating of the pumped multicomponent working fluid by heat recovered from the evaporated gaseous working fluid leaving steam generator;

reheatings of the expanded through the turbine gaseous working fluid, from the absorber or another heat source that has a temperature equal or lower the ambient temperature.

reexpanding of the reheating gaseous working fluid.

NEW: A multicomponent working fluid consisting of a lower boiling point component "solute" dissolved in higher boiling components "absorbant", is pumped as a liquid to a high working pressure. The liquid is heated up in a steam generator and is partially evaporated, splited into a gaseous working fluid consisted mainly from the lower boiling component and a lean solution with respect to lower boiling component,

After successive reheatings and expansions the gaseous working fluid is absorbed by the lean solution returning to absorber.

The purpose of this procedure is to increase the thermal efficiency of the cycle by expanding the gaseous working fluid to a low temperature and by reducing the heat amount rejected to ambient.

This invention relates to a method of generating energy in the form of useful energy from a heat source. The new thermodynamic cycle developed from this method has an improved heat utilization effeciency, compired with thermodynamic cycles which are in commercial application now and utilize heat sources available at the same temperature.

In accordance with one aspect of this invection, a method of generating energy comprises:

(a) Pumping an initial multicomponent working fluid streamin liquidstate having an initial composition of lower and higher boiling components to relatively high pressure;

(b) Su jecting said multicomponent working fluid stream to partial distillation in a distillation system, called steam generator, by means of heat to generate working fluid fractions of differing compositions;

(c) recovering heat from the one working fluid fraction which is a liquid lean solution and is impoverished with respect to the lower temperature boiling component, by heating aportion of the pumped initial multicomponent working fluid stream;

(d) recovering heat from the second working fluid fraction, which is a gaseous working fluid, and is enriched with respect to a lower temperature boiling component, by heating a portion of the initial pumped multicomponent working fluid;

(e) expanding the said liquid lean solution at a pressure relatively lower that the distillation pressure;

(f) expanding the said cooled gaseous working fluid through a turbine to transform its energy to useable form.

(g) condensing the spent gaseous working fluid in a main absorption stage by dissolving it with cooling in the lean solution at the pressure of the expanded liquid lean solution.

The expansion of the lean solution can be executed through a hydro-turbine which helps in pumping the initial multicomponent fluid, or through an expansion valve.

The gaseous working fluid released in the steam generator may be flashed to separate high and low boiling working fluid, depending on the conditions of temperature, pressure and comcentration prevailing in the steam generator as well as the particular multicomponent working fluid.

In an embodiment of the invention, the gaseous working fluid released in the steam generator may be super heated instead of cooled, the other steps of the method remaining the same. Cooling of the gaseous working fluid released in the steam generator, by means of heat recovery from the multicomponent working fluid, decreases the heat requirments of the cycle and increases the thermal efficiency of the cycle.

The expanded gaseous working fluid may be successively reheated and expanded one or more times. When the gaseous working fluid is expanded to a temperature lower than the ambient temperature, reheating may take place from a heat source at ambient or even lower temepratura. In this way, cogeneration of power and refrigeration is possible. Besides, a power cycle which rejects condensation heat at a temeprature lower than the ambient temeprature and a thermodynamic cycle converting heat of the ambient to useable work has been achieved. Applicant believes that this is an improvement of existing systems.

The method may include repe titions of the steps of

(a) reheating the expanding gaseous working fluid;

(b) expanding the reheated gaseous working fluid through a turbine to transform its energy into useable form.

The heat required for the reheatings may be selected from one or more members of the group comprising:

(a) a portion of the heat released in the absorber during condensation (absorbtion) of the gaseous working fluid;

(b) a heat source at ambiant temperature like ambient air or water.

(c) a heat source at a temperature lower than the ambient temperature.

(d) a heat source from another power cycle from the steam generator heat source, or any other heat source at convenient temperature.

When reheating from the absorder takes place, the absorber may be divided into two stages. The first stage rejects heat to the ambient and the second stage rejects heat to the gaseous working fluid. The second stage may therefore be kept at a temperature lower than the ambient temperature. This lower temperature gives the ability to increase the concentration in lower boiling component of the initial multicomponet fluid or to decrease the pressure of a portion of the condensing gaseous working fluid.

The method may include the steps of:

(a) dividing the absorber into two stages;

(b) reheating the gaseous working fluid which has been expanded to a temperature below the ambmient temperature, from the second stage of the absorber;

(c) expanding the gaseous working fluid through a turbine to transform its energy to useable energy while a portion of the gaseous working fluid leaves the turbine from an intermidiate stage;

(d) reheating the gaseous working fluid from the second stage of the absorber;

(e) condensing a portion of the gaseous working fluid in the first stage of the absorber and the other portion in the second stage of the absorber;

(f) pumping the reformed liquid working fluids from the two stages of the absorber to a common pressure level;

(g) mixing the two portions to reform the initial multicomponent working fluid.

Depending on the particular application, the temperature of the absorption may be high enough, to be used for space heating or objects heating.

The method may include the step of transfering the energy released in the absolber to use it for space or objects heating.

The heat source which is used in the steam generator to heat and partially evaporate the multicomponent working fluid may be selected from one or more members of the group comprising;

(a) The heat released at the absorber of another thermodynamic cycle as it has been described above;

(b) the heat released at the condender of a Ranking power cycle.

(c) the heat released from an internal combustion engine including heat released for cooling the engine and flue gases heat;

(d) solar, geothermal or any other heat source,like fuel burningor stored heat.

The initial multicomponent working fluid may be totally or partially evaporated.

The evaporated working fluid is superheated and expanded through a turbine. The expanded working fluid is cooled, so that a liquid consisted mainly of the higher boiling working fluid is greated.

The remaining gaseous working fluid consisted of the lower boiling working fluid is expanded through a turbine to a lower pressure level than that of the higher boiling working fluid condensation pressure. The condensed working fluid is subcooled and expanded to a lower pressure level where the lower boiling working fluid is finally absorbed.

The gaseous working fluid released in the absorber may undergo a multithermal compression so that the working pressure will be increased.

The method may conveniently include the repeated steps of:

(a) absorbing the gaseous working fluid released at steam generator (Gi) by a multicomponent working fluid;

(b) pumping the liquid working fluid greated by the absorption;

(c) heating the working fluid by heat recovered from the lean solution leaving steam generator (Gi + 1) and gaseous working fluid leaving steam generator (Gi + 1);

(d) Partially evaporating the working fluid to produce a lean liquid solution and a gaseous working fluid.

The working fluids involved in this multi heat compression are not necessarily the same.

To avoid heat of vaporization a modification can be made to the method based on different solubility of a working fluid in an intermediate absorbent fluid.

At least two different substances are used in solutions with a common working fluid.

The first solution is a weak absorbent fluid and the second is an intermediate absorbent fluid.

The intemediate fluid is used in one stage of the absorber to concentrate the weak absorbent solution by solvent extraction.

This method includes the steps of:

(a) absorbing a gaseous working fluid by weak asborbent fluid;

(b) concentrating the absorbent fluid by absorbent extraction using an intermediate absorbent fluid which absorbs part of the dissolved gaseous working fluid;

(c) using again the weak absorbent fluid to absorbe the gaseous working fluid;

(d) pumping the intermediate absorbent fluid which is enriched in dissolved gaseous working fluid to a higher pressure level;

(e) heating said enriched intermediate absorbent fluid to a higher temperature, generating two fluid streams, the first condisted of the liquid phase of the component used as gaseous working fluid and the other condisted of impoverished intermediate absorbent fluid;

(f) exhanging heat between impoverished intermediate absorbent fluid going to absorbent and enriched intermediate absorbent fluid going to separator,

(g) Pumping the liquid phase of the said gaseous working fluid to a higher pressure level or expanding it to a lower pressure level.

(h) heating said liquid phase of the gaseous working fluid to generate super heated steam in the form of a gaseous working fluid;

(i) expanding said gaseous working fluid (super heated steam) to tramsform its energy to useable form.

(j) absorbing said expanded gaseous working fluid in an absorber to generate initial weak absorbent fluid.

In general, standard equipments such as heat exchargers, tanks, pumps, turbines and fittings of the type used in a typical Ranking cycle may be employed in carrying out the method of this invention. Applicant believes that the constraints upon materials of construction would be the same for this invention as for coventional Rankine cycle power or refrigeration systems.

The expansion of the working fluid from a charged high pressure level to a spent low pressure level to transform its energy to useable form may be effected by any suitable conventional means known to those skilled in the art.

In a preferred embodiments of the invention, the working fluid may be expanded to drive a turbine of conventional type.

In accordance with another aspect of this invention, a solvent is solid state is used instead of a liquid phase.The solvent cousists of peaces so that the contact area with the absorbed gas is greater.The heat transfer from absorber - cold tank - and to steam generator - heat tank - can be performed with any way known to those dealed in the art.

The equilibrium pressure increases with temperature.

When a substance in solid state that has absorbed a substance with low boiling point is heated up, the substance with low boiling point is released in gas phase.

The gas may expanded to couver its energy to useable form.The expansion takes place through a machine like a turbine to produce mechanical work.

In the exit of the turbine the gas is absorbed by another substance in solid state.Cooling by heat rejection takes place in the same time and this substance is called cold tank. The substance which is heated to release gas is called heat tank.

The couple of the substances i.e. the heat tank and the cold tank may have the same or different composition.

The role of the two tanks is reversed.

The tank that has been cooled to absorb the gas is now heated to release the gas.The gas is expanded again through the turbine.In the exit of the turbine, the gas is absorbed by the other tank which is now cooled (which in the first step was heated).

These steps are repeated.

In this case no pump is used.

DRAWINGS

FIG. 1. shows a schematic representation of one system for carry out the method of the invection.

FIG. 2. shows a schematic representation of another system for carry out the method of the invection recovering absorption heat in order to heat the initial multicomponent working fluid.

FIG. 3. shows a schematic representation of another system for carry out the method of the invention, using an intermediate absorbent fluid.

FIG.1 of the drawings, refers generally to one embodiment of a thermodynamic system or cycle in accordance with this invention.

This system or cycle comprises a main steam generating stage 9..1 a first turbine 1.1 and a second turbine 2.1 , a first absorption stage 4.1. and a second absorption stage 3.1, a hydroturbine 5.1, a first heat exchanger 6.1. and a second heat exchanger 7.1. a flashing system 11.1 and another heat exchanger 12.1.

In use, using an ammonia - water working solution as a binary working fluid,liquid solution of ammonia-water at lower pressure is pumped from the first 4.1. and second 3.1. absorption stages through a hydro-turbine 5.1. to the higher steam generator pressure level.

This is an enriched in ammonia, liquid solution. This solution is splitted into two streams .

The first stream is heated through the heat exchanger 6.1. by the lean solution that flows along line 13.1 to the absorber.

The second stream is heated through the heat exchanger 7.1. by the gaseous working fluid which leaves steam generator. 9.1. along line 14.1.

The two preheated stream are driven to the stea: generator 9.1. along line 15.1. the solution is heated in the steam generator by a heat source 8.1.

In this way two fluids of differing composition are created. The first one is a lean liquid solution which is impoverished in ammonia.

The second one is a gaseous working fluid enriched in ammonia. The lean solution having a high temperature and pressure is cooled through heat exchanger 6.1., where its heat is recovered by the rich solution, then expanded through hydro-turbine 5.1. and finally enters absober along line 13.1.

The gaseous working fluid, is cooled through heat exchanger 7.1, where its heat is recovered by the rich solution, flashed through flashing system 11.1. and enters turbine 1.1. It is expanded through the turbine 1.1. transforming its energy to mechanical work. The gaseous working fluid exits turbine at a temperature lower than the absorber temperature and is reheated from the second stage of the absorber 3.1. through a heat exchanger. The reheated gaseous working fluid is expanded through the turbine 2.1 to transform its energy to mechanical work, reheated through absorption stage 3.1. and enters absorber where it is absorbed by the lean solution and forms the initial rich solutions.

The first stage of the absorber 4.1. is cooled by a working fluid stream like airor water through 10.1.

FIG. 2. of the drawings refers generally to another embodiment of a thermodynamic system or cycle in accordance with this invention.

This system or cycle comprises a steam generating stage 9.2, a turbine 1.2 a first absorption stage 4.2 and a second absorption stage 3.2, a hydro-turbine 5.2. heat exchangers 6.2. and 7.2 and a flashing system 11.2

In use, using an ammonia water working solution as a binary working fluid,initial solution in liquid state, of ammonia-water at low pressure is pumped from the first 4.2 and second 3.2. absorption stages through a hydro-turbine 5.2. to the higher steam generator pressure level along line 15.2. The said liquid solution is preheated through the absorption stages 4.2. and 3.2. and then it is heated through a steam generator. 9.2. Two fluid streams are generated. The first one is a lean liquid solution which is improverished in ammonia and which is cooled along line 13.2 by initial solution and or ambient air in heat exchanger 6.2. and expanded through a hydro-turbine or an expansion value 5.2.

The second fluid stream is a gaseous working fluid enriched in ammonia which is cooled along line 14.2 by initial solution or ambiant air in heat exchanger 7.2.

The gaseous working fluid is expanded through the turbine 1.2 to produce useable work, and then it is reheated through absorption stage 3.2, and enters absorber 4.2. and 3.2. where it is absorbed and condensed to generatc initial solution.

Fig. 3 refers to another embodiment of a thermodynamic system or cycle in accordance with this invention.

The system or sycle represented by this figure comprises a first stage of an absorber 4.3, a second stage of an absorber 3.3. a hydro-turbine 5,3 a pump 15.3 a first stage of a sepasator 16.3 a second stage of a separator 17.3. a steam generator 9.3 and a turbine 1.3,

In use, using water as a liquid-gaseous working fluid, LiBr-water as a weak absorbent and acetophenone as anintermediate absorbent, a gaseous working fluid is absorbed by the weak absorbent in the first stage of absorber 4.3.

The intermediate solution absorbs water from the weak solution in the second stage absorber 3.3.

The consentrated weak solution impoverished in water, flows along line 18.3, to be used again for absorbing the gaseous working solution. The enriched in water intermediate absorbent is pumped to the separator 16.3 where it is heated.

The solubility of water is decreased when temperature increases and a fluid stream of impoverished in water intermediate absorber returns to absorber 3.3. along line 19.3 after having been expanded through hydro-turbine 5.3, while water is pumped through pump 15.3 along line 20.3 to steam generator 9.3, Water is heated in steam generator and a gaseous working fluid in the phase of superheated steam is generated. The gaseous working fluid is expanded through the turbine 1.3 and enters absorber.

A case study was prepared to illustrate the advantages of the system in accordance with this invention. The multicomponent system is a binary system of ammonia-water. The lower boiling component is ammonia and the higher boiling component is water.

The parameters for the theoretical calculations which were performed again utilizing standard ammonia-water enthalpy/concentration diagrams are setout in Table 1 below . The points refered are in accordance with FIG. 1.

No heat losses have been considered. Flashing of the gaseous working fluid has been neglected.

TABLE 1

Point No	Temperature °F	°C	Pressure Psi	Kg/cm²	Enthalpy Btu/lb	Kcal/kg	Concentration NH_3 weight fraction
1	248	120	200	14	732	406,6	
2	190	87,7	200	14	698	387,7	
3	32	0	60	4.2	620	344,4	
4	68	20	60	4,2	643	357,2	
5	164	73,3	60	4,2	700	388,9	
6	-38	-38,9	11,5	0,8	600	333,3	
7	68	20	11,5	0,8	655	363,9	
8							0,3
9							0,27

The work produced is the sum of the work produced from turbine 1.1 and turbine 2.1 This work is the enthalpy change between turbine inlet and outlet.

$W = W_1 + W_2 = (698 - 620) + (700 - 600) = 178$ Btu/lb.

= 98,9 Kcal/Kg

The heat requirment has been estimated to be Q=505 Kcal/kg

The thermal efficiency is equal to $n = \frac{W}{Q} = \frac{98,9}{505} = 0.19$

Another example is presented where the solvent is solid statephase and no pump is required .

The solid substance is a metalic hybride.It is $LaNi_{4,7}Al_{0,3}$ having absorbed a substance of low boiling point.This substance is hydrogen (H_2).

The equilibrium pressure is:

$$llp = -\frac{4090}{T} + 12.84$$

Applying the temperature of Tn =473 K as a high temperature at the heat tank and the temperature T_c =273 K as a low temperature at the cold tank the following pressures result:

P_h=66,2 bar at the heat tank and P_c= 0,11 bar at the cold tankd.

The work produced by the turbine is w=740 Kcal/Kg.

The heat required at the heat tank to release hydrogen is:

Q=ΔH=16870 KI/kg ≅4035 Kcal/kg.

The therual efficiency is :$n=\frac{w}{a}=\frac{748}{4035}=0,18$

Let's note that all the processes are considered ideal.

CLAIMS:

1. A method and apparatus for implementing a thermodynamic cycle for energy conversion into useable form by using a multicomponent working fluid stream consisted of lower and higher boiling components, called solution, and comprising the steps of:

Pumping of a rich liquid solution(s) which exist(s) in an absorber and which is enriched in lower boiling component,to a uniform pressure;

mixing of rich liquid solutions if they are more than one, to form a uniform liquid solution;

heating of a part of said rich liquid solution using heat recovered from a hot lean liquid solution leaving a steam generator.

heating of a part of said rich liquid solution using heat recovered from a gaseous working fluid leaving the steam generator;

heating the total said rich liquid solution in the said steam generator by a heat source,so that two fluid streams are generated, the first being the said gaseous working fluid enriched in lower boiling component and the second being the said lean solution impoverished in lower boiling component;

expanding said lean liquid solution having left the steam generator and cooled, through an expansion valve or a hydro-turbine which hydro-turbine,when used,may help pumping the said rich solution leaving absorber;

flashing said gaseous working fluid, if necessary, to separate higher boiling component steam that may be condensed during expansion;

expanding said gaseous working fluid released in the steam generator and having transfered part of its energy to said rich liquid solution, through a turbine to transform its energy into usable form, the expansion taking place in one or two pressure levels depending on the stages of the absorber;

reheating of said gaseous working fluid by absorbing heat from the absorber and/or another heat source, the absorber kept in one temperature range or devided into two stages and the reheatings taking place in one of the stages so that it will remain in a lower temeprature having the same or a lower pressure;

reexpanding of said gaseous working fluid through a turbine to transform its energy into usable form, such reheatings and reexpansions taking place n times where $n \geq 0$;

absorbing the said working fluid in the absorber by the said lean solution, entering absorber after having been expanded to regenerate the initial rich solution(s) for reuse;

removing heat released in the absorber, if any, by a working medium that may be used for heating space and objects.

2. A method and apparatus for implementing a thermodynamic cycle consisted of combinations of thermodynamic cycles as they have been described in claim 1,

in which the heat released at the absorber of one cycle is used as a heat source at the generator of another cycle in order to heat the rich solution of that cycle, the solutions used to those cycles not being necessarelly the same.

3. The method and apparatus of claim 1 including additional thermal compressions, each thermal compression comprising the steps of:

absorbing the gaseous working fluid released at the steam generator (Gi) and having given part of its energy to rich solution entering steam generator, by a liquid solution.

compressing the produced rich liquid solution;

heating of the compressed rich liquid solution by heat transfered from a lean solution leaving a generator (Gi+ 1) and by the gaseous working fluid leaving steam generator (Gi+1);

heating of the solution by a heat source;

expanding the lean solution leaving steam generator G.. and having been cooled by said rich solution, through a hydro-turbine helping in compressing the said rich solution;

4. The method and apparatus of claim 1 including the steps of:

compressing a liquid working fluid;

heating of said liquid by a heat source producing superheated steam;

expanding the superheated steam to tranform its energy to usable form;

sucessive reheatings and reexpandings of said steam to transform its energy to usable form;

condensing the said steam in a condenser which condenser is at the same time the steam generator of the power cycle described in claim 1, transfering in this way the condensation heat of said steam, which is the heat source of the steam generator, to the working solution of the cycle described in claim 1.

6. The method and apparatus of claim 5 including the steps of;

burning a fuel in an internal combustion engine producing power;

cooling that engine, which consists part of the steam generator of the cycle, using the rich solution after having been compressed and heated by the lean solution as a coolant,releasing in this way part of the gaseous working fluid;

releasing and superheating gaseous working fluid, heating the said coolant solution and gaseous working fluid already released,from fluegases of the said internal combustion engine.

7. A method and apparatus for implementing a thermodynamic cycle comprising the steps of:

burning a fuel in an internal combustion engine producing power;

cooling that engine by partly evaporating a working fluid which working fluid is circulated around said engine;

evaporating more working fluid and superheating the total evaporated working fluid from the flue gases produced by said engine which fluegases are cooled by exchanging heat with said working fluid;

expanding the super heated steam to transform its energy into usable form;

condensing said working fluid; and

compressing said condensed working fluid.

8. The method and apparatus of claim 1 wherein the sucessive reheatings take place in a space which is kept in temperature lower than that of the ambient, achieving in this way simultaneous refrigeration and convertion of heat available at ambient or even lower temperature, to usable form.

9. The method of claim 5 including the additional steps of:

producing energy by appling a Rankine power cycle wherein the condensation takes place at a temperature higher than the ambient temperature in a condenser which consists the steam generator of cycle described in claim 5;

transfering heat in this way from the condensing steam of Rankine cycle to the solution entering steam generator;

superheating of the gaseous working fluid leaving steam generator, in the boiler of said Rankine cycle;

transfering and using the heat released in the absorber at a proper temperature for space heating.

10. A method and apparatus of generating energy which comprises:

pumping a multicomponent wokring fluid consisted from lower and higher boiling components, from a lower pressure level prevailing at an absorber, to a higher pressure level prevailing in a steam generator;

Preheating said working fluid by passing it through the absorber and recovering heat released by absorption and condensation of a gaseous working fluid in that absorber;

heating said multicomponent working fluid by an external heat source;

Separating the two fluid streams generated by said preheating and heating processes of multicomponent working fluid;

recovering heat from the first of the said generated working fluid streams which is a lean solution impoverished in lower boiling component, by heating the initial multicomponent working fluid;

recovering heat from the other of said generated working fluid streams, which is a gaseous working fluid enriched in lower boiling component, by heating the initial multicomponent working fluid;

expanding said lean solution through an expansion valve or a hydro-turbine which helps inpumping the initial multicomponent working fluid;

entering said lean solution to the absorber;

expanding said gaseous fluid to transform its energy to a useable form;

reheating said gaseous working fluid from one stage of the absorber which is at the lowest absorber temperature range;

absorbing said gaseous working fluid entering absorber by the said lean solution and condensing it by means of cooling to generate the initial multicomponent working fluid, the cooling executed by mean of gaseous working fluid reheating,initial multicomponent working fluid preheating and anyother cooling medium if necessary.

11. A method and apparatus of generating energy which comprises the steps of:

bonding (.i.e. absorbing) a gaseous working fluid by an absorbent solution in an absorber;

using an extraction solution to extract said working fluid from the dilute absorbent solution generating a concentrated solution;

compressing said created extraction solution;

releasing said working fluid from the created extraction solution by changing the temperature of the created extraction solution in a separator;

returning the remaining extraction solution to the absorber;

using again the remaining strong absorbent solution to absorb said gaseous working fluid;

exchanging heat between the extraction solution returning to absorber and the extraction solution going to separator;

compressing or throttling the resultant working fluid;

heating the working fluid to create superheated steam;

expanding said superheated steam through a turbine to transform its energy into usable form;

reheating and reexpanding the gaseous working fluid n times, where $n \geqslant 0$;

12. The method and apparatus of claim 1 where in no heat is rejected to ambient.

13. The method and apparatus of claim 12 wherein heat at ambient temperature is added to the absorber.

14. The method and apparatus of claim 1 where in the heat source used, is at a temperature equal to the temperature of the ambient.

15. The method and apparatus of claim 1 where in at least a portion of condensation takes place at a temperature lower than the ambient temperature.

16. The method and apparatus of claim 1 where in the total multicomponent working fluid is vaporized and expanded through the turbine, producing energy, the higher boiling component is condensed, cooled and expanded to a lower pressure, while the lower boiling component is expanded through another turbine producing energy and finally is absorbed by the condensed higher boiling component.

5. A method and apparatus for implementing a thermodynamic cycle for energy conversiun into useable form by using a multicomponent working fluid stream, consisted of lower and higher boiling components called solution and comprising the steps of:

pumping of a rich liquid solution(s) which exist(s) in an absorber and which is enriched in lower boiling component to a uniform pressure;

mixing of the rich liquid solutions if they are more than one, to form a uniform liquid solution ;

heating of said rich liquid solution using heat recoverec from a hot lean liquid solution leaving a steam generator;

heating the said rich liquid solution in the said steam generator by a heat source, so that two fluid streams are generated the first being the gaseous working fluic enriched in lower boiling component and the second being the said lean solution impoverished in lower boiling component;

expanding said lean liquid solution having left the steam generator and cooled, through an expansion valve or a hydro - turbine which hydro - turbine, when used, may help pumping the said rich solution leaving absorber;

Flashing said gaseous working fluid, ifnecessary, to separate higher boiling component steam that may be condensed during expansion;

super heating said gaseous working fluid;

expanding said gaseous working fluid released in the steam generator and having transfered part of its energy to said rich liquid solution, through a turbine to transform its energy into usable form, the expansion taking place in one or two pressure levels depending on the stages of the absorber;

reheating of said gaseous working fluid by absorbing heat from the absorber and/or another heat source, the absorber kept in one temperature range or devided into two stages and the reheatings taking place in one of the stages so that it will remain in a lower temperature having the same or a lower pressure;

re expanding of said gaseous working fluid through a turbine to transform its energy into usable form, such reheatings and re expansions taking place n times where $n \geqslant 0$;

absorbing the said working fluid in the absorber by the said lean solution entering absorber after having been expanded to regenerate the initial rich solution(s) for reuse;

removing heat released in the absorber, if any, by a working medium that may be used for heating space and objects;

17. A method and apparatus for implementing a thermodynamic cycle by using a couple of tanks, consisted of substances

in solid state having bonded a substance of low boiling point, successively as heat and cold tanks and comprising the steps of:

-heating of the heat tank resulting in releasing part of the substance with low boiling point in gas phase and creating a solid impoverished in substance with low boiling point.

-gas expansion through a machine, like a turbine, so that the gas energy is converted to mechanical work and then to electrical power.

-bonding of the expanded gas by the cold tank with simaltaneous cooling of the cold tank, so that the pressure of the cold tank is lower than the pressure of the heat tank.

-heating of the said cold tank, which is a heat tank now, resulting in releasing part of the substance with low b.p. in gas phase and creating a solid impoverished in substance with low boiling point.

-gas expansion through the said turbine so that the gas energy is converted to mechanical work and then to electrical power.

-bending of the expanded gas by the other tank, which is now the cold tank and was the heat tank of the first step, so that the pressure is lower than that of the heat tank.

18. The method and equipment of claim 17 with the difference that the turbine is fed successively by three couples of tanks is utilized to preheat another tank and comprising the steps of:

-heating of heat tank of the third couple resulting in releasing part of the substance with low boiling point in gas phase and creating a solid impoverished in substance with low boiling point.

-preheating of the tank of the first couple that will be the next heat tank, by converting heat from the tank of the second couple that was the present heat tank and optionally simaltaneous heating of the first couple heat tank by the gas released from the third couple.

-gas expansion through a machine like a turbine, to convert its energy to mechanical work and then to electrical power.

-bonding of the gas by the other tank of the third couple that is now a cold tank ,with simaltaneous cooling.

-heating of the tank of the first couple that has been preheated through the tank of the second couple and the gas released by the third couple resulting in releasing part of the substance with low boiling point in gas phase and creating a solid impoverished in substance with low boiling point.

-preheating of the tank of the second couple that will be the next heat tank by heat transfer from the tank of the third couple that was the previous heat tank and optionally simaltaneous heating of the heat tank of the second couple by the gas released like the said turbine to convert its energy to mechanical work and then to electrical power.

-bonding of the gas by the other tank of the first couple which is now a cold tank, with simaltaneous cooling .

-heating of the tank of the second couple that has been preheated through the tank of the third couple and the gas released by the first couple resulting in releasing part of the substance with low boiling point in gas phase and creating a solid impoverished in substance with low boiling point.

-preheating of the tank of the third couple that will be the next heat tank, by heat transfer fromthe tank of the first couple that was the previous heat tank and optionally simaltaneous heating of the third couple by the gas released now from the second couple

-gas expansion through a machine like the said turbine to convert its energy to mechanical work and then to electrical power.

-bonding of the gas by the other tank of the second couple which is now a cold tank, with simaltaneous cooling.

-repeatition of the above steps with the difference that the role of the tanks has been reversed and those which were cold tanks are now heat tanks and visa versa.

19. The method and apparatus of claim 18 where more couples of tanks are used.

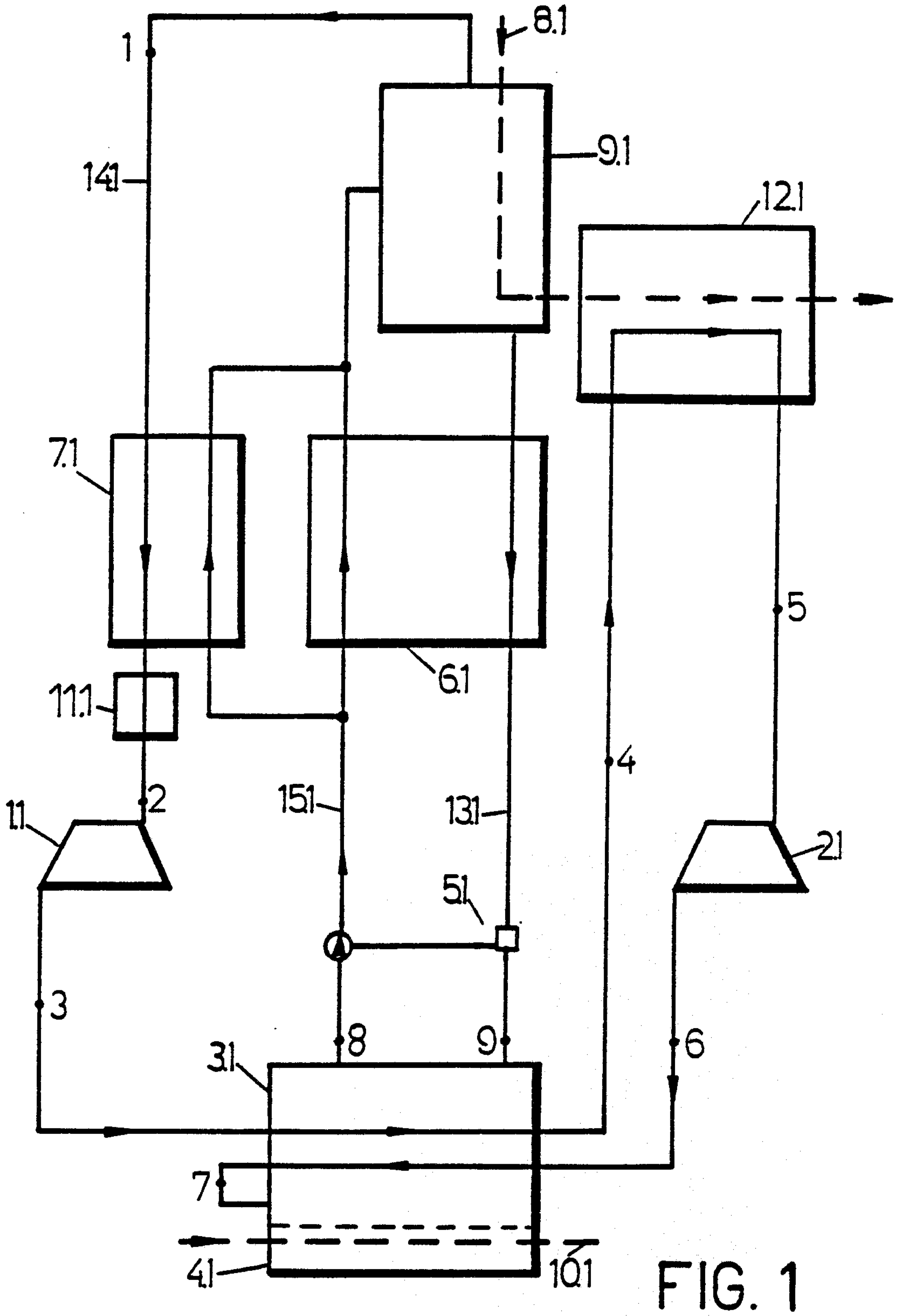

FIG. 1

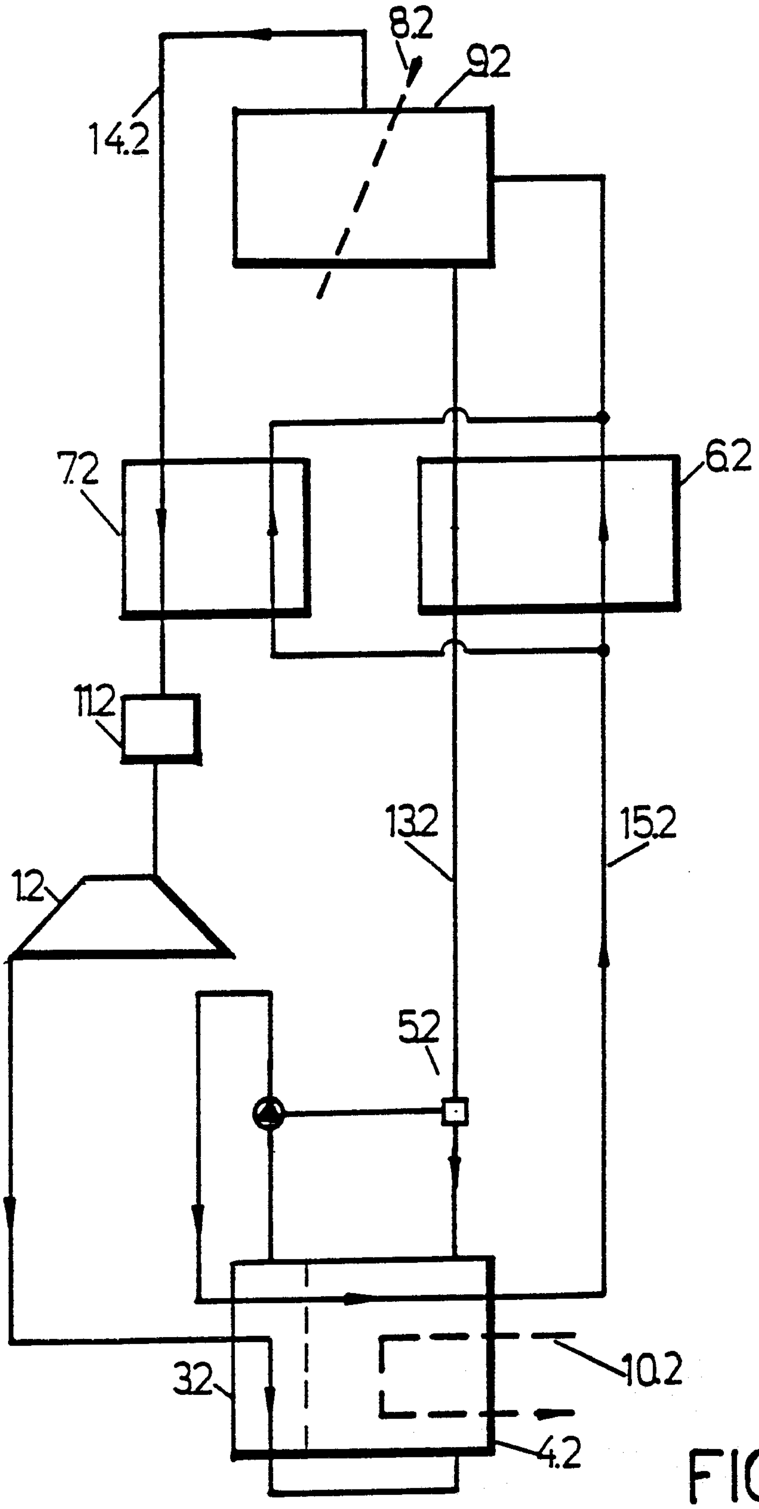

FIG. 2

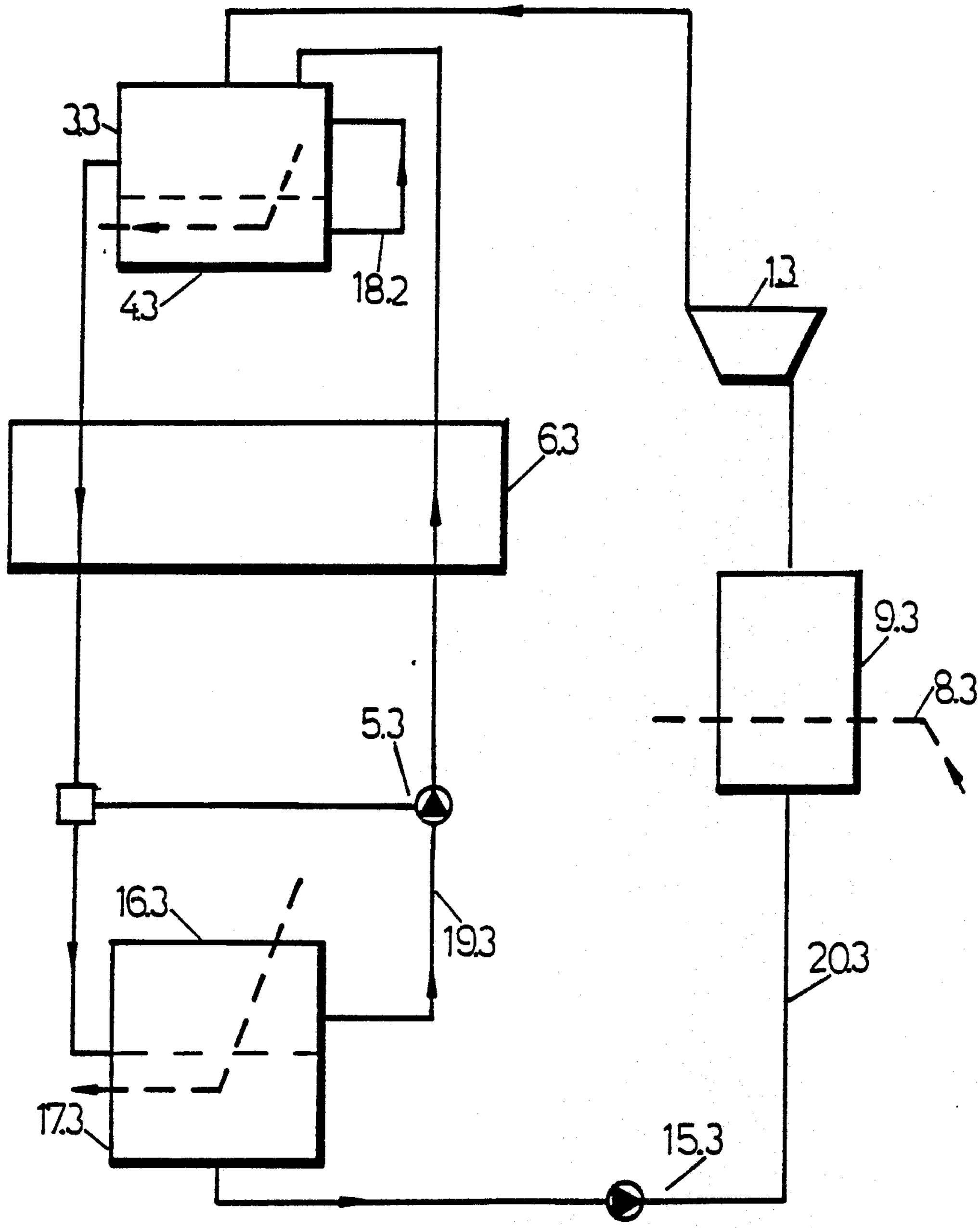

FIG. 3