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(54) Benævnelse: **APPARAT TIL KOMBINERET GENERERING AF SOLENERGI OG DAMP FRA EN EKSTERN KILDE**

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CN-U- 201 786 587
CN-U- 201 827 035
CN-U- 202 326 050
DE-A1- 19 723 543

DESCRIPTION

FIELD OF THE INVENTION

[0001] The invention relates to a power generation system using clean energy, and more particularly to a solar and external steam hybrid power generation system.

BACKGROUND OF THE INVENTION

[0002] With the decrease of reserves of traditional fossil fuels (coal, oil, natural gas), it has been a focus of widespread concern to look for a clean and renewable energy. Additionally, as environmental pollutions caused by use of fossil energy directly threatens human survival and development, it has become a worldwide consensus to emphasize and develop a clean and renewable energy and to decrease the emission of SO_2 and CO_2. Solar energy is advantageous in its wide distribution, unlimited servers, clean collection and utilization, and zero emission of SO_2 and CO_2. However, a large-scale development and utilization of concentrating solar power (CSP) have been largely restricted for a long time due to problems such as decentralization of the solar energy, strong dependence on weather, and instability and discontinuity of the thermal concentration. In modern large-scale industrial production, a large amount of waste steam byproduct is produced, which has a very low utilisation ratio. Thus, how to combine the waste steam with the CSP is an urgent problem to be solved for researchers in the technical field.

[0003] Document DE 197 23 543 A1 relates to an energy generating installation having a gas turbine driven by steam injection via a steam line.

SUMMARY OF THE INVENTION

[0004] In view of the above-described problems, it is one objective of the invention to provide a solar and external steam hybrid power generation system that can fully utilize waste heat produced by large-scale industrial production to overcome the shortcomings of conventional solar thermal power plants such as the dependence on weather and unstable and discontinuous thermal concentration.

[0005] To achieve the above objective, in accordance with one embodiment of the invention, there is provided a solar and external steam hybrid power generation system, comprising a solar steam generator, an external steam regulator, a turboset, and a power generator coupled to the turboset. A steam outlet end of the solar steam generator is connected to a high pressure steam inlet of the turboset via a first regulating valve. A steam outlet end of the external steam regulator is also connected to the high pressure steam inlet of the turboset via a second regulating valve and a second switch valve. A low pressure steam outlet of the turboset is connected to an input end of a condenser, and an output end of the condenser is connected to an input end of a deaerator. An output end of the deaerator is connected to an input end of a water feed pump. An output end of the water feed pump is connected to a circulating water input end of the solar steam generator via a first switch valve. The output end of the water feed pump is further connected to a water-return bypass of the external steam via a fourth switch valve whereby forming a circulation loop for the work of the external steam. The external steam regulator is configured to adjust the working conditions of the external steam so that the pressure and temperature of the external steam can meet the operating requirements of the turboset. Based on different working conditions, the external steam regulator is a temperature-decreased pressure reducer or a heat booster. The deaerator is configured to remove oxygen in the circulating water thereby preventing devices and pipes from oxidation and corrosion.

[0006] Preferably, the system further comprises a soft water storage tank. A water outlet of the soft water storage tank is connected a water inlet of the deaerator via a water supply pump, and a first pipe connecting the water outlet of the soft water storage tank and the water inlet of the deaerator is provided with a third regulating valve and a third switch valve. Consequently, a storage and replenishment system for the circulating water of the solar steam generator is constituted. The soft water storage tank is configured to store soft water prepared by a chemical water treatment device where the calcium and magnesium ions are removed, which can effectively prevent the internal fouling. The third regulating valve and the third switch valve control the supply and the flow rate of the soft water to supplement the circulating water according to actual loss.

[0007] Preferably, a second pipe close to the high pressure steam inlet of the turboset is provided with a pressure manometer and a thermometer. The arrangement of the pressure manometer and the thermometer is beneficial to the control of the pressure and temperature of the steam introduced to the turboset thereby meeting the operating requirements of the turboset.

[0008] As a first improvement of the invention, the solar steam generator comprises an overhead solar boiler and a plurality of heliostats matching therewith; an output end of a heat pipe of the overhead solar boiler is connected to the high pressure steam inlet of the turboset via the first regulating valve; and an input end of the heat pipe of the overhead solar boiler is connected to the output end of the water feed pump via the first switch valve. The thermal medium in the overhead solar boiler is water, no heat exchanger is involved, and the water is directly vaporized to yield high temperature and high pressure steam to drive the turboset. Thus, the power generation system has a simple structure and low production costs.

[0009] As a second improvement of the invention, the solar steam generator comprises an overhead solar boiler and a plurality of heliostats matching therewith; an output end of a heat pipe of the overhead solar boiler is connected to a thermal medium inlet of a regenerative heat exchanger via a fifth switch valve, and a thermal medium outlet of the regenerative heat exchanger is connected to an input end of the heat pipe of the overhead solar boiler via a heat pump; a steam outlet of the regenerative heat exchanger is connected to the high pressure steam inlet of the turboset via the first regulating valve; and a circulating water inlet of the regenerative heat exchanger is connected to the output end of the water feed pump via the first switch valve. The overhead soar boiler employs high temperature heat conduction oil as the thermal medium, such as heavy oil, paraffin, molten salts, liquid, or other known thermally conductive liquid mixture. For example, the heating temperature of a mixture of biphenyl and diphenyl oxide can reach 400°C. The high temperature thermal medium absorbs the solar energy and passes the thermal energy on to the water by means of the regenerative heat exchanger. The water is vaporized to yield high temperature and high pressure steam to drive the turboset to work stably, safely, and reliably.

[0010] As a third improvement of the invention, the solar steam generator comprises a plurality of solar vacuum heat pipes and a plurality of trough type parabolic reflectors matching therewith; output ends of the solar vacuum heat pipes are connected to the high pressure steam inlet of the turboset via the first regulating valve; and input ends of the solar vacuum heat pipes are connected to the output end of the water feed pump via the first switch valve. The thermal medium in the overhead solar boiler is water, no heat exchanger is involved, and the water is directly vaporized to yield high temperature and high pressure steam to drive the turboset. Thus, the power generation system has a simple structure and low production costs.

[0011] As a fourth improvement of the invention, the solar steam generator comprises a plurality of solar vacuum heat pipes and a plurality of trough type parabolic reflectors matching therewith; output ends of solar vacuum heat pipes are connected to a thermal medium inlet of a regenerative heat exchanger via a fifth switch valve, and a thermal medium outlet of the regenerative heat exchanger is connected to input ends of the solar vacuum heat pipes via a heat pump; a steam outlet of the regenerative heat exchanger is connected to the high pressure steam inlet of the turboset via the first regulating valve; and a circulating water inlet of the regenerative heat exchanger is connected to the output end of the water feed pump via the first switch valve. The overhead soar boiler employs high temperature heat conduction oil as the thermal medium, such as heavy oil, paraffin, molten salts, liquid, or other known thermally conductive liquid mixture. For example, the heating temperature of a mixture of biphenyl and diphenyl oxide passes the thermal energy on to the water by means of the regenerative heat exchanger. The water is vaporized to yield high temperature and high pressure steam to drive the turboset to work stably, safely, and reliably.

[0012] Working principle of the solar and external steam hybrid power generation system is described as follows. In daytimes when the sunlight is abundant, the second switch valve and the fourth switch valve are close, the first switch valve is open, and the solar steam generator operates to yield a high temperature and high pressure steam. The high temperature and high pressure steam is regulated by the first regulating valve to reach a rated pressure and a rated temperature, and transported to the turboset to do work for generating power. Steam after doing work is cooled by the condenser to form normal pressure and low temperature water which is transported to the deaerator for removal of the dissolved oxygen and then transported back to the solar steam generator via the water feed pump and the first switch valve for a next circulation. When the circulating water is required to be supplied, the third switch valve is open, and the soft water stored in the soft water storage tank is sucked by the water supply pump and is transported to the deaerator. The flow rate of the circulating water is regulated by the third regulating valve.

[0013] In night or rainy and cloudy days, the first switch valve is close, the first regulating valve stays at zero positions, the second switch valve and the fourth switch valve are open, and thus the external steam is introduced. The waste steam from large-scale industrial production is regulated by the external steam regulator and the second regulating valve to reach the rated pressure and rated temperature, and then transported to the turboset via the second switch valve to do work. The steam after doing work is cooled by the condenser to form normal pressure and low temperature water which is transported to the deaerator for removal of the dissolved oxygen and then transported back to the water-return bypass of the external steam via the water feed pump and the fourth switch valve whereby achieving the do-work circulation of the external steam.

[0014] Compared with the prior art, advantages of the invention are summarized as follows: the steam power of the designed power generation system comes from the clean and renewable power energy as well as the waste steam of the modem large-scale industrial byproduct. Compared with the power generation using the conventional fossil energy, not only is the emission of the SO_2 and CO_2 polluting the atmosphere avoided but also the waste heat resource is fully collected and utilized. Besides, the influence of fluctuation of the climate on the solar energy is alleviated. Thus, whenever day and night and whenever sunny day and cloudy day, the turboset is capable of stably running for power generation.

BRIEF DESCRIPTION OF THE DRAWINGS

[0015]

FIG. 1 is a schematic diagram of a solar and external steam hybrid power generation system according to Example 1 of the invention, in which, an overhead solar boiler matching heliostats directly supplies steam for a turboset;

FIG. 2 is a schematic diagram of a solar and external steam hybrid power generation system according to Example 2 of the invention, in which, an overhead solar boiler matching heliostats indirectly supplies steam for a turboset through heat exchange;

FIG. 3 is a schematic diagram of a solar and external steam hybrid power generation system according to Example 3 of the invention, in which, solar vacuum heat pipes matching trough type parabolic reflectors directly supplies steam for a turboset; and

FIG. 4 is a schematic diagram of a solar and external steam hybrid power generation system according to Example 4 of the invention, in which, solar vacuum heat pipes matching trough type parabolic reflectors indirectly supplies steam for a turboset through heat exchange.

DETAILED DESCRIPTION OF THE EMBODIMENTS

[0016] For further illustrating the invention, experiments detailing a solar and external steam hybrid power generation system are described below. It should be noted that the following examples are intended to describe and not to limit the invention.

Example 1

[0017] As shown in FIG. **1,** a solar and external steam hybrid power generation system primarily comprises: a solar steam generator, an external steam regulator **15,** a turboset **2,** and a power generator **1** coupled to the turboset **2,** a condenser **5,** a deaerator **6,** a water feed pump **7,** a soft water storage tank **9,** and a water supply pump **8,** which are assembled by pipes and valves. The valves comprise a first switch valve**16**, a second switch valve**19**, a third switch valve**21**, a fourth switch valve**23,** and a fifth switch valve**17** for controlling connection and disconnection of the pipes, and a first regulating valve**18**, a second regulating valve**20**, and a third regulating valve**22**for regulating the flow rate in the pipes.

[0018] The solar steam generator further comprises an overhead solar boiler **13** and a plurality of heliostats **14** matching therewith. The heliostats **14** are capable of tracing the sun to enable the sunlight to always concentrate on a heat pipe of the overhead solar boiler **13.** An output end of the heat pipe of the overhead solar boiler **13** is connected to a high pressure steam inlet **3** of the turboset **2** via the fifth switch valve **17** and the first regulating valve **18.** A steam outlet end of the external steam regulator **15** is also connected to the high pressure steam inlet **3** of the turboset **2** via the second regulating valve **20** and the second switch valve **19.** A second pipe close to the high pressure steam inlet **3** of the turboset **2** is provided with a pressure manometer **P** and a thermometer **T** for directly displaying pressure and temperature parameters of the steam.

[0019] A low pressure steam outlet **4** of the turboset **2** is connected to an input end of the condenser **5,** and an output end of the condenser **5** is connected to an input end of the deaerator **6.** A water outlet of the soft water storage tank **9** is connected a water inlet of the deaerator **6** via a water supply pump **8.** The third regulating valve **22** and the third switch valve **21** are disposed on a first pipe connecting the water outlet of the soft water storage tank **9** and the water inlet of the deaerator **6** for controlling the open and close of a water supply pipe and the volume of the supplying water. An output end of the deaerator **6** is connected to an input end of the water feed pump **7;** and an output end of the water feed pump **7** is connected to an input end of the heat pipe of the overhead solar boiler **13** via the first switch valve **16,** thereby forming a circulation loop of the solar steam generator. The output end of the water feed pump **7** is further connected to a water-return bypass**11** of the external steam via the fourth switch valve **23,** thereby forming a circulation loop for the work of the external steam.

[0020] Working process of the solar and external steam hybrid power generation system of Example **1** is as follows: in daytimes when the sunlight is abundant, the second switch valve **19** and the fourth switch valve **23** are close, the first switch valve **16,** the third switch valve **21,** and the fifth switch valve **17** are open, and the system runs at a concentrating solar thermal power generation state. At the time, the heliostats **14** trace the sunlight and concentrate the thermal energy of the sunlight on the heat pipe of the overhead solar boiler **13** to heat the circulating water therein to form a high temperature and high pressure steam. The high temperature and high pressure steam is output from the heat pipe of the overhead solar boiler **13,** regulated by the first regulating valve **18** to reach a rated pressure and a rated temperature, and transported to the turboset **2** to do work for generating power. Steam after doing work is cooled by the condenser **5** to form normal pressure and low temperature water at approximately 40°C which is transported to the deaerator **6**for removal of the dissolved oxygen and then transported back to the heat pipe of the overhead solar boiler **13** via the water feed pump **7** for a next circulation. Meanwhile, surface water or well water is collected, preliminarily purified, treated by a chemical water treatment plant for removing calcium and magnesium ions therein, and transported and stored in the soft water storage tank **9.** When water is required to be supplied, soft water is sucked by the water supply pump **8,** a flow rate of the water is then regulated by the third regulating valve **22,** and the soft water is transported to the deaerator **6** for supplementing the water loss.

[0021] At night or in rainy and cloudy days, the first switch valve **16,** the third switch valve **21,** and the fifth valve **17** are close, the first regulating valve **18** and the third regulating valve **22**stay at zero positions, the second switch valve **19** and the fourth switch valve **23** are open, and the system runs at the external steam power generation state. An external waste steam is introduced to the external steam regulator **15** for decreasing pressure and temperature or increasing pressure and temperature according to practical working condition of the waste steam, then fine regulated by the second regulating valve to reach the rated pressure and rated temperature, and transported to the turboset **2** to do work. The steam after doing work is cooled by the condenser **5** to form normal pressure and low temperature water at approximately 40°C which is transported to the deaerator **6**for removal of the dissolved oxygen and then transported back to the external waste steam source via the water feed pump **7** and the water-return bypass**11** of the external steam or transported and stored in the soft water storage tank **9.**

Example 2

[0022] As shown in FIG. **2,** a solar and external steam hybrid power generation system primarily comprises: a solar steam generator, an external steam regulator **15,** a turboset **2,** and a power generator **1** coupled to the turboset **2,** a condenser **5,** a deaerator **6,** a water feed pump **7,** a soft water storage tank **9,** and a water supply pump **8,** which are assembled by pipes and valves. The valves comprise a first switch valve **16,** a second switch valve **19,** a third switch valve **21,** a fourth switch valve **23,** and a fifth switch valve **17** for controlling connection and disconnection of the pipes, and a first regulating valve **18,** a second regulating valve **20,** and a third regulating valve **22** for regulating the flow rate in the pipes.

[0023] The solar steam generator further comprises an overhead solar boiler **13** and a plurality of heliostats **14** matching therewith. The heliostats **14** are capable of tracing the sun to enable the sunlight to always concentrate on a heat pipe of the overhead solar boiler **13.** An output end of a heat pipe of the overhead solar boiler **13** is connected to a thermal medium inlet of a regenerative heat exchanger **12** via the fifth switch valve **17,** and a thermal medium outlet of the regenerative heat exchanger **12** is connected to an input end of the heat pipe of the overhead solar boiler **13** via a heat pump **10**. The thermal medium is a mixed solution comprising biphenyl and diphenyl oxide filled in the regenerative heat exchanger **12** provided with a heat insulation layer. When the thermal medium absorbs heat, a temperature thereof increases to approximately 400°C, which is enough to be used for heat exchange to produce high temperature and high pressure steam. A steam outlet of the regenerative heat exchanger **12** is connected to the high pressure steam inlet **3** of the turboset **2** via the first regulating valve **18.** A steam outlet end of the external steam regulator **15** is also connected to the high pressure steam inlet **3** of the turboset **2** via the second regulating valve **20** and the second switch valve **19.** A second pipe close to the high pressure steam inlet **3** of the turboset **2** is provided with a pressure manometer **P** and a thermometer **T** for directly displaying pressure and temperature parameters of the steam.

[0024] A low pressure steam outlet **4** of the turboset **2** is connected to an input end of the condenser **5,** and an output end of the condenser **5** is connected to an input end of the deaerator **6.** A water outlet of the soft water storage tank **9** is connected a water inlet of the deaerator **6** via a water supply pump **8.** The third regulating valve **22** and the third switch valve **21** are disposed on a first pipe connecting the water outlet of the soft water storage tank **9** and the water inlet of the deaerator **6** for controlling the open and close of a water supply pipe and the volume of the supplying water. An output end of the deaerator **6** is connected to an input end of the water feed pump **7**; and an output end of the water feed pump **7** is connected to a circulating water inlet of the regenerative heat exchanger **12**via the first switch valve **16,** thereby forming a circulation loop of the solar steam generator. The output end of the water feed pump **7** is further connected to a water-return bypass**11** of the external steam via the fourth switch valve **23,** thereby forming a circulation loop for the work of the external steam.

[0025] Working process of the solar and external steam hybrid power generation system of Example **2** is as follows: in daytimes when the sunlight is abundant, the second switch valve **19** and the fourth switch valve **23** are close, the first switch valve **16,** the third switch valve **21,** and the fifth switch valve **17** are open, and the system runs at a concentrating solar thermal power generation state. At the time, the heliostats **14** trace the sunlight and concentrate the thermal energy of the sunlight on the heat pipe of the overhead solar boiler **13** to enable the thermal medium therein, the mixed solution comprising biphenyl and diphenyl oxide, to absorb heat.

The mixed solution comprising biphenyl and diphenyl oxide heated to approximately 400°C flows to the regenerative heat exchanger **12** via the fifth switch valve **17** and exchanges heat with the circulating water in another pipe of the regenerative heat exchanger **12.** Thus, the temperature of the mixed solution comprising biphenyl and diphenyl oxide gradually decreases, approximately 245°C after flowing out of the regenerative heat exchanger **12.** The mixed solution comprising biphenyl and diphenyl oxide is transported back to the heat pipe of the overhead solar boiler **13**by the drive of the heat pump **10,** for a next circulation of solar energy absorption. The circulating water in the regenerative heat exchanger **12** is transformed into the high temperature and high pressure steam after the heat exchange with the high temperature mixed solution comprising biphenyl and diphenyl oxide. The high temperature and high pressure steam is output from the regenerative heat exchanger **12,** regulated by the first regulating valve **18** to reach a rated pressure and a rated temperature, and then transported to the turboset **2** to do work. Steam after doing work is cooled by the condenser **5** to form normal pressure and low temperature water at approximately 40°C which is transported to the deaerator **6**for removal of the dissolved oxygen and then transported back to the regenerative heat exchanger **12**for heat exchange via the water feed pump **7,** thereby forming high temperature and high pressure steam again. Meanwhile, surface water or well water is collected, preliminarily purified, treated by chemical water treatment plant for removing calcium and magnesium ions therein, and transported and stored in the soft water storage tank **9.** When water is required to be supplied, soft water is sucked by the water supply pump **8,** a flow rate of the soft water is then regulated by the third regulating valve **22,** and the soft water is transported to the deaerator **6** for supplementing the water loss.

[0026] At night or in rainy and cloudy days, the first switch valve **16,** the third switch valve **21,** and the fifth valve **17** are close, the first regulating valve **18** and the third regulating valve **22**stay at zero positions, the second switch valve **19** and the fourth switch valve **23** are open, and the system runs at the external steam power generation state. An external waste steam is introduced to the external steam regulator **15** for decreasing pressure and temperature or increasing pressure and temperature according to practical working condition of the waste steam, then fine regulated by the second regulating valve to reach the rated pressure and rated temperature, and transported to the turboset **2** to do work. The steam after doing work is cooled by the condenser **5** to form normal pressure and low temperature water at approximately 40°C which is transported to the deaerator **6**for removal of the dissolved oxygen and then transported back to the external waste steam source via the water feed pump **7** and the water-return bypass**11** of the external steam or transported and stored in the soft water storage tank **9.**

Example 3

[0027] As shown in FIG. **3,** a structure of a solar and external steam hybrid power generation system is basically the same as that shown in FIG. **1** except for some slight variations that the solar steam generator comprises a plurality of solar vacuum heat pipes **13**'and a plurality of trough type parabolic reflectors**14**' matching therewith. Output ends of the solar vacuum heat pipes **13**'are connected to the high pressure steam inlet **3** of the turboset **2** via the fifth switch valve **17** and the first regulating valve **18.** Input ends of the solar vacuum heat pipes **13**'are connected to the output end of the water feed pump **7** via the first switch valve **16.** Working processes of the two solar and external steam hybrid power generation systems are basically the same, so that it will not be repeatedly illustrated herein.

Example 4

[0028] As shown in FIG. **4,** a structure of a solar and external steam hybrid power generation system is basically the same as that shown in FIG. **2** except for some slight variations that the solar steam generator comprises a plurality of solar vacuum heat pipes **13'**and a plurality of trough type parabolic reflectors**14**' matching therewith. Output ends of solar vacuum heat pipes **13**'are connected to a thermal medium inlet of a regenerative heat exchanger **12** via a fifth switch valve **17.** A thermal medium outlet of the regenerative heat exchanger **12** is connected to input ends of the solar vacuum heat pipes **13**'via a heat pump **10.** A steam outlet of the regenerative heat exchanger **12** is connected to the high pressure steam inlet **3** of the turboset **2** via the first regulating valve **18.** A circulating water inlet of the regenerative heat exchanger**12** is connected to the output end of the water feed pump **7** via the first switch valve**16**. Working processes of the two solar and external steam hybrid power generation systems are basically the same, so that it will not be repeatedly illustrated herein.

REFERENCES CITED IN THE DESCRIPTION

Patent documents cited in the description

- DE19723543A1 [0003]

Patentkrav

1. System til kombineret generering af solenergi og energi fra ekstern damp, hvilket system omfatter en soldreven dampgenerator, en ekstern dampregulator (15), en turbogenerator (2) og en energigenerator (1), der er koblet til turbogeneratoren (2), kendetegnet ved, at en dampudløbsende af den soldrevne dampgenerator er forbundet med et højtryksdampindløb (3) til turbogeneratoren (2) gennem en første reguleringsventil (18); en dampudløbsende af den eksterne dampregulator (15) er også forbundet med turbogeneratorens (2) højtryksdampindløb (3) gennem en anden reguleringsventil (20) og en anden omskifterventil (19); et lavtryksdampudløb (4) fra turbogeneratoren (2) er forbundet med en indgangsende af en kondensator (5), og en udgangsende af kondensatoren (5) er forbundet med en indgangsende af en luftudlader (6); en udgangsende af luftudladeren (6) er forbundet med en indgangsende af en vandtilførselspumpe (7); en udgangsende af vandtilførselspumpen (7) er forbundet med en cirkulationsvandindgangsende af den soldrevne dampgenerator gennem en første omskifterventil (16); og vandtilførselspumpens udgangsende (7) desuden er forbundet med et vandreturomløb (11) for den eksterne damp gennem en fjerde omskifterventil (23).

2. System ifølge krav 1, kendetegnet ved, at systemet desuden omfatter en opbevaringsbeholder (9) til blødt vand, et vandudløb fra opbevaringsbeholderen (9) til blødt vand er forbundet med et vandindløb til luftudladeren (6) gennem en vandforsyningspumpe (8), og et første rør, der forbinder vandudløbet fra opbevaringstanken (9) til blødt vand og luftudladerens (6) vandindløb er udstyret med en tredje reguleringsventil (22) og en tredje omskifterventil (21).

3. System ifølge krav 2, kendetegnet ved, at et andet rør i nærheden af turbogeneratorens (2) højtryksdampindløb (3) er udstyret med et manometer (P) og et termometer (T).

4. System ifølge krav 1, 2 eller 3, kendetegnet ved, at den soldrevne dampgenerator omfatter en overliggende soldreven kedel (13) og en flerhed af heliostater (14), der passer dermed; en udgangsende af et varmerør af den overliggende soldrevne kedel (13) er forbundet med turbogeneratorens (2) højtryksdampindløb (3) gennem den første reguleringsventil (18); og en indgangsende af den overliggende soldrevne kedels (13) varmerør er forbundet med vandtilførselspumpens (7) udgangsende gennem den første omskifterventil (16).

5. System ifølge krav 1, 2 eller 3, kendetegnet ved, at den soldrevne dampgenerator omfatter en overliggende soldreven kedel (13) og en flerhed af heliostater (14), der passer dermed; en udgangsende af et varmerør af den overliggende soldrevne kedel (13) er forbundet med et termisk mediums indløb til en regenerativ varmeveksler (12) gennem en femte omskifterventil (17), og et termisk mediums udløb fra den regenerative varmeveksler (12) er forbundet med en indgangsende af den overliggende soldrevne kedels (13) varmerør gennem en varmepumpe (10); et dampudløb fra den regenerative varmeveksler (12) er forbundet med turbogeneratorens (2) højtryksdampindløb (3) gennem den første reguleringsventil (18); og et cirkulationsvandindløb til den regenerative varmeveksler (12) er forbundet med vandtilførselspumpens (7) udgangsende gennem den første omskifterventil (16).

6. System ifølge krav 1, 2 eller 3, kendetegnet ved, at den soldrevne dampgenerator omfatter en flerhed af soldrevne varmerør under vakuum (13') og en flerhed af trugformede paraboliske reflektorer (14'), der passer dermed; udgangsender af de soldrevne varmerør under vakuum (13') er forbundet med turbogeneratorens (2) højtryksdampindløb (3) gennem den første reguleringsventil (18); og indgangsender af de soldrevne varmerør under vakuum (13') er forbundet med vandtilførselspumpens (7) udgangsende gennem den første omskifterventil (16).

7. System ifølge krav 1, 2 eller 3, kendetegnet ved, at den soldrevne dampgenerator omfatter en flerhed af soldrevne varmerør under vakuum (13') og en flerhed af trugformede paraboliske reflektorer (14'), der passer dermed; udgangsender af de soldrevne varmerør under vakuum (13') er forbundet med et termisk mediums indløb til en regenerativ varmeveksler (12) gennem en femte omskifterventil (17), og et termisk mediums udløb fra den regenerative varmeveksler (12) er forbundet med indgangsender af de soldrevne varmerør under vakuum (13') gennem en varmepumpe (10); et dampudløb fra den regenerative varmeveksler (12) er forbundet med turbogeneratorens (2) højtryksdampindløb (3) gennem den første reguleringsventil (18); og et cirkulationsvandindløb til den regenerative varmeveksler (12) er forbundet med vandtilførselspumpens (7) udgangsende gennem den første omskifterventil (16).

DRAWINGS

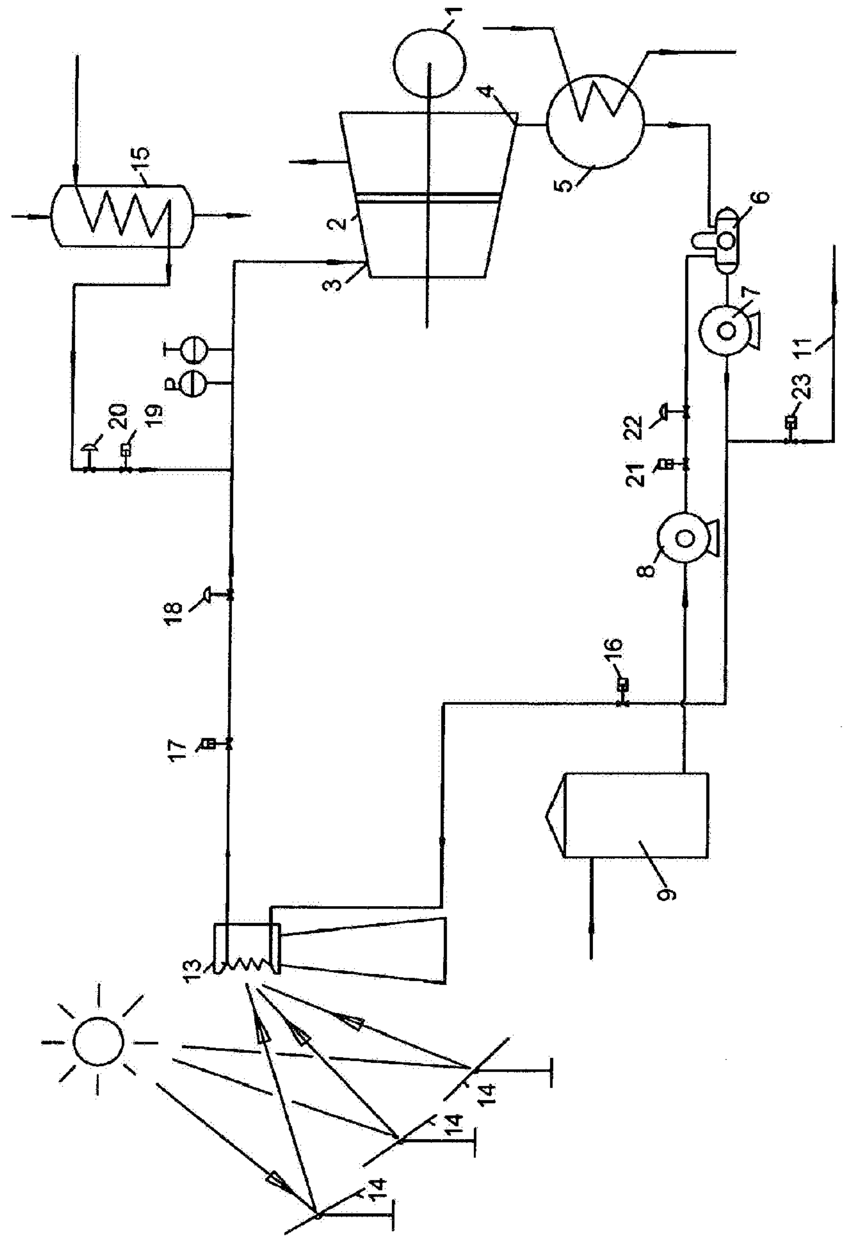

Fig. 1

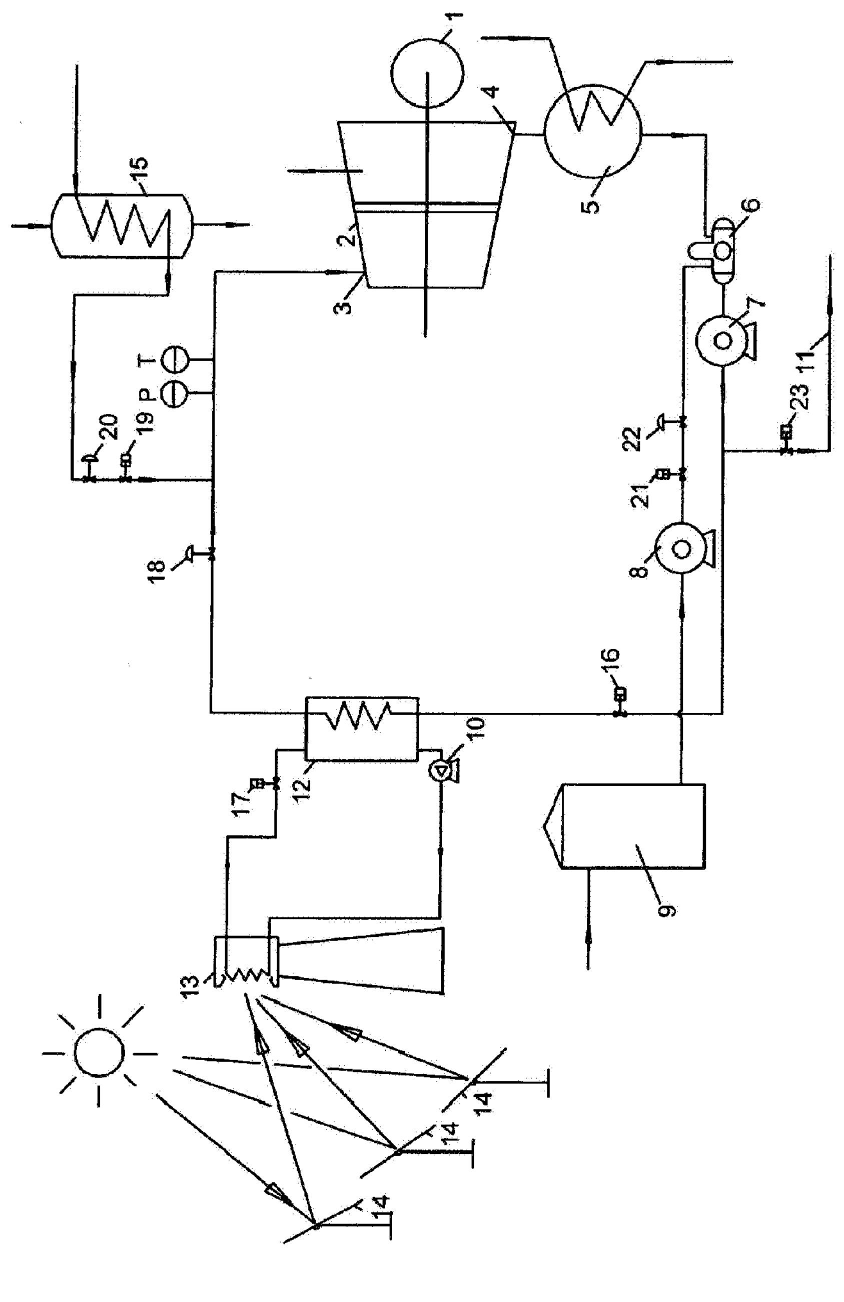

Fig. 2

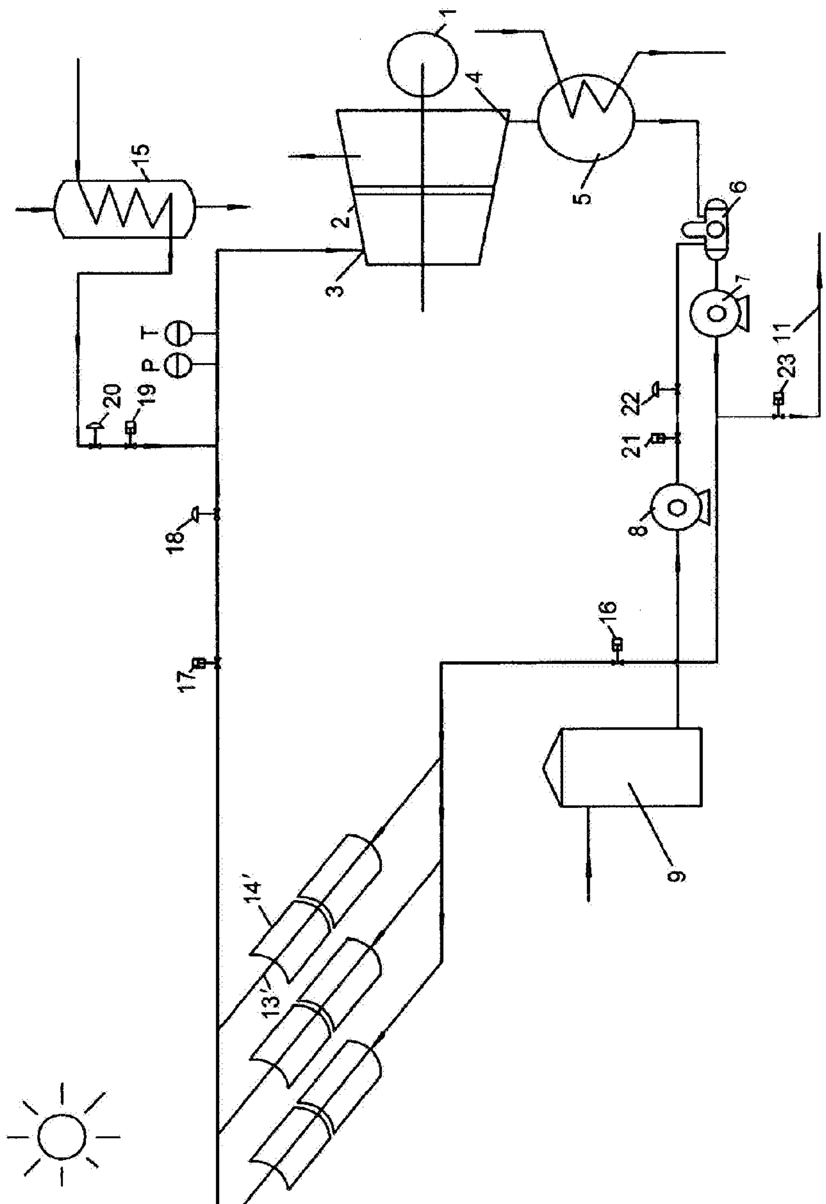

Fig. 3

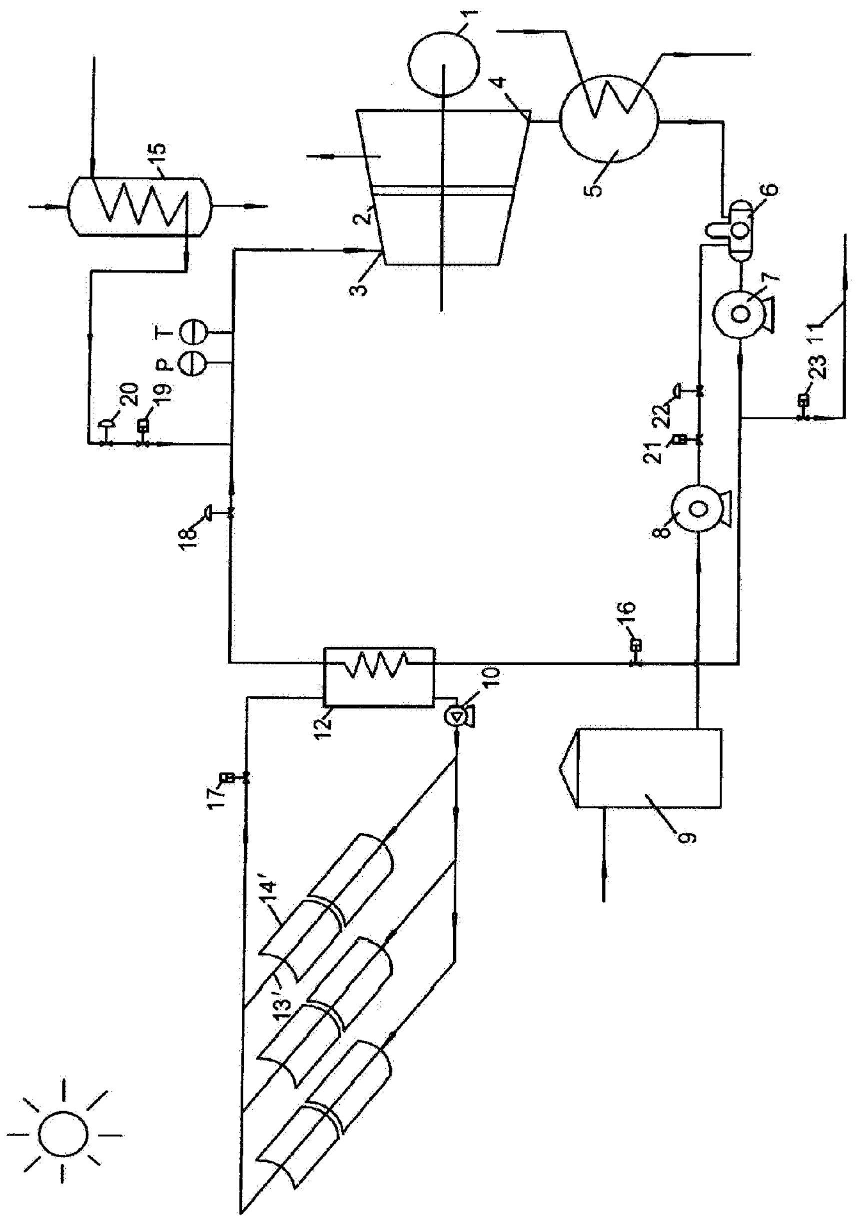

Fig. 4