

A METHOD OF GENERATING A HIGH-SPEED AIRFLOW

Field of the Invention

The invention provides a method of generating a high-speed airflow, belonging to a method
5 of converting thermal energy or fluid energy into mechanical energy.

Background of the Invention

In the prior art, a method of generating a high-speed airflow is to firstly pressurize the gas
and afterwards expand and eject the pressurized gas to generate the high-speed airflow. The
10 adoption of this method causes high energy consumption and great energy source waste; in
addition, due to many aspects of restrictions such as pressure endurance of a mechanical device,
tolerance of material on temperature, machine weight or dimensional requirement and the like,
the generated airflow is not in a very high speed and thus has relatively low use value.

The uppermost way of utilizing energy source by human beings is to convert thermal energy
15 into mechanical work. A traditional conversion way is to firstly convert thermal energy into
pressure potential energy and afterwards do work to the outside. However, this traditional
conversion way produces energy loss and consumes fossil energy source additionally.

Summary of the Invention

20 The invention is aimed to avoid shortcomings in the aforementioned prior art, and thus
provides a method of utilizing a low quality heat source to convert a low-speed airflow into a
high speed or extremely high-speed airflow with relatively high use value.

The invention is further aimed to convert the thermal energy carried by the fluid in the nature
into mechanical energy efficiently by utilizing the method of generating a high-speed airflow in
25 the present invention.

Objectives of the invention can be achieved by taking the following measures:

The method of generating a high-speed airflow of the invention is implemented by adopting
a device comprised of an air pipe 1, a circulating pipe 2 and a starting and controlling system 3.
The starting and controlling system 3 is comprised of one or a combination of any two or more
30 of a refrigerator 4, a circulating pump 5 and a heat exchanger 6; the method comprising the
following operation steps:

- ☐ filling the device with a working medium;
- ☐ activating the starting and controlling system 3;
- ☐ after having been pressurized under liquid state, the working medium absorbing heat and
35 being gasified, entering the air pipe 1, and generating the high-speed airflow.

The air pipe 1 is a key equipment for generating the high speed fluid. The designed shape of

the air pipe 1 can be adjusted according to different requirements of flow or flow rate. When temperature of the working medium in the air pipe 1 is decreased due to high gas flow rate and accompanied by liquid condensed, the air pipe 1 can make the liquid precipitate out by changing the shape of the air pipe, etc.

5 The circulating pipe 2 is a common pipeline that can meet fluid transportation.

The setting of the starting and controlling system 3 is aimed to enable part of the working medium to absorb heat and to be evaporated to re-enter the air pipe system after having been pressurized under liquid state. The starting and controlling system can play the roles of adjusting flow of the fluid, liquidizing the fluid, pressurizing the fluid, gasifying the fluid, heating the fluid,
10 opening and closing the circulating pipe.

The refrigerator 4 in the starting and controlling system 3 can be selected and matched according to boiling point and circulation volume of the working medium.

The circulating pump 5 in the starting and controlling system 3 can be selected and matched according to gas-liquid phase condition and circulation volume of the working medium. The
15 circulating pump is used for maintaining unidirectionality of the circulation and for pressurizing the liquidized fluid, so as to obtain a pressure difference required for generating high speed of the fluid in the air pipe.

The heat exchanger 6 in the starting and controlling system 3 can be selected according to evaporation demand of the working medium and temperature difference condition of a heat
20 exchange source.

The method of generating a high-speed airflow of the invention comprises the starting process as follows:

Preparation for the starting:

A gaseous working medium with low boiling point exists in the air pipe 1 and its inlet and
25 outlet ends, and another kind of working medium with high boiling point exists in the circulating pipe 2; the working medium with high boiling point flows through the starting and controlling system.

Activating the circulation of the circulating pipe 2 and the air pipe 1:

Firstly closing outer circulation inlet and outlet of the air pipe 1, afterwards activating the
30 circulating pump 5 and the refrigerator 4 in the starting and controlling system 3, liquidizing the working medium with low boiling point in the circulating pipe and transporting the liquid into the heat exchanger 6 via the circulating pump 5 to absorb heat and be evaporated. The gaseous working medium with low boiling point enters the air pipe 1 after absorbing heat from the outside environment and flows at a high speed in the air pipe 1, through the circulating pipe 2
35 and the starting and controlling system 3 to re-enter the air pipe 1. In this way, the working

medium with low boiling point is circulated rapidly between the circulating pipe 2 and the air pipe 1, and at that time aperture of the air pipe 1 can be adjusted to increase air flow rate.

Activating outer circulation of the air pipe 1:

5 Slowly opening the outer circulation inlet and outlet of the air pipe 1, to make the working medium with low boiling point in the outer circulation circulate directionally driven by the working medium with high boiling point from the circulating pipe 2. Due to invariant quality circulation volume of the working medium with high boiling point, adding of the circulation of the gaseous working medium with low boiling point will greatly accelerate linear speed of the fluid in the air pipe, and will further greatly accelerate airflow speed in the air pipe by further
10 narrowing ventilation aperture of the air pipe 1.

Applying load

Part or all of the working medium with high boiling point can be liquidized by accelerating flow speed and/or placing an energy consumption load equipment such as a steam turbine and so on into the circulation of the air pipe. The liquidized working medium with high boiling point is
15 guided into the circulating pipe 2 by a gas-liquid separation equipment and a flow guiding equipment such as a curve or a spiral or the like additionally provided in the air pipe 1, and afterwards is anew circulated to enter the air pipe 1 after absorbing heat by passing through the starting and controlling system 3.

In this way, a normal operating state is achieved, and a stable high-speed airflow with
20 extremely high speed is formed in the air pipe 1.

By adding power load into the circulation of the air pipe 1, energy consumption of the refrigerator 4 in the starting and controlling system 3 can be partially reduced or entirely eliminated, so as to achieve a power energy source system with an extremely high efficiency.

In the process of activating or operation, the circulating pump 5 is possible to be replaced by
25 a circulation system of the refrigerator 4 or by gravity of the condensed liquid or an impulsive force from the air pipe. For this reason, the circulating pump 5 is possible to be spared and not used, neither is the heat absorber 6 in the absence of sufficient outward energy output. The refrigerator 4 is also possible to be spared and not used as the energy taken away by the high-speed airflow is sufficient to liquidize part of the working medium. However, this system
30 must have an initial circulation power that comes firstly from circulation power of the circulating pump 5 or the refrigerator 4 of their own. The heat absorber 6 or the refrigerator 4 in themselves will be adjusted or selected upon different working conditions.

Sometimes the air pipe 1 and the circulating pipe 2 can be completely combined into one pipeline in terms of the physical structure, but at that time the pipeline must have dual functions
35 of both the air pipe and the circulating pipe. This can be achieved in the manner of designing a

liquid flow guiding groove or a backflow pipe and the like on the air pipe, and in this case the flow guiding groove or the backflow pipe can also be regarded as the circulating pipe 2.

Besides, the objectives of the invention can be achieved by taking the following measures:

In the method of generating the high-speed airflow of the invention, the air pipe 1 makes the gaseous working medium be condensed into liquid state and be guided into the circulating pipe 2 by necking the air pipe to vary the diameter thereof or by additionally providing the gas-liquid separation device and the flow guiding device such as the curve or the spiral, afterwards the working medium is anew circulated to enter the air pipe 1 after absorbing heat by passing through the starting and controlling system 3. This is a preferred technical solution.

In the method of generating the high-speed airflow of the invention, the air pipe 1 and the circulating pipe 2 are overlapped completely or partially, or in end-to-end connection. This is one technical solution of the invention.

In the method of generating the high-speed airflow of the invention, the starting and controlling system 3 and the circulating pipe 2 are in series connection with each other. This is one technical solution of the invention.

The method of generating the high-speed airflow of the invention is characterized in that the working medium flowing in the device is a fluid or a mixture of more than one fluid working mediums.

In the method of generating the high-speed airflow of the invention, air or water is adopted as the fluid working medium in the air pipe 1. This is a preferred technical solution.

In the method of generating the high-speed airflow of the invention, an inlet and an outlet of the air pipe 1 are all communicated to atmosphere. The circulating pipe is filled with water. The high-speed airflow is generated in the air pipe by forced circulation and liquefaction in the starting and controlling system 3. As the water in the high-speed airflow is at a low temperature in a high speed state, most of water vapor is liquidized to enter the circulating pipe 2, and the air in the air pipe is further accelerated under a driving force from the water vapor, and the high-speed airflow is discharged into the atmosphere. The water in the circulating pipe absorbs heat from the natural environment by the heat absorber and is evaporated to re-enter the air pipe 1 for circulation. A small part of water discharged into the atmosphere will be naturally supplemented by the water vapor in nature air via the inlet of the air pipe, to form a water balance.

The application of the method of generating the high-speed airflow of the invention is characterized in that the method is applied to an engine system and other devices using a high-speed airflow.

The method of generating the high-speed airflow disclosed in the invention has prominent

and substantive features and represents notable technical progresses over the prior art as follows:

1. Provided is a method of utilizing a low quality heat source to convert a low-speed airflow into a high-speed or extremely high-speed airflow with relatively high use value.

2. By utilizing the method of generating the high-speed airflow in the present invention, the thermal energy carried by the fluid in the nature is converted into mechanical energy efficiently.

3. Provided is a device that can directionalize unidirectional thermal motion of gas molecules directly to be converted into the high-speed airflow by avoiding the process of significant pressurization to the best extent and utilizing a low quality heat source.

4. The extremely high-speed airflow that is very difficult to generate by the method of pressurization can be generated.

5. The extremely high energy airflow can be generated by utilizing a relatively simple device.

Brief Description of the Drawings

Fig. 1 is a schematic diagram of a principle of the device implementing the method of generating a high-speed airflow of the invention.

Fig. 2 is a schematic diagram of a principle of conducting a power drive via the high-speed airflow generated by employing the method of the invention.

In the figures:

- 1 - air pipe;
- 2 - circulating pipe;
- 3 - starting and controlling system;
- 4 - refrigerator;
- 5 - circulating pump;
- 6 - heat absorber;
- 7 - power consumption device

Detailed Description of the Embodiments

Hereinafter the invention will be further described in details incorporating examples.

Example 1

The method of generating a high-speed airflow of the invention is implemented by utilizing a device comprised of an air pipe 1, a circulating pipe 2 and a starting and controlling system 3, wherein the air pipe 1 is filled with air and is in end-to-end connection (see Fig. 2), a steam turbine 7 is mounted on the air pipe 1, and the air in the air pipe 1 can pass through the steam turbine 7 to do work. The circulating pipe is filled with refrigerant R134a (or other working medium with atmospheric boiling point lower than environmental temperature). High-speed

R134a airflow is generated in the air pipe by forced circulation and liquefaction in the starting and controlling system 3. As the R134a (or other working medium with atmospheric boiling point lower than environmental temperature) in the high-speed airflow is at a low temperature in a state of high speed, part or all of the R134a is liquidized to enter the circulating pipe 2, and at the same time the air in the air pipe is further accelerated under a driving force from the high-speed R134a (or other working medium with atmospheric boiling point lower than environmental temperature) and drives the steam turbine to rotate to do and output work to the outside, so that the energy system of the overall system is decreased and the temperature is lowered. The R134a (or other working medium with atmospheric boiling point lower than environmental temperature) in the circulating pipe can absorb heat from the natural environment by the heat absorber and is evaporated to re-enter the air pipe 1 for circulation, so that the energy system of the overall system is maintained at a balanced level. The adjustment of parameters of the starting and controlling system 3 can reduce working frequencies or stop the working of the refrigerator 4 and the circulating pump 5 in the starting and controlling system 3, and can ensure an automatic circulation of the overall system as well as an automatic operation of the processes of absorbing heat and doing work.

Example 2

The method of generating the high-speed airflow of the invention is implemented by utilizing a device comprised of the air pipe 1, the circulating pipe 2 and the starting and controlling system 3 (see Fig. 2), wherein the air pipe 1 in itself can be in end-to-end connection to form a pipeline passage, in which only one kind of working medium exists, so that the overall circulation can be activated by activating the refrigerator and the circulating pump in the starting and controlling system 3, but in this case the working medium is only partially liquidized at a high speed, non-liquidized part of the working medium is remained to be circulated at a high speed in the air pipe 1, in such a way the using effect of example 1 can also be achieved.

Example 3

The method of generating the high-speed airflow of the invention is implemented by utilizing a device comprised of the air pipe 1, the circulating pipe 2 and the starting and controlling system 3 (see Fig. 2), wherein an inlet and an outlet of the air pipe 1 are all communicated to atmosphere. The circulating pipe is filled with water (or other working medium with atmospheric boiling point lower than environmental temperature). The high-speed airflow is generated in the air pipe by forced circulation and liquefaction in the starting and controlling system 3. As the water in the high-speed airflow is at a low temperature in a high speed state, most of the water (or other working medium with atmospheric boiling point lower than environmental temperature) is liquidized to enter the circulating pipe 2, and the air in the air pipe is further accelerated under

a driving force from water vapor (or other working medium with atmospheric boiling point lower than environmental temperature), and the high-speed airflow is discharged into the atmosphere. The water (or other working medium with atmospheric boiling point lower than environmental temperature) in the circulating pipe can absorb heat from the natural environment
5 by the heat absorber and is evaporated to re-enter the air pipe 1 for circulation. A small part of water discharged into the air will be naturally supplemented by the water vapor in nature air via the inlet of the air pipe, to form a water balance.

WHAT IS CLAIMED IS:

1. A method of generating a high-speed airflow, characterized by utilizing a device comprised of an air pipe (1), a circulating pipe (2) and a starting and controlling system (3), wherein the
5 starting and controlling system (3) is comprised of one or a combination of any two or more of a refrigerator (4), a circulating pump (5) and a heat exchanger (6); the method comprising the following operation steps:

- ☐ filling the device with a working medium;
- ☐ activating the starting and controlling system (3);
- 10 ☐ after having been pressurized under liquid state, the working medium absorbing heat and being gasified, entering the air pipe (1), and generating the high-speed airflow.

2. The method of generating a high-speed airflow according to claim 1, characterized in that the air pipe (1) makes the gaseous working medium be condensed into liquid state and be guided
15 into the circulating pipe (2) by necking the air pipe to vary the diameter thereof or by additionally providing a gas-liquid separation device and a flow guiding device such as a curve or a spiral in the air pipe (1), afterwards the working medium is anew circulated to enter the air pipe (1) after absorbing heat by passing through the starting and controlling system (3).

20 3. The method of generating a high-speed airflow according to claim 1, characterized in that the air pipe (1) and the circulating pipe (2) are overlapped completely or partially, or in end-to-end connection.

4. The method of generating a high-speed airflow according to claim 1, characterized in that
25 the starting and controlling system (3) and the circulating pipe (2) are in series connection with each other.

5. The method of generating a high-speed airflow according to claim 1, characterized in that the working medium flowing in the device is a fluid or a mixture of more than one fluid working
30 mediums.

6. The method of generating a high-speed airflow according to claim 1, characterized in that air or water is adopted as the fluid working medium in the air pipe (1).

35 7. The method of generating a high-speed airflow according to claim 1, characterized in that

an inlet and an outlet of the air pipe (1) are all communicated to atmosphere; that the circulating pipe is filled with water; that the high-speed airflow is generated in the air pipe by forced circulation and liquefaction in the starting and controlling system (3), wherein as the water in the high-speed airflow is at a low temperature in a state of high speed, most of water vapor is liquidized to enter the circulating pipe (2), and the air in the air pipe is further accelerated under a driving force from the water vapor, and the high-speed airflow is discharged into the atmosphere, and wherein the water in the circulating pipe absorbs heat from the natural environment by a heat absorber and is evaporated to re-enter the air pipe (1) for circulation; and that a small part of water discharged into the atmosphere will be naturally supplemented by the water vapor in nature air via the inlet of the air pipe, to form a water balance.

8. An application of the method of generating a high-speed airflow according to claim 1, characterized in that the method is applied to an engine system and other devices using a high-speed airflow.