CLAIMS

1. A rotor system, comprising:

a rotating shaft, a shaft body of the rotating shaft being of an integrated structure and the rotating shaft being horizontally arranged;

a motor, an air compressor and a turbine which are arranged on the rotating shaft in sequence; and

at least two radial bearings and a thrust bearing which are arranged on the rotating shaft and are all non-contact bearings, wherein

the thrust bearing is arranged at a preset position on one side of the turbine close to the air compressor, and the preset position is such a position that the center of gravity of the rotor system is capable of being located between two radial bearings that are farthest apart among the at least two radial bearings.

2. The rotor system according to claim 1, wherein

the at least two radial bearings comprise a first radial bearing and a second radial bearing, the first radial bearing being arranged on one side of the motor away from the air compressor, and the second radial bearing being arranged between the air compressor and the turbine, wherein

the thrust bearing is arranged between the first radial bearing and the motor; or

the thrust bearing is arranged on one side of the first radial bearing away from the motor; or

the thrust bearing is arranged between the motor and the air compressor.

3. The rotor system according to claim 2, wherein

the at least two radial bearings further comprise a third radial bearing arranged between the motor and the air compressor.

4. The rotor system according to claim 2 or 3, wherein

the at least two radial bearings further comprise a fourth radial bearing arranged on one side of the turbine away from the air compressor, wherein

the thrust bearing is arranged between the first radial bearing and the motor; or

the thrust bearing is arranged on one side of the first radial bearing away from the motor; or

the thrust bearing is arranged between the motor and the air compressor; or

the thrust bearing is arranged between the air compressor and the second radial bearing.

5. The rotor system according to claim 4, wherein

the fourth radial bearing is a hydrodynamic-hydrostatic gas hybrid radial bearing.

6. The rotor system according to claim 2, wherein

a heat insulation layer is arranged on one side of the turbine close to the second radial bearing.

7. The rotor system according to claim 1, wherein the motor is a dynamic-pressure bearing motor, and a portion of the rotating shaft corresponding to a bearing of the motor is provided with a first dynamic pressure

generating groove.

8. The rotor system according to claim 1, wherein the motor is a starter-generator integrated motor.

9. The rotor system according to claim 1, wherein

the rotor system further comprises a locking device configured to lock the rotating shaft when the rotating shaft is in a static state.

10. The rotor system according to claim 1, wherein

a portion of the rotating shaft where each bearing is mounted is coated with an anti-wear coating.

11. The rotor system according to claim 2, wherein

the thrust bearing is a gas-magnetic hybrid thrust bearing; and

at least one of the at least two radial bearings is a gas-magnetic hybrid radial bearing or a hydrodynamic-hydrostatic gas hybrid radial bearing.

12. A rotor system control method applied to the rotor system according to claim 11, the method comprising the following steps:

powering on a static-pressure bearing in the radial bearing and a static-pressure bearing in the thrust bearing to enable the rotating shaft to move to a preset radial position, such that the thrust disc of the thrust bearing moves to a preset axial position;

after a rotating speed of the rotating shaft is accelerated to a working speed, powering off the static-pressure bearing in the radial bearing and the static-pressure bearing in the thrust bearing;

in the case that the rotor system is stopped, powering on the static-pressure bearing in the radial bearing and the static-pressure bearing in the thrust bearing; and

after the rotating speed of the rotating shaft is reduced to zero, powering off the static-pressure bearing in the radial bearing and the static-pressure bearing in the thrust bearing, wherein

powering on the static-pressure bearings comprises: powering on a magnetic bearing in the corresponding bearing, and/or conveying a gas to a static-pressure intake throttle hole in the bearing; and

powering off the static-pressure bearings comprises: powering off the magnetic bearing in the corresponding bearing, and/or stopping conveying the gas to the static-pressure intake throttle hole in the bearing.

13. A rotor system control method applied to the rotor system according to a claim 11, the method comprising the following steps:

powering on a static-pressure bearing in the radial bearing and a static-pressure bearing in the thrust bearing to enable the rotating shaft to move to a preset radial position, such that the thrust disc of the thrust bearing moves to a preset axial position;

after a rotating speed of the rotating shaft is accelerated to a first preset value, powering off the static-pressure bearing in the radial bearing and the static-pressure bearing in the thrust bearing;

when the rotor system is accelerated to a first-order critical speed or a second-order critical speed, powering on the static-pressure bearing in the radial bearing and the static-pressure bearing in the thrust bearing;

after the rotor system smoothly passes the first-order critical speed or the second-order critical speed, powering off the static-pressure bearing in the radial bearing and the static-pressure bearing in the thrust bearing;

during the shutdown of the rotor system, when the rotor system is decelerated to the first-order critical speed or the second-order critical speed, powering on the static-pressure bearing in the radial bearing and the static-pressure bearing in the thrust bearing;

after the rotor system smoothly passes the first-order critical speed or the second-order critical speed, powering off the static-pressure bearing in the radial bearing and the static-pressure bearing in the thrust bearing;

when the rotating speed of the rotating shaft is decelerated to a second preset value, powering on the static-pressure bearing in the radial bearing and the static-pressure bearing in the thrust bearing; and

after the rotating speed of the rotating shaft is reduced to zero, powering off the static-pressure bearing in the radial bearing and the static-pressure bearing in the thrust bearing, wherein

powering on the static-pressure bearings comprises: powering on a magnetic bearing in each bearing, and/or conveying a gas to a static-pressure intake throttle hole in the bearing; and

powering off the static-pressure bearings comprises: powering off the magnetic bearing in the corresponding bearing, and/or stopping conveying the gas to the static-pressure intake throttle hole in the bearing.

14. A gas turbine generator set, comprising an intake channel, a combustion chamber, and the rotor system according to any one of claims 1 to 11, wherein the intake channel is communicated with an air inlet of the air compressor, an air outlet of the air compressor is communicated with an air inlet of the combustion chamber, and an air outlet of the combustion chamber is communicated with an air inlet of the turbine.

15. A gas turbine generator set control method applied to the gas turbine generator set according to claim 14, the method comprising the following steps:

powering on a static-pressure bearing in the radial bearing and a static-pressure bearing in the thrust bearing to enable the rotating shaft to move to a preset radial position, such that the thrust disc of the thrust bearing moves to a preset axial position;

starting the gas turbine generator set, wherein air is compressed by the air compressor and enters the combustion chamber to be mixed with a fuel in the combustion chamber and combusted, and high-temperature and high-pressure gas discharged from the combustion chamber impacts a turbine wheel of the turbine to rotate the turbine wheel, such that the turbine wheel drives the motor to rotate through the rotating shaft to generate electricity;

after a rotating speed of the rotating shaft is accelerated to a working speed, powering off the static-pressure bearing in the radial bearing and the static-pressure bearing in the thrust bearing;

in the case of the shutdown of the gas turbine generator set, powering on the static-pressure bearing in the radial bearing and the static-pressure bearing in the thrust bearing; and

after the rotating speed of the rotating shaft is reduced to zero, powering off the static-pressure bearing in the radial bearing and the static-pressure bearing in the thrust bearing, wherein

powering on the static-pressure bearings comprises: powering on a magnetic bearing in the corresponding bearing, and/or conveying a gas to a static-pressure intake throttle hole in the bearing; and

powering off the static-pressure bearings comprises: powering off the magnetic bearing in the corresponding bearing, and/or stopping conveying the gas to the static-pressure intake throttle hole in the bearing.