1. A supersonic nozzle vortex tube refrigeration and nano-fluid minimal quantity lubrication coupling supply system, comprising a low-temperature gas generating device, a nano-fluid minimal quantity lubrication supply system, a gas distribution control valve and at least one low-temperature oil gas external mixing atomizing nozzle, wherein:

the low-temperature gas generating device comprises a vortex tube nozzle, a volute diverter and a vortex tube heat pipe sequentially arranged in an intake sleeve; a sealing end cover is arranged at one end of the intake sleeve, and a nozzle gas outlet pipe of the vortex tube nozzle penetrates out of the sealing end cover; a nozzle flow channel slot communicated with the gas path of the nozzle gas outlet pipe is formed in the intake end of the vortex tube nozzle, so that compressed air is sprayed out from the nozzle gas outlet pipe via the nozzle flow channel slot; one end of the volute diverter is communicated with a compressed air inlet of the intake sleeve, and the other end is communicated with the nozzle flow channel slot; the vortex tube heat pipe penetrates out of the end face of the other end of the intake sleeve, and is communicated with the nozzle flow channel slot; a gas outlet tee joint communicated with the gas path is arranged at the end of the vortex tube heat pipe penetrating out of the intake sleeve, and a cool gas proportion adjusting valve is arranged in one port of the gas outlet tee joint;

a gas inlet quick plug of the gas distribution control valve is communicated with the nozzle gas outlet pipe of the vortex tube nozzle via a thermal insulation pipe; the quantity of gas outlet quick plugs of the gas distribution control valve is matched with that of the low-temperature oil gas external mixing atomizing nozzles, and the gas outlet quick plugs are respectively communicated with the gas paths of the corresponding low-temperature oil gas external mixing atomizing nozzles via thermal insulation pipes;

the nano-fluid minimal quantity lubrication supply system comprises a camshaft and a pump which are arranged in a box, and the camshaft is connected with an electromagnetic speed adjustment motor via a camshaft key; a shell piston cavity, an oil inlet cavity and a one-way valve cavity communicated with each other are sequentially formed in the pump; one end of a piston presses against a cam on the camshaft and is connected with the bottom surface of the pump via a cam spring, and the other end stretches into the shell piston cavity of the pump and can move relative to the pump; the oil inlet cavity is communicated with an oil cup pipeline via an oil inlet; the one-way valve cavity is communicated with oil outlets; the quantity of the oil outlets is matched

with that of the low-temperature oil gas external mixing atomizing nozzles, and the oil outlets are communicated with corresponding low-temperature oil gas external mixing atomizing nozzle pipelines respectively.

2. The supersonic nozzle vortex tube refrigeration and nano-fluid minimal quantity lubrication coupling supply system according to claim 1, wherein the low-temperature gas generating device further comprises a water tank; the water tank is sleeved on the outer wall of the vortex heat pipe; the water tank is arranged between the intake sleeve and the gas outlet tee joint, the end face of one end of the water tank is in tight contact with the end face of one end of the intake sleeve via a sealing gasket, the end face of the other end of the water tank is in tight contact with the end face of one end of the gas outlet tee joint, and the inner wall of the water tank is in tight contact with the outer wall of the vortex heat pipe via a Y-shaped sealing ring.

3. The supersonic nozzle vortex tube refrigeration and nano-fluid minimal quantity lubrication coupling supply system according to claim 1, wherein the outer diameter of the volute diverter is equal to the inner diameter of the intake sleeve, and the cross section of the inner wall of the volute diverter is of Archimedes spirals.

4. The supersonic nozzle vortex tube refrigeration and nano-fluid minimal quantity lubrication coupling supply system according to claim 1, wherein the supersonic nozzle comprises a nozzle boss, a nozzle disc and a nozzle gas outlet pipe; a cool gas passage is formed inside the nozzle disc; the nozzle boss is formed on the end face of one end of the nozzle disc, a through hole is formed in the center of the nozzle boss, nozzle flow channel slots are formed in the inner wall of the through hole, the nozzle flow channel slots divide the inner cavity of the through hole into a plurality of vortex chambers, and the volute diverter is arranged on the outer wall of the nozzle boss; the nozzle gas outlet pipe is arranged on the end face of the other end of the nozzle disc, and the inner diameter of the nozzle gas outlet pipe is gradually increased along the gas delivery direction; and the nozzle flow channel slots, the cool gas passage and the gas path of the nozzle gas pipe are communicated with each other.

5. The supersonic nozzle vortex tube refrigeration and nano-fluid minimal quantity lubrication coupling supply system according to claim 1, wherein the center lines of the nozzle flow channel slots comprise one of equiangular spirals, Archimedes spirals and rectangular lines.

6. The supersonic nozzle vortex tube refrigeration and nano-fluid minimal quantity lubrication coupling supply system according to claim 1, wherein threads are formed on the outer wall of the

vortex heat pipe; or a plurality of ribs are uniformly arranged on the outer wall of the vortex heat pipe.

7. The supersonic nozzle vortex tube refrigeration and nano-fluid minimal quantity lubrication coupling supply system according to claim 1, wherein the cool gas proportion adjusting valve comprises a stud and a nut matched with the stud; the stud is a flat end face conical stud, and the tapered angle of the stud is between 35 and 55 degrees; an elastic collar is arranged close to the tapered angle of the stud on the stud, and an O-shaped sealing ring is arranged away from the tapered angle of the stud.

8. The supersonic nozzle vortex tube refrigeration and nano-fluid minimal quantity lubrication coupling supply system according to claim 1, wherein the gas distribution control valve comprises a shell; a plurality of shell gas channels independent from each other are formed inside the shell, and each shell gas channel is communicated with the gas inlet quick plug and the gas outlet quick plug; a gas control valve is arranged on the pipeline of each shell gas channel, and the gas control valve can move vertical to the gas channel.

9. The supersonic nozzle vortex tube refrigeration and nano-fluid minimal quantity lubrication coupling supply system according to claim 1, wherein the low-temperature oil gas external mixing atomizing nozzle comprises a coiled pipe, a nozzle gas inlet pipe, a thermal insulation pipe, a nozzle tapered pipe , a nozzle sleeve and a nozzle needle; one end of the coiled pipe is in threaded connection with one end of the nozzle gas inlet pipe, and the other end of the nozzle gas inlet pipe is in threaded connection with one end of the nozzle sleeve; the nozzle tapered pipe and the nozzle needle are sequentially arranged in the nozzle sleeve along the gas spray direction, and one end of the nozzle needle is communicated with the tapered end of the nozzle tapered pipe; a tapered pipe rib plate is further arranged on the outer wall of the plane end of the nozzle tapered pipe, and the tapered pipe rib plate is provided with at least one tapered pipe rib plate vent; the thermal insulation pipe is arranged in the nozzle gas inlet pipe, one end of the thermal insulation pipe is communicated with the plane end of the nozzle tapered pipe, and the other end of the thermal insulation pipe is pressed on a second step of the nozzle gas inlet pipe; one end of an oil delivery pipe penetrates through the pipeline of the thermal insulation pipe and is communicated with the nozzle needle, and the other end penetrates through the pipeline of the coiled pipe and is communicated with the oil outlet of the nano-fluid minimal quantity lubrication supply system.

10. The supersonic nozzle vortex tube refrigeration and nano-fluid minimal quantity lubrication

coupling supply system according to claim 9, wherein the angle of the tapered end of the nozzle sleeve is the same as that of the tapered end of the nozzle tapered pipe, and the inner diameter of the straight part of the nozzle sleeve is greater than that of the straight part of the nozzle tapered pipe.