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Eskeli

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[54] **GAS COMPRESSOR**

[76] Inventor: **Michael Eskeli,** 6220 Orchid Ln., Dallas, Tex. 75230

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[52] **U.S. Cl.** **62/402,** 72/86

[51] **Int. Cl.** **F25d 9/00**

[58] **Field of Search** 62/402, 86, 87

[56] **References Cited**

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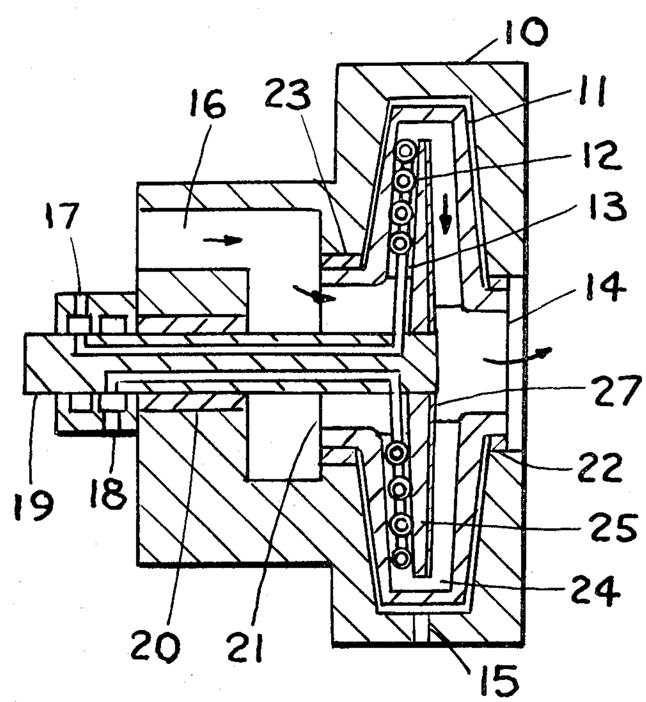
Primary Examiner—William J. Wye

[57] **ABSTRACT**

A method and apparatus for compressing gases, wherein a gas is compressed in a continuous flow centrifuge provided with cooling. The gas enters said centrifuge near axis of rotation, and leaves near axis of rotation, thus providing for low work input to the compressor. Gas to be compressed may be air, and the coolant may be water. Leaving gas after compression will have lower temperature than at compressor entry.

3 Claims, 2 Drawing Figures



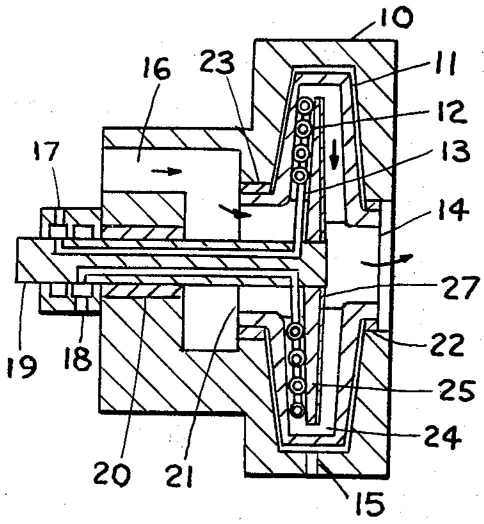

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FIG. 1

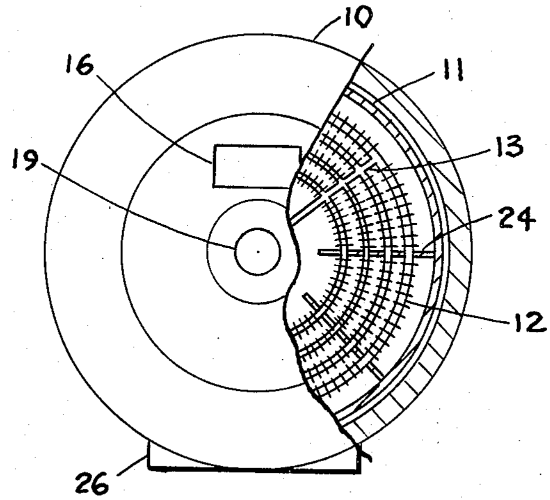
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FIG. 2

GAS COMPRESSOR

BACKGROUND OF THE INVENTION

This invention relates generally to devices for compressing air and other gases by employing centrifugal force to compress said gas, from a lower pressure to a higher pressure.

Various devices for compressing gases using centrifugal force have been used in the past. In most conventional centrifugal compressors, the gas is compressed by accelerating said gas to a high velocity within a rotating impeller, and then discharging said gas to a stationary diffuser where the gas velocity is reduced with an accompanying increase in gas pressure. These devices generally are inefficient due to high friction losses and turbulence losses in the rotor passages and in the diffuser.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 illustrates a cross section of the compressor, seen from the side, and

FIG. 2 shows an end view of the unit with a section removed to show the interior construction of the rotor and housing.

DESCRIPTION OF PREFERRED EMBODIMENTS

It is an object of this invention to provide a method and apparatus for compressing gases in a centrifugal machine wherein the energy required to compress said gas is partially supplied from external sources, and partially obtained from the gas being compressed, resulting in a compressor for which power input is low. Further, it is an object of this invention to provide a machine with a simple construction wherein gas velocities are low within the machine thus reducing friction losses.

In FIG. **1**, gas enters the machine via entry **16**, and passes to rotor **11** at entry port **21**, and then passes within the said rotor to near the periphery of said rotor and is being compressed by centrifugal action by said rotor, with cooling being provided during compression by cooling coil **12**. After compression, said gas is returned to center of rotor and leaves rotor at exit **14**. Coolant fluid is being supplied via coolant entry **17**, and passes to rotor via shaft **19**, to distribution conduit **13**, and from there to heat exchanger coil **12**, and from there back to passage in shaft, and to coolant exit **18**. **10** is rotor casing, **22** and **23** are rotor seals, **20** is rotor shaft bearing, **27** is thermal insulation applied to rotor divider **25**, **24** is rotor vane to assure that said gas will rotate with said rotor, and **15** is a vent opening from space between rotor and housing, said vent may be connected to a vacuum pump to evacuate said space and thus reduce drag on said rotor.

In FIG. **2**, an end view of the unit shown in FIG. **1**, is illustrated. A section is removed from the unit to show interior details. **10** is casing, **11** is rotor, **13** is coolant supply to heat exchanger **12**, **24** is a radial vane within rotor cavity, **16** is inlet for gas, **19** is rotor shaft, **26** is unit base.

In operation, said gaseous fluid enters said rotor, near the axis of rotation, and is compressed within the rotor cavity by centrifugal action by said rotor on said gas, said compression being nearly isothermal, with cooling being supplied during compression by a heat exchanger provided within said rotor cavity. After reaching rotor

periphery, said gaseous fluid is passed on the other side of said rotor back to rotor center; thus, the work require to compress said gaseous fluid on entry side of said rotor, is nearly all recovered on the exit side of said rotor, with vanes placed within rotor cavity assuring that the gaseous fluid will rotate with rotor at all times. There is a decrease in gaseous fluid pressure when the fluid passes from the rotor periphery to rotor exit at center of rotation, but this pressure loss is less than the pressure gain was on the entry side; thence, the unit exit pressure is higher than the unit entry pressure. Thermal insulation is placed on the rotor dividing wall to prevent heat being added to the cool gaseous fluid at the exit side of the rotor, as shown in FIG. **1**, item **27**. It should be noted that the gaseous fluid temperature is lower at unit exit, than at unit entry, and that the temperature of the leaving cooling fluid is higher than the temperature of the entering cooling fluid.

The rotor cavity is sized to provide for relatively low gaseous fluid velocities, relative to rotor, typically these velocities in the area near the periphery are below 100 feet per second. The rotor tangential velocities at periphery are high, and may range from 500 feet per second upwards; these rotor velocities are dependent of the physical properties of the fluid being compressed, and the pressure required at rotor exit.

Power from an external source is supplied to rotor shaft **19**.

The rotor entry and exit openings may be the same diameter, or they may be different, as indicated in FIG. **1**, or as required for pressure differential between rotor entry and exit.

The rotor side walls at rotor exterior may be built closely to rotor casing so that the space between rotor and wall may be partially evacuated by rotating thus reducing drag losses. Also, the space between rotor and casing may be evacuated by using a vacuum pump thereby eliminating losses due to friction on rotor outer surface.

There are variety of applications that this device may be used. It can be used as an air compressor, or to compress gases or various kinds. Also, it can be used as the compressor stage in gas turbines and jet engines; also, it can be used as the basic unit to form a thrust generator by attaching a suitable nozzle to the rotor exit opening, so that the gas is accelerated to high velocity and then discharged.

Control for the unit may be provided by controlling the coolant flow, or by having a control valve either at rotor entry or exit.

Various controls, gages and governors may be used with the device of this invention. They do not form a part of this invention and are not further described herein.

The heat exchanger is shown in the drawings to be made of finned tubing loops placed within said rotor cavity. There are numerous other heat exchanger arrangements that can be used without departing from the spirit of the invention.

What is claimed is:

1. A device for compressing gases and comprising:

a. a rotor for compressing said gas, rotatably mounted and supported by a shaft and bearing, said rotor having an entry for said gaseous fluid near center of rotation, said rotor having passages built within to pass said gaseous fluid from said entry outwardly to rotor periphery and then to an exit near the center of rotation, said gaseous fluid being compressed within said rotor by centrifugal action by said rotor on said gaseous fluid to a higher pressure near the periphery of said rotor, and then said gaseous fluid being allowed to expand on the exit side of said rotor, vanes being provided in rotor cavity to assure that said fluid will rotate with said rotor, said gaseous fluid being cooled by a coolant fluid being supplied to said rotor and being circulated in heat exchange relationship with said gaseous fluid during compression, said coolant fluid being supplied to said rotor near axis of rotation and then being discharged from said rotor near axis of rotation, said rotor being rotated and supplied with power from an external source, said gaseous fluid pressure being lower at rotor entry than at rotor exit; said coolant being in separate passages within rotor;

b. a casing to support said rotor and to house said rotor.

2. The device of claim **1** wherein said casing is sealed to said rotor at areas near the center of rotation, and where said casing space between said casing and said rotor is evacuated by using a vacuum pump to reduce friction losses on said rotor.

3. The device of claim **1** wherein said gaseous fluid is air, and said coolant fluid is water.

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