United States Patent [19]

Van Staveren

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[45] **Jan. 8, 1974**

[54] **CENTRIFUGAL FLUID VANES COMPRESSOR**

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[52] **U.S. Cl.** **417/67,** 415/185, 415/198, 417/406

[51] **Int. Cl.** **F04f 11/00**

[58] **Field of Search** ..... 417/67, 68, 120, 417/236, 248; 415/184, 185, 98, 199 A, 56, 198

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Primary Examiner—Henry F. Raduazo
Attorney—Watson, Cole, Grindle & Watson

[57] **ABSTRACT**

A centrifugal fluid vanes compressor for compressing an effluvium is described, which comprises a compression chamber bounded by two parallel walls between which the fluid vanes are rotating, which vanes are formed by a flowing fluid which emerges at a high velocity through jet openings in a rapidly rotating driven rotor.

The compressed effluvium is discharged and the fluid of the fluid vanes is collected in a fluid reservoir and recycled via a pump.

An improved fluid vanes compressor is described in which the fluid entrance opening of the rotor is situated substantially in the same circumferential plane of the rotor as the discharge openings of the jets.

As a result of these measures the relative rate of discharge of the fluid from the jet openings is substantially equal or little lower than the local circumferential speed of the rotor which results in a considerable improvement in efficiency.

2 Claims, 3 Drawing Figures

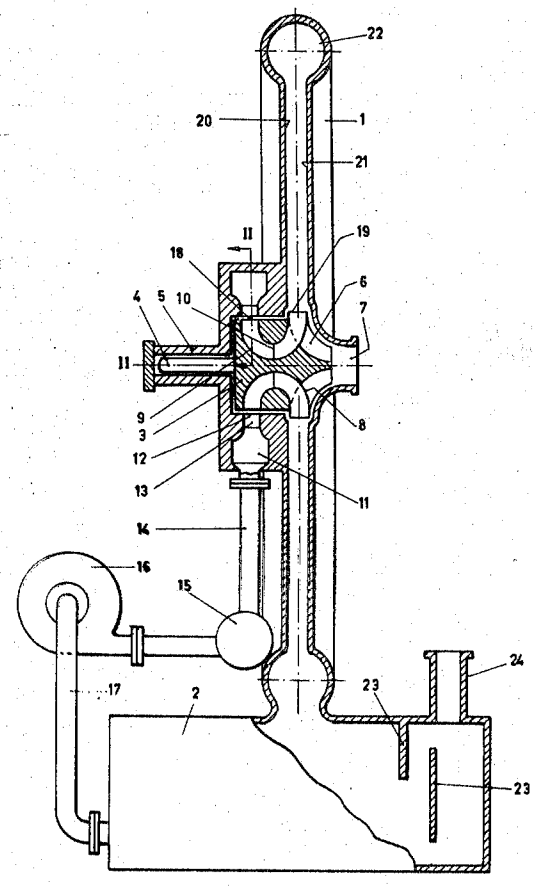


FIG. 1

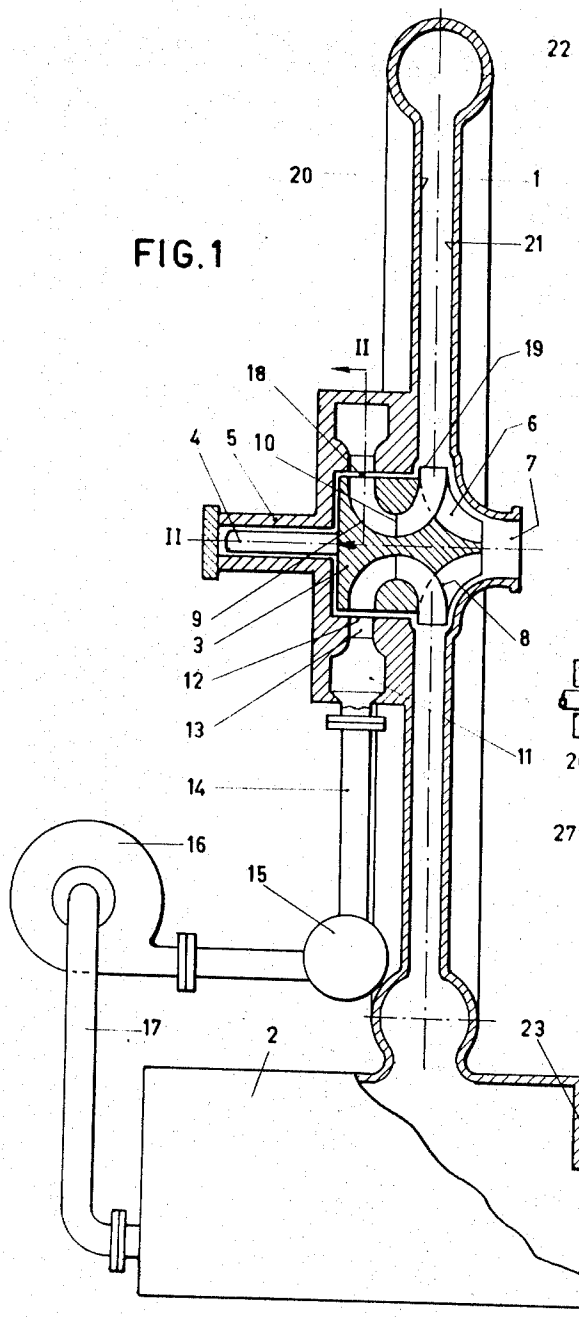


FIG. 2

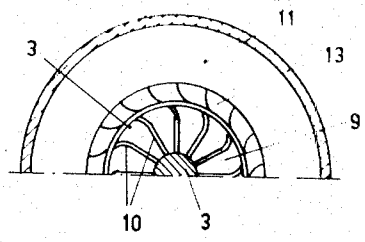
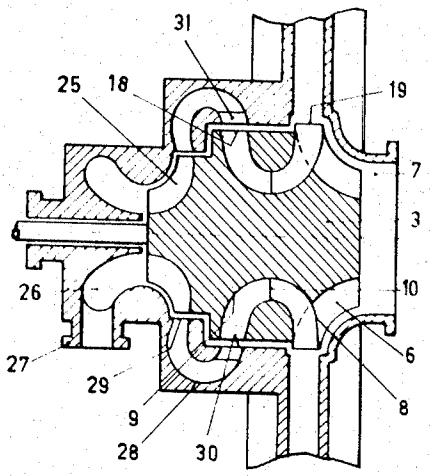


FIG. 3



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CENTRIFUGAL FLUID VANES COMPRESSOR

The invention relates to a centrifugal fluid vanes compressor for compressing an effluvium. Such compressors are generally known in the art. In the process, the vanes are formed by a flowing fluid, which emerges at a high velocity through openings in a rotating rotor. The fluid vanes are formed because in the driven rotor mechanical power is transmitted to the fluid. So as to have, in the rotor, transmitted to the fluid as much energy as possible, this fluid, therefore, is carried substantially axially into the rotor at a rate as low as possible. The relative velocity, with which the fluid emerges from the rotor, is, however, under those conditions equal to or greater than the local circumferential speed of the rotor.

Surprisingly it has been found that, when the relative rate of discharge of the fluid is lower than the local circumferential speed of the rotor, this yields a considerable improvement in efficiency. By efficiency is then understood that part of the power fed to the rotor that is transmitted to the effluvium to be compressed.

A reduction in the relative rate of discharge can be obtained by throttling away in the rotor a part of the speed energy of the fluid in the jets, for instance by providing wire gauzes in the jets.

This reduction in rate then results in thicker fluid vanes, which consequently are active up to a larger diameter than the original fluid vanes without the gauze packet in the jet. The fluid vanes are active up to a diameter at which they disintegrate into drops.

Though throttling a part of the speed energy of the fluid yields an improvement in efficiency, the kinetic energy, however, is converted into heat, which again results in considerable loss.

It is an object of the invention to improve the effiency of the centrifugal fluid vanes compressor without energy being lost.

It is another object of the invention to effect a reduction in the relative rate of discharge of the fluid from the jets in the rotor of the centrifugal fluid vanes compressor.

According to the invention the fluid in a centrifugal fluid vanes compressor is fed into the rotor at a rate of supply that is substantially equal to its local circumferential speed.

It is characterized in that the fluid-entrance opening of the rotor is situated substantially in the same circumferential plane of the rotor as the discharge openings of the jets and in that around the rotor opposite to the entrance opening an annular fluid chamber is provided that is connected to a fluid supply duct, and whose supply slit, which is provided over the inner diameter, is provided with guiding blades, which are tangentially directed, as much as possible, with respect to the rotor, in its direction of rotation and in that the absolute entrance speed of the fluid to the rotor is substantially equal to the local circumferential speed of the rotor.

A fluid vanes compressor with such a rotor has a considerably higher efficiency, on the one hand because the fluid vanes are active up to a larger diameter and on the other hand because less power need to be transmitted to the fluid.

With this fluid vanes compressor it is not possible to transmit all the power required in the driven rotor. Upon entering the rotor the fluid must already have a good deal of kinetic energy, so that a separate fluid pump is needed.

With advantage the dimensions of the rotor can be chosen such that in this rotor no power is transmitted to the fluid. In this case in the fluid pump the totally required power is transmitted to the fluid. Then the rotor of the fluid vanes compressor need not to be driven mechanically.

In doing so, the rotor is driven by the tangentially directed fluid.

Besides, it is possible to supply the fluid substantially axially to the rotor and to conduct to the periphery of the rotor via a bent supply duct. The important advantage of this is that the centrifugal pump required for it then can be assembled with the rotor so that more compactness is obtained.

With advantage a centrifugal fluid supply pump is mounted in the axial line of the rotor and united with the rotor to one unit and around the rotor, an annular fluid bypass channel is provided, of which a supply slit provided alongside the inner diameter is arranged opposite to the centrifugal pump and a discharge slit provided alongside the inner diameter is arranged opposite to the entrance opening of the rotor and the latter discharge slit is provided with guiding blades tangentially directed,as much as possible, with respect to the rotor in its direction of rotation.

The invention will be further elucidated below with reference to the drawings, in which by way of example an embodiment is shown.

Thereby:

FIG. 1 is a vertical cross-sectional view taken through a centrifugal fluid vanes compressor that is schematically shown;

FIG. 2 is a section taken through line II—II in FIG. 1; and

FIG. 3 is a vertical cross-sectional view taken through an embodiment of a rotor combined with a fluid pump, which is schematically shown.

The compressor shown in FIG. 1 consists of a compressor housing 1, which is assembled with a fluid reservoir 2. Centrally in compressor housing 1 a rotor 3 is mounted, which fixedly links up with a shaft 4, which has its bearings in a bearing housing 5, which fixedly links up with housing 1.

Rotor 3 is provided with blades 6 for sucking through a nozzle 7 an effluvium that has to be compressed, for example air.

Moreover, rotor 3 is provided with jets 8, which link up directly with an annular slit 9 provided in the rotor and in which over its whole periphery, blades 10 are provided and in which the fluid is distributed over the jets 8.

An annular fluid chamber 11 is situated around rotor 3; it partially encloses the rotor and is provided with a fluid discharge slit 12 alongside its inner diameter, which slit is situated opposite to supply 18 of annular slit 9. In fluid discharge slit 12 guiding blades 13 are provided, which are tangentially directed with respect to rotor 3 and in its direction of rotation. Rotor 3 is driven by the tangentially directed fluid.

Fluid chamber 11 links up with a fluid supply duct 14, which via an adjusting device 15 is coupled with a pump 16, which links up with fluid reservoir 2 via pump duct 17.

According to the invention entrance opening 18 for the fluid forming the fluid vanes and discharge openings 19 are situated substantially in the same circumferential plane of rotor 3 and the shortest connections be-

tween these openings then are formed by channels **8** and **9.**

FIG. **2** shows clearly the manner in which fluid chamber **11** encloses rotor **3** and the manner in which guiding blades **13** are tangentially directed.

The space within which the fluid vanes are formed is bounded by walls **20** and **21,** which are surrounded by a collecting-channel **22,** which is in open connection with fluid reservoir **2.**

In fluid reservoir **2** the compressed effluvium is, in a way known in the art, separated from the fluid with the aid of partitions **23** and then discharged via outlet **24.**

In FIG. **3** an embodiment is shown of a rotor according to the invention, which is combined with a centrifugal fluid vanes pump **25,** which on the one hand links up with an annular fluid chamber **26,** whose tee **27** can be connected to fluid supply duct **14** and, on the other hand, links up with an annular fluid bypass channel **28** of which a supply slit **29** provided alongside the inner diameter is situated opposite to centrifugal pump **25** and a discharge slit **30** is situated alongside the inner diameter opposite to entrance opening **18** of rotor **3.** In discharge slit **30** guiding blades **31** are arranged, which are tangentially directed, as much as possible, with respect to the rotor.

It is self-explanatory that the fluid vanes compressor according to the invention, as far as its compressor space concerns, can be constructed in accordance with the pending U.S. Pat. Application Ser. No. 19,758 filed by the same applicant and now U. S. Pat. No. 3,630,641 dated Dec. 28, 1971, in which the distance between the two walls bounding the compressor space gradually increases from the centre in radial direction and the layer of fluid remaining on the walls is removed during the compression process; or in accordance with the pending U.S. Pat. Application Ser. No. 13,932 filed by the applicant and now U.S. Pat. No. 3,612,723 dated Oct. 12, 1971, in which one or both of the parallel walls, bounding the compressor space, can freely rotate concentrically with the rotor and alongside its periphery is provided with blades that over their fronts facing the rotor are interconnected by a wire mesh

screen, which leads the compressed gaseous medium towards the discharge opening but allows the fluid of the fluid vanes to pass.

The construction of the centrifugal fluid vanes compressor according to the invention can with advantage be applied in a gas turbine cycle.

I claim:

1. A centrifugal fluid vanes compressor for compressing a gaseous medium comprising:

a compression chamber having a central inlet for a gas;

a driven rotor disposed generally in the center of the compression chamber;

said compression chamber having a pair of spaced walls disposed on opposite sides of the rotor and extending radially outwardly away from the rotor;

said rotor being provided with vanes for suction of gas through the central inlet and having jet channels extending therethrough;

a fluid supply duct including a fluid pump connected to the jet channels of the rotor;

a fluid reservoir in open communication with the compression chamber and connected with the fluid pump,

said reservoir having a discharge pipe for the compressed gas;

said jet channels having inlet ends which are situated in substantially the same circumferential plane as the outlet ends of said jet channels,

said inlet ends of the jet channels being surrounded by an annular fluid chamber connected to said fluid supply duct and having an outlet opening situated opposite said inlet ends of the jet channels,

said outlet opening of the annular chamber being provided with guiding blades directed substantially tangentially with respect to the periphery of said rotor in its direction of rotation.

2. A centrifugal fluid vanes compressor according to claim **1,** wherein the rotor is driven by the fluid tangentially directed by the guiding blades.

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UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 3,784,324 Dated January 8, 1974

Inventor(s) Pieter Van Staveren

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

In the title page please insert --Claims priority on application No. 7004990, filed in the Netherlands on April 7, 1970--.

Also, in the title page correct the word "Ondersoik" in the named assignee to --Onderzoek--.

Signed and sealed this 16th day of July 1974.

(SEAL)
Attest:

McCOY M. GIBSON, JR.
Attesting Officer

C. MARSHALL DANN
Commissioner of Patents

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