RE 25409

Jan. 17, 1961 R. COESTER 2,968,436

TURBO MACHINE

Filed Oct. 9, 1958 2 Sheets-Sheet 1

Fig. 1

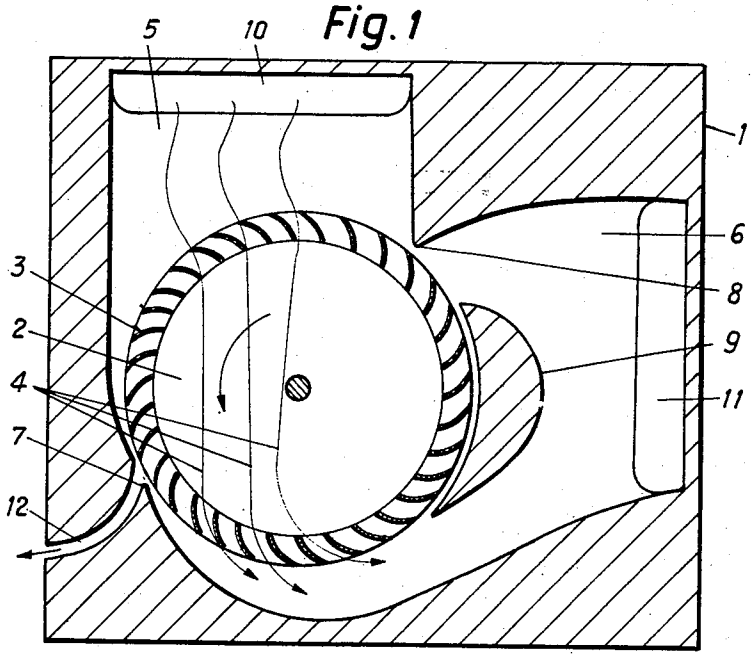
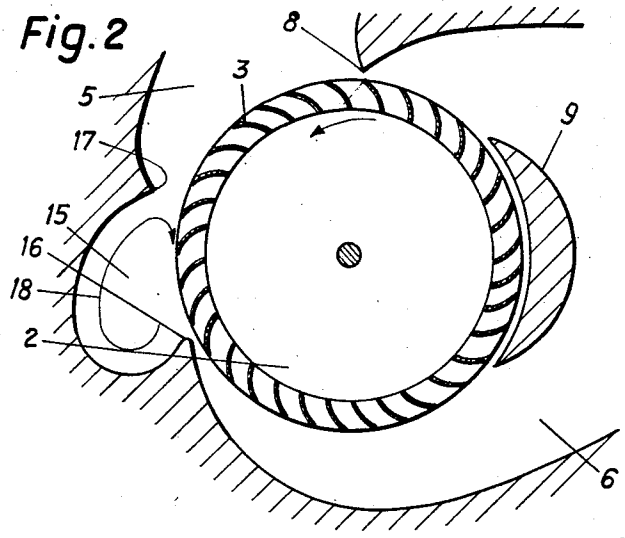


Fig. 2



Inventor:
Robert Coester

by
Wenderoth, Lind & Ponack,
Attys.

Jan. 17, 1961 R. COESTER 2,968,436

TURBO MACHINE

Filed Oct. 9, 1958 2 Sheets-Sheet 2

Fig.3

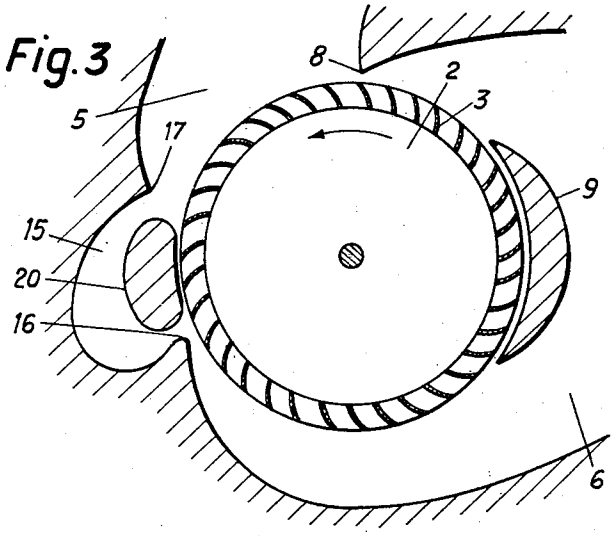


Fig.4

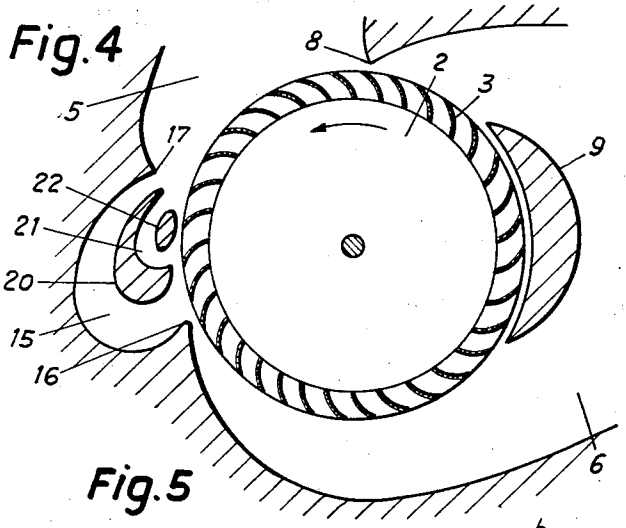
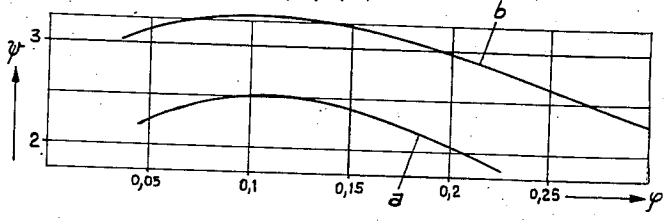


Fig.5



Inventor:
Robert Coester

by
Wenderoth, Lind + Ponack
Attys.

United States Patent Office 2,968,436
Patented Jan. 17, 1961

2,968,436

TURBO MACHINE

Robert Coester, Zurich, Switzerland, assignor to Maschinenfabrik Benninger A.-G., Uzwil, Switzerland

Filed Oct. 9, 1958, Ser. No. 766,229

Claims priority, application Switzerland Oct. 10, 1957

3 Claims. (Cl. 230—125)

The present invention relates to a pressure generating turbo machine and more particularly to a cross current blower in which a space is divided by a conveyor rotor into a high pressure and a low pressure chamber. The invention aims to improve in turbo machines of the mentioned type the efficiency and to increase the specific conveying pressure, more particularly for small specific conveying volume.

It is well known, that cross current blowers attain a relatively high efficiency for high loads. However, for smaller conveying volumes the pressure and the efficiency decrease rapidly. Decisive is the dimensionless volume figure

$$\varphi=\frac{Q}{D.b.u}$$

in which Q is the conveyed volume, D the rotor diameter, b the rotor width in axial direction and u the circumferential speed of the rotor periphery. Small volume figures φ are often desirable for example in ventilators which shall have the least possible current speeds or in blowers and pumps with small conveying volumes with respect to the delivery pressure.

A prime object of the present invention thus consists in the realization of an improvement of the efficiency of turbo machines which shall work with small φ.

To this end the turbo machine according to the present invention is characterized by means producing at the rotor periphery, at the transition of the rotor vanes from the low pressure chamber to the high pressure chamber a depression with respect to the low pressure chamber.

Other features and advantages of the machine according to the invention will become apparent from the description now to follow, of preferred embodiments thereof, given by way of example and in which reference will be made to the accompanying purely diagrammatical drawings in which:

Figs. 1, 2, 3 and 4 illustrate cross-sections taken through several different machines, and

Fig. 5 shows a diagram.

The turbo machine illustrated in Fig. 1 in cross-section comprises a casing **1** locating a rotor **2**. Vanes **3** are equidistantly provided on the circumference of this rotor **2**. The blower rotor is traversed crosswise by the medium to be conveyed as is diagrammatically indicated by the current lines **4**. The rotor **2** divides the inner space of the casing into a high pressure chamber **6** and into a low pressure chamber **5**, whereby the casing approaches at the points **7** and **8** the immediate vicinity of the outer limitation of the rotor. A covering body **9** may be arranged in the high pressure chamber **6** and may already result in an improvement of the efficiency of the turbo machine. The action of this covering body as well as its dimensioning has been described in my copending application 657,846, filed May 8, 1957. The medium to be conveyed may enter perpendicularly to the axial extension of the rotor into the low pressure chamber **5** and

leave from the high pressure chamber **6**. It is also possible to evacuate and to feed the medium through conduits extending parallelly to the rotor axis and indicated diagrammatically at **10** and **11** in Fig. 1.

It has been found that a substantial improvement of the efficiency of the machines of the described type is obtained by producing a depression immediately in front of the projection **7** of the inner casing wall, seen in direction of rotation, i.e. where the rotor vanes pass from the low pressure chamber to the high pressure chamber. A depression produced at this point has an accelerating action onto the current leaving the rotor after point **7** in direction of rotation, whereby the current losses in the rotor are greatly diminished and simultaneously the total pressure produced in the rotor is substantially increased. The depression at this point may be produced for example by the provision of a slotted opening **12** through which is sucked away a corresponding amount of the conveyed medium. The slot may to this end be connected for example with a pump. The slot may also be tapered in the manner of a diffuser, whereby it is also possible to obtain a suction effect. In addition thereto it is also possible to obtain the desired depression by a corresponding conformation of the casing wall at the transition point of the rotor vanes between the low pressure chamber and the high pressure chamber. Examples for this are represented in Figures 2–4 whereby similar parts are designated by like references.

In the blower represented in section in Fig. 2 a sack-like recess **15** is provided in the casing wall where the rotor vanes pass from the low pressure chamber to the high pressure chamber. This recess **15** is bordered towards the low pressure chamber by a projection **17** directed towards the rotor but not necessarily attaining the latter. The corresponding projection **16** of the inner wall of the casing between the recess **15** and the high pressure chamber **6** preferably extends to the immediate vicinity of the outer circumference of the rotor.

With such conformation of the casing wall at the mentioned transition point a whirl is originated at this point as indicated by the arrow **18**. This whirl produces as it has been proved by tests and measurements the desired depression. In all cases it should be tended to bring the center of this whirl as near as possible to the rotor periphery.

Fig. 3 illustrates an improvement of the blower shown in Fig. 2. In this variant an approximately oval body **20** is arranged in the recess **15** so as to almost lie with a flat side against the periphery of the rotor **2**. This body may adapt itself to the shape of the recess **15** and it results in a further approach of the whirl to the rotor periphery.

Fig. 4 shows still a further improvement of such an insert body **20**. As is visible from this figure, this body is provided with a recess **21** having a shape similar to that of the recess **15**. In a further variant a still further oval body **22** may be arranged in this recess **21**.

The improvement of the output obtained is visible from the diagram of Fig. 5. On the abscissa there is reported the dimensionless volume figure

$$\varphi=\frac{Q}{D.b.u}$$

while on the ordinate there is reported the also dimensionless pressure figure

$$\psi=\frac{p_2-p_1}{\frac{\delta}{2}\cdot u^2}$$

whereby p_2-p_1 is the pressure difference obtained in the apparatus, δ the density of the conveyed medium and u the peripheral speed of the rotor. Curve a has been ob-

tained with a blower similar to that of Fig. 1 yet without means for producing a depression at the transition point of the rotor vanes between the low pressure chamber and the high pressure chamber. Curve *b* has been obtained with a turbo machine according to Fig. 3. As is easily seen the values of curve *b* are improved to an average of 20% over those of curve *a*.

Only by way of example there shall now be indicated the pressure ratios which may lead to good results. The pressure in the low pressure chamber is indicated by p_1, the pressure in the high pressure chamber is indicated by p_2, while the pressure at the transition point of the rotor vanes from the low pressure chamber to the high pressure chamber is designated by p_u. The difference p_1-p_u may for example be 0.7, while p_2-p_1 may be 3.

I claim:

1. A transverse flow blower, comprising a rotor, a housing around said rotor and extending along the periphery of the rotor, said rotor having a plurality of blades spaced around the periphery thereof and having a hollow annular center into which the spaces between the blades open, said rotor being mounted in said housing for rotation in one direction, a low pressure inlet opening into said rotor housing along one portion of the periphery of said rotor, and a high pressure outlet opening out of said rotor housing from another portion of the periphery of said rotor, the rotor separating said inlet and outlet, and said housing having a swirl chamber therein opening into said rotor housing along the periphery of said rotor from a point immediately preceding the point where the blades of said rotor enter said high pressure outlet and back along the periphery of said rotor toward said low pressure inlet, the swirl chamber having a wall defining the chamber which has a shape of a portion of a spiral extending outwardly away from said rotor and back along the periphery of said rotor in a direction opposite to the direction of rotation of said rotor with the portion of the smaller radius of curvature being toward said high pressure outlet, said wall intersecting said housing along the periphery of said rotor adjacent said point immediately preceding the point where the blades of said rotor enter the high pressure outlet to form a first cut-off point, and intersecting the wall of said housing along the periphery of the rotor adjacent the inlet to form a second cut-off point, whereby fluid being drawn into said inlet is deflected inwardly through the blades of said rotor by said second cut-off point, thereby causing a reduced pressure in said swirl chamber which causes the fluid to be moved outwardly between the blades of the rotor into said swirl chamber, so that fluid is moved through the spaces between the blades as the blades enter the outlet.

2. A transverse flow blower as claimed in claim 1 in which said swirl chamber has a body therein which is substantially oval in cross-section and having one edge extending along and adjacent to the periphery of said rotor and the remaining edges spaced from the wall of said swirl chamber.

3. A transverse flow blower as claimed in claim 2 in which said body has a second swirl chamber therein opening out of the edge of said body which is adjacent said rotor, said second swirl chamber having a wall with the shape of a portion of a spiral with the portion of the smaller radius of curvature being toward said high pressure chamber, and a further body in said second swirl chamber in said body having a substantially oval cross-section with one edge extending along and adjacent to the periphery of said rotor and the remaining edges spaced from the wall of the second swirl chamber in said body.

References Cited in the file of this patent

UNITED STATES PATENTS

507,445	Mortier	Oct. 24, 1893
1,045,732	Nash	Nov. 26, 1912
1,429,044	Nash	Sept. 12, 1922
2,537,344	Gruss	Jan. 9, 1951

FOREIGN PATENTS

291,007	Great Britain	Aug. 2, 1928
477,345	Germany	June 12, 1929
929,668	Germany	June 30, 1955