ABSTRACT OF THE DISCLOSURE

A centrifugal compressor including an impeller enclosed within a casing made of two parts. A removable annular plate is also disposed within the casing for forming a diffuser between the disk and one part of the casing. Means are provided to cause the inner periphery of the plate to bear against the other casing part to form a seal between a high pressure scroll compartment and the low pressure region of the diffuser without degrading the required clearance between the impeller and the casing.

This invention relates to a centrifugal compressor and, more particularly, to the casing for the compressor.

An object of this invention is to provide a simplified, inexpensive rugged construction for a centrifugal compressor, which can be produced by volume production methods such as die casting.

Another object of this invention is to provide for the casing of the aforementioned object a means for maintaining a very small clearance between the casing and the rotating impeller.

Another object of this invention is to provide a casing for a centrifugal compressor with a removable annular plate dividing the diffuser from the scroll and having sufficient rigidity to form a pressure seal between the inner periphery of the plate and the casing without degrading the necessary clearance between the casing and the impeller.

The foregoing and other objects, advantages and characterizing features of this invention will become apparent from the ensuing detailed description of the illustrative embodiment thereof, reference being made to the accompanying drawings wherein:

FIG. 1 shows the assembled novel centrifugal compressor;

FIG. 2 shows the centrifugal compressor of FIG. 1 with the inlet and outlet member unclamped from the backup plate;

FIG. 3 is an axial view of the inlet and outlet member of the casing for the compressor of FIG. 1 showing the annular plate in place;

FIG. 4 is an axial view of the backup plate and impeller assembly of the compressor in FIG. 1;

FIG. 5 is an enlarged fragmentary view of the sealing surfaces encircled by circle 5-5 in FIG. 1 showing the components axially separated; and

FIG. 6 is an axial view of the inlet and outlet member of the casing for the compressor of FIG. 1 showing an alternate embodiment of the annular plate in place.

Referring to the drawings and to FIG. 1, in particular, the novel centrifugal compressor is shown assembled. The compressor includes a casing comprising a backplate 12 and an inlet and outlet member 13. Member 13 has an inlet tube 16 and flanges 14 and 18 disposed internally and externally, respectively, and coaxially therewith. The flange 18 forms a scroll compartment 24 together with an annular plate 22. An outlet tube 25 (FIG. 3) extends radially from the flange 18 in a manner well known in the art.

The flange 18 is formed to match the associated equipment. The periphery of the flange 18 is clamped to the backplate 12 by a suitable clamping means 20 that is well known in the art. Between the plate 22 and the backplate 12, a cervical directed passageway 26 which functions as a diffuser. Between the plate 22 and the backplate 12 a nonpermanent demountable seal is formed in a novel manner to be described hereinafter without degrading the clearance between the shroud flange 14 and the impeller 28. The impeller 28 is suitably fixed to a shaft 30 which is rotatably mounted in the backplate 12 in a manner well known in the art.

As shown in FIG. 2, when the clamping means is removed, the compressor is divided into a backup plate and impeller assembly 11 and the inlet and outlet member 13. The various dimensions of the components are such that a spacing 36 is formed for between the flange 18 and the backplate 12 when the member 13 is placed touching the plate 22 and plate 22 bears against assembly 11. The width of the spacing 36 is determined primarily by the length of pins 37 disposed on the plate 22. Preferably three pins 37 are uniformly spaced around the plate 22, as shown in FIG. 3, and extend axially. The length of the pins 37 is such that, when contact is made between the pins 37 and the backplate 12 and when contact is made between a radial shoulder 38 (more clearly shown in FIG. 5) on the inlet tube 16 and an anular surface 39 on the diffuser plate 22, the flange 18 is spaced, for example, 0.1 inch from the backplate 12. The backplate 12 includes suitable stiffening ribs so that the clamping means 20 causes the flange 18 to stretch to form contact with the backplate 12. In addition, the plate 22 is relatively stiff primarily due to an axially extending flange 40 formed thereon. Thus a relatively large bearing pressure is produced between surface 39 and shoulder 38. Since the plate 22 does not deflect appreciably, the required clearance is maintained between flange 14 and the impeller 28, which clearance should obviously be as small as practical. The flange 18 has an outer diameter of, for example, 6 inches and a thickness of 0.1 inch and the shoulder 38 has a diameter of 3 inches and a width of about 0.04 inch so that moderate clamping forces are needed to produce the relatively large bearing pressure. The inlet tube 16 has a fillet radius 41 (FIG. 5), as is customary in the art, to relieve any stresses that may be formed. Therefore a 45° chamfer 42 is formed on the inner periphery of surface 39 which chamfer is of sufficient size so as not to interfere with the fillet radius. Shoulder 38 and surface 39 are machined to a finish of having imperfections of, for example, less than 125 micro-inches, so that a gasket is not required. In addition, the backup plate 12 has three shallow wells 44 to receive freely the pins 37. This prevents the plate 22 from rotating. More than three pins 37 could be used but then each pin should be machined so that its length is exactly right to insure that all pins bear against the backplate 12 before the flange 18 is clamped to the backplate.

Although the embodiment shows a vanless diffuser, one skilled in the art would be able to add suitable vanes to the diffuser plate 22 as shown in FIG. 6. In addition, one skilled in the art could adapt the features of the invention on a radial turbine without departing from the spirit and scope of the invention. Other various modifications and variations of the present invention are contemplated that would be apparent to those skilled in the art without departing from the spirit and scope of the invention. Therefore, the invention is not limited to the exemplary apparatus or procedures described, but includes all embodiments within the scope of the claims.

What is claimed is:

1. An apparatus comprising:
   a casing having two parts clamped together, forming a
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scroll and an impeller chamber with an impeller rotatably mounted therein, one of said parts having a substantially flat portion disposed exterior of said impeller chamber, said other part having a coaxial flange disposed on the exterior thereof forming a portion of said scroll, an annular member having a first annular surface disposed at the inner periphery thereof, said annular member being disposed within said casing and around said impeller, and spaced from said flat portion to form a diffuser on one side thereof and the scroll on the other side,
said other part having a second annular surface which mates with said first surface, and
means for causing said first and second surfaces to bear against each other when said two parts are clamped together.

2. The apparatus of claim 1 wherein:
said means includes at least three lugs each having a predetermined length protruding axially from said annular member,
said lugs being disposed to contact said one part, at said flat portion and said one part having at least one well to receive one of said lugs to prevent said annular member from rotating.

3. The apparatus of claim 1 wherein:
said other part has an inlet tube forming a passageway leading to the impeller chamber,
said annular member is substantially flat,
said impeller is rotatably mounted on one side of said one part with the axis of rotation disposed normal thereto, and
stiffening ribs disposed on the other side of said one part which side is opposite from said impeller.

4. The apparatus of claim 3 wherein:
said annular member has an axially extending flange disposed on the inner periphery thereof to provide stiffness thereto, and
said coaxial flange on said other part has sufficient elasticity to elongate under the action of the clamping force.

5. The apparatus of claim 4 wherein:
said first annular surface is disposed on said axially extending flange of said annular member and said first annular surface lies in a plane perpendicular to the axis of rotation, and
said second annular surface on said other part also lies in a plane perpendicular to the axis of rotation.

6. The apparatus of claim 4 wherein:
said means includes at least three lugs each having a predetermined length protruding axially from said member, and
said lugs contact said one part and said one part has at least one well to receive one of said lugs to prevent the annular member from rotating, and
said lugs are located at a larger radius from said axis than said axially extending flange.

7. The apparatus of claim 6 wherein:
said first annular surface is disposed on said axially extending flange and lies in a plane perpendicular to the axis of rotation, and
said second annular surface also lies in a plane perpendicular to the axis of rotation.

8. The apparatus of claim 3 wherein:
said impeller is rotatably mounted on one side of said one part with the axis of rotation disposed normal thereto,
said annular member having a plurality of diffuser vanes disposed substantially radially and facing said one part,
said vanes bear against said one part when said surfaces are made to bear against each other, at least one of said vanes having an axially extending lug, and
said one part has at least one well to receive said lug to prevent rotation of said annular member.

9. The apparatus of claim 8 wherein:
said annular member has an axially extending flange disposed on the inner periphery thereof to provide stiffness thereto,
said first annular surface is disposed on said axially extending flange and lies in a plane perpendicular to the axis of rotation, and
said second annular surface also lies in a plane perpendicular to the axis of rotation.

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