

[54] AXIAL COMPRESSOR

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[56] References Cited

UNITED STATES PATENTS

137,471 4/1873 Meyers 415/132
1,227,141 5/1917 Hoover 415/1311,756,958 5/1930 Schmidt 415/131
2,123,818 7/1938 Wegmann 277/55
3,503,616 3/1970 Hickey 277/53
3,647,311 3/1972 Wootton 415/171
3,773,430 11/1973 Canova et al. 415/131

FOREIGN PATENTS OR APPLICATIONS

181,635 6/1922 Great Britain 277/54
292,553 9/1928 Great Britain 415/131

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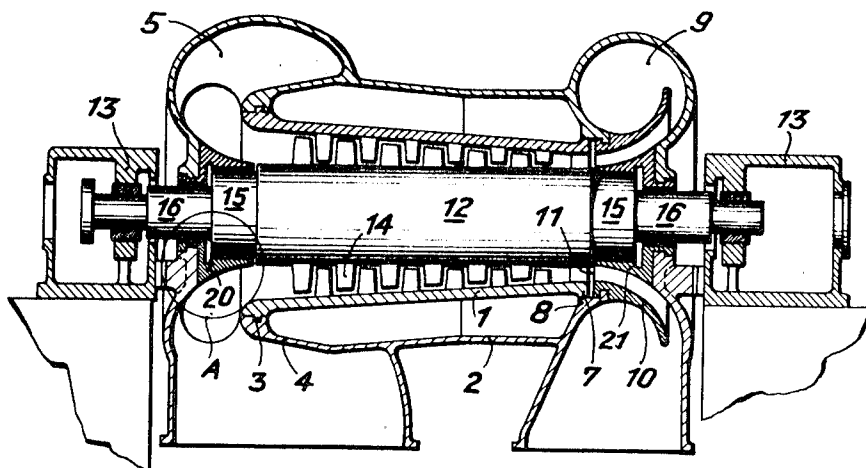
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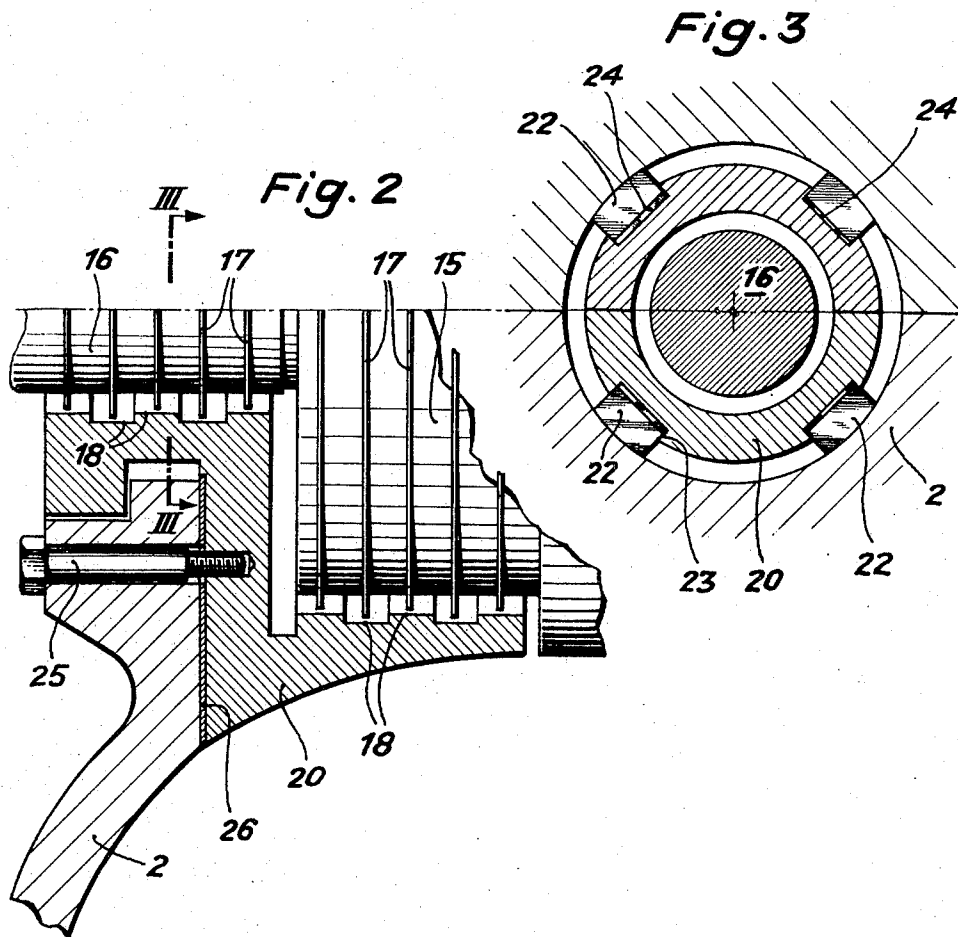
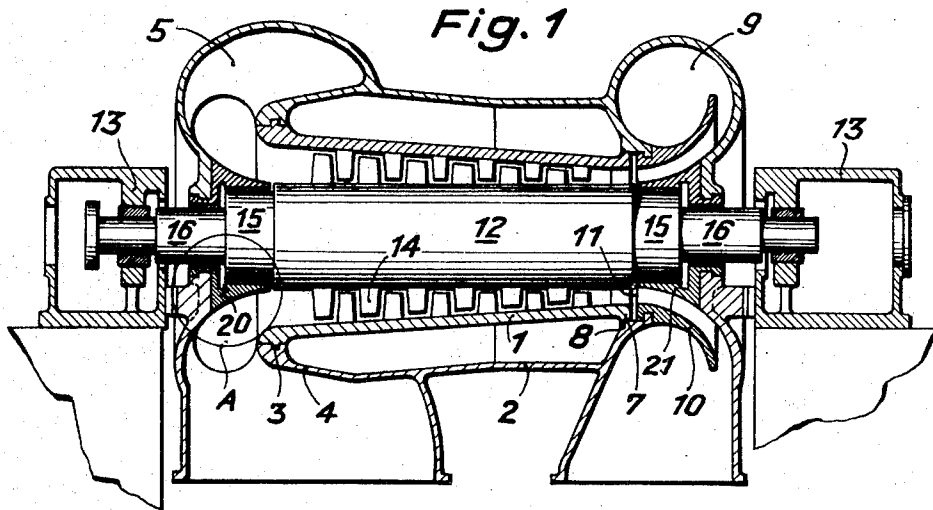
[57] ABSTRACT

An adjustably mounted structural part is disposed between the casing and rotor concentrically of each labyrinth seal to allow a centering adjustment to be made in the labyrinth seal formed by the internal surfaces in the part and the rings on the rotor. Wedge-shaped shim blocks and shims are used to effect the adjustment of each structural part on the casing.

One or more shim plates can be used to adjust the axial relation between a structural part and casing.

8 Claims, 3 Drawing Figures





AXIAL COMPRESSOR

This invention relates to an axial compressor and particularly to the centering of a rotor within a casing of an axial compressor.

Axial compressors have been known to have a stator blade support which is radially centered in a casing as well as a rotor which is centered with respect to the stator blade support by means of bearings. In order to simplify the sealing of the compressor, the stator blade support of some axial compressors has not been mounted so as to be adjustable with respect to the casing but has merely been mounted so as to be axially slidable under thermal expansion forces. This measure, however, requires the rotor to be centered with respect to the stator blade support, for example by displacement of the blocks in which the rotor bearings are mounted, fine adjustment being performed in the radial bearings themselves. Compressors constructed in this manner frequently give rise to difficulties relating to the adjustment of the usually used labyrinth seals between the casing and the rotor since these seals require closer tolerances than those tolerances required by the blade clearance of the rotor blades.

Accordingly, it is an object of the invention to facilitate the adjustment of labyrinth seals in axial compressors.

Briefly, the invention provides an axial compressor of the type having a casing, stator blade support radially centered within the casing, rotor and a labyrinth sealing means between the rotor and casing with a structural part to simplify the making of an adjustment in the sealing means. This structural part is mounted on the casing in an adjustable manner and has an inner annular surface surrounding the rotor in which a plurality of annular grooves are formed to cooperate with a plurality of radially directed rings on the rotor to define the labyrinth sealing means. The structural part is disposed to encircle one end of the rotor while a duplicate structural part envelops an opposite end of the rotor.

In order to effect an adjustment of one of the sealing means, the respective structural part is maneuvered within the casing to re-orient the annular grooves to achieve a centered relationship with the radial rings on the rotor after the rotor is put in place. To this end, means such as a plurality of shim blocks are disposed between the structural part and the casing to center the structural part radially with respect to the rotor with at least one shim between each shim block and at least one of the structural part and casing. The shims can be of varying thickness, and it is advantageous if four shim blocks are distributed over the external circumference by screw-mounting on the structural parts. Since an axial adjustment of the labyrinth sealing means is frequently required in addition to the radial adjustment, shims can be provided between the structural parts and the casing to adjust the axial relation of the structural parts to the casing.

These and other objects and advantages of the invention will become more apparent from the following detailed description taken in conjunction with the accompanying drawing in which:

FIG. 1 diagrammatically illustrates a vertical sectional view through an axial compressor according to the invention;

FIG. 2 illustrates to an enlarged scale the section A of FIG. 1; and

FIG. 3 illustrates a view taken along line III—III of FIG. 2.

Referring to FIG. 1, the axial compressor has a stator blade support 1 radially centered in a longitudinally split casing 2. An annular projection 3 of the support 1 bears on a suction side end of the compressor in a corresponding groove of a wall 4 which is associated with the casing 2 and defines a suction volute 5 with respect to the middle part of the casing 2.

The stator blade support 1 is also radially supported in the casing 2 on the delivery side and bears via a collar 7 on the mating surface of a shoulder 8 of the casing wall which defines a delivery volute 9. A gap 11 which permits axial motion of the delivery end of the stator blade support 1 is provided between the delivery side endface of the stator blade support 1 and a flared guide wall 10 of a diffuser which defines the transition into the delivery volute 9 in order to allow for thermal expansion.

In addition, a rotor 12 is journaled into two bearing blocks 13 which are separate from the casing 2. In order to effect a first rough approximation of the blade clearance of the rotor 12 with respect to the blade support 1, the bearing blocks 13 have means for adjusting the bearing blocks relative to the casing 2. For example shims (not shown) of varying thickness are inserted between the bearing blocks 13 and their support surfaces and a lateral displacement of the bearing blocks 13 is made before the blocks 13 are mounted on their support surfaces. Fine adjustment of the blade clearance is obtained in known manner (not shown) in the bearings themselves.

The rotor 12 is provided with a central portion which supports blades 14, and with stepped shoulders 15, 16 on either side of the central portion which, in turn, support sheet metal rings or plates 17 of labyrinth seals (FIG. 2). The rings 17 co-operate with stepped mating surfaces 18 of a split structural part 20, 21 respectively on the suction side and on the delivery side of the compressor. These stepped surfaces 18 define annular grooves, each of which receives a ring 17 as shown, between annular lands, each of which is concentric to a ring 17. The parts 20, 21 which also define the interior of the inlet and diffuser are adjustably mounted on the casing 2. Referring to FIGS. 2 and 3, in order to center each structural part 20 with respect to the labyrinth seal rings 17, four shim blocks 22 are disposed between the casing 2 and the part 20. As shown in FIG. 3, the shim blocks 22 are disposed in offset configuration with respect to the vertical and horizontal because of the horizontal division of the casing 2 and the structural parts 20, 21. Each block 22 is of a wedge-shape and co-operates with individual shims 24 of varying thickness.

The shim blocks 22 are inserted in corresponding grooves 23 of the structural parts 20, 21, respectively, and are retained therein by means of screw fasteners (not shown). Before being installed in the casing 2, the internal parts 20, 21 together with the shim blocks 23 screw-mounted thereon, are machine-turned in order to eliminate all eccentricity. After being installed, the structural parts 20, 21 are located in the casing 2 by means of screw fasteners 25 of which one is shown in FIG. 2.

In some circumstances, axial adjustment of the labyrinth seals is required in addition to the central adjustment. To this end, shim plates 26, whose number and/or thickness may be varied, are provided on the end-

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faces of the structural parts 20, 21 which are disposed outwardly to the casing 2.

What is claimed is:

1. In an axial compressor

a casing,

a stator blade support radially centered within said casing;

a bladed rotor rotatably mounted within said casing and stator blade support;

a structural part at least radially adjustably mounted on said casing between said casing and said rotor; and

a labyrinth seal between said structural part and said rotor and means to center said structural part radially with respect to said rotor.

2. In an axial compressor as set forth in claim 1 said labyrinth seal includes a plurality of radially directed rings on said rotor and a plurality of annular grooves in said structural part, each groove receiving a respective ring in spaced relation.

3. In an axial compressor as set forth in claim 1 a bearing block at each end of said rotor, each bearing block having means for adjustably mounting the bearing block with respect to said casing and said stator blade support for centering of said rotor relative to said stator blade support.

4. In an axial compressor as set forth in claim 1, said rotor having a central portion having rotor blades thereon and a pair of said structural parts, each part encircling an opposite end of said rotor relative to said central portion.

5. In an axial compressor

a casing,

a stator blade support radially centered within said casing;

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a rotor rotatably mounted within said casing and stator blade support;

a structural part adjustably mounted on said casing between said casing and said rotor;

5 a labyrinth seal between said structural part and said rotor; and

a plurality of shim blocks disposed between said structural part and said casing in circumferentially spaced relation about said structural part, and at least one shim between each shim block and at least one of said structural part and said casing for centering said seal relative to said rotor.

6. In an axial compressor as set forth in claim 5 having four of said shim blocks fixedly disposed in said structural part.

7. In an axial compressor as set forth in claim 5 at least one shim plate between said structural part and said casing for adjusting said part axially of said casing and said sealing means axially of said rotor.

8. In an axial compressor

a longitudinally split casing;

a stator blade support radially centered within said casing to define a suction volute on one side and a delivery volute on an opposite side;

25 a rotor rotatably mounted within said casing and stator blade support and having blades thereon; and

a labyrinth sealing means between said casing and said rotor including a structural part adjustably on said casing for radial movement and having an inner annular surface surrounding said rotor with a plurality of annular grooves therein and a plurality of radially directed rings on said rotor cooperating with said grooves and means to center said structural part radially with respect to said rotor.

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