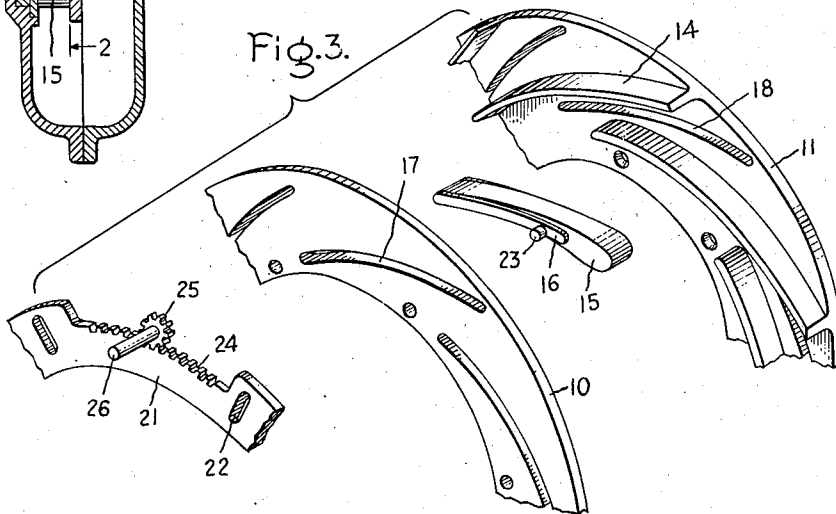
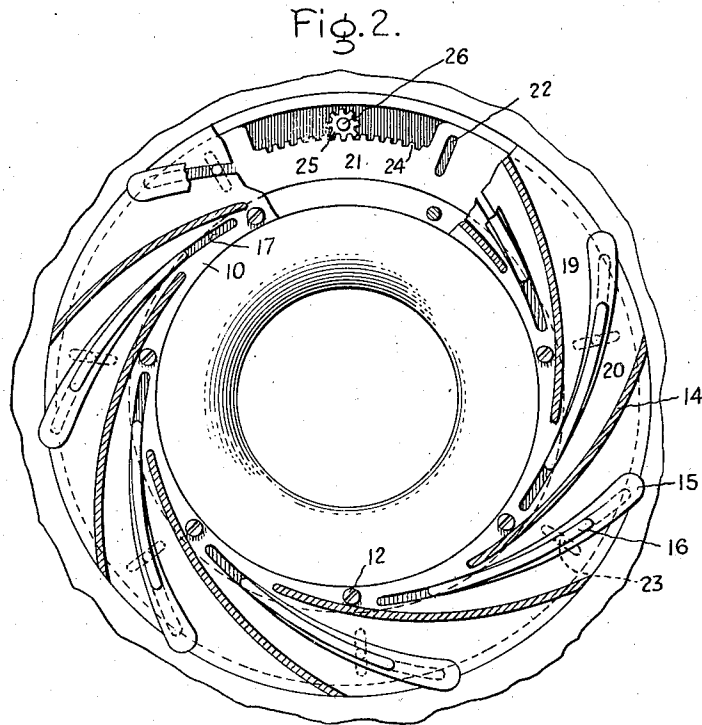
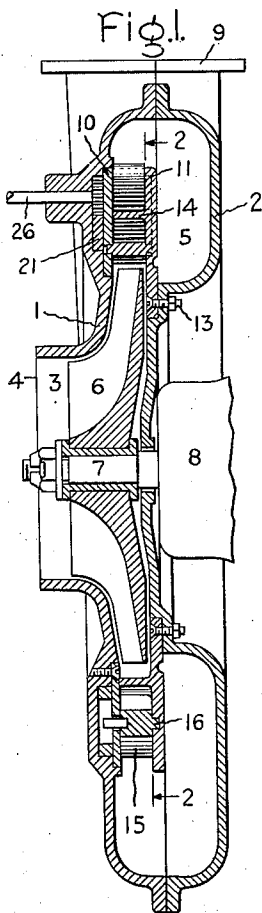


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W. S. THOMPSON
CENTRIFUGAL COMPRESSOR

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CENTRIFUGAL COMPRESSOR

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5 Claims. (Cl. 230-114)

The present invention relates to centrifugal compressors with variable diffusers for operation within a wide range of load or capacity as is required in connection with the supercharging of aircraft engines and cabins.

The object of my invention is to provide an improved construction of centrifugal superchargers, more particularly of the diffusers thereof whereby they may be operated within a wide range at high efficiency.

For a consideration of what I believe to be novel and my invention, attention is directed to the following description and the claims appended thereto in connection with the accompanying drawing.

In the drawing Fig. 1 illustrates a sectional view of a centrifugal compressor; Fig. 2 is a section along line 2-2 of Fig. 1; and Fig. 3 is a broken-away, exploded, perspective view of certain parts of Fig. 1.

The compressor comprises a casing having two halves 1 and 2 flanged together and forming an impeller chamber 3 with an inlet 4 formed by the casing half 1 and a discharge scroll 5. An impeller 6 is disposed within the impeller chamber 3 and secured to a shaft 7 rotatably supported on a bearing 8. During operation, medium such as air to be compressed passes through the inlet 4 and is forced radially outward by the impeller 6 into the scroll 5, whence it is discharged through a flanged outlet conduit 9 formed by the casing halves 1, 2.

Diffuser means are provided to convert part of the velocity energy of the compressed medium discharged from the impeller into pressure energy. This diffuser means surrounds concentrically the impeller 6 and in the present example is located substantially in the discharge scroll 5. More specifically, the diffuser comprises two axially spaced side walls or rings 10 and 11. The wall 10 is seated on shoulders formed by the casing half 1 and secured thereto by circumferentially spaced screws 12. The wall or ring 11 is seated on a shoulder formed by the casing half 2 and secured thereto by circumferentially spaced bolts or screws 13. A set of circumferentially spaced, curved diffuser vanes 14 is located between the side walls or rings 10 and 11. In the present example the set of vanes 14 is integrally formed with the wall 11. Adjacent vanes 14 form diffuser passages between them, which passages increase gradually in cross-sectional area from the radially inner ends or inlets toward the radially outer ends or outlets.

The diffuser so far described is typical of diffuser arrangements used in present day centrifugal compressors.

These diffusers operate well within a small load range only. As the flow through the compressor drops below a certain value this type of diffuser causes pulsations and renders the compressor unstable. In order to reduce such pulsations and to permit a wider load range I provide in accordance with my invention additional diffuser vanes adjustably arranged between the aforementioned set of stationary vanes.

In the present instance the embodiment in the drawing includes a second set of diffuser vanes, wedges or control members 15. Each of these vanes is centrally located between a pair of vanes 14 and subdivides the passage formed therebetween. More specifically, each vane 15 is in the form of a wedge-shaped member having a comparatively thin inner portion tapering gradually into a comparatively thick outer portion.

Each wedge or wedge-shaped member 15 forms a tongue and groove connection with the walls 10, 11. To this end each wedge 15 is provided on opposite edges with tongues 16 slidably projecting into curved openings 17 and grooves 18 formed in the side walls 10, 11, respectively. Each wedge 15 forms with adjacent, stationary vanes 14 a pair of diffuser passages 19, 20, Fig. 2. The width of the diffuser passages 19, 20, more particularly the throat area thereof, is a minimum when the wedges or adjustable vanes 15 are moved into their inner end position, and the throat areas become maximum as the wedges 15 are moved into their radially outer end positions. The end positions are determined by engagement between the ends of the tongues 16 with the corresponding ends of the openings 17 and grooves 18.

The arrangement according to my invention includes means for adjusting or positioning the adjustable diffuser vanes or wedges along the center lines or flow lines between the stationary vanes 14. This adjusting or positioning means comprises a ring 21 with a plurality of circumferentially spaced radial openings or slots 22 each for receiving a pin 23 projecting axially from a tongue 16 of each wedge 15. The ring 21 has a toothed portion or rack 24 meshing with a pinion 25. The latter is secured to a shaft 26 rotatably supported on the casing half 1. During operation, rotation of the shaft 26 causes turning movement of the pinion 25 which in turn effects angular displacement or movement of the ring 21. The latter through its slot and pin connections with the wedges or adjustable vanes 15 causes the latter to move along their center lines, that is, along the grooves 17, 18. Upon rotation of the pinion 25 in one direction

the wedges 15 are moved inward to reduce the minimum flow area or throat of the adjacent diffuser passages and upon rotation of the pinion 25 in the opposite direction the wedges are moved outward to increase the throat area of the adjacent diffuser passages. The curved wedge shape of the adjustable vanes or wedges and the positioning thereof along the center lines between adjacent stationary vanes 14 assures smooth diffuser passages and accordingly effective and efficient diffusion within a wide range of load. Thus, with my invention I have accomplished an improved diffuser arrangement which broadly comprises a pair of axially spaced walls or rings with a set of circumferentially spaced stationary vanes between them and another set of wedge-shaped vanes alternating with the stationary vanes and adjustably supported for positioning along the center lines between the stationary vanes.

What I claim as new and desire to secure by Letters Patent of the United States is:

1. Centrifugal compressor comprising a casing forming an impeller chamber and a scroll, an impeller disposed in the impeller chamber, and a variable diffuser for conducting compressed medium discharged from the impeller into the scroll, said diffuser comprising axially spaced side walls supported on the casing, a set of circumferentially spaced stationary vanes held on the side walls and a set of circumferentially spaced adjustable wedge-shaped vanes each centrally located between a pair of stationary vanes, and means for moving the adjustable vanes along the center lines between the stationary vanes.

2. Diffuser arrangement for centrifugal compressors comprising a pair of axially spaced rings, a set of circumferentially spaced curved stationary vanes located between the rings and secured to one of them, and a set of adjustable vanes located between the stationary vanes and dividing the passages between the stationary

vanes, and means for positioning the adjustable vanes along the center lines between the stationary vanes.

3. Diffuser arrangement for centrifugal compressors comprising a ring with a plurality of circumferentially spaced stationary vanes, a plurality of adjustable vanes located between the stationary vanes and forming tongue and groove connections with the ring, and means for moving the adjustable vanes along the center lines between adjacent stationary vanes to vary the flow area of the passages formed between the vanes.

4. Diffuser arrangement for centrifugal compressors comprising a pair of axially spaced rings, a set of stationary circumferentially spaced curved vanes secured to the rings and forming diffuser passages therewith and a set of adjustable circumferentially spaced curved wedge-shaped vanes interspersed between the stationary vanes and subdividing the diffuser passages formed thereby, each stationary vane having curved tongues on opposite edge portions located in grooves in the rings between stationary vanes, and means for moving the adjustable vanes along the grooves to vary the diffuser passages formed between them and the stationary vanes, said means comprising axially extending pins secured to the tongues, a ring having circumferentially spaced substantially radial slots for receiving the respective pins and gear means for angularly positioning said last named ring.

5. Diffuser arrangement for centrifugal compressors comprising a pair of axially spaced annular walls, a pair of stationary circumferentially spaced vanes supported between said walls and cooperating therewith to form a diffusing passage, a tapered control member located within the diffusing passage, and means for adjusting the member substantially along the center line of the passage to vary the effective area thereof.

WENDELL S. THOMPSON.