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(54) Variable diffuser actuation linkage for a cabin air compressor

(57) A variable diffuser (26) for a rotating machine (20) includes a multiple of diffuser vanes (34) mounted to a drive ring (36). The multiple of diffuser vanes (34) are movable in unison between a maximum flow position and a minimum flow position in response to rotation of a crank (44) to rotate the drive ring (36) about a centerline through a link arm (46).

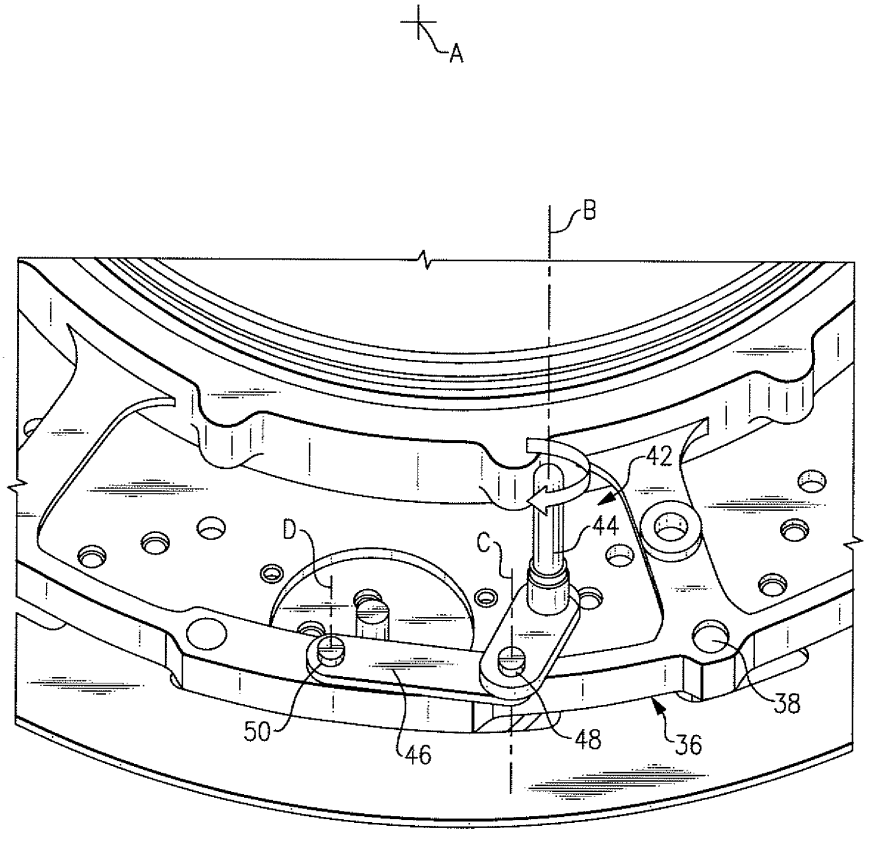

FIG.5

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Description

BACKGROUND

[0001] The present disclosure relates to a cabin air compressor, and more particularly to a variable diffuser therefor.

[0002] In traditional aircraft environmental control systems, pressurized air for the aircraft cabin is bled from a main engine or an auxiliary power unit. Environmental control systems for more electric aircraft (MEA) may use a dedicated compressor to pressurize ambient air for use as fresh air in the cabin. The compressor may, for example, be a single stage centrifugal configuration driven by a variable speed permanent magnet motor. A variable diffuser includes a drive ring that rotates about the compressor centerline. Rotation of the drive ring moves a series of diffuser vanes in unison between a maximum and minimum flow position.

SUMMARY

[0003] A variable diffuser for a rotating machine according to an exemplary aspect of the present disclosure includes a multiple of diffuser vanes engaged with a drive ring. The multiple of diffuser vanes are movable in unison between a maximum flow position and a minimum flow position in response to rotation of a crank to rotate the drive ring about a centerline through a link arm.

[0004] A rotating machine according to an exemplary aspect of the present disclosure includes a compressor drivable by an electric motor about a centerline. A variable diffuser downstream of the compressor. A multiple of diffuser vanes engaged with a drive ring. The multiple of diffuser vanes movable in unison between a maximum flow position and a minimum flow position in response to rotation of a crank to rotate the drive ring about a centerline through a link arm.

BRIEF DESCRIPTION OF THE DRAWINGS

[0005] Various features will become apparent to those skilled in the art from the following detailed description of the disclosed non-limiting embodiment. The drawings that accompany the detailed description can be briefly described as follows:

Figure 1 is a schematic view of a Cabin Air Compressor (CAC);
Figure 2 is a perspective view of a variable diffuser of the Cabin Air Compressor (CAC);
Figure 3 is an expanded view of the variable diffuser of Figure 2 in a maximum flow position;
Figure 4 is an expanded view of the variable diffuser of Figure 2 in a minimum flow position; and
Figure 5 is a perspective view of a linkage operable to position the variable diffuser between the maximum and minimum flow position.

DETAILED DESCRIPTION

[0006] Figure 1 schematically illustrates a Cabin Air Compressor (CAC) 20 that may be used to pressurize ambient air to provide fresh air in an aircraft cabin. Although the following description will describe the present application as used in aircraft, the following description should be understood to be applicable to other suitable uses, such as ground vehicles and stationary installations. It should also be appreciated that the present application is not limited to use in conjunction with a specific type of rotating machine. Thus, although the present application is, for convenience of explanation, depicted and described as being implemented in a cabin air compressor, it should be appreciated that it can be implemented in numerous other machines including, but not limited to, a gas turbine engine, an auxiliary power unit, a turbo charger, a super charger, an air cycle machine, an alternator, an electric motor, an electric generator, an integrated constant speed drive generator and gearboxes of various types.

[0007] The CAC 20 generally includes an electric motor 22, a compressor 24, a variable diffuser 26 and a diffuser actuator 28. The electric motor 22, the compressor 24 and the variable diffuser 26 are defined about a centerline A of the CAC 20. An inlet 30 communicates air into the CAC 20 where the air is compressed by the motor 22 driven compressor 24 then communicated from an outlet 32 through the variable diffuser 26. The variable diffuser 26 includes a multiple of diffuser vanes 34 (Figure 2) which are moved in unison by the diffuser actuator 28 between a maximum flow position (Figure 3) and minimum flow position (Figure 4) to control the airflow of the CAC 20 responsive to control 29.

[0008] With reference to Figure 5, the variable diffuser 26 includes a drive ring 36 that is rotatable about the centerline A. A series of drive pins 38 extends from the drive ring 36 to engage each respective diffuser vane 34. Each respective diffuser vane 34 pivots about a vane pin 40 (Figures 3 and 4) which is displaced from each of the respective drive pins 38. Rotation of the drive ring 36 moves the diffuser vanes 34 in unison between the maximum and minimum flow position about the respective vane pins 40.

[0009] The diffuser actuator 28 (not shown in Figure 5) interfaces with the drive ring 36 through a linkage 42. The diffuser actuator 28 may include a geared drive motor or other actuator system which operates to generate a rotary input about an axis of rotation B to rotate a crank 44. The crank 44 is pivotally connected to a link arm 46 at a pivot 48 which defines an axis C. The link arm 46 is pivotally connected to the drive ring 36 at a drive ring pivot 50 to define an axis D.

[0010] Rotation of the diffuser actuator 28 rotates the crank 44. The crank 44 drives the link arm 46 to thereby drive the drive ring 36 about the compressor centerline A. Selective rotation of the drive ring 36 about the compressor centerline A moves the diffuser vanes 34 in uni-

son between the maximum flow position (Figure 3) and minimum flow position (Figure 4). That is, the diffuser actuator rotary motion is converted to an arcuate path of motion. The linkage 42 facilitates the transfer of a mechanical advantage at the maximum flow position and the minimum flow position which are the extreme ends of the stroke and where maximum force is typically required. A relatively lower power diffuser actuator 28 may thereby be employed to control the range of the variable diffuser 26. A compact diffuser actuator 28 that maximizes mechanical advantage facilities an overall lightweight system.

[0011] It should also be appreciated that like reference numerals identify corresponding or similar elements throughout the several drawings. It should also be understood that although a particular component arrangement is disclosed in the illustrated embodiment, other arrangements will benefit herefrom.

[0012] The foregoing description is exemplary rather than defined by the limitations within. Various non-limiting embodiments are disclosed herein, however, one of ordinary skill in the art would recognize that various modifications and variations in light of the above teachings will fall within the scope of the appended claims. It is therefore to be understood that within the scope of the appended claims, the disclosure may be practiced other than as specifically described. For that reason the appended claims should be studied to determine true scope and content.

Claims

1. A variable diffuser (26) for a rotating machine (20) comprising:

a drive ring (36) rotatable about a centerline (A);
a crank (44) rotatable about an axis of rotation (B) different than said centerline (A);
a link arm (46) pivotably mounted to said crank (44) and said drive ring (36); and
a multiple of diffuser vanes (34) engaged with said drive ring (36), said multiple of diffuser vanes (34) movable in unison between a maximum flow position and a minimum flow position in response to rotation of said crank (44) to rotate said drive ring (36) about said centerline (A) through said link arm (46).

2. The variable diffuser as recited in claim 1, wherein said crank (44) is rotatable about said axis of rotation (B) different than said centerline (A) in response to rotary motion of an actuator (28).

3. The variable diffuser as recited in claim 2, wherein said rotary motion of said actuator (28) is converted to an arcuate path of motion of said drive ring through said crank (44) and said link arm (46).

4. The variable diffuser as recited in any preceding claim, further comprising a series of drive pins (38) which extend from said drive ring (36) to engage each of said multiple of diffuser vanes (34).

5. The variable diffuser as recited in any preceding claim, further comprising a series of vane pins (40) about which each of said multiple of diffuser vanes (34) are rotatable.

6. A rotating machine (20) comprising:

an electric motor (22);
a compressor (24) drivable by said electric motor (22) about a centerline (A); and
a variable diffuser as recited in any preceding claim downstream of said compressor, said drive ring (36) rotatable about the centerline (A).

7. The rotating machine as recited in claim 6, further comprising an inlet (30) defined along said centerline (A).

8. The rotating machine as recited in claim 6 or 7, further comprising a radial outlet (32).

9. The rotating machine as recited in claim 6, 7 or 8, further comprising an actuator (28), wherein said actuator (28) is operable to rotate said crank (44) about said axis of rotation (B) different than said centerline.

10. The rotating machine as recited in claim 9, wherein rotary motion of said actuator (28) is converted to an arcuate path of motion of said drive ring (36) through said crank (44) and said link arm (46).

11. The rotating machine as recited in any of claims 6 to 10, wherein said rotating machine is a cabin air compressor configured to pressurize ambient air and provide fresh air in an aircraft cabin.

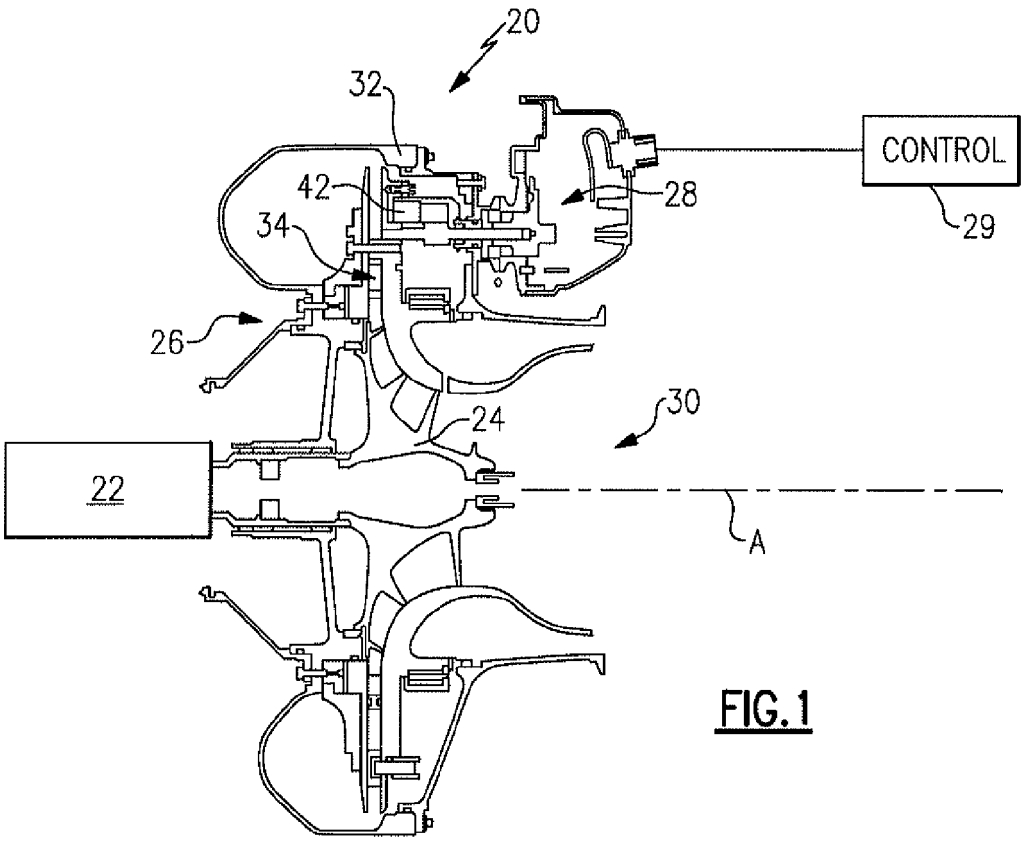

FIG.1

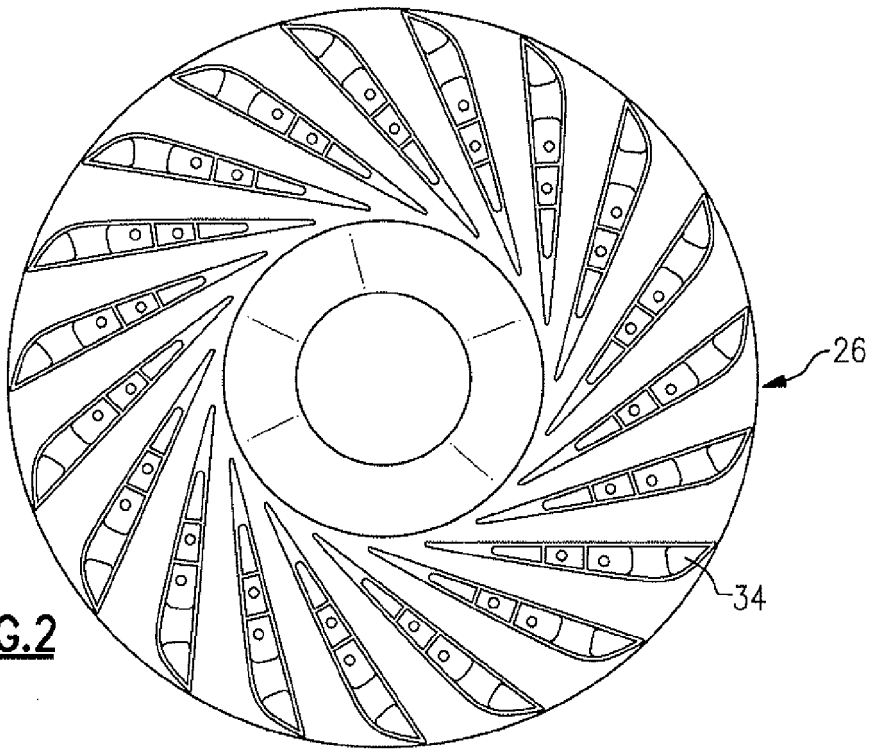

FIG.2

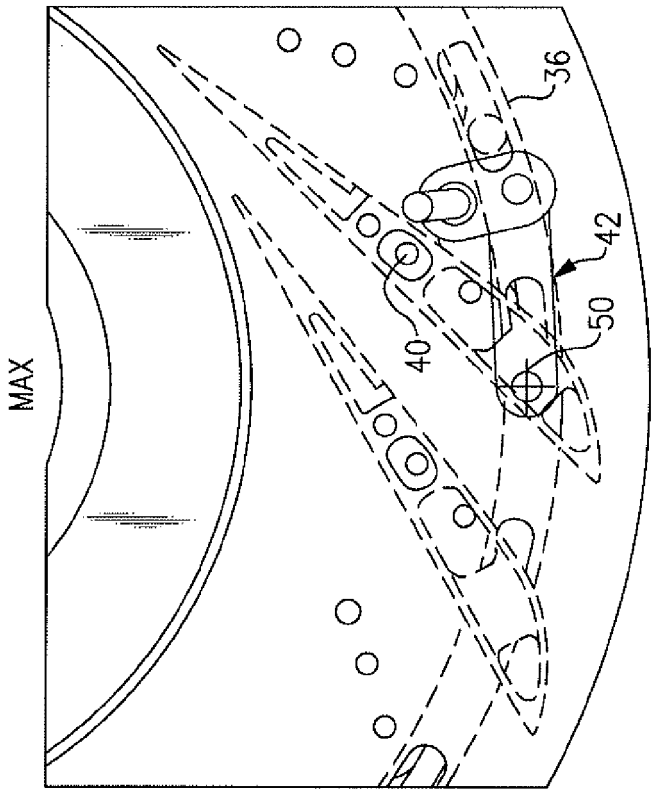

FIG.3

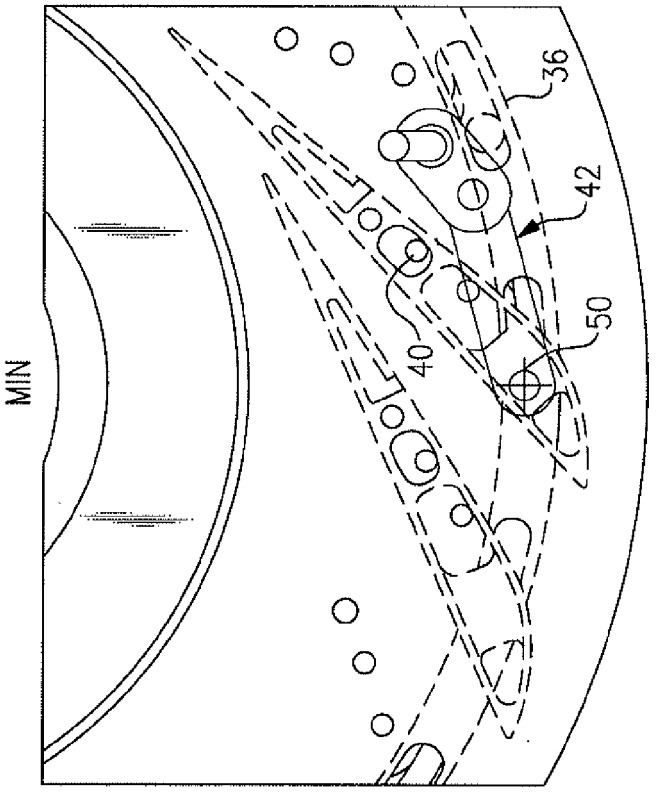

FIG.4

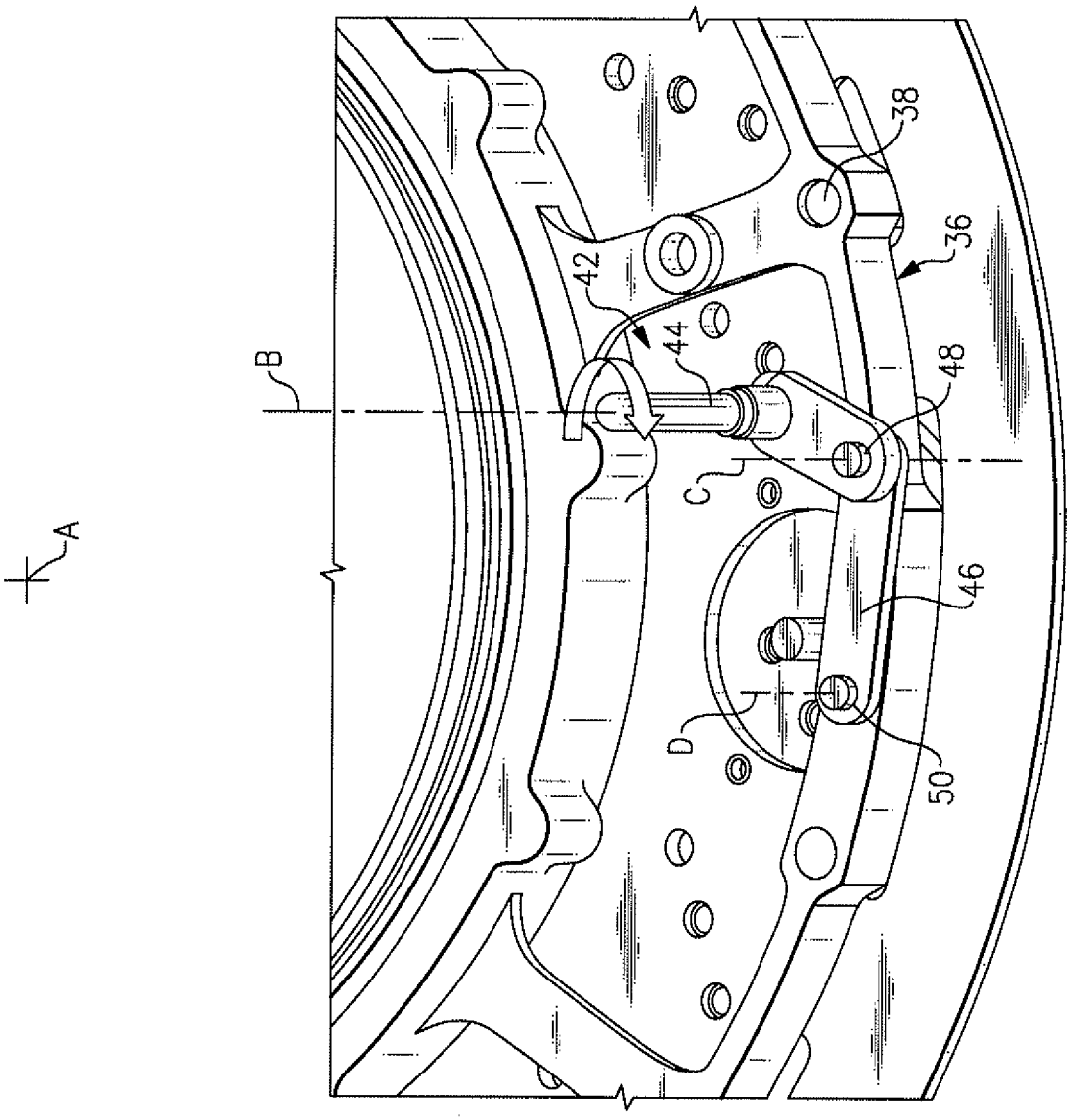

FIG.5