July 14, 1953 L. BAUGER ET AL 2,645,410

GASEOUS FLUID COMPRESSOR

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Fig. 1

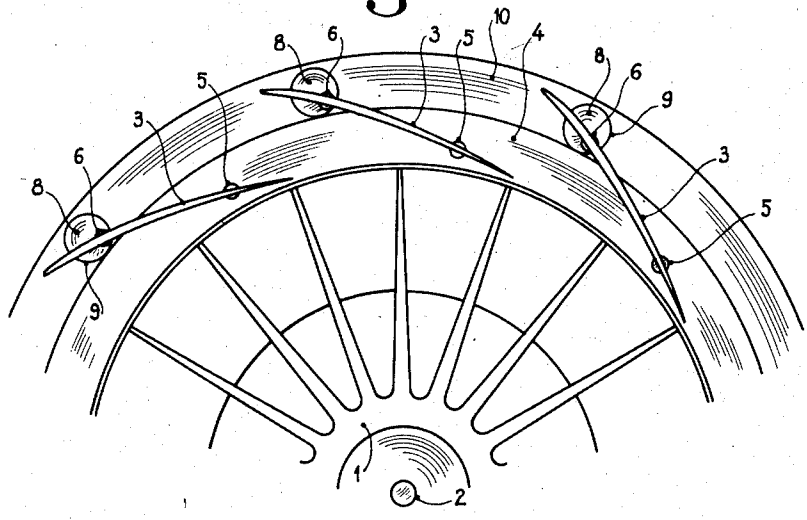


Fig. 2

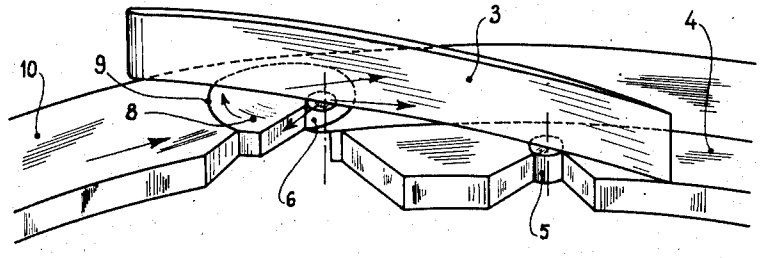
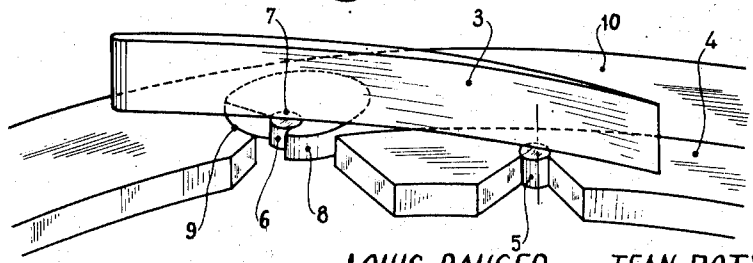


Fig. 3



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GASEOUS FLUID COMPRESSOR

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Fig. 4

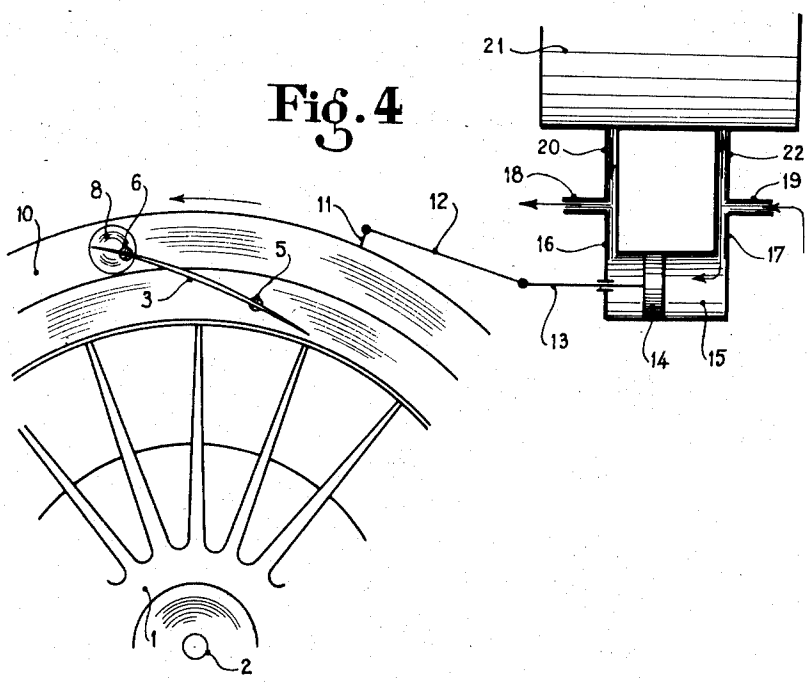

Fig. 5

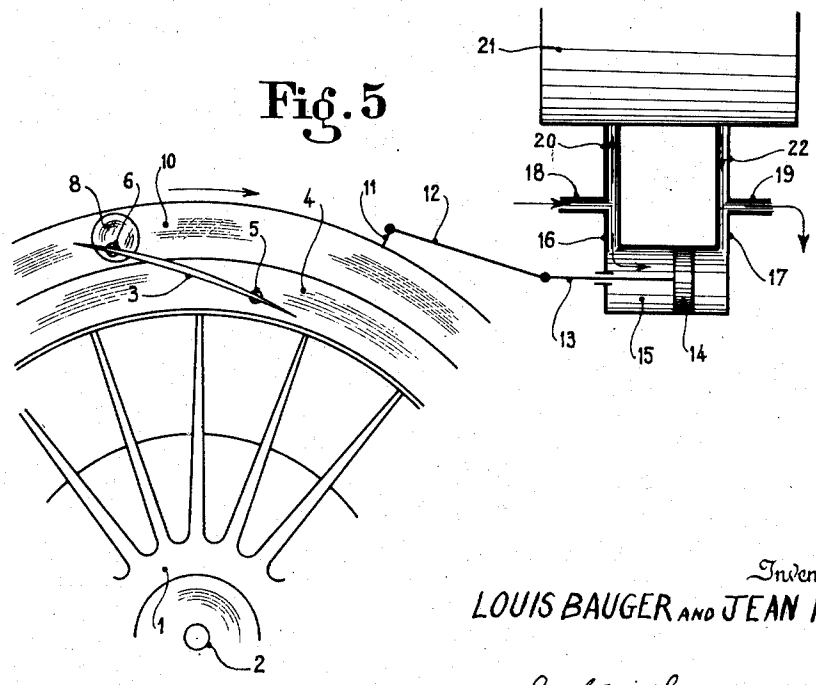

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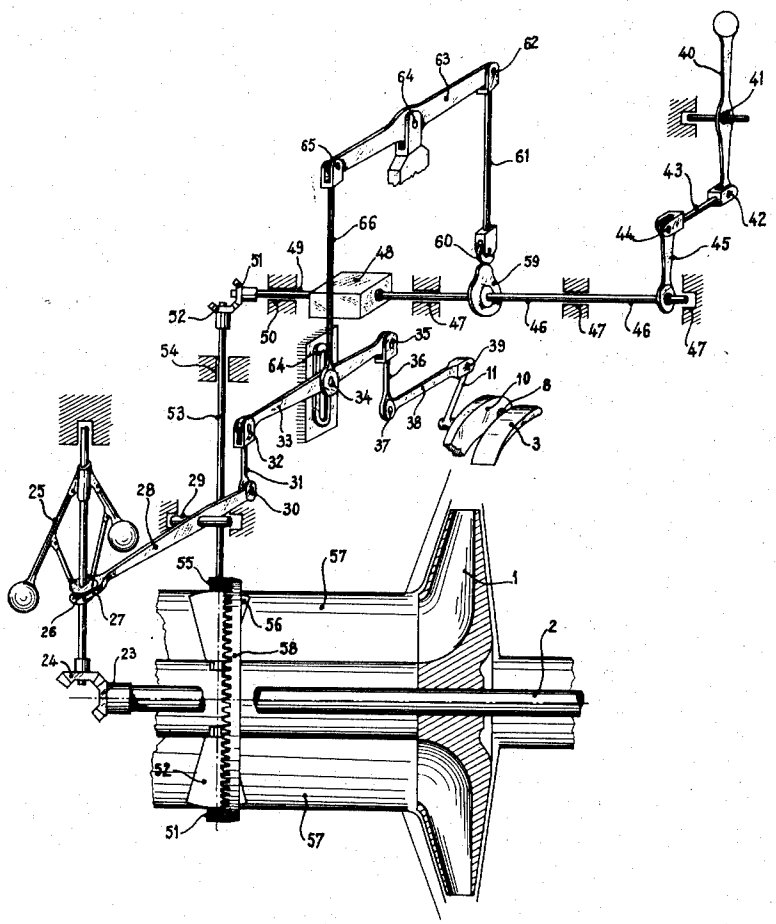
Fig. 6



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Patented July 14, 1953 2,645,410

UNITED STATES PATENT OFFICE

2,645,410

GASEOUS FLUID COMPRESSOR

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Application May 4, 1948, Serial No. 24,945
In France May 5, 1947

9 Claims. (Cl. 230—114)

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The present invention relates to gaseous fluid compressors.

Gaseous fluid compressors of different types, and, principally, compressors delivering air under pressure to the aircraft engines, are provided with diffusers having fixed blades or vanes.

The orientation of these vanes is calculated to give optimum conditions of flow of the gaseous fluid for a predetermined speed of the compressor, generally, for the speed of normal operation.

At any speed, and, principally, at a speed of rotation other than that for which the orientation of these vanes has been established, prejudicial effects on the output, chiefly shocks, are produced.

The object of the present invention is to remedy this inconvenience and, principally, to eliminate the impact of gaseous fluid against the vanes of the diffuser, at its emergence from the compressor, whatever may be the speed of the latter.

To this end, according to the present invention, a compressor of the type above defined is constructed not with fixed diffusion vanes, but with diffusion vanes of regulable orientation.

Numerous compressors having this characteristic may be constructed; amongst these, the present invention contemplates, more particularly, those having, at least, one of the following characteristics:

1. The mounting of each diffusion vane on a pivot carried by a fixed crown rigidly attached to the gear case of the compressor.

2. A common apparatus for simultaneous variation of the orientation of all the diffusion vanes, this apparatus being hereinafter referred to as the vane control.

3. A method of constructing such a vane control comprising:

(*a*) An outer crown, capable of being rotated, concentric with the fixed crown referred to in (1) above, and mounted directly on this latter which serves it as a bearing.

(*b*) For each vane, an eccentric mounted, so as to be capable of rotation in the said outer crown, which serves it as a rotation bearing.

(*c*) A pin rigidly connected to the said vane and engaged in this eccentric.

4. Means for the operation of this vane control, these means comprising, at least, one of the following:

(*a*) A member whose position or configuration varies with the speed of rotation of the compressor, this device being,

(α) actuated by an apparatus for varying the speed of rotation of the compressor or,

(β) actuated by the rotor of the compressor,

(*b*) A device for regulating the rate of admission of gaseous fluid into the compressor.

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5. In the case where the member described in 4 (*a*) is actuated by an apparatus as described in subsection (α) thereof, this latter apparatus can be a multi-speed clutch and the said member can be driven by the actuating device of this clutch member.

According to the present invention, further, the vane control can be placed under the simultaneous dependence of a device as in 4 (*a*) above and of another device as in 4 (*b*).

Such a single actuating device of the vanes can be formed, for example, by a pivoted lever of which one of the ends operates the mobile crown for actuating the vanes, the opposed end is actuated by a member as described in 4 (*a*) above, and the pivot is carried by a device actuated by an apparatus as described in 4 (*b*).

Each of the means above defined may be constructed in numerous ways.

The invention will be further described with reference to the accompanying diagrammatic drawings, given by way of example, and which do not limit, in any way, the scope of the present invention, wherein:

Fig. 1 is a partial section perpendicular to the axis of a compressor, the diffuser of this compressor and the apparatus for varying simultaneously the orientation of all its blades.

Fig. 2 shows, in perspective, a detail of mounting of one of the vanes of this compressor.

Fig. 3 is a similar view of the same vanes in another position of regulation.

Figs. 4 and 5 shows a diffuser of the type of Fig. 1, equipped with a device for actuation of the outer crown which operate all the vanes, Fig. 4 showing the device in the state of operation of the compressor in the first speed, and Fig. 5 showing the device in the state of operation of the compressor at the second speed.

Fig. 6 shows, in perspective, with the necessary stripping, a compressor provided with a diffuser as in Fig. 1 and with an apparatus for actuating the diffuser vanes comprising:

(*a*) A device driven by the compressor,

(*b*) A manual device for regulating the admission of gas to the compressor.

In these different figures the same references denote the same parts.

In Fig. 1, 1 is the rotor of the compressor, 2 its axis, 3 is diffusion vanes of regulable orientation. All these vanes are mounted on a fixed crown 4 with the help of pivots 5, here, rigidly connected to the said vanes. Each of these vanes, is provided with a pin 6 of circular section engaged in a housing 7 of the same section constructed eccentrically in a circular disc 8 itself mounted in a housing 9 of equal section, serving it as rotation

bearing, constructed in a circular crown 10 mounted rotatively on the crown 4. The outer crown 10 is operated by any suitable means.

For example, in Figs. 4 and 5, this operation is made dependent on the clutch of the compressor, a device supposed here to have two speeds, and which can be, for example, a device in accordance with that described by the applicants in an application for French Patent No. 534,041, dated May 5, 1947, for "Clutch mechanism, its applications and device resulting therefrom."

Here, the connection between the crown 10 and this clutch mechanism is obtained by means of the following elements: an arm 11, a connecting rod 12, a piston rod 13 and a piston 14 movable in a cylinder 15 full of a hydraulic fluid, for example, oil. This cylinder is connected at its ends to two pipes 16 and 17, the first pipe 16 is itself connected to a pipe 18 which can be put into communication either with the source of fluid under pressure, or with an emptying pipe. The second pipe 17 is connected to a pipe 19 similar to the pipe 18; at the same time, the pipe 18 is connected to a pipe 20 of the device 21 for clutching the compressor, and the pipe 19 is connected to a pipe 22 of the same clutch apparatus, this apparatus being supposed to be, here, in accordance with that described in the application for French Patent No. 534,041, dated May 5, 1947, for: "Clutch mechanism, its applications and devices resulting therefrom" of the applicant company. The introduction of fluid under pressure into the pipes 19 and 22 puts this apparatus, for example, into the first speed, and, at the same time, drives the piston 14 and the crown 10 for regulating of the orientation of the vanes in the direction of the arrows in Fig. 4, whilst the pipe 18 and with it the pipes 19 and 20 are put into communication with the evacuation.

In Fig. 5, the clutch apparatus 21 transfers the compressor into second speed, the piston 14 and the crown 10 being driven in the direction of the arrows in this figure.

In Fig. 6, the elements of the compressor are similar to those of the compressor of Figures 1–5, but, here, the regulation of the orientation of the vanes is affected by an arm receiving the action of:

1. A centrifugal governor driven by the compressor shaft.

2. A regulating device for the admission of air into the compressor.

The arrangement is the following:

The shaft 2 of the compressor drives a toothed train 23, 24 driving a centrifugal governor 25. On the movable sleeve 26 of this governor is mounted the end 27 of a lever 28 pivoting around an axis 29, of which the opposite end 30 carries the joint of a connecting rod 31. The other end of this rod is joined at 32 to a lever 33 pivoting around an axis 34. The other end of this lever 33 is joined at 35 to a connecting rod 36 itself joined at 37 to a lever 38.

In these conditions, the position of the crown 10 for varying the orientation of the vanes 3 depends on the speed of the centrifugal governor 25 that is to say on the speed of rotation of the shaft of the compressor.

The admission of air into the compressor 3 is regulated by a handle 40 pivoting about an axis 41, connected at 42 to a connecting rod 43, itself connected at 44 to an arm 45 which is keyed on a shaft 46 mounted in bearings 47. Here, this shaft carries a progressive admission pressure control, diagrammatically represented at 48 and which actuates a shaft 49, mounted in a bearing 50 and which carries a conical pinion 51 in engagement with a second conical pinion 52 keyed on a shaft 53. This shaft passes through a bearing 54 and carries, at its opposite end, a pinion 55 and a shutter 56. This shutter is in the annular passage 57 for the admission of air to the compressor. A toothed crown 58 is in engagement both with this pinion 55 and with, at least, one other pinion 55 rigidly attached to another shutter 56 mounted in the air admission passage 57 of the compressor.

The number of shutters 56 for regulation of admission of air into the compressor can be several, these are, of course, spaced regularly all around the axis of the compressor.

Thus, by the handle 40, the operator can regulate at will the orientation of the shutters 56 in the annular passage 57 for admission of air into the compressor. A cam 59 is keyed on the shaft 46, a roller 60 carried by a rod 61 is applied against this cam. The opposite end of this rod is connected at 62 to a lever 63 movable about a fixed pivot 64. The opposite end of this lever 63 is connected at 65 to a rod 66 of which the opposite end carries the part 34 of the oscillating lever 33 above described. This pivot 34 is movable in a fixed slide 64. The hole being so arranged that any displacement of the handle 40 produces a rotation of the cam 59 and consequently a modification in the position of the connection rod 61, the lever 63, the connection rod 66 and the pivot 34 of the lever 33 and this produces, as a result, the displacement of the levers 36—38—11, and, as a result, a rotation of the crown 10 for regulating the position of the vanes.

Under these conditions, this crown is subjected, on the one hand, to the action of the centrifugal governor 25 that is to say to variations in the speed of rotation of the shaft 2 of the compressor and, on the other hand, to movements of the handle 40, that is to say to variations in the position of the shutters 56 for regulation of admission of air to the compressor; thus, whatever may be the modification brought about in the operation of the compressor, the vanes are always brought into a position which will ensure the best output of the compressor in the circumstances.

We declare what we claim is:

1. An air compressor comprising an adjustable diffuser with a stationary crown surrounding the rotor of said compressor, a second crown rotatably mounted on said stationary crown, a plurality of vanes the rear end of each of which is pivotally connected to said stationary crown, said rotatable crown having a series of circular recesses formed therein, a plurality of circular discs each rotatively mounted in one of said crown recesses and a second plurality of pins each pivotally and eccentrically connected to one of said discs, each said pin being fixed to opposite end portion of one of said vanes and means for moving said second crown.

2. An air compressor comprising an adjustable diffuser with a stationary annular crown surrounding the rotor of said compressor, and having a series of openings formed therethrough, a second annular crown rotatably mounted about the periphery of said stationary crown, said rotatable crown having a series of circular recesses formed therearound, a plurality of circular discs each mounted in one of said recesses and having an opening formed eccentrically therein, a plurality of arcuate vanes, a plurality of pins

each rotatably mounted in one of said stationary crown openings and connected to the rear end of one of said vanes and a second plurality of pins each pivotally mounted in one of said disc openings and connected to the forward end of one of said vanes and means for rotating said rotatable crown.

3. An air compressor comprising an adjustable diffuser with a stationary crown surrounding the rotor of said compressor, a second crown rotatably mounted on said stationary crown, a plurality of vanes the rear end of each of which is pivotally connected to said stationary crown, said rotatable crown having a series of circular recesses formed therein, a plurality of circular discs each rotatively mounted in one of said crown recesses and a second plurality of pins each pivotally and eccentrically connected to one of said discs, each said pin being fixed to opposite end portion of one of said vanes and means for adjusting the position of said second crown according to the speed of rotation of said compressor.

4. An air compressor comprising an adjustable diffuser with a stationary crown surrounding the rotor of said compressor, a second crown rotatably mounted on said stationary crown, a plurality of vanes the rear end of each of which is pivotally connected to said stationary crown, said rotatable crown having a series of circular recesses formed therein, a plurality of circular discs each rotatively mounted in one of said crown recesses and a second plurality of pins each pivotally and eccentrically connected to one of said discs, each said pin being fixed to the opposite end portion of one of said vanes, means for adjusting the position of said second crown, and an apparatus for varying the speed of rotation of said compressor connected to said second crown adjusting means for controlling the operation thereof.

5. An air compressor comprising an adjustable diffuser with a stationary crown surrounding the rotor of said compressor, a second crown rotatably mounted on said stationary crown, a plurality of vanes the rear end of each of which is pivotally connected to said stationary crown, said rotatable crown having a series of circular recesses formed therein, a plurality of circular discs each rotatively mounted in one of said crown recesses and a second plurality of pins each pivotally and eccentrically connected to one of said discs, each said pin being fixed to opposite end portion of one of said vanes, an arm pivotally connected to said second crown and a governor connected to said rotor and said arm for adjusting the position of said second crown according to the speed of rotation of said rotor.

6. An air compressor comprising an adjustable diffuser with a stationary crown surrounding the rotor of said compressor, a second crown rotatably mounted on said stationary crown, a plurality of vanes the rear end of each of which is pivotally connected to said stationary crown, said rotatable crown having a series of circular recesses formed therein, a plurality of circular discs each rotatively mounted in one of said crown recesses and a second plurality of pins each pivotally and eccentrically connected to one of said discs, each said pin being fixed to opposite end portion of one of said vanes, an arm pivotally connected to said second crown, means for regulating the admission of air in said compressor and a governor connected to said means and said arm for adjusting the position of the second crown according to the admission of air in said compressor.

7. An air compressor comprising an adjustable diffuser with a stationary crown surrounding the rotor of said compressor, a second crown rotatably mounted on said stationary crown, a plurality of vanes the rear end of each of which is pivotally connected to said stationary crown, said rotatable crown having a series of circular recesses formed therein, a plurality of circular discs each rotatively mounted in one of said crown recesses and a second plurality of pins each pivotally and eccentrically connected to one of said discs, each said pin being fixed to opposite end portion of one of said vanes, an arm pivotally connected to said second crown, means for varying the speed of rotation of the compressor, means for regulating the admission of air in said compressor and means for adjusting the position of the second crown according to the position of means for varying the speed of rotation of the compressor and, simultaneously, the position of means for regulating the admission of air in said compressor.

8. An adjustable diffuser for air compressors comprising a stationary annular crown surrounding the rotor of said compressor, a second annular crown slideably mounted about the periphery of said stationary crown, said slideable crown having a series of annular recesses formed therearound, a plurality of discs each rotatably mounted in one of said crown recesses, a plurality of vanes each pivotally connected at one end portion to said stationary crown, a plurality of pins each fixedly connected to the opposite end portion of one of said vanes and pivotally and eccentrically connected to one of said discs, an arm pivotally connected to said rotatable crown, and automatic hydraulic means for operating said arm and thereby adjusting said vanes.

9. An adjustable diffuser for air compressors comprising a stationary crown surrounding the rotor of said compressor, a second crown rotatably mounted on said stationary crown, a plurality of vanes each pivotally connected at one end portion to said stationary crown, said rotatable crown having a series of annular recesses formed therein, a plurality of discs each rotatably mounted in one of said crown recesses, a plurality of pins each pivotally and eccentrically connected to one of said discs and fixed to the opposite end portion of one of said vanes, an arm pivotally connected to said second crown, manual means connected to said arm for positioning the same and said second crown, and a governor connected to said rotor and said arm for further adjusting the position of said second crown according to the speed of said rotor.

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JEAN ROTY.

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