June 11, 1957 A. BUCHI, SR., ET AL 2,795,371

OVERHUNG SUPPORTED TURBO-BLOWER ROTORS

Filed April 17, 1953 2 Sheets-Sheet 1

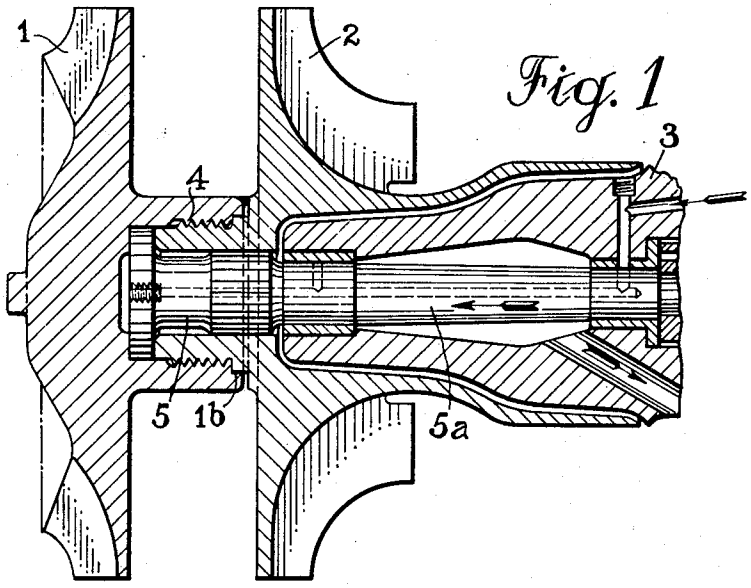


Fig. 1

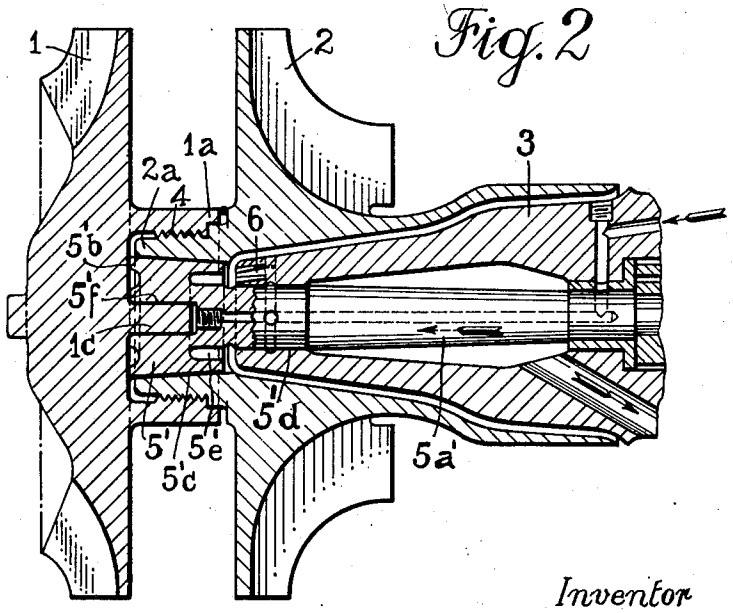


Fig. 2

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June 11, 1957 A. BUCHI, SR., ET AL 2,795,371

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Filed April 17, 1953 2 Sheets-Sheet 2

Fig. 4

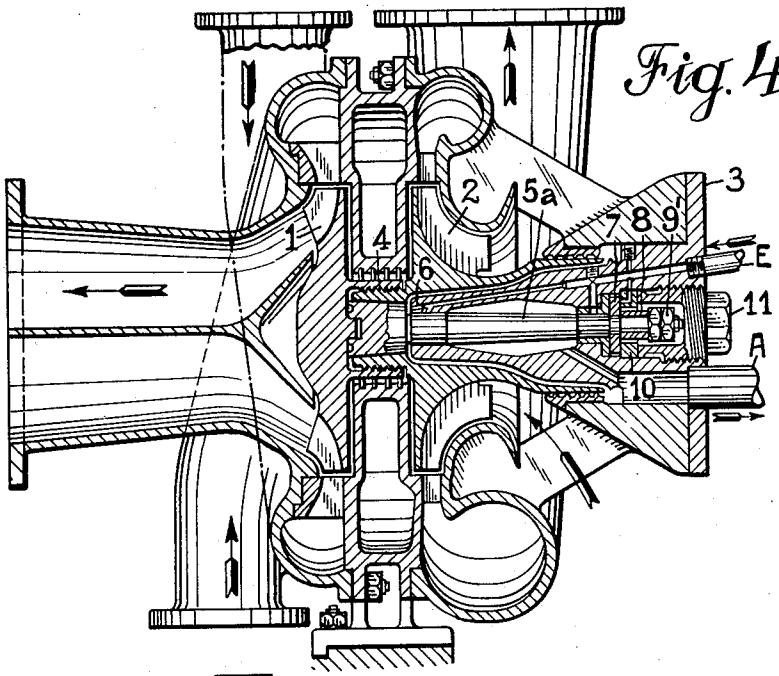
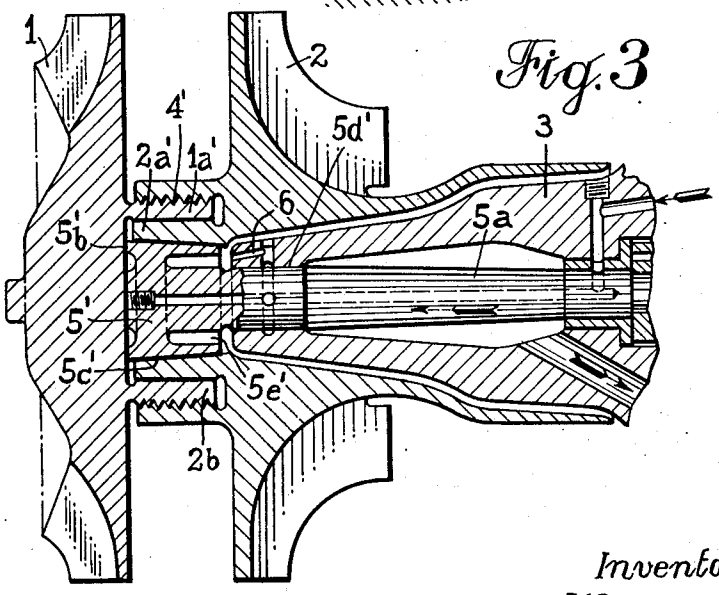


Fig. 3



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OVERHUNG SUPPORTED TURBO-BLOWER ROTORS

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12 Claims. (Cl. 230—116)

The present invention relates to an overhung supported turbo-blower rotor, comprising a separate turbine rotor for a hot actuating medium and a blower rotor for a relatively cool pressure medium, both rotors having central hub portions and being connected for rigid assembly to one another and to a common shaft; such connection is secured for rotation of the rotors and the shaft as a whole, the shaft being supported by a stationary bearing extending axially at least partially into the hub part of the blower rotor.

The main object of the invention is to provide beyond the projection of the stationary bearing, rigidly attached to said shaft, a central body projecting into, with respect to the turbine rotor, cool hub part of the blower rotor, and being held fast therein against rotation; and also to provide said connection loosable but firmly secured against relative movement of the rotors, and by means of said same connection, while it is being established, to firmly fasten said body in the hub part of the blower rotor; and moreover to reduce the contact surfaces of said body with the turbine rotor to a minimum, whereby heat transfer from the turbine rotor to the stationary bearing is minimized.

In a preferred construction said central body is made in the form of a truncated cone, so that on assembling both rotors by means of said connection the blower rotor is forced on to the truncated cone; and furthermore the outer surface of the truncated cone is being arranged centrally to the bearing surfaces so that the outer surface of said cone serves as a centering surface for the radial supporting of both the rotors.

The connection to the hubs of both rotors may consist of an external thread on the turbine rotor hub and an internal thread in the outer wall of an open annular recess in the hub of the blower rotor. This construction has for its object that the expansion of the turbine rotor hub embodying the external thread occurring as a result of the turbine rotor which is hot in operation, increases the compression pressure against the internal thread of the blower rotor hub. The construction may embody special means which reduce the transfer of heat from the turbine rotor in the direction towards the bearing. For example fresh oil can be sprayed against the cylindrical or truncated cone shaped body from an oil delivery passage in the stationary bearing by means of at least one nozzle.

Embodiments of the invention are shown in the accompanying drawings. Fig. 1 shows an axial section through the two rotors of the first embodiment and Figs. 2 and 3 show similar sections respectively of a second and third embodiment. Fig. 4 illustrates in axial section a turbo-blower with the features of the invention according to the second embodiment of Fig. 2.

Like numerals indicate in all figures like or similar parts.

In Fig. 1, 1 is the turbine rotor and 2 the blower rotor. 3 is the stationary bearing which projects at least partially

into the hub section of the blower rotor. The connection 4 of the two rotors consists of a screw connection disposed around a centrally arranged supporting body 5. The hub surfaces of the two rotors embodying the thread 4 comprise guide surfaces at the points 1*b* which are provided for centering the two rotors. This body 5 comprises a shaft-like extension 5*a* which is arranged for supporting the rotors at the turbo housing section 3 located at the blower side.

Fig. 2 also shows the two rotors 1 and 2 and the housing part 3 projecting into the blower rotor on the blower side. The connection of the two rotors is also marked 4. The centrally arranged body 5 of Fig. 1 is in this embodiment of truncated cone shape and is marked 5′ and the associated arrangement of the rotors is such that the connection on assembly of both rotors draws the blower rotor on to the truncated cone shaped body while the turbine rotor presses against the end face 5*b*′ of this body. The outer surface 5*c*′ of the truncated cone is arranged centrally to the bearing surfaces 5*d*′ in such a way that this outer surface 5*c*′ serves as a centering surface for the radial support of both rotors. It will be seen that in the embodiment shown the truncated cone shaped outer surface 5*c*′ is not in direct contact with the turbine rotor 1. This arrangement is therefore especially favourable since thereby the heat transfer from the hot turbine rotor to the bearing surfaces 5*c*′ is smaller. This property is obtained by the fact that the connection 4 is obtained with a hub part 1*a* on the turbine rotor provided with internal threads and a hub 2*a* on the blower rotor wheel provided with an external thread. The screw connection of both parts permits the blower rotor to be drawn on to the truncated cone shaped body 5′.

Further separate means are provided for reducing the heat transfer from the hot turbine rotor in the direction towards the bearing. Such means consist in the fact that cold oil is sprayed on to the truncated cone shaped body 5′ from an oil feed passage in the stationary bearing 3 through at least one nozzle 6. The truncated cone shaped body comprises for the same purpose open recesses on the surfaces 5*b*′ in contact with the turbine rotor which reduces the superficial area of these contact surfaces.

In order that the cooling action of the oil sprayed on to the truncated cone shaped body from the nozzle 6 shall be increased there is provided in the present embodiment a recess 5*e*′ on the surface of the truncated cone shaped body opposite to the nozzle. A pin 1*c* is provided at the center of the turbine rotor wheel which projects into a bore 5*f*′ with an exact diametral fit. This construction aims at providing a more exact centering of the two rotors with the bearing surfaces 5*d*′ whereby inaccuracies resulting from the radial play of the screw connection are avoided.

Fig. 3 shows a further construction of the invention. In this embodiment the hub 2*a*′ of the blower rotor 2 embodies an axially directed open recess 2*b* in which the hub of the turbine rotor wheel 1*a*′ is inserted. The connection 4′ of the two rotors is effected by means of an external thread on the hub of the turbine rotor and an internal thread in the outer wall of the open recess of the blower rotor hub. With this arrangement of the connection 4′ of both rotors the result is obtained that by the expansion of the turbine hub embodying the external thread as a result of the hot turbine rotor in operation, the radial pressure on the part of the blower rotor hub carrying the internal thread is increased. Thereby the enlarged head section 5′ of the bearing shaft 5*a* is also supported in a bore 5*c*′ of the relatively cold blower wheel hub. The head 5′ only touches the turbine wheel at 5*b*′. The centering of both rotors is improved also in

this arrangement and satisfactory cooling of the turbo rotor hub from the blower wheel is obtained.

Fig. 4 shows the freely supported turbo-blower rotor according to the present invention in association with the housing containing the guide device. This drawing shows how the housing part **3** located on the blower side is joined with the turbo blower housing.

Further the oil passages are shown which feed the oil to the bearings and also are connected with the nozzles **6** which spray the truncated cone shaped body. The oil system comprises the feed pipe E and the outflow pipe A. The drawing shows also how the axial bearing of the rotors is obtained by means of the shaft like extension **5***a* or **5***a'*. For this purpose a ring **7** is forced firmly on to the rotating shaft like extension and is secured by means of nuts **9'** with a distance piece **8**. A thrust member **10** is fixed by the sleeve **11** screwed into the housing part **3**. It will be seen that this arrangement which does not form the subject of the present invention supports the two rotors suitably in axial direction.

The main advantage of the present invention consists in the fact that the truncated cone shaped body and its extension serving as a bearing, effects, with the screw connection provided, a satisfactory centering of the blower rotor and of the turbine rotor even for the highest rotary speeds. Further the heat transfer from the hot turbine rotor in the direction towards the bearings is effectively reduced by the means referred to. The construction of the bearing elements can be arranged as shown or in other suitable manner.

We claim:

1. Overhung supported turbo-blower rotor, comprising a separate turbine rotor for a hot actuating medium and a blower rotor for a relatively cool pressure medium, a common shaft for both rotors, each of said rotors having central hub portions situated for rigid assembly of the rotors to each other and to said common shaft, said shaft being supported by a stationary bearing extending axially partially into the hub portion of the blower rotor, and comprising beyond said stationary bearing an extension formed to constitute a central connecting piece for both said rotors capable of being firmly connected to the inner surface of said central hub portion of the blower rotor, said central connecting piece and said inner surface being of truncated cone shape for securing a rigid connection.

2. Overhung supported turbo-blower rotor according to claim 1, wherein the said connection from the blower and turbine rotor is so formed, that on assembly of both rotors the blower rotor is drawn on to the truncated cone shaped connecting piece and the outer surface of said connecting piece is arranged co-axial to the bearing surfaces so that the outer surface is operative as a centering surface for the radial support of both rotors.

3. Overhung supported turbo-blower rotor according to claim 1 wherein the truncated cone shaped outer surface of the said connecting piece does not come into contact with the turbine rotor.

4. Overhung supported turbo-blower rotor according to claim 1, wherein the hub of the blower rotor embodies an axially directed open recess for the introduction of the hub of the turbine rotor.

5. Overhung supported turbo-blower rotor according to claim 4, wherein the connection of both rotors is effected by means of external threads on the hub of the turbine rotor and internal threads of the outer wall of the open recess of the blower in such a manner that the expansion of the hot turbine hub embodying the external thread increases the compression pressure of the screw connection of both rotors.

6. Overhung supported turbo-blower rotor according to claim 1, wherein means are provided which reduce the heat transfer from the turbine rotor in the direction towards the bearings.

7. Overhung supported turbo-blower rotor according to claim 6, wherein means are provided for spraying fresh oil on to the truncated cone shaped connecting piece from the stationary bearing.

8. Overhung supported turbo-blower rotor according to claim 1, wherein the truncated cone shaped connecting piece includes an open recess on the surface in contact with the turbine rotor for reducing the same.

9. Overhung supported turbo-blower rotor according to claim 7, wherein the surface of the truncated cone shaped body sprayed with oil embodies recesses increasing this surface area in order to increase the cooling action.

10. Overhung supported turbo-blower rotor according to claim 1, wherein a pin is provided at the center of the turbine rotor wheel and said connecting piece having a co-axial bore adapted to fit said pin whereby on assembly of the rotors the pin and the bore serve for centering both rotors.

11. Overhung supported turbo-blower rotor according to claim 1, wherein the surface of the hubs of the two rotors which are in direct mutual contact each embody a surface formed as a guiding and centering surface.

12. Overhung supported turbo-blower rotor, comprising a separate turbine rotor for a hot actuating medium and a blower rotor for a relatively cool pressure medium, a common rotary shaft rotating with said rotors, each of said rotors having a central integral hub portion protruding from the rear side of said blower and turbine rotors for rigid assembly of said rotors to one another, a stationary bearing for said common rotary shaft providing for the support of said rotors, said bearing extending axially partially onto said hub portion of said blower rotor, and having beyond said stationary bearing a central connecting piece for said rotors, the integral hub portion of said blower rotor having an axially directed open circular recess for the introduction of said integral hub portion of said turbine rotor, the connection of both rotors being effected by a screw connection comprising external threads on said integral hub portion of said turbine rotor and internal threads upon the outer wall of said open recess in said integral hub portion of said blower rotor by screwing said hub portion of said turbine rotor into said recess of said integral hub portion of said blower rotor so that both rotors are drawn tight onto said central connecting piece, the arrangement being such that said screw connection is provided at a radial distance from said connecting piece and said stationary bearing and axially spaced from the latter, whereby heat conduction towards said stationary bearing from said turbine rotor over said screw connection is substantially reduced, and the heat expansion of the hot turbine hub portion embodying the external threads increases the pressure of said screw connection.

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