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(54) **PRE-ASSEMBLED BLADE FOR FANS FOR COOLING THE COOLING FLUID OF MACHINES/VEHICLES AND FAN EQUIPPED WITH SAID BLADE**

VORMONTIERTE SCHAUFEL FÜR GEBLÄSE ZUR KÜHLUNG DER KÜHLFLÜSSIGKEIT IN MASCHINEN/FAHRZEUGEN UND MIT BESAGTER SCHAUFEL AUSGESTATTETES GEBLÄSE

AUBE PRÉ-ASSEMBLÉE POUR VENTILATEURS DE REFROIDISSEMENT DE LIQUIDE DE REFROIDISSEMENT DANS DES MACHINES/VÉHICULES ET VENTILATEUR POURVU DE LADITE AUBE

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Description

[0001] The present invention relates to a blade for fans for cooling the cooling fluid contained in the radiator of operating machines and/or vehicles, in particular agricultural tractors and off-road vehicles, and to an apparatus for actuating and controlling the rotation of the fan blades about their axes.

[0002] It is known that the driving of operating machines and vehicles by means of a heat engine involves the need to cool the latter by means of a cooling fluid which is stored inside a cellular radiator and recirculated through the engine; the cooling fluid is in turn cooled by the ambient air which is forced to pass through the radiator by the sucking action of a rotating fan.

[0003] Taking as a reference point the normal front part of the machine/vehicle the three elements are axially arranged with the radiator at the front, engine behind it and fan arranged in between the two.

[0004] It is also known that, in the technical sector of vehicles which are generally used in conditions where there is a large quantity of loose debris, as in the case of agricultural tractors or vehicles intended for off-road use, but also operating machines which work under stationary conditions, this loose debris tends to be deposited on the cellular surfaces of the radiator containing the vehicle cooling fluid, causing blockage thereof and therefore a reduced and/or no cooling of the fluid, with consequent overheating of the engine.

[0005] It is also known that the main cause of said accumulation of debris on the radiator is the forced air flow of the fan which is arranged behind the radiator in the direction of travel of the vehicle and connected to the driving shaft of the vehicle, said fan, when rotated, drawing in the air and forcing it to pass through the radiator, causing dissipation of the heat from the cooling fluid contained inside it, which is at a higher temperature, into the external environment, which is at a lower temperature.

[0006] It is also known that, under normal operating conditions, said fan must be made to rotate only when a definite predefined temperature of the cooling fluid is reached, this being detected by means of a thermostat.

[0007] In greater detail it is required that a motor vehicle fan should be able to draw air from the radiator towards the heat engine:

- in a small amount for cooling in low external temperature conditions,
- in large amounts when there are higher external temperatures or when the vehicle is used in demanding conditions resulting in overheating of the engine, but also
- air must be temporarily forced onto the radiator in the opposite direction in order to clean it of the impurities which have accumulated during normal operation.

[0008] In order to determine these operating conditions, fan actuating apparatus able to produce controlled rotation of the fan blades from a condition for suction of the air from the radiator into a condition for propelling air onto the radiator are known, whereby in the suction condition the angle formed by the surface of the blades with the axial direction of air - below referred to as inflow angle - may be adjusted within a certain range in order to increase/decrease the flow according to the actual fluid cooling requirements.

[0009] Although these apparatus, which are mainly of the fluid-dynamic type, fulfil their function, they require however special means for supplying the fluid to the blade movement devices, said means either not always being present on the vehicles or requiring the installation of a compressor or connection pipes, which possibility, apart from increasing the costs, is not always physically feasible.

[0010] In addition, the position of the blades at the various entry angles of the blades is unstable and requires complicated auxiliary locking elements such as counterweights or the like for opposing the thrust of the air which tends to cause rotation of the blades in the opposite direction to the direction of adjustment, resulting in undesirable and noisy angular oscillations of the blades.

[0011] US 3 420 311 describes a system for fastening together blade and device for adjusting the inflow angle of the blade, which uses a double screw/female thread connection; in view of the imprecision which is always present in the design of both male and female threads, the relative rotation positions the blades in a relative angular position which is not constant and definite, resulting in differences in orientation between blades, with a consequent reduction in the efficiency and increase in the energy consumption and wear.

[0012] The technical problem which is posed therefore is that of providing a blade for fans for cooling the cooling fluid in operating machines and/or vehicles, in particular vehicles such as agricultural tractors and off-road vehicles, which can be both easily and rapidly applied to a fan and can be controlled during rotation about its longitudinal axis.

[0013] In addition, it is specifically required that a definite and predetermined angular orientation of the fitted blade should be ensured so that all the blades are correctly and uniformly oriented once mounted on the fan, in order to avoid a worsening of the fluid-dynamic effects with a consequent increase in the energy consumption needed to achieve the predefined objects, both during cooling of the cooling fluid during normal operation of the machine/vehicle and during cleaning of the cells of the radiator in the event of blockage thereof.

[0014] In connection with this problem it is also required that said blade and fan should have small dimensions, be easy and inexpensive to produce, assemble and maintain and also be able to be easily installed and/or replaced on any operating machine/vehicle without the need for auxiliary devices and/or complicated connection lines and/or complex disassembly operations.

[0015] These results are achieved according to the present invention by a blade according to Claim 1 and by a fan for cooling the cooling fluid contained in the radiator of vehicles, in particular agricultural tractors and off-road vehicles, and/or operating machines according to the characteristic features of Claim 10.

[0016] Further details may be obtained from the following description of a non-limiting example of embodiment of the subject of the present invention, provided with reference to the accompanying drawings, in which:

Figure 1: shows an exploded view of a blade according to the present invention;
Figure 2: shows a partial vertical section through the blade of Fig. 1 in the preassembled condition;
Figure 3: shows a perspective view of the blade support hub according to the present invention;
Figure 4: shows a partial vertical section through the hub according to Fig. 3;
Figure 5: shows an axial vertical section through an embodiment of an apparatus for actuating and controlling rotation of the blades and the fan according to the present invention;
Figure 6: shows a perspective view of an auxiliary device for manually actuating rotation of the blades.

[0017] As shown in Fig. 1 and assuming only for the sake of easier description and without a limiting meaning a longitudinal axis X-X corresponding to the axis of rotation of a fan 10 and a radial transverse axis Y-Y of axial extension of a blade 20 as well as - with reference to the direction of travel of a vehicle indicated by the arrow "A" in Fig. 6 - a front part corresponding to the position of a radiator 1 and a rear part corresponding to the position of the heat engine 2 of the vehicle, the fan 10 is arranged behind the radiator 1 and in front of the engine 2 and comprises a hub 111 which is preferably closed at the front by a cover 111b. The hub 111 is axially locked to a pulley 3 for rotationally driving the fan, connected by means of a suitably driven belt 3a to the shaft of the heat engine 2.

[0018] The pulley 3 is mounted on a pair of bearings 3b,3c which are keyed onto a fixed support element, in example described consisting of a tubular sleeve 5 which is fixed to the base of the engine 2 via associated means 5a and inside which the apparatus 100 for controlling rotation of the blades 20, not described in detail, is preferably partially contained.

[0019] As shown in Figs. 1 and 2, it is envisaged that each blade 20 comprises the following pre-assembled parts:

-) a shank 21 divided into:

- a first part 21a suitable for joining together with the body 20a of the blade - for example by means of overmoulding - and
- a second part axially on the outside of the blade body and formed as a cylindrical pin 21b inside which at least one hole 21c with a female thread is formed; preferably a single hole 21c with female thread is present, the arrangement and function of which will become clearer below;

-) a blade flange 22 comprising

- a hollow cylindrical body 22a, the opposite end bases of which, in the transverse/radial direction Y-Y, comprise respectively:
- a flat edge 22b, which is preferably polygonal and provided with through-holes 22c preferably arranged at the vertices of the polygon;
- an annular surface 22d;

-) a disk having at least one through-hole 23a which, once the blade is assembled, is coaxial with said hole 21c in the blade shank, and an annular seat 23b for seating an anti-vibration O-ring 23c;

the disk 23 has, rigidly joined thereto, an eccentric pin 24 for rotationally actuating the blade as will emerge more clearly below; the disk may be for example formed as one piece with the pin 24 or may comprise an eccentric recess for receiving the pin 24 with friction;
-) said pin 24 rigidly joined to the disk 23 extends from the latter parallel to the transverse-radial direction Y-Y of axial extension of the blade and, according to the invention, comprises external toothing 24a formed on a part of its side surface; the toothing 24a is able, during use, to mesh with corresponding teeth of a rack 71 of a device 70 for adjusting the inflow angle of the said blade 20. In addition, the eccentric pin 24 is arranged in a predefined position with respect to the hole 21c of the shank pin 21 and the corresponding hole 23a of the disk 21, so as to determine a suitable angular orientation of the blade relative to the said pin.

[0020] A definite and predefined angular orientation may, for example, be obtained by means of complementary means comprising an eccentric pin 21e extending from the bottom surface of the shank 21 in the transverse-radial direction Y-Y and suitable for mating with a corresponding eccentric recess 23d in the disk 23.

-) at least one screw 25 suitable for mating with the female thread of the at least one hole 21c in the pin 21b for fixing the disk 23 to the pin 21b;
- means 26 for centring the shank 21b inside the hollow cylindrical body 22a; according to preferred embodiments, said centring means may be realized in the form of a bush (Fig. 1) or roller bearing;
-) thrust bearings 27, preferably of the roller type, arranged between the disk 23 and the blade flange 22.

[0021] Preferably the shank 21b is associated with a seal 21g designed to isolate from external forces the con-

nection with the support flange 22.

[0022] As illustrated in the view of Fig. 2, fixing of the screws 25 inside the hole 21c of the shank 21b of the blade 20 causes locking of the disk 23 and relative orientation of the blade with respect to the pin 24 and, via the latter, with respect also to the hub of the fan, as will emerge more clearly below.

[0023] According to a different embodiment, a plurality (for example three) holes 21c may be present in the blade shank 21 with an eccentric position with, when the blade is assembled, a corresponding number of through-holes 23a in the disk 23 coaxial with the holes 21c in the shank and screws or pins for connecting the disk 23 to the shank 21. With this configuration one or more holes 21c may have a female thread for assembly of shank 21 and disk 23, while all the holes 21c and corresponding holes 23d in the disk 23 cooperate to obtain the definite and predefined angular orientation, forming said means for relative orientation of pin 24 and blade shank 21.

[0024] By varying the position of the orientation means 23d, 21e; 21c,23a,25 relative to the eccentric pin 24 it is possible to obtain a corresponding rotation of the blade which, during pre-assembly, may assume a different angular rotation which is predefined, definite and stable, following tightening of the screw(s) 25.

[0025] According to a further aspect of the invention (Figs. 4 and 5) it is also envisaged that the hub 111 which supports the blades 20 and is connected to the means for rotationally actuating the fan is formed as a single body with an internal, axially extending, through-seat 111a and radial extensions 112 with a substantially parallelepiped shape having an internal cylindrical hole 112a suitable for connection with the blade flange 22 which may thus be coaxially engaged on the hub to which it is fixed by means of screws 113 inserted inside the through-holes 22c in the flat edge 22b and screwed into corresponding female threads of holes 112c formed on the outer surface of the radial extensions 112 of the hub, against which, once assembly has been performed, the flat edge 22b of the flange 22 bears.

[0026] The axially opposite front surfaces 111 of the hub have respectively: holes 111d suitable for mating with screws for fixing a front closing cover 111b on the outside and holes 111f for performing fixing to the rotor of an apparatus for actuating and controlling rotation of the fan described below.

[0027] As shown in Fig. 6, the apparatus for controlling rotation of the blades 20 about their longitudinal axis Y-Y comprises an electric motor 30 which is coaxially inserted inside the tubular sleeve 5 and the shaft 31 of which is connected to an epicyclic reduction gear 40 situated axially in front of said motor.

[0028] The kinematic output element 143 of the epicyclic reduction gear is connected to a screw 50, the threading 51a of which is connected to the female thread 76b of a slider joined by means of a flange 76a to the inner support of a bearing 12, the outer support of which supports the device 70 for adjusting the inflow angle of the blades 20, described below.

[0029] The device 70 for adjusting the inflow angle of the said blades 20 is arranged between the bearing 12 for rotation of the hub and the pin 24 rigidly joined to the shank 21b of the said blades 20.

[0030] The device 70 comprises a rack 71 fixed to the bearing 12 and provided with a longitudinal toothing comprising a plurality of radial teeth suitable for meshing with the corresponding toothing 24a of the radial pin 24 rigidly joined to the disk 23 and therefore to the shank 21b of the blade 20. Preferably, the device 70 is longitudinally guided parallel to the axis X-X by lugs, not shown, arranged in the body 111, and the slider 76 is displaceable and axially guided, but rotationally fixed.

[0031] The apparatus further comprises, preferably, a sensor 90 for detecting the axial distance between the slider 76 and a reference counter-plate 75, said sensor 90 being connected to the means - not shown - for programming and controlling rotation of the blades 20.

[0032] With this configuration of blade, hub and apparatus it is possible, once the blade has been pre-assembled with the predefined angular orientation, to arrange the rack 71 of the device 70 in a substantially central position with respect to its displacement in both directions along the longitudinal axis X-X so that each blade is fixed on the hub with a first same relative orientation of all the blades with respect to the radiator, for example for cooling the fluid; then, by activating the electric motor 30 which operates the device 70, it is possible to vary simultaneously the orientation in one direction or the other of all the blades so as to optimize the efficiency of the fan, or reverse the air flow when it is required to clean the radiator.

[0033] The preferred embodiment of the single-piece hub 111 is such as to allow machining of only the seats 112a which are bored with cylindrical internal cross-section which does not have an inwardly projecting annular edge, thereby avoiding the more complex machining of both the radial and the end inner walls which join together in the axial direction the two half-parts forming the hubs according to the prior art.

[0034] This solution, in combination with the pre-assembled structure of the blade, which can be fixed to the hub as described, has the further advantage of allowing separate and independent insertion/extraction of the blades in the event of malfunctioning of one or more blades, without the need for complicated assembly operations and openings and closures in the half-parts of the entire hub.

[0035] According to a preferred embodiment it is also envisaged that the blades 20 of the fan have a radially inner part with chamfered edges - preferably symmetrical - designed to allow the rotation about the respective axis without relative interference between adjacent blades; said blades may thus rotate through angles $\geq 180°$. The blade and the fan with hub according to the invention are therefore able to ensure an angular orientation which is the same for all the blades, optimizing the fluid-dynamic

effects with a consequent reduction in the energy consumption needed to achieve the predefined objects, as well as rapid and low-cost manoeuvres.

[0036] Although described in connection with a number of embodiments and a number of preferred examples of embodiment of the invention, it is understood that the scope of protection of the present patent is determined solely by the claims below.

Claims

1. Pre-assembled blade (20) for a fan (10) for cooling the cooling fluid contained inside the radiator (1) of operating machines and/or vehicles, comprising a blade body (20a) integral with an axial shank (21), wherein
the shank (21) has a part axially on the outside of the blade body in the form of a cylindrical pin (21b), at least one hole (21c) with a female thread being formed inside the pin (21b);
and the blade (20) comprises

-) a blade flange (22), suitable, in use, for fixing the pre-assembled blade (20) to a hub of the fan (10), comprising

• a hollow cylindrical body (22a), the opposite end bases of which comprise respectively:
• a flat edge (22b) provided with at least one through-hole (22c),
• an annular surface (22d);

-) a disk (23) having at least one through-hole (23a) coaxial, when the blade is assembled, with the said at least one hole (21c) in the shank (21);
-) an eccentric pin (24) rigidly joined to the said disk (23) and comprising an outer toothing (24a) on a part of its side surface, suitable for meshing during use with a rack of a device (70) for adjusting the inflow angle of the blade (20), for rotational operation of the said blade about its axis;
-) at least one screw (25) designed to pass through one of the through-holes (23a) in the disk (23) and mate with the female thread of one of the holes (21c) in the cylindrical pin (21b) in order to perform relative fixing of disk (23) and cylindrical pin (21b), ensuring a definite angular alignment of the blade body relative to the eccentric pin (24) during pre-assembly.

2. Blade according to Claim 1, **characterized in that** said flat edge (22b) is polygonal with through-holes (22c) arranged at the vertices of the polygon.

3. Blade according to Claim 1 or 2, **characterized in that** it comprises means (26) for centring the shank (21b) inside the hollow cylindrical body (22a).

4. Blade according to any one of Claims 1 to 3 above, **characterized in that** it comprises thrust bearings (27), preferably of the roller type, arranged between the disk (23) and the inset annular seat (22c) of the blade flange (22).

5. Blade according to any one of Claims 1 to 4, **characterized in that** said disk (23) has an annular seat (23b) for seating an anti-vibration O-ring (23c).

6. Blade according to any one of Claims 1 to 5, **characterized in that** it comprises an isolating seal (21c) arranged between the shank (21b) and the blade support flange (22).

7. Blade according to any one of the preceding claims, **characterized in that** it has a central hole in the shank and, corresponding thereto, a central hole in the disk (23) and a screw for joining the disk (23) to the shank (21);
and **in that** it comprises complementary means for definite relative orientation of eccentric pin (24) and blade body (20).

8. Blade according to the preceding Claim, **characterized in that** said complementary means comprise an eccentric pin on the bottom surface of the shank and a corresponding eccentric recess on a top surface of the disk (23) or at least one eccentric hole in the shank and a corresponding hole in the disk, with a pin for joining together disk (23) and shank (21).

9. Blade according to Claim 1, wherein the disk (23) is formed as one piece with the eccentric pin (24) or wherein the disk (23) has an eccentric recess for receiving with friction the eccentric pin (24).

10. Cooling fan (10) for operating machines and/or vehicles, in particular agricultural tractors and off-road vehicles, said fan comprising a hub (111) which can be rotationally operated about its axis (X-X) and is formed as a single body with an internal, axially extending, through-seat (111a) and radial extensions (112) with a substantially parallelepiped shape having an internal cylindrical hole (112a) suitable for coaxial insertion of the blade shank and for engagement with a corresponding blade flange (22), and at least one blade (20) rotatable about its axis perpendicular to the axis (X-X) of rotation of the hub (111), **characterized in that**
said blade is realized in accordance with the features of any Claim 1 to 8 and said radial extensions (112) of the hub (111) have holes (112c) with a female thread for mating with screws (123) for fixing the flange (22) of the blade (20).

11. Fan according to Claim 10, **characterized in that** the axially opposite front surfaces of the hub have respectively: holes (111d) suitable for mating with screws for fixing a front closing cover (111b) on the outside and holes (111f) for performing fixing to the rotor of an apparatus for actuating and controlling rotation of the fan.

12. Fan according to Claim 11, **characterized in that** the fixing screws pass, during use, through the holes (22c) in the flat edge (22b) of the flange (22).

Patentansprüche

1. Vormontierte Schaufel (20) für einen Lüfter (10) zum Kühlen von im Inneren des Kühlers (1) von Betriebsmaschinen und/oder Fahrzeugen befindlichen Kühlflüssigkeit, welche einen mit einem Axialkolben (21) integralen Schaufelkörper (20a) umfasst, wobei der Kolben (21) axial an der Außenseite des Schaufelkörpers ein Teil in der Form eines zylindrischen Stifts (20b) hat, bei dem wenigstens ein Loch (21c) einem weiblichen Gewinde im Inneren des Stifts (20b) gebildet ist;
und die Schaufel (20) umfasst:

- einen zum Befestigen der vor-montierten Schaufel (20) an eine Nabe des Lüfters (10), im Gebrauch, geeigneten Schaufelflansch (22), umfassend

  • einen Hohlzylinderkörper (22a), dessen gegenüberliegende Endgrundflächen jeweils umfassen:
  • eine mit wenigstens einem Durchgangsloch (22c) versehene Flachkante (22b),
  • eine ringförmige Fläche (22d);

- eine mit wenigstens einem besagten Loch (21c) in dem Kolben (21), wenn die Schaufel montiert ist, koaxialen Durchgangsloch (23a) aufweisender Scheibe (23);
- einen mit der besagten Scheibe starr verbundenen und eine äußere Zahnung (24a) an einem Teil von dessen Seitenfläche, die während dem Einsatz zum Kämmen mit einer Schiene einer Einrichtung (70) zum Einzelstellen des Zuflusswinkels der Schaufel (20) geeignet ist, umfassenden exzentrischen Stift (24), zum drehenden Betrieb besagter Schaufel um deren Achse;
- eine zum Durchtreten eines der Durchgangslöcher (3 20 A) in der Scheibe (3, 20) und zum Ineinandergreifen mit dem weiblichen Gewinde eines der Löcher (22c) in dem zylindrischen Stift (21b)zum Ausführen einer relativen Befestigung von Scheibe (23) und zylindrischem Stift (21b) ausgelegten Schraube (25), zum Sicherstellen einer definierten Winkelausrichtung des Schaufelkörpers relativ zum exzentrischen Stift (24) während der Vormontage.

2. Schaufel gemäß Anspruch 1, **dadurch gekennzeichnet, dass** besagte Flachkante (22b) polygonal mit den Durchgangslöchern (22c) an den Eckpunkten des Polygons angeordnet ist.

3. Schaufel gemäß Anspruch 1 oder 2, **dadurch gekennzeichnet, dass** sie Mittel (26) zum Zentrieren des Kolbens (21b) im hohlzylindrischen Körper (22a) umfasst.

4. Schaufel gemäß einer der vorangegangenen Ansprüche 1 bis 3, **dadurch gekennzeichnet, dass** sie zwischen der Scheibe (23) und dem eingesetzten ringförmigen Sitz (22c) des Schaufelflanschs (22) angeordnete Drucklager (27), vorzugsweise des Rollentyps, umfasst.

5. Schaufel gemäß einer der vorangegangenen Ansprüche 1 bis 4, **dadurch gekennzeichnet, dass** besagte Scheibe (3, 20) einen ringförmigen Sitz (23b) zum Aufnahme eines Anti-Schwingungs-O-Rings (23c) aufweist.

6. Schaufel gemäß eines der vorangegangenen Ansprüche 1 bis 5, **dadurch gekennzeichnet, dass** sie eine zwischen dem Kolben (eine 20 B) und dem Schaufelstützflansch (22) angeordnete isolierende Dichtung (21c) umfasst.

7. Schaufel gemäß einer der vorangegangenen Ansprüche, **dadurch gekennzeichnet, dass** sie ein zentrales Loch in dem Kolben und, zugehörig dazu, ein zentrales Loch in der Scheibe (23) und einen Schraube zum Verbinden der Scheibe (23) mit der Kolben (21) aufweist;
und, dass sie komplementäre Mittel zur definierten relativen Orientierung des exzentrischen Stifts (24) und des Schaufelkörpers (20) umfasst.

8. Schaufel gemäß dem vorangegangenen Anspruch, **dadurch gekennzeichnet, dass** besagte komplementäre Mittel einen exzentrischen Stift an der Bodenfläche des Kolbens und eine zugehörige exzentrische Aussparung an einer Deckfläche der Scheibe (23) oder wenigstens ein exzentrisches Loch in dem Kolben und ein zugehöriges Loch in der Scheibe, mit einem Stift zum Verbinden der Scheibe (3, 20) und des Kolbens (21), umfassen.

9. Schaufel gemäß Anspruch 1, wobei die Scheibe (23) als ein Stück mit dem exzentrischen Stift (24) ausgebildet ist oder, wobei die Scheibe (23) eine exzentrische Aussparung zum Aufnehmen des exzentrischen Stifts (24) mit Reibung aufweist.

10. Kühlungslüfter (10) für Betriebsmaschinen und/oder Fahrzeuge, insbesondere landwirtschaftliche Traktoren und Geländefahrzeuge, bei denen besagter Lüfter eine Nabe (111), welche drehbeweglich um deren Achse (X-X) betrieben werden kann und als ein einzelner Körper mit einem internen, axial erstreckenden, Durchgangssitz (lila) und radialen Erweiterungen (112) mit einer im Wesentlichen parallelepipeden Gestalt ausgeformt ist, die ein zum koaxialen Einsetzen des Schaufelkolbens und zum Eingreifen mit dem dazugehörigen Schaufelflansch (22) geeignetes inneres zylindrisches Loch (112a) aufweist, und wenigstens eine um deren Achse senkrecht zu der Rotationsachse (X-X) der Nabe (111) drehbare Schaufel (20) umfasst, **dadurch gekennzeichnet, dass**
besagte Schaufel gemäß der Merkmale einer der Ansprüche 1 bis 8 realisiert ist und besagte radiale Erweiterungen (112) der Nabe (111) Löcher (112 C) mit weiblichen Gewinden zum Ineinandergreifen mit Schrauben (103 20) zum Befestigen des Flansch (2, 20) der Schaufel (20) aufweisen.

11. Lüfter gemäß Anspruch 10, **dadurch gekennzeichnet, dass** die axial gegenüberliegenden Vorderflächen der Nabe jeweils aufweisen: zum Ineinandergreifen mit Schrauben zur Befestigung einer vorderseitigen Schließabdeckung (111b) an der Außenseite geeignete Löcher (111d) und Löcher (111f) zum Ausführen des Befestigens zum Rotor an einer Vorrichtung zum Stellen und Steuern der Rotation des Lüfters.

12. Lüfter gemäß Anspruch 11, **dadurch gekennzeichnet, dass** die Befestigungsschrauben, während der Benutzung, durch die Löcher (22c) in der Flachkante (22b) des Flansches (22) durchtreten.

Revendications

1. Pale préassemblée (20) pour un ventilateur (10) destiné à refroidir le liquide de refroidissement contenu à l'intérieur du radiateur (1) de machines et/ou de véhicules d'exploitation, comprenant un corps (20a) de pale d'un seul tenant avec une tige axiale (21), dans laquelle
la tige (21) comporte une partie située axialement sur l'extérieur du corps de pale sous la forme d'une broche cylindrique (21b), au moins un trou (21c) doté d'un filetage femelle étant ménagé à l'intérieur de la broche (21b) ;
et la pale (20) comprend

-) une bride (22) de pale appropriée, en utilisation, pour fixer la pale préassemblée (20) à un moyeu du ventilateur (10), comprenant

• un corps cylindrique creux (22a), dont les bases d'extrémité opposées comprennent respectivement :
• un bord plat (22b) doté d'au moins un trou traversant (22c),
• une surface annulaire (22d) ;

-) un disque (23) comportant au moins un trou traversant (23a) coaxial, lorsque la pale est assemblée, audit au moins un trou (21c) ménagé dans la tige (21) ;
-) une broche excentrée (24) reliée rigidement audit disque (23) et comprenant une denture extérieure (24a) sur une partie de sa surface latérale, appropriée pour engrener, en utilisation, avec une crémaillère d'un dispositif (70) pour régler l'angle de flux entrant de la pale (20), à des fins de mise en œuvre de rotation de ladite pale autour de son axe ;
-) au moins une vis (25) conçue pour traverser l'un des trous traversants (23a) ménagés dans le disque (23) et pour s'accoupler avec le filetage femelle de l'un des trous (21c) ménagés dans la broche cylindrique (21b) afin d'établir une fixation relative du disque (23) et de la broche cylindrique (21b), garantissant un alignement angulaire précis du corps de pale par rapport à la broche excentrée (24) pendant le préassemblage.

2. Pale selon la revendication 1, **caractérisée en ce que** ledit bord plat (22b) est polygonal, des trous traversants (22c) étant agencés au niveau des sommets du polygone.

3. Pale selon la revendication 1 ou la revendication 2, **caractérisée en ce qu'**elle comprend un moyen (26) destiné à centrer la tige (21b) à l'intérieur du corps cylindrique creux (22a).

4. Pale selon l'une quelconque des revendications précédentes 1 à 3, **caractérisée en ce qu'**elle comprend des paliers de butée (27), de préférence du type à rouleaux, disposés entre le disque (23) et le logement annulaire rentrant (22c) de la bride (22) de pale.

5. Pale selon l'une quelconque des revendications 1 à 4, **caractérisée en ce que** ledit disque (23) comporte un logement annulaire (23b) destiné à loger un joint torique antivibration (23c).

6. Pale selon l'une quelconque des revendications 1 à 5, **caractérisée en ce qu'**elle comprend un joint isolant (21c) disposé entre la tige (21b) et la bride (22) de support de pale.

7. Pale selon l'une quelconque des revendications pré-

cédentes, **caractérisée en ce qu'**elle comporte un trou central ménagé dans la tige et, en correspondance avec ce dernier, un trou central ménagé dans le disque (23) et une vis destinée à relier le disque (23) à la tige (21) ;
et **en ce qu'**elle comprend des moyens complémentaires d'orientation relative précise de la broche excentrée (24) et du corps de pale (20).

8. Pale selon l'une quelconque des revendications précédentes, **caractérisée en ce que** lesdits moyens complémentaires comprennent une broche excentrée située sur la surface inférieure de la tige et un évidement excentré correspondant ménagé sur une surface supérieure du disque (23) ou au moins un trou excentré ménagé dans la tige et un trou correspondant ménagé dans le disque, une broche étant destinée à relier l'un à l'autre le disque (23) et la tige (21) .

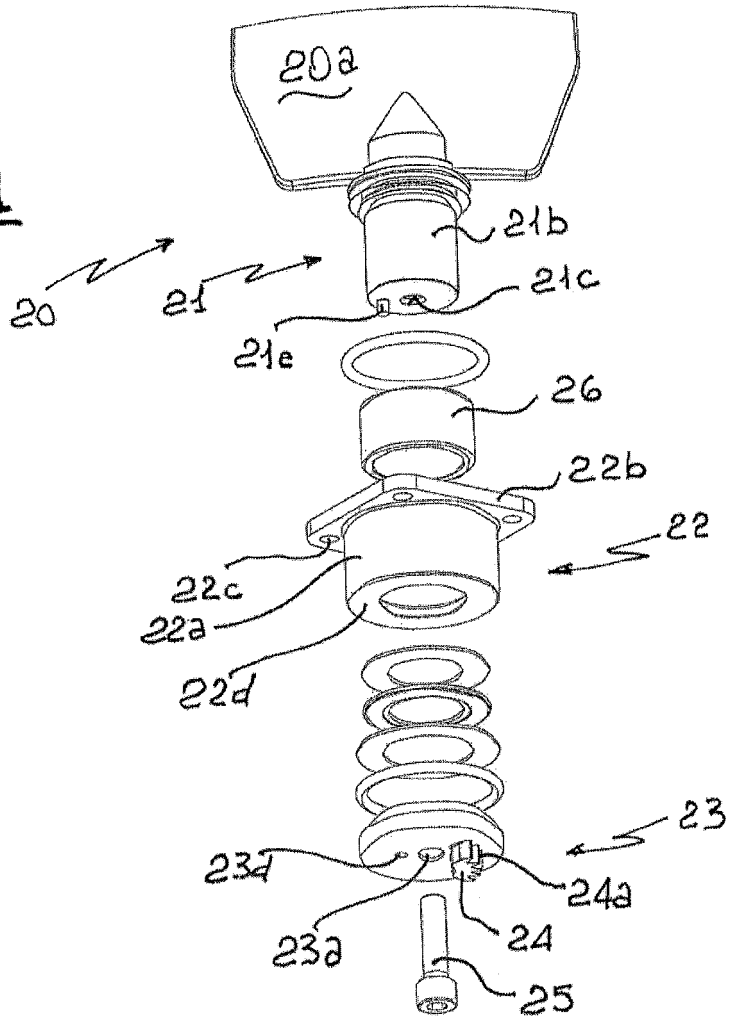
9. Pale selon la revendication 1, dans laquelle le disque (23) est formé d'un seul tenant avec la broche excentrée (24) ou dans laquelle le disque (23) comporte un évidement excentré destiné à recevoir à frottement la broche excentrée (24).

10. Ventilateur de refroidissement (10) de machines et/ou de véhicules d'exploitation, en particulier de tracteurs agricoles et de véhicules tout-terrains, ledit ventilateur comprenant un moyeu (111) qui peut être mis en œuvre en rotation autour de son axe (X-X) et qui est formé en tant que corps unique avec un logement traversant interne s'étendant partiellement (111a) et des prolongements radiaux (112) ayant une forme sensiblement parallélépipédique comportant un trou cylindrique interne (112a) approprié pour une introduction coaxiale de la tige de pale et pour une coopération avec une bride correspondante (22) de pale, et au moins une pale (20) pouvant tourner autour de son axe perpendiculaire à l'axe (X-X) de rotation du moyeu (111), **caractérisé en ce que** ladite pale est réalisée conformément aux caractéristiques de l'une quelconque des revendications 1 à 8, et lesdits prolongements radiaux (112) du moyeu (111) comportent des trous (112c) dotés d'un filetage femelle destinés à s'accoupler avec des vis (123) permettant de fixer la bride (22) de la pale (20).

11. Ventilateur selon la revendication 10, **caractérisé en ce que** les surfaces avant axialement opposées du moyeu comportent respectivement : des trous (111d) appropriés pour s'accoupler avec des vis de façon à fixer un cache de fermeture avant (111b) sur l'extérieur et des trous (111f) permettant une fixation au rotor d'un appareil d'actionnement et de commande de rotation du ventilateur.

12. Ventilateur selon la revendication 11, **caractérisé en ce que** les vis de fixation traversent, en utilisation, les trous (22c) ménagés dans le bord plat (22b) de la bride (22).

Fig 1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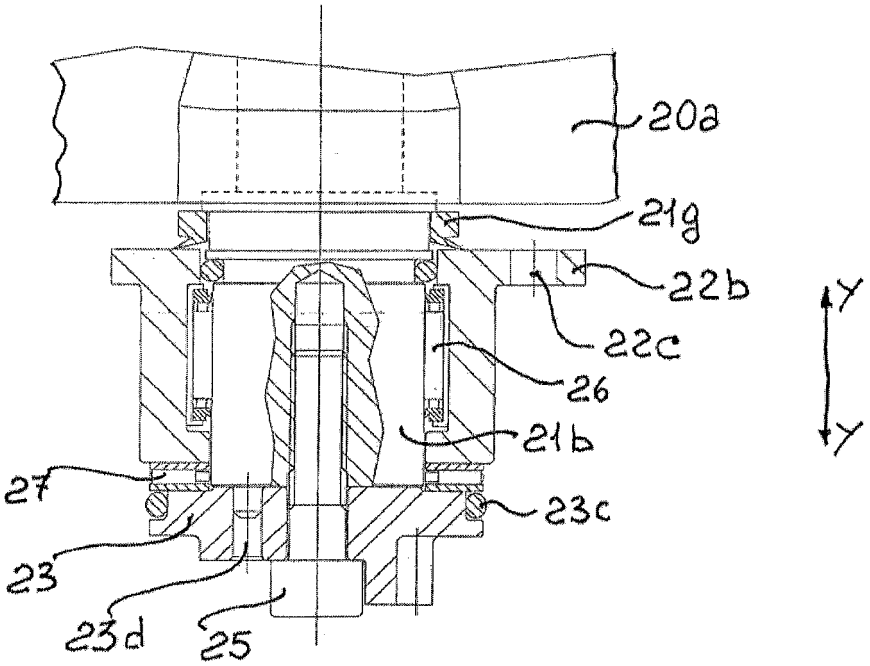
21b
20
21
21c
21e
26
22b
22
22c
22a
22d
23
23d
24a
23a
24
25

Fig 2


20a
21g
22b
22c
Y
26
21b
27
23c
23
23d
25
Y

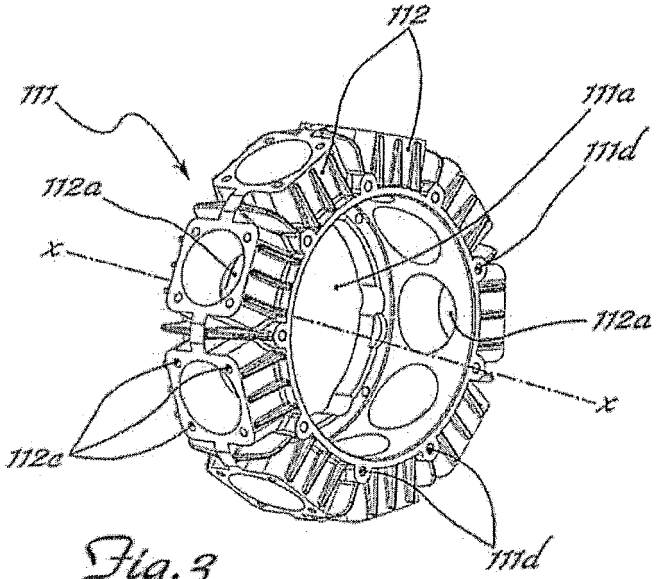


Fig.3

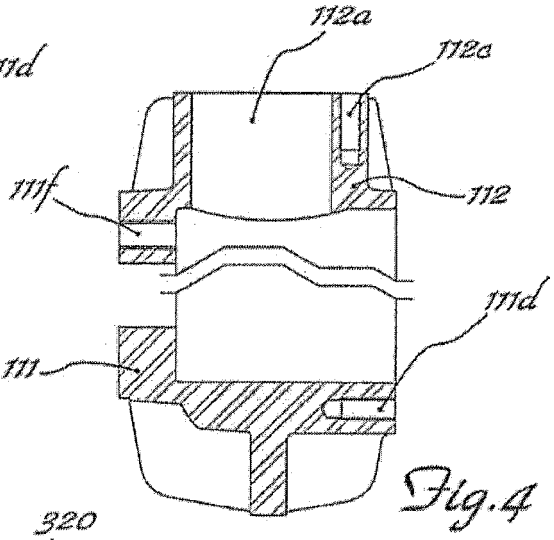


Fig.4

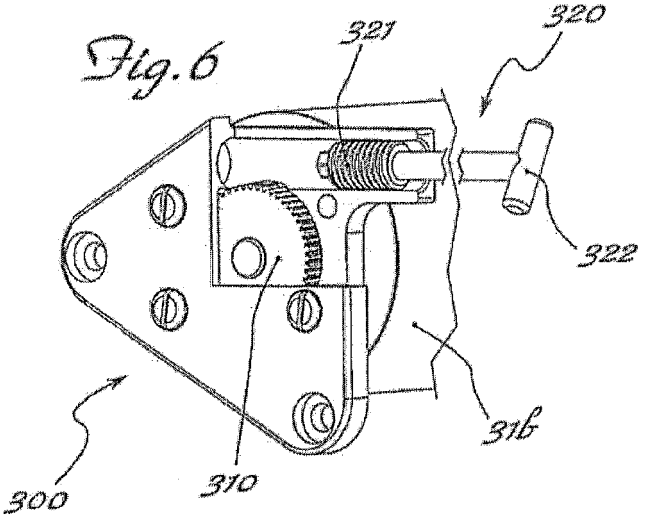
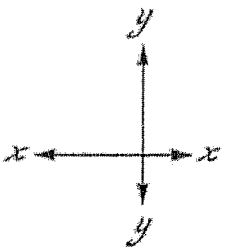


Fig.6



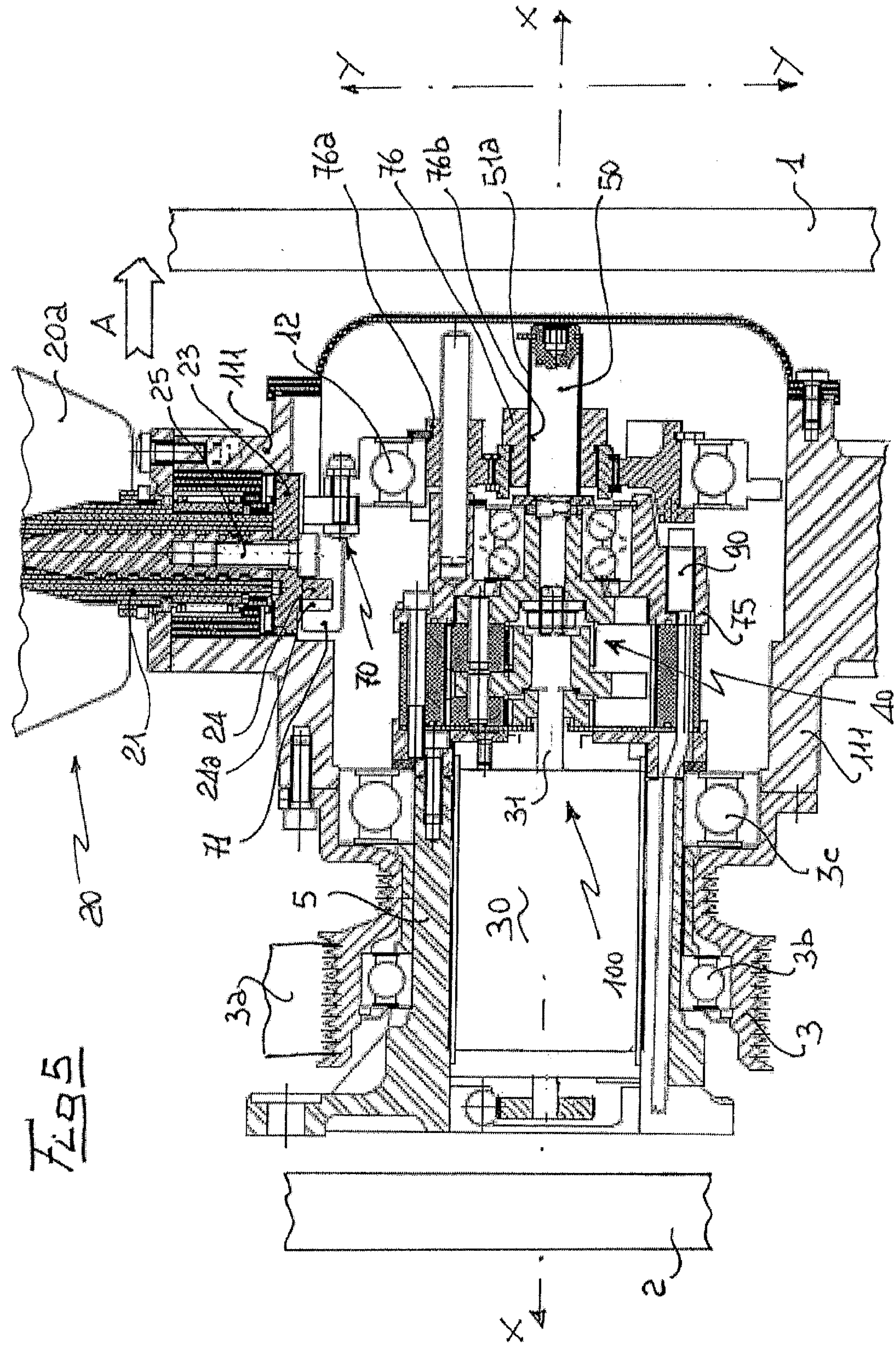

X
Y
Y
76a
76
76b
51a
50
1
20a
A
25
23
111
12
90
75
70
40
111
21
21a
24
71
31
3c
20
5
30
100
3b
3a
3
2
X

Fig 5

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

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