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(54) **Centrifugal drive device for automatic opening of fan louvers**

(57) The present invention relates to a centrifugal drive device for automatic opening of fan louvers (7), among those commonly used for ventilating large hangars, such as those intended for raising animals. This device has a special design based on the use of inertial masses (3.4.1) that exert in their rotation motion a centrifugal force transmitter by cranks (3.4) to an axially dis-

placeable plate (3.2). This second plate is guided and by means of a rod (4) which by means of a rod that is disengaged from the rotation motion by a bearing pushes (3.2.2) the central louver, which in turn with a common guide opens all the remaining louvers.

EP 1 359 326 A1

Description

OBJECT OF THE INVENTION

[0001] The present invention relates to a centrifugal drive device for automatic opening of fan louvers, among those commonly used for ventilating large hangars, such as those used for raising animals.

[0002] It is characterised by a special design of the device based on the use of inertial masses that exert in their rotation motion a centrifugal force transmitter by cranks to an axially displaceable plate.

[0003] This second plate is guided and by means of a rod, which is disengaged from the rotation motion by means of bearings, it pushes the central louver, which in turn with a common guide opens all the remaining louvers.

BACKGROUND OF THE INVENTION

[0004] Large fans are often provided with blinds comprised of louvers or similar means of closing the fan housing when the fan is stopped.

[0005] These louvers prevent air, dirt and even animals from entering when the fan is stopped.

[0006] The louvers are usually installed in the same structure that acts as a casing and support for the fan. Auxiliary devices for the correct operation of the fan are usually installed in this structure.

[0007] The electric power line for the fan impelling motor arrives at this assembly.

[0008] When the fan is turned on it impels the air, establishing a pressure difference between the inlet and outlet.

[0009] It is necessary that the louvers open when the fan is turned on in order to allow the air to pass; otherwise, the difference in pressure caused by the fan could damage the louvers or even the electric motor as there would not be enough refrigeration to dissipate the heat generated.

[0010] The louvers can be opened manually, by additional driving means or using the motion of the fan.

[0011] The first option is not desirable, as in the case of an oversight or mistake the aforementioned damage may occur and the air would not pass.

[0012] Moreover, it should be considered that these types of fans are usually located in inaccessible places, such as the highest areas of the hangars.

[0013] The second option is feasible, but requires the inclusion of an additional driving device, resulting in increased likelihood of malfunctions, greater cost of the equipment and increased complexity on the whole.

[0014] The last option is common and several driving means are known that use the centrifugal force exerted by moving elements that turn together with the fan.

[0015] One of the first Patents to describe a fan louver-driving device is US Patent 4,217,816.

[0016] This document describes a device employing

two masses attached to either end of a bar by two arms capable of opening by pivoting about said end.

[0017] In turn these arms are connected to a connecting rod that links to a second small plate that may move axially.

[0018] As the first bar turns together with the fan it forces the masses to move with it so that the centrifugal force makes them open, moving the plate in an axial sense.

[0019] The fully open position implies a position of the connecting rods that is perpendicular to the shaft, where the axial force tends to zero.

[0020] This position of zero force implies that the final position of the plate is not one of full extension but instead an intermediate point of equilibrium that can cause significant vibrations.

[0021] The initial position is restored by a spring.

[0022] Patent DE3739871 describes a fan with a casing such that its blades establish a closing when stopped.

[0023] The closed position is maintained by springs the resistance of which is overcome by inertial forces when the normal rotation speed is attained.

[0024] When the fan stops the air passage is again interrupted as the closing position is restored by the springs.

[0025] A later state of the art is determined by Patent EP489466.

[0026] This patent describes a centrifugal impulsion device applied to fan louvers.

[0027] In this device a certain number of inertial masses are installed in the elbows of two rods connecting two plates, one joined to the fan and another axially displaceable with respect to the first.

[0028] Initially, with the fan stopped, the louvers are closed with the aid of a spring that keeps the plates separated.

[0029] As the fan turns the masses, somewhat distanced from the shaft, are separated by action of the centrifugal force such that as they reach the elbow of the connecting rods there is a component of the tension that tends to make the plates approach each other.

[0030] This component overcomes the action of the spring and the force required to open the louvers.

[0031] In this type of devices the mass associated to the spring is not balanced in all positions and the coaxial arrangement of the plates is not ensured against the large forces applied by the inertial masses.

[0032] These two disadvantages lead to a device that can cause strong vibrations that are not easily compensated.

[0033] Patent no. EP563875, posterior, is an improvement of the first designs described in the aforementioned US Patent 4,217,816.

[0034] These improvements are mainly based on the constitution of each part, as well as on the connection means between them in order to achieve a greater stability.

[0035] However, the kinetic scheme is still the same, as the impulsion force is greatest at the start but least and tending to zero once open.

[0036] The present invention describes a driving device that overcomes previously known designs of the state of the art by using a special simple, sturdy, stable, balanced configuration with an improved axial impulsion capacity.

DESCRIPTION OF THE INVENTION

[0037] The present invention relates to a centrifugal drive device for automatically opening the louvers of a fan and which therefore does not require an auxiliary motor.

[0038] The fans for which it is designed comprise an outer casing which surrounds the fan and which in turn supports the drive motor and the traction means.

[0039] The side that is installed on the outside of the hangar is covered by a set of horizontal louvers that pivot about a horizontal shaft that is slightly separated from the centre of mass, so that they tend to remain closed.

[0040] The louvers pivot about a horizontal shaft by means of lateral clips capable of turning that hold them in place.

[0041] The vertical alignment of the louvers is connected by a common guide. Between this guide and each louver is an intermediate connecting rod in charge of defining a single degree of freedom in the opening of all louvers.

[0042] At a central point and therefore one near the fan shaft there is provided an impulsion rod.

[0043] This rod pushes on one of the clips such that when this clip opens the others open as well, due to the guide or guides.

[0044] The rod impulsion is what is achieved by the device object of the invention.

[0045] The device object of the invention is installed in the fan shaft such that it turns together with the impulsion of the motor.

[0046] The fan rotation causes a force to act on inertial masses that is used to make the louvers open.

[0047] This objective is achieved by the special design of its component parts and the kinetic scheme on which it is based.

[0048] The device comprises two plates, a main plate solidarily joined to the fan and fixed with respect to it, and a second, mainly rectangular plate that can move axially with respect to the first one by virtue of four guides, each of which is at a corner of the rectangle.

[0049] Taking the fan as a fixed reference, the support plate can be referred to as the fixed plate and the axially sliding plate can be referred to as the moving plate, keeping in mind that the reference is subject to a rotation about the fan shaft so that there are inertial forces acting on the masses of this system.

[0050] The four guides allow the axial displacement between the plates, where in turn the guides show their

main planes parallel.

[0051] The main plate extends its greater sides beyond the moving plate, on the ends of which are corresponding elbows with a joint that can turn about a shaft parallel to the minor sides.

[0052] In this joint pivots a crank that, while in the resting position when the two plates are nearest to each other, has one arm parallel to the rotation axis and another perpendicular to it and located between the two plates.

[0053] The outer arm of the crank, which is parallel to the main rotation axis, is provided on its end with an inertial mass that during rotation suffers the action of a centrifugal force in a radial sense.

[0054] The other arm, located between the plates, is provided on its end with a roller inside a groove common to the roller of the opposite crank.

[0055] This groove is perpendicular to the main rotation axis and defines a cam in which the two rollers are the followers.

[0056] The centrifugal force acts on all separate elements of the main axis and to a greater extent the greater the diameter and its mass.

[0057] The materials used for this device are lightweight, so that the inertial mass placed on the ends of the crank present dominating forces with respect to those of for example the rest of the arm that supports these masses.

[0058] The action of the centrifugal force tends to separate the inertial masses, rotating the cranks about the axis defined by the joint of the fixed plate on which it is secured.

[0059] As the cranks open the opposite ends of the cranks describe an arc about the joint that can be broken down into two projections, an axial one and one radial or perpendicular to the axis of rotation of the device.

[0060] The axial displacement pushes the moving plate to separate it, while the radial displacement simply implies a sliding of the roller inside the groove of the moving plate which houses it.

[0061] The two cranks open simultaneously as the four guides that keep the moving plate parallel to the fixed plate impose a single degree of freedom to the entire device.

[0062] The full opening of the cranks is achieved when the rollers reach the end of the race in the groove or cam of the moving plate.

[0063] In this position the two arms of the crank are at an approximate angle of $\pi/4$ radians, respectively positive and negative, with respect to the main rotation axis.

[0064] Ensuring the correct value of each mass is enough to achieve the dynamic equilibrium of the entire assembly, so that no further adjustment or maintenance is necessary.

[0065] In the initial position the centrifugal force acts perpendicularly to the arm and therefore achieves a maximum momentum of rotation.

[0066] In the final position the angle encompassed re-

duces to an extent the projection of the inertial force tangent to the rotation about the joint; however, because of its greater distance from the axis the greater modulus of the centrifugal force compensates its smaller projection.

[0067] The axial displacement of the moving plate carries with it the pushing rod that opens the central louver and with it the other louvers.

[0068] The device rotation is disengaged in the rod union by the presence of a bearing placed at the union with the moving plate.

[0069] As at the start the fan gradually increases its speed until it reaches the nominal rotation speed the push also increases gradually.

[0070] After the louvers have opened the centrifugal forces keep the masses separated without relative motion, so that no work is performed.

[0071] The only energy dissipated is that due to the aerodynamic drag in the rotation of the device.

[0072] When the fan stops the louvers recover their initial closed position by the action of gravity, and these push the moving plate until the masses once again are next to the moving plate.

DESCRIPTION OF THE DRAWINGS

[0073] The present descriptive memory is complemented by a set of drawings which illustrate the preferred example of embodiment and in no case are limitations of the invention.

[0074] Figure 1 shows a scheme of a side view of the assembly formed by the fan, the centrifugal drive device, the louvers and the opening guides when the operator is resting.

[0075] Figure 2 shows a scheme of the side view of the assembly formed by the fan, the centrifugal drive device, the louvers and the opening guides when the operator is rotating at the nominal speed.

[0076] Figure 3 shows a perspective view of the centrifugal drive device for the louvers of the fan plus the push rod in its resting position.

[0077] Figure 4 shows a plan view of the centrifugal drive device for the louvers of the fan plus the push rod in its resting position.

[0078] Figure 5 shows a perspective view of centrifugal drive device for the louvers of the fan plus the push rod in the open position when operating at the nominal speed.

[0079] Figure 6 shows a plan view of the centrifugal drive device for the louvers of the fan plus the push rod in an open position when operating at the nominal speed.

PREFERRED EMBODIMENT OF THE INVENTION

[0080] In view of the above, the present invention consists of a centrifugal drive device for the automatic opening of fan louvers.

[0081] Figures 1 and 2 show the same fan with its casing and louvers corresponding to the stopped fan position and the nominal rotation speed position respectively.

5 **[0082]** On the right side of the figure is shown the alignment of the louvers (7) in the same position.

[0083] This position is secured by a vertical guide (5) connected to each of the louvers by intermediate connecting rods (6).

10 **[0084]** Each louver (7) turns about a horizontal axis displaced from its centre of gravity so that the action of gravity makes it close.

[0085] The louvers (7) open by the pushing action of a pushing rod (4) that in turn is pushed by the centrifugal device (3) object of this invention.

15 **[0086]** The centrifugal device (3) is in charge of pushing the louvers (7) through the pushing rod (4). This pushing rod (4) also makes the device (3) recover its original position by action of the weight of the louvers (7) that tend to close.

20 **[0087]** The centrifugal device (3) is installed in the central part (1) of the fan, from where extend the vanes (2), being integrally joined to the fan and rotating together with it.

25 **[0088]** The device (3) is provided with two plates, a fixed plate (3.1) and a moving plate (3.2), taking as a fixed reference the central rotating core of the fan (1).

30 **[0089]** The fixed plate (3.1) connects to the central core (1) of the fan by front anchoring means (3.1.1) that secure it and maintain it firmly in place against the inertial and axial stresses it must withstand.

[0090] This fixed plate (3.1) extends laterally as elbowed ends in which is provided a joint (3.1.2) about which pivot two cranks (3.4).

35 **[0091]** Additionally, on the rear of the fixed plate (3.1) are provided four guides (3.3) by way of rods parallel to the main axis that form a rectangle in an elevation view.

[0092] It is inside these four guides (3.3) where the moving plate (3.2) slides, held by four bushings (3.2.3), one on each corner of the rectangular moving plate (3.2), so that they ensure at all times that said plate (3.2) remains parallel to the fixed plate (3.1) without preventing axial displacement.

40 **[0093]** The front part of the moving plate (3.2) opposite the fixed plate (3.1) has a groove (3.2.1) centred and parallel to the greater sides of the moving plate (3.2).

[0094] Between the fixed plate (3.1) and the moving plate (3.2) is located one end of each crank (3.4). At this end it is provided with a roller (3.4.2) internal of the groove (3.2.1), determining a linear sliding motion between the end of the crank (3.4) and the moving plate (3.2).

50 **[0095]** The other arm of the crank (3.4) is at an angle of $\pi/4$ to the inner arm and is provided at its end with a mass (3.4.1).

[0096] With the rotation of the assembly this mass (3.4.1) tends to open the arm, turning the crank (3.4).

[0097] The rotation of the crank (3.4) about the joint (3.1.2) implies the rotation of the inner end and therefore of the roller (3.4.2) inside the groove (3.2.1) of the moving plate (3.2).

[0098] The arc described by the roller (3.4.2) has two projections, one radial with respect to the rotation axis of the fan, and another axial, so that the former implies an internal sliding in the groove (3.2.1) in which it is housed towards the outside, and the second an axial displacement that pushes the moving plate (3.2) so that it separates from the fixed plate (3.1).

[0099] This separation is used to push the louvers (7) by means of the intermediate rod (4).

[0100] The rotation of the device (3) is disengaged from the louvers (7) by a bearing (3.2.2) located on the rear side of the moving plate (3.2).

[0101] The kinetic assembly formed by the fixed plate (3.1), the moving plate (3.2) and the cranks (3.4) allow only one degree of freedom, represented by the axial displacement of the moving plate (3.2) and that determines uniquely the rotation of the cranks (3.4) with respect to the joint (3.1.2).

[0102] Figures 5 and 6 shows the greatest separation of the moving plate (3.2) and therefore the greatest opening of the cranks (3.4).

[0103] In this position one can see that the masses (3.4.1) continue to exert a couple on the crank (3.4) that tends to open it more, so that the push is maintained in all positions.

[0104] The essence of this invention is not affected by changes in the materials, shape, size and arrangement of its component elements, described in a non-limiting manner that should suffice for its reproduction by an expert.

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Claims

1. Centrifugal drive device for automatic opening of fan louvers, from among centrifugal devices for automatic opening of louvers with restoration by gravity installed in the fan shaft and impelled by it, **characterised in that** it is comprised of:

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- Two cranks (3.4) with inertial masses (3.4.1) on one end and rollers (3.4.2) on the opposite end;
- A fixed plate (3.1) with coupling means (3.1.1) on its front face and lateral extensions that end at a jointed elbow (3.1.2) for installing the cranks (3.4), also provided on its rear with four parallel rods by way of a guide (3.3) for supporting a second moving plate (3.2);
- A mainly rectangular moving plate (3.2) with four bushings (3.2.3) each on one of the four corners of the rectangle, with a transverse groove (3.2.1) on its front face by way of a cam;
- A push rod (4) attached to the moving plate (3.2) and disengaged from the rotation motion

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by a bearing (3.2.2);

- A plurality of louvers (7) with off-centre shafts which tend to close under gravity and are interconnected by a common guide (5) which is connected to the other louvers by a connecting rod (6);

wherein the fixed plate (3.1) is integrally joined to the shaft of the fan (1) while the moving plate (3.2) is attached to the fixed plate (3.1) by the four bushings (3.2.3) allowing the relative axial displacement of the plates (3.1, 3.2) while at the same time ensuring the parallel arrangement of the plate (3.1) and the plate (3.2); each crank (3.4) pivots about its shaft located at the angle and attached to the jointed elbow (3.1.2) of the fixed plate (3.1), with the arm having the masses on the outside to allow the cranks (3.4) to open under the action of the centrifugal force as the assembly rotates, and the arm arranged internally with the rollers (3.4.2) placed between the fixed plate (3.4) and the moving plate (3.2), with the rollers (3.4.2) housed in the groove (3.4.1) of the moving plate (3.2) so that the opening of the cranks (3.4) implies the corresponding axial displacement of the moving plate (3.2) determined by the axial projection of the turn of the rollers (3.4.2) about their joint (3.1.2); this displacement causing the louvers (7) to open due to the push exerted by the rod (4) on the central louver (7), which in turn moves the others by a common guide (5) connected to each louver (7) by a connecting rod (6).

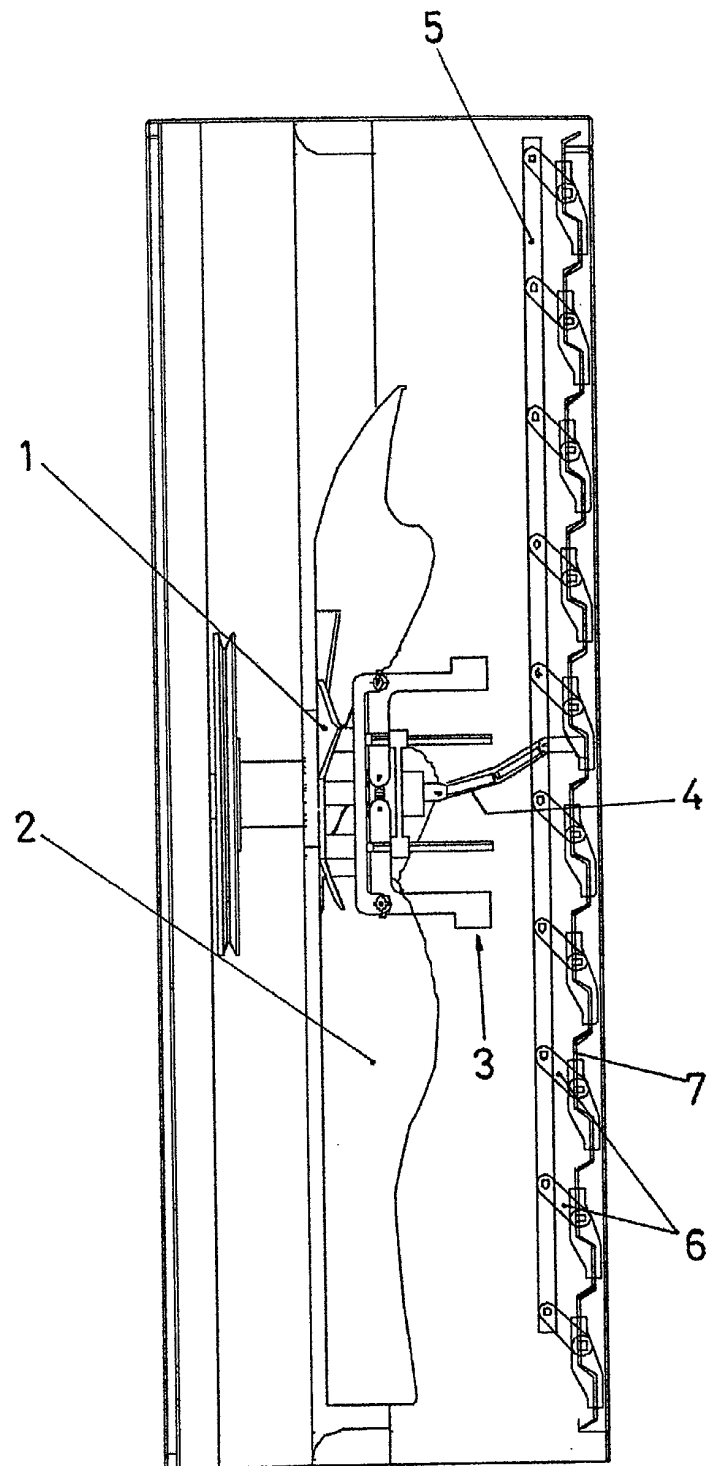


FIG. 1

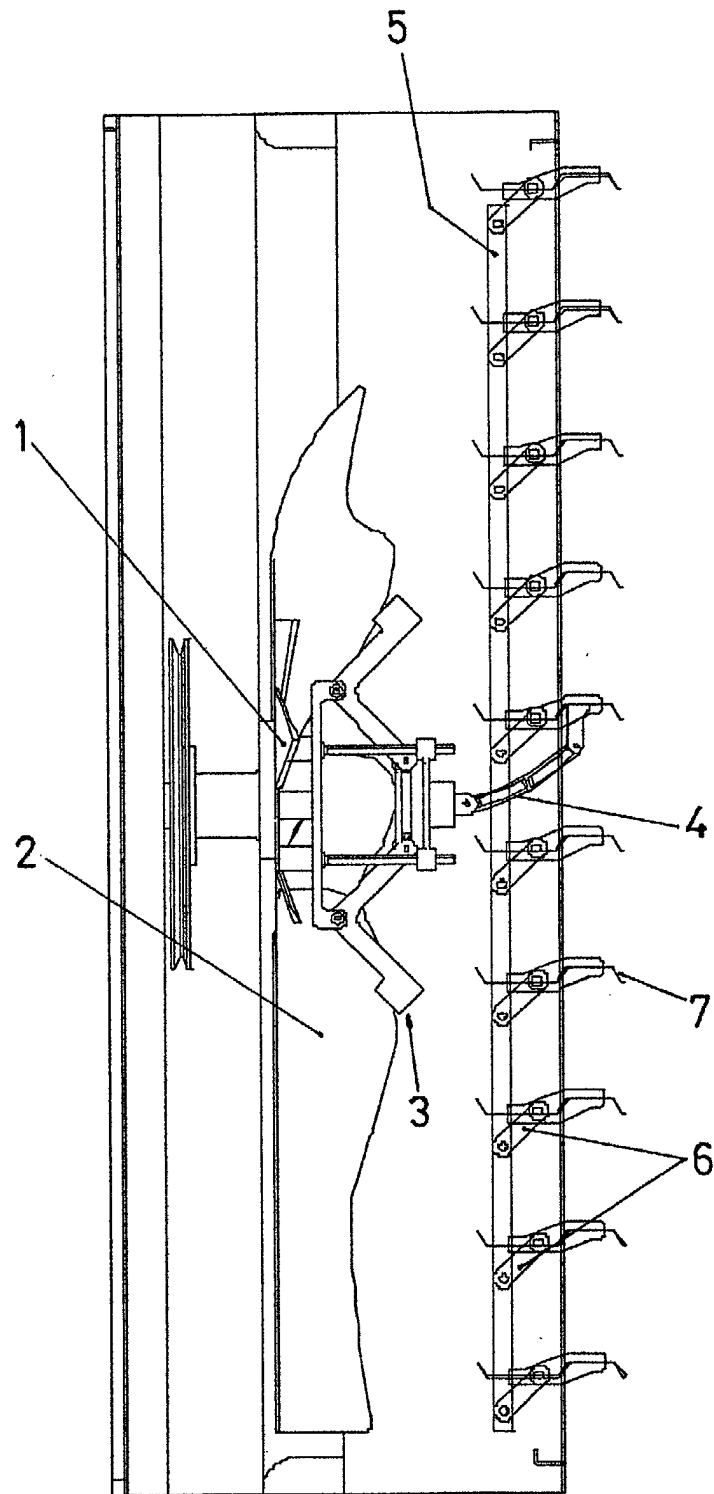


FIG. 2

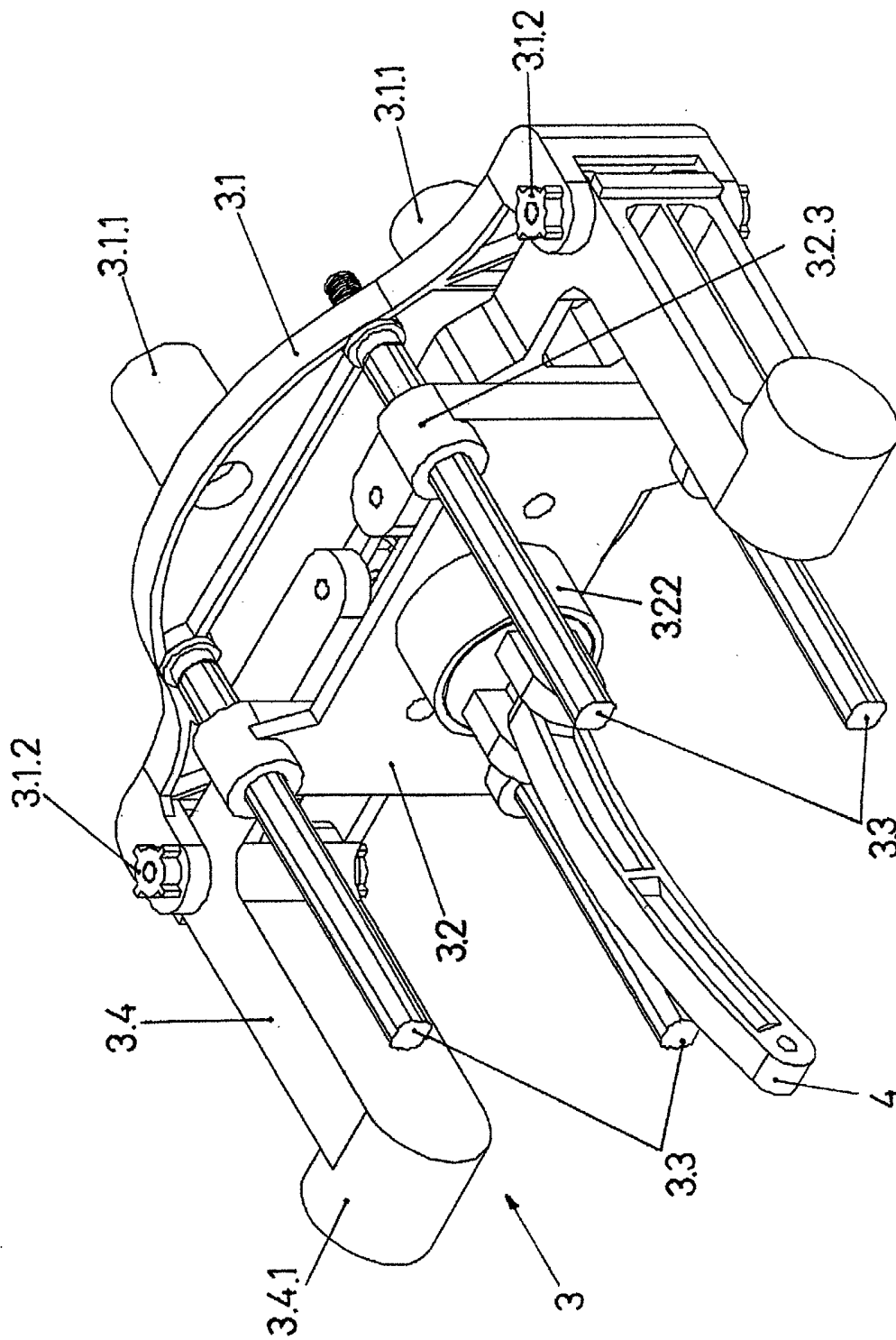


FIG. 3

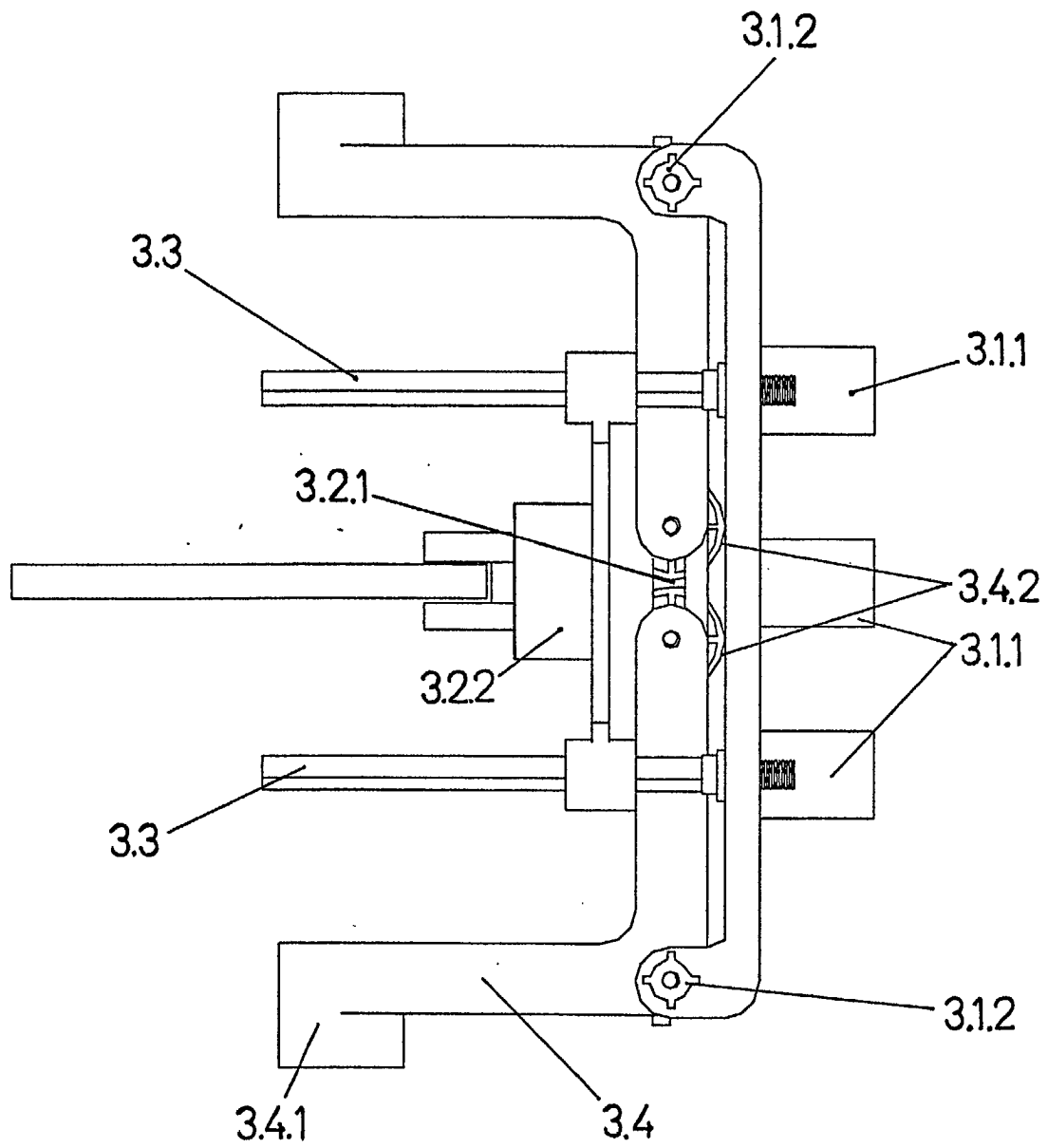


FIG. 4

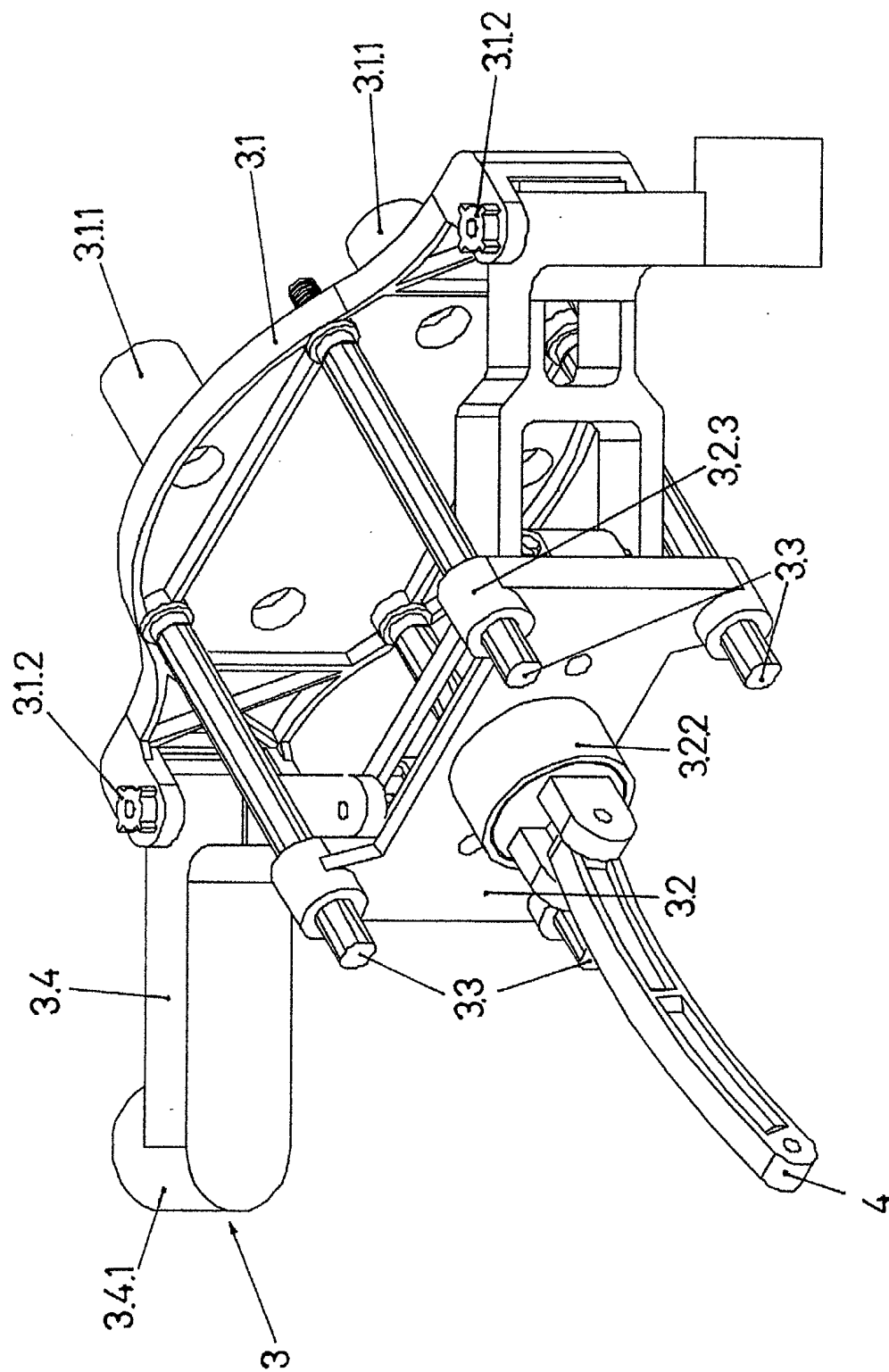


FIG. 5

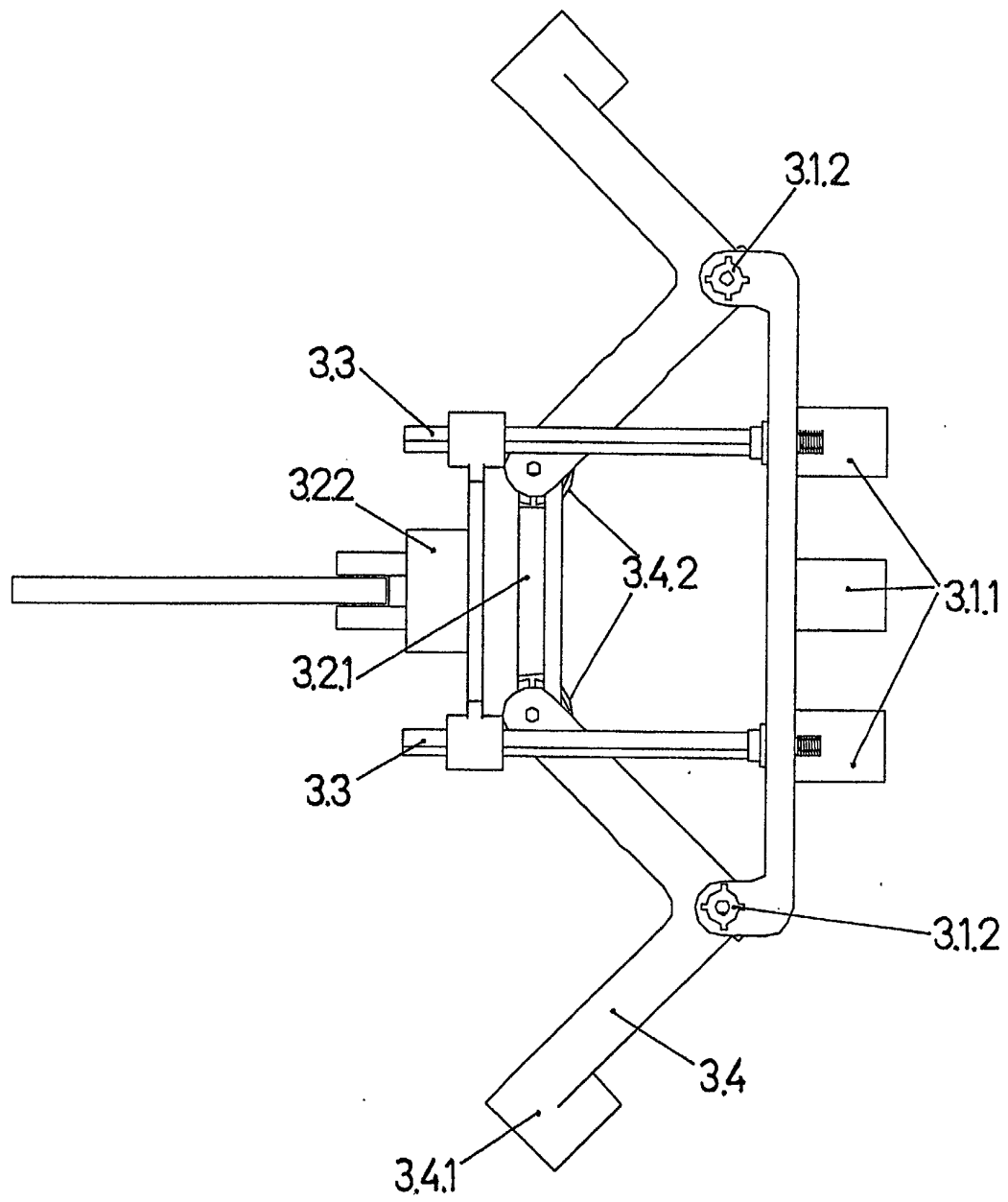


FIG. 6



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EUROPEAN SEARCH REPORT

Application Number
EP 02 38 0088

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A	US 6 276 895 B1 (MILANA ANGELO) 21 August 2001 (2001-08-21) * column 1, line 54 - column 2, line 17; figures 2,5,6 *	1	
			TECHNICAL FIELDS SEARCHED (Int.Cl.7)
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The present search report has been drawn up for all claims			
Place of search MUNICH		Date of completion of the search 11 September 2002	Examiner Lienhard, D
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

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**ANNEX TO THE EUROPEAN SEARCH REPORT
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EP 02 38 0088

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