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(54) A device for controlling the sweeping-angle of a fan.

(57) A device for controlling the sweeping angle of a fan comprises a casing; a main gear (5) meshing with a shaft of a worm gear (3); a spindle (7) and a hollow shaft (6); said main gear (5) is mounted on one of said spindle (7) and said hollow shaft (6), said spindle (7) being rotatably concentrically placed within said hollow shaft (6); a planetary carrier (9) fixedly mounted on one end of said hollow shaft (6) carrying a planet gear (11) rotatable around its own axis; a crank pin (10) fixed on said planet gear (11); a connecting bar (14) with its one end articulated on said crank pin (10); a sun gear (12) integrated with one end of said spindle (7) and meshing with said planet gear (11); a clutch means (16-18) disposed between said spindle and said hollow shaft and an adjusting means (19-21) for controlling said clutch means.

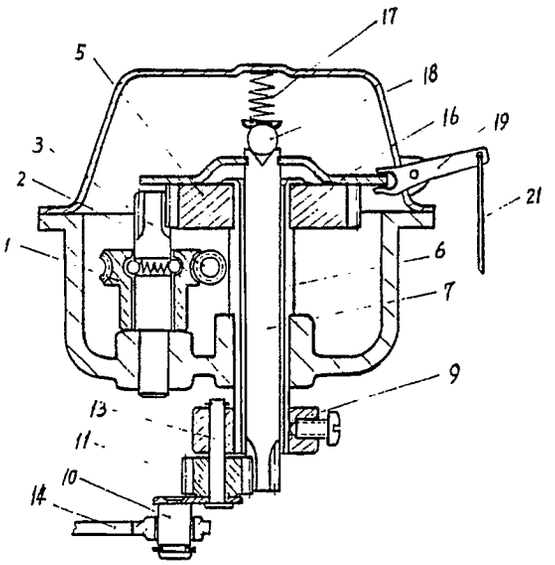

FIG. 1

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A DEVICE FOR CONTROLLING THE SWEEPING-ANGLE OF A FAN

This invention related to a device for controlling the sweeping-angle of a fan and more particularly to a device suitable for controlling the amplitude of the sweeping-angle when the fan sweeps.

Conventional fans can only work in two modes, either fixed mode (no sweeping) or sweeping mode. That is to say, it can only provide air flow either in a fixed direction or within a sectorial area corresponding to an unvariable sweeping angle. Fixed mode is rarely used even by only one person, because after hitting a person for quite a long time, the wind would make him feel uncomfortable, though it might make him feel cool in a relatively short time. If people are gathering within a relatively small area, the sweeping interval for sweeping mode would be too long to satisfy them. So it is understandable that people need a fan which is capable of sweeping with adjustable and controllable sweeping angle at their will.

The sweeping device in conventional electrical fan usually is a four-bar linkage. In order to change the amplitude of the sweeping angle, the length of one of the bars should be changed and usually that is the crank. Previously, people suggested a scheme to perform such length change, in which a pin or slidable bar can freely move in a slot resulting in corresponding change of the crank length and the parameters of the four-bar linkage, so that the sweeping angle will be adjustable.It should be noticed that the pin or slidable bar is moved and positioned in a slot by the force resulting from spring and adjusting mechanism and therefore this will cause some problems. On one hand, it is desired that the elastic force caused by spring or the friction force between the pin and slot should be as small as possible to make the motion of the pin or slidable bar easy. On the other hand, it is also desired that the above said forces should be large enough to withstand the reaction force caused by connecting bar during the rotation of the crank and therefore to ensured that the pin can be positioned and fixed securely after being adjusted. Unfortunately, it is very difficult to make a compromise especially because of the limited space in the gear box of the sweeping device. So either such a sweeping device based on above scheme will not be easy in adjusting or the sweeping angle will shift from preset value during operation.

The object of the present invention is to solve above problem exsisting in the prior art. The sweeping device of the present invention is ont only easy in adjusting, but also capable of keeping the crank length constant and consequently making the fan always sweep with a predetermined angle.

The achievement of the object is based on a following operation principle in which a planet gear system is used, which comprises a sun gear, a planet gear and a planetary carrier. An eccentric pin is fixed on the planet gear, and the sun gear meshes with said planet gear during operation. The planet gear is pivotally mounted on the planetary carrier which is fixedly connected with a hollow shaft. The sun gear is fixedly connected with a spindle which is coaxially arranged in said hollow shaft. When the planetary carrier rotates with respect to said spindle, the planet gear will rotate about the sun gear. Thus the distance between the axis of the eccentric pin fixed on the planet gear and the axis of the sun gear or the axis of the spindle can be continuously changed,and a length changeable crank is formed between the two axes. The distance between said two axes, i.e. the crank length will be kept constant when the rotation of the planetary carrier is synchronized with that of the sun gear. If said distance between the pin axis and the planet gear axis is equal to the distance between the planet gear axis and the sun gear axis, the crank length will be changeable from zero to maximum value. The maximum crank length will be twice the distance between the planet gear axis and the sun gear axis.

Replacing the constant length crank in conventional sweeping device of a fan with the length changeable crank of the present invention, the fan can sweep with a sweeping angle adjustable from zero to maximum value.

A main gear is mounted on one of said spindle and said hollow shaft, the main gear is meshed with a worm gear shaft in conventional sweeping device , by which power is transmitted to sweep the fan and change the crank length.

A clutch is arranged between the hollow shaft and spindle to permit relative rotation of the hollow shaft and spindle while adjusting the crank length and ensure a fixed crank length after obtaining desired crank length by engaging the clutch so that the hollow shaft and spindle are rotating synchronously. The clutch may be of ratchet type, or a friction disk type, or other suitable type. With the clutch being engaged, the spindle and the hollow shaft are locked with each other, thus said planetary gear system becomes a gear system with fixed axes, the sun gear, the planet gear, the planetary carrier. and the eccentric pin all rotating about the axis of the sun gear, and the crank rotating with a fixed length previously set. With the clutch being disengaged, the spindle and the hollow shaft are disconnected, while the rotation of another one of said spindle and said hollow shaft which is not connected with said main gear is

stopped,thus the gear system with fixed axes again becomes a planetary gear system, resulting in the rotation of the planet gear with respect to the sun gear. Thus the distance between the axes of the sun gear and the axis of the eccentric pin fixed on t planet gear is changed, so is the crank length.

The engaging and disengaging of the clutch is performed by an adjusting mechanism. The adjusting mechanism according to the present invention may be of manually operated type or automatically operated type.

The principle of the manual adjusting mechanism is as follows: the clutch is first manually disengaged by an user and the crank length is changed. Then the length change is fed back by some electric or mechanical means and shown on some kind of indicator.When the crank length corresponding to a sweeping angle is shown as desired,the clutch is then manually engaged and the fan will sweep within the adjusted angle.

The principle of operation of the automatic adjusting mechanism is as follows: an instruction for adjusting to a desired sweeping angle is input to the adjusting mechanism. The automatic adjusting mechanism then will automatically disengage the clutch and adjust the crank length.When the adjusted crank length corresponds to the desired sweeping angle, the clutch will automatically be engaged by the adjusting mechanism. Thus the fan will sweep within the desired sweeping angle.

In one type of the automatic adjusting mechanism according to the present invention, a sun gear and a planetary carrier are respectively fixed at the lower end of the spindle and the hollow shaft: a main gear meshed with a worm gear shaft is fixed at the upper end of the hollow shaft, a closed cam surface is integrated formed on the main gear, a carrier is securely mounted on the upper end of the spindle. The clutch is of a ratchet-pawl type, the ratchet is the above said main gear and the pawl mounted on the carrier is biased into engagement by a spring means; a supproter, which can rotate in a horizontal plane about a vertical pin, is mounted on the carrier. The supporter comprises a pushing plate and a swinging bar which can rotate about a horizontal pin on the supporter in a vertically plane and is biased downwardly by a spring means. A baffle is mounted n the casing of the device capable of moving only in one direction, for example, reciprocating in vertical direction, on the lateral of the baffle there is a notch only through which can the free end of the swinging bar rotate with the carrier. The front end of said pushing plate is abutted upon the pawl. The pushing plate is integrated with a stopper cooperated with a stopping surface formed on the carrier to delimit the motion of the supporter. A follower reciprocally movable is also mounted on the carrier. One end of the follower is abutted against the swinging bar and another end can slide along the above said cam surface. In this structure, the rising and falling of the cam surface causes the follower to reciprocate in approximately vertical direction. It is understandable that the cam surface may also undulate llaterally so that the follower reciprocates in approximately horizontal direction. In latter arrangement, the swinging bar can be saved and the follower mavable in horizontal direction can directly cooperate with the notch of the baffle which moves reciprocally in approximately horizontal direction.

Because a planetary gear system is used to adjust the crank length in the device according to the present invention, the crank length can be varied from zero to maximum value at your will. That is to say, the fan with the controlling device of the present invention can sweep with any sweeping angle ranging from zero to maximum value as desired.

Moreover, because a clutch is used in the device, the crank length adjusting is very easy and convenient. When adjusting, you only need to change the position of the baffle or press a key for controlling the clutch into engagement or disengagement. The power for adjusting the crank length is provided by the fan motor, and the crank length after adjusting is fixed by the engaged clutch so that it will remain unchanged. The device according to the present invention therefore has the advantages of being easy and convenient in adjusting and being smooth and reliable in running.

Other advantages and alternatives of the present invention will appear more clearly from the following detailed description which will be followed by preferred embodiments.

Figure 1 is a sectional view of the first embodiment of a device for controlling the sweeping angle of a fan according to the present invention, wherein the clutch is of a frictional type;

Figure 2 is a partial bottom view of the device shown in Fig. 1, showing the construction of the planetary gear system;

Figure 3 is a diagram of the planetary gear system, showing the relationship of the parts in the system;

Figure 4 is a sectional view of the second embodiment of the device for controlling the sweeping angle of a fan according the present invention, showing the construction of a ratchet type clutch, the planetary gear system (not shown being the same as that in the first embodiment;

Figure 5 is a sectional view along A-A of the device shown in Fig. 4, wherein the ratchet clutch is in the 'engaging' position;

Figure 6 is a drawing similar to Fig 5, wherein the ratchet clutch is in the 'disengaging'

position;

Figure 7 is a sectional view of the third embodiment of the present invention, showing the construciton of the device with an automatic adjusting mechanism;

Figure 8 is a partial front view of the automatic adjusting mechanism shown in figure 7;

Figure 9 is a partial view of the automatic adjusting mechanism shown in Fig. 7;

Figure 10 is a partial top view of the automatic adjusting mechanism shown in figure 7, wherein the clutch is in 'disengaging' position; Figure 11 is a drawing similar to Fig.10, wherein the clutch is in 'engaging' position.

Referring to figures 1 and 2, a worm gear 1 is meshed with a worm 2 connected with a motor shaft. Motion can be transmitted to a main gear 5 by a worm gear shaft 3. A well known unloading means and a clutch (not shown) are arranged between the worm gear 1 and its shaft 3. When the loading of the worm gear is increased up to a certain value , the unloading means will automatically make the connection between the worm gear 1 and the worm gear shaft 3 released, the clutch means controls the fan to stay in a fixed direction. For simplicity, the teeth meshed with the main gear 5 are directly formed on the upper end of the worm gear shaft 3, by which the power can be transmitted to the main gear 5. The main gear 5 is mounted on the upper end of a hollow shaft 6 (or a spindle 7), the spindle 7 being rotatable with respect to the hollow shaft 6 is coaxially arranged in the hollow shaft 6. The lower end of the hollow shaft 6 is securely connected with a planetary carrier 9 by a screw 8. A planet gear 11 with a eccentric pin 10 is pivoted on the planetary carrier 9 by a pin 13. A sun gear 12 is fixed on the spindle. The planet gear 11 can rotate about the pin 13 and is meshed with the sun gear 12. Thus a planetary gear system is formed by the sun gear 12, the planet gear 11 and the planetary carrier 9.

The s indle 7 may rotate with respect to the hollow shaft 6 which is connected with the planetary carrier 9. The planet gear 11 is eccentrically equipped with a crank pin 10 which may be int grated with the planet gear 11. Pivoted with the pin 10 is one end of a connecting bar 14. When the planetary carrier 9 rotates with respect to the spindle 7, the planet gear 11 will rotate with respect to the sun gear 12 and this will continuously change the distance between the axis of the crank pin 10 and the axis of the spindle 7, forming a length changeable crank. Usually the distance between the axes of the crank pin 10 and the planet gear 11 is selected to be equal to the centre-to-centre distance between the sun gear 12 and the planet gear 11.In this case, the crank length can be varied from zero to a maximum value which is twice the centre-to-centre distance between the sun gear 12 and the planet gear 11. Replacing the constant length crank in the four bar linkage of a conventional fan with the length changeable crank, the sweeping angle of the improved fan may be varied from zero to a maximum value, for instance 120°. Power is transmitted from the fan motor (not shown) to the main gear 5 through the worm 2, the worm gear 1 and the worm gear shaft 3. The four bars linkage will then swing accordingly, and the fan will sweep with the swinging of the one of said four bars.

In order to perform the crank length adjusting, a clutch means is arranged between the hollow shaft 6 and the spindle 7. The clutch means may be of a ratchet type or a friction type or other suitable type. The 'engaging" and 'disengaging' positions of the clutch can be controlled either manually or automatically. The clutch means used in the first embodiment is of a manually operated friction type, wherein a friction disk 16 is biased to abut on the upper end surface of the main gear 5 by a spring 17 via a steel ball 18, as shown in Fig. 1. One end of the spring 17 is abutted on a cover 15. An operating lever 19 is used to raise the friction disk 16 so as to separate it from the main gear 5, a clamping slot 20 is formed on the free end of the lever 19 for braking the friction disk 16 after separating. The action of the lever 19 is controlled via a pulling cable 21 by a key (not shown) mounted on the controlling board of a fan.

When the key is released, the friction disk 16 is connected with the main gear 5, integrating the hollow shaft 6, the spindle7, the planetary carrier 9, the planet gear 11, the sun gear 12 and the crank pin 10, thus abtaining a gear system with fixed axes operates with a constant crank length which determines the fan's sweeping angle. The solid line in Fig. 2 shows the position of the system with a maximum crank length. If the sweeping angle is to be changed to the position as shown in dotted line in Fig. 2, the key is pressed to cause the friction disk 16 to separated from the main gear 5 by the lever 19. The clamping slot 20 then brakes the friction disk 16. Because the planetary carrier 9 is still driven by the motor, the planet gear 11 and the crank pin 10 will be forced to rotate about the pin 13 so that the crank length will be changed. When the length is changed to a suitable value, the key is released to bring the friction clutch into engagement. Thus the fan will sweep with a new sweeping angle which is determined by the changed crank length.

Fig. 3 shows the geometric relationship between crank length, the hollow shaft and spindle, etc. it may be known from Fig. 3 that:

$e^2 = R^2 + R^2 - 2R\ R\ COS\alpha$,

$e = \sqrt{2R^2(1-COS\alpha)}$, where $\alpha = n\beta$

$e = \sqrt{2}^{\bullet}R \bullet \sqrt{1-COSn\beta}$,
where R stands for the centre-to-centre distance of the planet gear and the sun gear,
e is the crank length, α is the phase angle difference between the planet gear and the sun gear,
β means the phase angle difference between the spindle and the hollow shaft,
n is the ratio of the sun gear tooth number to the planet gear tooth number.
(n = 1,2,3,4,.....)

The second embodiment of the device for controlling the sweeping angle of the fan according to the present invention is shown in Fig. 4, wherein the adjusting mechanism with ratchet type clutch which is manually operated. The construction and the operation of the planetary gear system are the same as that in the first embodiment and therefore description is omitted here.

With reference to Fig. 4, a driven gear 23 is provided, which has the same teeth number and modulus as the main gear 105. Said gear 23 is mounted on the hollow shaft 106 and the gear 105 is mounted on the spindle 107. A clutch means comprises a pinion 25 and an escapement lever which may pivot about a pin 26. said pinion 25 is rotatably mounted on the escapement lever 24 which has a tip at one end thereof. Normally, the spring force caused by a spring 27 will make the pinion 25 meshed with both gear 105 and gear 23 and that is the 'engaging' position of the clutch means as shown in Fig. 5. Motor power can be directly transmitted either to the gear 105 or the gear 23. In this embodiment, the motor power is transmitted to the gear 105(not shown). When the sweeping angle is adjusted, a cable 121 is pulled to make the escapement lever 24 pivot so that the pinion 25 will be disengaged with both gears 105 and 23 and at the same time the tip of the escapement lever 24 will be inserted ointo the teeth of the gear 23 (or gear 105, if power is directly transmitted to the gear 23), to stop the rotation thereof, as shown in Fig.6.

Figs. 7 to 11 show another embodiment of the present invention, wherein the sweeping angle in this embodiment is automatically adjusted. By inputting a desired sweeping angle signal, the adjusting mechanism of the device will automatically control the engaging and disengaging positions of the clutch means and find the corresponding crank length. The planetary gear system in this embodiment is the same as above mentioned embodiments and description is omitted here.

With reference to Fig. 7 to 11, a worm 202 connected with a motor is meshed with a worm gear 201. Motion is transmitted by the worm gear shaft 203 to a main gear 205. The well known unloading means and a clutch (not shown) are arranged between the worm gear 201 and its shaft 203. When the loading of the worm gear 201 is increased to a certain value, the unloading means will automatically make the connection between the worm gear 201 and the shaft 203 released. Said clutch is used to control the fan to stay at an orientation position, For simplicity, the teeth meshed with the main gear 205 are directly formed on the upper end of the worm gear shaft 203, of which is rotatably mounted on a casing of the device. The main gear 205 may be fixed on either a hollow shaft 206 or on a spindle 207, i.e. power is introduced wither to the hollow shaft 206 or to the spindle 207. In this embodiment, the motor power is introduced to the hollow shaft 206 and a carrier 28 is therefore mounted on the spindle 207. Such an arrangement is easier to construct the intruduction of the motor power. If the main gear 205 is mounted on the spindle 207, the carrier 28 should be correspondingly mounted on the hollow shaft 206. A pawl 29 used as a clutch part is mounted on the lateral of the carrier 28. Said pawl 29 is biased into engagement with the main gear 205 by a spring means during normal operation, so that the hollow shaft 206 will rotate with the spindle 20 which is coaxially arranged in the hollow shaft 206. Fig. 10 shows the position that the main gear disengaged with the pawl 29 and Fig. 11 shows the main gear 205 is engaged with the pawl 29. A supporter 30 mounted on the carrier 28 is sweepable on the supporting surface about a pivot 31. Said supproter 30 comprises a swinging bar 32, a pushing plate 33, a stopper 34, the pushing plate 33 and the stopper 34 are integrally formed. When the supporter 30 is sweeping, it will push the pawl 29 out of the engagement with the main gear 205. The stopper 34 extends approximately vertically and is cooperated with a lateral surface of the carrier 28 with such a suitable distance between the stopper 34 and the carrier 28 that the stopper 34 may just abut the lateral surface of the carrier 28 when the pawl is pushed off the teeth of the main gear 205 by the pushing plate 33 so as to stop the rotation of the supporter 30. The upper end of the main gear 205 is formed with a closed cam surface 35. The cam surface facing up ard may be any smoothly curved. The supporter 30 is equiped with a swinging bar 32 which can sweep together with the supporter 30 with respect to the carrier 28, one end of the swinging bar 32 is pivoted mounted on the supporter 30. A pulling spring 36 is used to pull the swinging bar 32 which consequently pushes a cam follower 37 downwardly, so that one end of the cam follower 37 can always be kept in contact with the cam surface 35 of the main gear 205. The cam follower 37 is slidably positioned in a guide hole of the carrier 28 and its two ends contact with the swinging bar 32 and the cam surface 35 of the main gear 205,

respectively. The two ends of the cam follower 37 may be manufactured as ball-shaped or equiped with roller(s) to improve the moving ability. When the spindle 207 rotates with respect to the hollow shaft 206, the swinging bar 32. will swing upwardly and downwardly with the curve of the cam surface 35 under the action of the cam follower 37 and the pulling spring 36. The swinging bar 32 has two functions: the first is to swing in accordance with the locus determined by the curve of the cam surface 35, so that the relative angular displacement between the spindle 207 and the hollow shaft 206 can be indicated out. The second is to produce a torque when the rotation of the swinging bar 32 is res sted, making the clutch be disengaged and the spindle stop rotating. In order to control the relative angular displacement between the spindle 207 and the hollow shaft 206, an adjustable baffle 38 is arranged on the casing and is mounted on a guide post 40 of the casing. The baffle can not rotate and may be controlled by a knob on the control board of a fan via various transmission means, for instance, a pulling cable 221, to move along a line substantially parellel to the axis of the cam follower 37. A notch 39 with proper shape such as a wedge shape is formed at the suitable position on the lateral of the baffle 38. The opening of the notch only allows the free end of the swinging bar 32 to pass through, that is to say the opening of the notch should be only a little bit larger than the thickness of the swinging bar 32.

Each sweeping angle of the fan corresponds to a crank length , and the relationship therebetween may approximately be considered as a linear function. The relation of the crank length to the relative angular displacement is $e = \sqrt{2R^2(1-COSn\beta)}$. In order to get an approximately linear function between the fan sweeping angle change and the displacement of the baffle 38, the cam surface 35 should be formed with a nonlinear curve.

A closed-loop isochronous control system has been established in this embodiment, the operation is as follows:

The main gear 205 is driven by the motor via the worm 202, the worm gear 201, the worm gear shaft 203. The position of the notch 39 is set by a certain displacement of the baffle 38 which is controlled by the knob on the control board of a fan. A given signal is thus input to the control system. The value of the crank length, the adjusted object, is sampled by the cam-swinging bar mechanism and is amplified by the swinging bar 32. The amplified value of the crank length is fedback to the baffle 38 via the free end position of the swinging bar 32. The baffle 38 itself is also a comparator which is capable of calculating the difference between the sampled value and the given value. When the sampled value is equal to the given value, the position of the swinging bar 32 will be so matched with the position of the notch 39 that every cycle of the swinging bar 32 will not be resisted by the notch 39. If the sampled value is different from the given value, the free end of the swinging bar 32 will be stopped by the baffle 38 when it rotates to the baffle's position. This will make the clutch disengaged and the spindle 207 stopped. As a result, the planetary gear system will responds to operate, changing the crank length and the fan sweeping angle as well. At the same time, the cam surface will drive the swinging bar 32 to swing and the free end of the swinging bar 32 to slide on the lateral edge of the baffle 38, giving new sample of the crank length to the baffle 38 to compare with the given value. Because of the continuity of the curved cam surface, the above device will finally find a sampled value which is in accordance with the given value no matter the given value is a increased one or decreased one. When this is done, the free end of the swinging bar 32 will find and pass the notch 39. Therefore the stopped spindle 207 will be released and the clutch will be engaged so that the crank length adjusting process is finished and the fan will operate with a new sweeping angle.

The preferred embodiment of this invention has been described. It should be understood that this invention will not be limited in those embodiments and that other improvements and changes could be made without departing from the followed claimed scope of the present invention. For instance, the smoothly curved cam surface may be formed on the lateral of the cam. In this case, the cam follower 37 and the swinging bar 32 can be integrally formed and arranged horizontally. The baffle 38 is also arranged horizontally and with the notch 39 facing downwardly. One end of the cam follower, which does not contact with the cam surface, is bent upwardly. This bent part of the cam follower is of the same functions as the free end of the swinging bar 32 in above embodiment. The cam follower is mounted in a sleeve formed on the supporter 30, allowing the motion of the cam follower along the axis of the sleeve. When the free end of the cam follower (like the swinging bar 32) is stopped by the baffle, the supporter 30 will sweep with respect to the carrier so that the pawl will be pushed away from the main gear 205.

It should also be noted that in the pawl-ratchet type clutch means used in the device of the present invention wherein the ratchet functions as the main gear, the engaging position of the pawl with the ratchet and the meshing position of the main gear with the worm gear shaft are offset in the thickness direction of the main gear (ratchet).

Claims

1. A device for controlling the sweeping angle of a fan comprising a casing; a main gear meshing with the shaft of a worm gear; a spindle; a hollow shaft; said main gear being mounted on one of said spindle and said hollow shaft; a planetary carrier fixedly mounted on the lower end of said hollow shaft carrying a planet gear rotatable around its own axis; a crank pin fixed on said planet gear; a connecting bar with its one end articulated with said crank pin; a sun gear integrated with one end of said spindle and meshing with said planet gear; a clutch means disposed between said spindle and said hollow shaft; and an adjusting means for controlling said clutch means.

2. A device as claimed in claim 1, wherein said clutch means comprises a pawl and a ratchet.

3. A device as claimed in claims 1 and 2, wherein said main gear functions as a ratchet.

4. A device as claimed in claims 1,2 and 3, wherein said adjusting means comprises a carrier fixedly mounted on another one of said spindle and said hollow shaft; a supporter placed on said carrier and swingingable about a vertical pin substantially in a horizontal plane ,said supporter comprising a pushing plate and a swinging bar, said swinging bar being mounted on said supporter about a substantially horizontal pin swingingable substantially in a vertical plane and biased by a spring means; a baffle mounted on said casing and controlled movable reciprocally only in one direction, said baffle having a lateral edge with a notch formed thereon, the free end of said swinging bar can only pass said baffle through said notch so as to rotate together with said carrier; said pawl being mounted on said carrier with said pushing plate abutted thereon; a closed cam surface formed on said main gear; a cam follower movably mounted on said carrier with its one end slidably abutting on said cam surface and another end abutting on said swinging bar.

5. A device as claimed in claim 4, wherein said supporter further comprises a stopper integrally formed with said pushing plate, said stopper extending substantially vertically and cooperated with a stopping surface formed on said carrier to delimit the motion of said supporter.

6. A device as claimed in claim 4, wherein said pawl is biased into engagement with said ratchet by a spring means.

7. A device as claimed in claim 4, wherein said notch formed on said baffle is wedge shaped, the width of the opening of the notch being slightly larger than the thickness of the free end of said swinging bar.

8. A device as claim 5, wherein the distance between said stopper and the stopping surface is large enough to enable said pushing plate to push said pawl out of engagement with said ratchet.

9. A device as claimed in claims 1 to 4, wherein the engaging position of said pawl with said ratchet and the meshing position of said main gear with said worm gear shaft are offset in the thickness direction of said main gear.

10. A device as claimed in claim 4,wherein one end of said cam follower slidably abutting with said cam surface is provided with a roller, said roller being rotatable on said cam surface.

11. A device as claimed in claim 1, wherein the distance between the axes of said sun gear and said planet gear is equal to the distance between the axes of said planet gear and said crank pin.

12. A device as claimed in claim 1, wherein said crank pin is integrally formed with said planet gear.

13. A device as claimed in claim 1, wherein said clutch means comprises a friction disk fixedly mounted on another one of said spindle and said hollow shaft, said spindle being axially movable with respect to said hollow shaft, said friction disk being biased into frictional engagement with said main gear by a spring means, said adjusting means comprises a lever being controlled to move said friction disk out of engagement with said main gear and simultaneously brake said friction disk.

14. A device as claimed in claim 13, wherein the end of said lever cooperated with said friction disk being provided with a clamping slot.

15. A device as claimed in claim 1, wherein said clutch means comprises a driven gear fixedly mounted on another one of said spindle and said hollow shaft, said driven gear being identical to said main gear; an escapement lever pivotably mounted on said casing having a pinion rotatably disposed thereon and a tip; said escapement lever being biased by a spring means to make said pinion come into mesh with said both gears; a cable being connected with said escapement lever to control said pinion out of mesh with said both gears and simultaneously brake said driven gear by inserting said tip of said escapement lever into the teeth of said driven gear.

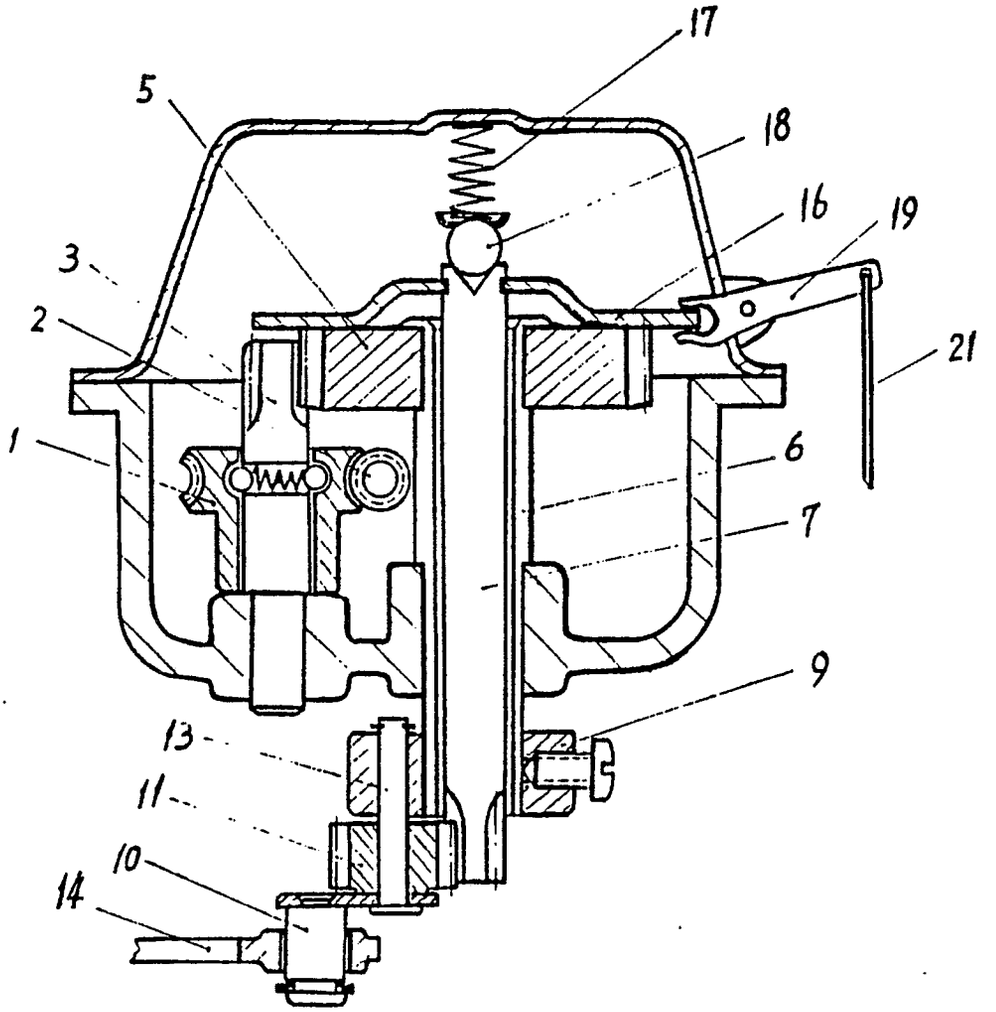

FIG. 1

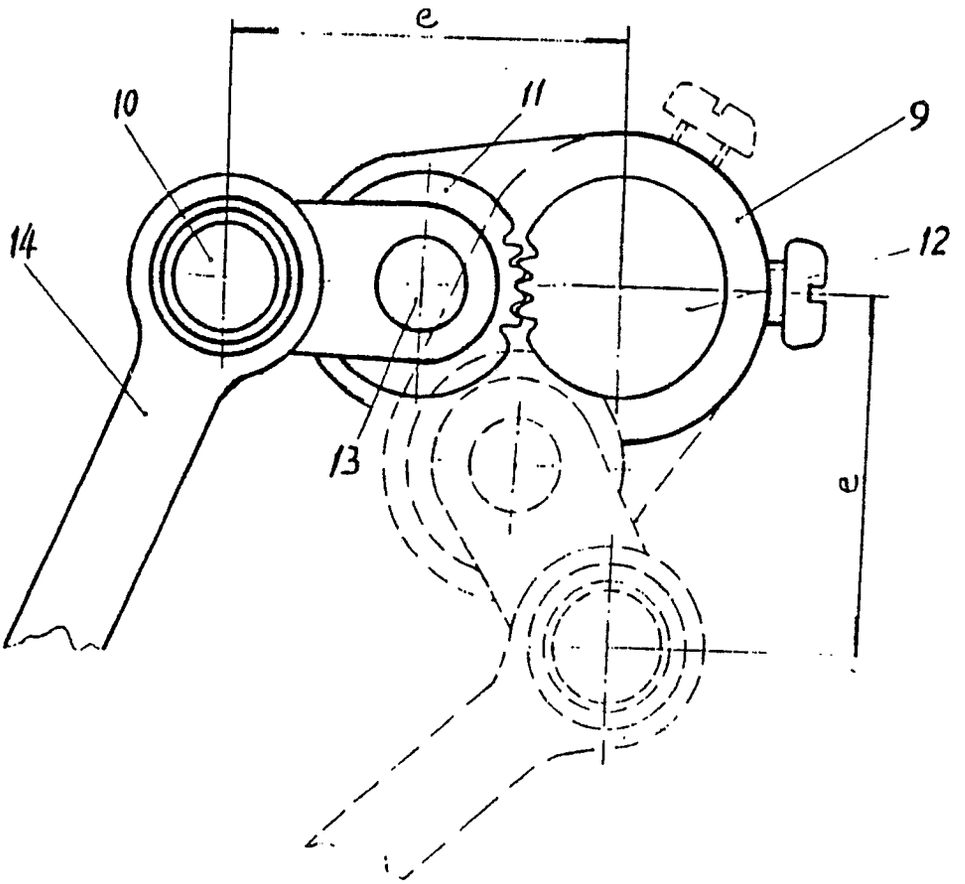

FIG. 2

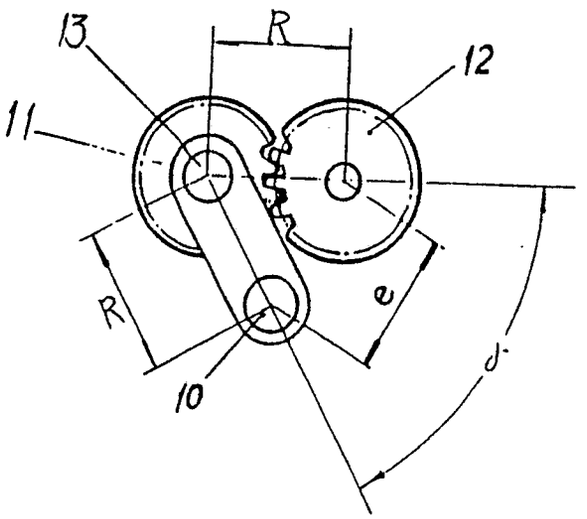

FIG. 3

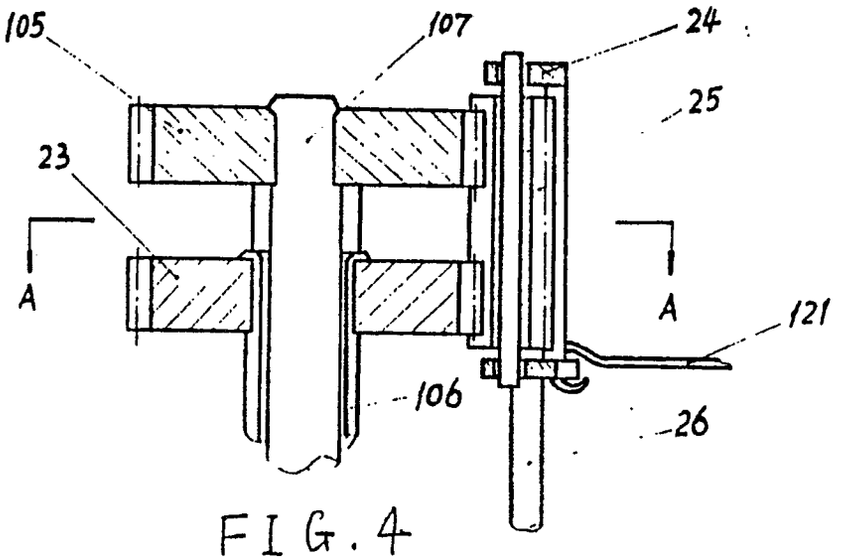

FIG. 4

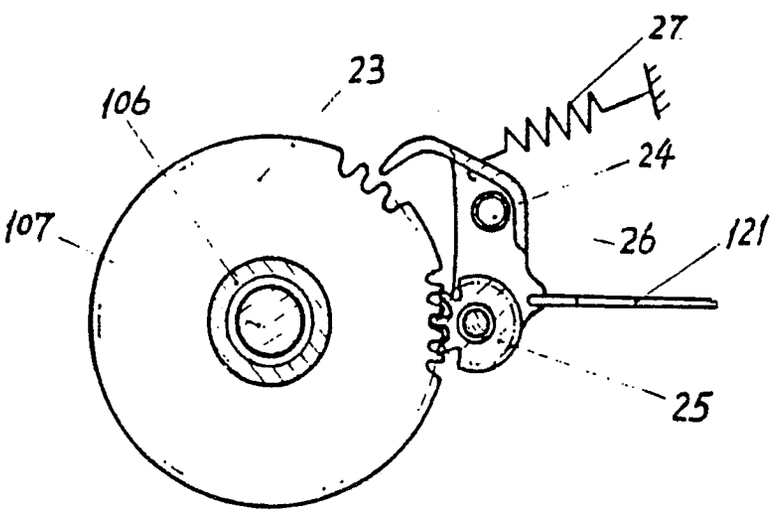

FIG. 5

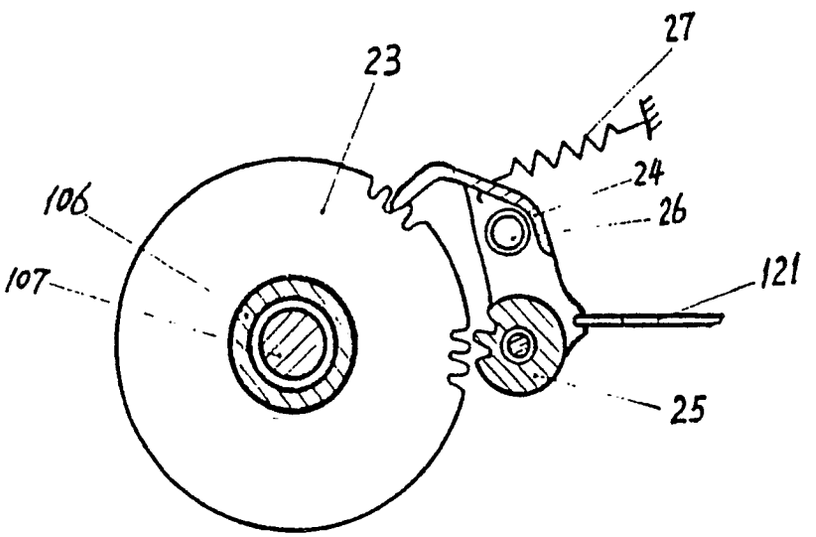

FIG. 6

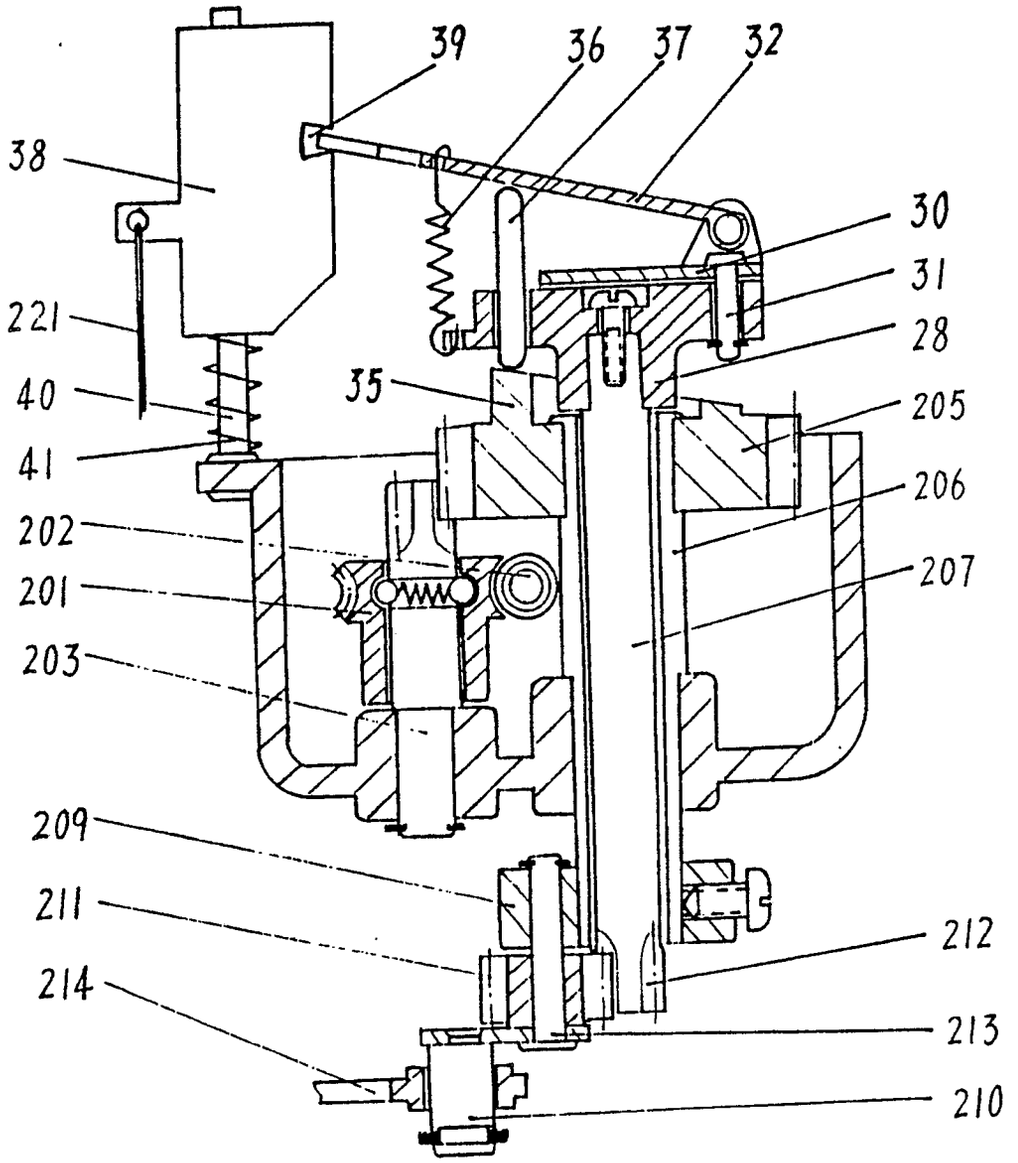
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FIG. 7

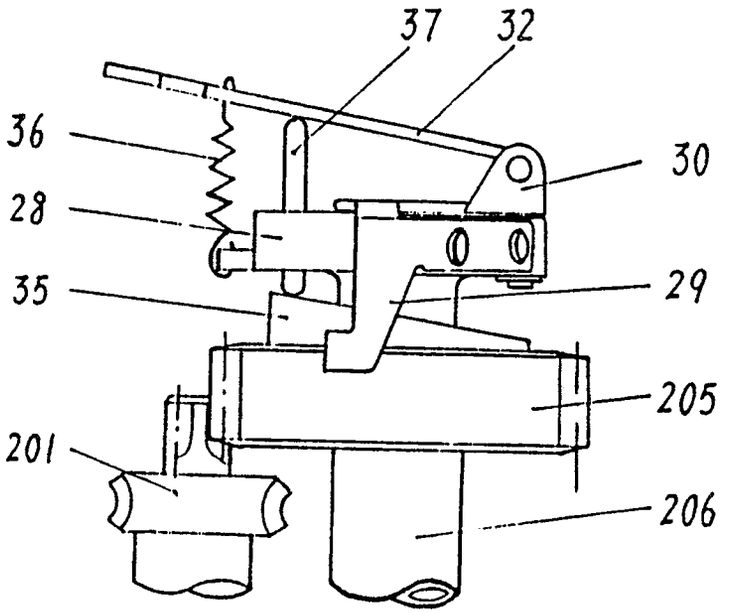

FIG. 8

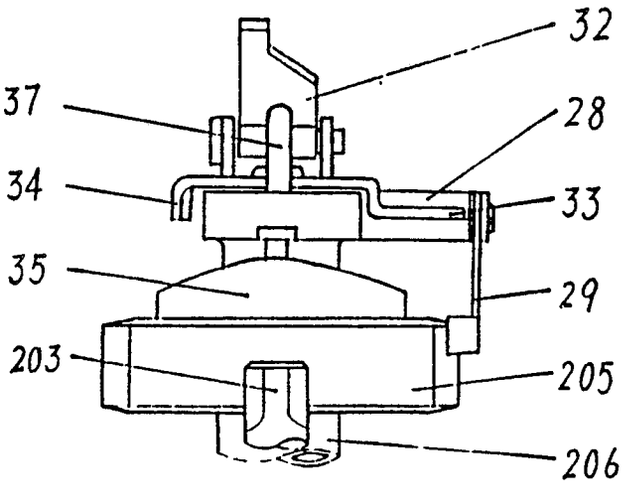

FIG. 9

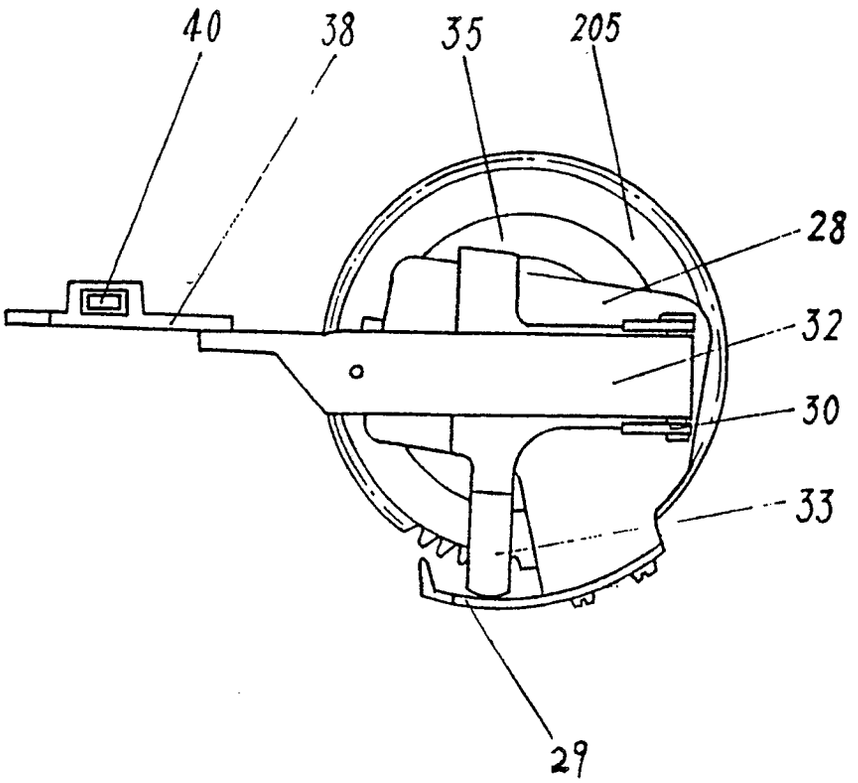

FIG. 10

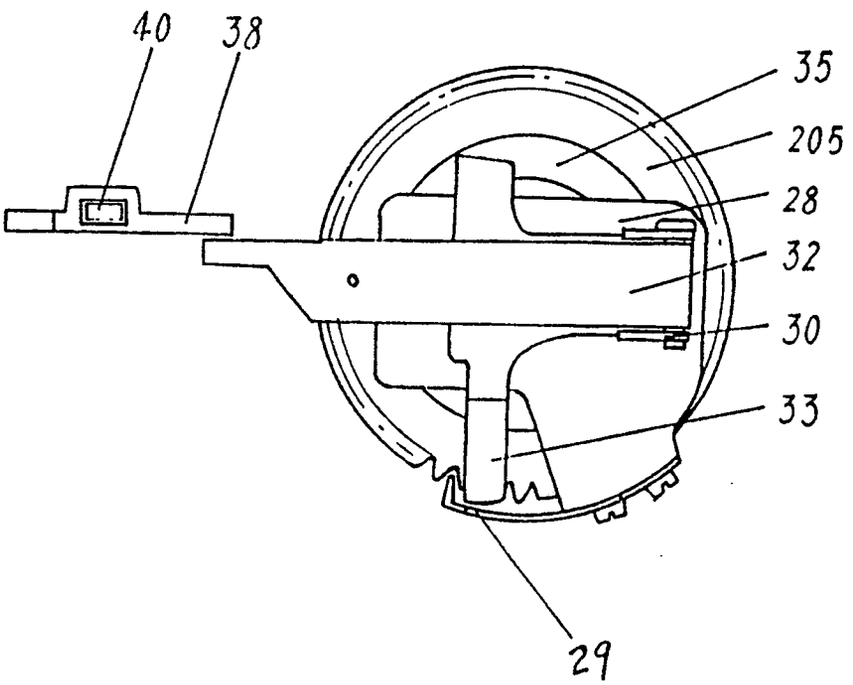

FIG. 11

European Patent Office

EUROPEAN SEARCH REPORT

Application Number

EP 89 30 1753

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.5)
Y	US-A-1403151 (DIEHL) * page 1, lines 8 - 41 * * page 1, line 95 - page 2, line 45 * * page 2, line 115 - page 3, line 23; figures 1-3 *	1, 2, 11	F04D25/10
Y	US-A-2791122 (MOMBERG) * column 1, lines 15 - 17 * * column 2, lines 16 - 45; figures 1-4 *	1, 2, 11	
A	US-A-1908287 (ELSHOFF) * page 1, lines 33 - 64; figures 1, 2 *	1, 2, 11	
A	GB-A-983671 (BRASKAMP) * the whole document *	1, 11, 13	
			TECHNICAL FIELDS SEARCHED (Int. Cl.5)
			F04D

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	20 OCTOBER 1989	TEERLING J.H.

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