(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) EP 0 780 642 A2

(12) EUROPEAN PATENT APPLICATION

(43) Date of publication:
25.06.1997 Bulletin 1997/26

(51) Int Cl.[6]: **F24F 13/14**

(21) Application number: **96309011.3**

(22) Date of filing: **11.12.1996**

(84) Designated Contracting States:
DE ES FR GB IT

(30) Priority: **21.12.1995 US 576070**

(71) Applicant: **Valeo Climate Control Inc.**
Rochester Hills, Michigan 48309 (US)

(72) Inventor: **Risch, Stephen**
Laingsburg, MI 48848 (US)

(74) Representative: **Neobard, William John et al**
Page White & Farrer
54 Doughty Street
London WC1N 2LS (GB)

(54) Control lever

(57) A fluid flow control apparatus comprises a body defining a path for fluid, a flow control device (2) selectably positionable with respect to the body (11,12,13,14) for controlling flow of said fluid in said fluid path (R); and a resilient member acting on the flow control device (2) to oppose movement thereof with respect to said body (11,12,13,14); wherein the flow control device (2) has a control portion and the resilient member exerts a force on said control portion the amount of which depends on the position of the flow control device (2) to counteract the action on the flow control device (2) of fluid in said path (R).

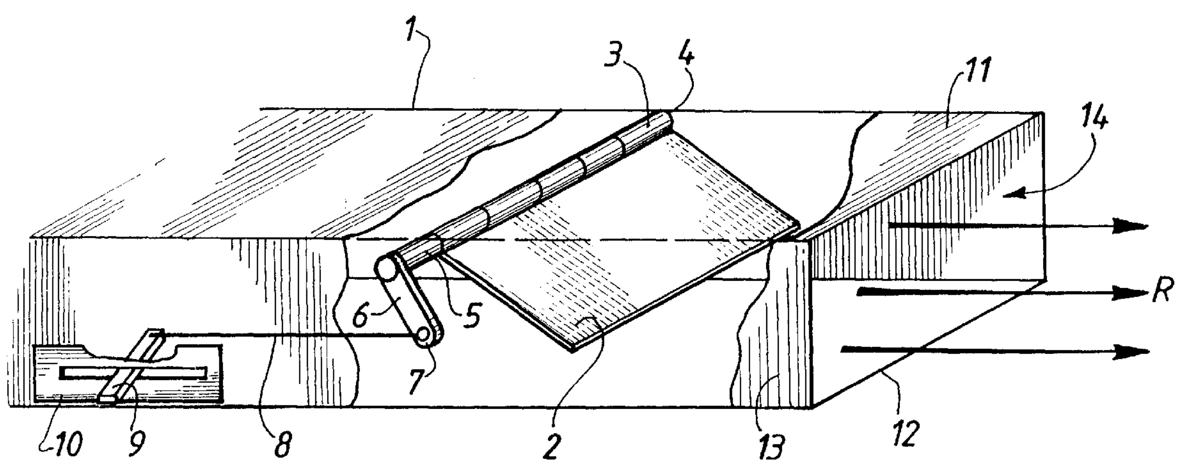

FIG.1

EP 0 780 642 A2

Description

The present invention relates to a control lever for an air conditioning apparatus, to an air conditioning apparatus, to an air flow control apparatus and to a fluid flow control apparatus.

There are many situations where a fluid flow control device, such as a flap valve, is positionable with respect to a fluid path for controlling the flow of fluid through the path. One example of this occurs in an automotive air conditioning apparatus where a flow control device known in the art as a blend door is moved within an air passage to control the flow of air in the passage, for example to control the temperature of air by controlling the relative proportions of air applied to respective hot and cold air passages.

A problem which is experienced in controlling the flow of fluid is that the fluid flow control device is subject to force due to the flow of the fluid through the path. In an air conditioning apparatus this problem is made worse by the use of a variable-speed blower. When it is desired to locate the blend door at a position intermediate two end positions, the force of air under high blower conditions may cause the blend door to move from the intermediate position toward one of the two end positions.

The problem is however not restricted to air conditioning apparatus and one skilled in the art will be aware of many situations where the flow of fluid tends to cause the fluid flow control device to move from a desired position.

Another problem arises when it is desired to move the flow control device against the force of fluid. Where the flow of fluid through the fluid path is sufficient to exert a substantial force on the flow control device, it will be necessary to provide a substantial opposing force, sufficient to overcome the force due to fluid flow, when it is desired to move the flow control device against that flow. In some arrangements, movement will be effected by a manual control device such as a control lever, and in other circumstances a motor such as the servo motor may be used.

It is accordingly an object of the present invention to at least partially mitigate the above-mentioned difficulties.

According to a first aspect of the present invention there is provided a fluid flow control apparatus comprising a body defining a path for fluid, a flow control device selectably positionable with respect to the body for controlling flow of said fluid in said fluid path; and a resilient member acting on the flow control device to oppose movement thereof with respect to said body; wherein the flow control device has a control portion and the resilient member exerts a force on said control portion the amount of which depends on the position of the flow control device to counteract the action on the flow control device of fluid in said path.

preferably the flow control device is rotatably mounted with respect to the body, the control portion of the fluid control device has a cam surface having a cam surface profile, the said resilient member acts on the cam surface of said flow control device in accordance with the position of the flow device.

Advantageously the resilient member comprises a leaf spring secured to said body.

Conveniently the cam surface profile is selected so that the force exerted by the resilient member follows a desired relation to the position of the flow control device.

According to a second aspect of the present invention there is provided an air flow control apparatus comprising a body defining an air passage, a flow control device and a resilient member, the flow control device being positionable with respect to said air passage for controlling the flow of air therethrough, the fluid control device having a cam portion and the resilient member exerting a force on the said cam portion the amount of which depends on the position of the flow control device to counteract the action of air on the flow control device.

Conveniently the flow control device is rotatably secured to said body.

Advantageously the cam portion has a profile selected so that the force exerted by the resilient member follows a desired relation to the position of the flow control device.

Conveniently the resilient member comprises a leaf spring secured to the said body.

According to a third aspect of the present invention there is provided an air conditioning apparatus comprising a body defining an air passage, a blend door rotatably secured to the body and adjustably positioned with respect to the passage for controlling the flow of air in said passage and a control mechanism for controlling the position of said blend door with respect to the said air passage, the control mechanism comprising a cam surface portion and a leaf spring, the leaf spring being secured to said body and engaging the cam surface portion to prevent flow of air in said air passage from opening the said blend door.

Preferably the control mechanism comprises a rotatable lever defining said cam surface portion, and having a cable securing portion for attachment thereto of a control cable for setting the position of said blend door.

According to a fourth aspect of the present invention there is provided a rotatable lever for an air conditioning apparatus having an actuating portion for rotating the lever, a drive portion for moving a blend door of said apparatus to a desired position for controlling the flow of air, and a cam surface portion for engaging a leaf spring to counteract the action of air in said passageway on said blend door.

An embodiment of the present invention will now be described with respect to the accompanying drawings in which:-

Figure 1 shows a partially cut away perspective view of a part of an air flow control apparatus illustrating the problems of the prior art.

Figure 2 shows a sectional view of a part of an air conditioning apparatus to which the present invention may be applied.

Figure 3 shows an isometric view of a control lever for use in the present invention.

Figure 4 shows a plan view of a control lever engaging a leaf spring for use in the present invention, the control lever being in a first rotational position.

Figure 5 shows a view similar to Figure 4, but with the control lever in a second rotational position.

In the figures like reference numerals indicate like parts. Referring to Figure 1, reference numeral 1 shows a portion of an air flow duct of generally rectangular cross section for use in an air flow control apparatus. The duct 1 has, as viewed in Figure 1 an upper wall 11, a lower wall 12 and opposing side walls 13 and 14, all of which form a body defining a passage for air which moves in the direction indicated as 'R'.

A flow control device 2, has the form of a flap valve, and is pivotably mounted in and with respect to the duct 1. The flow control device 2 is so dimensioned that when it is disposed generally transverse to the axis of the duct 1, the passage of air through the duct is substantially prevented. The pivotal mounting of the flow control device 2 allows it to move to a position where it is disposed generally along the top wall 11 of the duct 1, and substantially parallel to the axis of the duct 1. In this latter position, free passage of air through the duct is enabled.

In the arrangement of Figure 1, the flow control device 2 is secured to a shaft 3 which is supported at one end thereof by a pivot 4 in one side wall 14 of the duct 1. At the other end, the shaft is supported in a similar pivot 5 mounted in the opposite wall 13 of the duct. The above-mentioned other end of the shaft is secured to a control lever 6 which extends at right angles to the shaft. The control lever 6 has a distal end region 7 to which is secured a lever 8 adapted to move the lever 6 and hence the flow control device 2. The lever 8 may be actuated in any known fashion, and in Figure 1 there is shown a diagramatic representation of a slide lever 9 slidably mounted in a guide 10, in a control panel 15. The lever 8 could be replaced by a cable.

In operation when the slide lever 9 is moved to rotate the lever 6 anticlockwise, as seen in Figure 1, the flow control device 2 moves into abutment with the top wall 11 of the duct 1. Conversely when the slide lever 9 is moved in the opposite direction, the control lever 6 is rotated clockwise until the edge of the flow control device engages the lower wall 12 of the duct 1, whereby passage of air through the duct 1 is prevented.

It would of course be possible to provide some form of detent mechanism to positively locate the flow control device in both its open and closed position. Such detent mechanisms could be provided at the slide lever 9 for example. However, it is desirable to be able to set the flow control device 2 to a position intermediate the open and closed positions, and indeed it may be desirable to locate the device 2 at any desired position between the fully open and fully closed positions.

In the view of Figure 1, the device 2 is disposed approximately midway between the fully open and fully closed positions. Air passing through the duct in the direction "R" will impinge upon the surface of the device 2 and exert a force on the device so as to tend to move the device to its fully open position. To overcome this, it has been proposed to provide friction in the control arrangement to prevent the air passing through the duct from causing the device 2 to open. A problem with this approach is however that operating the control system requires substantial effort. When for example an associated blower is causing air to move rapidly through the duct and it is desired to move the flow control device 2 from a fully open position to a partially opened position, it would be necessary to apply sufficient force to the lever 9 to overcome the above-mentioned friction, and also to overcome the force acting on the device 2 due to the rapidly moving air.

Referring to Figure 2, an air conditioning device includes a fan 100 mounted for rotation in a duct 101, and, in operation, causing air to move in the direction shown by the arrows marked "A".

In the downstream direction, duct 101 divides into a first passage 102 and a second passage 103 which is generally parallel to the first passage 102. A heat exchanger 104, heated by liquid, such as engine coolant, is disposed in the second passage 103. Downstream of the heat exchanger 104 the two passages 102 and 103 combine together to form an outlet passage 105. A flow control device 110, known in the art as a blend door is pivotally mounted in the vicinity of the junction of the first and second passages 102, 103. The size of the blend door 110 is such that in a first end pivotal orientation 111 the blend door substantially closes the first passage 102 and in the second pivotal orientation 112 the blend door 110 substantially closes the second passage 103.

In operation, when warm fluid is supplied to the heat exchanger 104 and the fan blower 100 is operated, the pivotal orientation of the blend door 110 is controllable so as to set desired proportions of the air flow A to flow through the first passage 102 and the second passage 103. That quantity of air which passes through the first passage 102 passes through the outlet passage 105 with no substantial change in temperature, whereas that quantity of air which flows through the second passage 103 is raised in temperature by passing through the heat exchanger 104 into the outlet passage 105. Thus, increase in temperature of the air at the outlet passage 105 over the temperature in the duct 101 is controllable by selecting the position of the blend door 110.

In the arrangement shown in Figure 2, the air in the inlet duct 101 has already been passed through a cooling heat exchanger, so as to provide full air conditioning. It will however be understood that the device of Figure 2 might alternatively be applied to a vehicle heater, without air conditioning, in which case the inlet duct 101 could receive air either from the interior of the vehicle directly or from outside the vehicle.

It will be clear to one skilled in the art that a problem similar to that described above with respect to Figure 1, exists in Figure 2. Specifically, if the blend door shown in Figure 2 were positioned between the orientations shown at reference numerals 110 and 111, then the action of the blower fan 100, especially at high blower fan speeds, is liable to cause the blend door to move towards, and eventually to, the position shown at reference numeral 111. This is undesirable, because the consequence is that the temperature of the air in outlet passage 105 will be fully hot.

To overcome the problems described with respect to Figures 1 and 2, a control lever has been developed which will be described with respect to Figures 3-5.

Referring to Figure 3, control lever 20 has a distal end region 21 extending from a generally cylindrical body portion 22. A shaft portion 23 comprising a first locating portion 24 and a drive portion 25 extends axially from one end of the body portion 22 and is adapted to drive flow control device 2 of Figure 1 or blend door 110 of Figure 2. A cam portion 25 extends radially from the body portion 22.

Figure 4 shows a plan view of the control lever 20 of Figure 3 with the cam portion 25 engaging a leaf spring 30 and mounted on the wall 13 of Figure 1. The leaf spring consists of a first portion which is a generally straight strip of resilient metal and a hook portion 31 for engaging a support 32. The support 32 is shown as a generally cylindrical projection from the wall 13 of the duct 1. Where the duct is formed from plastics material, reinforcing ribs 33 are provided to give additional strength to the duct wall for supporting the projection 32. At the end of the spring 30 remote from the hook portion 31 two guide pins 34, 35 project from the wall 13 of the duct 1. The pins 34 and 35 have a gap between them, and are disposed so that the first pin 34 engages one side of the spring 30 and the second pin 35 engages the other side of the spring 30 while the spring remains in its rest condition.

The cam portion 25 has a profile which is chosen to provide a desired force between the spring 30 and the control lever 20 depending on the position of the associated blend door 2.

Continuing to refer to Figure 4, reference sign B represents a point of contact of the spring 30 on the cam portion 25. Reference sign O represents the pivotal center of the lever 20 and the line referenced F represents the direction of the force exerted by the spring 30 on the lever 20. It will be seen that the force F is directed along the line BO, in other words to the rotational center of the lever 20. Thus with the lever in this position, there is no torsional force acting on the control lever due to the spring 30.

Referring to Figure 5, the lever is shown in a second position, having been rotated clockwise, as shown in Figure 4, from the position of Figure 4. Reference sign C shows the point of contact of the spring 30 on the cam portion 25 of the lever 20 and reference sign G represents the direction of the force exerted by the spring 30 on the lever 20. It will be seen that with the lever in this position, the force exerted does not pass through the rotational center O of the lever 20. Thus the spring 30 exerts a torsional couple in an anticlockwise direction on the lever 20 so as to tend to rotate the lever in the anticlockwise direction. The force exerted by the spring 30 can be considered as having a first component at right angles to the line CO, which represents the torsional couple and a second component along the line CO which gives rise to a frictional holding force which tends to retain the control lever 20 in position.

The arrangement described with respect to Figures 3-5 has a cam portion 25 shaped to provide substantially no torsional force when the lever is in the position shown in Figure 4 and substantially a maximum torsional force when the lever is as shown in Figure 5. It will however be understood that other shapes of the cam portion 25 could be provided so as to a different distribution of torsional force. For example, it may be desirable for the cam to provide an anticlockwise couple when the lever is at one extreme position, a clockwise couple when the lever is at the opposite end position and no torsional couple when the lever is at the center position, so that the lever tends to return to the central position.

Claims

1. A fluid flow control apparatus comprising a body defining a path for fluid, a flow control device selectably positionable with respect to the body for controlling flow of said fluid in said fluid path; and a resilient member acting on the flow control device to oppose movement thereof with respect to said body; wherein the flow control device has a control portion and the resilient member exerts a force on said control portion the amount of which depends on the position of the flow control device to counteract the action on the flow control device of fluid in said path.

2. The fluid flow control apparatus of claim 1 wherein the flow control device is rotatably mounted with respect to the body, the control portion of the fluid control device has a cam surface having a cam surface profile, the said resilient member acts on the cam surface of said flow control device in accordance with the position of the flow device.

3. The fluid flow control apparatus of claim 2 wherein the resilient member comprises a leaf spring secured to said body.

4. The fluid flow control apparatus of claim 2 wherein the cam surface profile is selected so that the force exerted by the resilient member follows a desired relation to the position of the flow control device.

5. An air flow control apparatus comprising a body defining an air passage, a flow control device and a resilient member, the flow control device being positionable with respect to said air passage for controlling the flow of air therethrough, the fluid control device having a cam portion and the resilient member exerting a force on the said cam portion the amount of which depends on the position of the flow control device to oppose the action of air on the flow control device.

6. The air flow control apparatus of claim 5 wherein the flow control device is rotatably secured to said body.

7. The air flow control apparatus of claim 5 wherein the cam portion has a profile selected so that the force exerted by the resilient member follows a desired relation to the position of the flow control device.

8. The flow control apparatus of claim 5 wherein the resilient member comprises a leaf spring secured to the said body.

9. An air conditioning apparatus comprising a body defining an air passage, a blend door rotatably secured to the body and adjustably positioned with respect to the passage for controlling the flow of air in said passage and a control mechanism for controlling the position of said blend door with respect to the said air passage, the control mechanism comprising a cam surface portion and a leaf spring, the leaf spring being secured to said body and engaging the cam surface portion to prevent flow of air in said air passage from moving the said blend door.

10. The air conditioning apparatus of claim 9 wherein the control mechanism comprises a rotatable lever defining said cam surface portion, and having a cable securing portion for attachment thereto of a control cable for setting the position of said blend door.

11. A rotatable lever for an air conditioning apparatus having an actuating portion for rotating the lever, a drive portion for moving a blend door of said apparatus to a desired position for controlling the flow of air, and a cam surface portion for engaging a leaf spring to counteract the action of air in said passageway on said blend door.

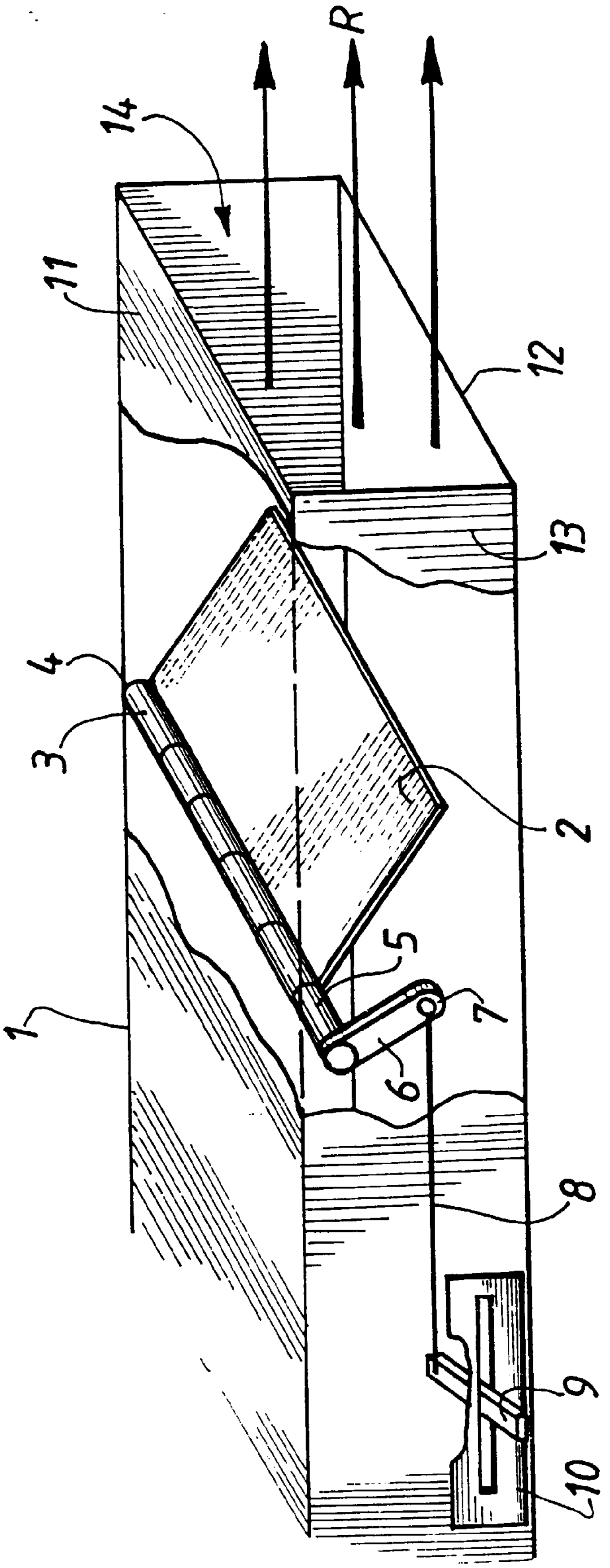

FIG.1

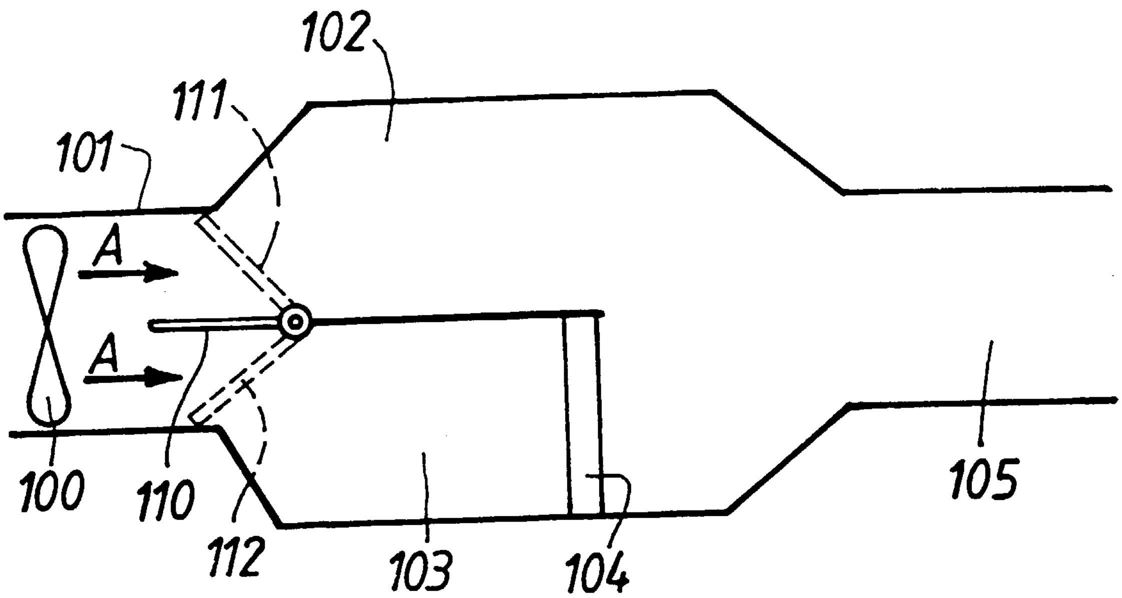

FIG.2

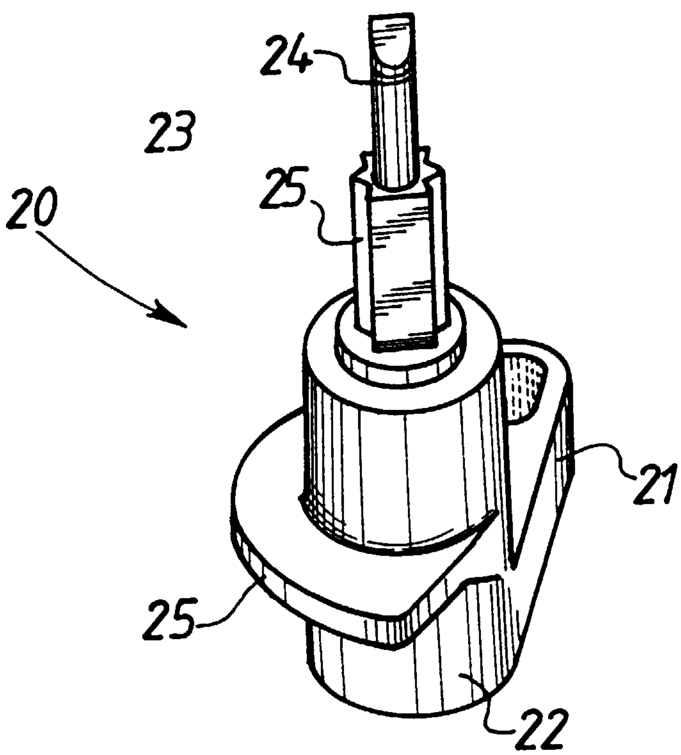

FIG.3

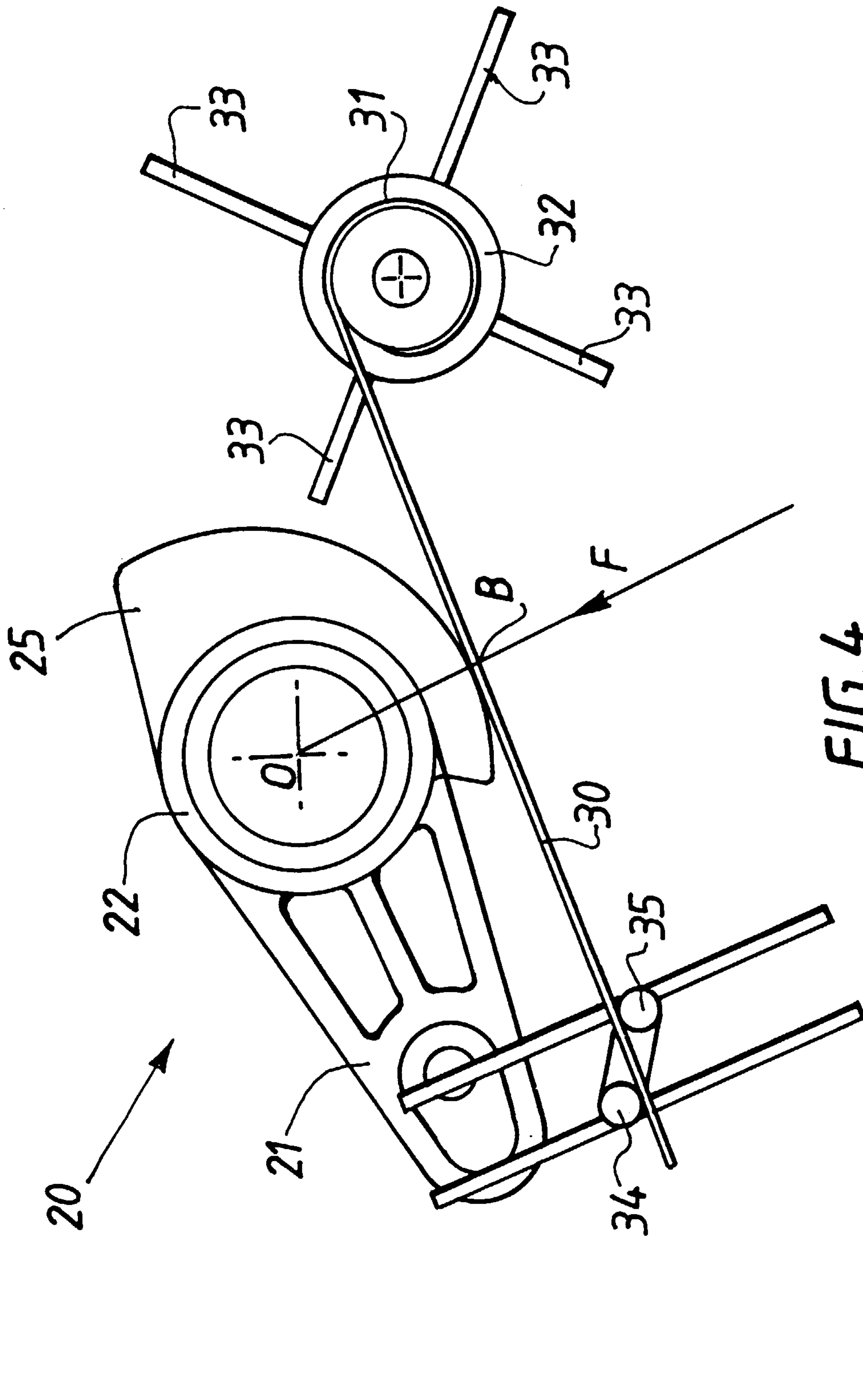

FIG.4

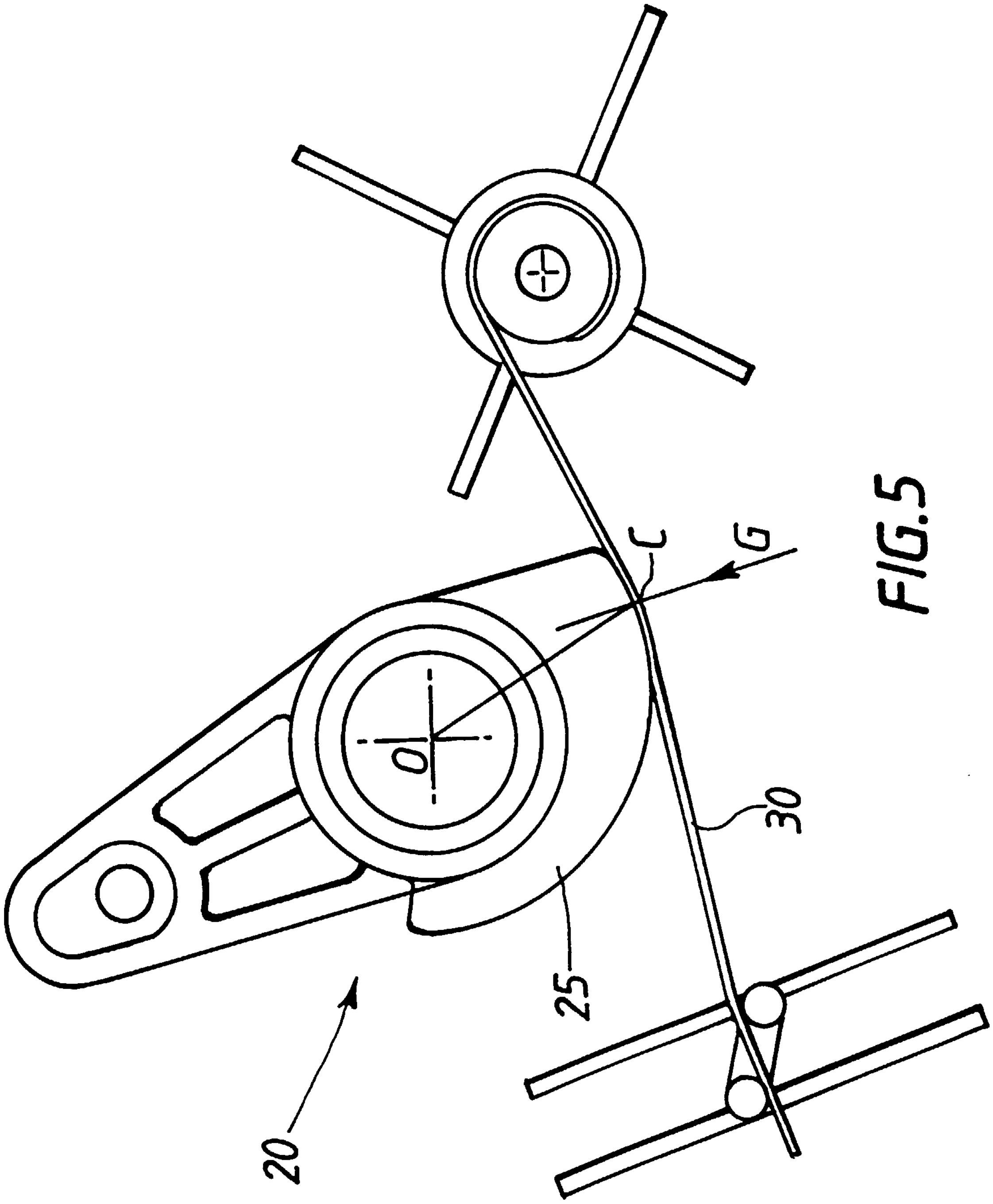

FIG.5