AUTOMOTIVE HVAC DEVICE

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ABSTRACT

The invention provides a device for heating, ventilating and air conditioning in vehicles and includes a temperature flap arranged rotatable in the region of a hot air channel and a cold air channel. The temperature flap is designed to largely reduce the temperature dip of the mixed air in an outlet channel, with reference to an associated temperature/rotational position curve. The temperature flap includes a rotational plate with at least one flap opening and at least one dosing element assigned to the flap opening. In the region of the closing element, an opening mechanism, dependent on the rotational position of the temperature flap, actuates the dosing element and opens the flap opening.
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BACKGROUND OF THE INVENTION

1. Field of the Invention

The invention relates to a heating, ventilating and air conditioning device for vehicles. More specifically, the invention relates to such a device having a temperature flap that reduces the variance of the mixed air in the outlet channel from an associated temperature/rotational position of the flap curve.

2. Related Technology

A traditional device for heating, ventilating and air conditioning (HVAC device) includes a fan, which produces an inlet air stream flowing into the casing of the device through a heat exchanger assembly (in form of an evaporator) located in the associated inlet casing. Downstream of the evaporator there is an air temperature control valve in the form of a temperature flap, which is rotatably supported at an inlet opening into an inlet channel of the device casing. At the inlet opening, the inlet channel divides into a through channel—the cold air channel—for the undisturbed air flow and an air heating channel—the hot air channel—which passes another heat exchanger assembly, in the form of a heater core, where the air stream is heated. The through channel and the air heating channel subsequently join to form an outlet channel, which finally leads into the passenger compartment. The temperature of the air stream in the outlet channel can be adjusted between “cold” to “hot” in the passenger compartment by a control unit, which is connected to an actuation mechanism for rotating the temperature flap.

Another device for heating, ventilating and air conditioning is described in DE 100 04 751 A1, in which the output temperature of the air stream into the passenger compartment is also controlled by means of a temperature flap. The temperature flap is rotatably supported in the device casing. In the device casing an evaporator and an air heating heat exchanger are provided, whereby the inflowing air is cooled by the evaporator and the flowing air can be optionally heated by the heat exchanger. The heat exchanger can be provided with a baffle to establish a heating chamber that can be closed by means of the temperature flap.

The temperature flap can divide the air flowing in from the evaporator into two streams. A first inflowing air stream can flow almost undisturbedly through the cold air channel and then to the outlet channel. The second air stream, passing the heat exchanger, can flow through the hot air channel. Both air streams are directed to the outlet channel where mixing occurs. A mixing temperature of the outlet air results. When the hot air channel is closed (0% of the rotational position) by the temperature flap, only cooled air or fresh air (ventilating) enters through the cold air channel into the outlet channel. The temperature of the undisturbed air stream represents the 0%-temperature point “cold” of the air. When the cold air channel is dosed (100% of the rotational position) by the temperature flap, only hot air (heating) is entered through the hot air channel into the outlet channel. The temperature of the hot air stream represents the 100%-temperature point “hot” of the air. Both end positions, and the mixing positions in between (air conditioning), of the temperature flap together with the resulting temperatures in the outlet channel produce a temperature/rotational position curve (control curve) B, as shown in FIG. 9, which in the region of small rotational positions has a deep dip of the outlet air temperature.

In this device the temperature flap can be connected to an actuation assembly that adjusts the rotational positions of the temperature flap through control commands of an actuatable control device.

The problem of the known devices is that for heating, ventilating and air conditioning the control curve is a relatively deep temperature dip, particularly in the regions between 10%- and 50%- rotational positions, due to the pressure drop different between the cold air channel and the hot air channel. On the part of the hot air channel the portion of the hot air stream is not sufficient to raise the outlet temperature in the outlet channel in the mentioned region of the rotational positions.

In order to reduce the temperature dip in the control curve B, baffles are provided in the device casing to reduce the pressure drop on the part of the cold air channel.

One problem associated with this measure is that those baffles produce an additional disturbing effect of reducing the air flow in the HVAC device and also disturbingly raise the noise level, which is particularly due to the impact of the air flow onto the baffles.

Another device for heating, ventilating and air conditioning, inclusive of controlling the output temperature for conditioning the air in the passenger compartment of vehicles, is described in U.S. Pat. No. 4,452,301. Here, a manually actutable temperature flap is provided which is movable in both the air conditioning and heating modes to regulate the air flow rate through a heating heat exchanger and to control the temperature of the air delivered by the device into the passenger compartment. An air temperature control unit is provided that includes an air guide flap that is arranged on the face side transverse to the temperature flap and can be moved with it and is itself rotatable relative to the temperature flap so that the air flow rate, particularly through the heating heat exchanger, can be adjusted for various positions.

Guided by a cam, the air guide flap is connected to a guide element and is rotatable in a guide way made in the casing. The rotation point is a notch which in the end allows to tilt the air guide flap onto the temperature flap when the hot air channel is closed. In other rotational positions of the temperature flap, the cam-track controlled air guide flap, when the hot air channel is opened, has to throttle the air stream on the part of the cold air channel and thereby to raise the portion of the hot air stream in the outflowing mixed air stream, simultaneously reducing the portion of the undisturbed cold air stream.

A double cam control curve, which performs the air guide flap control, causes the air guide flap to carry out motions assigned to the position of the temperature flap. A predetermined cam control curve is used, which is defined either for the air conditioning mode or the heating mode, so that heat transfer is achieved that are intended to produce a linear relationship between the air temperature measured in the outlet channel and the temperature flap position in both the air conditioning and the heating modes.
[0014] A problem is that in the low rotational positions, particularly between the 0%-(ventilating) and 30%-(air conditioning) positions of the temperature flap, there is a deep temperature dip in the associated control curve. Additionally, the load of the notch in the air guide flap can be sufficiently high to create a danger or fracture after an extended time of operation. On the whole, the device has a complicated structure susceptible to failures due to the use of a relatively great number of parts.

[0015] Further, a device for air flow control in a climatic channel is described in U.S. Pat. No. 2,933,100 which is intended to produce a largely constant airflow in the outlet region of the channel. An associated control unit includes two neighboring perforated plates which largely extend over a transverse section of the channel. Both perforated plates have openings of approximately the same width. One of the plates can be transversely moved over the surface of the other plate, which is rigidly attached to the channel. Under normal conditions, the openings of both plates are coincident and allow the inflowing air stream to pass. The residual portion of the channel section and the control unit is a rigidly attached sensor arrangement, which is an air flow pressure sensor. The sensor arrangement is connected to a spring-supported elbow lever for the actuation of the movable perforated plate in such a way that at a too high pressure in the sensor arrangement the movable perforated plate is moved by means of the sensor arrangement. The resulting openings are reduced due to shifting of the opening in both perforated plates relative to each other. This makes possible to reduce the air flow pressure.

[0016] A problem with this construction is the sensor arrangement allows control of the pressure conditions for an optimal air supply with a largely constant outlet air flow in only one channel which, however, is not sufficient to eliminate the temperature dip of the control curve in the lower temperature regions and flap positions.

[0017] A flow distributing device is known from U.S. Pat. No. 3,735,809 that includes a channel with a cam, a heat exchanging casing (which is spatially attached to the channel within the cam such that a free air flow connection path is created) a slide plate rotatably supported at the casing, a first plate with a plurality of first holes attached to channel, a second plate with plurality of second holes, a device to connect the second plate to slide plate, and an apparatus connected to the slide plate functioning to hold the slide plate in a first or second position and to move the slide plate therebetween. The slide plate closes the free air flow connection path, when the slide plate is in a first position. In this case the air powerfully flows through the casing with the slide plate covering a portion of the casing. When the slide plate is in the second position, the air flow is passed through that free air flow connection path and an uppermost surface of the first plate touches the bottom surface of the slide plate.

[0018] A problem is that the air stream is passed through the heat exchanger assembly by means of a rotatably supported plate or by means of a single plate to which a perforated plate is rotatably attached or is guided through a perforated plate or by means of a perforated plate. An improving influence on the temperature adjustment of the outlet air that leaves the outlet channel cannot be achieved.

[0019] In U.S. Pat. No. 4,739,924 an air stream regulating valve for an HVAC device is described. The valve is provided in an air distribution apparatus and has a first open position, a closed position and a second open position, and includes means to maintain a relatively constant volume of the air flow for air inlet pressure changes. The valve can be cylindrical or flat and supports the temperature control of the mixing chamber.

[0020] The airflow is controlled within the HVAC channel by a reciprocating or rotating perforated cylinder or by two flat slide plates, including a reciprocating plate and a fixed plate. A vertical movement of the plates, which creates alignment of the openings in all plates, is produced by an actuating bolt, which is moved through holes in the fixed plate and vertical slots in the movable plate.

[0021] One problem with this design is that, similar to the sensor arrangement presented in U.S. Pat. No. 2,933,100, for the displacement of the perforated plates there is a bellows which has a pressure tube directed to the inlet side and records the inlet pressure flow, whereby the bellows is applied with the inlet pressure and changes its volume so that a bar/spring arrangement connected to the bellows causes the plates to displace. Also, by this means the resulting cross-section of the openings is reduced while it is intended to keep the air flow rate largely constant. The valve, which regulates the air flow, is not suitable to control the output temperature from an HVAC device.

[0022] Most known solutions directly associated with the HVAC device have in common a temperature/position curve B, as shown in FIG. 9, with a relatively deep temperature dip, particularly marked in the region of the 0%-to the approximately 50%-rotation positions of the temperature flaps. That means that there is a sharp deviation from the linear relationship (control curve A in FIG. 9) between the temperature adjustment of the mixed/outlet/output air in the outlet channel, for example, into the passenger compartment and the associated positions of the temperature flaps in the region of the hot air channel.

**SUMMARY**

[0023] The invention is aimed at a device for heating, ventilating and air conditioning in a vehicle that is configured in such a way that the design structure of the temperature flap is improved and thereby the temperature dip of the outlet air in the outlet channel in relation to the associated temperature/rotational position is significantly reduced.

[0024] The problem is solved by the device embodying the principles of the invention, in which the temperature flap is established as temperature valve flap that includes a rotational plate with at least one flap opening and at least one closing element assigned to the flap opening. In the region of the closing element, an opening mechanism actuates the dosing element and releases the flap opening depending on the rotational position of the temperature valve flap. The opening mechanism can be established considering the casing. The temperature valve flap is provided with at least one flap opening that is variable in cross-section and closable. Thus, the effective cross-sectional area of the hot air channel can be varied continuously, as well as diaphragm-like. The opening mechanism can be designed such that, depending on the respective position of the temperature valve flap, it displaces the dosing element and, depending on
the direction of displacement, opens or closes the flap opening. In this manner, the temperature of the air stream in
the outlet channel, depending on the rotational positions, largely follows an approximately linear temperature/rotational position curve C.

[0025] The rotating plate of the temperature valve flap can preferably have a rectangular base plate, in which there is a preferably rectangular flap opening. In each of the opposing side edge regions of the base plate there can be preferably parabola-like holding elements, whereby both holding elements equally directed and equally shaped and offset from the edge by a given distance a, are attached in the side edge regions at a right angle to the base plate. In the apex regions of the parabola-like holding elements there are pivots directed outwards on the same rotational axis, which project from the side edges and are rotationally fit into associated rotation holes in the casing. The holding elements may preferably be in connection to only a portion of the base plate, whereas the residual portion is provided with the flap opening arranged in the base plate preferably parallel to the rotational axis in transverse direction and vertical to the holding elements offset inwards.

[0026] To the rotationally supported rotational plate, the closing element can belong, which in the 0%-rotational position ("hot") of the temperature valve flap closes the flap opening. The closing element is provided with a covering plate that corresponds in its area at least to the passage cross-sectional area of the flap opening and completely seals the flap opening. Face-sidedly on either narrow side of the covering plate there is a side strip that is provided with a spring arc ending in a band matched with the plane of the covering plate attached to the side edge regions at the distance a. The rotational plate, the flap opening and also the covering plate can be designed different from a rectangular shape. Non-rectangular flap opening passage sections enable to reach a "softer" opening process of the flap opening so that a given opening characteristics can be realized.

[0027] The opening mechanism can be provided with two projections, particularly designed as cams, essentially functioning as opening elements, which are attached to the casing at the level of the spring arcs, whereby for a sliding movement of the covering plate of the dosing element on the base plate a pressure support exerted by the cams onto the edge-side spring of the cam is sufficient.

[0028] The cams are preferably designed flat and have a thickness smaller than the distance a of the holding elements offset inwards in the side edge regions of the base plate. The contour of the cams is designed such that it predetermines at which time how fast the covering plate is slideable in direction away from the flap opening, in order to obtain a controlledly branching off hot air partial stream from the hot air channel directed at least into the end region of the cold air channel. The cams are shaped such that on rotations of the temperature valve flap, in connection with the force action onto the spring arcs, the temperature dip is reducible according to the temperature/rotational position curve C and that in the region of the 10%-to 50%-rotational positions of the temperature valve flap the effective passage cross-sectional area of the flap opening can act sufficiently.

[0029] The cams can, for example, be similar to a bell-like shape in a longitudinal section adapted to the range of rotation and attached to the casing, whereby the bell edges contacting the spring arcs are the pressure actuators for the spring arcs. Linking, or the attachment, respectively, of the cams within the casing is also predetermined depending on the location and design of the spring arcs.

[0030] Optionally, the opening mechanism can also have other mechanical opening elements or else electrical and/or magnetic opening elements, which are established as opening elements corresponding with the closing element(s) and can be connected to them.

[0031] The variable flap opening makes it possible that before the hot air stream and the cold air stream are brought together in the outlet channel, optionally, at least one hot air partial stream related to the flap opening passage cross-sectional area branches off from the original hot air stream and is entered into the cold air stream. The branching off hot air stream pre-tempers the cold air stream so that the temperature of the outlet air stream in the outlet channel is adapted to a largely linear temperature/rotational position curve C) by valve control.

BRIEF DESCRIPTION OF THE DRAWINGS

[0032] The invention will be illustrated by means of an example of embodiments with reference to a number of drawings, in which:

[0033] FIG. 1 is a schematic representation of a device for heating, ventilating and air conditioning in vehicles according to the state-of-the-art and showing both end positions of the temperature flap;

[0034] FIG. 2 is a schematic representation of a device in a 25%-rotational position of the temperature flap seen in FIG. 1;

[0035] FIG. 3 is a schematic representation of a device embodying the principles of the invention for heating, ventilating and air conditioning in vehicles with a temperature valve flap in a 25%-rotational position and with a partially open flap opening;

[0036] FIG. 4 is a schematic representation of the device seen in FIG. 3 with a temperature valve flap in a 50%-rotational position with an open flap opening;

[0037] FIG. 5 is a schematic representation of the device seen in FIG. 3 with the temperature valve flap in a 75%-rotational position and with a closed flap opening;

[0038] FIG. 6a is a perspective view of the temperature valve flap with a spring-assisted dosing element for the flap opening and being in a dosed condition;

[0039] FIG. 6b is a perspective view of the rotational plate of the temperature valve flap according to the invention without closing element of FIG. 6a;

[0040] FIG. 6c is a perspective view of the dosing element seen in FIG. 6a;

[0041] FIG. 7 is a perspective view of the temperature valve flap in a 0%-rotational position and showing the opening mechanism for the flap opening without cam contact;

[0042] FIG. 8 is a perspective of the temperature valve flap in an approximately 50%-rotational position and showing the opening mechanism with cam contact; and
[0043] FIG. 9 is a graph of an ideal linear temperature/rotational position curve (control curve) A, a control curve B of the state-of-the-art and an improved control curve C according the temperature valve flap of the present invention.

DETAILED DESCRIPTION

[0044] A device 100 for heating, ventilating and air conditioning (HVAC device) in vehicles is shown in FIGS. 1 and 2 and includes, according to the state-of-the-art, a casing 102 with at least one fan 103, two heat exchanger assemblies (an evaporator assembly 104, a heating core assembly 105). An air entry channel 106 is divided into a cold air channel 107 and a hot air channel 108, which are subsequently brought together leading into an outlet channel 109. A temperature flap 140, which in the region of the hot air channel 108 and the cold air channel 107 is rotatably arranged between the end positions 111, 112 to close the hot air channel 108 or the cold air channel 107 and provide for the temperature-dependent air flow distribution in the outlet channel 109.

[0045] FIG. 1 especially shows the extreme end position 111, 112 of the known flap temperature 140. FIG. 2 shows the temperature flap 140 in the 25%-rotational position, designated at 135.

[0046] According to the invention, the temperature flap 10, shown in FIGS. 7, 8, includes a rotational plate 39 with at least one flap opening 13 defined therein and at least one dosing element 16 assigned to the flap opening 13. In the region of the closing element 16, there is a casing-connected opening mechanism 14. Depending on the rotational position 11, 35, 36, 37, 12 of the temperature valve flap 10, the opening mechanism 14 actuates the closing element 16 so that, optionally, a partial hot air stream 42 branching off from the remaining hot air stream 43 can flow through the passage cross-sectional area of the flap opening 13, at least into the end region of the hot air channel 7 and subsequently into the outlet channel 9. The temperature valve flap 10 is provided, by analogy with FIG. 1, with a flap opening 13 that is dosed at least in the end positions 11, 12.

[0047] The opening mechanism 14 is designed such that, depending on the actual rotational position of the temperature valve flap 10, it opens and closes the flap opening 13. Thus, the temperature of the air stream in the outlet channel 9 depends on the rotational positions 11, 35, 36, 37, 12 and largely follows an approximately linear temperature/rotational position curve C, as shown in FIG. 9.

[0048] The temperature valve flap 10 includes, as shown in FIG. 6a, essentially the rotational plate 39 provided with a flap opening 13 and the associated closing element 16.

[0049] The rotational plate 39 of the temperature valve flap 10, as shown in FIG. 6b, of a preferably rectangular base plate 15, that defines therein a preferably rectangular flap opening 13. Each of the opposing side edges 19, 20 of the base plate 15 there is a parabola-like or otherwise shaped holding element 17, 18. Both holding elements 17, 18 are equally offset from the edge of the base plate 15 by a given distance a and are attached to the side edge regions 19, 20 at a right angle to the base plate 15. In the apex regions 21, 22 of the holding elements 17, 18 are pivots 24, 25 directed outwards on the same rotational axis 23. The pivots 24, 25 project from the side edges 19, 20 and rotationally fit into associated rotation holes (not shown) in the casing 2. The holding elements 17, 18 preferably are connected to only a portion of the base plate 15, while the residual portion is provided with the preferably rectangular flap opening 13. The flap opening is preferably arranged in the base plate 15 generally parallel to the rotational axis 23 in transverse direction and vertical to the holding elements 17, 18 offset inwards. Obviously, alternative designs from that illustrated for the holding elements 17, 18 and the associated pivots 24, 25 can be employed.

[0050] The rotationally supported rotational plate 39 is provided with the closing element 16 in the 0%-rotational position 11 of the temperature valve flap 10 and dosing the flap opening 13 in FIG. 6a. The dosing element 16 includes a covering plate 26, which is sized to the passage cross-sectional area of the flap opening 13 so as to completely seal the flap opening 13 in the end rotational positions 11, 12. Face-sidedly on either narrow side of the covering plate 26 are side strips 27 and 28. The side strips are provided with a spring arc 29, 30 and end in a band 31, 32 matched with the plane of the covering plate 26 and attached to the side edge regions 19, 20 of the base plate 15 at the distance a.

[0051] In the FIGS. 7 and 8, the design of the opening mechanism 14 is shown. In FIG. 7 the 0%-rotational position 11 is shown and in FIG. 8 the 50%-rotational position 36 is shown after a rotation 44 from the 0%-rotational position 11 of the temperature valve flap 10 according to the invention.

[0052] The opening mechanism 14 includes opening elements in the form of two projections, particularly the cams 33, 34, which can be attached to the casing 2 generally at the level of the spring arcs 29, 30. The cams 33, 34 are flat and have a thickness smaller than the distance a by which the holding elements 17, 18 are offset inwards from the side edge regions 19, 20 of the base plate 15. To cause the sliding movement of the covering plate 26 of the dosing element 16 on the base plate 15, the pressure exerted by the cams 33, 34 onto the edge-side spring arcs 29, 30 are sufficient. The profile 41 of the cams 33, 34 depends on the condition at which time how fast the covering plate 26 has to be pushed from the flap opening 13 in order to obtain a hot air partial stream actually branching off from the hot air channel 8 and directed to the cold air channel 7.

[0053] The cams 33, 34 are shaped such that for a rotation of the temperature valve flap 10 in connection with the force action onto the spring arcs 29, 30 the dip in the temperature/rotational position curve C compared with the control curve B is significantly reduced. It is useful that the peripheral shape of the cams 33, 34 is such that, preferably in the region of the 10%-to 50%-rotational positions of the temperature valve flap 10, the effective flap opening 13 is opened so as to be effective. After the 75%-rotational position, the flap opening 13 may already be closed again, following the comparison between the temperature/rotational position curve C and the ideal temperature/rotational position curve A.

[0054] The cams 33, 34 can, for example, have a shape similar to a shape bell-like in the longitudinal section turned in view, whereby the contour of the bell edges 41 contacting the spring arcs 29, 30 is the pressure actuator onto the spring arcs 29, 30. Depending on the course of the useful release of
the passage cross-sectional area of the flap opening 13, the cams 33, 34 could alternatively have a cylindrical or semi-cylindrical shape. Hereby a useful linking, or attachment, respectively, of the cams 33, 34 within the casing 2 in relation to the location and design of the spring arcs 29, 30 is provided.

[0055] In FIG. 9 three temperature/rotational position curves (control curves) A, B, C are shown in comparison. One of the representations refers to an ideal linear temperature/rotational position curve (control curve) A, for which the temperature (as percentage) in the outlet channel 9 and the rotational position (as percentage) are proportional to one another. For purposes of comparison, a control curve B of the existing state-of-the-art with the traditional temperature flap 140 and the improved control curve C with the temperature valve flap 10 of the invention are also shown therein.

[0056] By means of FIG. 1 and FIGS. 3 to 5, together with the representations of the control curves A, B, C in FIG. 9, the function of the temperature valve flap 10 will be explained.

[0057] By analogy with the temperature flap 140 in FIG. 1, the temperature valve flap 10 of the invention is movable between the 0%-cold end position 11 and in the 100%-hot end position 12, whereby the 0%-rotational position 11 is assigned to the 0%-temperature point and the 100%-rotational position 12 is assigned to the 100%-temperature point on the control curves A, B, C. The flap opening 13 is closed in the end positions 11, 12. The 0%-temperature point can correspond, for example, to a real temperature of 10°C ("cold"), the 100%-temperature point to a real temperature of 50°C.""hot").

[0058] In the 0%-rotational position 11 ("cold") the hot air channel 8 is closed and completely sealed by the temperature valve flap 10. As soon as the actuation mechanism (not shown) begins to rotate the temperature valve flap 10 from the 0%-rotational position 11, the spring arcs 29, 30 approach the cams 33, 34, which are fixed to the casing 2. After the spring arcs 29, 30 have contacted the cams 33, 34, the spring arcs 29, 30 are pressed in the direction of the base plate 15 as the rotation continues. With the pressing of the spring arcs 29, 30, the covering plate 26 is slidingly pushed from its closing position. The passage cross-sectional area of the flap opening 13 is thus increasingly opened approximately in the region from the 25%-rotational position 35 (FIG. 2) to the 50%-rotational position 36 (FIG. 4, FIG. 8). With this opening of the flap opening 13, the effective cross-sectional area of the hot air channel 8 increases gradually. A branching off hot air portion will flow through the flap opening 13 from the hot air passing on the rear side 38 of the temperature valve flap 10 and be added to the flowing cold air of the cold air channel 7 to be mixed with it. Due to the branching off hot air partial stream 42, in the lower rotational positions (5% to 50%-rotational position 36) a pretempering of the cold air stream occurs in the end region of the cold air channel 7, as compared with the known HVAC devices with the temperature flap 140 and the continuous hot air stream 143 of the hot air channel 108. The comparison between the hot air flow rates in FIG. 2 (state-of-the-art) and FIG. 3 for the 25%-rotational position 35 in each case demonstrates the hot air portion in the cold air stream due to the branching off hot air partial stream 42 now existing and the remaining hot air stream 43 in FIG. 3. With increasing rotation the effective passage cross-sectional area of the flap opening 13 is again reduced by the spring arcs 29, 30 and the covering plate 26 until, depending on the design of the spring arcs and cams, it is closed in the regions of approximately 75%-rotational position 37 to 100%-rotational position 12 ("hot"). In this position, the whole hot air stream 43 is directed to the outlet channel 9.

[0059] The output temperature of the mixed/outlet air entering the passenger compartment, therefore, is for lower rotational positions higher compared with the know constructions. Thus, according to the invention, the temperature course is raised when compared with the known temperature dip of the control curve B (especially for low rotational positions), and approaches the ideal linear control curve A to a greater extent.

[0060] Optionally, the flap opening 13 can be closed in the 75%-rotational position 37 of the temperature valve flap 10, where it is not necessary to change the control curve C. There the control curve C approximately corresponds to the control curve A.

[0061] The dosing element 16, by modification of the opening mechanism described above, can be actuated by a different opening mechanism, particularly a cam control device or connection device, which optionally can also be a different closing element pushing device. The rotational position-dependent switchable flap opening 13 of the temperature valve flap 10 can also be considered as a small-scale valve automatically controlled internally within a controllable large-scale valve actuated from the exterior.

[0062] As a person skilled in the art will readily appreciate, the above description is meant as an illustration of implementation of the principles of this invention. This description is not intended to limit the scope or application of this invention in that the invention is susceptible to modification, variation and change, without departing from the spirit of this invention, as defined by the following claims.

1. A device for heating, ventilating and air conditioning a vehicle comprising:

   a casing;

   a fan coupled to the casing and being operable to provide air into and through the casing;

   a heat exchanger located within the casing;

   an air passageway defined through the casing, the air passageway having an inlet channel dividing into a cold air channel and a hot air channel and converging into an air outlet channel;

   a temperature flap located in the region of the converging of the hot and cold air channels, the flap rotatably mounted in the casing for movement between positions alternately closing the hot and cold air channels and providing temperature dependent air flow distribution in the air outlet channel, the flap including a base plate with a flap opening defined therein and including a closing element selectively movable between a position covering the flap opening and a position uncovering the flap opening depending on the rotational position of the flap.
2. The device of claim 1 further comprising an opening mechanism coupled to the dosing element, the opening mechanism moving the dosing element between the positions covering and uncovering the flap opening depending on the rotational position of the flap.

3. The device of claim 2 wherein the opening mechanism includes portions attached to the casing.

4. The device of claim 2 wherein the opening mechanism is a mechanical linkage.

5. The device of claim 1 wherein, depending on the rotational position of the flap, the flap opening is sized such that the temperature of the air in the air outlet channel generally follows an approximately linear temperature/rotational curve profile.

6. The device of claim 1 wherein the flap opening is uncovered by the closing element.

7. The device of claim 1 further comprising holding elements extending from side portions of the base plate and being offset from an edge of the base plate, the holding elements including pivots extending outwardly therefrom defining a common axis, the pivots engaging pivot openings defined in the casing.

8. The device of claim 7 wherein the holding elements extend from a first portion of the base plate and the flap opening is defined in a second portion of the base plate.

9. The device of claim 7 wherein the flap opening is oriented generally parallel to the rotational axis and transverse to air flow across the base plate.

10. The device of claim 7 wherein the base plate, the flap opening and closing element are generally rectangular.

11. The device of claim 1 wherein the dosing element covers the flap opening in both 0% and 100% rotational positions of the flap.

12. The device of claim 11 wherein the dosing element at least partially uncovers the flap opening in the range of 25% to 50% rotational positions of the flap.

13. The device of claim 11 wherein the dosing element covers the flap opening in a 75% rotational position of the flap.

14. The device of claim 7 wherein the dosing element includes a covering plate of an area at least as large as the flap opening, the dosing element further including side strips on opposing sides, said side strips having spring area ending in portions attached to side edge regions of a base plate.

15. The device of claim 1 wherein the closing element includes a covering plate of an area at least as large as the flap opening, the dosing element further including side strips on opposing sides, said side strips having spring area ending in portions attached to side edge regions of a base plate.

16. The device of claim 15 further comprising an opening mechanism including two projections attached to the casing at a level corresponding to the spring arcs whereby upon rotation of the flap the projections depress the spring arcs causing sliding motion of the covering plate to uncover the flap opening.

17. The device of claim 16 wherein the projections are cams.

18. The device of claim 17 wherein the cams have a profile varying the rate at which the covering plate is moved to uncover the flap opening.

19. The device of claim 17 wherein the cams have a bell-shaped profile that contacts the spring arcs.

20. A method for the air conditioning of the passenger compartment of a vehicle, comprising the steps of:

- providing a cold air stream;
- providing a hot air stream;
- merging the cold air stream with the hot air stream to produce an outlet air stream;
- before merging, diverting a partial hot air stream into the cold air stream to pretemper the cold air stream so that the temperature of the outlet air stream is adapted to a generally linear temperature/rotational position curve of a temperature flap;

wherein said diverting step diverts the partial hot air stream through an opening defined in a temperature flap, the size of the opening being dependent on the rotational position of the temperature flap between positions closing either the hot or cold air stream.

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