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P. SWAIN
Certifying Officer

AUTOMOBILE WINDSHIELD WIPER BLADE

RELATED APPLICATION

[0001] This application is a continuation of co-pending U.S. Application No. 13/179,132, filed July 8, 2011, which is a continuation of U.S. Application No. 12/364,092, filed February 2, 2009, now U.S. Patent No. 8,099,823, which is a divisional of co-pending U.S. Application No. 11/760,394, filed June 8, 2007, now U.S. Patent No. 7,484,264, which is a divisional of U.S. Application No. 10/312,279, filed July 29, 2003, now U.S. Patent No. 7,228,588, which is a national stage filing under 35 U.S.C. 371 of International Application No. PCT/DE2002/001336, filed April 11, 2002, which claims foreign priority to German Patent Application No. 10120467.1, filed April 26, 2001, the entire disclosure of each of which are hereby incorporated by reference.

BACKGROUND

[0002] In wiper blades with a spring-action support element, the support element is intended to guarantee as even a distribution of wiper blade pressure onto the windshield issued from the wiper arm as possible, and over the entire wipe field swept by the wiper blade. By appropriately bending the un-loaded support element into shape – the unloaded state being when only the two ends of the wiper blade sit against the windshield – the ends of the wiper strip, which sits completely against the windshield when the wiper blade is in operation, are pushed toward the windshield by the loaded support element, even if the radii of curvature of spherically curved vehicle windshields change with the wiper blade position. The curvature of the wiper blade must therefore be somewhat greater than the maximum curvature measured within the wipe field on the windshield to be wiped. This is because during wiping, the wiper strip, or its wiping lip that sits against the windshield, must be continuously pressed against the windshield with a specific force. The support element thus replaces the expensive stirrup design with two flexible rails located in the wiper strip, as is practiced in conventional wiper blades (DE-OS 15 05 257) since the support element provides the necessary cross-stiffening of the elastic rubber wiper strip in addition to providing a distribution of pressure. Specifically, in the known wiper blade the

contact force directed toward the windshield that is exerted by a wiper arm onto a main stirrup is conveyed to two claw-like stirrups and distributed from these onto the elastic rubber wiper strip via four claws. The two flexible rails of this wiper blade mainly provide a cross-stiffening of the wiper strip between the claws when the wiper blade is pushed across the windshield perpendicular to its longitudinal length.

SUMMARY OF THE INVENTION

[0003] In a prior art wiper blade of this type (DE 197 36 368.7), the wiper blade is provided with a so-called wind deflection strip in order to produce a force component directed toward the windshield to counteract the tendency of the wiper blade to lift off of the windshield due to the airflow at high vehicle speeds. To this end, the wind deflection strip has a leading edge during the pendulum wiping motion that is mainly impacted by the driving wind, said leading edge being designed as an incident surface. The cross section of the wind deflection strip has approximately the shape of a right triangle, one leg of which directly opposite the support element and the hypotenuse of which represents the incident surface. This makes a sharp angle with the pendulum-like plane of motion of the wiper blade and with the surface of the windshield. The triangle profile used requires a relatively large amount of material to manufacture the wind deflection strip, which is reflected in the costs of the wiper blade. Moreover, the weight of the wiper blade becomes undesirably high. Specifically, the increased mass to be accelerated in the pendulum wiping motion requires a more powerful drive system as well as a more expensive design of pendulum gear attached to it. Furthermore, the action of the support element and of the wiper blade can be adversely affected by the bending stiffness, which depends on its profile, of a wind deflection strip thus formed.

[0004] In the wiper blade according to the invention, the weight of the wind deflection strip is considerably reduced due to the cross sectional structure of an angular profile. Moreover, in addition to the material savings, there is a reduction in the moving mass along with the advantages with respect to the design of the drive system and the pendulum gear as a result. Also, the bending stiffness of the wind deflection strip is reduced, thus considerably reducing its influence on the bending and spring behavior of the wiper blade support element. For more

detailed shapes, this wind deflection strip can be manufactured both as an injection molded part as well as using the simple, and thus cost effective, extrusion process.

[0005] In a further development of the invention, at least one support means is placed between the two sides of the wind deflection strip at a distance from their common base point, said support means stabilizing the sides. This provides a certain degree of stiffening even when using a relatively soft material for the manufacture of the wind deflection strip, which provides the necessary form stability of the wind deflection strip even at a high wind loads.

[0006] What is helpful here is that the support means is made up of a wall that extends in the longitudinal direction of the wind deflection strip that is connected to both sides, said wall extending along the entire length of the wind deflection strip, if necessary.

[0007] If the support element is made up of two flexible rails, each of which sits in a longitudinal notch associated with it, respectively, said longitudinal notches being open toward the opposite lateral sides of the wiper strip, and if the outer strip edges of each of said flexible rails extend out of these notches, the support means are positioned at a distance from the support element. This results in a space between the wiper strip and the support means into which the area of the wiper strip located above the support element can extend. By correspondingly dimensioning this space, undesired friction between the wiper strip and the wind deflection strip is prevented.

[0008] In another embodiment of the concept of the invention, the free ends of the sides of the wind deflection strip are provided, respectively, with claw-like extensions that grip tightly around these exterior strip edges of the support element at least in sections. This provides the ability to snap the wind deflection strip onto the exterior edge or to push it onto this edge in the longitudinal direction. This makes it possible to do away with a glued connection between the wind deflection strip and the support element. A glued connection of this type can limit the flexibility of the support element needed to attain a satisfactory wipe result due to its stiffness.

[0009] In the process, it can be advantageous if the wind deflection strip is designed as a binary component whose longitudinal area provided with the claw-like extensions is made of a harder material than the longitudinal area lying closer to the base. In this way, the longitudinal

area of the wind deflection strip provided with the extensions can be manufactured from a material that is well suited for the purposes of securing the wind deflection strip to the support element, whereas the area of the wind deflection strip provided with the incident surface can be made of a material that accounts for the further requirements on the wind deflection strip.

[0010] In a wiper blade designed in this way, it can be advantageous if the transition from the harder longitudinal area to the softer longitudinal area occurs near the wall.

[0011] According to another embodiment of the invention, it can be advantageous in certain applications if the wind deflection strip and the wiper strip form a one-piece component that is penetrated by a longitudinal channel in which the support element sits that is designed as a one-piece flexible belt. It is further advantageous for the channel wall facing the upper belt surface of the support element to constitute the support means located between the two sides of the wind deflection strip. Designing the wiper blade according to the invention in this way is especially cost-effective to install since the wind deflection strip is made in one piece together with the wiper strip and thus some installation steps can be eliminated.

[0012] If the wall surfaces of the longitudinal channel facing the two belt surfaces of the support element are provided with longitudinal ribs that sit against the belt surfaces, this makes it considerably easier to insert the support element into the longitudinal channel as a result of the reduced friction surfaces.

[0013] In a wiper blade with a one-piece component encompassing the wind deflection strip and the wiper strip, the component has three longitudinal strip areas that are permanently connected to one another as seen in cross section, of which the wiper strip can be pressed against the windshield. The wiper strip is located on the side of the base strip, which contains the longitudinal channel, that is opposite the wind deflection strip. The three strip areas thus resulting must be designed to meet the requirements placed on them individually.

[0014] Thus, it can be very helpful if at least one of the strip areas of the component is made of a material whose hardness differs from the hardness of the other strip areas. In this way, it is possible to optimize the materials to be used with respect to the associated tasks of the individual strip areas.

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