Abstract:

Title: WINDSCREEN WIPER DEVICE AND METHOD OF MAKING

(57) Abstract: A windscreen wiper device for cleaning a windshield of a vehicle is provided. The windscreen wiper device includes a wiper strip of a flexible material for scaling against the windshield to drive rain, snow, ice and other elements away therefrom. The windscreen wiper device also includes at least one carrier element extending between opposite ends, and in some minimum, downwardly curved end portions and in engagement with the wiper strip to bias it into a predetermined configuration. A frame structure includes a plurality of claws in engagement with the carrier elements between the end portions. The frame structure also includes a pair of end caps that are pivotally coupled to at least an adjacent portion of the frame structure and engage the end portions of the carrier elements.
WINDSCREEN WIPER DEVICE AND METHOD OF MAKING

CROSS REFERENCE TO RELATED APPLICATION

[0001] This application claims the benefit of application serial number 61/570,563, filed December 14, 2011, the entire contents of which is hereby incorporated by reference.

BACKGROUND OF THE INVENTION

1. Field of the Invention

[0002] The present invention is related generally to windscreen wiper devices for automobiles and more particularly to hybrid windscreen wiper devices.

2. Related Art

[0003] The majority of automotive windscreen wiper devices, or wiper blades, can be categorized as either conventional-style wiper blades (hereinafter referred to as "conventional blades") or beam-style wiper blades (hereinafter referred to as "beam blades"). Conventional blades typically include an elongated wiper strip, at least one carrier element (also known as a flexor) and a frame structure with a plurality of linkages and claws. The carrier elements are generally linearly shaped when in a relaxed state, and the frame structure distributes a force from a wiper arm across the lengths of the carrier elements and the wiper strip while allowing the carrier elements and wiper strip to flex and conform to the curvature of a vehicle's windshield. This establishes a seal between the wiper strip and the windshield.

[0004] Beam blades, in contrast to conventional blades, lack a frame structure. Instead, the carrier elements of beam blades are curved when in a relaxed state. When a beam blade is pressed against a windshield, the curved carrier elements conform the wiper strip to the curvature of the windshield and press substantially the entire length of the wiper
strip against the windshield to establish the seal between the wiper strip and the windshield. Beam blades also typically include one or more spoiler elements, which use a flow of air over the beam blade to apply a down force on the carrier elements and the wiper strip while the vehicle is in motion to further press the wiper.

[0005] Some wiper blade manufacturers have begun producing and marketing "hybrid blades" which include certain features from both conventional and beam blades. Such hybrid blades typically include a frame structure, but the frame structure is covered by a spoiler-shaped cover piece that gives the otherwise conventional blade the down force effect of beam blades.

SUMMARY OF THE INVENTION

[0006] According to one aspect of the present invention, a windscreen wiper device for cleaning a windshield of a vehicle is provided. The windscreen wiper device includes an elongated wiper strip of a flexible material for sealing against the windshield and at least one carrier element extending between opposing end portions. The at least one carrier element is coupled to the elongated wiper strip to bias the elongated wiper strip into a predetermined configuration. The windscreen wiper device also includes a frame structure with a plurality of claws in engagement with the at least one carrier element and including at least two end caps slidably supporting the end portions of the at least one carrier element. At least the end portions of the at least one carrier element are curved when in a relaxed state to bias the wiper strip against the windshield, and the end caps are pivotably coupled to at least an adjacent portion of the frame structure.

[0007] In operation, the ends of the wiper strip are biased against the windshield by the curved carrier element or elements to seal against the windshield while the end caps pivot freely relative to at least the adjacent portions of the frame structure. The
remaining portions of the wiper strip may be biased against the windshield either by elements of the frame structure other than the end caps or by other curved portions of the carrier strips or combinations thereof.

[0008] According to another aspect of the present invention, the frame structure further includes a main bridge extending generally between the end caps, and wherein the end caps are pivotable relative to the main bridge. The exterior surfaces of the main bridge and the end caps are all generally spoiler shaped to create an aerodynamic down force against the carrier elements to further bias the wiper strip against the windshield when the vehicle is travelling at speed to improve the seal between the wiper strip and the windshield. This aerodynamic down force is substantially the only biasing force imposed by the end caps onto the carrier element and the wiper strip, i.e. there is approximately zero biasing force by the end caps on the carrier element and the wiper strip when the vehicle is stationary.

BRIEF DESCRIPTION OF THE DRAWINGS

[0009] These and other features and advantages of the present invention will be readily appreciated, as the same becomes better understood by reference to the following detailed description when considered in connection with the accompanying drawings wherein:

[0010] Figure 1 is a perspective and elevation view of an exemplary wiper blade assembly;

[0011] Figure 2 is a partially exploded view of the wiper blade assembly of Figure 1;

[0012] Figure 3 is an exploded view of an exemplary end piece sub-assembly from the wiper blade assembly of Figure 1;
Figure 4 is a partially exploded view of the end piece sub-assembly of Figure 3 and showing two of the pieces being coupled together;

Figure 5 is a perspective and elevation view of an end piece sub-assembly from the wiper blade assembly of Figure 1;

Figure 6 is a perspective and fragmentary view of a portion of a main bridge from the wiper blade assembly of Figure 1;

Figure 7 is a cross-sectional view of the main bridge taken along line 7-7 of Figure 6; and

Figure 8 is a perspective and elevation view of a pair of carrier elements from the wiper blade assembly of Figure 1.

DESCRIPTION OF THE ENABLING EMBODIMENT

Referring to the Figures, wherein like numerals indicate corresponding parts throughout the several views, an exemplary embodiment of a hybrid windscreen wiper device, or a hybrid wiper blade assembly 20, is generally shown in Figure 1. The exemplary wiper blade assembly 20 includes a wiper strip 22 of a flexible and resilient material, such as rubber, for sealing against a vehicle's windshield and for driving rain, snow, ice or other elements away therefrom. The exemplary wiper strip 22 includes a pair of oppositely facing grooves that extend substantially the entire longitudinal length of the wiper strip 22 and receive a pair of carrier elements 24 (also known as flexors) to bias the wiper strip 22 into a predetermined configuration. The carrier elements 24 are formed from thin strips a flexible and spring-like material, such as spring steel. The carrier elements 24 are preferably entirely slidably disposed within the grooves or locked into engagement with the wiper strip 22 at only one location, such that the remaining portions of the wiper strip 22 may slide relative to the carrier elements 24 in a lengthwise direction. Either of these configurations has the effect
of relieving internal stresses within the wiper strip 22 when it is bent to conform to the curvature of a windshield (not shown) to improve the wipe quality and durability of the wiper blade assembly 20.

[0019] The exemplary wiper blade assembly 20 also includes a frame structure 26 which is coupled to the carrier elements 24 and distributes a force from a wiper arm (not shown) across a portion of the wiper strip 22 to seal that portion of the wiper strip 22 against the windshield. As best shown in the partially exploded view of Figure 2, the exemplary frame structure 26 includes a main bridge 28 and a pair of end piece sub-assemblies 30 configured for attachment with opposite ends of the main bridge 28. A connecting device 32 is disposed in a generally central location of the main bridge 28 and is configured for attachment to an end of the wiper arm. It should be appreciated that the connecting device 32 could be of a range of different designs for attaching with different types of wiper arms including, for example, hook-style wiper arms, pin-style wiper arms or bayonet-style wiper arms.

[0020] Referring now to Figure 3, an exploded view of one of the end piece sub-assemblies 30 is shown. The exemplary end piece sub-assembly 30 includes a linkage 34, a connecting piece 36 and an end cap 38 (or end cover). The exemplary connecting piece 36 is generally U-shaped as viewed in cross-section and has an upper wall and a pair of side walls. The side walls include two sets of apertures 40 spaced from one another, and the upper wall has a spring loaded tab 42 (or a bayonet) which is located in between the sets of apertures 40. The spring loaded tab 42 is configured to snap into engagement with a recess 44 (shown in Figure 7) that is shaped similarly to the spring loaded tab 42 and is disposed within the main bridge 28 to interconnect the end piece sub-assembly 30 with the main bridge 28.
As shown, one end of the end cap 38 presents a downwardly extending flange portion 46 and a pair of generally L-shaped holding elements 48 for wrapping partially around and supporting the carrier elements 24 (shown in Figure 1) without restricting movement of the carrier elements 24 relative to the end cap 38 or the rest of the frame structure 26 in a lengthwise direction, i.e. the holding elements 48 are not clamped, staked or otherwise fixed onto the carrier elements 24. An outwardly extending tongue 50 with a pair of oppositely facing posts 52 is disposed on the end of the end cap 38 opposite of the downwardly extending flange portion 46. As shown in Figure 4, the posts 52 on the tongue 50 are inserted into one of the sets of apertures 40 on the connecting piece 36 to establish a pivoting relationship between the end cap 38 and the connecting piece 36. As such, the end cap 38 is also pivotable relative to the main bridge 28. The open bottom of the connecting piece 36 allows the end cap 38 to pivot downwardly, and the upper wall of the connecting piece 36 serves as a stopping point to restrict pivoting of the end cap 38 upwardly.

The linkage 34 of each end piece sub-assembly 30 includes two sets of claws 54 spaced apart from one another. The sets of claws 54 are interconnected with one another through a V-shaped bridge 56 which has a pair of oppositely extending posts 53 disposed at its apex. As shown in Figure 5, the posts 53 are inserted into one of the sets of apertures 40 in the connecting piece 36 to establish a pivoting relationship between the linkage 34 and the connecting piece 36. The open bottom of the connecting piece 36 allows the linkage 34 to pivot in two directions. Similar to the holding elements 48 on the end caps 38, the claws 54 are in sliding (i.e., non-fixed) engagement with the exemplary carrier elements 24, thereby biasing the wiper strip 22 against the windshield while also allowing the carrier elements 24 and the wiper strip 22 to slide in a lengthwise direction relative to the linkages 34. This feature improves the wipe quality and durability of the wiper blade.
assembly 20 by reducing the internal stresses within the carrier elements 24 and the wiper strip 22 when they are bent to conform to the curvature of a windshield.

[0023] Referring back to Figure 1, in the exemplary wiper blade assembly 20, movement of the carrier elements 24 and wiper strip 22 relative to the frame structure 26 is limited by the flange portions 46 on the end caps 38, which are disposed adjacent the ends of the carrier elements 24 and the wiper strip 22. Specifically, the carrier elements 24 and wiper strip 22 may only slide relative to the frame structure 26 within the confines established by the flange portions 46 of the end piece sub-assemblies 30. As such, the wiper blade assembly 20 is configured to prevent the wiper strip 22 or the carrier elements 24 from becoming detached from the frame structure 26.

[0024] Referring now to Figure 8, each of the carrier elements 24 is pre-shaped to present a curved end portion 58 before it is inserted into the groove of the wiper strip 22. Specifically, at least the end portions 58 of the carrier elements 24 are curved concavely downwardly to bias the ends of the wiper strip 22 against a vehicle windshield. As such, between the claws 54 on the linkages 34 of the frame structure 26 and the curved end portions 58 of the carrier elements 24, the entire length of the wiper strip 22 is biased against the windshield to establish a sealing relationship between the wiper blade assembly 20 and the windshield. The curvature is preferably formed into the carrier elements 24 through a roll forming process wherein at least one roller is pressed against the carrier element 24 to plastically deform the material of the carrier element 24 thereby giving the carrier element 24 a curvature as it exits the rollers. This force may be varied, for example by coupling the at least one roller to a cam, which allows a carrier element 24 to be formed with both curved sections and straight sections as well as with sections of differing curvatures. The curvature of the end portions 58 of the carrier elements 24 is preferably chosen such that the wiper strip 22 is substantially uniformly pressed against the windshield to substantially uniformly seal
the wiper strip 22 against the windshield. A curvature with a greater radius will result in a lesser seal between the wiper strip 22 and the windshield, whereas a curvature with a smaller radius will result in a stronger seal between the wiper strip 22 and the windshield.

[0025] Referring back to Figure 1, the exterior surfaces of the end caps 38 and the main bridge 28 are generally spoiler shaped. This creates a down force to further bias the wiper strip 22 against the windshield and improve the seal established therebetween and improve the wipe quality when the vehicle is travelling at speeds. In the exemplary embodiment, this aerodynamic down force is substantially the only biasing force applied onto the carrier elements 24 and the wiper strip 22 by the end caps 38 which are freely pivotable relative to the main bridge 28, i.e. any biasing by the end caps 38 onto the carrier elements 24 and the wiper strip 22 from the force of gravity is not substantial.

[0026] Obviously, many modifications and variations of the present invention are possible in light of the above teachings and may be practiced otherwise than as specifically described while within the scope of the appended claims.
What is claimed is:

1. A windscreen wiper device for cleaning a windshield of a vehicle, comprising:
   an elongated wiper strip of a flexible material for sealing against the windshield;
   at least one carrier element extending between opposite end portions and in engagement with said elongated wiper strip to bias said elongated wiper strip into a predetermined configuration;
   a frame structure including a plurality of claws in engagement said carrier elements between said end portions for biasing a portion of said wiper strip against the windshield and also including at least two end caps slidably supporting said end portions of said at least one carrier element; and
   wherein said end caps are pivotably coupled to at least an adjacent portion of said frame structure and at least said end portions of said at least one carrier element are curved when in a relaxed state to bias said wiper strip against the windshield.

2. The windscreen wiper device as set forth in claim 1 wherein said frame structure includes a main bridge and a pair of end piece sub-assemblies coupled to opposite ends of said main bridge and wherein said end caps are in said end piece sub-assemblies.

3. The windscreen wiper device as set forth in claim 2 wherein each of said end caps includes at least one holding element wrapping partially around said at least one carrier element.
4. The windscreen wiper device as set forth in claim 3 wherein said at least one holding element is further defined as a pair of holding elements.

5. The windscreen wiper device as set forth in claim 4 wherein said holding elements are generally L-shaped.

6. The windscreen wiper device as set forth in claim 2 wherein each of said end piece sub-assemblies also includes at least one linkage with at least one set of said claws in engagement with said at least one carrier element.

7. The windscreen wiper device as set forth in claim 6 wherein said sets of claws are in sliding engagement with said at least one carrier element to allow said at least one carrier element to slide in a lengthwise direction relative to said linkages.

8. The windscreen wiper device as set forth in claim 7 wherein each of said end caps further includes a downwardly extending flange portion disposed next to adjacent ends of said wiper strip and said at least one carrier element to establish confines for restricting the movement of said at least one carrier element and said wiper strip relative to said frame structure in said lengthwise direction.

9. The windscreen wiper device as set forth in claim 2 wherein each of said end piece sub-assemblies includes a linkage and said end cap and a connecting piece interconnecting said linkage and said end cap with said main bridge.

10. The windscreen wiper device as set forth in claim 9 wherein said connecting piece of each end piece sub-assembly includes sets of apertures for receiving posts on said
end cap and said linkage to establish pivoting relationships between said end cap and said connecting piece and between said linkage and said connecting piece.

11. The windscreen wiper device as set forth in claim 10 wherein each of said connecting pieces is generally U-shaped as viewed in cross-section with a pair of side walls and an upper wall.

12. The windscreen wiper device as set forth in claim 11 wherein said apertures on said connecting pieces are on said side walls.

13. The windscreen wiper device as set forth in claim 11 wherein each of said connecting pieces includes a spring loaded tab on its upper wall for snapping into engagement with said main bridge.

14. The windscreen wiper device as set forth in claim 11 wherein each of said end caps includes a tongue extending outwardly and presenting said posts to establish said pivoting relationship between said end cap and said connecting piece.

15. The windscreen wiper device as set forth in claim 1 wherein said at least one carrier element is generally linearly shaped between said curved end portions when it is in said relaxed state.
**INTERNATIONAL SEARCH REPORT**

**A. CLASSIFICATION OF SUBJECT MATTER**

**INV. B60S1/38**

According to International Patent Classification (IPC) or to both national classification and IPC

**ADD.**

According to International Patent Classification (IPC) or to both national classification and IPC

**B. FIELDS SEARCHED**

Minimum documentation searched (classification system followed by classification symbols)

B60S

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic database consulted during the international search (name of database and, where practicable, search terms used)

EPO-Internal

**C. DOCUMENTS CONSIDERED TO BE RELEVANT**

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Further documents are listed in the continuation of Box C. See patent family annex.

- Special categories of cited documents:
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Date of the actual completion of the international search: 27 February 2013

Date of mailing of the international search report: 06/03/2013

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