



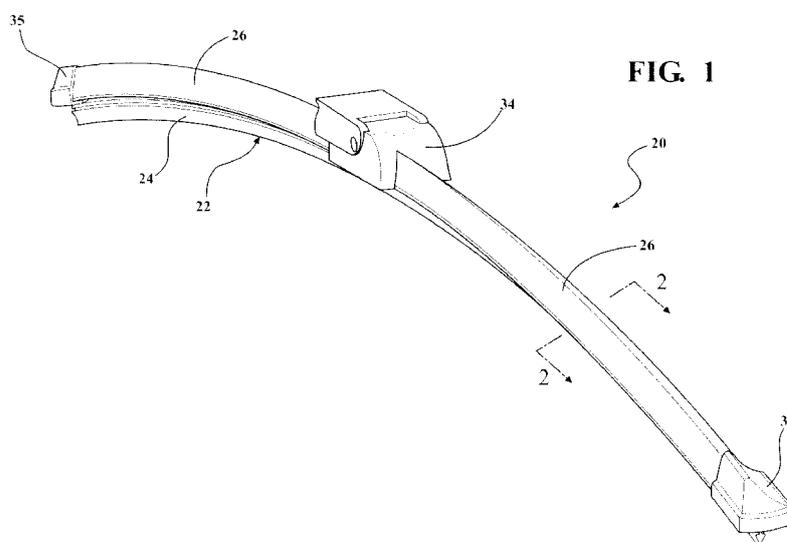
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(54) Title: WINDSCREEN WIPER DEVICE



(57) Abstract: A windscreen wiper device (20) is provided including a longitudinally extending wiper strip (22) of a flexible material. At least one carrier of a spring-like material operatively supports and biases the wiper strip (22) into a predetermined configuration. The windscreen wiper device (20) further includes a connecting device for connection with a wiper arm. At least a portion of the wiper strip (22) has a microtextured surface formed directly into the flexible material. The microtextured surface may be on, for example, any one of or any combination of a wiping portion (24), a channel, a hinge portion (28) and a spoiler portion (26) of the wiper strip.



WINDSCREEN WIPER DEVICE

CROSS-REFERENCE TO RELATED APPLICATIONS

[0001] This application claims the benefit of U.S. Provisional Application Serial Nos. 61/589,039, filed January 20, 2012, and 61/561,618, filed November 18, 2011, which are incorporated herein by reference in their entireties.

BACKGROUND OF THE INVENTION

1. Field of the Invention

[0002] The present invention is generally related to windscreen wiper devices, and more precisely to wiper strips of windscreen wiper devices.

2. Related Art

[0003] The wiper strips of typical windscreen wiper devices, or wiper blades, are formed of a rubber material which seals against a vehicle's windshield to drive water, snow or other elements away therefrom. Materials having, among other things, a good resistance to abrasion, a low frictional surface and good slip properties are generally chosen to give the wiper blades a good wipe quality. Oftentimes, a material which improves one or more of these qualities has a negative effect on others. For example, soft rubbers may produce wiper strips which exhibit exceptional wipe quality but also have an undesirably high frictional resistance, which could reduce the lifespans of such wiper blades

[0004] Some wiper manufacturers have attempted to improve the performance of their wiper blades by applying a coating having hydrophobic properties to the wiper strips. Such coatings allow the wiper strip to be formed of a harder rubber, resulting in reduced friction and longer life, without compromising wipe quality. However, such coatings may be

very costly, difficult to apply to the wiper strip and/or may wear out over time, resulting in a reduced wipe quality.

SUMMARY OF THE INVENTION

[0005] One aspect of the present invention provides for a windshield wiper device for a vehicle with improved performance and lifespan. The windshield wiper device includes a longitudinally extending wiper strip of a flexible material. At least one carrier of a spring-like material operatively supports and biases the wiper strip into a predetermined configuration. The windshield wiper device also includes a connecting device for connection with a wiper arm. At least a portion of the wiper strip has a microtextured surface formed directly into the flexible material. The microtextured surface may be configured to improve the wiper strip's resistance to abrasion, reduce the wiper strip's frictional surface and improve the wiper strip's slip properties.

[0006] According to another aspect of the present invention, the microtextured surface is formed directly into a wiping portion of the wiper strip. The microtexturing provides the wiping portion with hydrophobic properties to improve the wipe quality of the windshield wiper device. Additionally, the microtexturing reduces the friction between the wiper strip and the vehicle's windshield, thereby allowing the wiper strip to be formed of a softer material, thus further improving wipe quality without compromising the windshield wiper device's lifespan.

[0007] According to yet another aspect of the present invention, the wiper strip includes a channel for receiving the carrier, and the channel is microtextured. The microtexturing reduces the friction between the wiper strip and the carrier to reduce internal stresses within the wiper strip that could otherwise form when the wiper strip is biased into a curved configuration by the carrier.

[0008] According to still another aspect of the present invention, the wiper strip includes a hinge portion that is microtextured. The microtexturing on the hinge portion prevents snow, ice, dust or other debris from becoming lodged in the hinge portion and preventing the wiping portion from pivoting back and forth during when the windshield wiper device changes direction during operation of the vehicle's wiper blade system.

[0009] According to a further aspect of the present invention, the wiper strip includes a spoiler portion that is microtextured. The microtexturing on the spoiler portion could be configured to improve the down-force provided by the spoiler portion or it could be configured to reduce the aerodynamic drag of the wiper blade.

[0010] Another aspect of the present invention is a method of making a windshield wiper device. The method includes the step of forming a longitudinally extending wiper strip of a flexible material and having at least one surface with microtexturing formed directly into the flexible material.

[0011] According to yet another aspect of the present invention the forming step is extruding the wiper strip out of an extrusion die having a shaped opening with microtexturing. The microtexturing on the extrusion die forms linearly extending microtextures on the wiper blades extruded therefrom. This may provide manufacturing advantages because the microtexturing may reduce the friction between the material being extruded through the shaped opening and the extrusion die.

[0012] According to still another aspect of the present invention, the forming step is injection molding the wiper strip in a mold having a mold cavity with a microtextured surface. The microtexturing on the wiper strips formed in the mold cavity may either be pillar-shaped or they may extend linearly in a manner similar to the microtexturing on wiper strips formed through extrusion.

BRIEF DESCRIPTION OF THE DRAWINGS

[0013] 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:

[0014] Figure 1 is a perspective and elevation view of an exemplary windshield wiper device;

[0015] Figure 2 is a cross-sectional view of the exemplary windshield wiper device taken through line 2-2 of Figure 1;

[0016] Figure 3A is a perspective and elevation view of a wiper strip formed through an injection molding process in the windshield wiper device of Figure 1;

[0017] Figure 3B is an enlarged view taken of a wiping portion of the wiper strip in Figure 3A and showing a microtextured surface formed during the injection molding process;

[0018] Figure 3C is an enlarged view of a channel of the wiper strip of Figure 3A and showing a microtextured surface formed during the injection molding process;

[0019] Figure 3D is an enlarged view of a hinge portion of the wiper strip of Figure 3A and showing a microtextured surface formed during the injection molding process;

[0020] Figure 3E is an enlarged view of a spoiler portion of the wiper strip of Figure 3A and showing a microtextured surface formed during the injection molding process;

[0021] Figure 4A is a front view of an exemplary extrusion die for extruding a wiper strip;

[0022] Figure 4B is an enlarged view of a portion of the extrusion die of Figure 4A;

[0023] Figure 5A is a front view of an exemplary mold for injection molding a wiper strip;

[0024] Figure 5B is an enlarged view of the exemplary mold of Figure 5A; and

[0025] Figure 6 is an enlarged view showing an exemplary microtextured surface formed through an extrusion process.

DESCRIPTION OF THE ENABLING EMBODIMENT

[0026] Referring to the Figures, wherein like numerals indicate corresponding parts throughout the several views, an exemplary windscreen wiper device **20** (or a wiper blade) constructed according to one aspect of the invention is generally shown in Figure 1. Referring now to the cross-sectional view of Figure 2, the exemplary windscreen wiper device **20** includes a wiper strip **22** having a wiping portion **24**, a spoiler portion **26** and a hinge portion **28** all integrally connected to one another and formed as one piece of material with the hinge portion **28** being disposed between the wiping and spoiler portions **24**, **26**. The spoiler portion **26** presents a longitudinally extending channel **30**, and a carrier **32** (sometimes referred to as a “flexor”) is disposed in the channel **30**. The carrier **32** is of a spring-like material (such as spring steel) and operatively supports and biases the wiper strip **22** into a predetermined configuration. Referring back to Figure 1, the exemplary windscreen wiper device **20** is a “beam” style device because it lacks the levers and frame found on traditional windscreen wiper devices. As such, the exemplary carrier **32** (shown in Figure 2) is self-biased into a curved shape to bias the wiper strip **22** into a curved configuration, thereby allowing it to conform to windshields of differing curvatures. The exemplary windscreen wiper device **20** also includes a connecting device **34** for connection with a wiper arm (not shown). Additionally, end caps **35** are secured to either the wiper strip **22** or to the

carrier **32** at the ends of the exemplary windscreen wiper device **20**. However, it should be appreciated that a traditional style windscreen wiper device having a frame with a plurality of levers and a generally linearly biased carrier could alternately be employed.

[0027] The exemplary one-piece wiper strip **22** is formed of a flexible and elastic material, such as rubber, for sealing against a vehicle's windshield (not shown) and for driving rain, snow or other elements away therefrom. Referring now to Figures 3A and 3B, the outer surface of the wiping portion **24** of the exemplary wiper strip **22** is microtextured with a plurality of pillars or other protrusions **36** formed directly into the flexible material and extending generally perpendicularly away from the surrounding areas of the outer surface. This microtexturing gives the wiping portion **24** hydrophobic properties to drive rain and snow away from the windshield, thereby improving the wipe quality of the windscreen wiper device **20** as compared to comparable windscreen wiper devices lacking the microtexturing. Additionally, the microtexturing on the outer surface of the wiping portion **24** reduces the total contact area between the wiper strip **22** and the windshield to reduce the friction between these components. The reduction in the friction between the wiper strip **22** and the windshield allows the wiper strip **22** to be formed of a softer material to further improve wipe quality without compromising the lifespan of the windscreen wiper device **20**. The microtexturing also resists the buildup of ice or other debris on the wiping portion **24**, thereby further improving the windscreen wiper device's **20** performance.

[0028] The protrusions **36** of the microtexturing may have any desirable shape and may even be ridges extending along the length of the wiper strip **22**. The protrusions **36** could be arranged in a pattern or they could be randomly arranged relative to one another. Although not shown, the microtextured surface may include one or more cavities in addition to or in place of the protrusions **36**. Additionally, the microtexturing could take a range of

different configurations to optimize, for example, hydrophobicity, friction reduction or aerodynamic drag.

[0029] Referring now to Figure 3C, the exemplary wiper strip **22** additionally includes microtexturing on the walls of the longitudinally extending channel **30** for reducing the friction between the wiper strip **22** and the carrier **32**. This improves the performance of the windscreen wiper device **20** by reducing internal stresses within the wiper strip **22** when it is biased by the carrier **32** into the curved configuration shown in Figure 1. As shown in Figure 3, the microtexturing on the channel **30** is different than the microtexturing on the wiping portion **24**. Specifically, the microtexturing on the channel **30** is optimized only for friction reduction, rather than both friction reduction and hydrophobicity.

[0030] Referring now to Figure 3D, the exemplary wiper strip **22** also includes a microtextured surface on the hinge portion **28** which is configured differently than the microtexturings on the wiping portion **24** and the channel **30**. Specifically, the microtexturing on the hinge portion **28** is optimized to prevent the buildup of snow, ice or dust on the hinge portion **28** which could affect the performance of the windscreen wiper device **20** by preventing or restricting pivoting movement of the wiping portion **24** when the windscreen wiper device **20** changes direction during operation of the vehicle's windshield wiper system.

[0031] Referring now to Figure 3E, the exemplary wiper strip **22** further includes a microtextured surface on the spoiler portion **26** which is configured differently than the microtexturings on the wiping portion **24**, channel **30** and hinge portion **28**. Specifically, the microtexturing on the spoiler includes a plurality of dimples **40** to reduce the aerodynamic drag of the windscreen wiper device **20**. Alternately, the microtexturing could be configured to increase the down-force provided by the spoiler portion **26** to improve the

seal between the wiping portion **24** and the windshield when the vehicle is travelling at high speeds.

[0032] The exemplary microtexturings on the wiping portion **24**, the channel **30**, the hinge portion **28** and the spoiler portion **26** are all point or pillar shaped and formed through an injection molding process. If the wiper strip **22** is formed through an extrusion process, then the microtexturings would extend linearly. For example, the microtexturing shown in Figure 6 is formed through an extrusion process and includes a plurality of rib-like projections **41** extending generally linearly and in parallel with one another.

[0033] Another aspect of the present invention provides for a method of making a windscreen wiper device **20**. The method includes the step of forming a longitudinally extending wiper strip **22** of a flexible material and having at least one microtextured surface including a plurality of protrusions **36** and/or cavities formed directly into the flexible material. The at least one microtextured surface could be disposed on any one of or any combination of an outer surface of a wiping portion **24**, a wall of an inner longitudinally extending channel **30**, an outer surface of a spoiler portion **26** or an outer surface of a hinge portion **28**. Additionally, the microtextured surface or surfaces could be configured to provide hydrophobicity, reduced friction or aerodynamic drag.

[0034] In one embodiment, the step of forming the wiper strip **22** is through an extrusion process using an extrusion die **42**, such as the extrusion die **42** shown in Figures 4A and 4b. The exemplary extrusion die **42** includes an opening **44** shaped similarly to the profile of the wiper strip **22** shown in Figure 2 and discussed above. As shown in Figure 4B, areas of the perimeter of the opening **44** are microtextured with very small notches **46** or grooves. When the rubber (or any other flexible material) is extruded through the shaped opening **44**, micro-sized ridges are formed on the wiper strip by these notches **46** to provide the resulting wiper strip **22** with at least one microtextured surface. The notches **46** on the

exemplary extrusion die **42** are generally rectangularly shaped. However, it should be appreciated that they could take a wide range of different shapes other than those shown in the drawings. It should also be appreciated that the extrusion die **42** could have a plurality of very small projections in addition to or in place of the notches **46**. The notches **46** could be disposed along the entire perimeter of the shaped opening **44**, or they could be disposed only in predetermined portions of the opening **44**.

[0035] In addition to the performance advantages that are provided by the microtextured surfaces on the wiper strips produced from the extrusion die **42**, the microtextured surfaces of the extrusion die **42** also provide for manufacturing advantages. Specifically, the microtextured surfaces on the extrusion die **42** may have the effect of reducing friction between the extrusion die **42** and the material being extruded through the opening **44**. Less friction at this point in the manufacturing of the wiper strip **22** allows for better control of the extrusion process and reduces the pressure required to urge the rubber through the opening **44** of the extrusion die **42**.

[0036] In another embodiment, the step of forming the wiper strip **22** is through an injection molding process using a mold **48** (such as the mold **48** shown in Figures 5A and 5B) having a mold cavity **50** shaped for injection molding a wiper strip **22**. As shown in the enlarged view of Figure 5b, the mold **48** presents a plurality of recesses **52**. Similar to the notches **46** in the extrusion die **42** discussed above, the recesses **52** are very small to form a microtextured surface in the wiper strips injection molded in the mold **48**. The recesses **52** could have any desirable shape and could be disposed throughout the mold cavity **50** or they could be disposed only in predetermined portions of the mold cavity **50**. For example, it might be preferred to only include the microtextured surface in the portions of the mold cavity **50** that form the wiping portions of the wiper strips.

[0037] It is to be understood that the above detailed description is with regard to some presently preferred embodiments, and that other embodiments readily discernible from the disclosure herein by those having ordinary skill in the art are incorporated herein and considered to be within the scope of any ultimately allowed claims.

CLAIMS

What is claimed is:

1. A windshield wiper device, comprising:
 - a longitudinally extending wiper strip of a flexible material;
 - at least one carrier of a spring-like material operatively supporting and biasing said wiper strip into a predetermined configuration;
 - a connecting device for connection with a wiper arm; and
 - wherein at least a portion of said wiper strip has a microtextured surface formed directly into said flexible material.
2. The windshield wiper device as set forth in claim 1 wherein said microtextured surface includes a plurality of pillars.
3. The windshield wiper device as set forth in claim 1 wherein said wiper strip includes a wiping portion, a hinge portion, and a spoiler portion integrally connected as one piece of said flexible material with one another with said hinge portion being disposed between said wiping and spoiler portions.
4. The windshield wiper device as set forth in claim 3 further including a longitudinally extending channel formed into said wiper strip, wherein said at least one carrier is disposed in said longitudinally extending channel, and wherein said at least one microtextured surface is in said channel.

5. The windshield wiper device as set forth in claim 3 wherein said at least one microtextured surface is on said wiping portion of said wiper strip.

6. The windshield wiper device as set forth in claim 3 wherein said at least one microtextured surface is on said hinge portion.

7. The windshield wiper device as set forth in claim 3 wherein said at least a portion of said wiper strip having a microtextured surface is further defined as at least two distinct portions of at least two of said wiping, hinge and spoiler portions having different microtexturing.

8. The windshield wiper device as set forth in claim 1 wherein said carrier is self-biased into a curved shape to bias said wiper strip into a curved configuration.

9. A method of making a windshield wiper device, comprising the steps of:
forming a longitudinally extending wiper strip of a flexible material and having at least one surface with microtexturing formed directly into the flexible material.

10. The method as set forth in claim 9 wherein the step of forming the wiper strip is further defined as extruding a longitudinally extending wiper strip of a flexible material and having at least one surface with microtexturing formed directly into the flexible material.

11. The method as set forth in claim 9 wherein the step of forming the wiper strip is further defined as injection molding a longitudinally extending wiper strip of a flexible

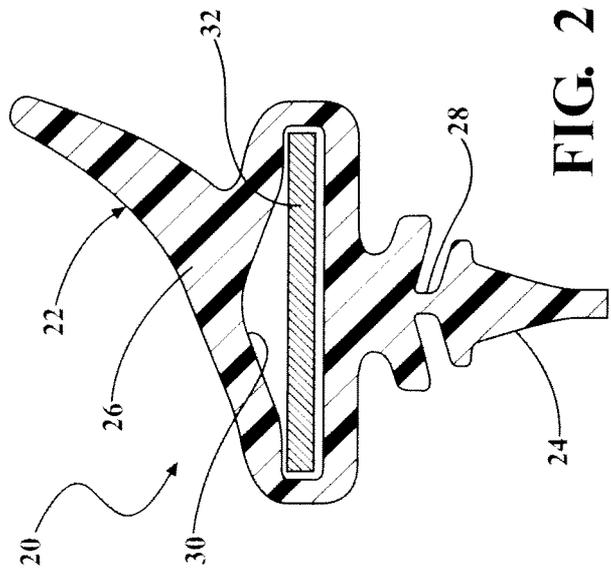
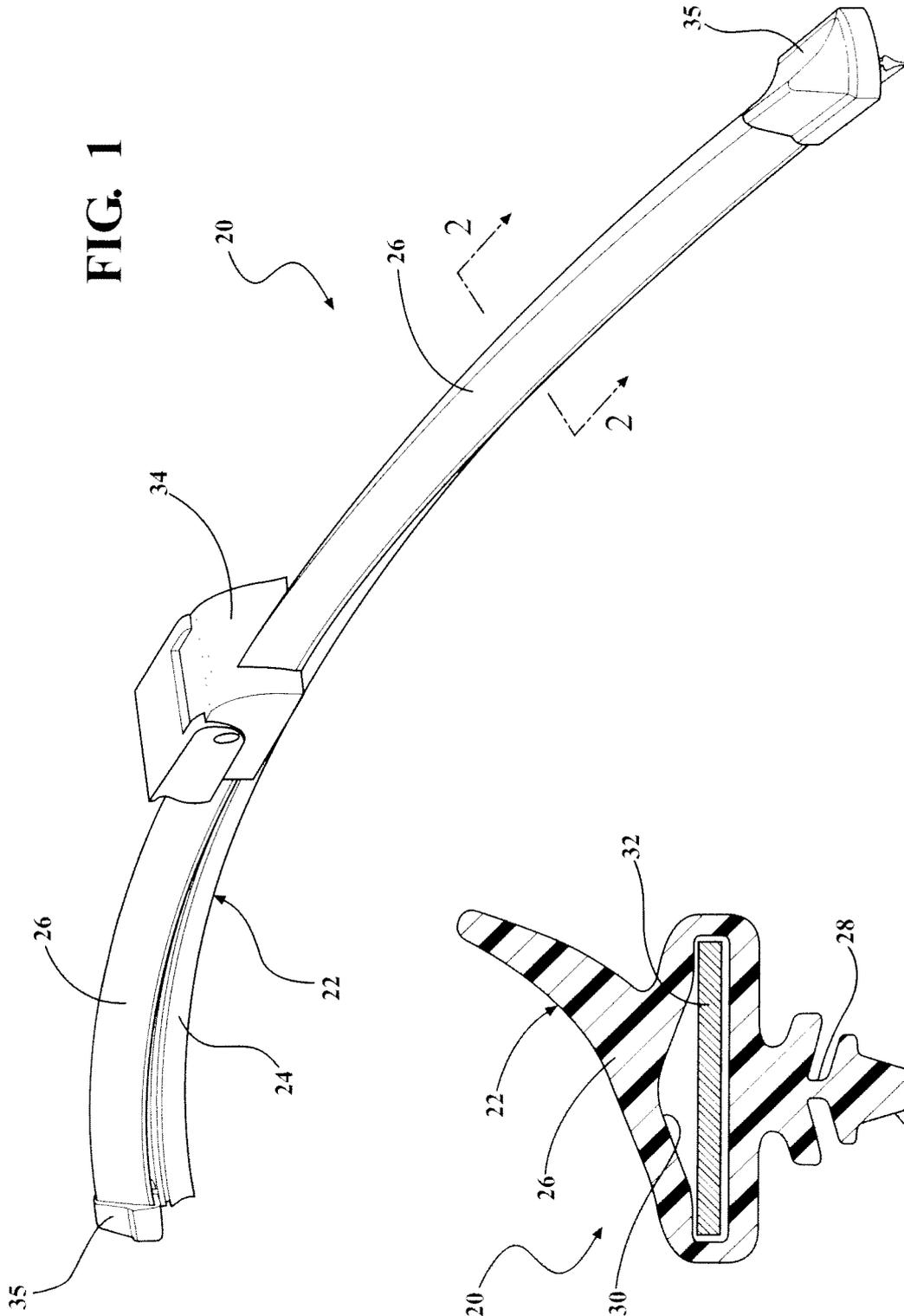
material and at least one surface with microtexturing formed directly into the flexible material.

12. The method as set forth in claim 9 wherein the step of forming the wiper strip is further defined as forming a wiper strip having a spoiler portion, a hinge portion and a wiping portion all interconnected and of one piece of material and at least one surface with microtexturing formed directly into the flexible material.

13. The method as set forth in claim 12 wherein the wiper strip is formed with a longitudinally extending channel that is microtextured and further including the step of inserting a carrier of a spring-like material into the channel to bias the wiper strip into a predetermined configuration.

14. The method as set forth in claim 12 wherein at least two of the spoiler portion, hinge portion and wiping portion have microtextured surfaces with differing microtextures.

15. The method as set forth in claim 9 wherein the microtexturing includes a plurality of pillars.



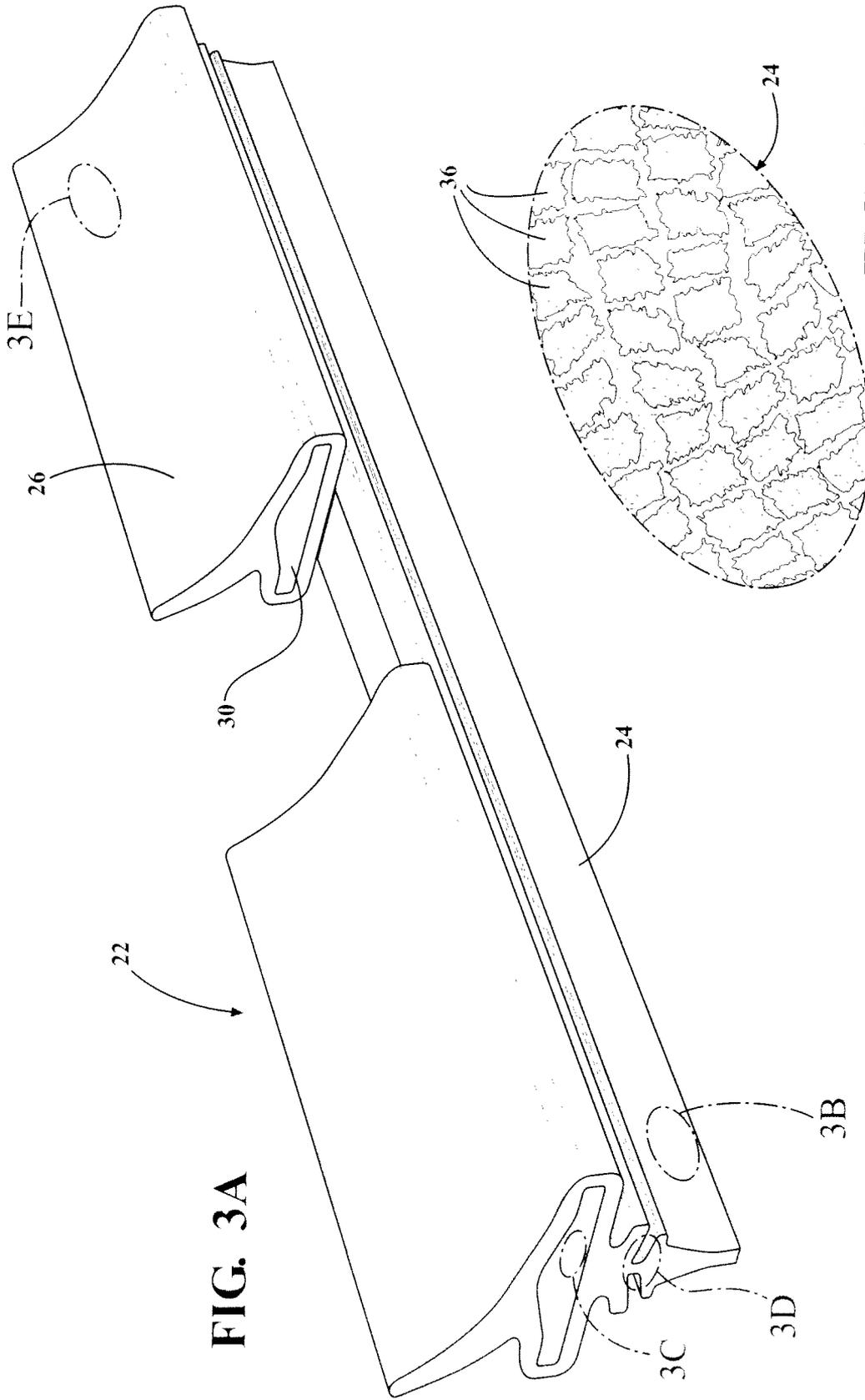
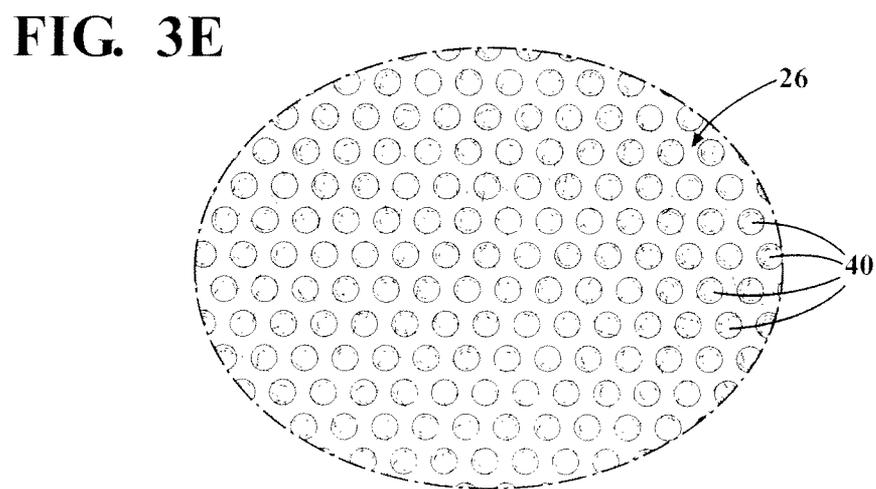
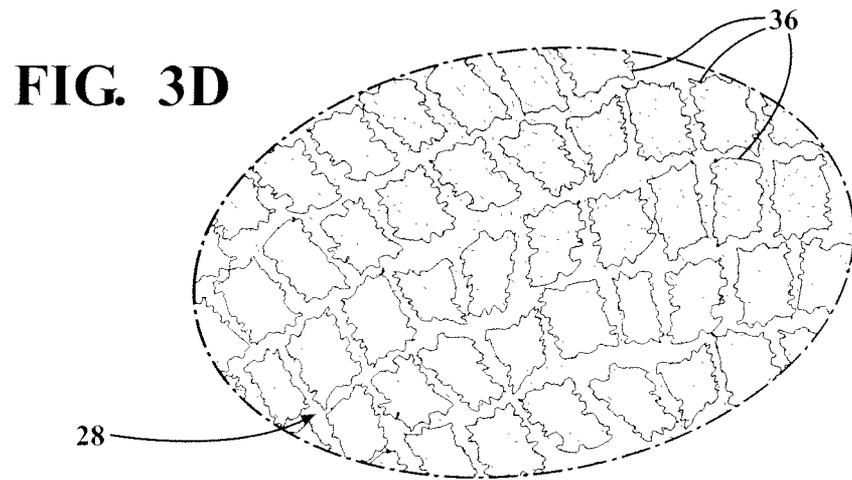
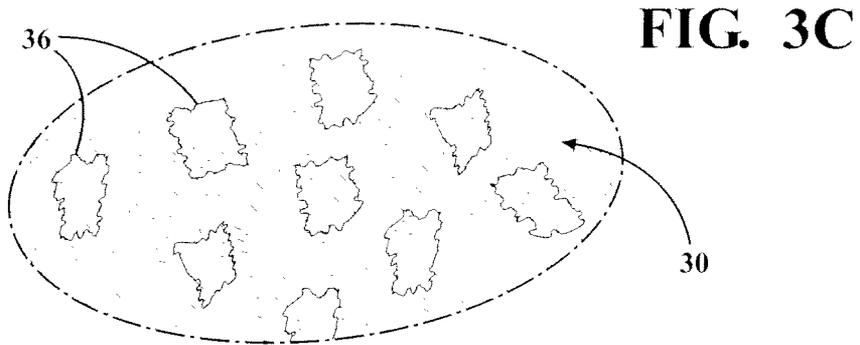


FIG. 3A

FIG. 3B



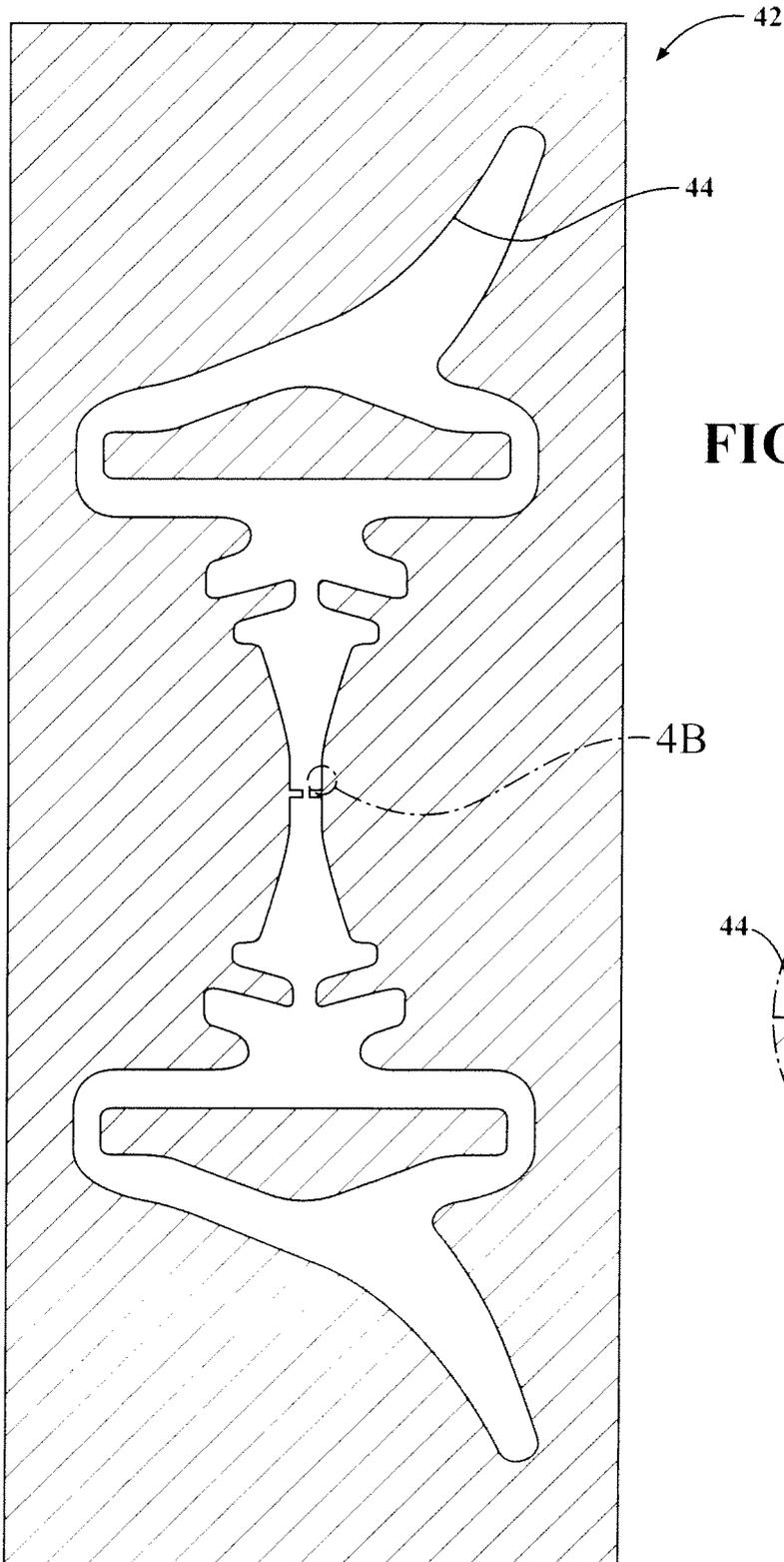


FIG. 4A

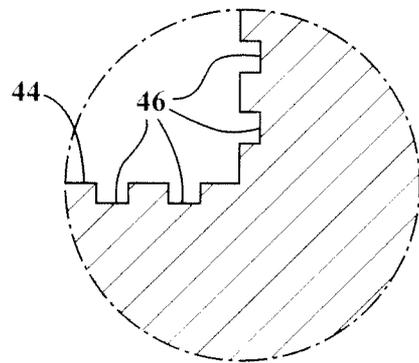


FIG. 4B

FIG. 5A

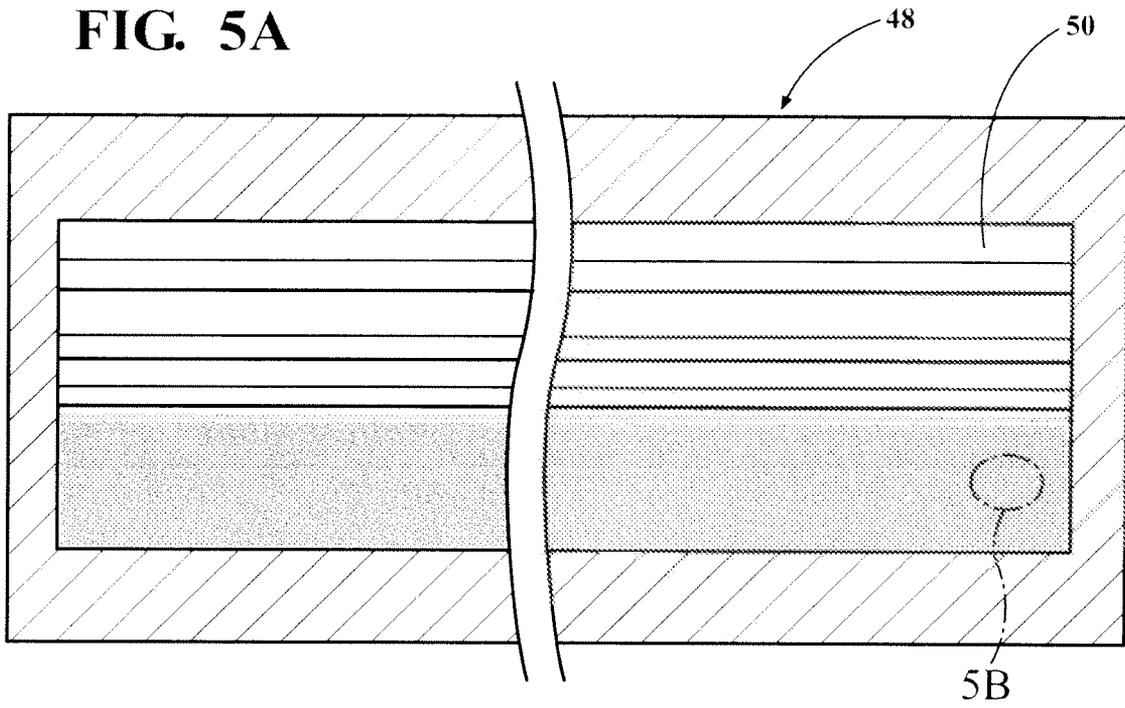


FIG. 5B

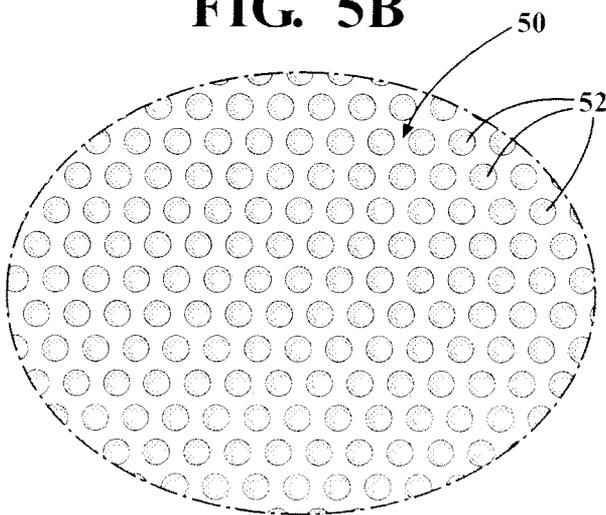
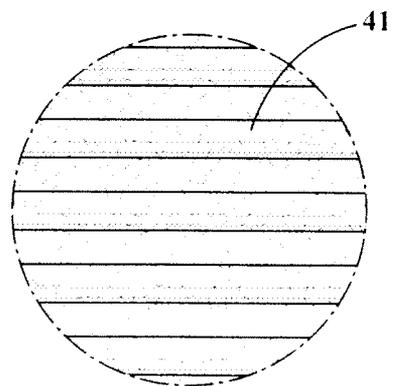


FIG. 6



INTERNATIONAL SEARCH REPORT

International application No
PCT/US2012/065435

A. CLASSIFICATION OF SUBJECT MATTER INV. B60S1/38 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 data base consulted during the international search (name of data base and, where practicable, search terms used) EPO-Internal, WPI Data		
C. DOCUMENTS CONSIDERED TO BE RELEVANT		
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Y	US 2010/119780 A1 (SCHILLING ANDREAS [CH] ET AL) 13 May 2010 (2010-05-13) paragraph [0006] - paragraph [0031]; figures paragraph [0059] - paragraph [0081]	1-15
Y	US 2011/059301 A1 (LAY REINER [DE] ET AL) 10 March 2011 (2011-03-10) paragraph [0006] - paragraph [0012]; figures paragraph [0016] - paragraph [0025]	1-15
A	WO 2011/026512 A1 (FEDERAL MOGUL SA [BE]; BOLAND XAVIER [BE]) 10 March 2011 (2011-03-10) page 4, line 23 - page 6, line 17; figures ----- -/--	3,8
<input checked="" type="checkbox"/> Further documents are listed in the continuation of Box C. <input checked="" type="checkbox"/> See patent family annex.		
* Special categories of cited documents :		
"A" document defining the general state of the art which is not considered to be of particular relevance "E" earlier application or patent but published on or after the international filing date "L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified) "O" document referring to an oral disclosure, use, exhibition or other means "P" document published prior to the international filing date but later than the priority date claimed	"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention "X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone "Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art "&" document member of the same patent family	
Date of the actual completion of the international search <p style="text-align: center;">20 December 2012</p>	Date of mailing of the international search report <p style="text-align: center;">08/01/2013</p>	
Name and mailing address of the ISA/ European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016	Authorized officer <p style="text-align: center;">Sangiorgi, Massimo</p>	

INTERNATIONAL SEARCH REPORT

International application No
PCT/US2012/065435

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
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Information on patent family members

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