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(71) Applicant: BETA FRAMES LLC [—/US]; 1900 Embarcadero Rd., Palo Alto, CA 94303 (US).

(72) Inventors: ZIDER, Robert, B.; 25 Deer Meadow, Portola Valley, CA 94028 (US). RICHARDSON, Timothy, H.P.; 1055 Trinity Dr., Menlo Park, CA 94025 (US).

(74) Agent: RICHARDSON, T.H.P.; 1055 Trinity Dr., Menlo Park, CA 94025 (US).

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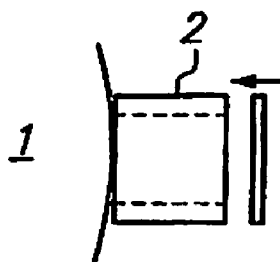
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(54) Title: EYEGLASS FRAMES



**FIG. 4**

(57) Abstract: An eyeglass assembly which comprises (1) an eyeglass lens comprising a body portion and an engaging portion, and (2) a frame member which is fitted to the engaging portion, and (3) a securing member which is bonded to the engaging portion and to surfaces of the frame member which, in the absence of the securing member, are exposed to the atmosphere. In one method, the frame member is fitted to the engaging portion and an adhesive is used to bond them to a separate securing member. In another method, the frame member is fitted to the engaging portion, and part of the engaging portion is heated and deformed to provide the securing member. Another method makes use of a separate securing member which comprises a polymeric composition. The frame member is fitted to the engaging portion, the separate securing member is placed adjacent to exposed surfaces of the frame member and the engaging portion, and is then heated and deformed so that it is melt-bonded to the engaging portion and the frame member.



WO 2014/134226 A1

## Eyeglass Frames

### RELATED APPLICATION.

This application claims priority from US application No. 13/779,612, filed  
February 27, 2013.

### BACKGROUND OF THE INVENTION.

#### Field of the Invention.

This invention relates to eyeglass frames.

#### Introduction to the Invention.

U.S. Patent No. 6,164,775 discloses and claims an eyeglass lens attachment arrangement comprising an eyeglass frame and a pair of lenses, each of the lenses including at least one shaped engaging portion, the shaped engaging portion cooperating with an attachment member which attaches a respective one of the lenses to the eyeglass frame such that the lenses are removably attached to the frame.

International Publication WO 2007/044221 and U.S. Patent No. 8,322,849 disclose that, in an eyeglass assembly, an engaging portion on an eyeglass lens can be maintained in contact with an eyeglass frame member by means of a removable bonding member (RBM) which

- (a) contacts the engaging portion and the frame member; and
- (b) under typical conditions of use of the assembly, maintains the engaging portion and the frame member in direct or indirect contact with each other; and
- (c) under selected atypical ambient conditions, undergoes a change which separates the engaging portion and the frame member, or permits the engaging portion and the frame member to be separated from each other by pulling them apart manually.

The removable bonding member is preferably a removable bonding adhesive (RBA).

International Publication WO 2010/039176 and US Application No. 12/998,271 (now US 8,465,150) disclose that when contacting surfaces of (i) an engaging portion on an eyeglass lens and (ii) an eyeglass frame member are to be maintained in contact, improved results can be obtained by (A) providing (i) a passage which passes away from the contacting surface of the frame member, preferably to an exterior surface of the frame member, and/or (ii) a passage which passes away from the contacting surface of the engaging portion, preferably to an exterior surface of the engaging portion, (B) coating at least part of the contacting surfaces of one or both of the engaging portion of the lens and the frame member with a composition which is relatively soft when the contacting surfaces of the lens and the frame member are brought into contact, (C) bringing the contacting surfaces into contact in such a way that the composition is forced into the passage, (D) treating the composition so that it hardens (the treatment being for example exposure to ultraviolet or other radiation, or simply leaving the composition to harden at ambient temperature and pressure), thus providing a physical lock which helps to secure the lens and the frame member together. WO 2010/039176 and US Application No. 12/998,271 (now US 8,465,150) also disclose that the union between the frame member and the engaging portion can be strengthened by inserting a metal or polymer rod or tube through a hole drilled through the frame member and into the engaging portion of the eyeglass lens.

International Patent Application No. PCT/US 2012/054524 and US Application 13/199,896 (now US 8,622,541) disclose a temple arm for an eyeglass frame, the temple arm comprising (1) a side member, (2) an auxiliary member, and (3) a return member which comprises an attachment portion for fitting to (preferably fitting around or into) an engaging portion on the periphery of a lens; the auxiliary member (i) being connected to the side member and to the front of the return member, and (ii) providing a front surface of the temple arm. International Patent Application No. PCT/US 2012/054524 and US Application 13/199,896 (now US 8,622,541) also disclose novel eyeglasses in which an engaging portion at the top of each lens is secured to a frame member which connects the two temple arms.

.U.S. 4,895,438, 4,896,955, 6,523,952 and 6,843,561 disclose improved eyeglass frames, some of which make use of a member composed of a shape-memory alloy (often hereinafter abbreviated to SMA) and/or a lens including a shaped engaging portion.

5 US 6,394,599 discloses eyeglasses which comprise a lens having an engaging portion extending from the periphery of an eyeglass lens, and a frame member having a recess which is open on at least one side, so that it can be engaged with engaging portions of different thicknesses.

10 The entire disclosure of each of the U.S. Patents, the international publications and the corresponding US national phase applications referred to above is incorporated herein by reference for all purposes.

15 Conventional eyeglasses include two lenses, a bridge member which is attached to each lens and which rests on the nose of the wearer, and two temple members each of which is secured to one of the lenses and which rest on the ears of the wearer. The terms "eyeglass frame member", "frame member" and "frame" are used herein to include temple members, bridge members, and auxiliary members to which a temple member or a bridge member is, or can be, secured. Such members can for example be composed of a metallic and/or polymeric material.

## 20 SUMMARY OF THE INVENTION.

In one aspect, this invention provides an assembly which comprises

- (1) an eyeglass lens comprising (i) a body portion having a periphery and (ii) an engaging portion at the periphery of the body portion, and
- (2) a frame member which is fitted to the engaging portion, and
- 25 (3) a securing member which (i) is bonded to (a) the engaging portion and (b) surfaces of the frame member which, in the absence of the securing member, are exposed to the atmosphere, and (ii) maintains a fixed relationship between the engaging portion and the frame member.

30 In some embodiments the invention, the assembly is produced by fitting the frame member to the engaging portion, and bonding the securing member to exposed surfaces of the frame member and the engaging portion by means of an adhesive. In

other embodiments, the assembly is produced by fitting the frame member to the engaging portion, and then heating and deforming part of the engaging portion so that it spreads out over adjacent surfaces of the frame member, thus forming a securing member. In other embodiments, the assembly is produced by fitting the frame member to the engaging portion, providing a securing member which comprises a polymeric composition, placing the securing member adjacent to exposed surfaces of the engaging portion and the frame member, and heating and deforming the securing member so that it is melt-bonded to the engaging portion and the frame member. Preferably the frame member has a generally tubular terminal portion which is fitted to the engaging portion of the lens. The generally tubular terminal portion can have a closed or an open cross-section.

This invention can be used in place of, or in conjunction with, previously proposed methods for securing a frame member to an eyeglass lens, for example as disclosed in the documents incorporated by reference herein.

The invention preferably does not make use of screws to secure the frame member to the lens. In preferred embodiments, the securing member (i) comprises a polymeric composition and (ii) is the sole means for maintaining the fixed relationship between the engaging portion and the frame member.

Preferably, the eyeglass frame member is secured to the engaging portion in such a way that the field of the wearer's vision through the lens is completely free of obstructions.

An advantage of the invention, as compared to the known processes in which a generally tubular portion of a frame member is secured by an adhesive which lies between a frame member and an engaging portion on a lens, is that the security of the connection is less dependent on precise matching of the dimensions of the tubular portion and the engaging portion.

Another advantage of the invention, as compared to the known processes in which a generally tubular portion of a frame member is secured by an adhesive which lies between the generally tubular portion and the engaging portion on a lens, is that the area of the contacting surfaces of the engaging portion and the frame member can be reduced. For example, the length of the engaging portion can be reduced.

The invention includes tools which can be used in the manufacture of eyeglass assemblies of the invention, for example

(A) a tool which comprises a terminal portion which is

(a) shaped so that it fits over (i) an exposed part of an engaging portion of an eyeglass lens, after a frame member has been fitted to the engaging portion, or (ii) over a separate heat-deformable securing member which contacts an engaging portion of an eyeglass lens and a frame member fitted to the engaging portion, and

(b) can be heated to a temperature which is controlled within a range which will enable the engaging portion or the securing member to be heated and deformed so that the engaging portion and the frame member are melt bonded to each other, for example within a range from 70 to 250°C, for example within the range from 100 to 220°C e.g. 140-220°C, a

(B) a tool which comprises a terminal portion which is

(a) shaped so that a precursor for a separate polymeric securing member can be retained therein,

(b) can deliver the precursor to the exposed surfaces of an engaging portion of a lens and of a frame member which is fitted to the engaging portion, and which can heat and deform the precursor to provide a polymeric securing member which is melt bonded to the engaging portion and to the frame member.

The tool can be part of a machine for applying the terminal portion, or can comprise a handle so that it can be manually used to produce an eyeglass assembly of the invention.

Eyeglass lenses are often made of a polycarbonate composition or a polyurethane-polyurea (Trivex) composition, and the part of the eyeglass frame which is fitted to the engaging portion of the lens are often made of a metal or a polymeric composition, e.g. nylon.

In describing and claiming the invention, reference will generally be made to securing a single frame member to a single engaging portion on an eyeglass lens. The frame member can be a bridge member or a temple member, or a frame member which

can be later connected to another frame member to form a bridge member or a temple member. A completed eyeglass assembly conventionally includes (1) two lenses, each of which has two engaging portions, (2) a bridge member which is attached to one of the engaging portions of each lens and which, when the eyeglass frame assembly is in use, rests on the nose of the wearer, and (3) two temple members each of which is secured to the other engaging portion of one of the lenses and which, when the eyeglass frame assembly is in use, rest on the ears of the wearer. In a completed eyeglass assembly making use of this invention, preferably each of the frame members is secured to a respective engaging portion of a lens in the same way. However, the invention includes the possibility that not all the connections between the frame members and the lenses are the same, so long as at least one of the connections is in accordance with the invention.

#### BRIEF DESCRIPTION OF THE DRAWINGS

The invention is illustrated in the accompanying drawings, which are diagrammatic and not to scale, which illustrate only the terminal part of the frame member which become secured to the engaging portion of the eyeglass lens, and in which

Figures 1, 2 and 3 are front, top and side views of an eyeglass lens having a body portion and an engaging portion extending from the periphery of the body portion,

Figures 4 and 5 are front and top views of an eyeglass lens having a terminal tubular portion of a frame member fitted to the engaging portion, and showing an adhesive coated securing member ready to be applied to the exposed surfaces of the engaging portion and the tubular portion,

Figures 6 and 7 are front and top views of Figures 4 and 5 after the adhesive coated securing member has been secured to the engaging portion and the tubular portion,

Figures 8, 9 and 10 are rear, front and top views of an eyeglass lens having a three-sided terminal tubular portion of a frame member fitted to the engaging portion, and showing an adhesive coated securing member ready to be applied to the exposed

surfaces of the engaging portion in the tubular portion, the securing member having a tab to assist in the correct placing of the securing member,

Figures 11 and 12 are front and top views of Figures 9 and 10 after the adhesive coated securing member has been secured to the engaging portion and the tubular portion, and the tab has been removed,

Figures 13 and 14 are front and top views of an eyeglass lens having a terminal tubular portion of a frame member fitted to the engaging portion, the size of the tubular portion being such that a distal portion of the engaging portion extends away from the tubular portion, and a thermoforming tool which is ready to be applied to the distal portion of the engaging portion,

Figures 15 and 16 are front and top views of Figures 13 and 14 after the thermoforming tool has been used to heat and deform the distal portion of the engaging portion to provide a polymeric securing member, and

Figure 17 is a side view of an eyeglass lens having a terminal tubular portion of a frame member fitted to the engaging portion and a tool for delivering a precursor for a polymeric securing member to exposed surfaces of the engaging portion and the tubular portion, and to heat and deform the precursor so that it provides a polymeric securing member.

## DETAILED DESCRIPTION OF THE INVENTION.

In the Summary of the Invention above, the Detailed Description of the Invention below, and the accompanying drawings, reference is made to particular aspects and features (including for example components, ingredients, devices, apparatus, systems, groups, ranges, method steps, test results, etc.) of the invention. It is to be understood that the disclosure of the invention in this specification includes all possible combinations of such particular features. For example, where a particular feature is disclosed in the context of a particular aspect, a particular embodiment, a particular claim, or a particular Figure, that feature can also be used, to the extent appropriate, in the context of other particular aspects, embodiments, claims and Figures, and in the invention generally. The invention disclosed herein includes embodiments not specifically described herein and can for example make use of features which are not



specifically described herein, but which provide functions which are the same, equivalent or similar to, features specifically disclosed herein.

The term "comprises" and grammatical equivalents thereof are used herein to mean that, in addition to the features specifically identified, other features are optionally present. For example, an apparatus "comprising" (or "which comprises") components A, B and C can contain only components A, B and C, or can contain not only components A, B and C but also one or more other components. The term "consisting essentially of" and grammatical equivalents thereof is used herein to mean that, in addition to the features specifically identified, other features may be present which do not materially alter the claimed invention. The term "at least" followed by a number is used herein to denote the start of a range beginning with that number (which may be a range having an upper limit or no upper limit, depending on the variable being defined). For example "at least 1" means 1 or more than 1, and "at least 80%" means 80% or more than 80%. The term "at most" followed by a number is used herein to denote the end of a range ending with that number (which may be a range having 1 or 0 as its lower limit, or a range having no lower limit, depending upon the variable being defined). For example, "at most 4" means 4 or less than 4, and "at most 40%" means 40% or less than 40 %. When, in this specification, a range is given as " (a first number) to (a second number)" or "(a first number) - (a second number)", this means a range whose lower limit is the first number and whose upper limit is the second number. For example, "from 8 to 20 inches" or "8-20 inches" means a range whose lower limit is 8 inches, and whose upper limit is 20 inches.

Where reference is made herein to "a" or "an" feature, this includes the possibility that there are two or more such features (except where the context excludes that possibility). Where reference is made herein to two or more features, this includes the possibility that the two or more features are replaced by a lesser number or greater number of features providing the same function (except where the context excludes that possibility). The numbers given herein should be construed with the latitude appropriate to their context and expression; for example, each number is subject to variation which depends on the accuracy with which it can be measured by methods conventionally used by those skilled in the art.

This specification incorporates by reference all documents referred to herein and all documents filed concurrently with this specification or filed previously in connection with this application, including but not limited to such documents which are open to public inspection with this specification.

5 Various optional embodiments of the invention are described in detail below.

### **First Preferred Aspect of the Invention.**

In a first preferred aspect, this invention provides an eyeglass frame assembly which comprises (1) an eyeglass lens comprising (i) a body portion having a periphery and (ii) an engaging portion which is at the periphery of the body portion, and which  
10 preferably extends from the periphery of the body portion, (2) a frame member which is fitted to the engaging portion, and (3) a separate securing member which is secured to the frame member and the engaging portion through an adhesive, the securing member being secured to surfaces of the frame member and the engaging portion which, in the  
15 absence of the securing member, are exposed to the atmosphere.

An eyeglass frame according to the first preferred aspect can be made by a method which comprises

- (1) fitting the frame member to the engaging portion,
- (2) providing a securing member which is not part of the engaging portion  
20 or of the frame member,
- (3) placing an adhesive between the securing member and the frame member and between the securing member and the engaging portion, and
- (4). bonding the engaging portion and the frame member to the securing member through the adhesive

25 When a suitable adhesive is used, for example a removable bonding adhesive (RBA) as described in International Patent Application No. PCT/US 2012/054524 and US Application 13/199,896 (now US 8,622,541), an eyeglass frame according to the first preferred aspect of the invention can be disassembled by subjecting the assembly to atypical conditions which do not damage the engaging portion or the frame member  
30 but which weaken the strength of the adhesive so that it is no longer effective. Preferably the atypical conditions are such that the frame member can be disassembled

from the engaging portion by pulling them apart manually. The atypical conditions which weaken the adhesive preferably comprise one or more of

(a) a temperature greater than 50°C, for example 50 to 150°C, e.g. 50 to 100°C, or 60 to 90°C,

(b) immersion in a liquid, for example a heated liquid, which may be an aqueous liquid which is free of organic materials, organic liquid which is free of water and other inorganic materials, or a mixed aqueous/organic liquid,

(c) immersion in a bath of heated solid particles, e.g. a bath of heated glass particles,

(d) exposure to electromagnetic radiation outside the visible wavelengths, and

(e) exposure to ultrasonic radiation.

In another embodiment of the first preferred aspect of the invention, the securing member is composed of a material which, together with the adhesive, (i) maintains the desired bonding between the engaging portion and the frame member under typical conditions of use of the eyeglass assembly, but (ii), under selected atypical ambient conditions which do not damage the engaging portion or the frame member, undergoes a change such that the bond between the engaging portion and the frame member is significantly weakened such that the frame member can be disassembled from the lens, preferably by pulling them apart manually.

For example, the securing member can comprise a polymeric composition such that the securing member itself can be weakened by a treatment which does not damage the eyeglass lens or the frame member, for example a treatment which makes use of one or more of the conditions set out in paragraphs (a)-(e) above. In this case, the adhesive need not be (though it can be) an adhesive which is weakened by the treatment.

The securing member can for example comprise a composition based on a side chain crystalline polymer (SCCP), for example an SCCP which contains (in addition to the repeating units comprising long side chains which provide the polymer with crystallinity) repeating units which are compatible with the adhesive. By choosing the monomer units from which the SCCP is prepared, a polymer having a desired melting point can be obtained. For use in this invention, for example, the SCCP has a melting

point above any temperature encountered in the normal use of the eyeglasses, but below a temperature to which the assembly can be conveniently exposed to allow the frame member to be separated from the lens, e.g. a melting point within the range 70-100°C. The SCCP can be cross-linked so that the securing member retains its shape even above the melting point of the SCCP.

SCCPs are well known, and are for example described in U.S. Patent Nos. 4,830,855, 5,120,349, 5,156,911, 5,387,450, 5,412,035, 5,665,822, 5,783,302, 5,752,926, 5,807,291, 5,469,867, and 5,826,584; J. Poly. Sci. 60, 19 (1962), J. Poly. Sci, (Polymer Chemistry) 7, 3053 (1969), 9, 1835, 3349, 3351, 3367, 10, 1657, 3347, 18, 2197, 19, 1871, J. Poly. Sci, Poly-Physics Ed 18 2197 (1980), J. Poly. Sci, Macromol. Rev, 8, 117 (1974), Macromolecules 12, 94 (1979), 13, 12, 15, 18, 2141, 19, 611, JACS 75, 3326 (1953), 76; 6280, Polymer J 17, 991 (1985); and Poly. Sci USSR 21, 241 (1979). The entire disclosure of each of those United States Patents is incorporated in this specification by reference.

The surface of the securing member adjacent to the frame member and the engaging portion can be roughened in order to improve the adhesive bond between the securing member and the frame member and the engaging portion.

Adhesives which are not RBA adhesives can be used in the present invention. If need be, even when the securing member itself cannot be weakened by an appropriate treatment, assemblies making use of adhesives which are not RBA adhesives can be disassembled by procedures which do not damage the body of the lens, for example by cutting or grinding the securing member. The procedure preferably enables the frame member to be disassembled from the lens by pulling them apart manually. In some cases, the residue of the engaging portion may be useful for further assembly in accordance with the present invention or the other procedures which make use of an engaging portion. If the disassembly procedure (or some subsequent receipt) completely removes the engaging portion, the lens can be reused using conventional mounting techniques.

The adhesive can be one which is applied as a precursor and which is converted to an effective adhesive by a specific treatment, for example by exposure to heat and/or electromagnetic radiation. Preferably the adhesive shrinks by less than 10%, preferably

less than 3%, particularly less than 1.5%, by volume and/or linearly, when it is converted from the precursor to the adhesive (since excessive shrinkage of the adhesive on curing can induce stress in the engaging portion and/or the frame member).

5 In the first aspect of the invention, the securing member can be made of any suitable material. When using an adhesive which is activated by ultraviolet or other specific electromagnetic radiation, the securing member is preferably sufficiently transparent to that radiation that the activation of the adhesive is not inhibited. Similarly, if the adhesive is activated by heat, the securing member preferably should not reflect  
10 heat.

The adhesive, or a precursor of the adhesive, can be applied to the securing member and/or to the engaging portion and/or to the frame member before the securing member is brought into contact with the engaging portion and the frame member. Additional adhesive, preferably the same adhesive which lies between the securing  
15 member and the engaging portion and the frame member, can be placed between the contacting surfaces of the engaging portion and the frame member.

The preferred size of the separate securing member will be related to the size of the surfaces to which it is to be bonded. Thus, it should be large enough to cover a sufficiently large area of each of the frame member and the engaging portion to ensure  
20 that it secures them together.

When the frame member (i) has a generally tubular portion having a closed cross-section and to open ends, and (ii) is placed around an engaging portion having substantially the same length as the tubular portion, the securing member preferably has dimensions which are substantially the same as, or just a little smaller  
25 than, the cross-section of the generally tubular portion; in this way the securing member adheres to the whole of the end of the engaging portion and all or most of the end surfaces of the tubular portion.

When the frame member (i) has a generally tubular portion having an open cross-section, one open end and one closed end, and (ii) is placed around an engaging  
30 portion having substantially the same length as the tubular portion, the securing member preferably has dimensions such that it contacts the exposed side of the

engaging portion and the adjacent exposed longitudinal sides of the tubular portion. If both ends of the generally tubular portion are open, then the securing member can in addition be secured to the end of the engaging portion and the adjacent exposed end surfaces of the tubular portion.

5 In order to assist in placing the securing member correctly, it can include a tab which extends from the periphery of the securing member and which is removed (e.g. by cutting or grinding) before the assembly is complete. Similarly, if any part of the securing member extends beyond the frame member and the engaging portion, it can be removed (e.g. by cutting or grinding) before the assembly is complete.

### 10 **The Second Preferred Aspect of the Invention.**

In a second preferred aspect, this invention provides an eyeglass frame assembly which comprises (1) an eyeglass lens comprising (i) a body portion having a periphery and (ii) an engaging portion which extends from the periphery of the body portion, (2) a frame member which is fitted to the engaging portion, and (3) a securing member which comprises a polymeric composition and which is melt bonded to the engaging portion and to the frame member. The term "melt bonded" is used in this specification to mean that the securing member is in intimate contact with the engaging portion and the frame member as a result of being contacted with the engaging portion and the frame member while the polymeric composition is at a temperature which enables it to be deformed. Many polymers melt over a range of temperature, and can, therefore, be deformed, at a temperature below the nominal "melting point" of the polymer, to enable the securing member to be melt bonded to the engaging portion and the frame member. Those skilled in the art will have no difficulty in recognizing when the desired result has been obtained, and in making use of temperatures which are high enough to provide the desired melt bond, but not so high as to damage the integrity of the bond between the securing member, the engaging portion and the frame member and/or the appearance of the assembly.

25 A first method of making an assembly according to the second preferred aspect of the invention comprises

- 30 (1) fitting the frame member to the engaging portion,

(2) after step (1), heating part of the engaging portion so that the heated part of the engaging portion can be deformed, and

(3) deforming the heated part of the engaging portion so that it bonds the frame member to the engaging portion.

5 A second method of making an assembly according to the second preferred aspect of the invention comprises

(1) fitting the frame member to the engaging portion,

(2) providing a separate securing member comprising a polymeric composition,

10 (3) applying the separate securing member to exposed surfaces of the frame member and the engaging portion,

(4) heating the securing member so that the polymeric composition can be deformed, and

15 (5) deforming the securing member so that it bonds the frame member to the engaging portion.

In the second method, the separate securing member comprises, and can consist of, the polymeric composition. It can, for example, be a simple sheet of, the polymeric composition, or it can include other components which add additional strength or an improved appearance to the securing member, and which do not substantially interfere with (and may enhance) the melt bonding of the securing member. The other component can for example be a reinforcing web of fibers at least partially surrounded by the polymeric composition. The fibers in the reinforcing web may for example be inorganic or be composed of a polymer composition such that the fibers retain their integrity while the securing member is being deformed. Alternatively or additionally, the securing member can have a continuous or discontinuous backing on the surface remote from the engaging portion and the frame member.

25 The polymeric composition in the separate securing member must be such that, after being deformed by heat in contact with the engaging portion and the frame member, it will melt bond the engaging portion to the frame member. In many cases, the part of the frame member which is fitted to the engaging portion is composed of metal or polymeric composition. In many cases, the lens and the engaging portion, are

composed of a polycarbonate or a polyurethane-polyurea(Trivex). In some embodiments, the polymeric composition in the securing member is the same as, or is based on the same type of polymer as, the polymeric composition of the lens. For example, a polycarbonate securing member can be used with a polycarbonate lens, and a polyurethane-polyurea securing member can be used with a polyurethane-polyurea (Trivex) lens. In other embodiments, the polymeric composition is based on polyethylene, an ethylene copolymer or another olefin polymer, or on an SCC polymer as described above.

#### **Optional Features of the First and Second Aspects of the Invention.**

(1) The engaging portion of the lens is preferably a member projecting from the periphery of the lens, so that the periphery of the lens is continuous and a wearer's field of vision is free of obstructions. However, the engaging portion can also be: –

(a) A member projecting from the front or back of the lens.

(b) A recess in the lens, the recess optionally having one or more of the following features.

(i) it extends through the thickness of the lens;

(ii) it extends from the back of the lens but not through the front of the lens;

(iii) it extends from the front of the lens but not through the back of the lens;

(iv) it is wholly within the lens, so that the periphery of the lens is continuous;

(v) it extends through the periphery of the lens, so that at most part of the periphery of the lens is continuous;

(vi) it extends through the periphery of the lens and does not interrupt the front or the back of the lens;

(vii) the periphery of the recess is smoothly curved, for example is in the shape of a circle or an oval;



(viii) the periphery of the recess comprises at least one straight section, and optionally at least one smoothly curved section, for example is in the shape of a regular polygon, e.g. a square, or a rectangle;

(ix) the recess includes a raised central portion; the height of the raised central portion can be less than, the same as, or greater than, the depth of the recess; the shape of the edge of the raised central portion can be the same as, or different from, the shape of the periphery of the recess; for example, the cross-section of the periphery can be a regular or irregular annulus.

(2) The body portion and the engaging portion of the lens are preferably monolithic, for example are produced by machining or otherwise shaping a block of optical material, for example a polycarbonate or like transparent polymeric material. Alternatively, the engaging portion comprises a member which is permanently secured (including welded) to the body portion and which projects from the periphery of the lens, which is preferred, or from the back or from the front of the lens.

(3) The engaging portion and/or the frame member comprises at least one physical feature which assists in placing them in a desired position relative to each other, for example features which permit sliding contact in one dimension only, and/or which prevent relative rotation of the engaging portion and the frame member when they are in a desired position relative to each other. For example, the engaging portion can have a generally rectangular cross-section, and the part of the frame member which is fitted to the engaging portion can have a terminal portion which fits slidably over the engaging portion.

(4) One or more of the engaging portion, the frame member and the securing member can include physical and/or compositional features which make it easier to assemble and disassemble the assembly. In some exemplary embodiments, one or more of the engaging portion, the frame member and the securing member can include apertures, e.g. channels, through which fluids, e.g. heated liquids or gases, can contact the engaging portion and/or the frame member and/or the securing member. In other exemplary embodiments, the engaging portion and/or the frame member is constructed

of a material which is relatively transparent to electromagnetic or ultrasonic radiation or which is a good conductor of heat.

(5) The frame member is fitted to the engaging portion on the eyeglass lens. For this purpose, the frame member preferably comprises a terminal portion having dimensions such that it can be closely fitted to the engaging portion. Many different engaging portions and corresponding terminal portions are disclosed in the documents incorporated by reference. However, as noted above, the engaging portion of the lens preferably projects from the periphery of lens, in which case the frame member preferably comprises a generally tubular portion which fits over the engaging portion. In many cases, the engaging portion has a generally rectangular (including square) cross-section, and the terminal portion of the frame member is open at both ends and has a corresponding generally rectangular tubular cross-section. The tubular portion preferably has a closed cross-section so that it fits completely around the engaging portion, but the invention includes the possibility that the tubular portion has at least one side which is incomplete, or which is completely missing so that the tubular cross-section has only three sides.

### **The Drawings.**

In the drawings,

1 denotes an eyeglass lens,

11 denotes an engaging portion extending from the periphery of the lens, and part of which, denoted 12, is exposed in some of the Figures,

2 denotes the terminal tubular portion of a frame member, the remainder of which is not shown,

3 denotes a laminar securing member which is coated with adhesive (not shown) on the surface facing the lens,

32 denotes a tab on the securing member to assist the correct placing of the securing member,

4 denotes a polymeric securing member which is melt bonded to the engaging portion and to the tubular portion of the frame member,

41 denotes a precursor for a polymeric securing member,

7 denotes a tool having a handle 71 and a terminal portion 72 which can be heated to a controlled temperature and which is shaped so that it fits over, heats and deforms an exposed part 12 of an engaging member 11, and thus creates a polymeric securing member 4 which is melt bonded to the engaging portion and the frame member, and

8 denotes a tool having a handle 81, and a terminal portion 82 which carries a precursor 41 for a polymeric securing member which the tool can deliver to a surface comprising part of the engaging portion 11 and part of the tubular portion 2, and can heat and deform the delivered precursor to create a polymeric securing member which is melt bonded to the engaging portion and the frame member.

#### Example 1.

This Example is an example of the first aspect of the invention. The lens was composed of a polycarbonate composition and had a monolithic engaging portion extending from the periphery of the body portion of the lens. The engaging portion extended about 4 mm from the periphery of the lens, had a dimension parallel to the plane of the lens of about 3 mm, and a dimension at right angles to the plane of the lens of about 1.6 mm. The frame member was made of metal and had a generally tubular terminal portion having a closed cross-section and open ends, and a length which was the same as the length of the engaging portion. The terminal portion was fitted over the engaging portion, so that the exposed face of the engaging portion and the outer faces of the terminal portion were in the same plane, as generally shown in Figures 4 and 5. A sheet of a polycarbonate composition having the same dimensions as the outer periphery of the terminal tubular portion was prepared for use as the securing member. One face of the sheet was coated with an adhesive precursor available from Dimax Corporation under the trade name Ultra Light-Weld 3094 series which can be converted into an adhesive by exposure to ultraviolet light. The adhesive-coated face of the sheet was held in contact with the exposed face of the engaging portion and the outer faces of the terminal portion, and exposed

to ultraviolet light, thus curing the adhesive. After the adhesive had cured, frame member could not be separated from the lens by manual forces. When the engaging portion, frame member and securing member were heated by putting them in a bath of glass beads heated to about 100°C, they could be separated by manual forces, leaving the engaging portion attached to the lens. The lens, therefore, could be reused (for example after re-polishing) in accordance with the present invention or in accordance with one of the other methods disclosed in the documents incorporated by reference herein.

#### Example 2.

This Example is an example of the second aspect of the invention. The lens was composed of a polycarbonate composition and had a monolithic engaging portion extending from the periphery of the body portion of the lens. The engaging portion extended about 4 mm from the periphery of the lens, had a dimension parallel to the plane of the lens of about 3 mm, and a dimension at right angles to the plane of the lens of about 1.6 mm. The frame member was made of metal and had a generally tubular terminal portion having a closed cross-section and open ends, and a length which was less than the length of the engaging portion. The terminal portion was fitted over the engaging portion, so that about 1.5 mm of the engaging portion was exposed beyond the tubular terminal portion, as generally shown in Figures 13 and 14. A small iron heated to about 150°C was pressed against the exposed end of the engaging portion, which deformed and spread out over the end of the tubular terminal portion. After cooling, the frame member could not be separated from the lens by manual forces. When the bonded engaging portion and frame member were heated by putting them in a bath of glass beads heated to about 150°C, they could be separated by manual forces, leaving the residue of the engaging portion attached to the lens.

## CLAIMS

1. An assembly which comprises
- (1) an eyeglass lens comprising (i) a body portion having a periphery and (ii) an engaging portion at the periphery of the body portion, and
- (2) a frame member which is fitted to the engaging portion, and
- (3) a securing member which (i) is bonded to (a) the engaging portion and (b) surfaces of the frame member which, in the absence of the securing member, are exposed to the atmosphere, and (ii) maintains a fixed relationship between the engaging portion and the frame member.
2. An assembly according to claim 1 wherein (i) the engaging portion of the lens extends from the periphery of the body portion of the lens and (ii) the frame member has a generally tubular portion which fits around at least part of the engaging portion.
3. An assembly according to claim 2 wherein
- (i) the generally tubular portion of the frame member (a) has a closed cross-section and open ends, and (b) extends completely around the engaging portion, and
- (ii) the securing member is bonded to outer surfaces of the engaging portion and of the frame member.
4. An assembly according to claim 2 wherein
- (i) the generally tubular portion of the frame member (a) has an open cross-section, and (b) extends around part of the engaging portion, and
- (ii) the securing member is bonded to outer surfaces of the engaging portion and of the frame member.
5. An assembly according to claim 3 or 4 wherein the securing member (i) is separate from the engaging portion and the frame member and (ii) is bonded to the engaging portion and to the frame member by an adhesive.

6. An assembly according to claim 4 or 5 wherein the adhesive is a removable bonding adhesive (RBA) which

(i) under typical conditions of use of the assembly maintains the fixed relationship between the engaging portion and the frame member, and

(ii) under selected atypical ambient conditions, undergoes a reduction in adhesive strength which permits the engaging portion and the frame member to be separated from each other by pulling them apart manually.

7. An assembly according to any of claims 2-4 wherein the securing member comprises a polymeric composition which is melt bonded to the engaging portion and to the frame member.

8. An assembly according to claim 7 wherein the securing member and the engaging portion are monolithic, the securing member having been produced by melting the engaging portion.

9. An assembly according to claim 7 wherein the securing member is distinct from the engaging portion.

10. An assembly according to claim 9 wherein the polymeric composition comprises a polycarbonate.

11. An assembly according to claim 9 wherein the polymeric composition comprises a side chain crystalline polymer.

12. An assembly according to claim 11 wherein the side chain crystalline polymer is cross-linked.

13. An assembly according to any of claims 8-13 wherein the securing member

- (i) under typical conditions of use of the assembly maintains the fixed relationship between the engaging portion and the frame member, and
- (ii) under selected atypical ambient conditions, undergoes a reduction in strength which permits the engaging portion and the frame member to be separated from each other by pulling them apart manually.

14 An assembly according to claim 6 or claim 13 wherein the selected atypical ambient conditions comprise heating the securing member.

15. An assembly according to any of the preceding claims wherein the securing member (i) comprises a polymeric composition and (ii) is the sole means for maintaining the fixed relationship between the engaging portion and the frame member.

16. An assembly according to claim 4 wherein there is an adhesive which (i) lies between adjacent surfaces of the engaging portion and the frame member, and (ii) is the same as the adhesive which bonds the securing member to the engaging portion and the frame member.

17. A method of making an assembly according to any of the preceding claims which comprises

- (1) fitting the frame member to the engaging portion, and
- (2) bonding the securing member to the frame member and the engaging portion.

18. A method according to claim 17 which comprises

- (1) providing an eyeglass lens comprising (i) a body portion and a periphery, and (ii) an engaging portion which extends from the periphery of lens, the engaging part having a proximal portion adjacent to the lens and a distal part remote from the lens;
- (2) providing a frame member having a generally tubular terminal portion which has a closed cross-section and is open at both ends;

(3) fitting the generally tubular terminal portion around the proximal part of the engaging portion so that the distal part of the engaging portion is not surrounded by the generally tubular terminal portion; and

(3) heating and deforming the distal part of the engaging portion to form the securing member.

19. A method according to claim 18 which comprises

(1) providing an eyeglass lens comprising (i) a body portion and a periphery, and (ii) an engaging portion which extends from the periphery of lens;

(2) providing a frame member having a generally tubular terminal portion;

(3) fitting the generally tubular terminal portion around the engaging portion so that outer surfaces of the engaging portion and outer surfaces of the generally tubular terminal portion are exposed;

(4) providing a securing member which comprises a polymeric composition;

(5) placing the securing member adjacent the exposed surfaces of the engaging portion and the generally tubular terminal portion; and

(6) heating the securing member so that it is melt-bonded to said exposed surfaces.

20. A method according to claim 19 wherein the exposed surfaces lie in a plane.

21. A method according to claim 19 or 20 wherein

(i) the generally tubular portion of the frame member (a) has a closed cross-section and open ends, and (b) extends completely around the engaging portion, and

(ii) the securing member is bonded to said exposed surfaces.

22. A method according to claim 19 or 20 wherein

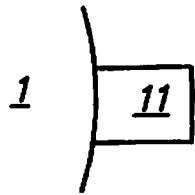
(i) the generally tubular portion of the frame member (a) has an open cross-section, and (b) extends around only part of the engaging portion, and

(ii) the securing member is bonded to said exposed surfaces.

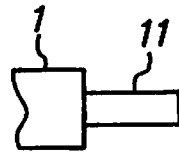


23. A method according to any of claims 19-22 which comprises
- (A) providing, between the securing member and said exposed surfaces, a precursor which can be converted into an effective adhesive by exposure to heat and/or electromagnetic radiation; and
- (B) bonding the securing member and said exposed surfaces by exposing the precursor to conditions which convert the precursor into an adhesive.
24. A method of disassembling an assembly according to claim 7 or claim 14 which comprises subjecting the assembly to atypical ambient conditions, and separating the engaging portion and the frame member by pulling them apart manually.

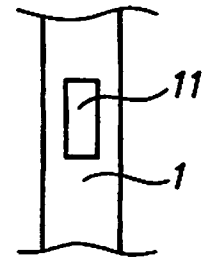
1/2



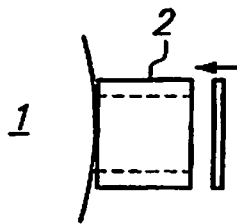
**FIG. 1**



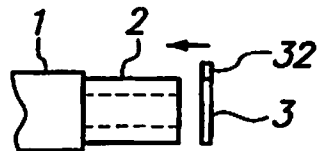
**FIG. 2**



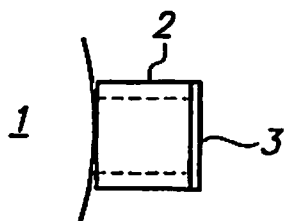
**FIG. 3**



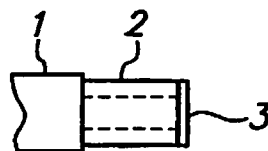
**FIG. 4**



**FIG. 5**

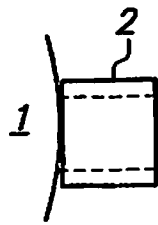


**FIG. 6**

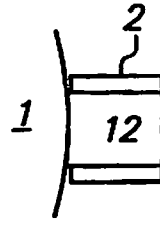


**FIG. 7**

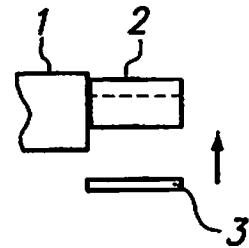
2/2



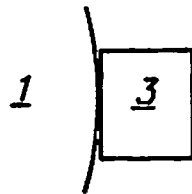
**FIG. 8**



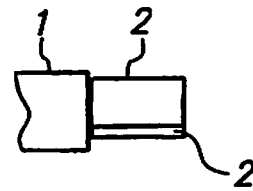
**FIG. 9**



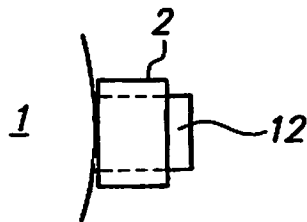
**FIG. 10**



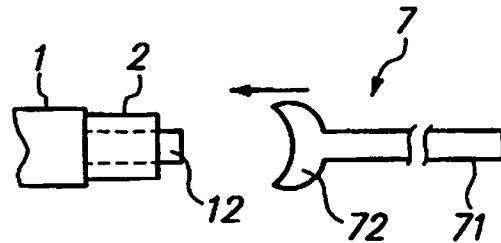
**FIG. 11**



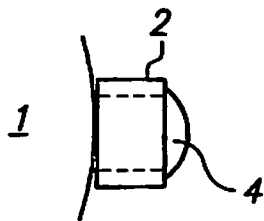
**FIG. 12**



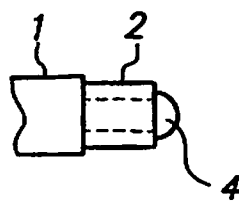
**FIG. 13**



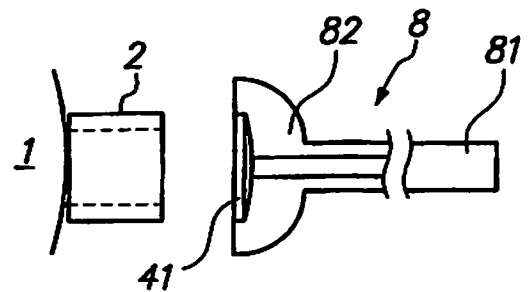
**FIG. 14**



**FIG. 15**



**FIG. 16**



**FIG. 17**

## INTERNATIONAL SEARCH REPORT

International application No  
PCT/US2014/018808

## A. CLASSIFICATION OF SUBJECT MATTER

INV. G02C1/02 G02C5/02 G02C5/10 G02C13/00  
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)  
G02C

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

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	WO 2007/044221 A2 (BETA FRAMES LLC [US]; KRUMME JOHN J [US]; ZIDER ROBERT B [US]; PLOUGH) 19 April 2007 (2007-04-19) cited in the application the whole document	1,2,5,6, 14-17,24
X	DE 10 2006 017090 A1 (BOBBERT ELENA [DE]) 11 October 2007 (2007-10-11)	1
Y	the whole document	2-4
X	FR 2 828 744 A1 (ATELIER BARK SERVICES ABS [FR]) 21 February 2003 (2003-02-21) abstract; figures	1
Y	US 6 394 599 B1 (BLANVILLAIN ERIC HENRI EUGENE [FR]) 28 May 2002 (2002-05-28) cited in the application abstract; figures	2,4
	- / - -	



Further documents are listed in the continuation of Box C.



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

13 May 2014

Date of mailing of the international search report

04/08/2014

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

Windecker, Robert

## INTERNATIONAL SEARCH REPORT

International application No

PCT/US2014/018808

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	WO 2010/039176 A1 (BETA GROUP LLC [US]; ZIDER ROBERT B [US]; KRUMME JOHN J; THOMPSON BRIAN) 8 April 2010 (2010-04-08) cited in the application abstract; figures -----	2,3

# INTERNATIONAL SEARCH REPORT

International application No.  
PCT/US2014/018808

## Box No. II Observations where certain claims were found unsearchable (Continuation of item 2 of first sheet)

This international search report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claims Nos.:  
because they relate to subject matter not required to be searched by this Authority, namely:
2. ☐ Claims Nos.:  
because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:
3. ☐ Claims Nos.:  
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

## Box No. III Observations where unity of invention is lacking (Continuation of item 3 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

see additional sheet

1. ☐ As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims.
2. ☐ As all searchable claims could be searched without effort justifying an additional fees, this Authority did not invite payment of additional fees.
3. ☐ As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.:
4. ☒ No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

1-6, 16(completely); 14, 15, 17, 24(partially)

### Remark on Protest

- ☐ The additional search fees were accompanied by the applicant's protest and, where applicable, the payment of a protest fee.
- ☐ The additional search fees were accompanied by the applicant's protest but the applicable protest fee was not paid within the time limit specified in the invitation.
- ☐ No protest accompanied the payment of additional search fees.

# INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/US2014/018808

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
WO 2007044221 A2	19-04-2007	EP 1932054 A2	18-06-2008
		EP 2544041 A2	09-01-2013
		US 2010290000 A1	18-11-2010
		WO 2007044221 A2	19-04-2007
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DE 102006017090 A1	11-10-2007	NONE	
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FR 2828744 A1	21-02-2003	NONE	
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US 6394599 B1	28-05-2002	EP 1083456 A1	14-03-2001
		FR 2799009 A1	30-03-2001
		US 6394599 B1	28-05-2002
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WO 2010039176 A1	08-04-2010	EP 2342598 A1	13-07-2011
		US 2011187987 A1	04-08-2011
		WO 2010039176 A1	08-04-2010
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**FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210**

This International Searching Authority found multiple (groups of) inventions in this international application, as follows:

1. claims: 1-6, 16(completely); 14, 15, 17, 24(partially)

An assembly and a method of making an assembly with an eyeglass lens comprising a body portion and a periphery with an engaging portion, a frame member, and a securing member bonded to the frame member and the engaging portion wherein the securing member is an adhesive.

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2. claims: 7-13, 18-23(completely); 14, 15, 17, 24(partially)

An assembly and a method of making an assembly with an eyeglass lens comprising a body portion and a periphery with an engaging portion, a frame member, and a securing member bonded to the frame member and the engaging portion wherein the securing member comprises a polymeric composition which is melt bonded.

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