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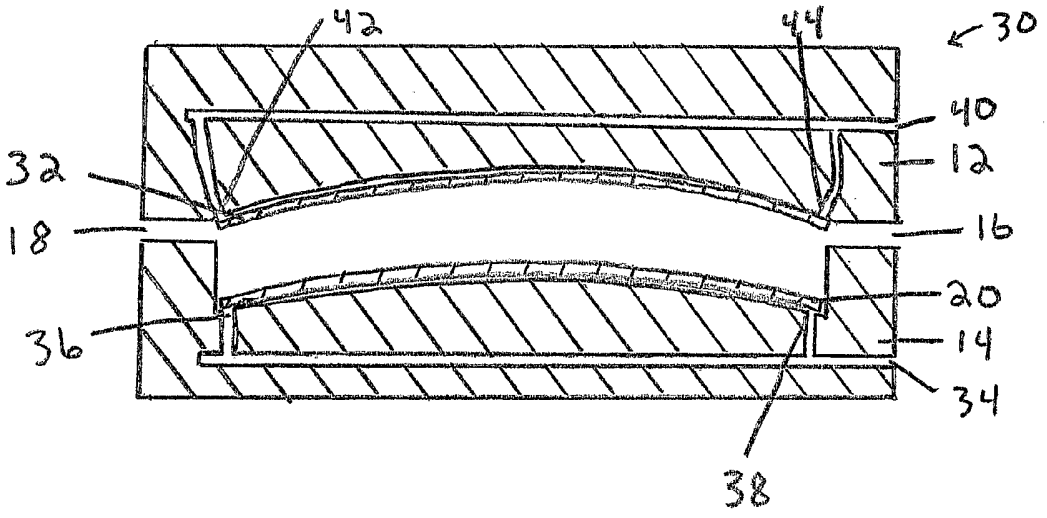
(54) Title: MOLDED-IN FILMS FOR SPECTACLE LENSES



(57) Abstract: Injection molding of a lens material behind and/or in front of films is described. The films may be of any desired thickness and are pre-inserted into a mold to produce a finished spectacle lens. The films may have been treated or may be configured to offer properties such various tints, abrasion resistance, chemical resistance, weathering, ultra-violet degradation resistance, antifog, polarization, photochromicity, anti-glare, anti-reflection, electrostatic discharge and static dissipation.

WO 2005/123370 A1

MOLDED-IN FILMS FOR SPECTACLE LENSES

BACKGROUND

[0001] The present disclosure describes a novel molded-in film spectacle lens and a method for providing molded-in films for spectacle lenses.

[0002] Conventional methods of coating lenses include applying coatings to a lens via a dipping procedure or deposition (e.g., vacuum deposition) of coatings on lens surfaces.

[0003] Plastic spectacle lenses are commonly injection molded with an optically clear material. Lenses may then undergo various secondary operations, such as dip and/or vacuum deposited coatings to impart to them desirable properties, such as abrasion resistance, chemical resistance, anti-fogging capability, polarization and photochromicity.

[0004] There is a need in the art for more efficient methods of forming lens and film composites.

SUMMARY

[0005] The presently described apparatus and method alleviates the deficiencies of the prior art by providing an efficient procedure for injection molding of a lens material behind and/or in front of films of any desired thickness that have been pre-inserted into a mold to produce a finished spectacle lens. In one embodiment, the lens material is an optically clear material, such as polycarbonate.

[0006] The films may have been treated or configured to offer properties, including but not limited to offering: various tints, abrasion resistance, chemical resistance, weathering, ultra-violet degradation resistance, antifog, polarization, photochromicity, anti-glare, anti-reflection, electrostatic discharge and static dissipation.

[0007] Accordingly, the present disclosure provides a molded spectacle lens in the same injection tool or mold with built-in property enhancements without the need for expensive secondary treatments.

[0008] The above-discussed and other features and advantages of the apparatus and method will be appreciated and understood by those skilled in the art from the following drawings and detailed description.

BRIEF DESCRIPTION OF THE DRAWINGS

[0009] Referring now to the drawings, wherein like elements are numbered alike in the several FIGURES:

[0010] FIGURE 1 illustrates an exemplary injection molded composite lens provided within an injection mold; and

[0011] FIGURE 2 illustrates an exemplary injection mold for molding in multiple films.

DETAILED DESCRIPTION OF EXEMPLARY EMBODIMENTS

[0012] Reference will now be made in detail to exemplary embodiments, examples of which are illustrated in the accompanying drawings.

[0013] Referring now to FIGURE 1, the presently described injection molding of a lens material behind and/or in front of films is illustrated generally at 10. The illustrated injection mold has a top 12 and a bottom 14 mold portion. When placed together, injection inlets and outlets may be seen at 16 and 18. A film is illustrated in place within the mold at 20, and injected lens material is illustrated at 22.

[0014] The film 20 may be of any desired thickness. It is pre-inserted into the mold, and lens material is injected into the mold to produce a finished lens. In one embodiment, the lens material is an optically clear material, such as polycarbonate. However, the lens material may be any suitable material, as is known in the art of injection molding lenses.

[0015] The films may have been treated or may be configured to offer properties such various tints, abrasion resistance, chemical resistance, weathering, ultra-violet degradation resistance, antifog, polarization, photochromicity, anti-glare, anti-reflection, electrostatic discharge and static dissipation.

[0016] The films may be cold-formed, pressure formed, or thermoformed to reproduce the shape of the spectacle lens. One or more films are placed in an injection mold and may be

held in place by vacuum, mechanical or some other means. Such mechanical means may include, but are not limited to, adhesives, e.g., applied along an edge and configured to release the film or degrade during or subsequent to the injection molding process, spring tabs, e.g., configured to engage one or more edges of the shaped film, or a friction fit aspect or cavity within the mold configured to receive the shaped film. The films may be placed in the mold manually or automatically (e.g., robotically). The lens material bonds with the pre-formed insert(s) within the mold during the molding cycle.

[0017] Accordingly, the present disclosure provides a molded spectacle lens in the same injection tool or mold with built-in property enhancements without the need for expensive secondary treatments. One or many films may be used in the same lens forming process.

[0018] Referring now to FIGURE 2, another exemplary embodiment of the mold including inserts is illustrated generally at 30. In such embodiment, a lower film 20 and an upper film 32 is positioned within the mold 30. The lower film 20 is positioned on the bottom mold portion 14. The lower film is securely positioned in place by action of a vacuum line 34. In the illustrated exemplary embodiment, the vacuum line 34 holds the film 20 in position at a plurality of locations 36, 38. These locations may be central to the lens, or as illustrated, may be provided at positions around the peripery of the film 20.

[0019] Referring still to FIGURE 2, upper film 32 may similary be held in position by vacuum line 40. In the illustrated exemplary embodiment, the vacuum line 40 holds the film 32 in position at a plurality of locations 42, 44. The upper mold portion 12 may also include an indent (similar to that shown for the lower mold portion 14, however, as long as such indent is deep enough to seat at least a portion of the width of the upper film) to facilitate in positioning of the film prior to or concurrent with application of the vacuum.

[0020] In another exemplary embodiment, an automated process for production of a molded-in film lens is provided. In such exemplary embodiment, a film is cold-formed, pressure-formed or thermoformed into a shape corresponding to an aspect of the spectacle lens to be produced (e.g. to the shape of the front or back of the lens to be produced). The film-forming process may comprise an automated process, whereby the shaped film is output from the forming process. A machine (e.g., robotic arm) then moves such shaped film to the mold and positions

the film in proper location within the mold. Where multiple films are to be placed within the mold, the same machine or a duplicate machine (e.g., an arm on the opposite side of the mold) may place the additional film(s) in position within the mold. Also, where a vacuum source is utilized to hold such film(s) in place, the timing of application of the vacuum to the film(s) may be coordinated such that upon or immediately subsequent to such positioning, the vacuum source is applied to the film(s).

[0021] In such exemplary procedure, the lens material may be injected into the mold once the film(s) are in place, and a lens produced by the injection molding of the lens material onto the film(s) may be ejected from the mold.

[0022] It will be apparent to those skilled in the art that, while exemplary embodiments have been shown and described, various modifications and variations can be made to the present apparatus and method disclosed herein without departing from the spirit or scope of the invention. Accordingly, it is to be understood that the various embodiments have been described by way of illustration and not limitation.

[0023] What is claimed is:

CLAIMS

1. A method for producing a molded-in film spectacle lens, comprising:

providing a film formed into a shape corresponding to an aspect of the spectacle lens to be produced;

positioning said film in a portion of an injection molding cavity; and

injecting lens material in front of or behind said positioned film in an injection molding process to produce a spectacle lens having a molded-in film.

2. A method in accordance with claim 1, wherein said film is secured in place adjacent a portion of the mold by application of a vacuum.

3. A method in accordance with claim 2, wherein said vacuum is applied to multiple portions of said film to secure said film in place prior to injecting lens material into said mold.

4. A method in accordance with claim 1, wherein said film is guided into proper position by virtue of an indent in said mold corresponding to at least an aspect of said film.

5. A method in accordance with claim 4, wherein said indent is deep enough to accept at least a portion of the width of said film.

6. A method in accordance with claim 1, further comprising positioning a second film, formed into a shape corresponding to an aspect of the spectacle lens to be produced, adjacent a second portion of an injection molding cavity.

7. A method in accordance with claim 6, wherein said second film is secured in place adjacent said second portion of said mold by application of a vacuum.

8. A method in accordance with claim 1, wherein said positioning of said film comprises at least part of an automated lens production system, wherein a supply of films, formed into a shape corresponding to an aspect of the spectacle lens to be produced, are positioned by at least one machine within said mold, wherein said lens material is injected into said mold in an injection molding process, and wherein said molded-in film lens is ejected or automatically removed from the mold such that the process may be automatically repeated.

9. A method in accordance with claim 8, wherein a robotic arm is used to select a film from said supply of films and to place said film in position within said mold.

10. A method in accordance with claim 8, wherein a second film, automatically selected from a supply of films formed into a shape corresponding to an aspect of the spectacle lens to be produced, is automatically positioned adjacent a second portion of an injection molding cavity.

11. A method in accordance with claim 8, wherein concurrent with the positioning of said film, or immediately subsequent to positioning of said film, a vacuum is applied to at least a portion of said film to secure said film in place within said mold.

12. A method in accordance with claim 10, wherein concurrent with the positionings of said film and said second film, or immediately subsequent to positionings of said film and said second film, respectively, a vacuum is applied to at least a portion of said film and said second film to secure said film and said second film in place within said mold.

13. A method in accordance with claim 12, wherein said vacuum is applied to at least one portion on the periperies of said films to hold said films in place for said injection molding process.

14. A method in accordance with claim 13, wherein said vacuum is applied to multiple portions on the periperies of said films to hold said films in place for said injection molding process.

15. A method in accordance with claim 1, wherein said film is cold-formed, pressure formed, or thermoformed.

16. A method in accordance with claim 1, wherein said film is treated or is configured to offer properties such various tints, abrasion resistance, chemical resistance, weathering, ultra-violet degradation resistance, antifog, polarization, photochromicity, anti-glare, anti-reflection, electrostatic discharge and static dissipation.

17. A method in accordance with claim 1, wherein said film is a polycarbonate.

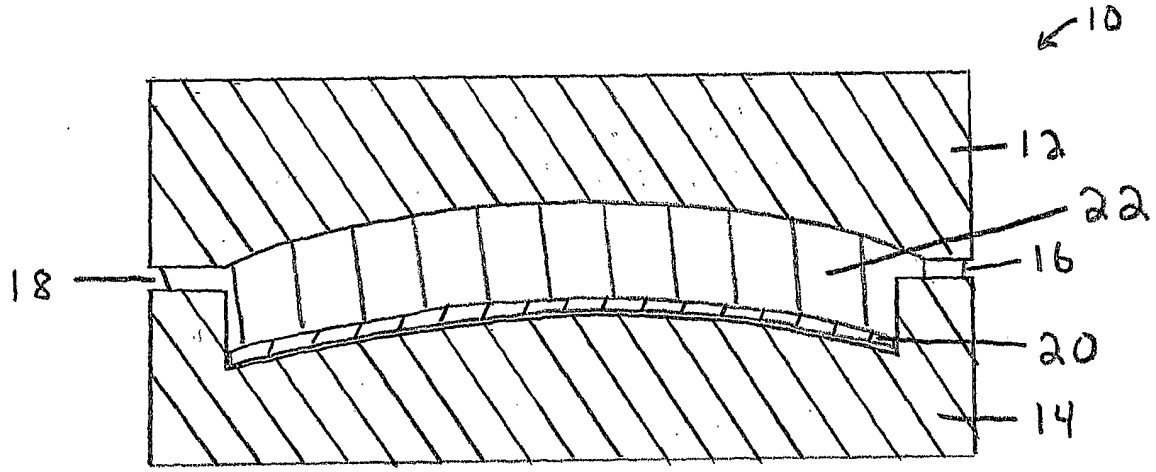


FIG..1

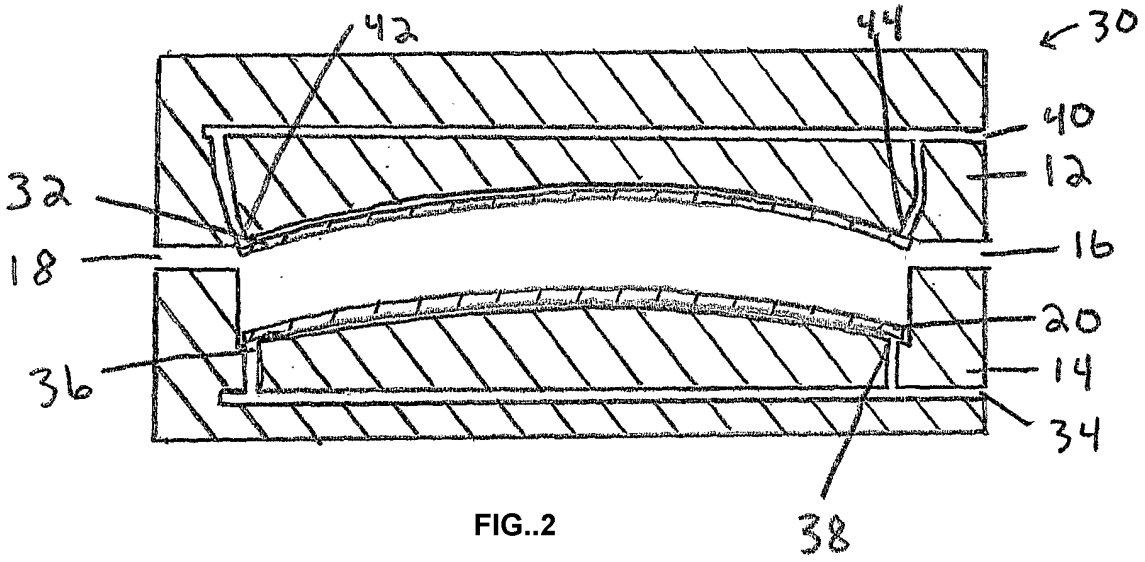


FIG..2

INTERNATIONAL SEARCH REPORT

International Application No
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A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 B29D11/00 B29C45/14

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)
IPC 7 B29D

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 practical, search terms used)
EPO-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

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X	US 6 491 851 B1 (KELLER GERHARD ET AL) 10 December 2002 (2002-12-10) claim 19	1-17

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[X] Further documents are listed in the continuation of box C.

[X] Patent family members are listed in annex.

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"A" document defining the general state of the art which is not considered to be of particular relevance

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"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
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Name and mailing address of the ISA	Authorized officer
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INTERNATIONAL SEARCH REPORT

International Application No
PCT/US2005/020329

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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