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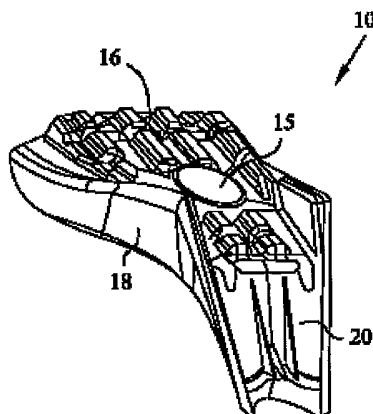
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(54) Title: METHOD FOR ASSEMBLING ARTICLES



(57) Abstract: Methods and tools for assembling an article are provided. The method includes providing a mold (24) having a cavity (28) configured as a desired shape (46), positioning a base (12) within the mold so that a surface of the base material is exposed, applying a coating material (48), e.g., urethane or polyurethane, to substantially cover both the exposed surface of the base (12) and an inner surface of the cavity (28), depositing a cushion material (18) into the cavity (28) and sealing the cavity (28) with the exposed surface of the base (12) so that the coating material (48) forms a skin around the cushion material (18) and adheres the cushion material (18) to the base (12).

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METHOD FOR ASSEMBLING ARTICLES

TECHNICAL FIELD

5 The invention provides methods and tools for assembling articles, e.g., seats for vehicles.

BACKGROUND ART

Recreational vehicles, such as all-terrain vehicles, personal watercraft, snowmobiles, and motorcycles are generally provided with seats having a cushion
10 material attached to a seat base. The cushion material is generally surrounded by a protective coating, e.g., a waterproof coating. Vehicle seats are often made by assembling separately produced components such as the seat base, cushion material, protective cover and one or more fastening components. A piece of cushion material is often separately manufactured and then covered with a piece of protective material
15 such as vinyl or leather. A portion of the protective cover is then stapled, stitched, screwed, glued or attached using any other fastening component to a seat base. If an emblem is desired, it is often stitched onto the protective cover. The stitches, staples and other such fastening components create holes in the cover. Recreational vehicles are often exposed to moisture, e.g., water and snow and this moisture often seeps
20 through the holes in the protective cover, causing the cushion material to mildew. The moisture also degrades the fastening components, e.g., by corroding the staples, stitches, screws or other fasteners or reducing the adhesiveness of an exposed glue. Thus, it is desirable to have a method of assembling seat components that does not require fastening components.

25 This type of assembly process also tends to be very labor intensive. First, each part of the seat must be separately manufactured and/or provided. Then, a laborer must assemble the seat by putting all of the parts together. Some laborers are often more skilled than other laborers, so the quality of the finished seat often varies depending on the skill of the laborer. It would also be desirable to provide a more

standardized assembly process which is less labor intensive and more repeatable from a quality standpoint.

Assembly processes of this nature are also very costly, since several parts must be manufactured or in some cases, purchased from another source.

5 Additionally, laborers must be compensated for their time and skill in assembling seats. Thus, it would also be desirable to provide an assembly process which has reduced costs.

DISCLOSURE OF INVENTION

Methods and tools for assembling an article, e.g. a seat for a vehicle are

10 provided. The improved method provides several advantages. For example, the method provides a more simplified process wherein fewer components such as staples and protective covers are needed. The method also reduces the labor needed, e.g., by eliminating the need for assembling several components in several steps. The method also standardizes the assembly process, thereby ensuring that the quality of the

15 finished article is more repeatable and does not depend on the skill of the laborer. Thus, the improved method substantially reduces the chance of operator error and allows for the articles to be produced on a larger scale.

An article is also provided having a base and a cushion material, wherein the cushion material has an outer protective covering of a coating material and the base

20 and cushion material are adhered together by a layer of coating material. Methods and tools for making such articles are also provided. In preferred embodiments, the coating material comprises urethane and polyurethane. A variety of urethanes and polyurethanes are suitable for use with the invention. In some cases, an aromatic polyurethane is used. In other cases, an aliphatic polyurethane is used. One suitable

25 aromatic polyurethane that works particularly well is distributed by BASF Corporation, a company based in Florham Park, New Jersey and is available under the product number NB#19747-5-54 titled "Spray Aromatic Urethane Elastomer Skin for Non-Automotive Seating Applications". Another suitable urethane for adhering the

base and cushion is distributed by Lord Corporation, a company based in Cary, North Carolina and is available under the product number 7542 A/B.

In certain embodiments, an article, e.g., a seat, having a base and a cushion material is provided. The base can be any substrate upon which a cushion material is to be attached. In some cases, the cushion material includes an inner breathable cavity. The cushion material is itself adhered to the base by a layer of coating material and is also covered or lined with a protective layer of coating material. The layer of coating material covering the outer surface of the cushion material functions to protect and seal the cushion material. The layer is also waterproof, thereby giving the cushion material waterproof protection.

In certain embodiments, the article comprises a seat for a recreational vehicle, e.g., an all-terrain vehicle, a motorcycle, a moped, a scooter, a utility vehicle, a snowmobile or a personal watercraft. The seat includes a seat base having a top surface adhered to a cushion material via a layer of coating material and a bottom surface being configured to be mounted on a seating area of a vehicle. A layer of coating material also covers and protects the outer surface of the cushion material. In some cases, the coating material cover displays a desired texture, one or more emblems, colors or other visible features. More than one layer of coating material can also be used, e.g., wherein one layer forms a protective surface and one or more other layers are placed over such protective surface and include the desired texture, emblems or other features. In certain cases, the features are selected from the group consisting of decals, fabrics, vinyls, leathers, rubbers and paints.

Molds for producing an article are also provided. The mold includes a hollow cavity configured as a desired shape. For example, a mold for assembling a vehicle seat can be provided having a cavity shaped for producing a desired seat, e.g., a motorcycle seat, an ATV seat and the like. The hollow cavity has an opening which is generally smaller in cross-sectional area than the hollow interior. The opening is configured for receiving a lid, which seals the opening and also the cavity. The lid can be provided as part of the mold itself, e.g., being attached to the mold near the opening of the cavity via a hinged connection or the lid can be provided separately.

Certain molds can be provided for shaping the cushion material where as others are provided for adhering the cushion material to a base. In some cases, the mold is configured for shaping the cushion material and receives a lid which imparts a desired shape or design to the top of the cavity. In some cases, the underside of the lid imparts a desired shape into the cavity. The lid can also include a downwardly extending protrusion which imparts a desired shape to the closed cavity when the lid is in place. In some cases, the lid underside has the same properties of the top portion of a desired seat base and imparts a shape having that profile into the top of the cavity. In other cases, the lid underside has the same profile as the top portion of a desired seat base and further includes a protrusion which imparts a space or groove into the cushion for forming a breathable cavity. When the cushion material is deposited into the cavity and the lid is closed, it will be formed to have a shape having the profile of the top portion of a desired seat base, so the top portion can later be mated with the cushion material.

In other cases, the mold receives a base, e.g. seat base, within the cavity. A cushion material can either be shaped in a previous shaping cavity or it can be shaped in the cavity receiving the base. When the cushion material is formed in a previous cavity, the pre-formed cushion material is inserted into the cavity and a layer of coating material is deposited on either the exposed top surface of the cushion material or the bottom surface of the base. The base is then inserted into the cavity so that the top surface is in contact with the layer of coating material and the cavity is closed. The layer of coating material adheres the top surface of the base to the cushion material. The completed article is then removed from the mold. In some cases, the pre-formed cushion material can be placed into a fixture, and then the base can be adhered to the cushion material through a layer or bead of coating material. Thus, the step of adhering the cushion material to a seat base need not always be done by using a mold.

When the cushion material is formed in the cavity receiving the base, the interior surface of the cavity can be lined with a layer of coating material and then a cushion material, e.g., an expandable foam, can be deposited into the cavity. A layer or a bead of coating material can also be deposited onto the top surface of the base,

which is affixed to the lid. The lid is then placed over the cavity opening so that the base is inside of the cavity. The expandable foam expands to the volume of the cavity and also adheres to the layers of coating material lining the cavity and the top surface of the base. Thus, the foam adheres to the top surface of the base. In some cases, the coating material applied to the interior surface of the cavity so that the coating material seals and protects the cushion material. In other cases, the coating material is not applied to the interior cavity but is applied only to adhere the cushion material to the base. In most cases, the coating material is applied so that it both seals and protects the cushion material and also adheres the cushion material to the base. The completed article is then removed from the mold.

In other embodiments, a system including a series of molds for producing articles is provided. In such a system, at least one mold is configured for shaping a cushion material and at least one mold is configured for attaching a base to the cushion material. In certain embodiments, the system includes a primary mold and a secondary mold. The primary mold shapes and forms the cushion material, which is then transferred to a secondary mold, which attaches the cushion material to a base. The primary mold has an opening which is smaller in cross-sectional area than the opening of the secondary mold. Also, the primary mold is adapted for receiving a lid having a shaped underside and/or a downwardly extending protrusion wherein the secondary mold is adapted for receiving a base inside of the cavity. The wider opening of the secondary mold is generally provided so that a base material can easily be positioned inside of the cavity. Once the base is in place, the secondary mold is sealed with a lid so the base and cushion material adhere together. In some cases, the cushion material and attached base are removed from the secondary mold and placed in another mold which is configured for applying an additional layer of coating material which includes desired textures, emblems, colors and other visible features.

In some embodiments, an assembly tool is provided for producing an article. The tool includes a mold having a cavity configured as a desired shape. The tool also provides a lid for sealing the cavity. In certain cases, the tool has two portions, a first portion and a second portion, which are adapted to be closed against one another. In some cases, the first portion and second portion are connected together, e.g., by one or

more hinges, so that they can be pivoted against one another and closed. When closed together, the portions form a rectangular structure or locked box. However, the closed tool can form any other suitable structure as well.

5 In some cases, the second portion includes a cavity for shaping a cushion material and the first portion includes a lid which closes against the opening of the cavity and seals it shut. The lid includes a downwardly extending protrusion which extends into the cavity when the two portions are closed together. This protrusion imparts a shape into the cavity.

10 In other cases, the second portion includes a cavity configured for receiving and attaching a base material to a cushion material. In yet other cases, the second portion includes a cavity configured for both shaping a cushion material and also for attaching a base material to the cushion material. In these cases, the first portion has a lid which temporarily holds in place a base, which is positioned and released within the cavity when the first and second portions are closed together.

15 Methods for producing articles, e.g., seats of the invention are also provided. In certain methods, an article is assembled using a single mold. In other methods, an article is assembled using a series of molds. Each mold can be provided alone or as a part of a seat-assembly tool. One method includes providing a base, e.g., a seat base and a mold having a cavity for receiving the base. The base has a top surface and a
20 bottom surface, the top surface being configured for contacting the cushion material. The top surface of the base is optionally flame treated and then a layer of coating material is applied to both the base and the inner cavity. This layer of coating material can be applied to both at the same time or at different times. For example, in some cases, a layer of coating material is first applied to the interior surface. Then, a
25 cushion material, e.g., expandable foam, is deposited into the cavity. The top surface of the base material is then lined with a layer of coating material and placed inside of the cavity so that the top surface comes into contact with the cushion material. The cavity is then sealed and the layer of coating material between the top surface of base material and the cushion material adheres these two parts together. The coating

material lining the interior surface of the cavity also adheres to the cushion material to form a protective cover.

BRIEF DESCRIPTION OF DRAWINGS

Fig. 1 is a perspective view of a seat base according to an embodiment of the
5 invention.

Fig. 2 is a perspective view of a seat according to an embodiment of the invention

Fig. 3 is an upside down perspective view of the seat of Fig. 2.

Fig. 4 is a cross-sectional view of a primary mold having a cavity according to
10 an embodiment of the invention.

Fig. 5 is a cross-sectional view of a secondary mold having a cavity according to an embodiment of the invention.

Fig. 6 is a cross-sectional view of a primary mold having a lid according to an embodiment of the invention.

Fig. 7 is a cross-sectional view of the primary mold of Fig. 6 having a shaped
15 cushion material according to an embodiment of the invention.

Fig. 8 is a cross-sectional view of a secondary mold receiving the shaped cushion material of Fig. 7 according to an embodiment of the invention.

Fig. 9 is a cross-sectional view of the secondary mold of Fig. 8 receiving a
20 seat base according to an embodiment of the invention.

Fig. 10 is a cross-sectional view of a primary mold having a lid according to another embodiment of the invention.

Fig. 11 is a cross-sectional view of the primary mold of Fig. 10 having a shaped cushion material according to an embodiment of the invention.

Fig. 12 is a cross-sectional view of a secondary mold receiving the shaped cushion material of Fig. 11 according to an embodiment of the invention.

Fig. 13 is a cross-sectional view of the secondary mold of Fig. 12 receiving a seat base according to an embodiment of the invention.

5 Fig. 14 is perspective view of a seat-forming tool adapted to receive a seat base according to an embodiment of the invention.

Fig. 15 is perspective view of the seat-forming tool of Fig. 14 having the seat base mounted thereon according to an embodiment of the invention.

10 Fig. 16 is a perspective view of the seat-forming tool of Fig. 14 in a closed configuration.

MODES FOR CARRYING OUT THE INVENTION

Embodiments of the invention will now be described with reference to methods and tools for assembling a vehicle seat. However, it should be understood that the methods and tools can be used for assembling other articles as well.

15 Fig. 1 illustrates a seat base 12 according to an embodiment of the invention, which includes a top surface 14 and a bottom surface 16. The seat base 12 has a desired shape depending upon the vehicle in which it is used. The base typically comprises a rigid plastic component e.g., HDPE, formed by a molding process. However, the base can be made of any suitable material which adheres to the coating
20 material. The top surface 14 is adapted for being adhered to a cushion material and the bottom surface 16 is configured to be mounted on a seating area of a given vehicle, e.g., an all-terrain vehicle, a motorcycle, a snowmobile, moped, scooter, utility vehicle or a personal watercraft. The bottom surface 16 often includes a number of ribs, which imparts structural integrity to the base, although this is not
25 required. The seat base 12 also includes a forward narrow portion 20 for allowing the operator's legs increased room for comfort. In some cases, the seat bases include a ventilation aperture 15, which allows the cushion material to breathe. Often times, the cushion material itself contains a breathable cavity and air is allowed to enter into this

breathable cavity through this ventilation aperture 15. Of course, this ventilation aperture is purely optional.

The seat base is generally attached directly to a vehicle frame or to a rear cab portion of the vehicle. The base can be mounted to the vehicle according to a wide variety of mounting techniques known in the art. In some cases, the bottom surface 16 has a slide in hook type fastener (not shown) at the narrow portion 20 which holds the front of the base down upon the vehicle and includes a latching mechanism (not shown) at the opposite end of the seat base which attaches the seat to the vehicle. This effectively secures the base in place upon a vehicle. In addition, the seat may also include a backrest section (not shown) for an operator or passenger.

Figs. 2 and 3 illustrate an assembled vehicle seat 10 according to an embodiment of the invention. The seat 10 includes a seat base 12 (Figure 1) having a top surface 14 and a bottom surface 16. A cushion material 18 is adhered to the top surface 14 of the seat base 12 by a layer of coating material (not shown) and without the use of staples or other mechanical fasteners. In some cases, the cushion material 18 includes an inner breathable cavity (not shown). The bottom surface 16 of the seat base 12 remains exposed after the seat 10 is completed, so the seat 10 can be attached to an appropriate place in or on a vehicle.

The cushion material 18 also has an outer covering 48 (Figure 6) of coating material, which serves to protect and waterproof the cushion material 18. A rider sits on the cushion material 18 and covering of coating material 48 when operating the vehicle. The covering 48 can include one or more seat features 22, e.g., definition lines, patterns, emblems and textures, depending on how a designer wants the seat to look. This is especially useful as designers generally desire hard lines on the seat for styling. The covering 48 may also include paints and/or decals embedded therein. Such features are incorporated within the coating material cover 48. This covering 48 can be comprised of a single layer of coating material or more than one layer. In some cases, a first inner layer of coating material is provided which serves as a protective cover and a second outer layer of coating material is provided over the first layer and

includes the desired seat features. These layers are generally applied separately to the cushion material while in different molds.

A mold is also provided for producing a seat according to an embodiment of the invention. The mold has a hollow cavity for producing a cushion material having a desired shape. The cavity has an opening which is generally smaller in cross-sectional area than the hollow interior. The shape, size and topography of the cavity will largely depend on the type of seat being made, e.g., a motorcycle seat, an ATV seat, a snowmobile seat and the like. The hollow cavity can also have areas or crevices configured as lines, patterns, textures or other features desired to be imparted into the coating material cover 48 itself. The layer of coating material fills the crevices defining the detailed features and once hardened, retains these features. One advantage of such process is that such desired features can be imparted into the layer of coating material covering the seat without having to insert rigid objects into the seat to create these features. Additionally, the hollow cavity can include one or more ditches, which receives paints or decals. When the coating material is deposited into the cavity, such paints and decals become embedded in the coating material covering once hardened.

In the illustrated embodiment, a vehicle seat 10 is assembled using a primary mold 24 and a secondary mold 26. With reference to Figs. 4 and 5, the primary mold 24 includes a cavity 28 and an opening 32 to the cavity 28 and the secondary mold 26 includes a cavity 30 and an opening 34 to the cavity 30. The opening 32 of the primary mold 24 is smaller in cross-sectional area than the opening 34 of the secondary mold 26. The primary mold 24 is adapted for receiving a lid having an underside and/or a downwardly extending protrusion, which imparts a desired shape to the top of the cavity 28, as will be described hereinafter. The lid also seals the opening 32 of the cavity 28. The secondary mold 26 is adapted for receiving a seat base 12 within the cavity 30 and also for receiving a lid to seal the opening 34 of the cavity 30. In many cases, the seat base is attached to the underside of the lid. The larger opening 34 of the secondary mold 26 makes it easier for a seat base 12 to be positioned within the cavity 30.

The primary and secondary molds 24, 26 can be made using standard procedures known to those in the art. For example, the molds can be comprised of machined billet shells. The shells are generally made of a metal, e.g., nickel. In some cases, the surface of the metal shell includes a layer of a more durable metal, e.g.,
5 chrome. This increases the durability of the shell. Additionally, the interior surface of the shell, which forms the cavity of the mold, can have an acid etched grain. This etching forms any desired crevices, ditches and the like which impart desirable features into the coating material cover.

The primary mold 24 is adapted for receiving a lid having an underside and/or
10 downwardly extending protrusion, which imparts a shape to the top of the cavity 28. The lid underside can have a variety of shapes. The lid underside generally has the same profile or shape as the top surface of a desired seat base and imparts a shape into a cavity having that same profile. In many cases, the lid underside also contains a
15 downwardly extending protrusion which imparts a groove or space into the cushion material for a breathable cavity. When the cushion material is deposited into the cavity and then allowed to harden, it has a portion retaining a shape corresponding to the top portion of a desired seat base, so the top portion can later be mated with the cushion material.

Figs. 6 and 7 illustrate a primary mold 24 having a lid 36 having an underside
20 40 according to one embodiment and Figs. 10 and 11 illustrate a primary mold 24 having a lid 38 having an underside 42 and protrusion according to another embodiment. With reference to Figs. 6 and 7, the mold 24 receives a lid 36 having an underside 40 having a profile or shape which is the same or substantially similar to the top portion 14 of the seat base shown in Fig. 9. Once the lid 36 is secured about
25 the opening 32, the underside 40 imparts a shape 44 into the cavity (as shown in Fig. 8) which corresponds to shape of the base top surface 14.

With references to Figs. 10 and 11, the mold 24 in this embodiment receives a lid 38 having an underside 42 which also includes a protrusion which extends into the cavity for forming a breathable cavity. The underside 42 of the lid also has a shape
30 which is similar to the top portion 14 of the seat base but also includes a protrusion

which extends deeper. Once the lid 38 is secured about the opening 32, the underside 42 imparts a shape 46 into the cavity (as shown in Fig. 11) which corresponds to the shape of the top surface 14 and also a groove which extends further into the cavity for forming the breathable cavity.

5 Referring to Figs. 9 and 13, the secondary mold 26 is configured to receive a seat base 12 inside of the hollow cavity 30. The opening 34 to the cavity is wide enough so that a seat base 12 can be passed through into the cavity 30. The secondary mold 26 is also configured to receive a lid (not shown), which holds the seat base 12 in place against the cushion material 18 and also seals the opening 34 of the cavity.

10 A method will now be described using the primary and secondary molds as part of an assembly process. A method of assembling a seat will now be described with reference to Figs. 6-9. Referring to Fig. 6, a primary mold 24 is provided, which has a cavity 28 receiving a lid 36 having a rectangular shaped protrusion. The interior surface of the cavity is then covered with a first layer of coating material 48. In some
15 cases, the interior surface of the cavity is sprayed with a spray of coating material. Additionally, the interior surface of the cavity 28 can also have areas or crevices configured as lines, patterns, textures or other features desired to be imparted into the cushion material 18 itself. The first layer of coating material 48 fills the crevices defining the detailed features and once hardened, retains these features.

20 Once the cavity 28 is lined with a first layer of coating material 48, a cushion material 18 is then deposited into the cavity 28. The first layer of coating material 48 is generally allowed to cure or harden before depositing the cushion material 18 into the cavity. Suitable cushion materials for providing the inner structure of the seat base 12 include any pourable liquid plastic, sculpted bun stock, and expandable foam.
25 While a variety of cushion materials can be used for this purpose, expandable foam, e.g., isocyanate foam is preferred. The expandable foam can be injected into the cavity 28 using an injection tool, e.g. a reaction injection molding machine, known in the art. With reference to Fig. 6, the lid 36 is then closed against the mold 24 so that the cavity 28 is sealed and lid underside 40 extends into the cavity. The foam or other
30 expandable material is then allowed to expand and fill the volume of the cavity 28.

During this time, the first layer of coating material 48 lining the interior surface of the cavity 28 also adheres to the cushion material 18 and solidifies to form an outer protective layer.

5 In some cases, more than one different type of cushion material is used. For example, different types of cushions, e.g., foams can be positioned in different areas about the cavity to provide varying levels of hardness in different areas of the cushion. In other cases, an inflatable air cushion is placed into the cavity so that the operator can inflate or deflate the cushion to a desired comfort level. When the cushion is inflated, the surrounding cushion material presses against the outer
10 covering, providing a harder, rigid seat. When the cushion is deflated, the surrounding cushion material no longer pressures against the outer covering, providing a softer seat.

Once the foam has fully expanded and solidified, the lid 36 is removed to expose the cavity 28. As shown in Fig. 7, the cushion material 18 has a shape
15 corresponding to the internal volume of the cavity 28. The cushion material 18 also includes a shape 44 on its top, which corresponds to the profile of the top portion 14 of the seat base. The first layer of coating material 48 forms a protective cover protecting the external surface of the cushion material 18 except for the surfaces formed by the shape 44, which contacted the lid underside 40 and did not receive the
20 first layer of coating material 48 during forming. The cushion material 18 is then removed from the primary mold 24.

In many cases, one or more release agents can be used for ensuring that the cushion material and coating material layers are easily released from the mold. For example, Chemtrend CT1007 Wax, a release agent distributed by Chem Trend, a
25 company located in Howell, Michigan, may be applied, e.g., wiped, to the mold in areas not in contact with the coating material layer to facilitate release of the cushion material from contact with the mold surface. Likewise, 567 Release is a product distributed by W. N. Shaw and Company, a company located in Villa Ridge, Missouri, that is sprayed onto the mold in areas not in contact with the coating
30 material layer to release the cushion material from contact with the surface of the

mold cavity itself. ACMOS 36-5111-343 Release is another release product distributed by ACMOS, a company located in Bremen, Germany. The ACMOS product can be used to release the coating material layers from contact with the surface of the mold cavity and is sprayed onto the mold in areas in contact with the coating material layer. The Chem Trend CT1007 Wax typically is applied only once prior to the production run, whereas the W. N. Shaw and Company 567 Release and ACMOS 36-5111-343 are generally applied before each molding cycle. Of course, application of these mold releases may vary.

The cushion material 18 formed in the primary mold 24 shown in Figs. 6 and 7 is then placed into a secondary mold 26 shown in Figs. 8 and 9. The secondary mold 26 has a hollow cavity 30 that corresponds to the hollow cavity 28 of the primary mold 24, so that the cushion material 18 formed in the primary mold 24 also fits within the cavity 30 of the secondary mold 26. However, the secondary mold 26 has a wider opening 34 than the primary mold 24, so parts of the exterior surface lined with the first layer of coating material 48 are exposed at the top of the cavity 30. Then, the top, exposed surface of the cushion material 18 is lined with a second layer of coating material 50. Areas of the exterior surface already lined with the first layer of coating material 48 will now also be lined with a second layer of coating material 50. However, the surface lining the shape 44 only has the second layer of coating material 50.

A seat base 12 is provided having a top surface 14 and a bottom surface 16. With reference to Fig. 9, the top surface 14 of the seat base 12 is positioned within the cavity 30 in contact with the second layer of coating material 50 and the cavity 30 is then closed with a lid (not shown). In most cases, the top surface 14 of the seat base 12 is mateable with the shape 44 in the cushion material 18. The seat base 12 can also be flame treated before being positioned within the cavity 30. Flame treatment can be performed by applying a flame, e.g. from a blowtorch, to a given surface, which removes oils and other contaminants which would prevent or decrease adherence of coating material to that surface, as well as, altering the surface properties of the material.

The entire surface area of the seat base 12 can be flame treated or only the top surface 14 which is positioned in contact with the cushion material 18. The second layer of coating material 50 adheres the top surface 14 of the seat base 12 to the cushion material 18 to form a seat 10. The seat base 12 may be additionally heated so that when it comes in contact with the second layer of coating material 50 it alters the cure time. The seat 10 is then removed from the secondary mold 26 and is later mounted in a vehicle. Generally the strength of the connection between the seat base 12 and the cushion material 18 is strong so that the seat 10 can easily be removed from the secondary mold 26. Alternatively, the cushion material 18 formed in the primary mold 24 shown in Figs. 6 and 7 could simply be placed in a holding fixture (not shown) such that the seat base 12 is clamped to the cushion material 18 after the second layer of coating material 50 is applied between the cushion material 18 and the seat base 12. The seat base 12 again may be flame or heat treated to strengthen the bond of the second layer of coating material 50 between the cushion material 18 and the seat base 12.

A method of assembling a seat having a breathable cavity will now be described with reference to Figs. 10-13. Figs. 10-13 illustrate a method of forming a seat 10 wherein the cushion material 18 contains a breathable cavity 52. This method is similar to the method already described with reference to Figs. 6-9. The main difference in these methods is that the method of Figs. 10-13 provides a breathable cavity 52 in the cushion material 18.

Referring to Fig. 10, a primary mold 24 is provided, which has a cavity 28 for receiving a lid 38 having an underside 42 which also contains a downwardly extending protrusion. The protrusion extends deeper into the cavity 28 than the underside 42 and forms a space or groove which becomes the breathable cavity 52. The interior surface of the cavity 28 is then covered with a first layer of coating material 48. In certain cases, the interior surface of the cavity 28 is sprayed with a spray of coating material.

Once the cavity 28 is lined with the first layer of coating material 48, a cushion material 18, e.g., an expandable foam is then deposited into the cavity 28. Referring to Fig. 10, the lid 38 is then closed against the mold 24 so that the cavity 28 is sealed and the lid underside 42 extends into the cavity. The foam is then allowed to
5 expand and fill the volume of the cavity 28. During this time, the first layer of coating material 48 lining the interior surface of the cavity 28 also adheres to the cushion material 18 and solidifies to form an outer protective layer.

After the foam has solidified, the lid 38 is removed to expose the cavity 28. As shown in Fig. 11, the cushion material 18 has a shape corresponding to the internal
10 volume of the cavity 28. The cushion material 18 also includes a shape 46 on its top, which was imparted into the material by the lid underside 42. The first layer of coating material 48 forms a protective cover over the external surface of the cushion material 18 except for surface lining the area of shape 46, which contacted the lid underside 42 during forming and did not receive this first layer of coating material 48.
15 The cushion material 18 is then removed from the primary mold 24.

The cushion material 18 is then placed into a secondary mold 26 shown in Figs. 12 and 13. The secondary mold 26 has a hollow cavity 30 that corresponds to the hollow cavity 28 of the primary mold 24 of Figs. 10 and 11, so that the cushion material 18 formed in the primary mold 24 also fits within the cavity 30 of the
20 secondary mold 26. However, the secondary mold 26 has a wider opening 34 than the primary mold 24, so parts of the exterior surface lined with the first layer of coating material 48 are exposed at the top of the cavity 30. Then, either the top, exposed surface of the cushion material 18 or the top surface 14 of a seat base 12 is lined with a second layer of coating material 50. Those parts of the exterior surface already
25 lined with the first layer of coating material 48 will also receive the second layer of coating material 50, so that two layers are provided in these areas. The surface in the area of shape 46 does not have a first layer of coating material 48, so this area will only have a second layer of coating material 50.

The seat base 12 includes a top surface 14 and a bottom surface 16. With
30 reference to Fig. 13, the top surface 14 of the seat base 12 is positioned within the

cavity 30 in contact with the top, exposed surface of the cushion material 18 with the second layer of coating material 50 adhering the two surfaces together. The cavity 30 is then closed with a lid (not shown). The top surface 14 of the seat base 12 is mateable with the shape 46 in the cushion material 18, but not with the lower groove of the shape 46, which forms the breathable cavity 52. In this case, when the seat base 12 is placed within the cushion material 18, a breathable cavity 52 is left in the interior of the cushion material 18. The breathable cavity 52 is also lined with the second layer of coating material 50, which forms a protective cover for the breathable cavity 52. The seat base 12 can also be flame treated before being positioned within the shape 46. The second layer of coating material 50 in contact with the seat base 12 adheres the top surface 14 of the seat base 12 to the cushion material 18 to form a seat 10. In some cases, the seat base 12 includes a ventilation aperture 15, which provides an air passage through the seat base 12 into the breathable cavity 52.

The breathable cavity 52 can serve several different purposes depending on the configuration of the seat. For example, in cases where the seat base 12 does not contain one or more ventilation apertures, the seat base 12 (and the second layer of coating material 50) fully seals the breathable cavity, so that air is trapped inside and air cannot move in or out. In these cases, the trapped air in the cavity 52 imparts rigid support and less flexibility to the cushion material. Such a rigid cushion material may be desirable in certain applications. In cases where the seat base 12 does include one or more ventilation apertures, the apertures provide an air passage to the breathable cavity 52 when the seat base 12 is positioned against the cushion material. Air enters into the breathable cavity 52 when a rider is not sitting on the seat and is expelled from the breathable cavity 52 out through the apertures when a rider sits on the seat. In this case, the air trapped in the cavity acts like a spring when riding the vehicle, providing more comfort for the rider. In addition, the cushion material 18 may not be sealed by the second layer of sprayed coating material 50 within the breathable cavity 52. Such a layer of coating material can be strategically applied to the top surface of the seat base or to the exposed cushion material so that coating material does not cover the apertures. This allows air trapped inside the cushion material to be expelled when the rider sits on the seat. When the rider leaves the seat, the air travels back into

the cushion material. In most cases, the cushion material and breathable cavity are shielded from water intrusion since the apertures are located on the underside of the seat between the cushion material and the vehicle. However, in some cases, it may be desirable to provide a seat base having its entire surface or one or more surfaces covered with a vapor permeable, liquid impermeable membrane, e.g., Gortex brand, to ensure that no water or liquid is ingested into the cavity while still allowing air and gases to pass in and out of the breathable cavity.

As mentioned above, in other embodiments of the method, the foam seat can be formed, and attached to the seat base part in a single step or mold. The mold receives the base within a cavity and the seat part can be shaped in a cavity around the base. The mold would include a cavity formed by one or more parts of the mold, such that the cavity is in the form of the seat to be molded, and the base is positioned in a position to be molded to the seat padding.

In one such embodiment, the interior surface of the cavity that receives the base, is lined with a layer of coating material. The base is then placed within the mold. A layer or a bead of coating material is also deposited onto the top surface of the base (the portion of the base against the foam). A cushion material, e.g., an expandable foam, is then deposited into the cavity, and molded around, and to the base.

The mold can be comprised of two parts which closes to form the completed mold. In this embodiment, the lid is then placed over the cavity opening so that the base is inside of the cavity. The expandable foam expands to the volume of the cavity and also adheres to the layer(s) of coating material lining the cavity and the top surface of the base. Thus, the foam adheres to the top surface of the base in the mold. In some cases, the coating material is applied to the interior surface of the cavity so that the coating material seals and protects the cushion material. In other cases, the coating material is not applied to the interior cavity but is applied only to adhere the cushion material to the base. In most cases, the coating material is applied so that it both seals and protects the cushion material and also adheres the cushion material to the base. The completed article is then removed from the mold.

The expandable foam can be placed into the cavity prior to the mold closing, or can be injected into cavity of the closed mold.

More particularly, and with reference to Figs. 14-16, the mold can be part of a seat assembly tool 58. For example, a seat assembly tool 58 is illustrated according to an embodiment of the invention. The seat assembly tool 58 in this embodiment includes a mold wherein a seat base 12 is attached to the cushion material 18 via a layer of coating material. The tool 58 comprises a first portion 60 and a second portion 62. The first and second portions are connected together by hinges 64 and can be closed against one another to close the tool 58, as shown in Fig. 16. When closed together, the tool 58 forms a rectangular external structure, as shown in Fig. 16. However, the closed tool 58 can form any other suitable structure as well.

Referring to Figs. 14 and 15, the first portion 60 of the tool has a base receiving area 66 which temporarily receives a bottom surface 16 of the seat base 12. The base receiving area 66 has grooves and other configurations that are mateable with those configurations seen on the bottom surface 16 of the seat base 12. A seat base 12 is simply placed within the receiving area 66 and is temporarily locked in place. The base can be temporarily held in place by numerous methods including using clamps, clips, Velcro and the like. Fig. 15 illustrates the tool 58 wherein the first portion 60 is loaded with a seat base 12 and is ready for use.

The second portion 62 of the tool 58 generally functions as a mold and includes a cavity 68 having a desired shape of the seat to be formed. In the illustrated embodiment, the second portion 62 includes a cavity 68 configured to correspond to the shape of the seat padding desired, and also corresponds to the outer perimeter of the seat base 12 so that once the tool 58 is closed together, the seat base 12 is placed within the cavity 68 and the opening is sealed. As mentioned above, the foam can be injected into the cavity, either prior to or after the closing of mold part 62.

While the illustrated seat assembly tool 58 includes a mold portion configured to receive a seat base, it should be understood that tools including a primary mold are also within the scope of the invention. In such tools, the first portion includes a lid having a protrusion rather than a seat base receiving area. When the first and second

portions are closed together, the protrusion extends downwardly into the cavity of the second portion to impart shape into the cushion material 18. Additionally, it should be understood that tools including molds other than primary or secondary molds are within the scope of the invention.

5 Thus, embodiments of the invention are disclosed. One skilled in the art will appreciate that the present invention can be practiced with embodiments other than those disclosed. The disclosed embodiments are presented for purposes of illustration and not limitation, and the present invention is limited only by the any of claims that follow.

10

What is any of claimed is:

1. A method of assembling an article (10), the method comprising the steps of:
providing a frame (12) having a first surface (14) to which a cushion material (18) is to be adhered, and a second surface and opposite surface;
5 providing a plurality of undulations to said frame, to increase the surface area for adhesion of said cushion material;
applying a coating layer (50) to said frame;
applying said cushion material about said frame, with the cushion material having complementary surfaces to join said frame undulations.
10
2. The method of claim 1, wherein said cushion material is molded first and said frame is applied to said cushion material.
3. The method of claim 1, wherein said cushion material is molded to said frame
15 in a mold.
4. A method of assembling an article (10), the method comprising the steps of:
providing a mold (58) having a cavity (68) configured as a desired shape;
positioning a base (12) within the mold so that a surface (14) of the base
20 material is exposed;
applying coating material (50) to substantially cover both the exposed surface of the base and an inner surface of the cavity; and
depositing a cushion material (18) into the cavity so that the coating material forms a skin around the cushion material and adheres the cushion material to the base.
25
5. The method of claim 4, wherein the coating material is comprised of urethane.
6. The method of any of claims 4 or 5, wherein the coating material is comprised of polyurethane.
30

7. The method of any of claims 4-6, wherein the applying the coating material includes spraying the coating material.
8. The method of any of claims 4-7, wherein the cushion material comprises an
5 expandable foam.
9. The method of claim 8, wherein the expandable foam comprises an expandable isocyanate foam.
- 10 10. The method of any of claims 4-9, wherein the cushion material comprises one or more different materials.
11. The method of any of claims 4-10, wherein the base is a flame treated base.
- 15 12. The method of any of claims 4-11, wherein the cavity of the mold has a surface including one or more features so that the coating material retains such features when it forms a skin.
13. The method of claim 12, wherein the one or more features is selected from the
20 group consisting of decals, fabrics, vinyls, leathers, rubbers and paints.
14. The method of any of claims 12 or 13, wherein the one or more features includes textures.
- 25 15. The method of any of claims 4-14, wherein the mold includes a lid (62) and the positioning a base within the mold so that a surface of the base is exposed comprises removably attaching the base to the lid.
16. The method of any of claims 4-15, wherein the step of sealing the cavity
30 comprises closing the lid.

17. The method of any of claims 4-16, wherein the mold comprises a first portion (60) and a second portion (62), the first portion adapted to receive the base and the second portion configured as a cavity (68), wherein sealing the cavity comprises sealing the first and second portions together.

5

18. The method of any of claims 4-17, wherein the positioning a base within the mold so that a surface of the base material is exposed comprises loading the base into the first portion so that a surface of the base is exposed.

10 19. A method of assembling an article, comprising the steps of:
applying coating material (48) into a cavity (28) of a mold (24) that defines a desired profile;
depositing expandable cushion material (18) into the cavity of the mold;
closing a lid (36) of the mold and allowing the expandable cushion material to
15 expand to a volume defined by the mold and the lid;
opening the lid; and
adhering a base (12) to the expandable cushion material by applying a coating material (50) between the base and the expandable cushion material.

20 20. The method of claim 19, wherein the coating material is comprised of urethane.

21. The method of any of claims 19 or 20, wherein the coating material is comprised of polyurethane.

25

22. The method of any of claims 19-22, wherein the applying the coating material includes spraying the coating material.

23. The method of any of claims 19-22, wherein the expandable cushion material
30 comprises one or more expandable foams.

24. The method of claim 23, wherein at least one expandable foam comprises an expandable isocyanate foam.
25. The method of any of claims 19-24, wherein the base is a flame treated base.
- 5 26. The method of any of claims 19-25, wherein the cavity of the mold has a surface including one or more features so that the coating material retains such features when it forms a skin.
27. The method of claim 26, wherein the one or more features is selected from the
- 10 group consisting of decals, fabrics, vinyls, leathers, rubbers and paints.
28. The method of any of claims 26 or 27, wherein the one or more features includes textures.
- 15 29. The method of any of claims 19-29, wherein the lid contains an underside which projects into the cavity to impart a shape in the expandable cushion material once expanded.
30. The method of claim 29, wherein the base is configured to mate with the shape
- 20 in the expandable cushion material created by the underside.
31. The method of any of claims 19-29, wherein the underside of the lid further includes a protrusion which projects deeper into the cavity than the underside to impart a shape in the expandable cushion material once expanded to form a breathable
- 25 cavity.
32. The method of any of claims 19-31, wherein the base is configured to mate with the shape in the expandable cushion material created by the underside so that the breathable cavity is formed between the base and the expandable cushion material.
- 30 33. The method of any of claims 19-32, further comprising removing the expandable cushion material from the cavity and placing the expandable cushion

material into a cavity (30) of a secondary mold (26) before adhering the base to the expandable cushion material.

34. The method of any of claims 19-33, wherein the opening of the cavity of the secondary mold is larger than the opening of the cavity from which the expandable cushion material is removed.

35. The method of any of claims 19-34, further comprising removing the expandable cushion material from the cavity and placing the expandable cushion material into a fixture prior to adhering the base to the expandable cushion material.

36. The method of any of claims 19-35, wherein applying a coating material between the base and the expandable cushion material comprises placing a bead of coating material between the base and the expandable cushion material.

37. The method of any of claims 19-36, wherein applying a coating material between the base and the expandable cushion material seals the expandable cushion material with the coating material.

38. The method of any of claims 19-37, wherein applying a coating material between the base and the expandable cushion material does not seal the expandable cushion material with the coating material.

39. The method of any of claims 19-38, wherein a vapor permeable, liquid impermeable membrane is applied to the article to seal the expandable cushion material from liquid.

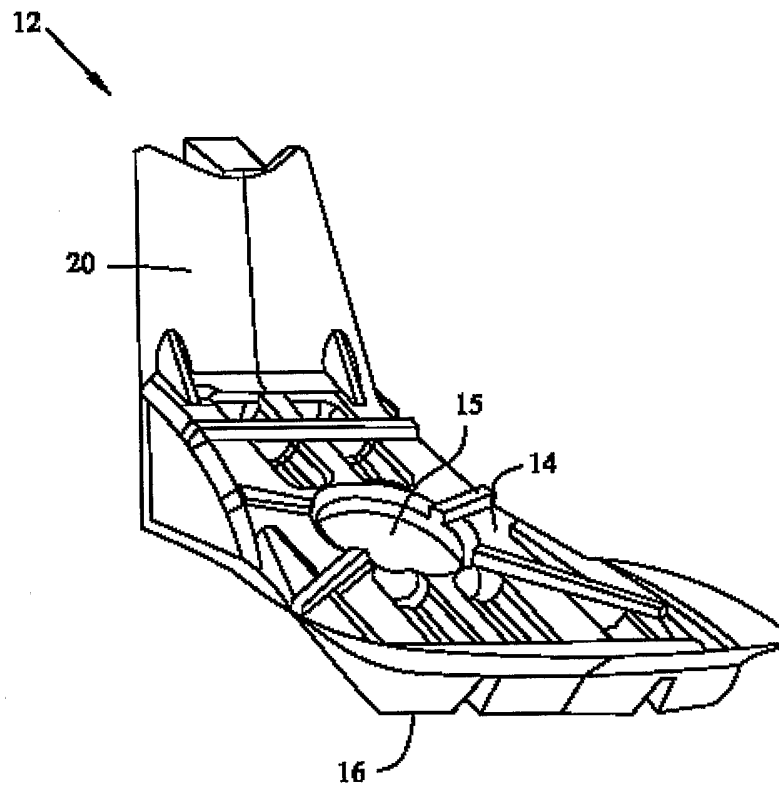
40. An article comprising a base (12) and a cushion material (18) having a skin comprised of a coating material (50), wherein the base and the cushion material are bonded together by the coating material.

41. The article of claim 40, wherein the coating material is comprised of urethane.

42. The article of any of claims 40 or 41, wherein the coating material is comprised of polyurethane.
- 5 43. The article of any of claims 40-42, wherein the cushion material further includes an outer protective covering.
44. The article of claim 43, wherein the outer protective covering is comprised of urethane.
- 10 45. The article of claim 44, wherein the outer protective covering is comprised of polyurethane.
46. The article of any of claims 40-45, wherein the outer protective covering
15 further includes one or more features.
47. The article of claim 46, wherein the one or more features is selected from the group consisting of decals , fabrics, vinyls, leathers, rubbers and paints.
- 20 48. The article of any of claims 46 or 47, wherein the one or more features includes textures.
49. The article of any of claims 40-48, wherein the article is a seat for a vehicle.
- 25 50. An article comprising a base and a cushion material having a skin comprised of a coating material, the article being made according to the method of any of claims 1-39.
51. A vehicle seat made according to any of the method of any of claims 1-39.

52. A vehicle comprising the vehicle seat of claim 51, wherein the vehicle is selected from a group consisting of a motorcycle, moped, scooter, all terrain vehicle, utility vehicle, snowmobile and personal watercraft.

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**FIG. 1**

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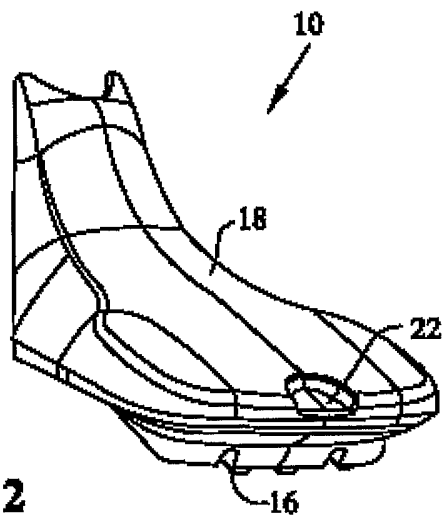


FIG. 2

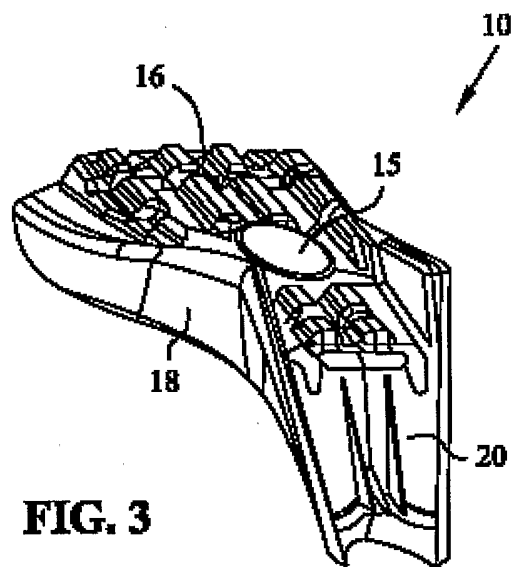


FIG. 3

Fig. 4

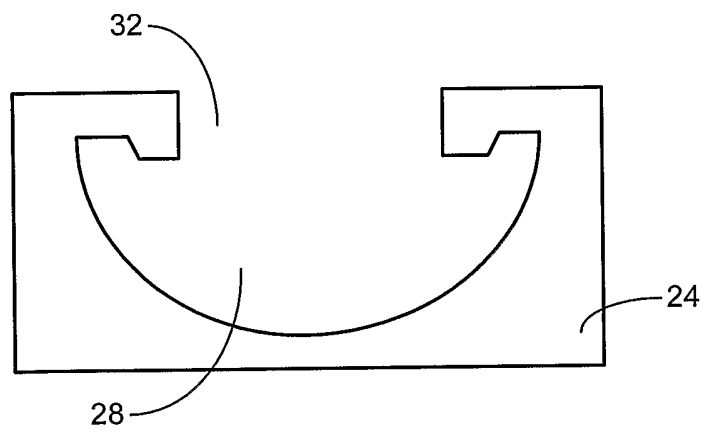
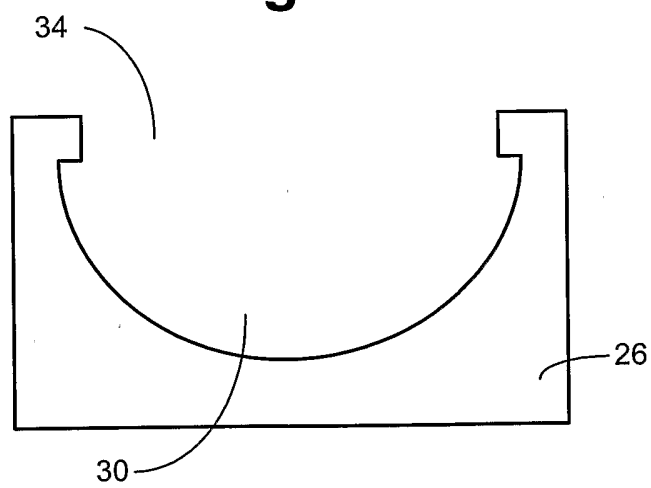
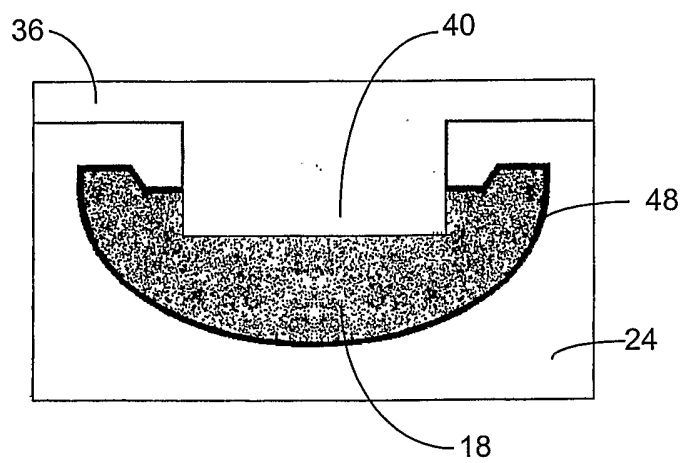
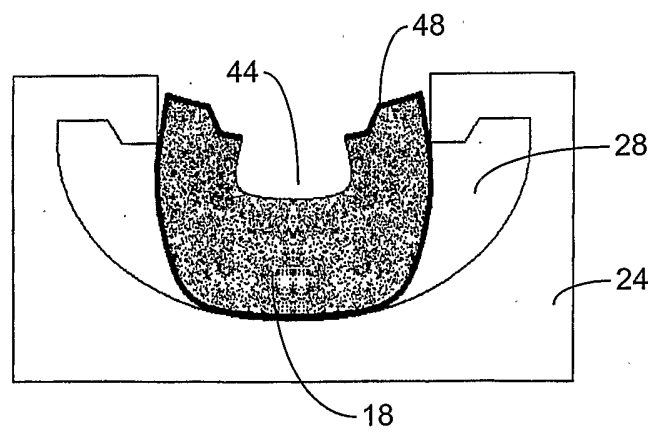


Fig. 5



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Fig. 6**Fig. 7**

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Fig. 8

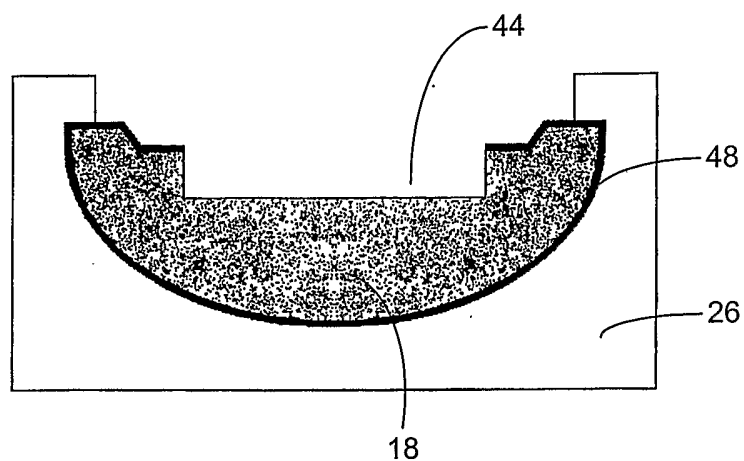
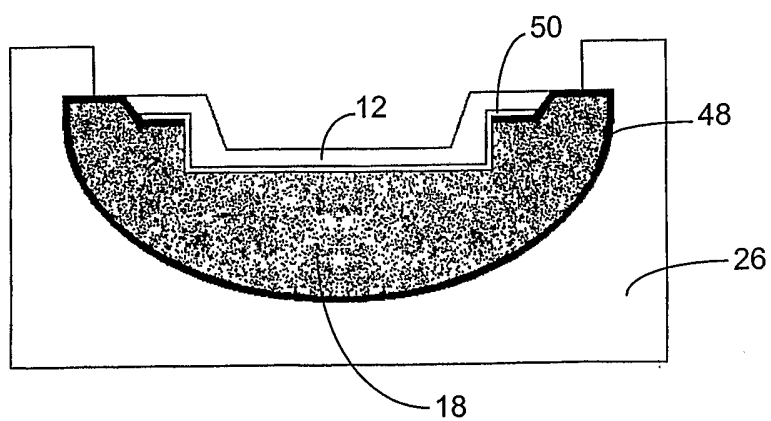


Fig. 9



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Fig. 10

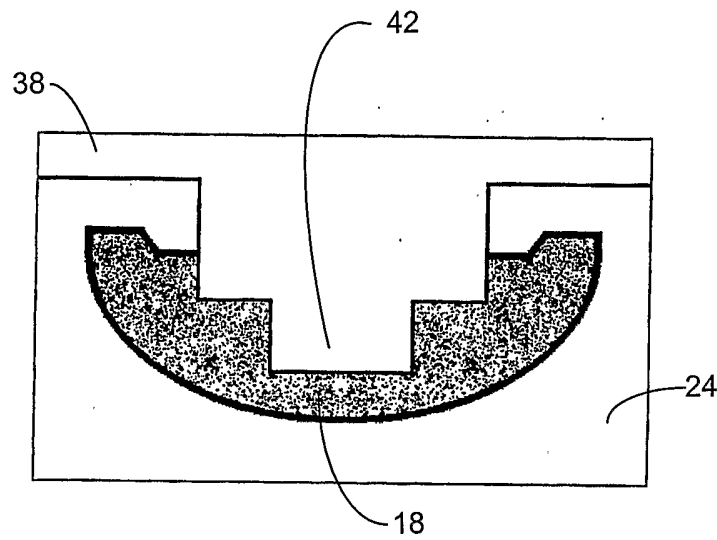


Fig. 11

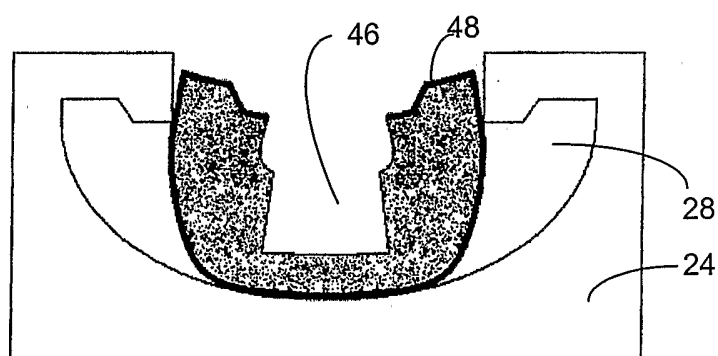


Fig. 12

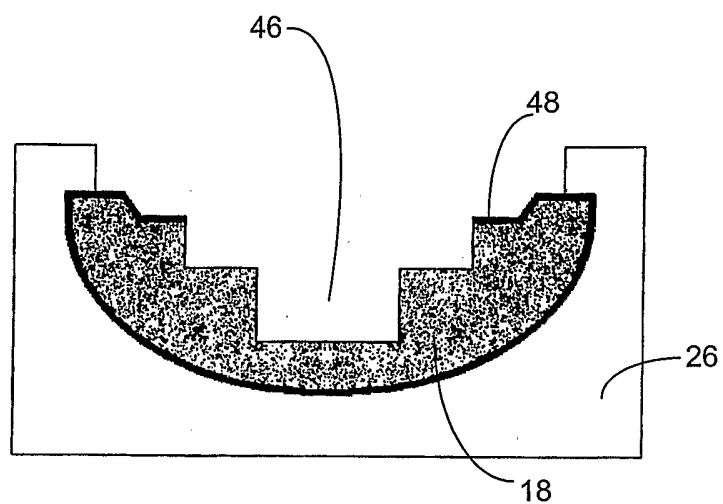
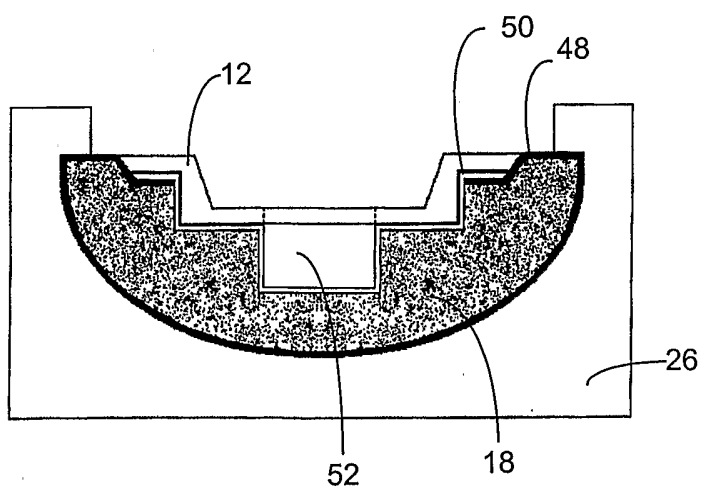


Fig. 13



den

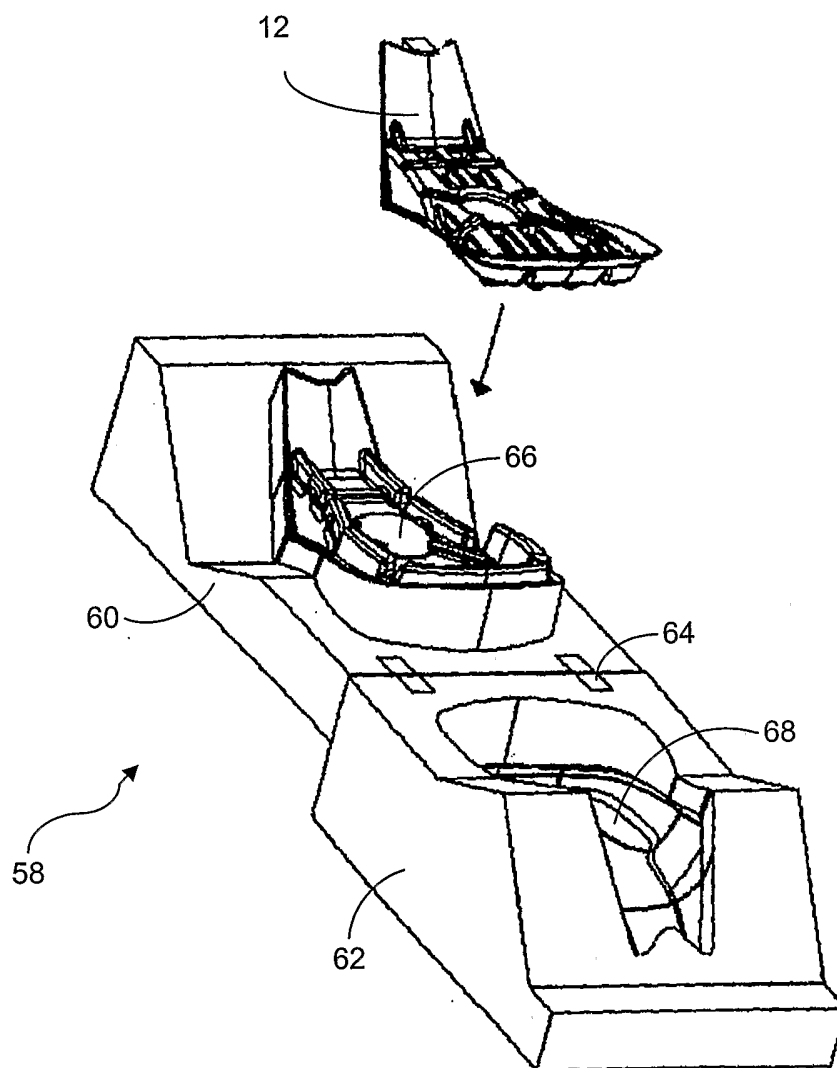
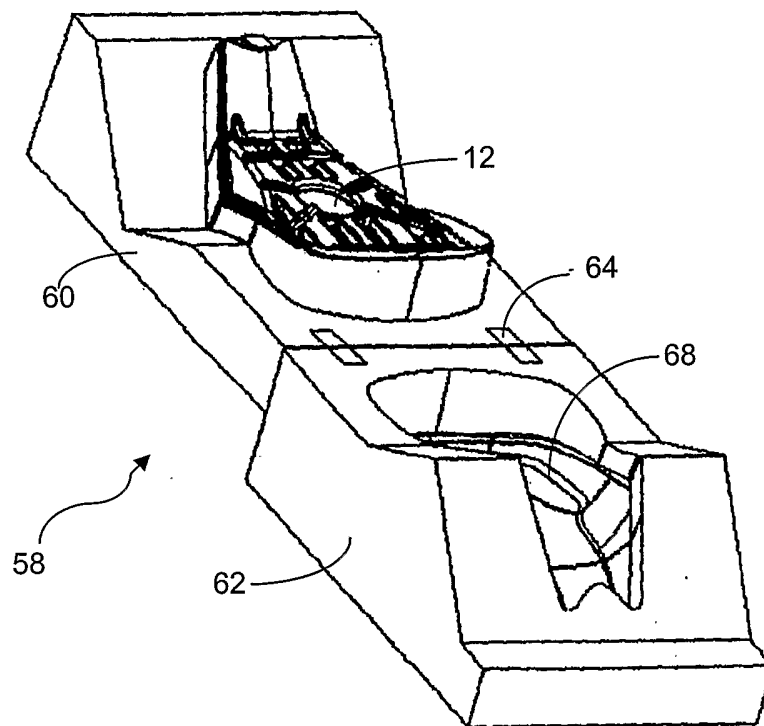
Fig. 14

Fig. 15

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Fig. 16

