REMOVABLE SPACER TOOL FOR PROTECTING RAISED FRAMELESS VEHICLE WINDOW GLASS DURING WINDOW FILM INSTALLATION, AND METHOD OF USE

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CROSS-REFERENCE TO RELATED APPLICATIONS

0001 None.

STATEMENT REGARDING FEDERALLY SPONSORED RESEARCH OR DEVELOPMENT

0002 Not applicable.

FIELD

0003 The present disclosure relates generally to tools and accessories for automotive window film ("tint") installation. More particularly, it relates to a removable, hand-held spacer tool that is temporarily interposed between the raised window glass of a frameless or semi-frameless vehicle door and an opposing trim or weather-seal structure, so that an accidental closing of the door does not drive the trim or seal into the edge of the glass. The disclosure also relates to methods of using such a tool during window film installation.

BACKGROUND

0004 Many current vehicles, including certain sedans, coupes, and crossover/SUV models, use frameless or semi-frameless doors. In these doors the movable window glass has no door-mounted window frame around its upper edge. When the door is closed, the upper edge of the glass seats against, and is sealed by, trim and/or a weather seal carried by the vehicle body, for example at the roof rail, the door-opening flange, or a pillar.

0005 Applying window film to such glass, including heat-shrinking the film to the curvature of the glass and finishing the film edges, generally requires that the glass be held fully raised, sometimes called "locked up," for the duration of the work. Dropping the glass into the door during these steps degrades film quality and prevents proper edge work.

0006 Some vehicles with frameless doors automatically lower the glass slightly when the door opens and raise it again after the door closes. During tint work the glass may be held in its fully raised position (for example, by a vehicle service or "tint" mode) so that it does not perform this short-drop movement. The manner in which the glass is held raised may vary by vehicle make and model and may include manual operation of the window switch, a vehicle menu or service setting, or another technique; the present disclosure is not limited to any particular one.

0007 While the door is open with the glass held raised, the upper edge of the glass sits directly in line with the trim or seal that it normally meets only after the short-drop sequence. If the door is then closed, whether by a coworker, a customer, the installer, or wind (as often happens on mobile jobs), the trim and/or seal is driven against the exposed upper edge of the glass. The concentrated load can chip or crack tempered glass, bend trim, break trim clips, damage the freshly installed film, and turn a routine film installation into a glass-replacement repair.

0008 Existing shop practices, such as verbal warnings, signs, or tape, depend on people remembering not to close the door, and they do nothing to prevent wind-driven closing. A simple, inexpensive, quickly deployed physical safeguard is needed that can stay in place while the glass is held raised and that takes the closing load so the glass edge and trim do not.

SUMMARY

0009 This Summary introduces, in simplified form, concepts that are further described in the Detailed Description. It is not intended to identify key or essential features of the claimed subject matter or to limit its scope.

0010 In one aspect, a spacer tool includes an elongated body having a first end portion, an opposite second end portion, and an intermediate grip portion between them. The first end portion forms a load-bearing spacer portion sized to be removably interposed in the load zone between an upper edge of a raised window glass of a frameless vehicle door and an opposing trim or weather seal. If the door closes while the tool is seated, the closing load passes through the spacer portion instead of being applied by the trim directly to the glass edge.

0011 In embodiments, the spacer portion tapers in width toward a rounded distal tip to make insertion into a narrow gap easier. The spacer portion may have first and second recesses on opposite major faces, separated by a central web, giving a generally I-shaped (I-beam) cross-

section that reduces material and weight while keeping a raised peripheral rim that bears load. A lug or projection may extend transversely from one major face at or near the distal tip to locate the tool, limit its insertion, and/or retain it in position against the glass or trim, and to serve as a visual and tactile orientation cue. The grip portion may have a series of notches separated by teeth along its lateral edges for a secure grip with gloved or wet hands. The second end portion may form a widened head with a through-aperture (for example, for a lanyard, hook, or tool-board storage) and an open-ended slot defining two prongs.

0012 In another aspect, a method of protecting frameless vehicle window glass during window film installation includes raising the glass to a locked-up working position, seating the spacer tool between the upper edge of the glass and the opposing trim or seal, performing the film installation steps (including heat-shrinking) while the tool stays seated, and removing the tool after the step that requires the raised glass is complete.

BRIEF DESCRIPTION OF THE DRAWINGS

0013 The accompanying drawings show an exemplary embodiment and are not necessarily drawn to scale. FIGS. 12–14 are schematic.

0014 **FIG. 1** is a top perspective view of a spacer tool according to an embodiment of the present disclosure.

0015 **FIG. 2** is a bottom perspective view of the spacer tool of FIG. 1.

0016 **FIG. 3** is a top plan view of the spacer tool of FIG. 1, indicating the longitudinal axis and section lines 8–8, 9–9, 10–10, and 11–11.

0017 **FIG. 4** is a bottom plan view of the spacer tool of FIG. 1.

0018 **FIG. 5** is a side elevation view of the spacer tool of FIG. 1.

0019 **FIG. 6** is an end elevation view of the spacer tool of FIG. 1, viewed from the first (tip) end.

0020 **FIG. 7** is an end elevation view of the spacer tool of FIG. 1, viewed from the second (head) end.

0021 **FIG. 8** is a longitudinal cross-sectional view taken along line 8–8 of FIG. 3.

0022 **FIG. 9** is an enlarged transverse cross-sectional view taken along line 9–9 of FIG. 3 through the spacer portion.

0023 **FIG. 10** is an enlarged transverse cross-sectional view taken along line 10–10 of FIG. 3 through the grip portion.

0024 **FIG. 11** is an enlarged transverse cross-sectional view taken along line 11–11 of FIG. 3 through the head and its aperture.

0025 **FIG. 12** is a schematic side elevation view of a frameless vehicle door with its window glass raised and the spacer tool seated in the load zone along the upper edge of the glass.

0026 **FIG. 13** is an enlarged schematic cross-sectional view of the load zone of FIG. 12 with the door open, showing the spacer tool interposed between the upper edge of the glass and the opposing trim/weather seal.

0027 **FIG. 14** is a view similar to FIG. 13 after the door has been closed, showing the closing load carried through the spacer tool.

0028 **FIG. 15** is a flowchart of a method of protecting frameless window glass during window film installation using the spacer tool.

DETAILED DESCRIPTION

0029 The following description refers to the accompanying drawings, in which like reference numerals refer to like elements. The embodiments are described in enough detail to enable those skilled in the art to make and use them. Other embodiments may be used, and structural, material, and procedural changes may be made, without departing from the scope of the disclosure. Terms such as "top," "bottom," "upper," "lower," "front," and "side" refer to the orientation shown in the drawings and do not limit how the tool is oriented in use. "About" and "approximately" mean within ±20% of the stated value unless context indicates otherwise. "Trim" refers broadly to any interior or exterior trim, garnish, molding, weather seal, weatherstrip, or body flange that the upper edge of the window glass approaches or contacts when the door is closed.

Reference Numerals

10	spacer tool

12	elongated body
14	first end portion, load-bearing spacer portion, or blade
16	distal tip
18	lug or transverse projection
20	first recess in top face
22	second recess in bottom face
24	central web
26	peripheral rim
28	intermediate grip portion
30	notches
32	teeth or ridges between notches
34	second end portion / head
36	through-aperture
38	open-ended slot
40	first prong
42	second prong
44	first (top) major face
46	second (bottom) major face
48	lateral side edge
50	shoulder
52	longitudinal axis
100	vehicle
102	frameless door
104	window glass
106	upper edge of glass
108	trim / weather seal
110	body structure, such as roof rail or door-opening flange
112	load zone between glass edge and trim
116	window film

118	load-transfer contact interface
F	door-closing force
200	start
202	raise glass step
204	seat tool step
206	film application / heat-shrink step
208	accidental-closure protection
210	remove tool step
212	end

Overall Structure (FIGS. 1–7)

0030 Referring to FIGS. 1–7, a spacer tool 10 includes an elongated body 12 extending along a longitudinal axis 52 (FIG. 3) from a first end portion 14 to an opposite second end portion 34, with an intermediate grip portion 28 between them. In the illustrated embodiment the body 12 is a single, unitary, monolithic piece with no moving parts and no separately attached components. For that reason no exploded view is provided; the internal configuration is shown in the cross-sections of FIGS. 8–11. The body 12 has a first (top) major face 44 and an opposite second (bottom) major face 46 (FIGS. 1, 2, 5), joined by lateral side edges 48 (FIGS. 2, 10). As seen in the plan views of FIGS. 3–4, the body is generally symmetric about the longitudinal axis 52. All external edges and corners are rounded or filleted, so the tool has no sharp edges that could scratch glass, film, paint, or trim.

0031 Proportions. The following approximate proportions were measured from a digital 3D model of the illustrated embodiment and are expressed relative to the overall length L of the body 12: maximum width (at the head 34) about 0.18 L; maximum width of the spacer portion 14 (at the shoulder 50) about 0.14 L, narrowing to about 0.03–0.06 L near the tip 16; width of the grip portion 28 about 0.12 L across the teeth 32 and about 0.09 L at the notches 30; nominal body thickness between faces 44 and 46 about 0.066 L; projection of the lug 18 beyond the bottom face 46 about 0.055 L, giving an overall height at the tip of about 0.12 L; and length of the spacer portion 14, the grip portion 28, and the head 34 about 0.37 L, 0.45 L, and 0.18 L, respectively. These proportions are exemplary only and are not limiting. In some embodiments

the overall length L is about 75 mm to about 300 mm, for example about 100 mm to about 250 mm; the nominal body thickness is about 3 mm to about 25 mm, for example about 5 mm to about 15 mm; the maximum width is about 15 mm to about 60 mm; the lug projects about 2 mm to about 20 mm beyond the adjacent major face; and the through-aperture has a diameter of about 4 mm to about 20 mm. Other dimensions may be selected to suit a particular vehicle, gap, or seal.

First End Portion / Spacer Portion 14

0032 The first end portion 14 forms the load-bearing spacer portion, also called the blade. As best seen in FIGS. 3 and 4, it is generally an elongated, tapered (approximately triangular or wedge-shaped) form in plan view. Its width increases from a rounded distal tip 16 to a shoulder 50, where it meets the grip portion 28. The shoulder 50 is the widest part of the spacer portion 14 and may be angled, as shown, so the transition to the narrower grip portion 28 is smooth. The narrow, rounded tip 16 makes it easier to slide the spacer portion 14 into a narrow load zone 112 (FIG. 13). The widening plan form spreads load over a larger bearing area toward the shoulder 50.

0033 As shown in FIGS. 1, 3, 8 and 9, the top major face 44 of the spacer portion 14 has a first recess 20, and as shown in FIGS. 2, 4, 8 and 9, the bottom major face 46 has a second recess 22 opposite the first recess 20. In plan view each recess 20, 22 is elongated and tapered, roughly following the outline of the spacer portion 14, with a rounded end near the shoulder 50 and a pointed or narrowed end toward the tip 16. The recesses 20, 22 are separated by a central web 24 (FIGS. 8, 9). Each is surrounded by a raised peripheral rim 26 (FIGS. 1, 3, 9). The spacer portion 14 therefore has a generally I-shaped or H-shaped ("I-beam") cross-section (FIG. 9), in which the rims 26 provide flat, spaced bearing surfaces on both faces and the web 24 ties them together. In the illustrated model, the web 24 is roughly 40–50% of the nominal body thickness, and each recess runs for roughly 0.30 L along the spacer portion 14. This structure reduces material use and weight while keeping bending and compressive stiffness. It also gives the spacer portion 14 two spaced lines of contact on each face, which may help the tool sit stably against the curved glass or trim. In various embodiments the recesses 20, 22 may also serve as finger or thumb locators, provide clearance for a raised bead or lip of a weather seal, receive a cushioning insert, provide a location for a label or marking, and reduce sink, warpage, print time, or cycle time

during manufacture. In alternative embodiments the recesses can be omitted (solid spacer portion), provided on only one face, replaced with through-openings, ribs, or a lattice, or filled with an elastomeric insert.

0034 A lug 18 projects transversely (in the illustrated embodiment, generally perpendicular to the longitudinal axis 52) from the bottom major face 46 at or next to the distal tip 16 (FIGS. 1, 2, 5, 6, 8). In the illustrated embodiment the lug 18 is a short, generally cylindrical post with a rounded free end. Its diameter is about the width of the tip 16, and it extends beyond the bottom face 46 by about 0.8 times the body thickness. Together, the lug 18 and spacer portion 14 give the first end of the tool a generally L-shaped side profile (FIGS. 5, 8). The lug 18 may serve one or more of the following purposes: an insertion stop that limits how far the spacer portion 14 slides into the gap; a hook or locator that engages the upper edge 106 of the glass, the edge of the trim 108, or an adjacent body feature to keep the tool from slipping or falling out while the door is moved or the film is heat-shrunk; a handle or finger catch for pulling the tool out; and a tactile and visual cue that shows the correct orientation. Depending on the vehicle and the orientation chosen by the user, the lug 18 may bear against the inboard face of the glass, the outboard face of the glass, the upper edge of the glass, a lip or face of the trim or weather seal, or an adjacent body surface, or it may remain free of contact and serve only as a grip and orientation feature.

Intermediate Grip Portion 28

0035 The intermediate grip portion 28 (FIGS. 1, 3, 4, 5, 10) is a generally straight bar of roughly rectangular cross-section with rounded corners (FIG. 10). Each lateral side edge 48 has a row of notches 30 separated by teeth or ridges 32 (FIGS. 1, 3). In the illustrated embodiment each edge has nine notches 30 spaced at roughly equal pitch (about 0.05 L). The notches 30 are rounded (scalloped) and run through the full thickness of the body between faces 44 and 46, as seen in the side elevation of FIG. 5. The notches 30 and teeth 32 give the user a secure, positive grip and finger positions, including with gloves or hands wet with slip solution, and help the user feel the tool's orientation without looking. In some embodiments the notches 30 may also serve as a gauge for gaps or film-edge reveals, a seat for a cord or band, or a rest for a squeegee or hard card. The number, pitch, depth, and shape of the notches are not critical and may vary; for example, from two to twenty notches may be provided on one or both edges. Other embodiments

may use more or fewer notches, notches on only one edge, knurling, ribs on the major faces, an over-molded elastomer grip, or a smooth grip.

Second End Portion / Head 34

0036 The second end portion 34 forms a head that is wider than the grip portion 28 (FIGS. 1–4). In plan view it is generally diamond- or lozenge-shaped, with angled flanks diverging from the grip portion 28 to a maximum width and then converging toward the second end. A through-aperture 36 passes through the head 34 between faces 44 and 46 (FIGS. 1–4, 8, 11). In the illustrated embodiment the aperture 36 is roughly circular, with a diameter of about 0.075 L. The aperture 36 may be used to hang the tool on a hook, pegboard, tool cart, or lanyard, or to tether it to the vehicle or to another tool so it is not misplaced. The aperture 36 may also reduce weight and provide a finger loop for withdrawing the tool.

0037 An open-ended slot 38 extends inward from the second end of the head 34 along the longitudinal axis 52 (FIGS. 1, 3, 4, 7, 8), leaving a first prong 40 and a second prong 42 on either side (FIGS. 2, 3). In the illustrated embodiment the slot 38 has a rounded (U-shaped) bottom and a width of about 0.046 L, and the prongs 40, 42 have rounded, slightly flared ends. In various embodiments the slot 38 and prongs 40, 42 may be used to straddle or engage an edge, lip, or flange, for example the lip of a weather seal, a trim edge, or the edge of the glass; to lift or hold back a seal or trim edge; to hold a film edge, card, or squeegee; to hang the tool on a hook or edge; or to act as a secondary spacer at the second end of the tool. In some embodiments the slot and prongs are omitted.

0038 The head 34 may also carry identification or authenticity markings, such as a printed or molded label or a code that can be checked online. Different finishes or colors (for example red, blue, green, and black) may be provided so tools are highly visible in a work bay and can be assigned to specific bays or technicians. Such markings may be located on either major face, in a recess, or on the head 34.

Materials and Manufacture

0039 The body 12 is formed of a material that is rigid or semi-rigid enough to resist the closing load of a vehicle door without collapsing to the point where the trim 108 reaches the glass edge 106, and soft enough not to scratch or chip the glass 104, the film 116, or painted or trim

surfaces. Suitable materials include, without limitation, thermoplastics such as PLA, PETG, ABS, ASA, polycarbonate, nylon (PA6/PA12), acetal (POM), and polypropylene; fiber-reinforced polymers (for example glass- or carbon-fiber-filled nylon); thermoplastic elastomers and polyurethanes, alone or as an over-mold or contact pad; and wood, composite, or coated metal cores with a non-marring covering. The body 12 may be made by additive manufacturing (for example FDM/FFF, SLS, MJF, or SLA), injection molding, compression molding, machining, or casting. Color may be provided by pigmented material, painting, dyeing, coating, or anodizing (for metal cores). In some embodiments the material has a hardness between about Shore 60A and about Shore 85D, and the material and cross-section are selected so that the spacer portion remains at least partially uncompressed under a typical door-closing load, keeping the trim spaced from the glass edge. In other embodiments the tool deliberately includes a compliant zone that deforms elastically to absorb part of the closing energy.

Installation Environment (FIGS. 12–14)

0040 FIG. 12 schematically shows a vehicle 100 with a frameless door 102. Its window glass 104 is in the raised, locked-up working position, with its upper edge 106 exposed above the door. When the door 102 is closed, the upper edge 106 approaches and meets trim or weather seal 108 carried by the vehicle body (shown in broken lines in FIG. 12 as environment). The region between the upper edge 106 and the trim 108 is the load zone 112. In FIG. 12, the spacer tool 10 is seated in the load zone 112 along the upper edge 106 of the glass. One example vehicle is the rear door of a Tesla Model Y, which has frameless door glass. The tool is equally usable on front and rear frameless or semi-frameless doors of other vehicles, including sedans, coupes, convertibles, crossovers, and SUVs, and on other frameless glass panels such as frameless rear quarter or hatch glass. Because seal profiles, gap sizes, and glass curvatures differ between vehicles, the tool may be provided in different sizes, thicknesses, or shapes (see Alternative Embodiments), so that a tool suited to a particular vehicle or door can be selected.

0041 FIG. 13 is an enlarged schematic cross-section of the load zone 112 with the door open or ajar. The window glass 104, which may carry window film 116 on its interior face, ends at its upper edge 106. The trim/weather seal 108 is carried by a body structure 110 such as the roof rail or door-opening flange. The spacer tool 10 is interposed in the load zone 112 between the upper edge 106 and the trim 108. In the exemplary orientation shown, the spacer portion 14 (shown in

the I-shaped section of FIG. 9) lies along the upper edge 106 with one major face toward the glass edge and the other toward the trim 108. Other orientations are possible. The tool may lie along the upper edge 106, be placed at a front or rear upper corner of the glass, or be placed at a pillar region where the glass edge meets the trim or seal. Either major face may face the glass. The tool may be held in place by friction between the glass and the trim or seal, by engagement of the lug 18, by gravity, or by a retention feature described below.

0042 FIG. 14 shows the same region after the door has been closed, for example by a door-closing force F (FIG. 13) applied unintentionally by a person or by wind. The relative motion between the door and body closes the load zone 112, and the closing load is carried through the spacer tool 10 at a load-transfer contact interface 118 between the glass edge 106 and the tool, and between the tool and the trim 108. Because the spacer tool 10 holds the trim 108 away from the upper edge 106 of the glass by at least the thickness of the spacer portion 14, the trim 108 does not drive directly into the glass edge. The load is spread over the bearing surfaces of the rims 26 instead of being concentrated on the narrow glass edge. In some embodiments the tool also stops the door short of full latching, which leaves the door ajar so the user notices it and opens it again. Depending on the tool thickness and the vehicle, the door may latch with the tool trapped between the glass and the trim, may stop partly closed, or may rebound open. In embodiments that include a compliant material, the tool may also absorb part of the closing energy by elastic deformation.

Method of Use (FIG. 15)

0043 FIG. 15 shows a method of protecting frameless window glass during window film installation. After start 200, in step 202 the installer raises the window glass 104 to its fully raised, locked-up working position, for example using the vehicle's window controls or a service or tint mode that keeps the glass from making its normal short-drop movement. In step 204 the installer seats the spacer tool 10 in the load zone 112 between the upper edge 106 of the glass and the opposing trim 108, using the tapered tip 16 to guide the spacer portion 14 into place and the grip portion 28 to hold and position the tool, and checks that the tool is seated and stable and will not fall out. In step 206, with the tool still seated, the installer applies the window film 116, including any heat-shrinking, edge finishing, and squeegee steps that need the glass raised. If, as indicated at 208, the door is closed by accident during step 206, the closing load is carried

through the tool 10 as described for FIG. 14, and the glass 104 and trim 108 are protected. In step 210, once the step that needs the raised glass is complete, the installer removes the tool 10, for example by pulling it out by the grip portion 28 or the head 34, and the glass may then be lowered or the door closed normally. The method ends at 212. The method may be repeated for each frameless door of the vehicle, and several tools 10 (for example a pack of four) may be used at the same time, one per door. The method may also include telling people near the vehicle that the tool is a glass/trim protector and not a door stop for walking through.

Alternative Embodiments

0044 The illustrated embodiment is only one example. The following variations, alone or in any combination, are also within the scope of this disclosure:

- Size and scale: the tool can be made in any overall length (for example about 75 mm to about 300 mm), width, and thickness (for example about 3 mm to about 25 mm in the spacer portion) to suit different gaps, seals, and glass curvatures. Several sizes or thicknesses may be offered as a set, or the spacer portion may have stepped or graduated thicknesses along its length so one tool fits several gaps.
- Shape: the spacer portion can be rectangular, oval, wedge-shaped in thickness (tapering in thickness as well as width), curved in plan or in profile to follow the glass edge, or include a channel or groove that receives the glass edge or seal lip. The lug can be a hook, flange, ridge, barb, clip, or be omitted. The head can be round, rectangular, or the same width as the grip, and can have no aperture or slot, or several.
- Two-ended or multi-function tools: both end portions can be spacer portions of the same or different thickness, or the second end portion can form a secondary tool such as a seal lifter, trim tool, card or squeegee holder, or film-edge tuck tool.
- Compliance and padding: the spacer portion can carry, be covered by, or be made of an elastomeric, foam, felt, microfiber, or other non-marring pad on one or both bearing faces, or be made with variable stiffness (for example a rigid core with a soft skin) to cushion the glass and spread load.
- Retention: the tool can be held in place by friction, by the lug, by a spring clip, by a suction cup, by a magnet attached to a body panel, by a removable low-tack adhesive pad, or by a tether through the aperture; and it can include a high-visibility flag, tag, or streamer that hangs outside the door so the tool is not forgotten.
- Indicators: the tool can include a color, label, RFID/NFC tag, or QR/authenticity code; a load or deformation indicator showing that a door-closing impact occurred; or a bright finish so it is easy to see in the bay.
- Vehicles and glass: the tool can be used on front and rear frameless or semi-frameless passenger-car, SUV, truck, and convertible doors, frameless hatch or quarter glass, and other

glazing where a raised glass edge meets a closing trim or seal, as well as non-automotive frameless glass doors and panels (for example cabinets, appliances, showers, and marine and RV glazing).

- Uses beyond tint: protecting raised frameless glass during paint protection film application, detailing, glass cleaning or ceramic coating, seal replacement, door or window regulator service, vehicle inspection, or transport, whenever the glass must stay up with the door open.

0045 Features described with respect to one embodiment may be combined with features of other embodiments. The terms "comprising," "including," and "having" are open-ended. "A" or "an" means one or more.

EXAMPLE CLAIMS

The following example claims are provided to illustrate subject matter of the disclosure and do not limit it. What is claimed is:

1. A spacer tool for protecting raised window glass of a frameless vehicle door, the spacer tool comprising: an elongated body extending along a longitudinal axis and having a first end portion, a second end portion opposite the first end portion, and an intermediate grip portion between the first end portion and the second end portion; wherein the first end portion defines a load-bearing spacer portion sized to be removably interposed between an upper edge of the window glass, held in a raised position, and an opposing trim or weather seal of the vehicle, such that when the door is closed while the spacer portion is interposed, a closing load is transmitted through the spacer portion instead of from the trim or weather seal directly to the upper edge of the window glass.

2. The spacer tool of claim 1, wherein the spacer portion tapers in width toward a rounded distal tip.

3. The spacer tool of claim 1, further comprising a projection extending transversely from a major face of the body at or adjacent a distal tip of the first end portion, the projection being configured to act as at least one of an insertion stop, a locator, and a retainer for the spacer portion.

4. The spacer tool of claim 1, wherein the spacer portion includes a first recess in a first major face and a second recess in an opposite second major face, the first and second

recesses being separated by a web such that the spacer portion has a generally I-shaped cross-section with a peripheral rim surrounding each recess.

5. The spacer tool of claim 1, wherein the grip portion includes a plurality of notches spaced along at least one lateral side edge of the body.

6. The spacer tool of claim 1, wherein the second end portion forms a head wider than the grip portion, the head defining a through-aperture.

7. The spacer tool of claim 6, wherein the head further defines an open-ended slot extending from a free end of the head along the longitudinal axis, the slot defining a pair of prongs.

8. The spacer tool of claim 1, wherein the body is a unitary, one-piece polymer body having rounded external edges.

9. A method of protecting window glass of a frameless vehicle door during installation of window film, the method comprising: positioning the window glass in a raised working position with the door open; removably seating a spacer tool between an upper edge of the window glass and an opposing trim or weather seal of the vehicle; with the spacer tool seated, applying window film to the window glass, including heat-shrinking the window film; and after the applying, removing the spacer tool.

10. The method of claim 9, wherein, if the door is closed while the spacer tool is seated, the spacer tool carries a closing load between the trim or weather seal and the upper edge of the window glass, preventing the trim or weather seal from contacting the upper edge directly.

11. The method of claim 9, wherein the spacer tool is the spacer tool of any one of claims 1 to 8.

12. A kit comprising a plurality of the spacer tools of claim 1, for simultaneous use on a plurality of frameless doors of a vehicle.

ABSTRACT

A removable spacer tool protects the raised window glass of a frameless vehicle door during window film installation. An elongated one-piece body has a tapered, load-bearing spacer portion at one end, a notched grip portion, and a widened head with a through-aperture and an open-ended slot at the other end. The spacer portion may have opposed recesses that give it an I-shaped cross-section, and a transverse lug at its tip. With the glass held fully raised for heat-shrinking film, the spacer portion is seated between the upper edge of the glass and the opposing body trim or weather seal. If the door is closed by accident, the closing load passes through the tool rather than from the trim into the glass edge, reducing the risk of cracked glass and damaged trim. The tool is removed when the raised-glass work is complete.

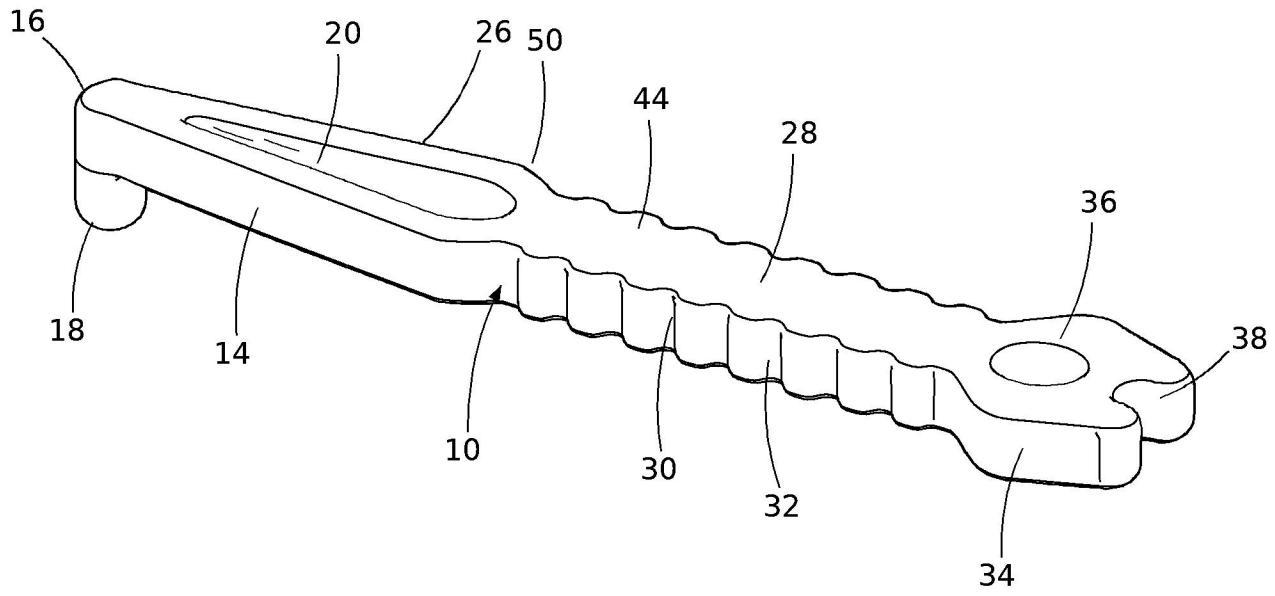


FIG. 1

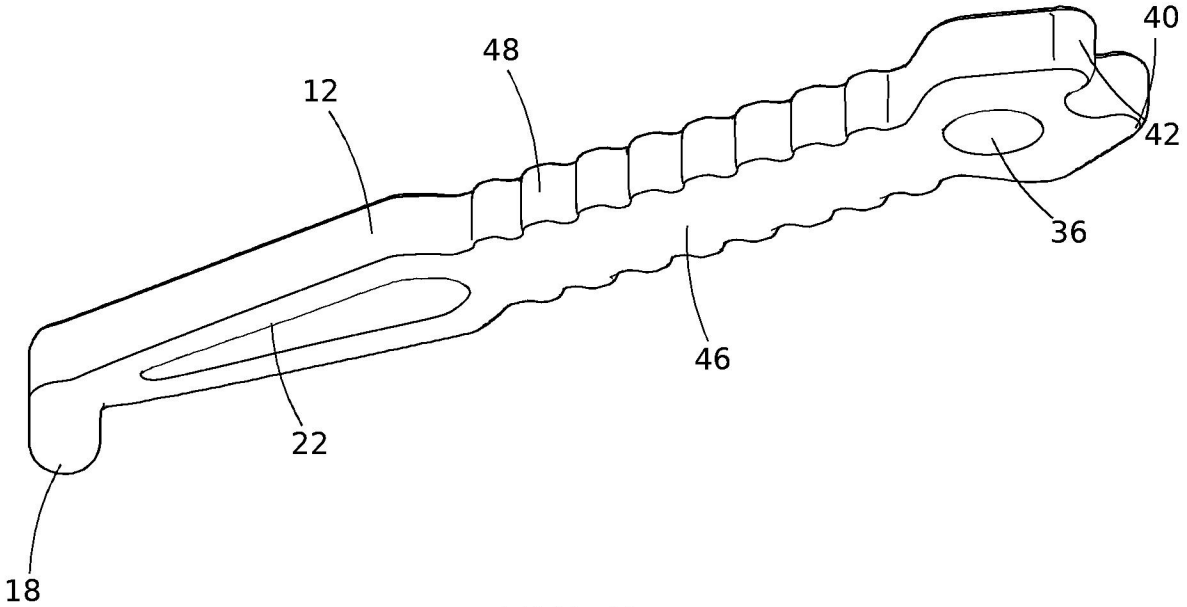


FIG. 2

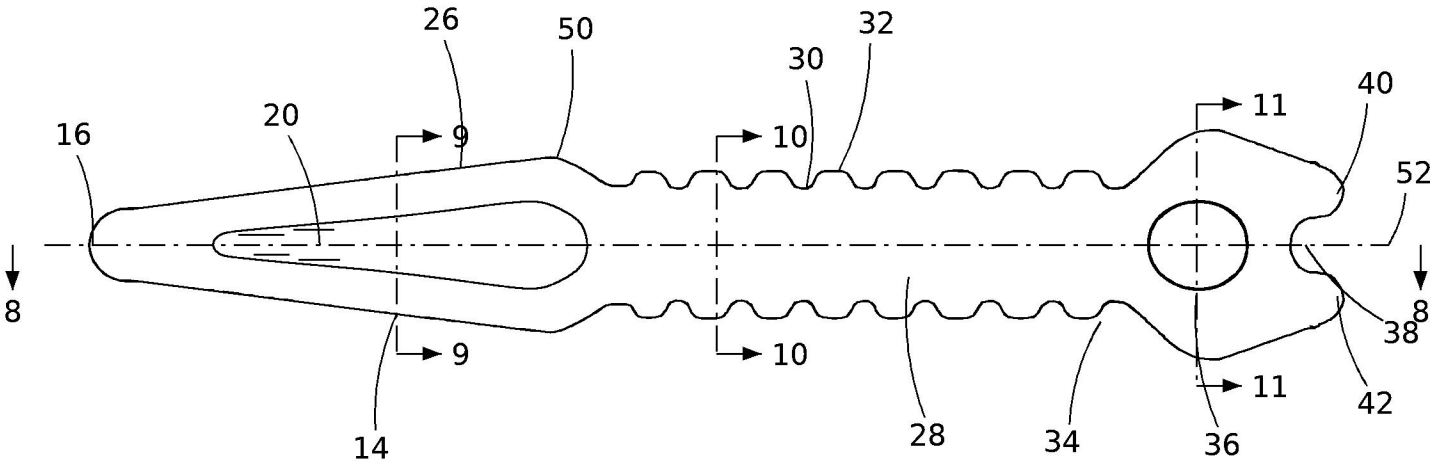

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FIG. 3

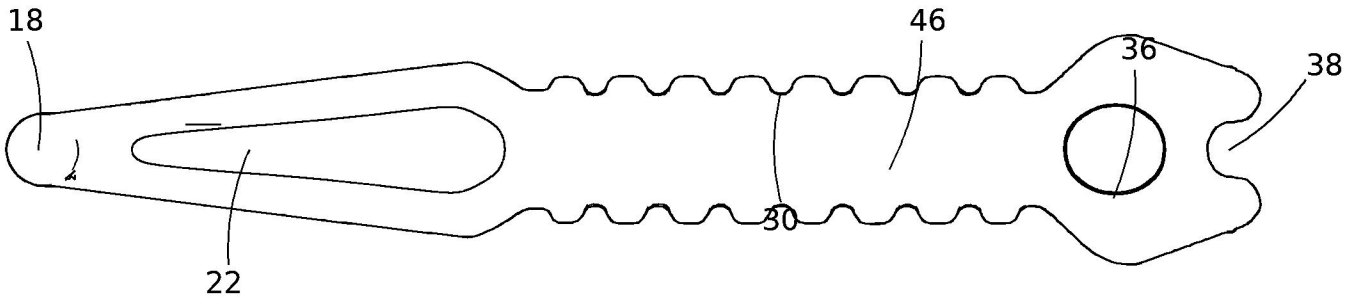

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FIG. 4

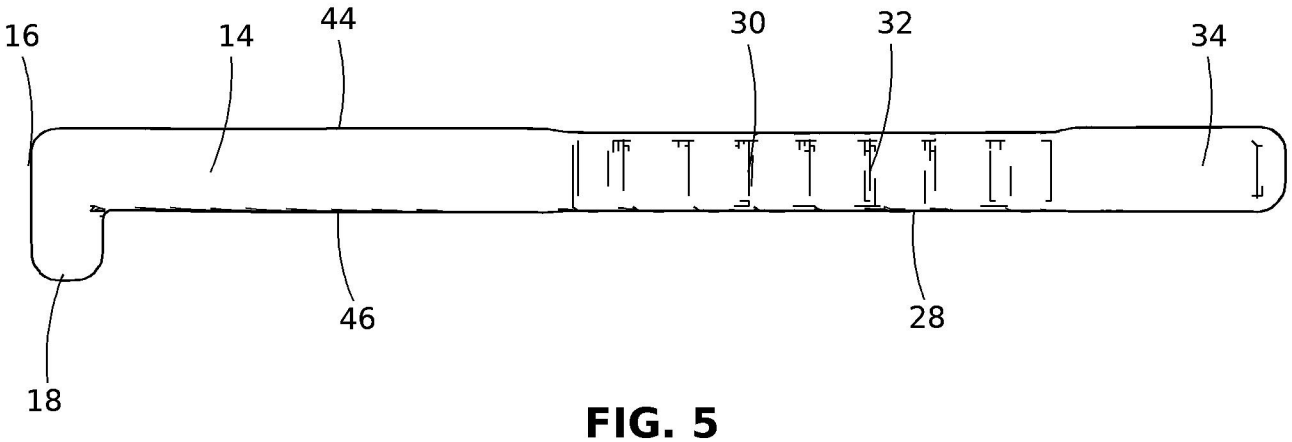


FIG. 5

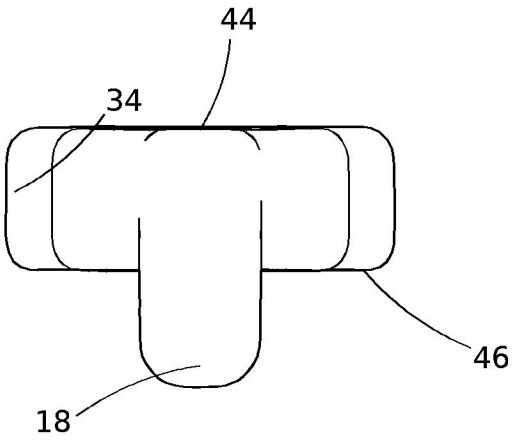


FIG. 6

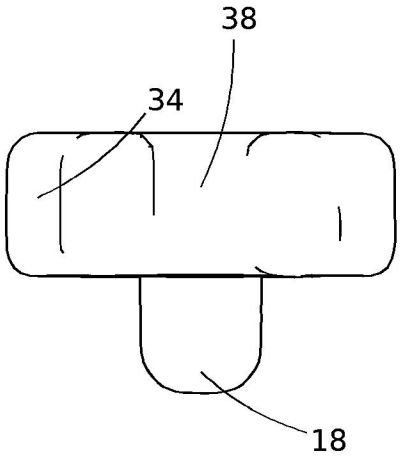


FIG. 7

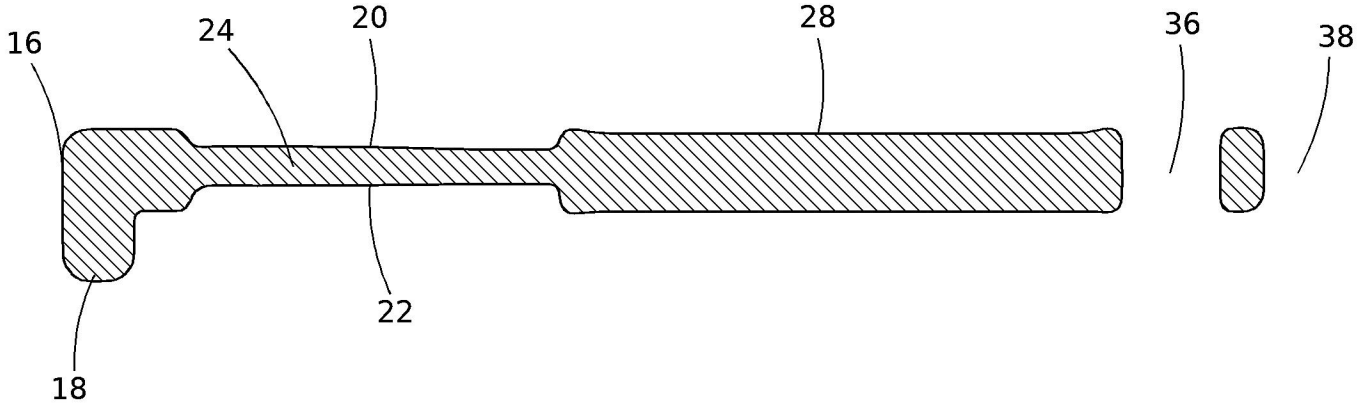


FIG. 8

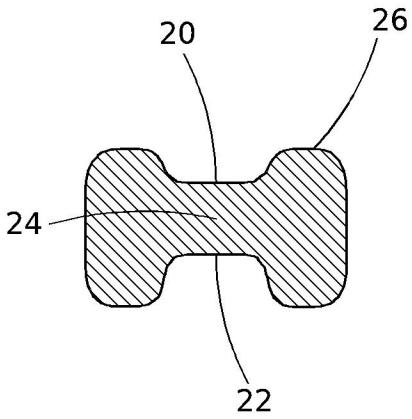


FIG. 9

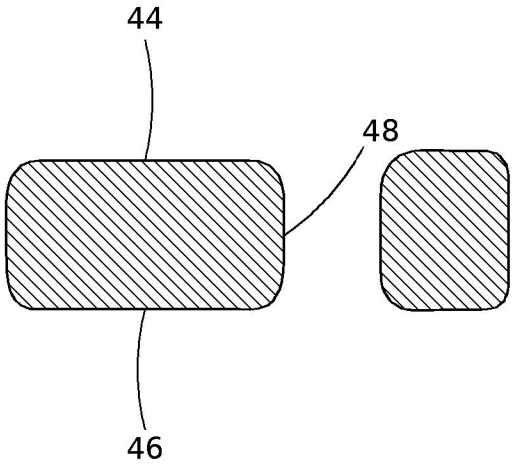


FIG. 10

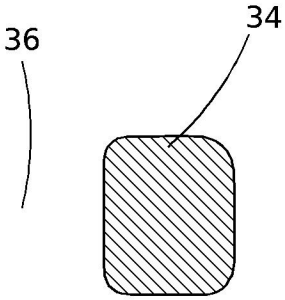


FIG. 11

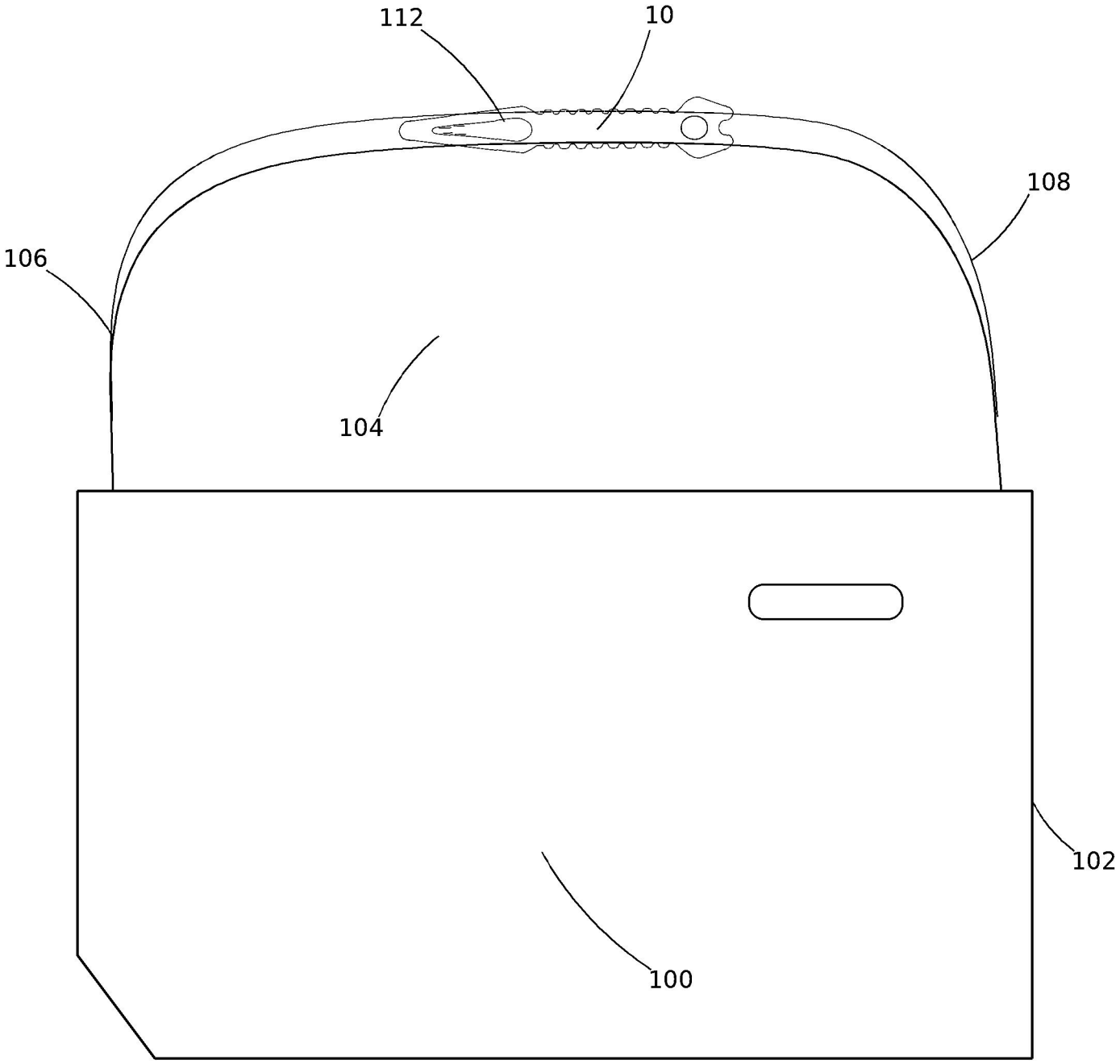


FIG. 12

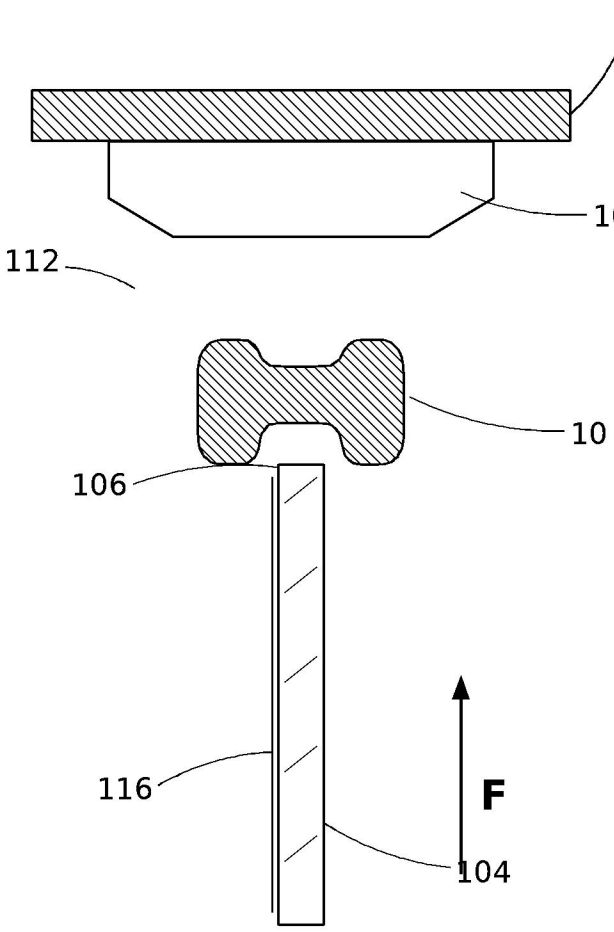


FIG. 13

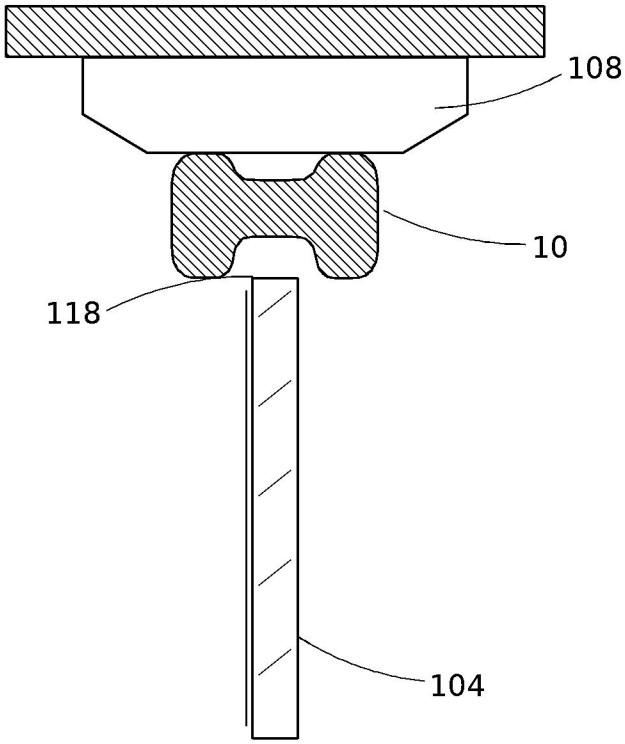


FIG. 14

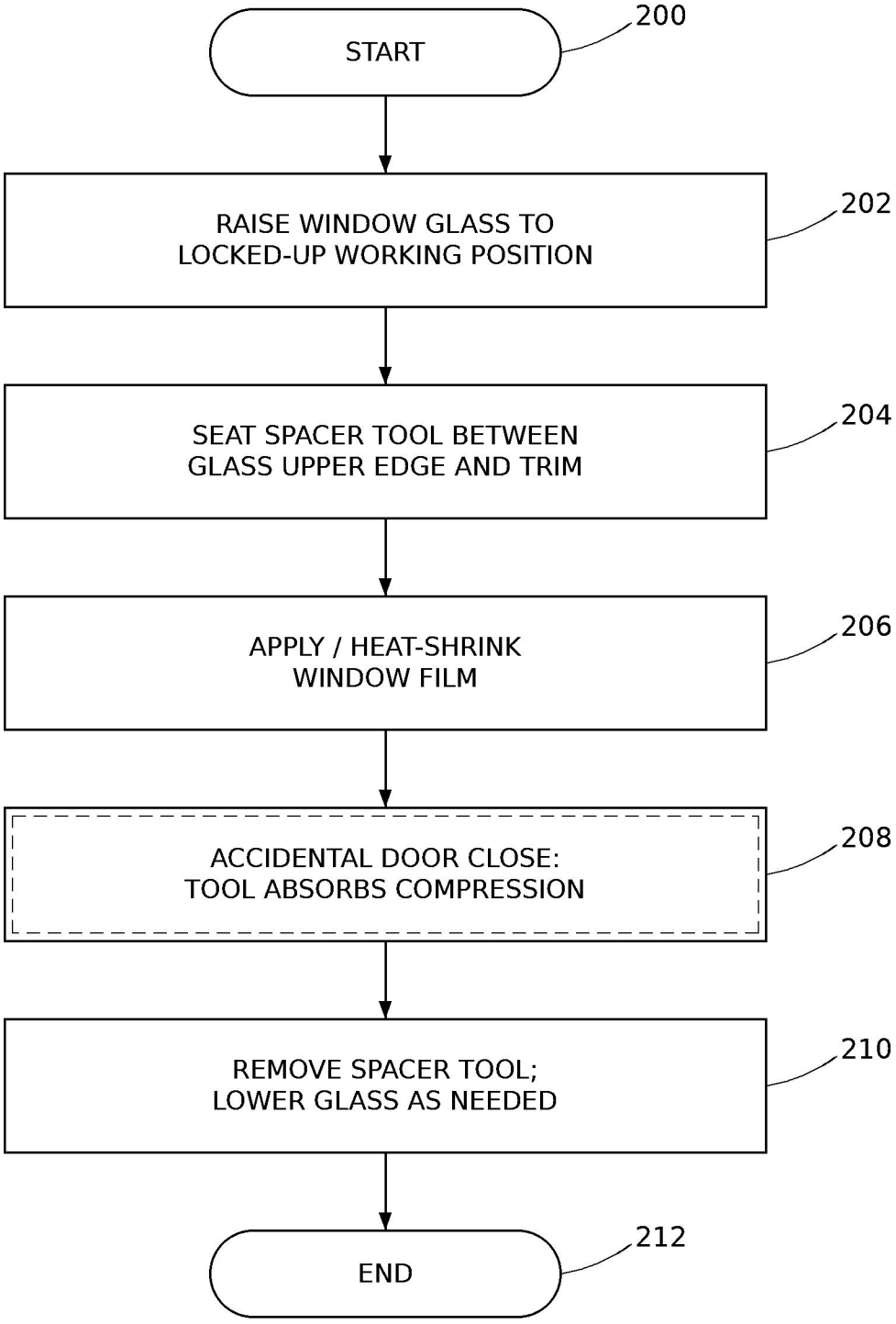

START
200
RAISE WINDOW GLASS TO
LOCKED-UP WORKING POSITION
202
SEAT SPACER TOOL BETWEEN
GLASS UPPER EDGE AND TRIM
204
APPLY / HEAT-SHRINK
WINDOW FILM
206
ACCIDENTAL DOOR CLOSE:
TOOL ABSORBS COMPRESSION
208
REMOVE SPACER TOOL;
LOWER GLASS AS NEEDED
210
END
212

FIG. 15