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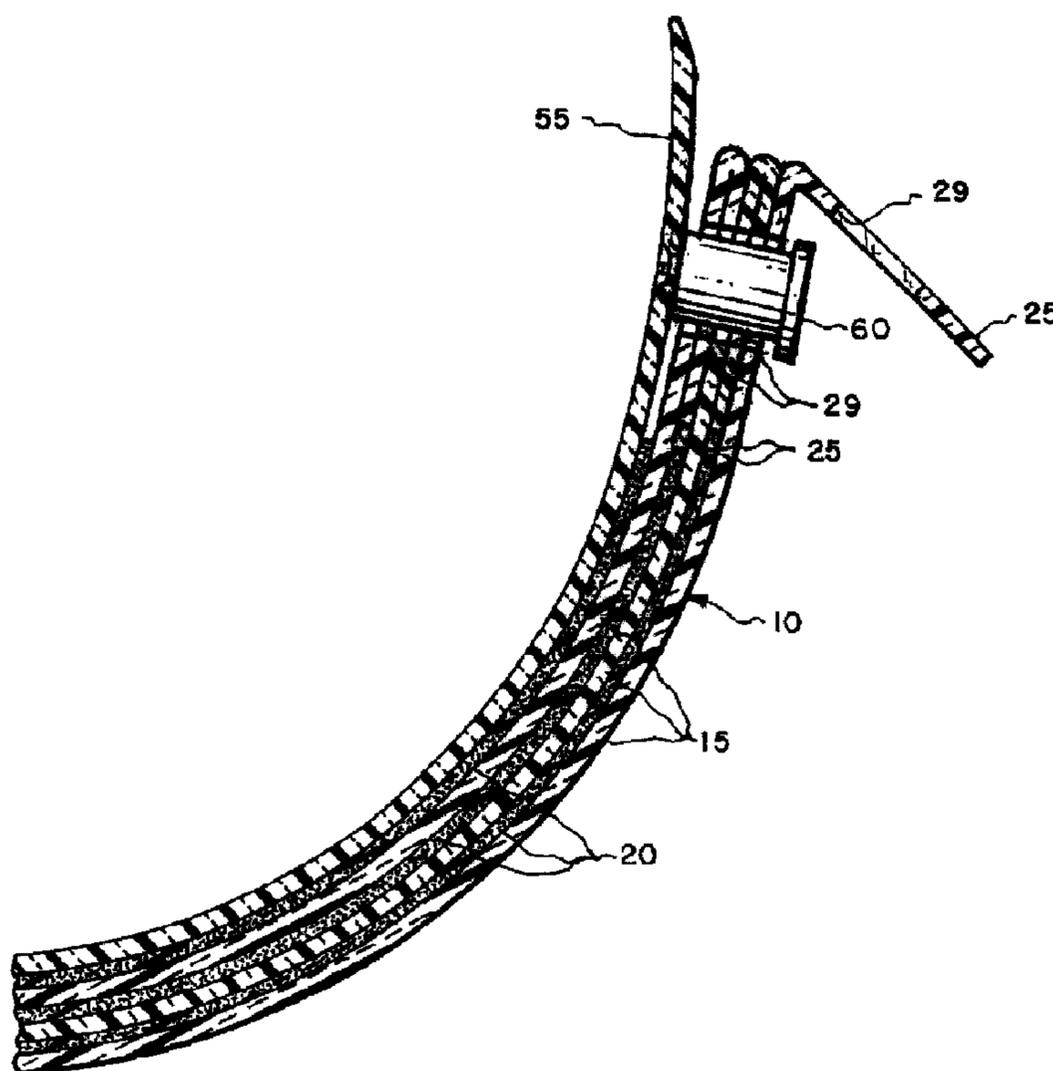
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(54) Titre : PILE DE LENTILLES OPTIQUES LAMINEES AMOVIBLES POUR ECRANS FACIAUX, FENETRES ET DISPOSITIFS D'AFFICHAGE

(54) Title: OPTICAL STACK OF LAMINATED REMOVABLE LENSES FOR FACE SHIELDS, WINDOWS, AND DISPLAYS



(57) Abrégé/Abstract:

A stack of laminated transparent lenses consists of two alternating optically clear materials in intimate contact. The materials are a plastic lens and clear adhesive. The adhesive is uninterrupted. The lens and the adhesive have refraction mismatch of less than 0.2. A tab portion is part of each lens and acts as an aid in peeling away the outermost lens after contamination of the lens layer during racing conditions. The lens stack can be mounted to the posts on the face shield of a racing helmet or laminated directly to a windshield.

OPTICAL STACK OF LAMINATED REMOVABLE LENSES
FOR FACE SHIELDS, WINDOWS, AND DISPLAYS

35

ABSTRACT

36 A stack of laminated transparent lenses consists of two
37 alternating optically clear materials in intimate contact. The
38 materials are a plastic lens and clear adhesive. The adhesive is
39 uninterrupted. The lens and the adhesive have refraction mismatch
40 of less than 0.2. A tab portion is part of each lens and acts as
41 an aid in peeling away the outermost lens after contamination of
42 the lens layer during racing conditions. The lens stack can be
43 mounted to the posts on the face shield of a racing helmet or
44 laminated directly to a windshield.

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TITLE OF THE INVENTION: optical stack of laminated
removable lenses for face shields,
windows, and displays

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention pertains to the following areas of
technology: Apparel - Guards and Protectors; for wearer's head

1 and face; eye shields such as goggles having a lens-cover plate;
2 and windshield covers.

3 2. Description of the Prior Art:

4 Face shields are employed in environments where
5 contamination of the eyes may occur. It is well known in the art
6 that flexible transparent lenses affixed by numerous methods are
7 overlaid on the face shield for protection. The lenses are easily
8 removed and discarded when visibility is reduced from the
9 accumulation of dirt or other contaminants. In motor sports for
10 instance, multiple layers of transparent lenses are overlaid on
11 the face shield, each being sequentially removed as they become
12 contaminated, because they reduce the visibility of the operator.
13 The drawback of the lenses in the prior art is that each
14 transparent lens applied over the face shield is itself a
15 hindrance to good visibility due to its optical index of
16 refraction. Most common materials used as plastics have optical
17 indexes of refraction ranging from 1.47 to 1.498. The index
18 mismatch between the removable lens and air (air has an optical
19 index of 1.00) causes a reflection of 4% of the light that would
20 normally come to the operator's eyes. This reflection effect is
21 additive for each additional surface to air interface. Then for

1 each removable lens having two surfaces, the reflections are 8%.
2 Thus a stack of seven lenses would reflect 42% of the light away
3 from the operator thereby reducing the brightness of the objects
4 viewed. A second optical phenomenon occurs simultaneously that
5 also reduces visibility. The reflections are bi-directional and
6 thus make the lens stack appear as a semi-permeable mirror to the
7 operator. This mirror effect further reduces visibility, because
8 the light that passes through the lens stack reflects off of the
9 operator's face and then reflects off of the lens stack into the
10 operator's eyes. The effect to the operator is that he sees his
11 own image on the inside of the stack nearly as brightly as the
12 objects viewed on the outside. This significantly reduces
13 visibility.

14 Another drawback to this stacking arrangement is that
15 moisture exhaled by the operator's breath can cloud or fog-up the
16 lenses also reducing visibility. The air spaces between each lens
17 allows the moisture to enter this area.

18 19 SUMMARY OF THE INVENTION

20 Accordingly the present invention seeks to provide a series
21 of easily removable optically clear lens stacks that do not cause

1 reflection to the operator's eyes. The prior art discloses
2 reflective lens stacks that do cause reflections to the
3 operator's eyes. An example of this type of prior art of
4 reflective lens stacks is disclosed in U.S. Patent No. 5,592,698
5 issued on Jan. 14, 1997 to Woods.

6 Refraction is the change in the direction in which waves
7 travel when they pass from one kind of matter into another. Waves
8 are refracted (bent) when they pass at an angle from one medium
9 into another in which the velocity of light is different. The
10 amount that a ray of a certain wavelength bends in passing from
11 one medium to another is indicated by the index of refraction
12 between the two mediums for that wavelength. The index of
13 refraction indicates the amount that a light ray bends as it
14 passes out of one substance and into another. When light passes
15 from air to a denser substance, such as Mylar™ film, it slows
16 down. If the light ray enters the Mylar film at any angle except
17 a right angle, the slowing down causes the light ray to bend at
18 the point of entry. This bending is called refraction. The ratio
19 of the speed of light in air to its speed in the Mylar film is
20 the Mylar film's index of refraction.

In one broad aspect the invention pertains to an optical stack of laminated removable lenses for affixing to a face shield on a helmet comprising a plurality of superposed removable lenses adhesively affixed to one another, each removable lens being held to each successive lens with a clear uninterrupted adhesive layer interposed between each removable lens. Each lens has a removal tab portion on at least one end which does not have any adhesive layer on either side of the tab portion for allowing the wearer of the helmet to quickly grasp the removal tab portion for removing the top lens and exposing a clean lens directly underneath the removed top lens.

Another aspect of the invention provides an optical stack of removable lenses for affixing to an optical window comprising a plurality of generally rectangular superposed removable lenses adhesively affixed to one another and forming a continuous perimeter, each removable lens being held to each successive lens with a clear uninterrupted adhesive layer interposed between each removable lens. The perimeter has generally straight edge portion, the area adjacent the straight edge portion having a banded portion that does not have any adhesive affixed to any of the layers of film to assist in allowing each film layer to be peeled off successively along the straight edge portion. A plurality of staggered tabs are affixed to each film layer and extend from the straight edge portion to assist the user in removing the uppermost soiled film layer, and successively removing each next clean layer as the top exposed layer becomes contaminated.

More particularly, the present invention includes a series of alternating

1 optically clear films whose indexes of refraction are matched to
2 within .2 and which will nearly eliminate all reflections to the
3 operator's eyes. The layers of film are adhesively laminated to
4 one another and are compliant so there is no air between the
5 layers. The film layers can be large and generally rectangular in
6 shape with a tab extending from each of the film layers. The tabs
7 can be staggered so that the user can remove the top most layer
8 and then the next succeeding layer. This embodiment of the
9 present invention can be applied to race car windshields,
10 windows, visors or direct view displays such as ATM machines that
11 are subject to contaminating environments. Accordingly, the
12 present invention is an adhesively laminated multi-layered clear
13 film adapted to be used on a racer's face shield, or on the
14 windshield of a race car to keep the viewing area clean during
15 the course of a race.

16 BRIEF DESCRIPTION OF THE DRAWINGS

17 FIG. 1 is a perspective view of an off-road wearer's helmet
18 showing one embodiment of the present invention affixed to the
19 face shield of the helmet.

1 **FIG. 2 is a front elevational view of the helmet shown in**
2 **FIG. 1 showing the tab portion without any adhesive for allowing**
3 **the wearer of the helmet to easily grasp the tab and peel-off the**
4 **soiled top layer of the present invention.**

5 **FIG. 3 is a partial sectional view taken along line 3--3 in**
6 **FIG. 2. This view shows the tension post extending outwardly from**
7 **the face shield with the left-side end tab portion of the present**
8 **invention.**

9 **FIG. 4 is a front elevational view illustrating the present**
10 **invention before it is affixed to the face shield of the helmet.**

11 **FIG. 5. is a top view of the stackable lenses illustrating**
12 **seven layers of lens held together by an adhesive applied between**
13 **each lens with the thicknesses of the layers of each lens and**
14 **applied adhesive highly exaggerated to clearly show the**
15 **relationship between the lenses and the adhesive and also to show**
16 **the end portions that do not have any adhesive between each lens**
17 **layer for forming the removable tab portions at both ends of the**
18 **present invention.**

19
20 **FIG. 6 illustrates a 60" wide roll of film, which will be**

1 used to cut out the optical stacks that are illustrated in FIG.
2 4. The gray stripes illustrate the clear adhesive, and the clear
3 stripes illustrate the clear film without adhesive. It is to be
4 understood that the gray stripes are for illustration purposes
5 only, because the adhesive is clear.

6 FIG. 7 is an exploded perspective view illustrating seven
7 sheets of film layer and seven layers of clear adhesive
8 interposed between each sheet of film layer. This embodiment is
9 used for windshields, windows and the like.

10 FIG. 8 is a view of the laminated sheets illustrated in FIG.
11 7 having a rectangular shape with a series of six tabs for
12 removing each top layer of the lenses successively as the
13 uppermost exposed lens layer becomes soiled or otherwise
14 contaminated.

15

1 Detailed Description of the Invention

2 The present invention will now be discussed in detail. As
3 stated above, FIG. 4 is a front elevational view illustrating the
4 present invention 10 before it is affixed to the face shield of
5 the helmet 50. The top view in FIG. 5 illustrates 7 layers of
6 lenses 15 adhesively affixed to each successive lens. The
7 adhesive layer is numbered 20. The material used to form the
8 lenses is preferably a clear polyester. The lens layers are
9 fabricated from sheets of plastic film sold under the registered
10 trademark Mylar owned by the DuPont Company. The several
11 trademark registrations for the mark Mylar list several types of
12 products sold under that mark, and include polyester film. The
13 type of Mylar used in the present invention is made from the
14 clear polymer polyethylene terephthalate, commonly referred to as
15 PET, which is the most important polyester. PET is thermoplastic-
16 -that is, it softens and melts at high temperatures. Uses of PET
17 film include magnetic tapes and shrink wrap. The adhesive 20 used
18 to laminate the lenses together sequentially is a clear optical
19 low tack material. The thickness of each lens will range from .5
20 mil to 7 mil (1 mil is .001"). The preferred thickness will be 2
21 mil. Even after the adhesive material is applied to a 2 mil
22 thickness lens, the thickness of the 2 mil thickness lenses will
23 still be 2 mil.

1 The adhesive has nominal thickness. As illustrated in FIG. 5,
2 after the seven layers of film and the six layers of adhesive are
3 laminated together, the overall thickness of the end product is
4 15 mils. The term "wetting" can be used to describe the
5 relationship between the laminated film layers. When viewing
6 through the laminated layers, it appears to be one single piece
7 of plastic film. No reflections are evident. The end tab portions
8 without the adhesive exhibit reflections are not a hindrance to
9 the user, because these end portions are folded back over the
10 posts as illustrated in FIG. 3, and do not affect the visibility
11 of the user.

12 The adhesive material 20 will be a water-based acrylic
13 optically clear adhesive or an oil based clear adhesive, with the
14 water based adhesive being the preferred embodiment. After the
15 seven layers are laminated or otherwise bonded together with the
16 adhesive layers, the thickness of each adhesive layer is
17 negligible even though the adhesive layers are illustrated in
18 FIGS. 4 and 5 as distinct layers. FIG. 5. is a top view of the
19 stackable lenses illustrating seven layers of lens held together
20 by an adhesive applied between each lens with the thicknesses of
21 the layers of lenses and applied adhesive highly exaggerated to
22 clearly show the relationship between the lenses and the adhesive

1 and also to show the end portions that do not have any adhesive
2 between each lens layer for forming the removable tab portions 25
3 at both ends of the present invention.
4

5 The individual stackable lenses package, illustrated in FIG.
6 5 for use with racing helmets, can be fabricated from a roll of
7 film as illustrated in FIG. 6. The film in FIG. 6 includes seven
8 layers of clear polyester film, and having the water-based
9 acrylic adhesive laminating the seven film layers to one another.
10 Keep in mind that each layer of the lenses can be easily peeled
11 away as the top layer exposing the next clean lens. Each
12 succeeding lens layer can be removed as the top lens becomes
13 contaminated with dirt and grime during racing conditions.

14 Referring back now to FIG. 3. As previously stated, FIG. 3
15 illustrates the tension post 60 extending outwardly from the face
16 shield 55 with the left side end tab portion 25 of the present
17 invention illustrated. The face shield 55 has a left tension post
18 60 and a right tension post 65. The present invention 10 has the
19 following dimensions: 18" in length; 2 ½" in height; and about 15
20 mils in thickness (1 mil is .001"). The present invention is
21 symmetrical about its vertical medial axis and about its
22 horizontal medial axis. The left end has a removable tab portion

1 25, and the right end has a removable tab portion 35. The left
2 portion has a finger hole 39, and the right portion has a finger
3 29. The area 10 indicates where the adhesive 20 is applied to the
4 layers of the lens 15. The bilateral demarcation lines 31 and 41
5 indicate where the adhesive stops on either side. The demarcation
6 lines 31 and 41 also indicate where the tab portions begin. The
7 present invention has a pair of bilateral keyhole-shaped slots 27
8 and 37 for demountably engaging the two helmet posts 60 and 65
9 respectively. The curved distance between the two helmet posts 60
10 and 65 is the same as the distance between the centers of the
11 pair of slots 27 and 37. The user secures the lenses to the face
12 shield by positioning the slots adjacent the helmet posts and
13 passing the posts through the slots. It is preferable that the
14 remainder of the tab portion outboard from the slot be folded
15 back upon itself so that the finger hole is also passed through
16 the helmet post. This is illustrated in FIG. 3. The proper
17 installation of the present invention on the helmet requires the
18 user to position the bottom lens of the stack through the post
19 hole by passing the post through the slot, then folding back the
20 remainder of the tab portion 25 so that the post passes through
21 the finger hole 29. This is done for each lens working from the
22 bottom up until the tab portion 25 of the top lens extends
23 unfolded as illustrated in FIG. 2. In this manner, the helmet

1 wearer can easily put his index finger through the finger hole 29
2 in the topmost lens layer and peel off to remove the topmost lens
3 layer. The clean layer below the removed layer is then exposed
4 and the removal tab portion on the exposed layer will spring back
5 to the unfolded position to expose the finger hole so that the
6 helmet wearer can easily remove that layer after it becomes
7 soiled and contaminated. The plastic material forming the lenses
8 is resilient and will spring back to its unfolded position and
9 extend outwardly from the face shield. The thicknesses of the
10 layered lenses and folded tab portions illustrated in FIG. 3 are
11 highly exaggerated to clearly show the folding relationship. In
12 actual practice seven lenses and seven tab portions will be
13 stacked into the space between the end of the post and the outer
14 surface of the face shield. Remember that there is no adhesive
15 between the tab portions. This allows the removal tab portions to
16 fan out. They do not stick to one another.

17 The present invention as shown in the Drawing Figures has
18 removal tab portions at both ends. This allows a right or left-
19 handed person to easily remove the topmost layer. It also allows
20 the driver to pull the tab with either hand depending on the
21 circumstances of the race. It is to be understood that the

1 present invention includes a laminated lenses with only a left
2 tab portion 25, or only a right tab portion 35, or both a left
3 and a right tab portion.

4 The windshield embodiment 100 illustrated in FIGS. 7 and 8
5 will now be discussed in detail. An optical stack of removable
6 lenses for affixing to an optical window such as a racing car
7 windshield is disclosed in FIG. 8. The embodiment 100 has a
8 plurality of seven generally rectangular superposed removable
9 lenses 105 adhesively affixed to one another. The outer perimeter
10 is continuous. Each of the removable lens 105 is held to each
11 successive lens with a clear uninterrupted adhesive layer 110
12 interposed between each of the removable lens. The perimeter has
13 at least one generally straight edge portion 115. In the
14 embodiment illustrated in FIG. 8, the perimeter is rectangular
15 and has four straight edge portions, one for each side. It is to
16 be understood that the invention could be practiced with only one
17 generally straight edge portion. The area adjacent to the
18 straight edge portion 115 has a banded portion 120 that does not
19 have any adhesive affixed to any of the layers of film to assist
20 in allowing each said film layer 105 to be peeled off
21 successively along the straight edge portion. A plurality of
22 staggered tabs 125 are affixed to the film layers one-at-a-time.

1 The tabs 125 extend from the straight edge portions 120 to assist
2 the user in removing the uppermost soiled and grimy film layer,
3 and to successively remove each next clean layer as the top
4 exposed layer becomes contaminated.

5 The adhesive layer can be foreshortened so as to expose
6 successively a portion of the lens layers without optical wetting
7 to create a grasping tab.

8 The stack of removable lenses as illustrated in FIGS. 7 and
9 8 can have an optically clear adhesive as the bottom last layer
10 to aid in mounting the stack of lenses to the windshield. The
11 stack is affixed to the windshield in much the same way that
12 tinted window plastic film is affixed to a window. The windshield
13 is sprayed with water and the bottom adhesive layer with the
14 stack is then applied to the windshield. Air bubbles and the like
15 are eliminated with a squeegee appliance. The bottom layer
16 becomes "wetted" to the windshield.

17 The stack of removable lenses 100 can be applied to any type
18 of optical window such as windshield, window, face shield, or a
19 video display. It is common at an ATM terminal to have a video
20 display for the customer. The surface of the display can be kept

1 clear by using the present invention.

2

While the present invention has been shown and described herein in what is conceived to be the best mode contemplated, it is recognized that departures may be made therefrom within the scope of the invention which is therefore not to be limited to the details disclosed herein, but is to be afforded the full scope of the invention.

WHAT IS CLAIMED IS:

1 1. An optical stack of laminated removable lenses for
2 affixing to a face shield on a helmet comprising:

3 a plurality of superposed removable lenses adhesively
4 affixed to one another;

5 each said removable lens being held to each successive lens
6 with a clear uninterrupted adhesive layer interposed between each
7 said removable lens;

8 each said lens having a removal tab portion on at least
9 one end which does not have any adhesive layer on either side of
10 said tab portion for allowing the wearer of the helmet to quickly
11 grasp said removal tab portion for removing the top lens and
12 exposing a clean lens directly underneath said removed top lens.

 2. The optical stack of removable lenses as recited in claim
1 further comprising:

 a second removable tab portion opposite the end of said
removal tab portion.

3. The stack of removable lenses as recited in claim 1
further comprising:

slots for mounting said optical stack of removable lenses to
a face shield.

4. The stack of removable lenses as recited in claim 1
further comprising:

means for mounting said optical stack of removable lenses to
a face shield.

5. The optical stack of removable lenses as recited in claim
1 wherein:

said removable lenses and said clear adhesive layers have an
index of refraction between 1.40 and 1.52.

1 6. An optical stack of removable lenses for affixing to an
2 optical window comprising:

3 a plurality of generally rectangular superposed removable
4 lenses adhesively affixed to one another and forming a continuous
5 perimeter;

6 each said removable lens being held to each successive lens
7 with a clear uninterrupted adhesive layer interposed between each
8 said removable lens;

9 said perimeter having a generally straight edge portion;

10 the area adjacent said straight edge portion having a banded
11 portion that does not have any adhesive affixed to any of the
12 layers of film to assist in allowing each said film layer to be
13 peeled off successively along said straight edge portion; and

14 a plurality of staggered tabs affixed to each said film
15 layer and extending from said straight edge portion to assist the
16 user in removing said uppermost soiled film layer, and
17 successively removing each said next clean layer as said top
18 exposed layer becomes contaminated.

19

20 7. The stack of removable lenses as recited in claim 6

21 wherein:

22 the adhesive layer is foreshortened as to expose a portion
23 of the lens layers without optical wetting, creating a grasping
24 tab.

25

26 8. The stack of removable lenses as recited in claim 6

27 wherein:

28 an optically clear adhesive is the last layer to aid in
29 mounting to a face shield.

30 9. The stack of removable lenses as recited in claim 6

31 wherein:

32 the optical window to which said stack of removable lenses
33 is mounted includes a windshield, window, face shield, or a video
34 display.

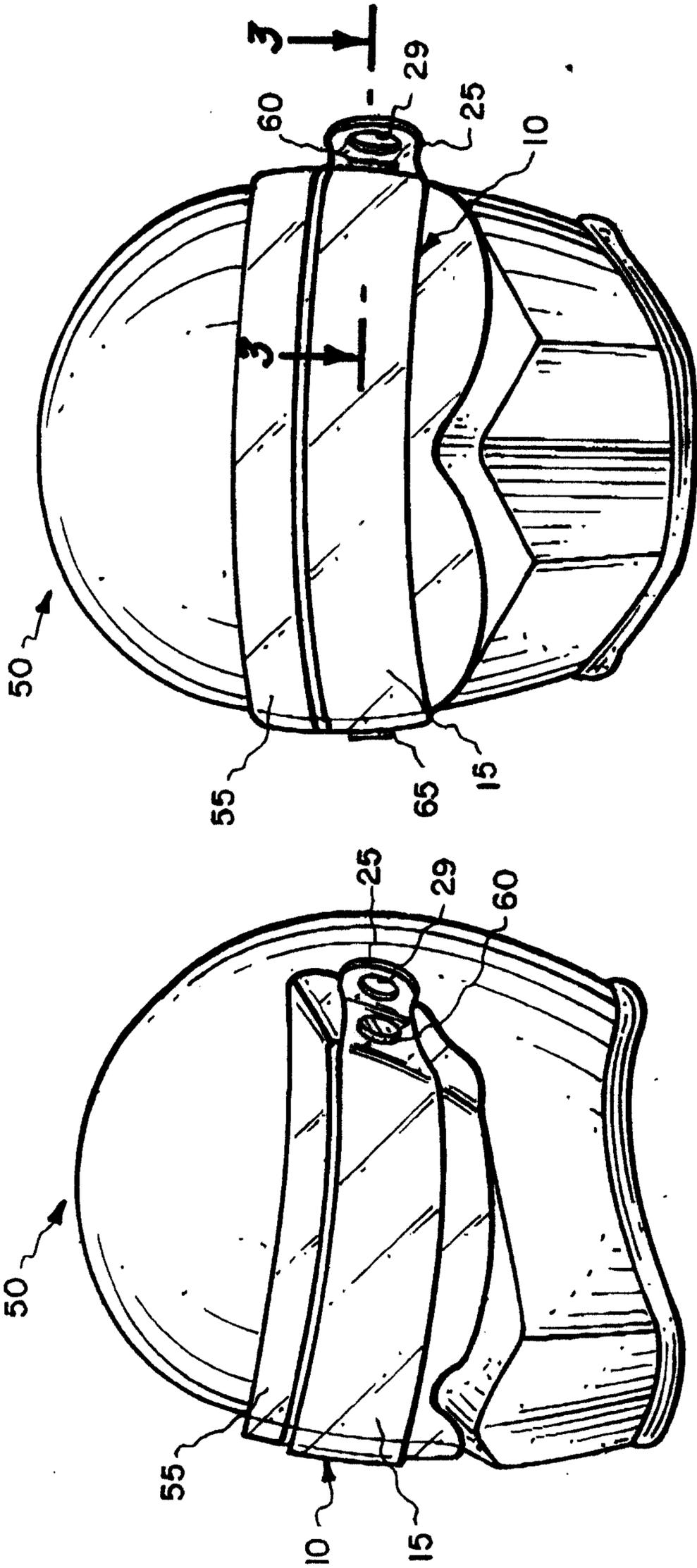


Fig. 2.

Fig. 1.

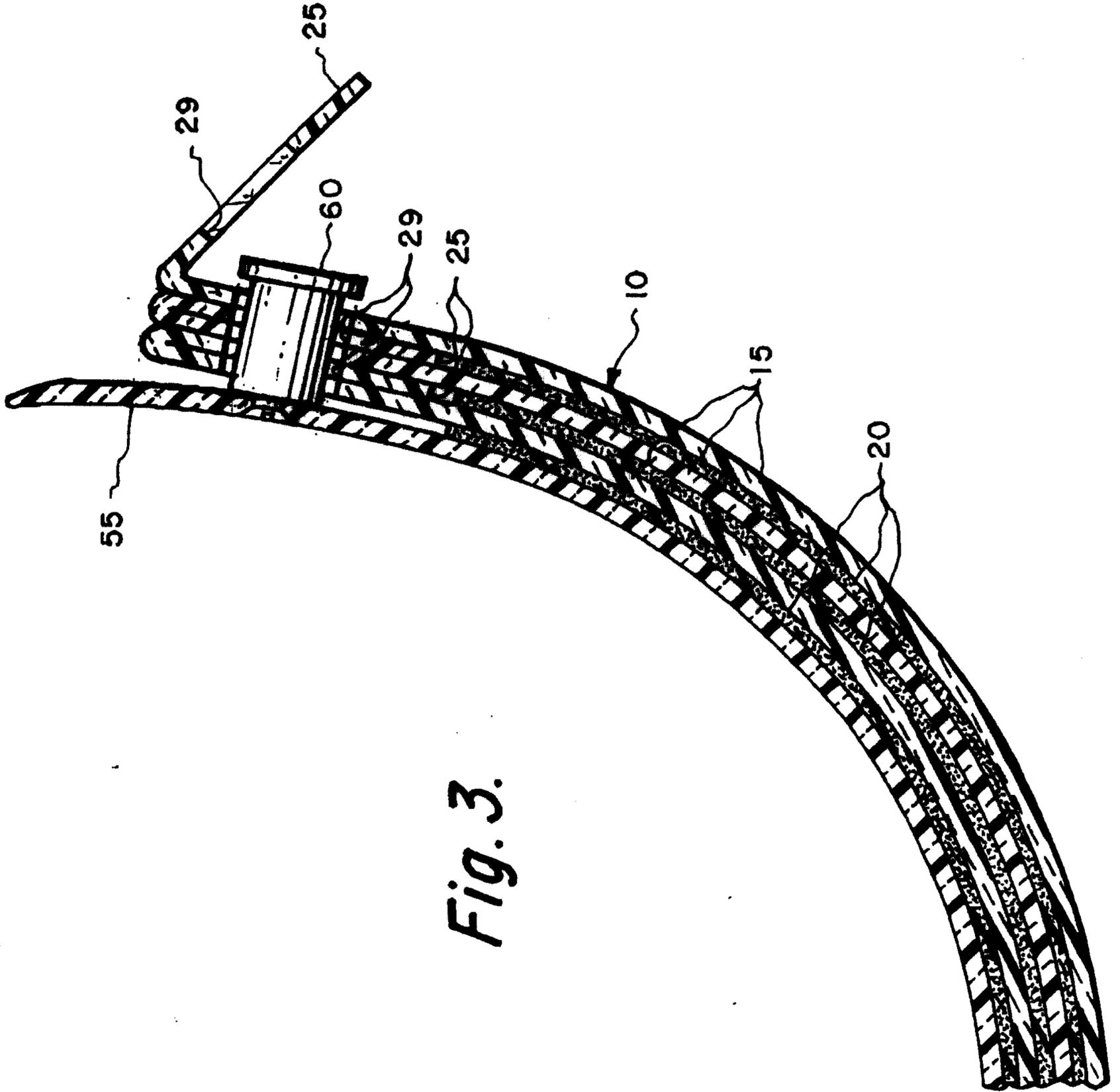


Fig. 3.

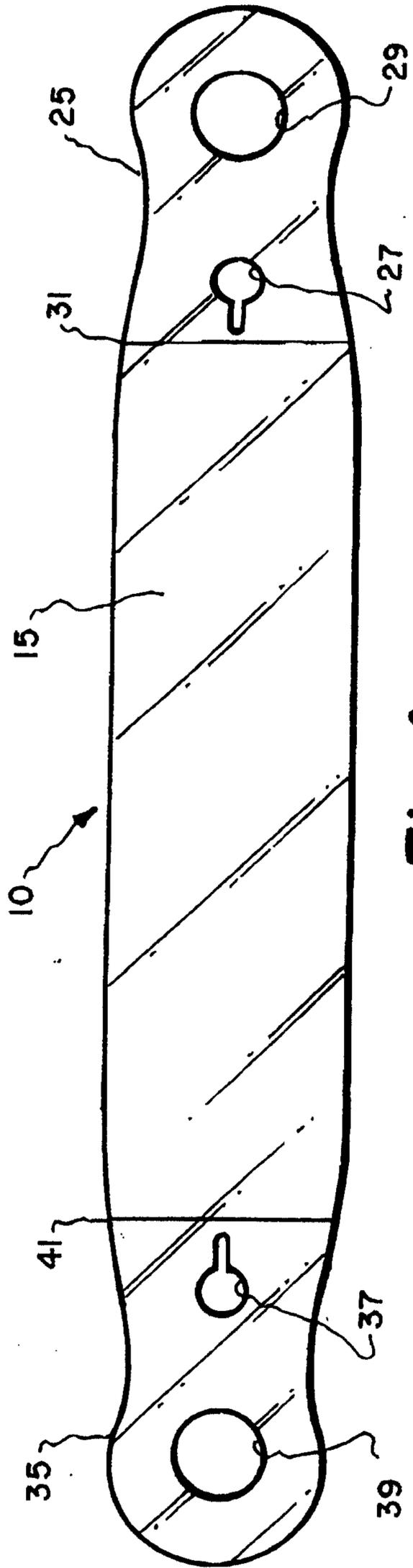


Fig. 4.

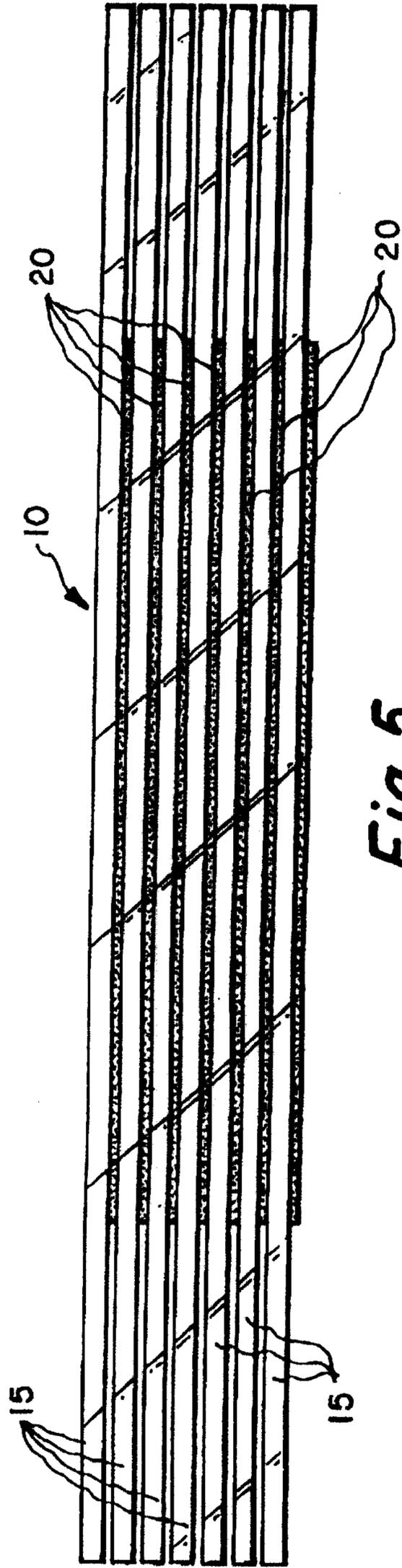


Fig. 5.

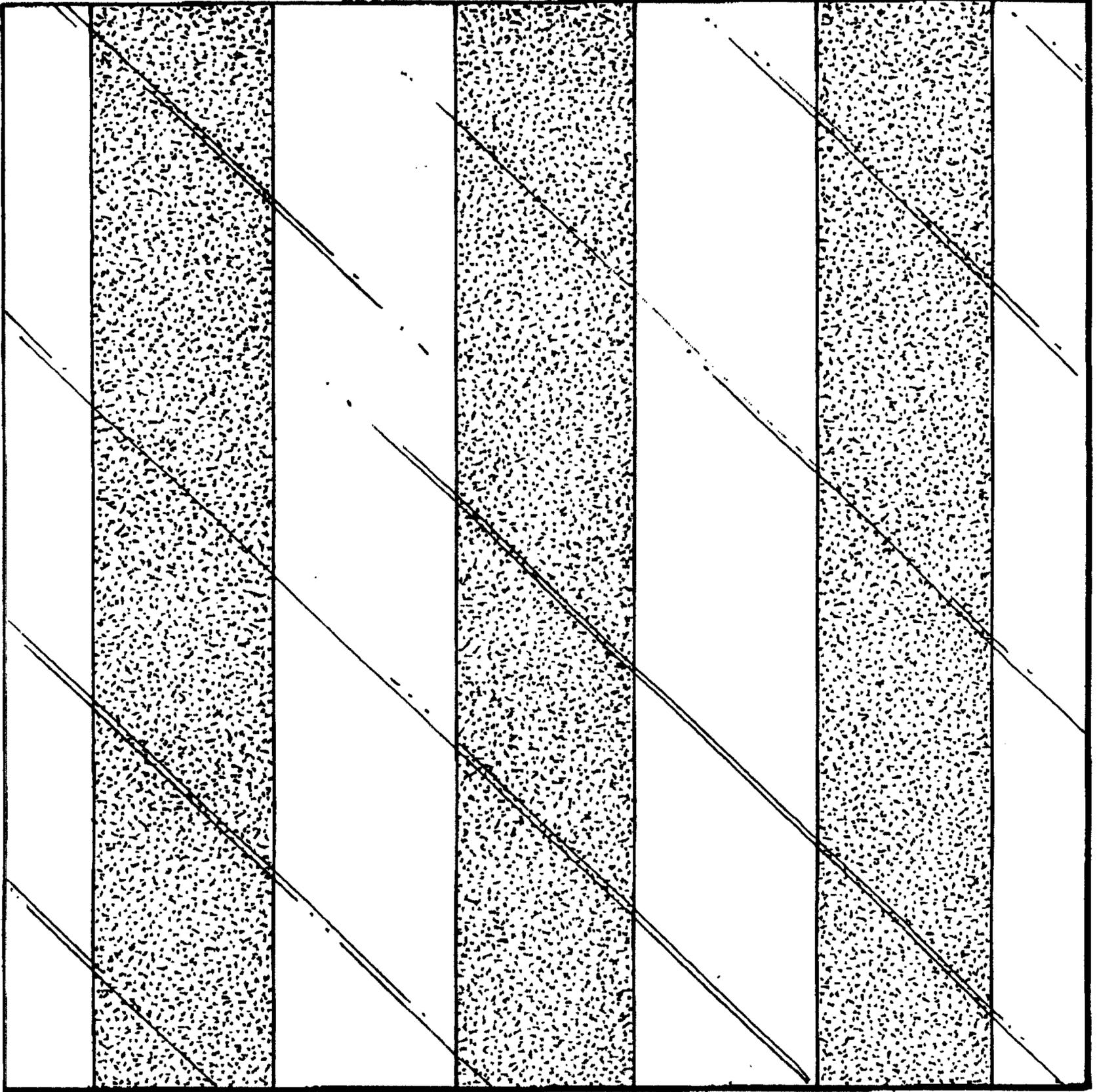


Fig. 6.

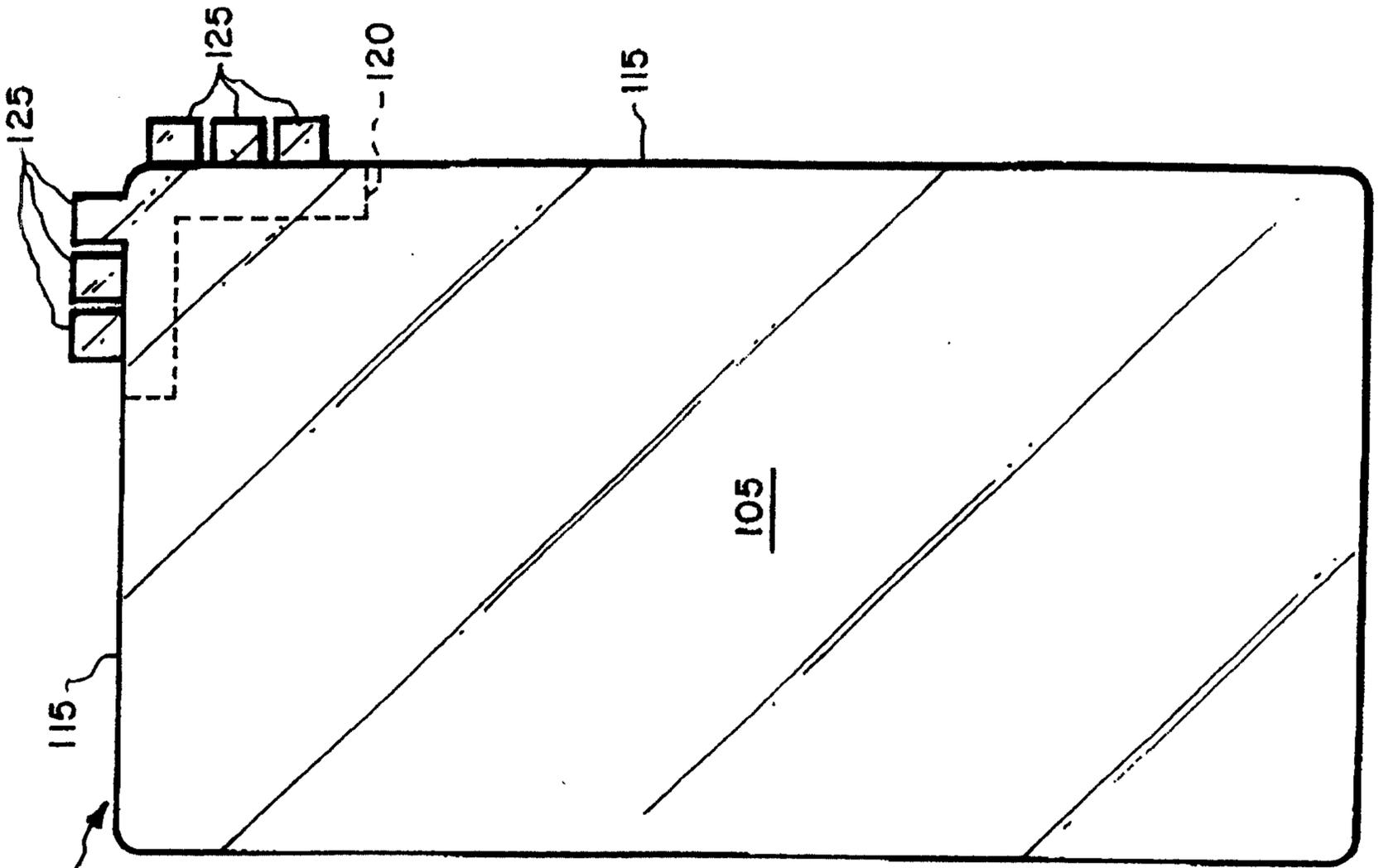


Fig. 8.

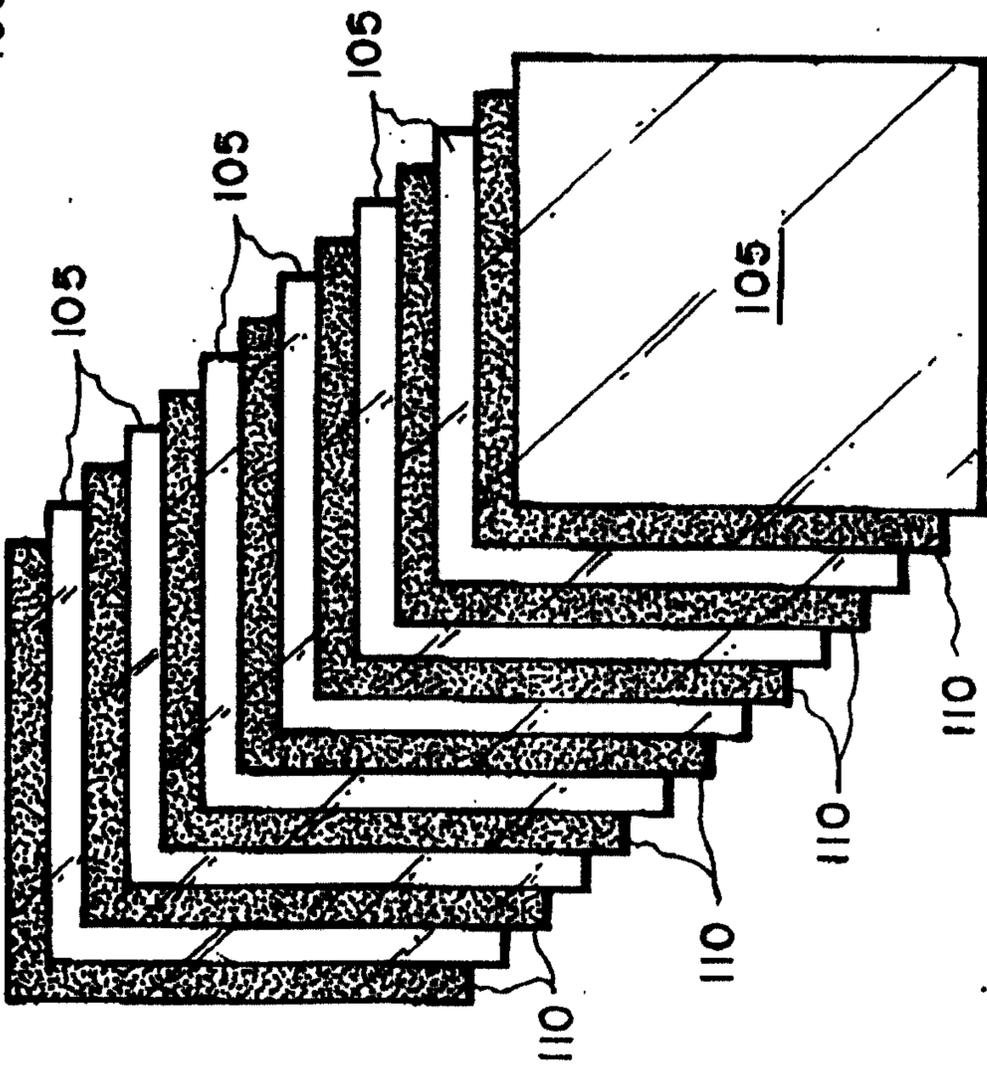


Fig. 7.

