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HUANG

(54) WATERPROOF PANEL FRAME STRUCTURE

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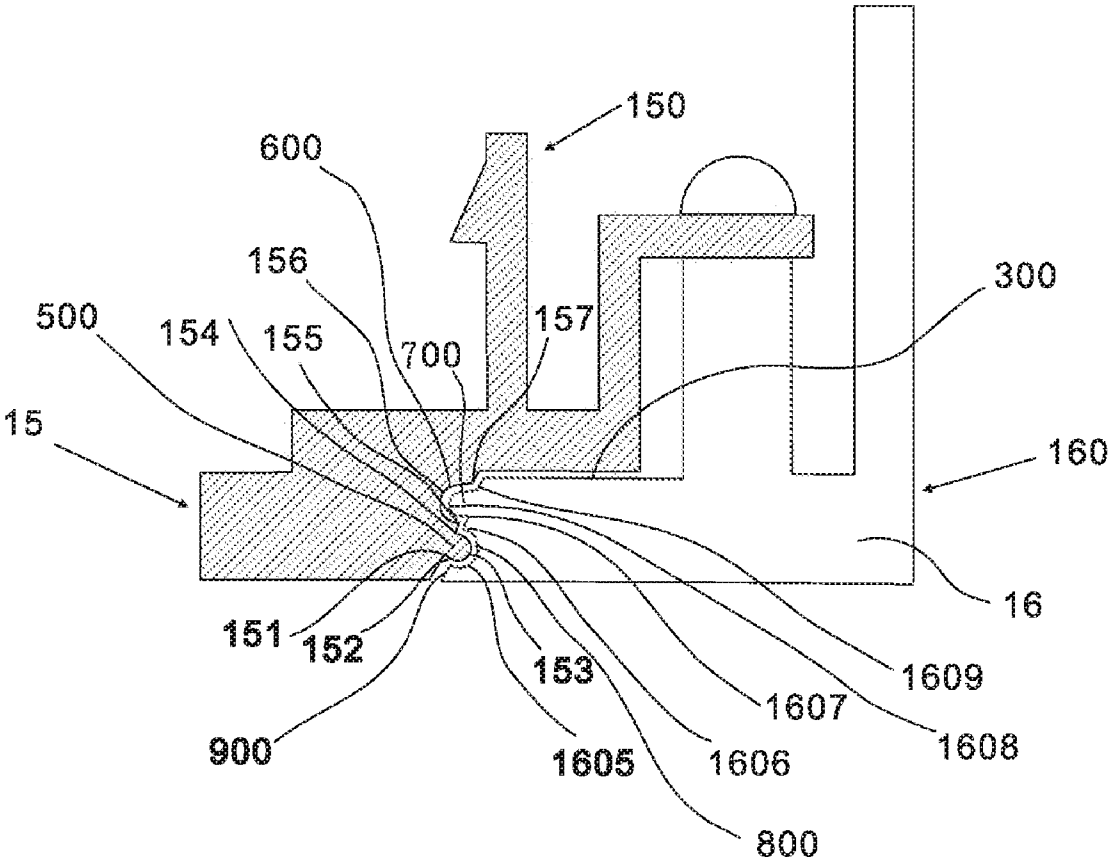
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(57) **ABSTRACT**

A waterproof panel frame structure comprises a front housing and a panel supporter. The front housing and the panel supporter are matched with each other to form conjunctive slants at right and left sides which slant inward and to form conjunctive slants at upper and down sides which slant downward. The front housing and the panel supporter comprise a groove and a ridge matched with each other and disposed at the conjunctive position between the front housing and the panel supporter for keeping water or liquid from infiltrating under atmosphere pressure.



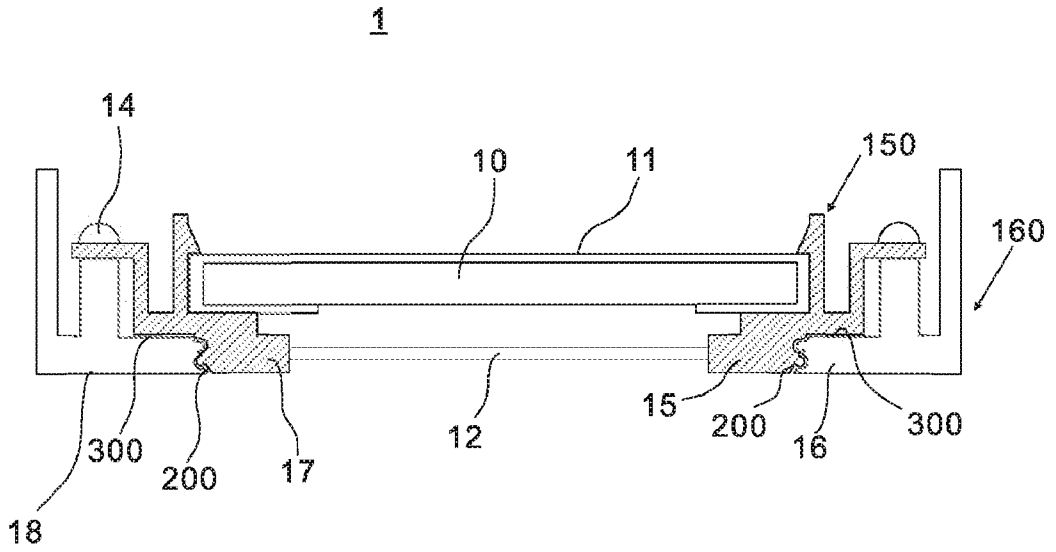

1
14
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11
150
160
300
200
17
12
15
200
16
300
18

Fig. 1

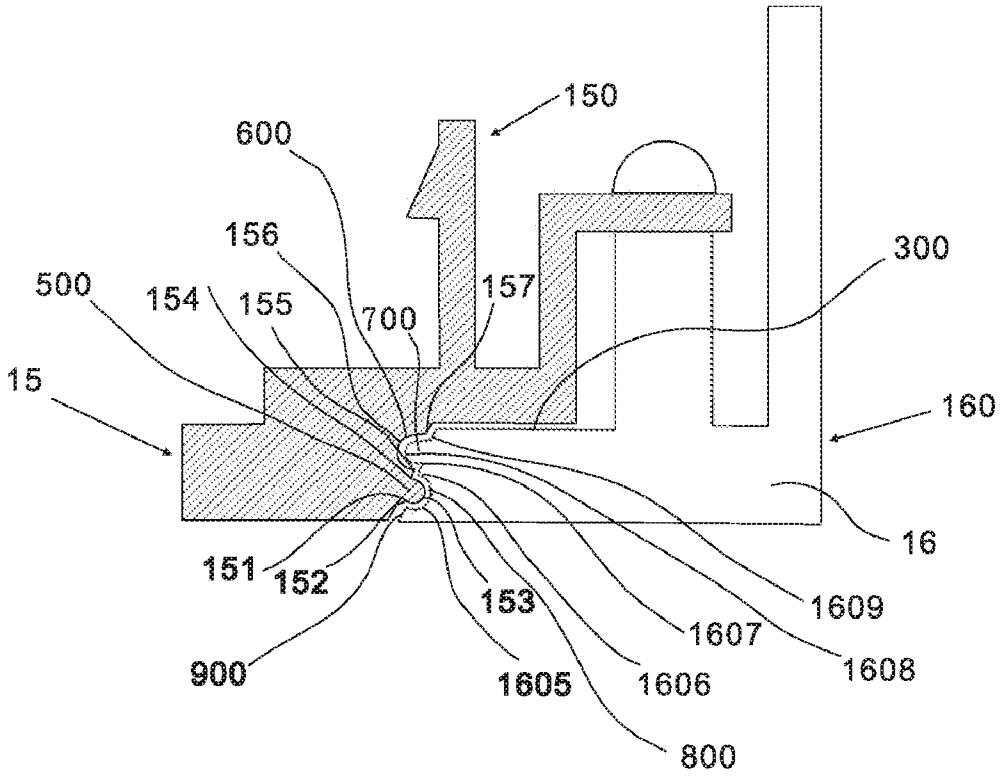

150
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156
300
500
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155
700
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160
16
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152
153
1609
1607
1608
900
1605
1606
800

Fig. 2

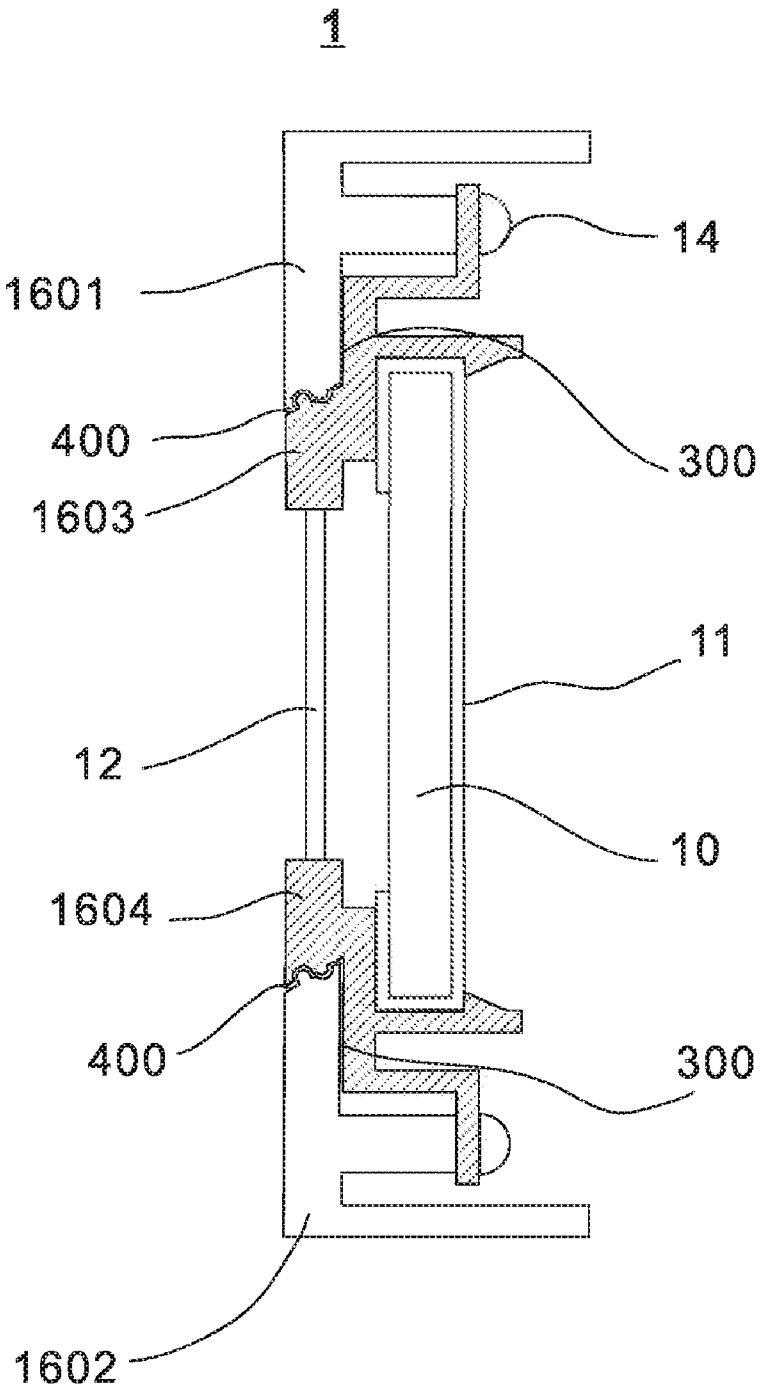


Fig. 3

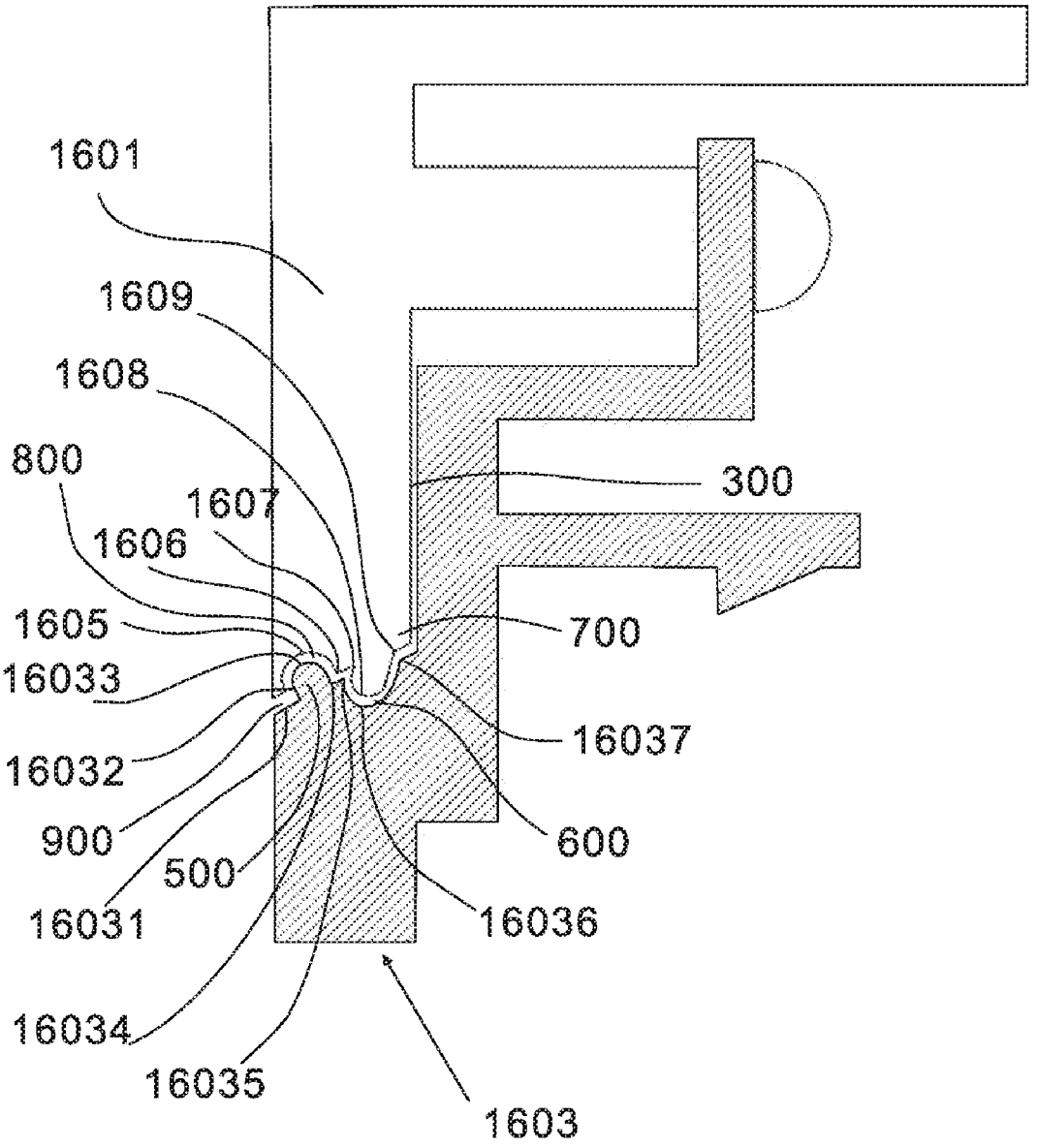

1601
1609
1608
800
1607
1606
1605
16033
16032
900
500
16031
16034
16035
1603
16036
600
16037
700
300

Fig. 4

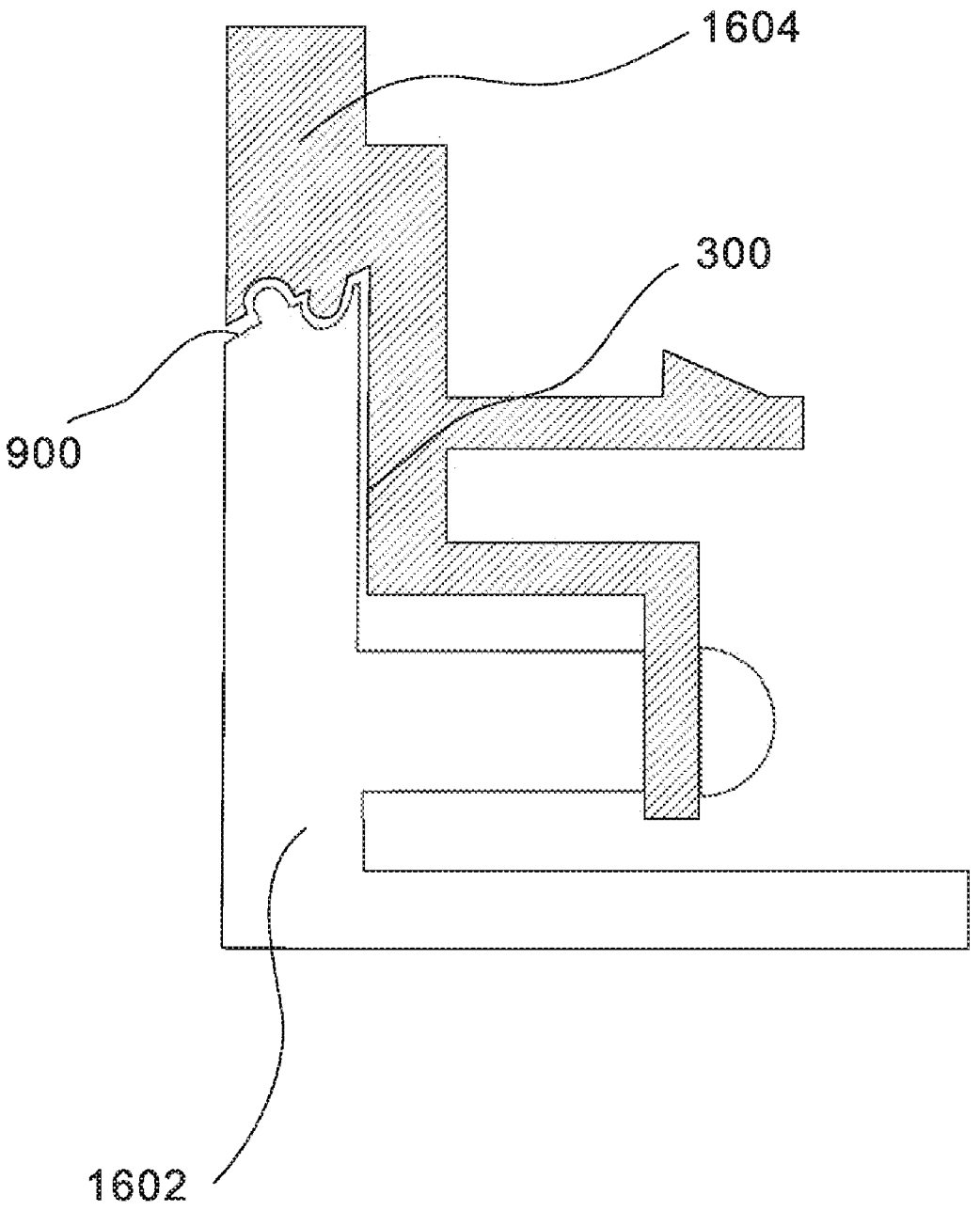


Fig. 5

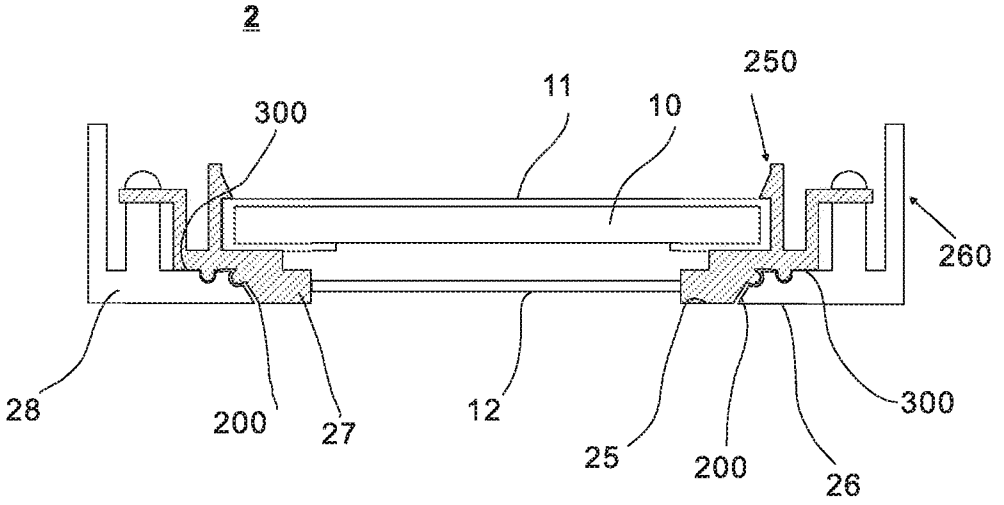

2
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250
260
28
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27
12
25
200
26
300

Fig. 6

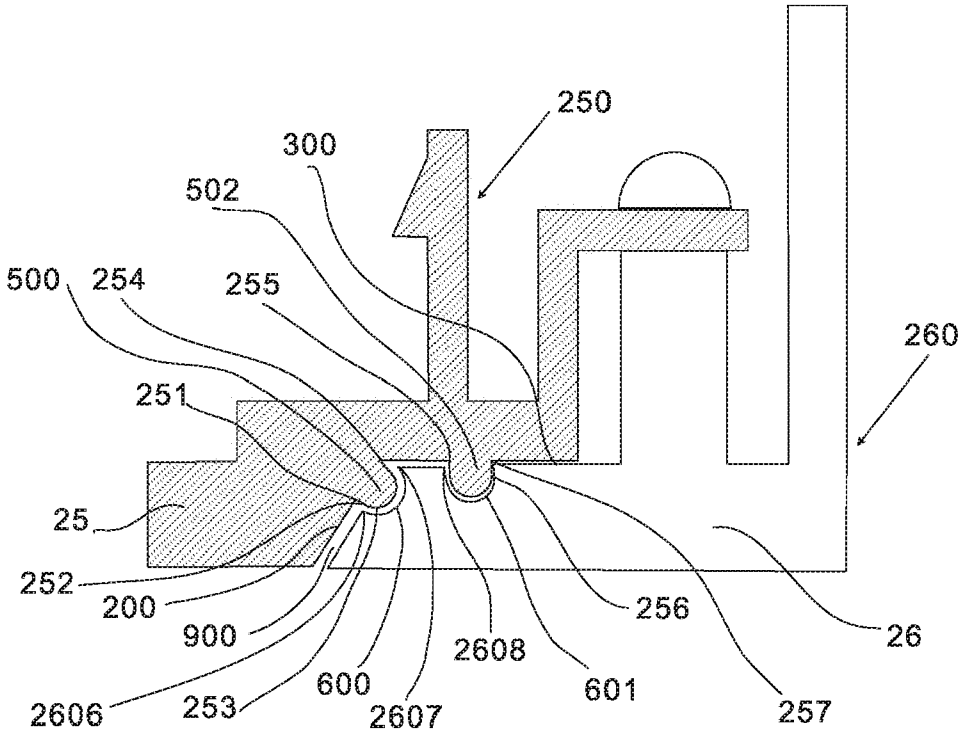

250
300
502
500
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25
252
200
900
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2608
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256
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26

Fig. 7

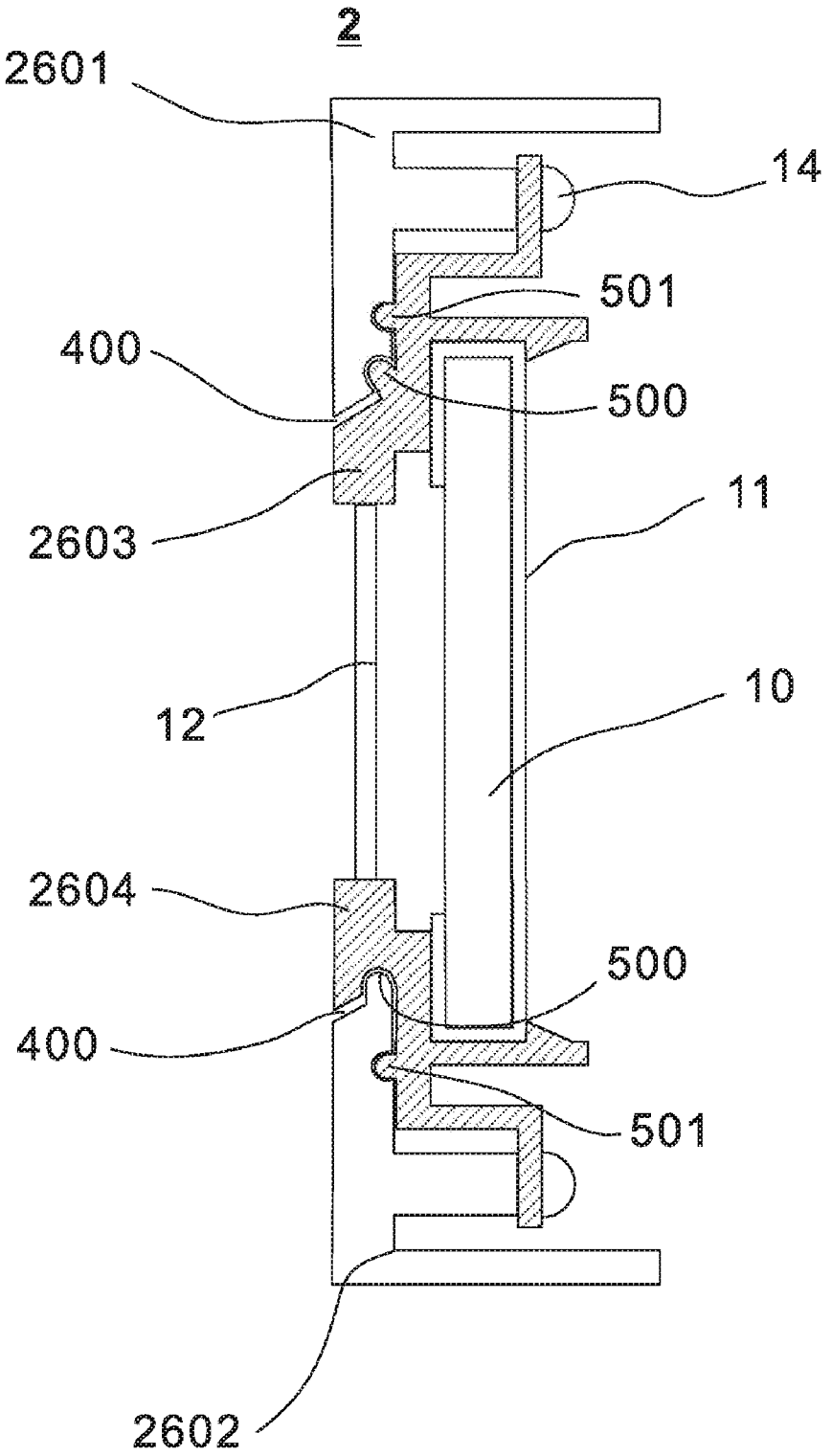


Fig. 8

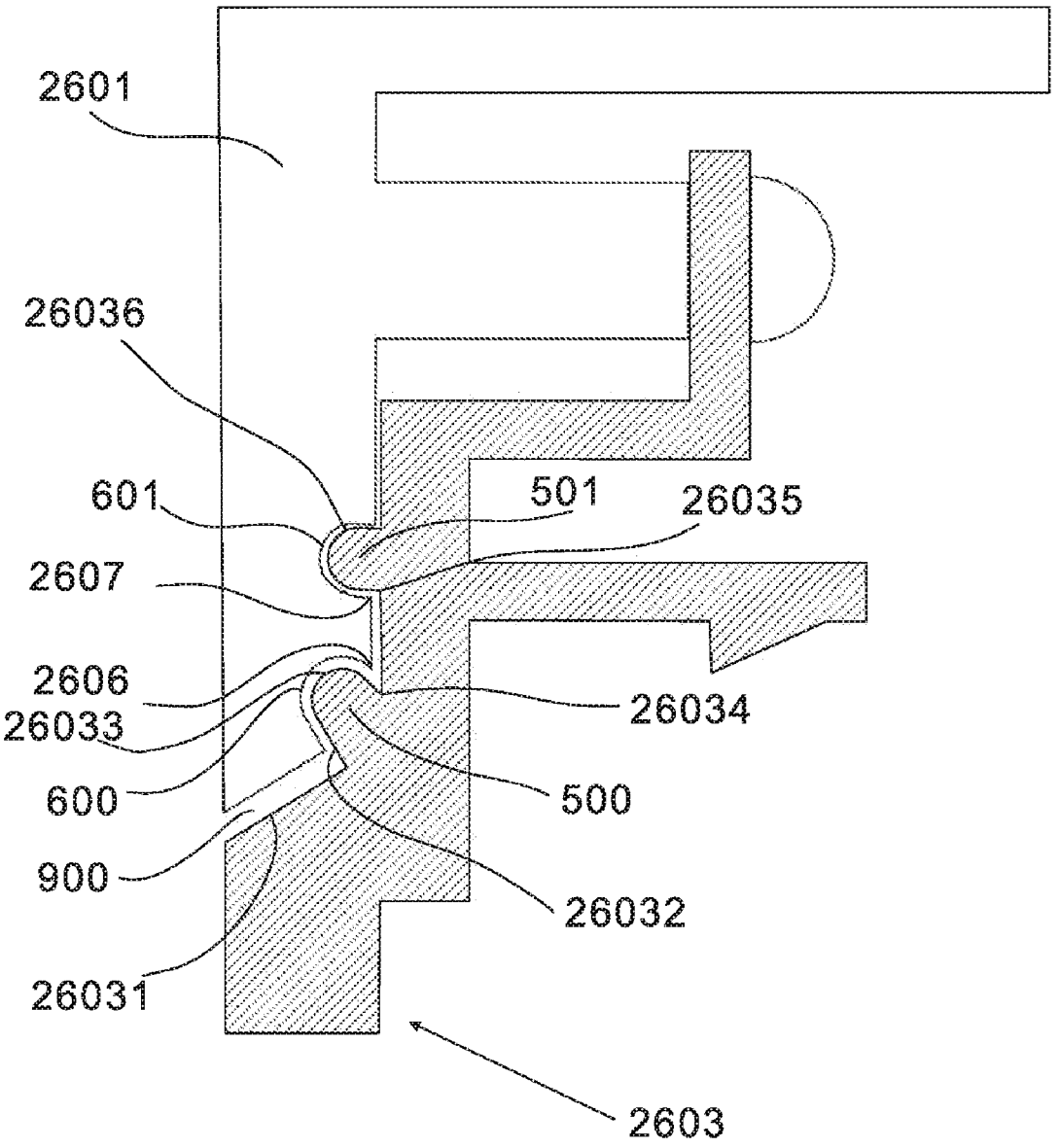

2601
26036
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2607
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900
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26031
2603

Fig. 9

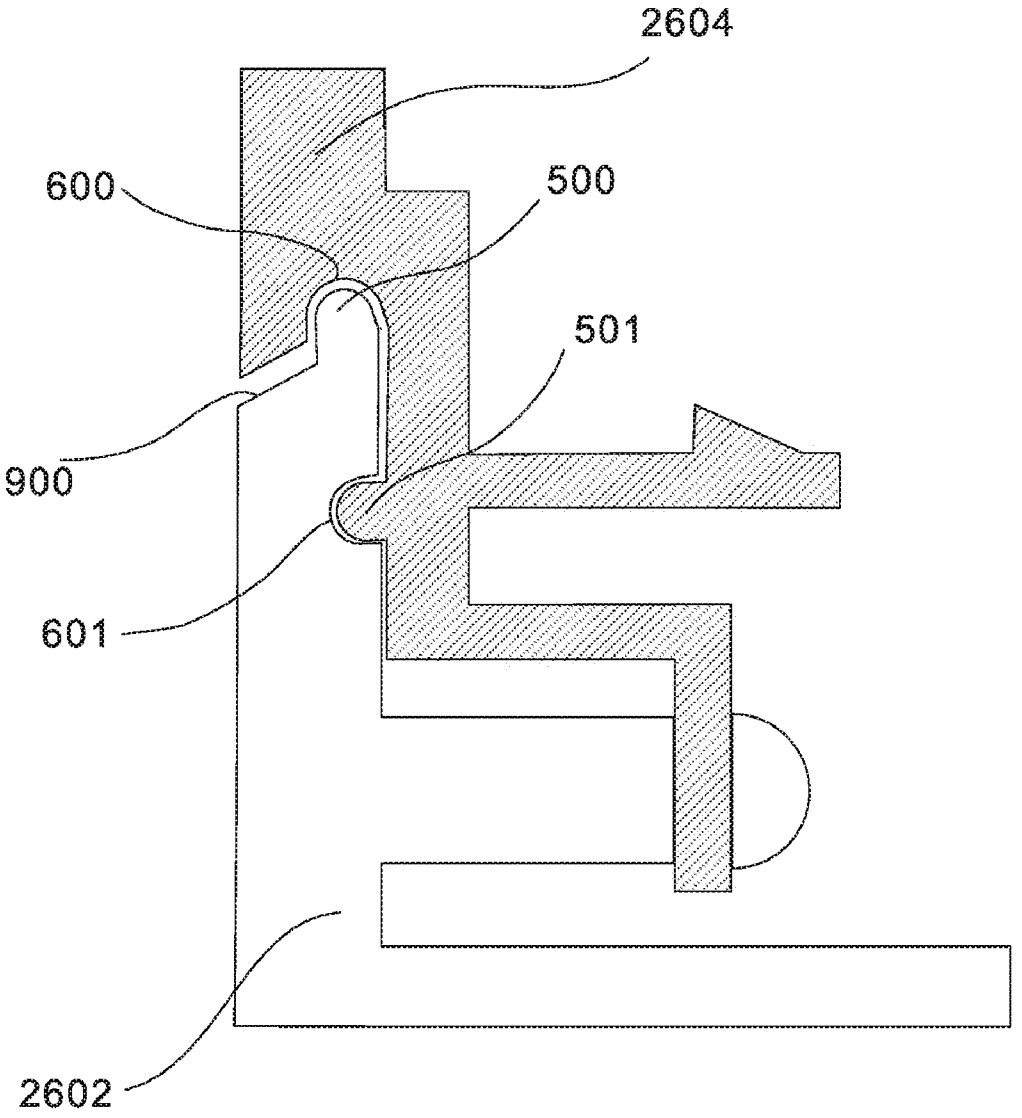


Fig. 10

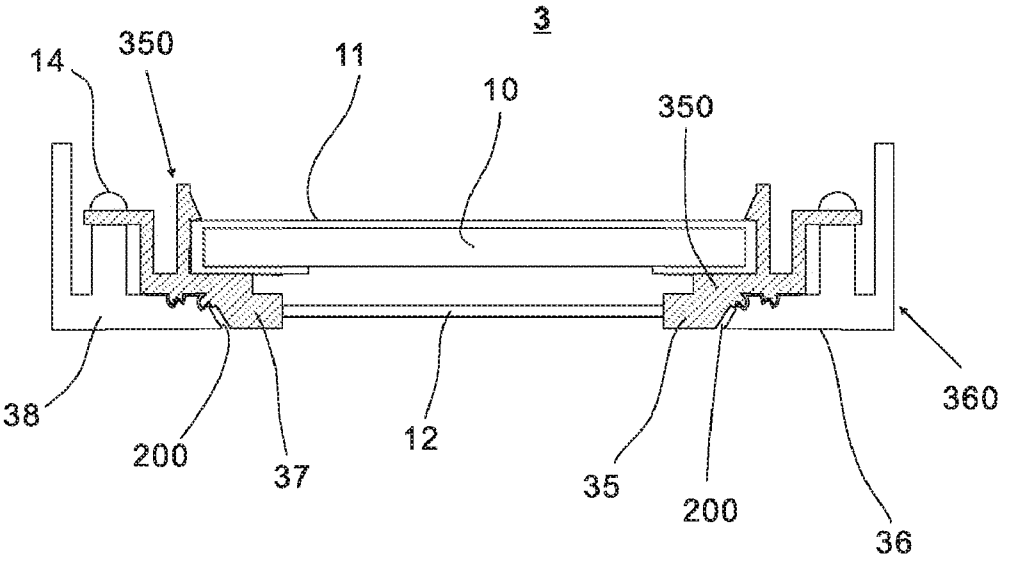


Fig. 11

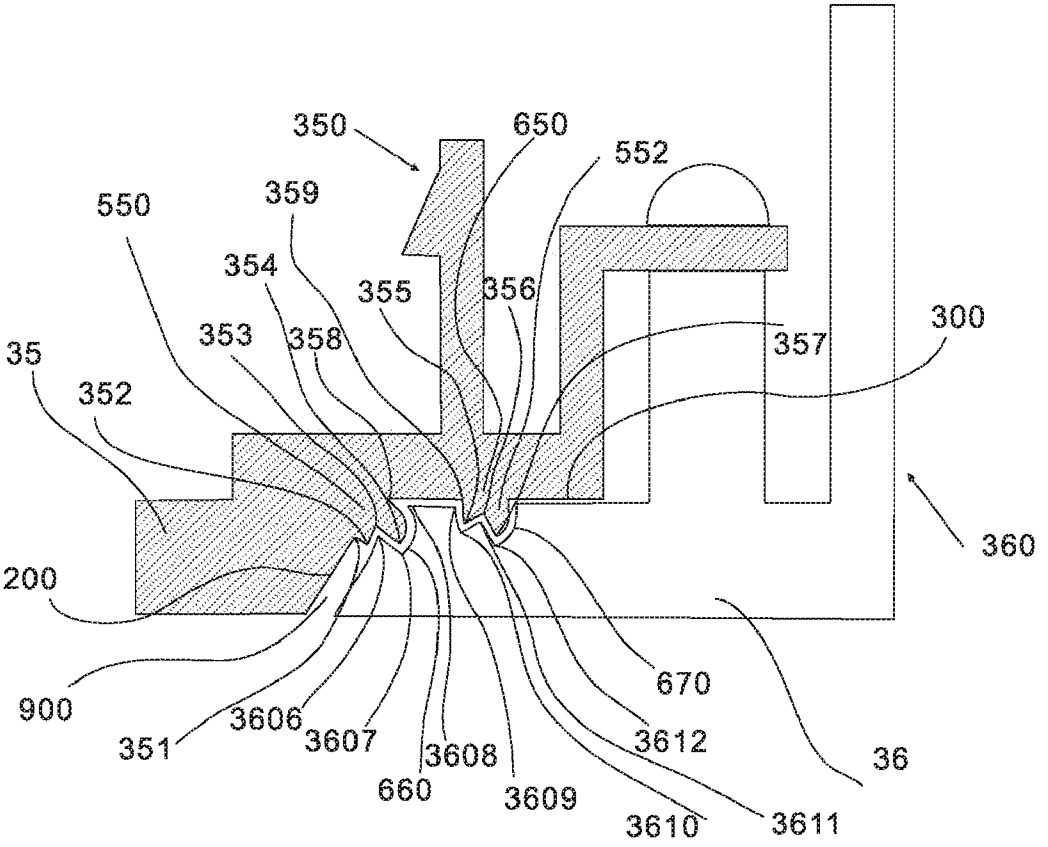

350
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550
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357
300
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360
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670
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3612
351
36
660
3609
3610
3611

Fig. 12

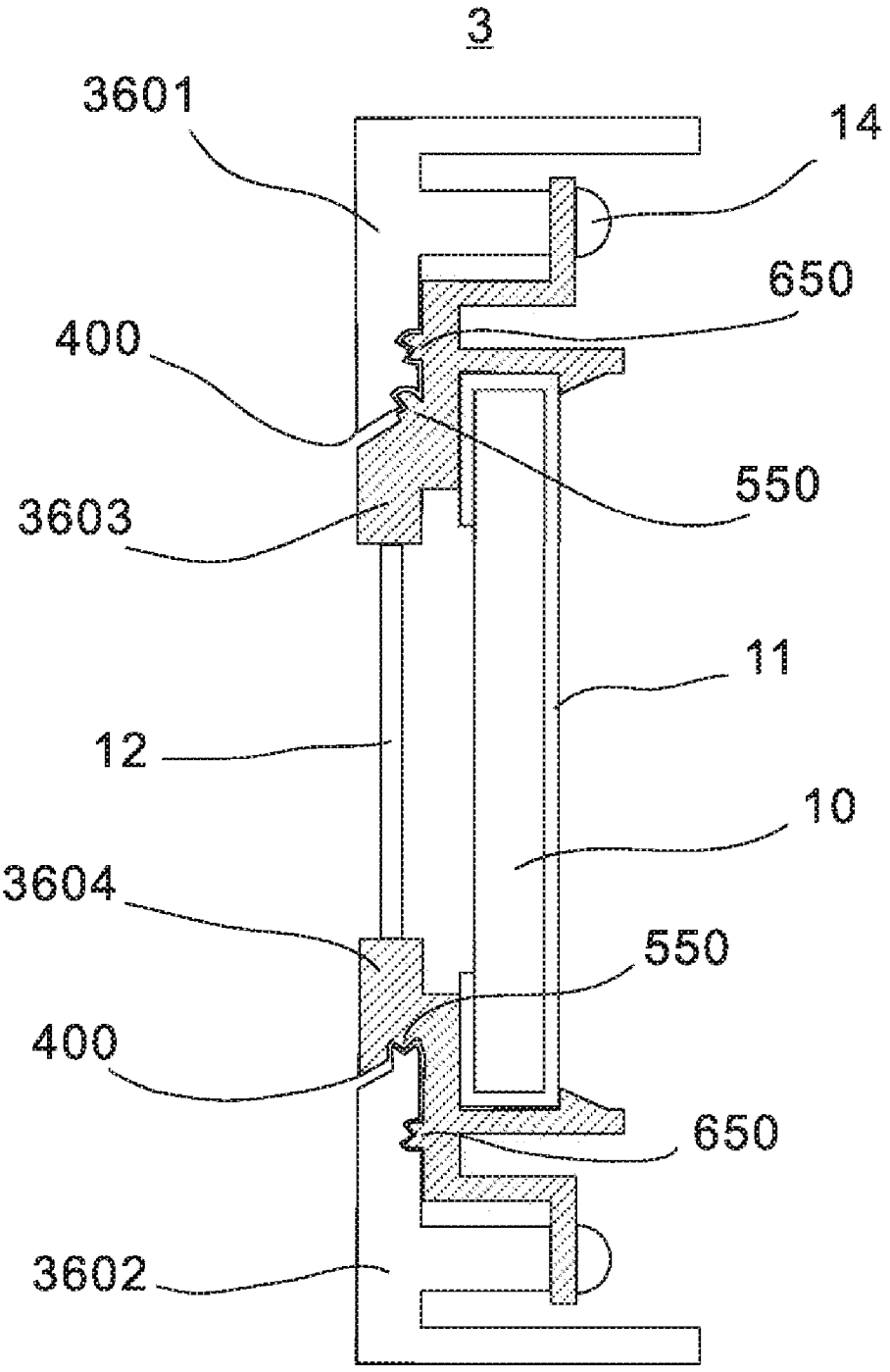


Fig. 13

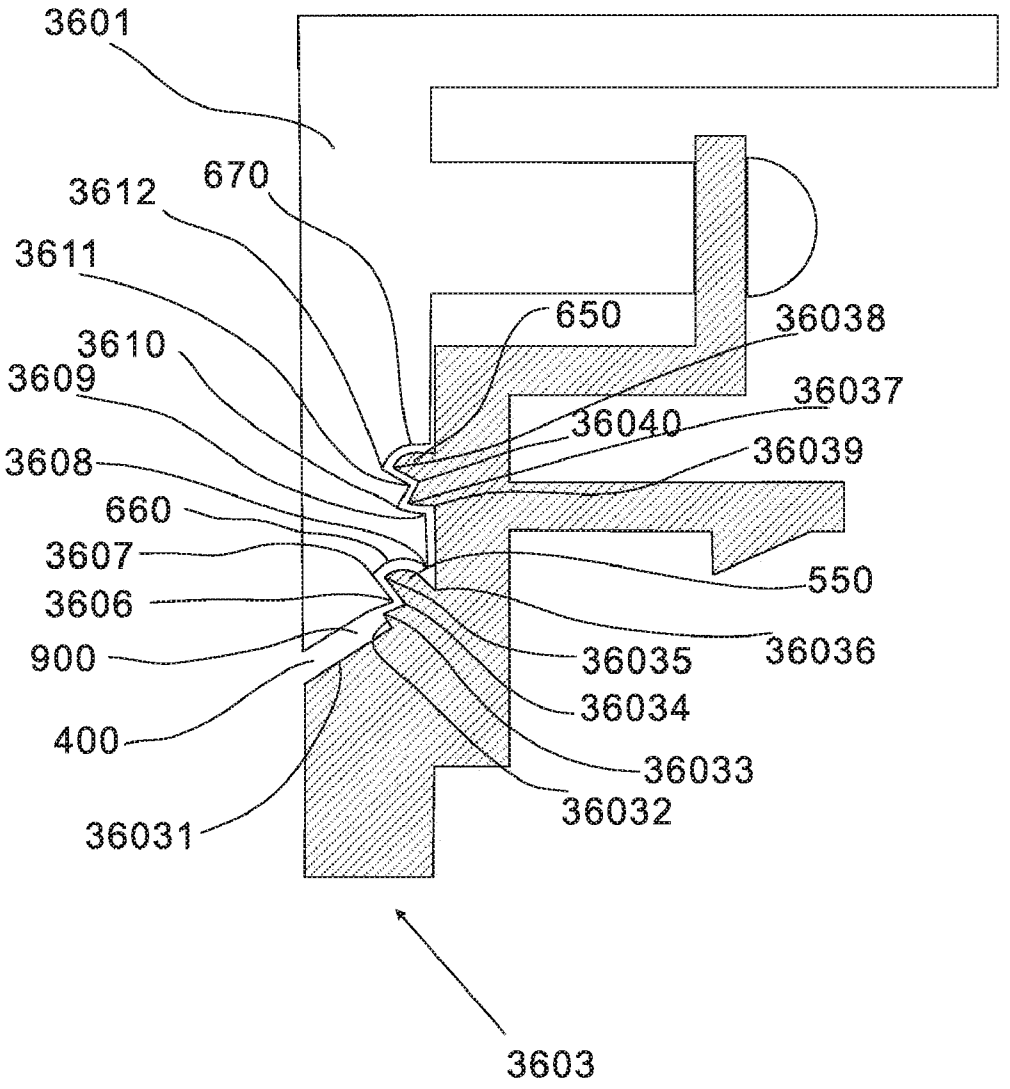

3601
670
3612
3611
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36038
3610
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36037
36040
3608
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660
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3606
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900
36035
36034
400
36033
36032
36031
3603

Fig. 14

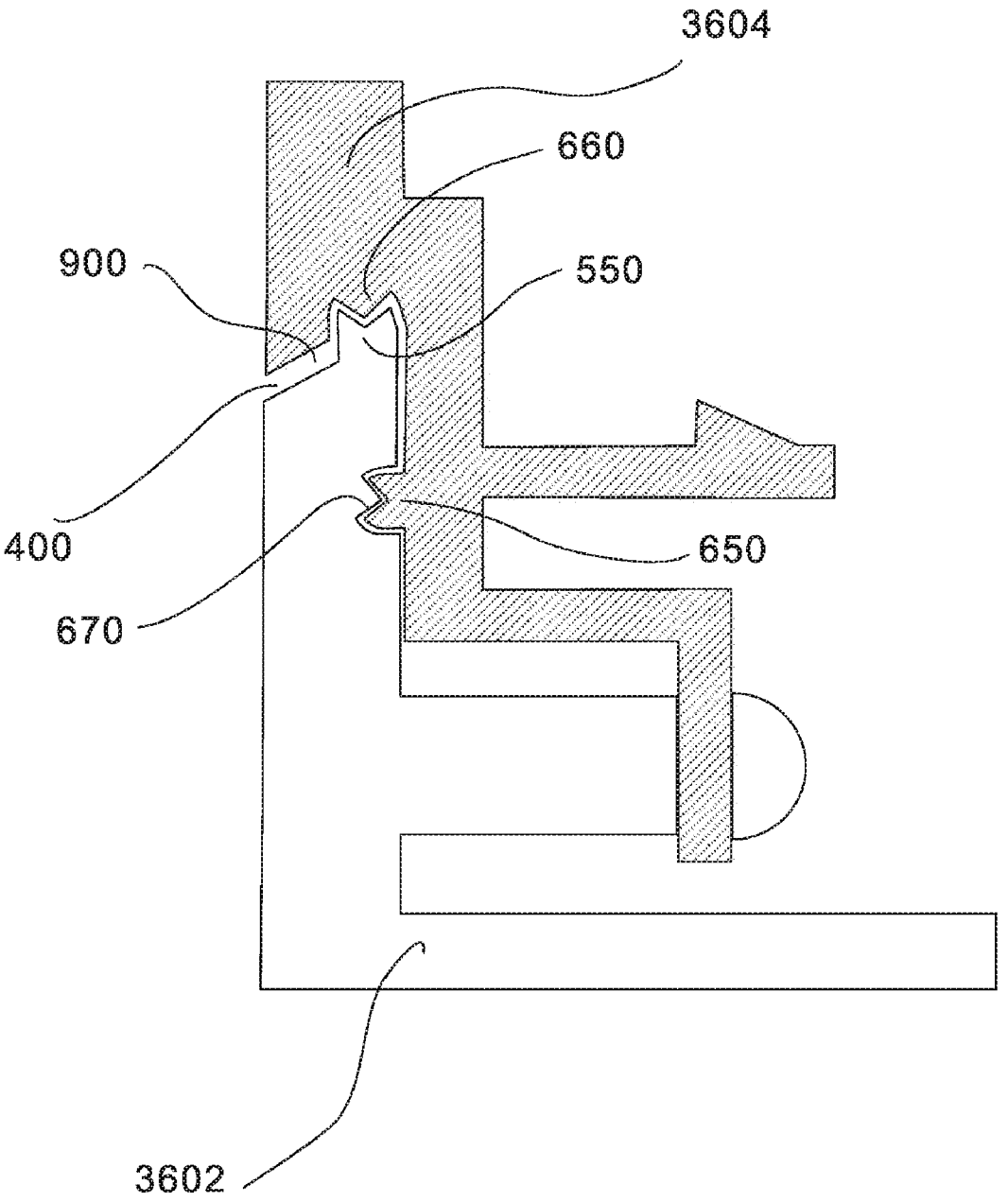


Fig. 15

WATERPROOF PANEL FRAME STRUCTURE

BACKGROUND OF THE INVENTION

[0001] 1. Technical Field

[0002] The present invention is related to a waterproof panel frame structure comprising a front housing and a panel supporter. The front housing and the panel supporter are matched with each other to form conjunctive slants at right and left sides of the panel frame which slant inward and conjunctive slants at upper and down sides of the panel frame which slant downward. The front housing and the panel supporter comprise a groove and a ridge matched with each other and disposed at the conjunctive position between the front housing and the panel supporter.

[0003] 2. Description of the Related Art

[0004] The known waterproof structure for 3C electronic products all are suitable for being used under atmosphere pressure, some of them only provide waterproof function, and some of them provide anti-dust functions and even shock-proof functions.

[0005] For example, United States Patent Application Publication No. 2008/0245452 A1, entitled "Weatherproofing Apparatus and Method for Cameras and Video Recorders,' discloses a waterproof apparatus having a groove and a ridge snapped and matched with each other so as to achieve the function of waterproofing. However, the disclosed waterproof apparatus can not be waterproofed for a long time, and there is still possibility of water infiltration.

[0006] Also, U.S. Pat. No. 5,125,175, entitled "Children's waterproof, safety picture frame,' discloses a picture frame capable of keeping the humidity in air or water in normal condition from infiltrating. However, a sealant and precise tolerance are necessary for achieving the waterproof function, so the manufacturing processes will be complex and costly.

[0007] Further, Taiwan utility model patent application No. 97212449 discloses a sealed waterproof structure, which uses a rectangular loop structure and a snapping-locking structure for providing sealing, anti-dust, waterproof, and shockproof functions. However, the disclosed structure also need to have elastic sealing material, such as rubber, for sealing, anti-dust and shockproof, and the manufacturing processes will be complex and costly.

SUMMARY OF THE INVENTION

[0008] It is a object of the present invention to provide a waterproof structure which can be manufactured without complex processes, is low in cost and simple in structure, and is able to keep water or liquid from infiltrating under atmosphere pressure.

[0009] The present invention provides a waterproof panel frame structure for a flat panel display comprising a display panel, a support frame, a front housing, a panel supporter, and a protective cover. The support frame is disposed to surround the display panel so as to fix the display panel. The front housing is disposed on the outer of the waterproof panel frame structure. The panel supporter is sandwiched between the front housing and the support frame, securely fixed to the front housing, and snapped with the support frame. The front housing and the panel supporter are matched with each other to form conjunctive slants at right and left sides of panel frame which slant inward and conjunctive slants at upper and down sides of panel frame which slant downward. The front housing and the panel supporter comprise a groove and a ridge matched with each other and disposed at the conjunctive position between the front housing and the panel supporter. The protective cover is closely attached to the display panel and securely fixed to the panel supporter.

[0010] Further, the groove and the ridge are disposed on the conjunctive slants of the front housing and the panel supporter, and closely matched with each other.

[0011] Further, the groove and the ridge are disposed on the conjunctive slants of the front housing and the panel supporter and on planes behind the conjunctive slants.

[0012] Further, the groove and the ridge are in the shape of a closely-matched convex and concave.

[0013] Still further, the groove and the ridge are closely-matched zigzag in shape.

[0014] The invention may best be understood by reference to the following description of the presently preferred embodiments together with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

[0015] FIG. **1** is a top cross-sectional view of a waterproof panel frame structure according to an embodiment of the present invention.

[0016] FIG. **2** is an enlarged top cross-sectional view of the waterproof panel frame structure according to an embodiment of the present invention.

[0017] FIG. **3** is a side cross-sectional view of a waterproof panel frame structure according to an embodiment of the present invention.

[0018] FIG. **4** is an upper enlarged side cross-sectional view of a waterproof panel frame structure according to an embodiment of the present invention.

[0019] FIG. **5** is a lower enlarged side cross-sectional view of a waterproof panel frame structure according to an embodiment of the present invention.

[0020] FIG. **6** is a top cross-sectional view of a waterproof panel frame structure according to another embodiment of the present invention.

[0021] FIG. **7** is an enlarged top cross-sectional view of the waterproof panel frame structure according to another embodiment of the present invention.

[0022] FIG. **8** is a side cross-sectional view of a waterproof panel frame structure according to another embodiment of the present invention.

[0023] FIG. **9** is an upper enlarged side cross-sectional view of a waterproof panel frame structure according to another embodiment of the present invention.

[0024] FIG. **10** is a lower enlarged side cross-sectional view of a waterproof panel frame structure according to another embodiment of the present invention.

[0025] FIG. **11** is a top cross-sectional view of a waterproof panel frame structure according to still another embodiment of the present invention.

[0026] FIG. **12** is an enlarged top cross-sectional view of the waterproof panel frame structure according to still another embodiment of the present invention.

[0027] FIG. **13** is a side cross-sectional view of a waterproof panel frame structure according to still another embodiment of the present invention.

[0028] FIG. **14** is an upper enlarged side cross-sectional view of a waterproof panel frame structure according to still another embodiment of the present invention.

[0029] FIG. **15** is a lower enlarged side cross-sectional view of a waterproof panel frame structure according to still another embodiment of the present invention.

DETAILED DESCRIPTION OF THE INVENTION

[0030] Referring to FIG. **1**, FIG. **2**, FIG. **3**, a waterproof panel frame structure **1** according to a first embodiment of the present invention is shown, and comprises a display panel **10**, a support frame **11**, a protective cover **12**, a front housing **160** and a panel supporter **150**. The support frame **11** is disposed to surround the display panel **10** so as to fix the display panel **10**. The protective cover **12** is disposed in front of the waterproof panel frame structure **1**. The front housing **160** is disposed on the both sides of the waterproof panel frame structure **1**. The panel supporter **150** is sandwiched between the front housing **160** and the support frame **11**, securely fixed to the front housing **160** by means of fixing screws **14**, and snapped with the support frame **11**. An S-shaped conjunctive slant **200** is formed at the conjunction between the front housing **160** and the panel supporter **150**, which are coupled to each other via a ridge **500** matching with a coupling groove **800**, a groove **600** matching with a coupling ridge **700** and a coupling plane **300**. The front housing **160** comprises a front housing right portion **16**, a front housing left portion **18**, a front housing upper portion **1601** and a front housing lower portion **1602**. The panel supporter **150** also comprises a panel right supporter **15**, a panel left supporter **17**, a panel upper supporter **1603**, and a panel lower supporter **1604**.

[0031] The panel right supporter **15** comprises the continuous ridge **500** and the continuous groove **600** along by the conjunctive slant **200**. The ridge **500** and the panel right supporter **15** are formed at an acute angle so as to form a first waterproof convex **152** and a first waterproof reservoir **151**. The groove **600** is formed as a third waterproof reservoir **156**. A second waterproof reservoir **154** and a first turning angle **155** are formed between the ridge **500** and the groove **600**. A second turning angle **157** is formed between the groove **600** and the coupling plane **300**. As such, when water or liquid spills and infiltrates through an assembling gap **900**, the infiltrating water flows along the conjunctive slant **200**. The flow of the infiltrating water will be blocked by the first reservoir **151** until the infiltrating waster accumulates to certain volume and then turned to the first waterproof convex **152**. Then, the flow of the infiltrating water will be blocked by the first waterproof convex **152** until the infiltrating water accumulates to certain volume and then flows over the first waterproof convex **152**. Then, the flow of the infiltrating water will be blocked by a second reservoir **154** and the first turning angle **155**. Then, if the flow of the infiltrating water further flows, it will be blocked by the continuous groove **600** until the infiltrating waster accumulates to certain volume. Then, before the flow of the infiltrating water or liquid flows to the coupling plane **300**, it will be blocked by the third waterproof reservoir **156** and the second turning angle **157**. In addition, the front housing right portion **16** is also provided with a groove **1605** and a ridge **1608** correspondent to the ridge **500** and the groove **600** of the panel right supporter **15**, and is further provided with a first turning angle **1606** and the second turning angle **1607** disposed between the groove **1605** and the ridge **1608** so as to form the small and twisty assembling gap **900** for guiding and blocking the infiltrating water. The panel left supporter **17** and the front housing left portion **18** are matched with each other in the way similar to that described hereinbefore.

[0032] As shown in FIG. **3**, FIG. **4**, and FIG. **5**, the panel upper supporter **1603** comprises the continuous ridge **500** and the continuous groove **600** along an extension slant **400**. The ridge **500** is matched with the panel upper supporter **1603** at an acute angle so as to form a waterproof convex **16033** and a waterproof wall **16032** as well as an upper drain surface **16031** in front. The groove **600**, therefore, is used to form a second reservoir **16036**. A first reservoir **16034** and a first turning angle **16035** are formed between the ridge **500** and the groove **600**. A second turning angle **16037** is formed between the groove **600** and the coupling plane **300**. As such, when water or liquid spills and infiltrates through an assembling gap **900**, the infiltrating water drains down away from the upper drain surface **16031**. If the infiltrating water flows over the waterproof convex **16033**, it will be blocked by the first reservoir **16034** and the first turning angle **16035** until the infiltrating waster accumulates to certain volume and then turned to the second reservoir **16036**. In addition, the front housing upper portion **1601** also comprises a groove **1605** and a ridge **1608** correspondent to the ridge **500** and the groove **600** of the panel upper supporter **1603**, and further comprises a first turning angle **1606**, a second turning angle **1607**, and a third turning angle **1609** disposed between the groove **1605** and the ridge **1608** so as to form the small and twisty assembling gap **900** for guiding and blocking the infiltrating water. The front housing lower portion **1602** and the panel lower supporter **1604** are matched with each other in the way similar to that described hereinbefore, and the only difference is that the coupling plane **300** is disposed on the lower right side of the extension slant **400**.

[0033] Referring to FIG. **6**, FIG. **7**, and FIG. **8**, a waterproof panel frame structure **2** according to a second embodiment of the present invention is shown, and comprises a display panel **10**, a support frame **11**, a protective cover **12**, a front housing **260** and a panel supporter **250**. The display panel **10**, the support frame **11**, the protective cover **12**, the front housing **260** and the panel supporter **250** are assembled in the way similar to that described in the first embodiment, and, for purposes of brevity and clarity, the assembling position thereof will not be repetitively described.

[0034] The panel right supporter **25** comprises the continuous ridge **500** and a vertical ridge **502** along by the conjunctive slant **200**. The ridge **500** and the panel right supporter **25** are formed in an acute angle so as to form a first waterproof convex **253**, a waterproof wall **252** and a waterproof reservoir **251**. The vertical ridge **502** is used to form a second waterproof convex **256**. A second turning angle **255** and a first turning angle **254** are formed between the ridge **500** and the vertical ridge **502**, and a third turning angle **257** is formed between the vertical ridge **502** and the coupling plane **300**. As such, when water or liquid spills and infiltrates through the assembling gap **900**, the infiltrating water flows along the conjunctive slant **200**. The flow of the infiltrating water will be blocked by the reservoir **251** until the infiltrating waster accumulates to certain volume and then turned to the waterproof wall **252**. Then, the flow of the infiltrating water will be blocked by the first waterproof convex **253** until the infiltrating waster accumulates to certain volume and then flows over the first waterproof convex **253**. Then, the flow of the infiltrating water will tarry at the second turning angle **255** and the first turning angle **254**. If the flow of the infiltrating water flows further, the flow will be blocked by the second waterproof convex **256** and then flows over the second waterproof convex **256** to the coupling plane **300**. In addition, the front

housing **260** is also provided with a groove **600** and a horizontal groove **601** correspondent to the ridge **500** and the vertical ridge **502** of the panel right supporter **25**, and is further provided with a first turning angle **2606**, a second turning angle **2607**, and a third turning angle **2608** disposed between the groove **600** and the horizontal groove **601** so as to form the small and twisty assembling gap **900** for guiding and blocking the infiltrating water. The panel left supporter **27** and the front housing left portion **28** are matched with each other in the way similar to that described hereinbefore.

[0035] As shown in FIG. **8**, FIG. **9**, and FIG. **10**, the panel upper supporter **2603** comprises the continuous ridge **500** and a horizontal ridge **501** along an extension slant **400**. The ridge **500** is matched with the panel upper supporter **2603** at an acute angle so as to form a waterproof wall **26032** and a waterproof convex **26033** as well as an upper drain surface **26031** in front. The horizontal ridge **501** is used to form a second waterproof convex **26036**. A first turning angle **26034** and a second turning angle **26035** are formed between the ridge **500** and the horizontal ridge **501**. As such, when water or liquid spills and infiltrates through an assembling gap **900**, the infiltrating water drains down away from the upper drain surface **26031**. If the infiltrating water flows over the waterproof convex **26033**, it will be blocked by the waterproof wall **26032** and the waterproof convex **26033** until the infiltrating waster accumulates to certain volume, and then flows and tarries at the position between the first turning angle **26034** and the second turning angle **26035** and is blocked by the second waterproof convex **26036**. In addition, the front housing upper portion **2601** also comprises a groove **600** and a horizontal groove **601** correspondent to the ridge **500** and the horizontal ridge **501** of the panel upper supporter **2603**, and further comprises a first turning angle **2606** and a second turning angle **2607** disposed between the groove **600** and the horizontal groove **601** so as to form the small and twisty assembling gap **900** for guiding and blocking the infiltrating water. The front housing lower portion **2602** and the panel lower supporter **2604** are matched with each other in the way similar to that described hereinbefore, and the only difference is that the panel lower supporter **2604** comprises the groove **600** and the horizontal groove **601**, and the front housing lower portion **2602** comprises correspondingly the ridge **500** and the horizontal ridge **501**.

[0036] Referring to FIG. **11**, a waterproof panel frame structure **3** according to a third embodiment of the present invention is shown, and comprises a display panel **10**, a support frame **11**, a protective cover **12**, a front housing **360** and a panel supporter **350**. The display panel **10**, the support frame **11**, the protective cover **12**, the front housing **360** and the panel supporter **350** are assembled in the way similar to that described in the first embodiment, and, for purposes of brevity and clarity, the assembling position thereof will not be repetitively described.

[0037] As shown in FIG. **11** and FIG. **12**, the panel right supporter **35** comprises a continuous forked ridge **550** and a continuous vertical forked ridge **552**, which both are zigzag in shape, along by the conjunctive slant **200**. The forked ridge **550** and the panel right supporter **35** are formed in an acute angle so as to form a first waterproof convex **352** and a waterproof reservoir **351** as well as a second waterproof convex **354** and a second waterproof reservoir **353** at a slightly upper position. The vertical forked ridge **552** is used to form a third waterproof convex **355** and a third waterproof reservoir **356** as well as a fourth waterproof convex **357** at a slightly upper position. A second turning angle **359** and a first turning angle **358** are formed between the forked ridge **550** and the vertical forked ridge **552**. As such, when water or liquid spills and infiltrates through the assembling gap **900**, the infiltrating water flows along the conjunctive slant **200**. The flow of the infiltrating water will be blocked by the reservoir **351** until the infiltrating waster accumulates to certain volume and then turned to the waterproof convex **352**. Then, the flow of the infiltrating water will be blocked by the waterproof convex **352** until the infiltrating waster accumulates to certain volume and then flows over the waterproof convex **352**. Then, the flow of the infiltrating water will be blocked by the second waterproof reservoir **353** and the second waterproof convex **354** before the flow tarries at the position between the first turning angle **358** and the second turning angle **359**. If the flow of the infiltrating water flows further, the flow will be blocked by the third waterproof convex **355**, the third waterproof reservoir **356**, and the fourth waterproof convex **357** of the horizontal ridge **650** before the flow reaches the coupling plane **300**. In addition, the front housing right portion **36** is also provided with a groove **660** and a horizontal groove **670** correspondent to the forked ridge **550** and the vertical forked ridge **552** of the panel right supporter **35**, and is further provided with a first turning angle **3606**, a second turning angle **3607**, a third turning angle **3608**, a fourth turning angle **3609**, a fifth turning angle **3610**, a sixth turning angle **3611**, and a seventh turning angle **3612** disposed between the groove **660** and the horizontal groove **670** so as to form the small and twisty assembling gap **900** for guiding and blocking the infiltrating water. The panel left supporter **37** and the front housing left portion **38** are matched with each other in the way similar to that described hereinbefore.

[0038] As shown in FIG. **13**, FIG. **14**, and FIG. **15**, the panel upper supporter **3603** comprises the forked ridge **550** and a horizontal ridge **650** along an extension slant **400**. The forked ridge **550** is matched with the panel upper supporter **3603** at an acute angle so as to form a waterproof wall **36032** and a waterproof convex **36033** as well as a second waterproof convex **36035** and a first turning angle **36034** at the slightly upper position of the waterproof wall **36032**. An upper drain surface **36031** is formed at the front of the waterproof wall **36032**. The horizontal ridge **650** is used to form a third waterproof convex **36037**, a fourth waterproof convex **36038**, and a fourth turning angle **36040**. A second turning angle **36036** and a third turning angle **36039** are formed between the forked ridge **550** and the horizontal ridge **650**. As such, when water or liquid spills and infiltrates through an assembling gap **900**, the infiltrating water drains down away from the upper drain surface **36031**. If the infiltrating water flows over the waterproof convex **36033**, it will be blocked by the waterproof wall **36032** and the waterproof convex **36033** until the infiltrating waster accumulates to certain volume, and then flows over the second waterproof convex **36035**, tarries at the position between the second turning angle **36036** and the third turning angle **36039** and is blocked by the third waterproof convex **36037** and the fourth waterproof convex **36038**. In addition, the front housing upper portion **3601** also comprises a groove **660** and a horizontal groove **670** correspondent to the forked ridge **550** and the horizontal ridge **650** of the panel upper supporter **3603**, and further comprises a first turning angle **3606**, a second turning angle **3607**, a third turning angle **3608**, a fourth turning angle **3609**, a fifth turning angle **3610**, a sixth turning angle **3611**, and a seven turning

angle **3612** disposed between the groove **660** and the horizontal groove **670** so as to form the small and twisty assembling gap **900** for guiding and blocking the infiltrating water. The front housing lower portion **3602** and the panel lower supporter **3604** are matched with each other in the way similar to that described hereinbefore, and the only difference is that the front housing lower portion **3602** comprises the forked ridge **550** and the horizontal groove **670**, and the panel lower supporter **3604** comprises correspondingly the groove **660** and the horizontal ridge **650**.

[0039] While the invention has been described by way of example and in terms of preferred embodiment, it is to be understood that the invention is not limited thereto. To the contrary, it is intended to cover various modifications and similar arrangements (as would be apparent to those skilled in the art). Therefore, the scope of the appended claims should be accorded the broadest interpretation so as to encompass all such modifications and similar arrangements.

What is claimed is:

1. A waterproof panel frame structure for a flat panel display, comprising:

a display panel;

a support frame disposed to surround the display panel so as to fix the display panel;

a front housing disposed on the outer of the waterproof panel frame structure;

a panel supporter sandwiched between the front housing and the support frame, securely fixed to the front housing, and snapped with the support frame, wherein the front housing and the panel supporter are matched with each other to form conjunctive slants at right and left sides of panel frame which slant inward and conjunctive slants at upper and down sides of panel frame which slant downward, and the front housing and the panel supporter comprise a groove and a ridge matched with each other and disposed at a conjunctive position between the front housing and the panel supporter; and

a protective cover closely attached to the display panel and securely fixed to the panel supporter.

2. The waterproof panel frame structure as claimed in claim **1**, wherein the groove and the ridge are disposed on the conjunctive slants, and closely matched with each other.

3. The waterproof panel frame structure as claimed in claim **1**, wherein the groove and the ridge are disposed on the conjunctive slants and planes behind the conjunctive slants.

4. The waterproof panel frame structure as claimed in claim **1**, wherein the groove and the ridge are in the shape of a closely-matched convex and a closely-matched concave.

5. The waterproof panel frame structure as claimed in claim **3**, wherein the groove and the ridge are closely-matched zigzag in shape.

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