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(54) **Title**: REFLECTIVE BUBBLE LEVEL

(54) **发明名称** : 反射水泡水平尺

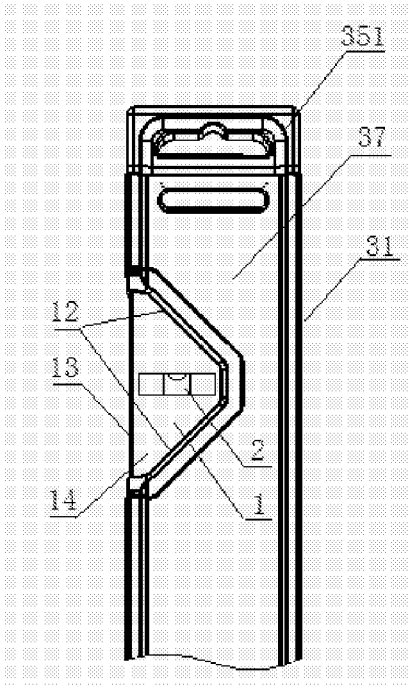

图 6 /Fig.6

(57) **Abstract**: A reflective bubble level comprises an elongated level body. The elongated level body comprises a first surface (31) and a second surface (32). A hollow cavity is provided between the first surface (31) and the second surface (32), and provided with an opening on the second surface (32); a level arranged in the hollow cavity comprises a non-opaque level body (1) and a bubble assembly (2), the non-opaque level body (1) being provided with sloping faces (12) and a first observation surface (13); the bubble assembly (2) is arranged inside the level body (1), the longitudinal axis of the bubble assembly (2) is perpendicular to the first surface (31), the first surface (31) is arranged between a first end (21) of the bubble assembly (2) and surface to be checked, and the first observation surface (13) is arranged between a second end (22) of the bubble assembly (2) and a user; the image of the bubble assembly (2) is formed by reflection from the sloping faces (12); and through the first observation surface (13), the user can observe the image of the bubble assembly (2) reflected by the sloping faces (12). In the present reflective bubble level, a reflection is produced when light passes through an interface, so that the user can observe the bubble assembly from the front side while checking perpendicularity. The level is one-step molded and does not require additional assembly and calibration, and therefore is simple to manufacture and low in cost.

(57) **摘要**:

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本国际公布:

— 包括国际检索报告(条约第 21 条(3))。

一种反射水泡水平尺，包括长形尺体，包括第一表面（31）与第二表面（32），第一表面（31）与第二表面（32）之间具有空腔，空腔在第二表面（32）上具有开口；设置于空腔中的水平尺包括：非不透光体尺体（1），具有斜面（12）与第一观察面（13）；设置于尺体（1）内水泡组件（2），水泡组件（2）的纵轴垂直于第一表面（31），第一表面（31）被设置于水泡组件（2）的第一端（21）与被测表面之间，第一观察面（13）设置于水泡组件（2）的第二端（22）与使用者之间；通过斜面（12）反射形成水泡组件（2）的图像；使用者能够通过第一观察面（13）观察通过斜面（12）反射的水泡组件（2）的图像。该反射水泡水平尺利用光线通过界面时产生反射，使得使用者测量垂直度时能够从正面观察水泡组件，该水平尺采用一次成型制作，无需额外的装配与校准，因而制作简单、成本低。

SPIRIT LEVEL HAVING REFLECTION BUBBLE

Field of the Invention

The present invention relates to a spirit level having reflection bubble, which belongs to the field of the measuring tool.

Description of the Prior art

A spirit level having reflection bubble is a measuring tool used for measuring the levelness and the verticality of the surface of an object, the general spirit level takes the bottom surface as the level plane, leaning the spirit level's bottom surface against the surface of an object which should be measured, then judging whether the measured surface is horizontal or vertical by observing the corresponding bubble in the spirit level.

When measuring whether a plane is horizontal, put the spirit level on the measured surface, and observe whether the level bubble which in the 180° bubble component moves to the middle of the two scale lines on the bubble vial. If the level bubble is in the middle, the measured surface is horizontal; otherwise, the measured surface is not horizontal.

When measuring whether a plane is vertical, lean the spirit level against the measured surface, and observe whether the level bubble which in the 90° bubble component moves to the middle of the two scale lines on the bubble vial. If the level bubble is in the middle, the measured surface is vertical; otherwise, the measured surface is not vertical.

Because the common 90° bubble component can only observe the level bubble via the side of the spirit level, it is not convenient when using the spirit level especially in

some special occasions when the side is blocked, thus, a spirit level having reflection bubble is invented which the bubble location can be observed by specular reflection from the direction of facing to the measured surface. However this spirit level having reflection bubble needs to install the specula into the spirit level having reflection bubble, the manufacturing is relatively complex, and the production cost is relatively high.

Summary of the Invention

For the problems in the prior art, the present invention provides a spirit level which is observed from the front to measure the verticality. The manufacturing is simple and the cost is low.

The present invention provides a spirit level, comprising:

a body, which is a non-opaque body, which has a level face for measuring a verticality of a measured surface, a slope which intersects with the level face and a first viewing plane;

a bubble component, that is arranged in the body, and a longitudinal axis of the bubble component is perpendicular to the level face which is arranged between a first end of the bubble component and the measured surface, the first viewing plane facing to the level face is arranged between a second end of the bubble component and a user;

the slope and the level face form an obtuse angle at one side of arranging the bubble component, and an image of the bubble component is formed by reflection of the slope;

the user can observe the image of the bubble component formed by the reflection of the slope from the first viewing plane.

Further, the body is formed integrally, the slope for reflecting the bubble component is formed in the integrally-formed process, additional assembly and calibration are not needed, so the manufacturing is simple and the cost is low.

Further, the body is a transparent body which facilitates the light transmitting in the body and forming a clear image of the bubble component.

Further, the body also comprises a second viewing plane which is a side of the body, and the user can directly observe the bubble component from the second viewing plane.

Further, the number of the slope is one.

Further, the number of the slopes is two, the images of the bubble component reflected by the slopes are observed from two sides of the bubble component, which increases the viewing angle range that can observe the images of the bubble component reflected by the slopes.

Further, two slopes are symmetrically arranged about the bubble component, the two images formed by the reflection of these two slopes are observed from a second end of the bubble component at the same time, which can test whether processing the spirit level is precise based on whether they are consistent.

Further, the bubble component is an independent component that is mounted in a hole of the body.

Further, the an outer wall of the bubble component is a wall of a hole of the body, using the wall of the hole of the body which is formed in the integrally-formed process as the outer wall of the bubble component, the bubble component is formed by adding the liquid and the gas and sealing.

Further, coating a film on the slope can enhance the brightness of the reflected image.

Further, the obtuse angle formed by the slope and the level face at a side of arranging the bubble component is 120°-150°.

Further, the obtuse angle formed by the slope and the level face at a side of arranging the bubble component is 135°.

The present invention provides a spirit level having reflection bubble, comprising:

an elongate body which comprises a first surface and a second surface, a cavity is arranged between the first surface and the second surface, the cavity has an opening on the second surface, the first surface is a level face for measuring the measured surface;

a spirit level is arranged in the cavity, comprising:

a body that is a non-opaque body having a slope and a first viewing plane;

a bubble component that is arranged in the body, and a longitudinal axis of the bubble component is perpendicular to the first surface which is arranged between a first end of the bubble component and the measured surface, the first viewing plane facing to the first surface is arranged between a second end of the bubble component and a user;

the slope and the first surface form an obtuse angle at a side of arranging the bubble component, and an image of the bubble component is formed by reflection of the slope;

the user can observe the image of the bubble component reflected by the slope from

the first viewing plane;

the user can observe the first viewing plane of the spirit level via the opening of the second surface.

Further, the body of the spirit level is formed integrally, the slope for reflecting bubble component is formed in the integrally-formed process, additional assembly and calibration are not needed, so the manufacturing is simple and the cost is low.

Further, body of the spirit level is a transparent body which facilitates the light transmitting in the body and forming a clear image of the bubble component.

Further, the body of the spirit level comprises a second viewing plane which is a side face of the body, and user can observe the bubble component from the second viewing plane directly.

Further, a window part is arranged at the opening of the second surface.

Further, the body of the spirit level having reflection bubble comprises a third surface and a forth surface that faces to each other, the cavity has an opening on the third surface and/or the forth surface, the user can observe the second viewing plane of the spirit level from the opening on the third surface and/or the forth surface.

Further, a window part is arranged at the opening of the third surface and/or the forth surface.

Further, the number of slope of the body of the spirit level is one or two, and when the number of slope is two, the images of bubble component by reflection of the slopes can be observed from two sides of the bubble component, which increases the range of observing the images of the bubble component by the reflection of the slopes.

Further, when the number of the slope of the body of the spirit level is one, the slope of the body of the spirit level is closer to a longitudinal midpoint of the body of the spirit level having reflection bubble than the bubble component of the spirit level.

Further, when the number of the slope of the body of the spirit level is one, the bubble component of the spirit level is closer to a longitudinal midpoint of the body of the spirit level having reflection bubble than the slope of the body of the spirit level.

Further, the spirit level having reflection bubble also comprises a first bubble component which is arranged in the middle part of the body of the spirit level having reflection bubble; a longitudinal axis of the first bubble component for measuring the levelness of the measured surface is parallel to the first surface.

Further, the body of the spirit level having reflection bubble also comprises the first end and the second end.

Further, the spirit level is arranged in the first end or the second end of the body of the spirit level having reflection bubble.

Further, end caps are mounted respectively on the first end and the second end of the body of the spirit level having reflection bubble. The first surface of the body of the spirit level having reflection bubble is the level face which has the highly accurate flatness and smoothness. In order to protect the level face, the end caps, typically made of plastic, are mounted respectively on the first end and the second end of the body of the spirit level having reflection bubble.

Further, the spirit level having reflection bubble also comprises an illuminating apparatus which is arranged between the first surface and the spirit level, the brightness of the bubble component is enhanced by means of using the illuminating apparatus, which enhances the brightness of the reflected image.

Further, the illuminating apparatus is a LED light.

Compared with the prior art, the beneficial effects of the spirit level and the spirit level having reflection bubble provided by the present invention are as follows:

(1) Using light to enter optically sparse material from optically dense material (or to enter optically dense material from optically sparse material) which creates reflection and refraction when through the plane, the body of the spirit level for measuring the verticality is a transparent body formed integrally, the slope for reflecting the bubble component is formed in the integrally-formed process, additional assembly and calibration are not needed, so the manufacturing is simple and the cost is low.

(2) Compared with the reflector, the brightness of the image formed by the reflection of the slope of the body is weaker, coating a film on the slope and/or installing the illuminating apparatus enhance the brightness of the reflected image.

Referencing now to the figures, the conception, detailed structure and induced technical effects of the present invention will be expounded for understanding of the purpose, characterizations and effects of the present invention:

Brief Description of the Drawings

Figure 1 is a perspective view of the spirit level with two slopes in an embodiment of the present invention;

Figure 2 is a side view of the spirit level shown in Figure 1;

Figure 3 is a perspective view of the spirit level with a single slope in another embodiment of the present invention;

Figure 4 is a side view of the spirit level with a independent bubble component in

another embodiment of the present invention;

Figure 5 is a perspective view of the spirit level having a reflection bubble with two slopes in another embodiment of the present invention;

Figure 6 is a partial side view of the spirit level having a reflection bubble shown in Figure 5;

Figure 7 is a partial side view of the spirit level having reflection bubble in which installed the spirit level with a slope in another embodiment of the present invention;

Figure 8 is a partial side view of the spirit level having a reflection bubble in which installed the spirit level having a slope in another embodiment of the present invention;

Figure 9 is a perspective view of the spirit level having a reflection bubble on which mounted the window parts;

Figure 10 is a partial side view of the spirit level having a reflection bubble in which mounted the illuminating apparatus.

Detailed Description of the Preferred Embodiments

As shown in Figure 1 and Figure 2, the spirit level in an embodiment of the present invention comprises:

a body 1 that is a non-opaque body, comprising a level face 11 for measuring the verticality of the measured surface, a slope 12 intersecting with the level face 11 and a first viewing plane 13.

a bubble component 2 that is arranged in the body 1, and the longitudinal axis of the

bubble component 2 is perpendicular to the level face 11 which is arranged between a first end 21 of the bubble component 2 and the measured surface, the first viewing plane 13 facing to the level face 11is arranged between a second end 22 of the bubble component 2 and a user;

the slope 12 and the level face 11 form an obtuse angle at a side of arranging the bubble component 2, and an image of the bubble component 2 is formed by reflection of the slope 12;

the user can observe the image of the bubble component 2 formed by the reflection of the slope 12 from the first viewing plane 13.

When using the spirit level in the embodiment measures the verticality, the user can not only directly observe the bubble component 2 from the sides of the spirit level, i.e., from the second viewing plane 14, but also observe the image of the bubble component 2 formed by reflection of the slope 12 from the first viewing plane 13, making measuring the verticality more convenient.

The image of the bubble component 2 comprises a bubble floating in the bubble component and the scale lines 23 located at two sides of the longitudinal midpoint of the bubble component 2.

The obtuse angle formed by the slope 12 and the level face 11 at the side of arranging the bubble component 2 is 120° to 150°, in the embodiment, the obtuse angle is 135°.

The body 1 is formed integrally, the slope 12 for reflecting the bubble component 2 is formed in the integrally-formed process, additional assembly and calibration are not needed, so the production processing is simple and the cost is low.

The body 1 is a transparent body which facilitates the light transmitting in the body 1

and forming a clear image of the bubble component 2.

The body also comprises the second viewing plane 14 which is the side of the body 1, the user can directly observe the bubble component 2 from the second viewing plane 14.

In the embodiment, the number of the slopes 12 is two, the user can observe the image of the bubble component 2 formed by reflection of the slopes 12 from two sides of the bubble component 2, which increases the range that can observe the image of the bubble component 2 formed by reflection of the slopes 12.

The two slopes 12 are symmetrically arranged about the bubble component 2, the user can observe the images of these two slopes 12 at the same time from the second end 22 of the bubble component 2, which can test whether processing the spirit level is precise based on whether they are consistent.

As shown in the Figure 3, the number of the slope 12 is one in another embodiment of the present invention.

As shown in the Figure 4, in another embodiment of the present invention, the bubble component 2 is an independent component mounted in a hole 15 of the body 1.

In another embodiment of the present invention, the outer wall of the bubble component 2 is the wall of the hole 15 of the body 1, using the wall of the hole 15 of the body 1 which is formed integrally as the outer wall of the bubble component 2, the bubble component 2 is formed by adding the liquid and gas and sealing.

Compared with a reflector, the brightness of the image formed by the reflection of the slope of the body is weaker, thus coating a film on the slope 12 enhance the brightness of the reflected image.

As shown in the Figure 5 and Figure 6, the spirit level having reflection bubble 3 in another embodiment of the present invention, comprises:

an elongate body which comprises a first surface 31 and a second surface 32, a cavity is arranged between the first surface 31 and the second surface 32, the cavity has an opening on the second surface 32, the first surface 31 is a level face for measuring a measured surface;

a spirit level is arranged in the cavity, comprising:

a body 1 that is a non-opaque body having a slope 12 and a first viewing plane 13;

a bubble component 2 that is arranged in the body 1, and a longitudinal axis of the bubble component 2 is perpendicular to the first surface 31 which is arranged between a first end 21 of the bubble component 2 and the measured surface, the first viewing plane 13 which is arranged between a second end 22 of the bubble component 2 and a user facing to the first surface 31;

the slope 12 and the first surface 31 form an obtuse angle at a side of arranging the bubble component, an image of the bubble component 2 is formed by reflection of the slope;

the user can observe the image of the bubble component 2 reflected by the slope from the first viewing plane 13;

the user can observe the first viewing plane 13 of the spirit level via the opening of the second surface 32 so that can observe the image of the bubble component 2formed by reflection of the slope 12.

The body 1 of the spirit level is formed integrally, the slope 12 for reflecting the

bubble component 2 is formed in the integrally-formed process, additional assembly and calibration are not needed, so the manufacturing is simple and the cost is low.

The body 1 of the spirit level is a transparent body which facilitates the light transmitting in the body 1 and forming a clear image of the bubble component 2.

The body 1 of the spirit level comprises the second viewing plane 14 which is the side face of body 1, and the user can observe the bubby component 2 from the second viewing plane 14 directly.

The spirit level having reflection bubble also comprises the first bubble component 34 which is arranged in the middle part of the body of the spirit level 3 having reflection bubble, a longitudinal axis of the first bubble component 34 for measuring the levelness of the measured surface is parallel to the first surface 31.

The number of the slope 12 of the body of the spirit level is one or two.

The number of the slope 12 of the spirit level is two in the embodiment, it can observe the image of the bubble component 2 which is reflected via slopes 12 from two sides of the bubble component 2, and it increases the range that can observe the image of the bubble component 2 which is reflected via the slopes 12; the user can observe the image of these two slopes 12 at the same time from the second end 22 of the bubble component 2, which can test whether processing the spirit level is precise based on whether they are consistent.

As shown in the Figure 7, the number of slope 12 of the body of the spirit level is one in another embodiment; the slope 12 of the body of the spirit level is closer to a longitudinal midpoint of the body of the spirit level having reflection bubble than the bubble component 2 of the spirit level.

As shown in the Figure 8, the number of slope of the body of the spirit level is one in another embodiment; the bubble component 2 of the spirit level is closer to the longitudinal midpoint of the body of the spirit level having reflection bubble than the slope 12 of the body of the spirit level.

The body of the spirit level having reflection bubble also comprises a first end 351 and a second end 352.

The spirit level is arranged in the first end 351 or the second end 352 of the body of the spirit level having reflection bubble 3.

End caps are arranged respectively on the first end 351 and the second end 352 of the body of the spirit level having reflection bubble 3, the first surface 31 of the body of the spirit level having reflection bubble 3 is the level face which has highly accurate flatness and smoothness. In order to protect the level face, the end caps, typically made of plastic, are arranged respectively on the first 351 end and the second end 352 of the body of the spirit level having reflection bubble 3.

As shown in the Figure 9, a window part 321 is arranged at the opening of the second surface 32 in the spirit level having reflection bubble 3 in another embodiment of the present invention, and the image of bubble component 2 formed by reflection of the slope can be observed via the window part 321.

In another embodiment of the present invention, the body of the spirit level having reflection bubble 3 also comprises a third surface 36 and a forth surface 37 that faces to each other, the cavity has opening(s) on the third surface 36 and/or the forth surface 37, the user can observe the second viewing plane 14 of the spirit level from the opening(s) on the third surface 36 and/or the forth surface 37.

A window part 361 is arranged at the opening of the third surface 36 and/or a window

part is arranged at the opening of the forth surface 37, and the bubble component 2 can be observed directly via the window part.

As shown in the Figure 10, the spirit level having reflection bubble 3 also comprises an illuminating apparatus 381 which is arranged between the first surface 31 and the spirit level, the illuminating apparatus 381 is coupled to a power supply via a wire 382, the brightness of the bubble component 2 is enhanced by the illuminating apparatus 381, which enhances the brightness of the reflected image.

The illuminating apparatus 381 is a LED light.

The spirit level and the spirit level having reflection bubble provided by the present invention use light to enter optically sparse material from optically dense material (or to enter optically dense material from optically sparse material) which creates reflection and refraction when through the plane, the body of the spirit level of measuring the verticality is a transparent body formed integrally, the slope for reflecting the bubble component is formed in the integrally-formed process, additional assembly and calibration are not needed, so the manufacturing is simple and the cost is low. Compared with a reflector, the brightness of the image formed by reflection of the slope of the body is weaker, coating a film on the slope and/or installing the illuminating apparatus enhance the brightness of the reflected image.

The ongoing description details the preferable embodiments of the invention. It should be understood that with the general technicians of this field, no inventive work is necessary as to make multiple amendments and changes according to conception of this invention. Therefore, all the technical schemes gained from logical analysis, deductions or limited experimentation based on the present invention by technicians in this field, should be considered within the protection range asserted in the Claims.

Claims

1. A spirit level, characterized by comprising:

A body that is a non-opaque body, having a level face for measuring a verticality of a measured surface, a slope intersecting with the level face, and a first viewing plane;

a bubble component that is arranged inside the body, a longitudinal axis of the bubble component being perpendicular to the level face, the level face being arranged between a first end of the bubble component and the measured surface, and the first viewing plane facing to the level face and being arranged between a second end of the bubble component and a user;

wherein the slope and the level face form an obtuse angle at a side arranged with the bubble component, and an image of the bubble component is formed by reflection of the slope;

wherein the user can observe the image of the bubble component reflected by the slope from the first viewing plane.

2. The spirit level according to Claim 1, characterized in that the body is formed integrally.

3. The spirit level according to Claim 1, characterized in that the body is a transparent body.

4. The spirit level according to Claim 1, characterized in that the body further comprises a second viewing plane which is a side of the body, and the user can directly observe the bubble component from the second viewing plane.

5. The spirit level according to Claim 1, characterized in that the number of the slope is one.

6. The spirit level according to Claim 1, characterized in that the number of the slopes is two.

7. The spirit level according to Claim 6, characterized in that the two slopes are arranged symmetrically about the bubble component.

8. The spirit level according to Claim 1, characterized in that the bubble component is an independent component that is mounted in a hole of the body.

9. The spirit level according to Claim 1, characterized in that an outer wall of the bubble component is a wall of the hole of the body.

10. The spirit level according to Claim 1, characterized in that a film is coated on the slope.

11. The spirit level according to Claim 1, characterized in that the obtuse angle is 120°-150°.

12. The spirit level according to Claim 11, characterized in that, the obtuse angle is 135°.

13. A spirit level having reflection bubble, characterized by comprising:

an elongate body which comprises a first surface and a second surface, a cavity being arranged between the first surface and the second surface, the cavity having an opening on the second surface, and the first surface being a level face for measuring a measured surface;

a spirit level arranged in the cavity, the spirit level comprising:

a body that is a non-opaque body having a slope and a first viewing plane;

a bubble component that is arranged inside the body, a longitudinal axis of the bubble component being perpendicular to the first surface, is the first surface being

arranged between a first end of the bubble component and the measured surface, and the first viewing plane facing to the first surface and being arranged between a second end of the bubble component and a user;

wherein the slope and the first surface form an obtuse angle at a side arranged with the bubble component, and an image of the bubble component is formed by reflection of the slope;

wherein the user can observe the image of the bubble component reflected by the slope from the first viewing plane ;

wherein the user can observe the first viewing plane of the spirit level via the opening of the second surface.

14. The spirit level having reflection bubble according to Claim 13, characterized in that the body of the spirit level is formed integrally.

15. The spirit level having reflection bubble according to Claim 13, characterized in that the body of the spirit level is a transparent body.

16. The spirit level having reflection bubble according to Claim 13, characterized in that the body of the spirit level comprises a second viewing plane which is a side of the body, and the user can directly observe the bubble component from the second viewing plane.

17. The spirit level having reflection bubble according to Claim 13, characterized in that a window part is arranged at the opening of the second surface.

18. The spirit level having reflection bubble according to Claim 13, characterized in that the body of the spirit level having reflection bubble comprises a third surface and a forth surface that face to each other, the cavity has an opening on the third surface and/or the forth surface, and the user can observe the second viewing plane of the spirit level from the opening on the third surface and/or the forth surface.

19. The spirit level having reflection bubble according to Claim 18, characterized in that a window part is arranged at the opening of the third surface and/or the forth surface.

20. The spirit level having reflection bubble according to Claim 13, characterized in that the number of the slope of the body of the spirit level is one or two.

21. The spirit level having reflection bubble according to Claim 20, characterized in that when the number of the slope of the body of the spirit level is one, the slope of the body of the spirit level is closer to a longitudinal midpoint of the body of the spirit level having reflection bubble than the bubble component of the spirit level is.

22. The spirit level having reflection bubble according to Claim 20, characterized in that when the number of the slope of the body of the spirit level is one, the bubble component of the spirit level is closer to a longitudinal midpoint of the body of the spirit level having reflection bubble than the slope of the body of the spirit level is.

23. The spirit level having reflection bubble according to Claim 13, characterized in that the spirit level having reflection bubble further comprises a first bubble component which is arranged in the middle part of the body of the spirit level having reflection bubble, and a longitudinal axis of the first bubble component for measuring the levelness of the measured surface is parallel to the first surface.

24. The spirit level having reflection bubble according to Claim 13, characterized in that the body of the spirit level having reflection bubble further comprises a first end and a second end.

25. The spirit level having reflection bubble according to Claim 24, characterized in that the spirit level is arranged in the first end or the second end of the body of the

spirit level having reflection bubble.

26. The spirit level having reflection bubble according to Claim 24, characterized in that end caps are arranged respectively on the first end and the second end of the body of the spirit level having reflection bubble.

27. The spirit level having reflection bubble according to Claim 13, characterized in that the spirit level having reflection bubble further comprises an illuminating apparatus which is arranged between the first surface and the spirit level.

28. The spirit level having reflection bubble according to Claim 27, characterized in that the illuminating apparatus is a LED light.

Drawings of the Description

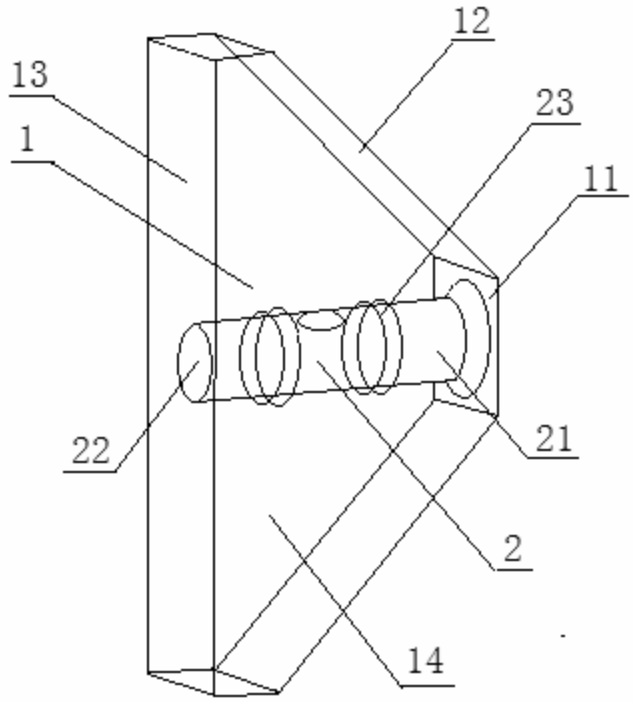

Fig. 1

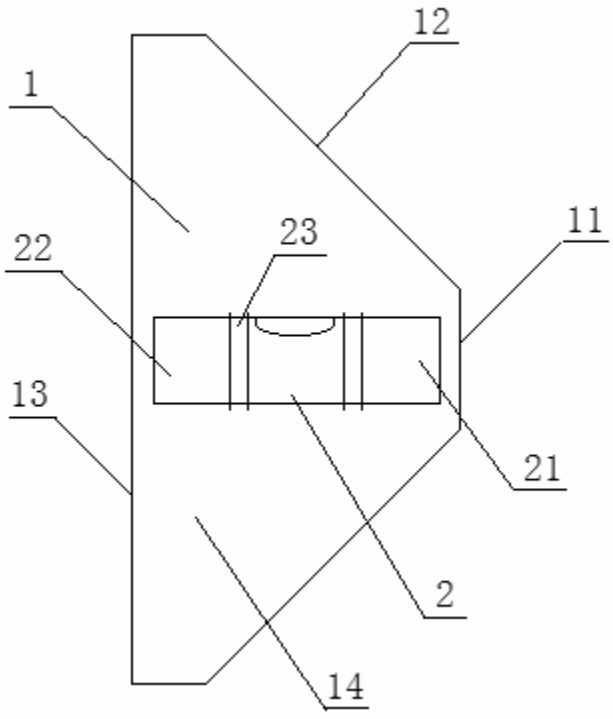

Fig. 2

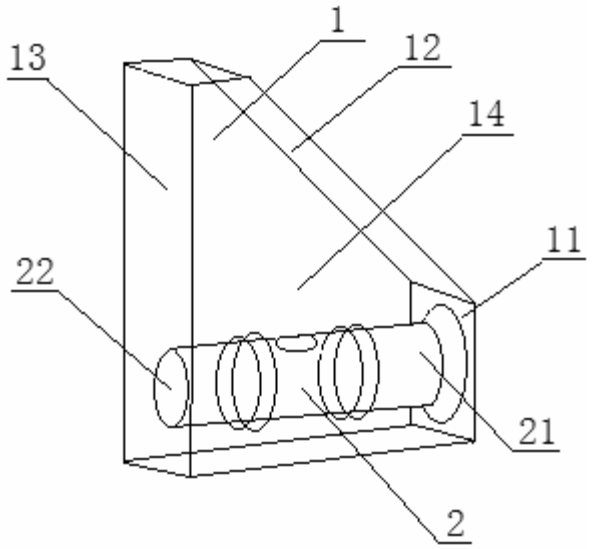

Fig. 3

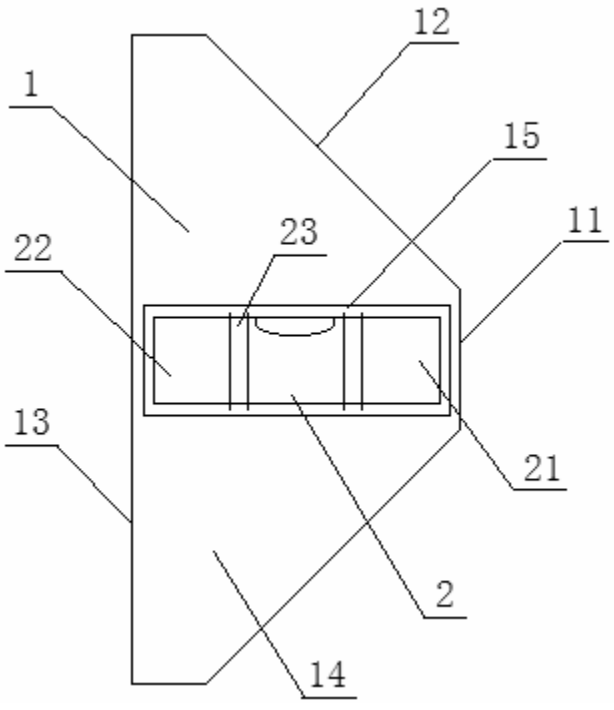

Fig. 4

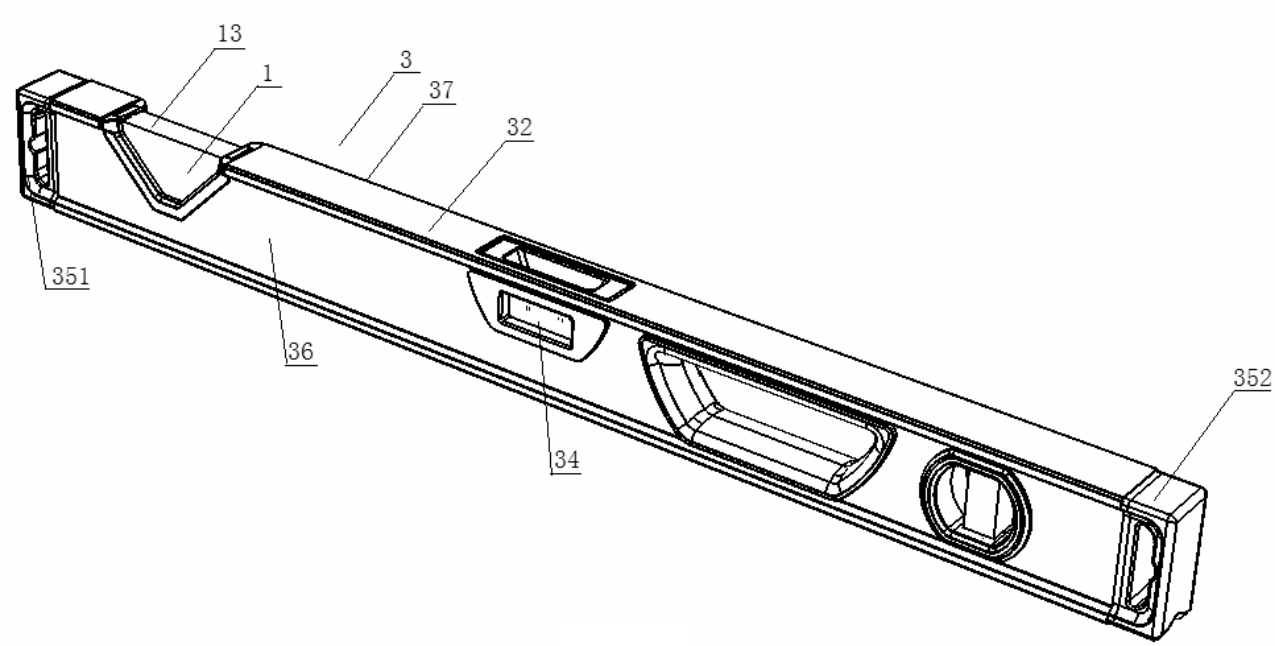

Fig. 5

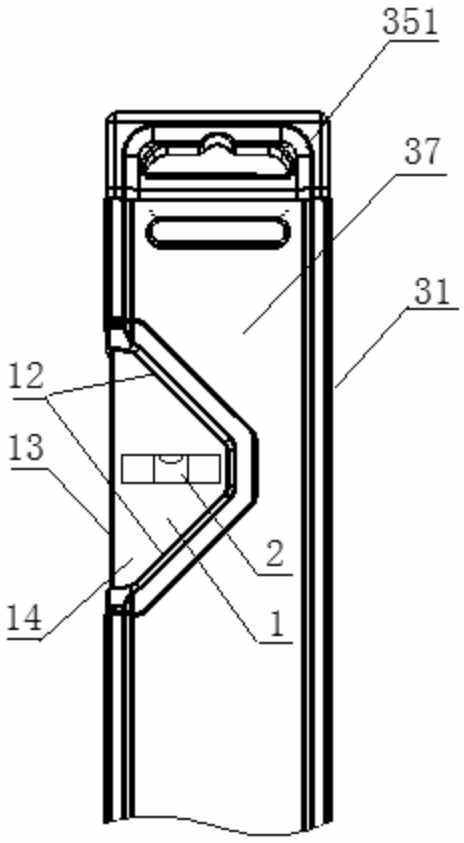

Fig. 6

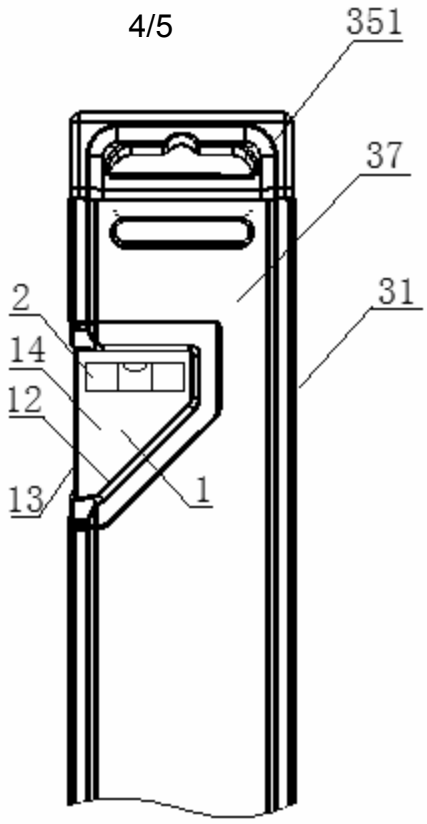

Fig. 7

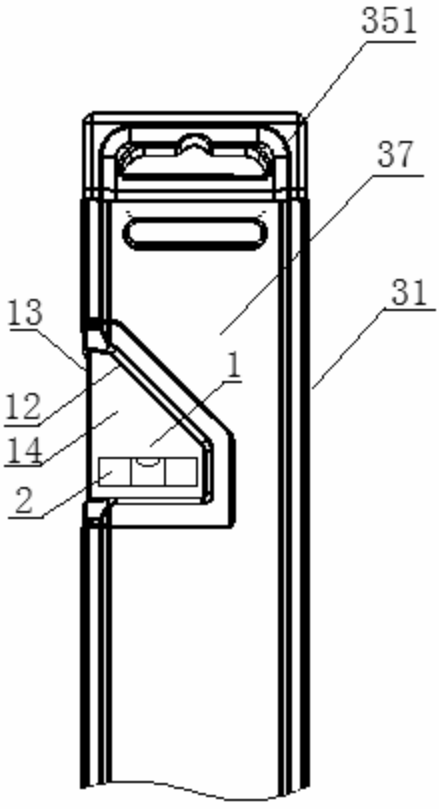

Fig. 8

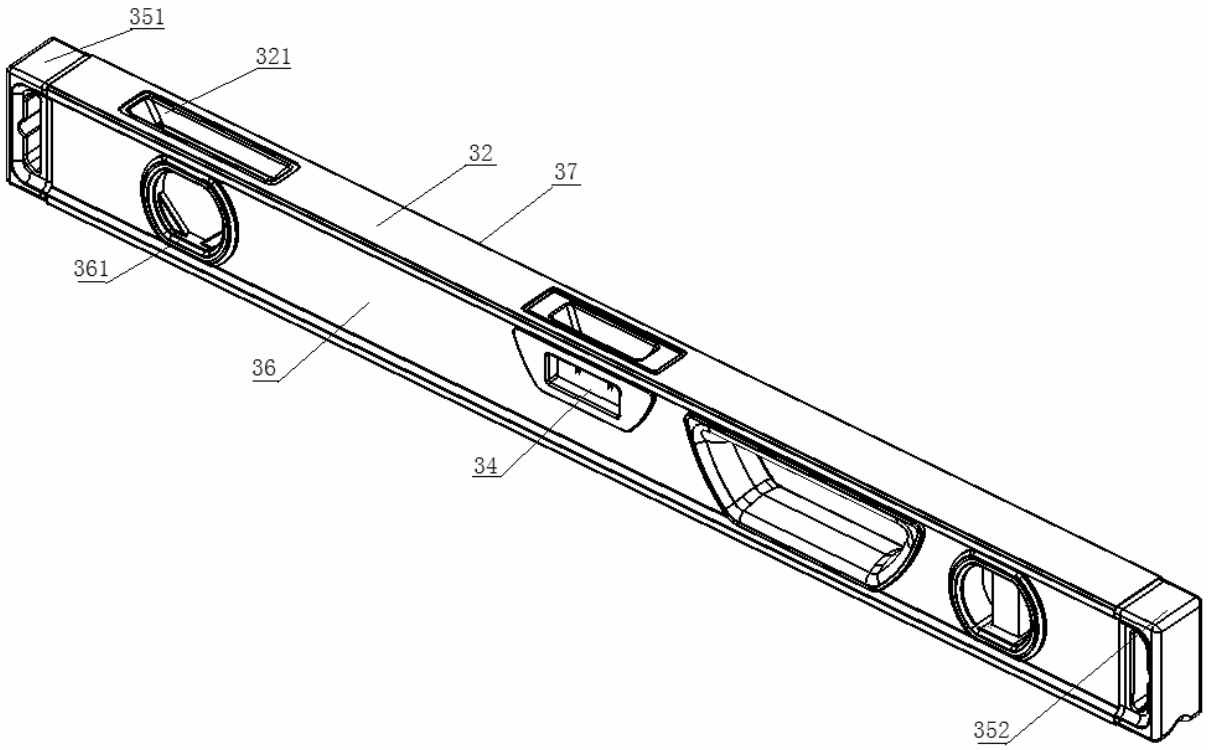

Fig. 9

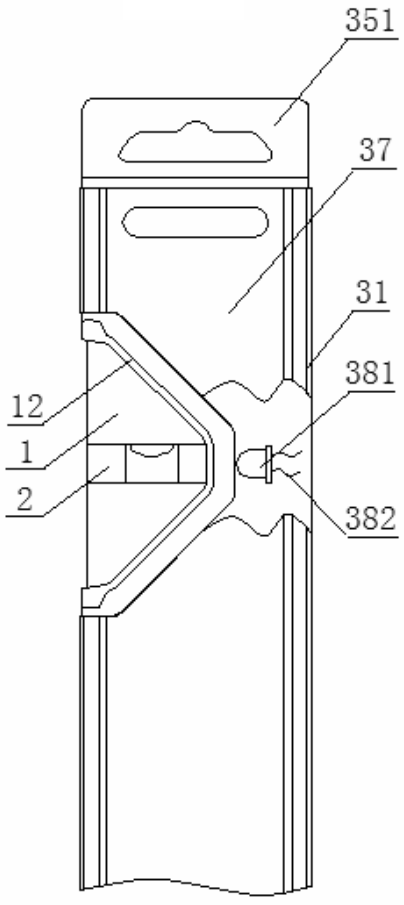

Fig. 10