

(19)



(11)

EP 3 115 497 A1

(12)

EUROPEAN PATENT APPLICATION

(43) Date of publication:
11.01.2017 Bulletin 2017/02

(51) Int Cl.:
D06F 39/00 (2006.01) **A47L 15/42** (2006.01)
D06F 39/14 (2006.01) **F24C 15/20** (2006.01)

(21) Application number: **16176924.5**

(22) Date of filing: **29.06.2016**

(84) Designated Contracting States:
**AL AT BE BG CH CY CZ DE DK EE ES FI FR GB
 GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO
 PL PT RO RS SE SI SK SM TR**
 Designated Extension States:
BA ME
 Designated Validation States:
MA MD

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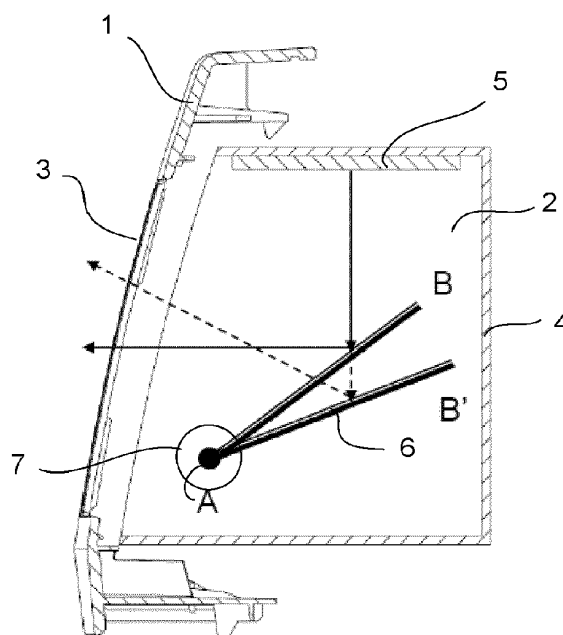
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(30) Priority: **08.07.2015 CN 201510398923**

(54) HOUSEHOLD APPLIANCE WITH DISPLAY APPARATUS

(57) The present invention discloses a household appliance with a display apparatus, where the display apparatus includes a planar projection plate (6, 16, 26, 36, 46) and a projection source (5, 15, 25, 35, 45) that projects light onto the projection plate (6, 16, 26, 36, 46), where there is a tilt angle between a light projection direction of the projection source (5, 15, 25, 35, 45) and the projection plate (6, 16, 26, 36, 46), and the projection

plate (6, 16, 26, 36, 46) reflects at least a part of the light projected by the projection source (5, 15, 25, 35, 45). A user of the household appliance sees displayed content that is from the projection source (5, 15, 25, 35, 45) by means of the light reflected by the projection plate (6, 16, 26, 36, 46), so that the displayed content has relatively strong depth of field effect, and has a sense of space.

**FIG. 1****EP 3 115 497 A1**

Description

[0001] The present invention relates to a display apparatus of a household appliance, and in particular, to a display apparatus of a household appliance such as a washing machine, a dishwasher, a refrigerator, a range hood, or a cooktop.

[0002] A household appliance such as a washing machine, a dishwasher, a refrigerator, a range hood, or a cooktop generally has a planar display apparatus. The display apparatus is generally located on the case body, to display information such as a program, a parameter, a state of the household appliance.

[0003] An objective of the present invention is to improve a display apparatus of a household appliance.

[0004] To achieve the foregoing objective, a technical solution used in the present invention is: A household appliance with a display apparatus is provided, where the display apparatus includes a planar projection plate and a projection source that projects light onto the projection plate, where there is a tilt angle between a light projection direction of the projection source and the projection plate, and the projection plate reflects at least a part of the light projected by the projection source.

[0005] A user of the household appliance sees displayed content that is from the projection source by means of the light reflected by the projection plate, so that the displayed content has relatively strong depth of field effect, and has a sense of space.

[0006] In one of improved solutions, the projection plate is capable of transmitting a part of the light and simultaneously reflecting the other part of the light. Because of this characteristic of the projection plate, not only the projection plate may reflect projected content to the user, but also in some applications, the user may see vision behind the projection plate, so that the displayed content has more sense of space. Moreover, the projection plate reflecting only a part of the light weakens light that is reflected by a mechanical structure around the projection source through the projection plate, so that the projected content seen by the user is not interfered.

[0007] In one of optional implementation manners, the household appliance includes an adjustment apparatus that is connected to the projection plate for adjusting an angle of the projection plate relative to an observer. An observer with a different height may find a best angle suitable for the observer by adjusting the angle of the projection plate relative to the observer by using the adjustment apparatus, so as to see the projected content conveniently and more clearly.

[0008] In one of the optional implementation manners, the adjustment apparatus includes a rotating mechanism. The angle of the projection plate can be adjusted relatively conveniently by using the rotating mechanism connected to the projection plate.

[0009] In one of the optional implementation manners, the rotating mechanism includes a motor or a knob. The motor may be controlled by an electric control apparatus,

and the rotating mechanism is driven to rotate when the motor rotates. In another implementation manner, the user may manually turn the knob for adjustment.

[0010] In one of the optional implementation manners, the display apparatus includes a dark background. The dark background helps to improve resolution of display.

[0011] In one of the optional implementation manners, the household appliance includes a chamber, where the chamber has a transparent observation window, and the projection plate is located in the chamber. The observation window may protect the projection plate and the projection source.

[0012] In one of the optional implementation manners, the chamber is disposed on a case body of the household appliance. The case body includes an internal cavity surrounding the household appliance, and a mechanical structure constituting the appearance of the household appliance.

[0013] In one of the optional implementation manners, the household appliance includes a washing machine, and the chamber is disposed in a transparent door of the washing machine. The transparent door generally includes transparent space made of glass. The chamber of the display apparatus is provided in the transparent door, which not only saves space but also achieves a relatively large display area.

[0014] In one of the optional implementation manners, the projection source is provided in a front panel, which is equipped with the transparent door, of the washing machine, which facilitates installation of the projection source and a connection between the projection source and a control apparatus in the washing machine. Moreover, the projection source may be less visible.

[0015] In one of the optional implementation manners, a lens for enlarging an image is provided in a projection direction of the projection source. Therefore, the projection source may be relatively small, which facilitates installation and implementation. Moreover, the projected image may be larger, so that a display effect is more desirable.

[0016] In one of the optional implementation manners, the lens is provided in the front panel. The lens, which is provided in the front panel rather than in the transparent door, may cooperate with the projection source more stably, which also help to improve a projection effect.

[0017] In one of the optional implementation manners, there is a light guide channel between the projection source and the lens. The light guide channel connects the projection source and the lens, so that an installation position of the projection source is more flexible.

[0018] In one of the optional implementation manners, it is such configured that when powered on, the projection source is controlled by a control apparatus to turn off an image when the transparent door is opened, thereby avoiding waste of electricity and preventing the user from confusion caused because the projection source projects light onto another place.

[0019] In one of the optional implementation manners,

the household appliance includes a combination of a range hood and a cooktop, the projection plate is an air guiding plate that is installed on the range hood and that tilts relatively to a top plate of the cooktop, and the projection source is provided in the cooktop. The air guiding plate has a relatively large receiving surface; therefore, a display effect is prominent. Moreover, the air guiding plate is substantially parallel to sight of the user, which greatly facilitates observation. The projection source is provided in the cooktop below the range hood, and a relatively desirable installation position may be selected without affecting basic functions and performance of the range hood and the cooktop.

[0020] In one of the optional implementation manners, the projection source is in wireless communication with a first control apparatus provided in the range hood.

[0021] In one of the optional implementation manners, the projection source communicates with the second control apparatus provided in the cooktop, and selectively projects information about the range hood or the cooktop according to control of the first control apparatus or a second control apparatus.

[0022] In one of the optional implementation manners, the projection plate includes a transparent substrate and a reflective film covering the transparent substrate.

[0023] The following further describes preferred implementation manners of the present invention with reference to the Figures of the accompanying drawing. In the drawing,

- FIG. 1 is a schematic partial cross-sectional diagram of a control panel of a washing machine with a display apparatus;
- FIG. 2 is a schematic diagram of a principle of the display apparatus;
- FIG. 3 is a schematic partial cross-sectional diagram of a front panel and a door of a washing machine with a display apparatus;
- FIG. 4 is a locally enlarged diagram of FIG. 3;
- FIG. 5 is a schematic partial cross-sectional diagram of a top cover of a washing machine with a display apparatus;
- FIG. 6 is a schematic partial cross-sectional diagram of a door of a refrigerator with a display apparatus; and
- FIG. 7 is a schematic diagram of a combination, of a range hood and a cooktop, with a display apparatus.

[0024] As shown in FIG. 1, in a first implementation manner, a control panel 1 of a washing machine includes a chamber 2. The chamber 2 has a transparent observation window 3 on a side towards a user, and a side opposite to the observation window 3 is a dark background 4. A projection source 5 is provided on the top of the chamber 2, and is provided with a planar projection plate 6 on a projection direction of the projection source 5. There is a tilt angle between the projection plate 6 and

a light projection direction of the projection source 5. Light that includes display information and that is projected by the projection source 5 is refracted the projection plate 6, then passes through the observation window 3, and may be finally seen by the user. The projection source 5 may be an LCD or LED display screen, or may be another imageable projection device. Projected content may be static or dynamic image information.

[0025] As shown in FIG. 2, A1A2 is content that is actually displayed by the projection source 5, and B1B2 is a visual image obtained after projection. Light is first reflected onto human eyes through an optical path 1. Because the human eyes can see only linear light, a final imaging position is B1 B2, which gives people a wrong impression, to seem an image to be in the front of people, so that displayed image information produces a depth of field effect.

[0026] More preferably, the projection plate 6 uses a material or structure that can transmit a part of the light and simultaneously reflect a part of the light, for example, is formed by a transparent substrate and a reflective film covering the transparent substrate. After being projected onto the projection plate 6, the light may be partially reflected. Therefore, the user may see, through the projection plate 6, the image information projected by the projection source 5, and simultaneously, the user may see a structure and a scene behind the projection plate 6 through the projection plate 6, so that the displayed content has more sense of space, the user has a more realistic feel that the image is behind the projection plate 6. Moreover, the projection plate reflecting only a part of the light weakens light that is reflected by a mechanical structure around the projection source through the projection plate, so that the projected content seen by the user is not interfered.

[0027] To adapt to users with different heights, a first end A of the projection plate 6 is connected to an adjustment apparatus 7, to adjust an angle of the projection plate 6 relative to an observer. Obviously, the adjustment apparatus 7 may also be connected to another position of the projection plate 6. The adjustment apparatus 7 includes a rotating mechanism. Therefore, the projection plate 6 may be driven by the rotating mechanism to move from a position of AB to a position of AB', or another position suitable for observation. The rotating mechanism may be a motor, or may be a knob that can be manually operated.

[0028] In a second implementation manner, as shown in FIG. 3 and FIG. 4, the washing machine includes a transparent door 9 installed on a front panel 8. The transparent door 9 has a hollow chamber 12 made of glass. The projection plate 16 is disposed in the chamber 12 of the transparent door 9 in a tilting manner, and the projection source 15 is provided in the front panel 8. A lens 17 for enlarging an image is provided in the projection direction of the projection source. The lens 17 is provided in the front panel 8, and there is a light guide channel 18 between the projection source 15 and the lens 17. The

projection source 15 is preferably a micro projector, and due to a small volume of the projection source 15, a relatively large image may be obtained due to magnification of the lens 17. The projection plate 16 preferably uses a material or structure that can transmit a part of the light and simultaneously reflect a part of the light.

[0029] The projection source 15 is connected to a control apparatus 10, and is controlled by the control apparatus 10. When powered on, the projection source right turns off an image when the transparent door 9 is opened, and the projection source 15 displays the image again when the transparent door 9 is closed.

[0030] In a third implementation manner, as shown in FIG. 5, a chamber 22 is located in a case body 21 of a household appliance such as a washing machine or a cooktop. A projection plate 26 tilts relatively to a projection source 25, and a reflection surface of the projection plate 26 faces a user. An observation window 23 is parallel to an outer surface of the case body 21. The projection plate 26 preferably uses a material or structure that can transmit a part of light and simultaneously reflect a part of the light.

[0031] In a fourth implementation manner, as shown in FIG. 6, a chamber 32 is located in a door body 31 in the front of a household appliance such as a refrigerator or dishwasher. A projection plate 36 tilts relatively to a projection source 35. An observation window 33 is parallel to an outer surface of the door body 31. The projection plate 36 preferably uses a material or structure that can transmit a part of light and simultaneously reflect a part of the light.

[0032] In a fifth implementation manner, as shown in FIG. 7, a projection source 45 is installed on a top plate 44 of a cooktop 40. A range hood 41 fitting the cooktop 40 is installed above the cooktop 40. The range hood 41 has an air guiding plate 46 that tilts relatively to the top plate of the cooktop 40. The projection source 45 transmits image information to the air guiding plate 46, and reflects the image information onto eyes of a user through the air guiding plate 46. The air guiding plate 46 preferably uses a material or structure that can transmit a part of light and simultaneously reflect a part of the light.

[0033] Preferably, the projection source 45 is in wireless communication with a first control apparatus 42 provided in the range hood 4, so that the projection source 45 projects information about the range hood 41 onto the air guiding plate 46.

[0034] More preferably, the projection source 45 simultaneously communicates with a second control apparatus 43 provided in the cooktop 40, and selectively projects information about the range hood 41 or the cooktop 40 according to control of the first control apparatus 42 or a second control apparatus 43.

[0035] Various specific implementation manners described in the foregoing and shown in accompanying drawings are merely used for illustrating the present invention, and are not considered as the entirety of the present invention. Within the scope of the basic technical

thought of the present invention, any types of modifications to the present invention made by persons ordinarily skilled in the art fall within the protection scope of the present invention.

REFERENCE NUMERALS

[0036]

10	1	Control panel
	2	Chamber
	3	Observation window
	4	Background
	5	Projection source
15	6	Projection plate
	7	Adjustment apparatus
	8	Front panel
	9	Door
20	12	Hollow chamber
	15	Projection source
	16	Projection plate
	17	Lens
	18	Light guide channel
25	21	Case body
	22	Chamber
	23	Observation window
	25	Projection source
30	26	Projection plate
	31	Door body
	32	Chamber
	33	Observation window
35	35	Projection source
	36	Projection plate
	40	Cooktop
	41	Range hood
	42	First control apparatus
40	43	Second control apparatus
	44	Top plate
	45	Projection source
	46	Air guiding plate

Claims

1. A household appliance with a display apparatus, **characterized in that:**

the display apparatus comprises a planar projection plate (6, 16, 26, 36, 46) and a projection source (5, 15, 25, 35, 45) that projects light onto the projection plate (6, 16, 26, 36, 46), wherein there is a tilt angle between a light projection direction of the projection source (5, 15, 25, 35, 45) and the projection plate (6, 16, 26, 36, 46), and the projection plate (6, 16, 26, 36, 46) re-

- reflects at least a part of the light projected by the projection source (5, 15, 25, 35, 45).
2. The household appliance according to claim 1, **characterized in that:**

the projection plate (6, 16, 26, 36, 46) is capable of transmitting a part of the light and simultaneously reflecting the other part of the light.
 3. The household appliance according to any preceding claim, **characterized by:**

comprising an adjustment apparatus (7) that is connected to the projection plate (6) for adjusting an angle of the projection plate (6) relative to an observer.
 4. The household appliance according to claim 3, **characterized in that:**

the adjustment apparatus (7) comprises a rotating mechanism.
 5. The household appliance according to claim 4, **characterized in that:**

the rotating mechanism comprises a motor or a knob.
 6. The household appliance according to any preceding claim, **characterized in that:**

the display apparatus comprises a dark background (4).
 7. The household appliance according to any preceding claim, **characterized by:**

comprising a chamber (2, 12, 22, 32), wherein the chamber (2, 12, 22, 32) has a transparent observation window (3, 23, 33), and the projection plate (6, 16, 26, 36, 46) is located in the chamber (2, 12, 22, 32).
 8. The household appliance according to claim 7, **characterized in that:**

the chamber (2, 12, 22, 32) is disposed on a case body (1, 8, 9, 21, 31) of the household appliance.
 9. The household appliance according to claim 8, **characterized in that:**

the household appliance comprises a washing machine, and the chamber (12) is disposed in a transparent door (9) of the washing machine.
 10. The household appliance according to claim 9, **characterized in that:**

the projection source (15) is provided in a front panel (8), which is equipped with the transparent door (9), of the washing machine.
 11. The household appliance according to claim 10, **characterized in that:**

a lens (17) for enlarging an image is provided in a projection direction of the projection source (15).
 12. The household appliance according to claim 11, **characterized in that:**

the lens (17) is provided in the front panel (8).
 13. The household appliance according to any of claims 11 and 12, **characterized in that:**

there is a light guide channel (18) between the projection source (15) and the lens (17).
 14. The household appliance according to any of claims 10 to 13, **characterized in that:**

it is configured such that when powered on, the projection source (15) is controlled by a control apparatus (10) to turn off an image when the transparent door (9) is opened.
 15. The household appliance according to any preceding claim, **characterized in that:**

the household appliance comprises a combination of a range hood (41) and a cooktop (40), the projection plate (46) is an air guiding plate (46) that is installed on the range hood (41) and that tilts relatively to a top plate (44) of the cooktop (40), and the projection source (45) is provided in the cooktop (40).
 16. The household appliance according to claim 15, **characterized in that:**

the projection source (45) is in wireless communication with a first control apparatus (42) provided in the range hood (41).
 17. The household appliance according to claim 16, **characterized in that:**

the projection source (45) communicates with a second control apparatus (43) provided in the cooktop (40), and selectively projects information about the range hood (41) or the cooktop

(40) according to control of the first control apparatus (42) or the second control apparatus (43).

18. The household appliance according to any preceding claim, **characterized in that:** 5

the projection plate (6, 16, 26, 36, 46) comprises a transparent substrate and a reflective film covering the transparent substrate. 10

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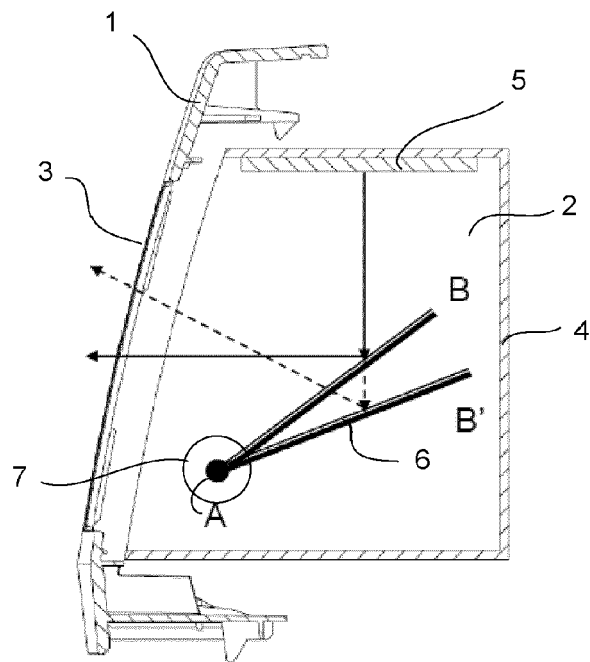


FIG. 1

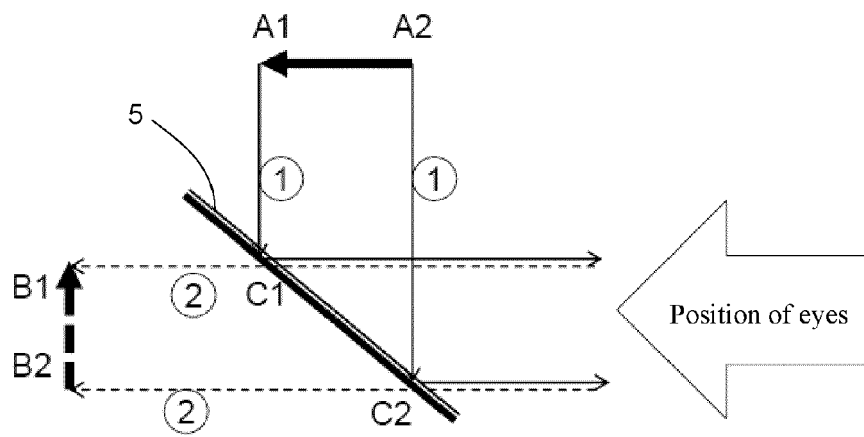


FIG. 2

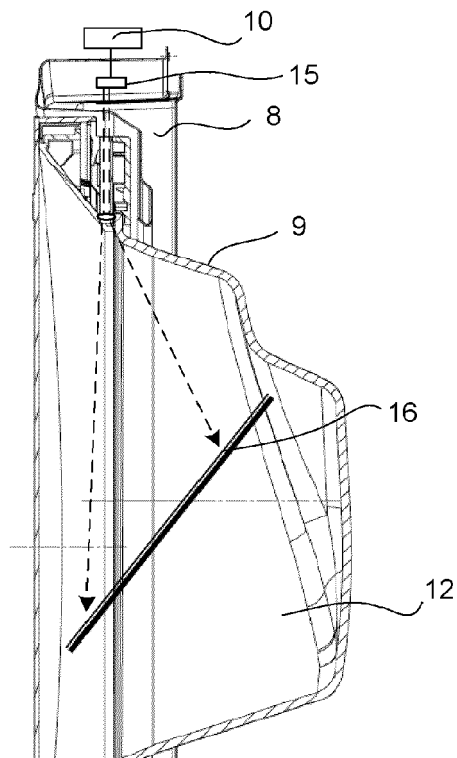


FIG. 3

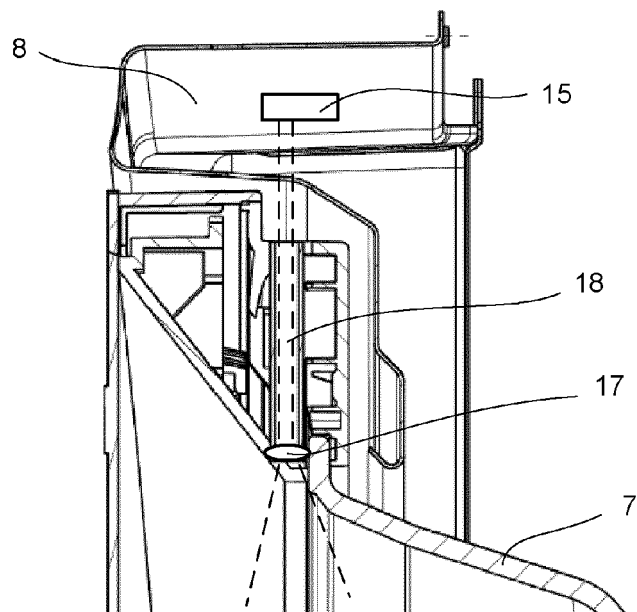


FIG. 4

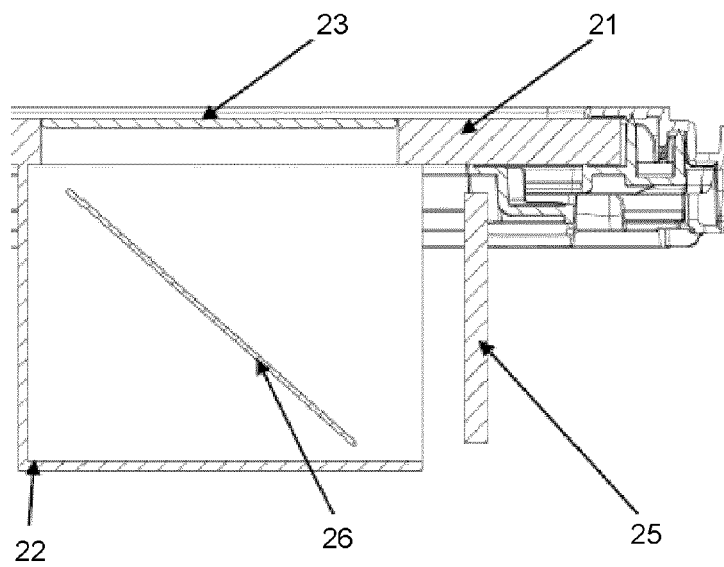


FIG. 5

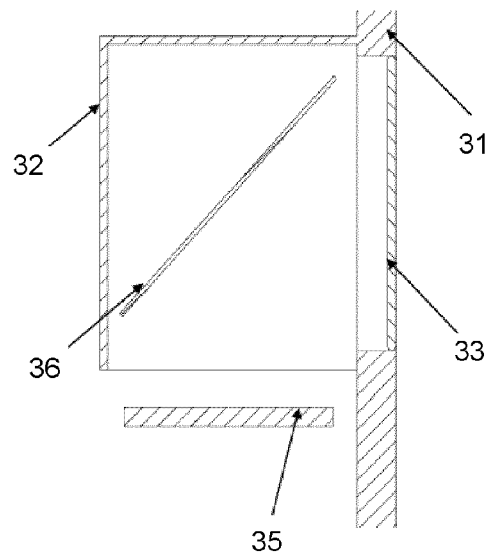


FIG. 6

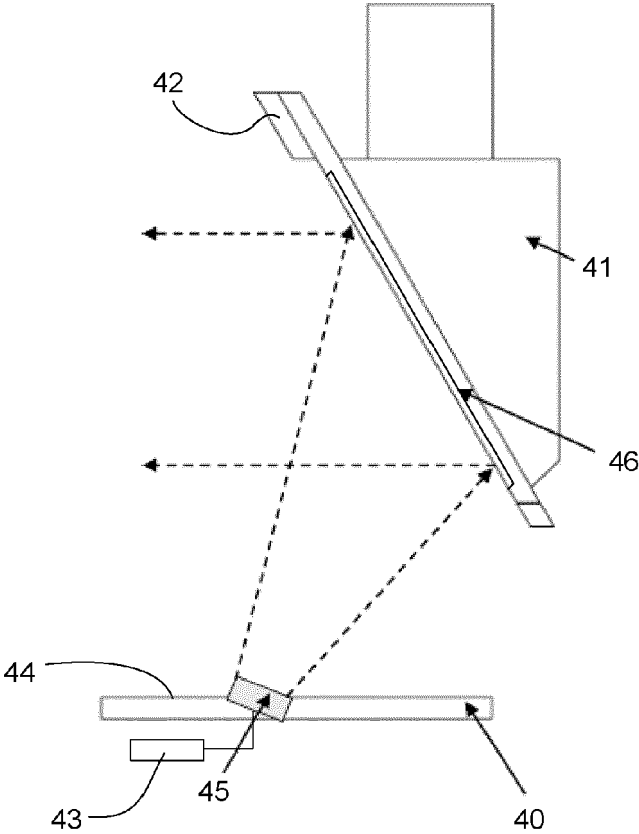


FIG. 7



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 Application Number
 EP 16 17 6924

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**ANNEX TO THE EUROPEAN SEARCH REPORT
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