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An apparatus for protecting an optical device

Technical field

The present invention relates to an apparatus for protecting an optical device. In particular, the present invention relates to an apparatus for protecting an optical device comprising an optical window for the passage of light through the optical window, wherein the optical devices include but are not limited to lasers, cameras, light level monitors, etc.

Background

It is known that production lines include various sensors and cameras that are monitored by multiple automated systems to continually check all the processes are running smoothly. For example, cameras may be used to check the size or presence of manufactured objects on a conveyor belt (e.g. as shown in the Figure 1) or to confirm that packaging has been correctly applied to an item.

Many industrial processes generate steam, dust or fumes in quite large quantities. Despite the use of fume extraction systems a, there can be a significant build-up of contaminants on items located around the production lines in factories. This can be of a particular problem for optical devices installed to monitor many automated processes in production lines. The build up of contaminants on optical windows of optical devices, such as camera lenses

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reach the point where the collected images can no longer be used as required to automatically identify or measure objects. For some critical cameras, this can even cause an entire production line to shut down unless an engineer is able to establish which camera is dirty and manually clean it. This loss of production time can become increasingly costly.

Some solutions known in the art include cameras fitted with a small visor 4 on top as shown in Figure 1, to prevent the accumulation of dirt to try to shield the camera by placing more and/or larger visors around it. Another solution known in the art includes a tube that the camera could be placed inside to shield the camera (i.e. with the camera lens directed out of the open end of the tube).

Another known solution, shown in Figure 2 includes installing air nozzles near one side of a camera to blast a continual flow of compressed air over the camera lens, with the idea being that the airflow will simply blow any unwanted material off the camera lens.

A further known solution is shown in Figure 3which shows an apparatus, comprising a camera placed inside a sealed box with a clear window that is wiped by the wiper. Nozzles near the box are used to squirt a cleaning liquid onto the outside of the window. However, such method is not suitable for use in factories where consumer goods may be stored or packaged because the dispensing cleaning liquid may fall into said consumer goods. Moreover, the wiper could scratch the window overtime.

Summary of invention

According to a first aspect of the present invention, there is an apparatus for protecting an optical device comprising an optical window, wherein the apparatus comprises: a space configured to secure the optical device and a housing for the optical device. The housing comprises: an inlet for receiving air and an air outlet for expelling said air. The air outlet is configured to be optically aligned with the optical window of the optical device, and wherein the apparatus further comprises an airgap between the space configured to secure the optical device and the housing, wherein said air gap extends from the air inlet to the air outlet such that the air gap is configured to carry a flow of air from the air inlet to the air outlet for keeping the optically window clean.

Advantageously, when air flows through the air gap via the air inlet, it travels along the air gap the air outlet from which it is then expelled. Since the air outlet is aligned with the optical window of the optical device, the expulsion of air through the air outlet stops dust, debris or other contaminants from entering the air outlet and depositing on the optical window of the optical device. The inventors have found that this keeps the optical window clear over prolonged periods of time.

As defined herein, the term optically aligned refers to an alignment that does no obstruct the flow of light.

As used herein, the term optical device relates to devices that are configured to release or take in (sense) light beams.

Optionally [claim 2], the air inlet is positioned at a first end of the housing, and wherein the air outlet is positioned at a second end of the housing.

Optionally [claim 3] the air inlet comprises a connection means that is configured to be connectable to a compressed air supply for receiving the air. Advantageously, this provides an easy way of providing a supply of air though the air gap for keeping the optical window of the optical device clean since compressed air is readily available at most factories.

Optionally [claim 4], the connection means is a pressure regulator configured to control an air flow rate through the air gap. Advantageously this allows the required air flow rate to be co figured according to the users needs.

Optionally [claim 5], the apparatus further comprising an air pump connected to the air inlet, wherein the air pump is configured to provide a flow of air through the air gap. Advantageously, this provides an easy way of providing a supply of clean air though the air gap for keeping the optical window of the optical device clean.

Optionally [claim 6], the air inlet further comprises an air filter releasably connected to the air inlet, wherein the air filter is configured to prevent any contaminants from flowing into the air gap. Advantageoulsy, this ensures that any contaminants are removed before flowing through the air inlets and into the air gaps.

Optionally [claim 7], wherein the width of the air gap near the air outlet is narrower as compared to the width of the air gap near the air inlet.

Advantageoulsy, this creates acceleration zone in the air gap which increase the speed of airflow over the optical window in use. The acceleration zone is a passive way of increasing the air flow rate through the air gap of the apparatus.

Even more advantageously, the acceleration zone provides an increased air flow over the optical window (in use) without having to configure an increased air flow rate from the air supply. This advantageously reduces the power consumption leading lower cost of operation of the apparatus as the acceleration zone is a passive way of increasing the air flow rate through the apparatus.

Optionally [claim 8], the width of the air gap near the air outlet is narrower by a factor of two, as compared to the width of the air gap near the air inlet. Advantageously, this provides a substantial increase in air flow rate near the air outlet, and thus near the optical window (which is aligned with the air outlet) of the optical device.

Optionally [claim9], the apparatus further comprising one or more air guides positioned within the air gap near the air outlet, wherein the one or more air guides are configured to guide the flow of air between the air inlet and the air outlet, whilst also restricting the restricting the air gap to cause air acceleration. Advantageously, the air guides minimise the result of tubule air flow near the air outlet

Optionally [claim 10], wherein the one or more air guides are curved air guides.

Optionally [claim 11], wherein the air inlet further comprises one or more air inlets. Advantageously, this results in a larger volume of air flow through the air gap which further reduces the risk of any contaminants or debris being deposited on the optical window of the optical device.

Optionally [claim 12], the apparatus further comprises a shutter positioned within the air gap, wherein the shutter is configured to slide between a first

position wherein the shutter blocks the flow of air within the air gap between the air inlet and the air outlet, and a second position, wherein the shutter permits the flow of air within the air gap between the air inlet and the air outlet. Advantageously, the shutter provides a control which allows the control of airflow through the air gap.

Optionally [claim 13], the shutter further comprises a first shutter and a second shutter, wherein the first shutter is configured to slide between a first position wherein the first shutter blocks the flow of air within the air gap between a first air inlet and the air outlet, and a second position, wherein the first shutter permits the flow of air within the air gap between the first air inlet and the air outlet, and wherein the second shutter is configured to slide between a first position wherein the second shutter blocks the flow of air within the air gap between a second air inlet and the air outlet, and a second position, wherein the second shutter permits the flow of air within the air gap between the second air inlet and the air outlet. Advantageous, this allows the direction of air flow through the air gap to be controlled such that air flow can be configured to flow through the air gap in a first direction over the optical window and out of the air outlet and/or air flow can be configured to flow through the air gap in a second direction over the optical window and out of the air outlet

Optionally [claim 14], the apparatus further comprising an inner housing, wherein the inner housing comprises an optically transparent window, wherein the inner housing is configured to receive the optical device such that the

optically transparent window of the inner housing is aligned with the optical window of the optical device.

Optionally [claim 15], wherein the inner housing comprises a non-stick coating on the optically transparent window. Advantageously, this reduces the adhesion of contaminants on the outer surface of the optically transparent window.

Optionally [claim 16], the apparatus is configured to secure the optical device by virtue of the inner housing being secured to the space within the apparatus.

Optionally [claim17], the inner housing is releasably secured to the space within the apparatus.

Optionally [claim18], the inner housing is permanently secured to the space within the apparatus.

Optionally [claim19], the air outlet is tubular opening.

Optionally [claim 20], the housing further comprises an opening configured to receive the optical device.

Optionally [claim 21], wherein the apparatus further comprises a door hingedly connected to the housing, wherein the door is configured to move between a first position, where the optical device can be inserted into the apparatus via the opening and secured to the space within the apparatus, and a closed position wherein the optical device cant be removed from the apparatus via the opening. Advantageously, this allows a user to insert and remove an optical device with ease. Even more advantageously, the closing of the door creates a seal in the housing which prevents the leakage of air out the air gap.

Optionally [claim 21], the housing and the inner housing, comprises a common wall comprising an opening configured to receive the optical device.

Optionally [claim 22], the housing further comprises a door hingedly connected to the housing, wherein the door is configured to move between a first position, where the optical device can be inserted into the apparatus and secured to the space within the apparatus, and a closed position wherein the optical device cant be removed from the apparatus. Advantageously, this allows a user to insert and remove an optical device with ease.

According to a second aspect of the present invention, there is provided a kit comprising an apparatus according to any preceding claim and an optical device.

The inner and outer housing may be in the shape of cuboid. The optical devices may be one or more of laser devices that emit a light beam, light level monitors, or cameras.

The invention is now described by way of example only with reference to the following figures:

Figure 1 shows a perspective view of a prior art solution;

Figure 2 shows a perspective view of a second prior art solution;

Figure 3 shows a perspective view of a third prior art solution;

Figure 4 shows a top view of a first embodiment according to the present invention;

Figure 5 shows a top view of a second embodiment according to the present invention;

Figure 6 shows a top view of the second embodiment according to the present invention.

Detailed description

As shown in Figure 4 of the present invention, there is provided an apparatus for protecting an optical device 40 comprising an optical window 48, wherein the apparatus comprises: a space configured to secure the optical device 40; a housing 43 for the optical device; wherein the housing comprises: an inlet 45, 44 for receiving air and an air outlet for expelling said air, wherein the air outlet is configured to be aligned with the optical window 48 of the optical device, and wherein the apparatus further comprises an airgap 47 between the space configured to secure the optical device and the housing, wherein said air gap extends from the air inlet to the air outlet such that the air gap is configured to carry a flow of air 46 from the air inlet to the air outlet for keeping the optically transparent window clean.

As also show in Figure 4, the apparatus comprises an inner housing 41, wherein the inner housing comprises an optically transparent window 42, wherein the inner housing is configured to receive the optical device such that the optically transparent window of the inner housing is aligned with the optical window of the optical device.

As shown in Figure 4, the width (g2) of the air gap 47 near the air outlet is narrower as compared to the width (g1) of the air gap near the air inlet 44,45. Advantageoulsy, this creates acceleration zone in the air gap which increase the speed of airflow over the optical window in use. The acceleration zone is a passive way of increasing the air flow rate through the air gap of the apparatus.

The apparatus further comprises a door 49 hingedly connected to the housing, wherein the door is configured to move between a first position, where the optical device 40 can be inserted into the apparatus via the opening and secured to the space within the apparatus, and a closed position wherein the optical device 40 cant be removed from the apparatus via the opening. Advantageously, this allows a user to insert and remove an optical device with ease.

Figure 5 shows a top view of the second embodiment of the present invention. The apparatus comprising two curved air guides 160, 161 positioned within the air gap 147 near the air outlet, wherein the one or more air guides are configured to guide the flow of air between the air inlet 145, 144 and the air outlet, whilst also restricting the restricting the air gap to cause air acceleration.

Figure 5 also shows the apparatus, wherein the air inlets 144, 145 comprises an air filter 101,100 releasably connected to the air inlet 144,145, wherein the air filter is configured to prevent any contaminants from flowing into the air gap.

As also shown in Figure 5, the housing 143 and the inner housing 141, comprises a common wall 181 comprising an opening (not shown) configured to receive the optical device through the opening.

The apparatus comprises shutters 170, 171 positioned within the air gap 147, wherein the shutters 170, 171

As shown in Figure 6, the shutters 170,171 is configured to slide between a first position (as shown by shutter 170) wherein the shutter 170 blocks the flow of air within the air gap between the air inlet and the air outlet, and a second

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position (as shown by shutter 171), wherein the shutter permits the flow of air 200 within the air gap 147 between the air inlet and the air outlet.

Advantageously, the shutter provides a control which allows the control of airflow through the air gap.

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Abstract

An apparatus for protecting an optical device

The present invention relates to an apparatus for protecting an optical device. In particular, the present invention relates to an apparatus for protecting an optical device comprising an optical window for the passage of light through the optical window, wherein the optical devices include but are not limited to lasers, cameras, light level monitors, etc. The present invention relates to an apparatus for protecting an optical device 40 comprising an optical window 48, wherein the apparatus comprises: a space configured to secure the optical device and a housing 43 for the optical device. The housing comprises: an inlet 45,44 for receiving air 46 and an air outlet for expelling said air 46. The air outlet is configured to be optically aligned with the optical window 48 of the optical device, and wherein the apparatus further comprises an airgap 47 between the space configured to secure the optical device 40 and the housing 43, wherein said air gap 47 extends from the air inlet to the air outlet such that the air gap is configured to carry a flow of air from the air inlet to the air outlet for keeping the optically window 48 clean.

Figure 1

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Claims

1. An apparatus for protecting an optical device comprising an optical window, wherein the apparatus comprises:

    a space configured to secure the optical device;

    a housing for the optical device;

    wherein the housing comprises:

    an inlet for receiving air and an air outlet for expelling said air, wherein the air outlet is configured to be optically aligned with the optical window of the optical device, and

    wherein the apparatus further comprises an airgap between the space configured to secure the optical device and the housing,

    wherein said air gap extends from the air inlet to the air outlet such that the air gap is configured to carry a flow of air from the air inlet to the air outlet for keeping the optically window clean.

2. An apparatus according to claim 1, wherein the air inlet is positioned at a first end of the housing, and wherein the air outlet is positioned at a second end of the housing.

3. An apparatus according to any preceding claim, wherein the air inlet comprises a connection means that is configured to be connectable to a compressed air supply for receiving the air.

4. An apparatus according to claim 3, wherein the connection means is a pressure regulator configured to control an air flow rate through the air gap.
5. An apparatus according to any of claims 1-2, further comprising an air pump connected to the air inlet, wherein the air pump is configured to provide a flow of air through the air gap.
6. An apparatus according to any preceding claim, wherein the air inlet further comprises an air filter releasably connected to the air inlet, wherein the air filter is configured to prevent any contaminants from flowing into the air gap.
7. An apparatus according to any preceding claim, wherein the width of the air gap near the air outlet is narrower as compared to the width of the air gap near the air inlet.
8. An apparatus according to claim 7, wherein the width of the air gap near the air outlet is narrower by a factor of two, as compared to the width of the air gap near the air inlet.
9. An apparatus according to any preceding claim, further comprising one or more air guides positioned within the air gap near the air outlet,

   wherein the one or more air guides are configured to guide the flow of air between the air inlet and the air outlet, whilst also restricting the restricting the air gap to cause air acceleration.
10. An apparatus according to claim 9, wherein the one or more air guides are curved air guides.

11. An apparatus according to any preceding claim, wherein the air inlet further comprises one or more air inlets.

12. An apparatus according to any preceding claim, wherein the apparatus further comprises a shutter positioned within the air gap,

wherein the shutter is configured to slide between a first position wherein the shutter blocks the flow of air within the air gap between the air inlet and the air outlet, and a second position, wherein the shutter permits the flow of air within the air gap between the air inlet and the air outlet.

13. An apparatus according to claim 12 when dependent on claim 11, wherein the shutter further comprises a first shutter and a second shutter, wherein the first shutter is configured to slide between a first position wherein the first shutter blocks the flow of air within the air gap between a first air inlet and the air outlet, and a second position, wherein the first shutter permits the flow of air within the air gap between the first air inlet and the air outlet,

and wherein the second shutter is configured to slide between a first position wherein the second shutter blocks the flow of air within the air gap between a second air inlet and the air outlet, and a second position, wherein the second shutter permits the flow of air within the air gap between the second air inlet and the air outlet.

14. An apparatus according to any preceding claim, further comprising an inner housing, wherein the inner housing comprises an optically transparent window, wherein the inner housing is configured to receive the optical device such that the optically transparent window of the inner housing is aligned with the optical window of the optical device.

15. An apparatus according to claim 14, wherein the inner housing comprises a non-stick coating on the optically transparent window.
16. An apparatus according to claims 14-15, wherein the apparatus is configured to secure the optical device by virtue of the inner housing being secured to the space within the apparatus.
17. An apparatus according to claim 16, wherein the inner housing is releasably secured to the space within the apparatus.
18. An apparatus according to claim 16, wherein the inner housing is permanently secured to the space within the apparatus.
19. An apparatus according to any of claims 2-18, wherein the air outlet is tubular opening.
20. An apparatus according to any of claims 1-13, wherein the housing further comprises an opening configured to receive the optical device through the opening.
21. An apparatus according to claim 20, wherein the apparatus further comprises a door hingedly connected to the housing, wherein the door is configured to move between a first position, where the optical device can be inserted into the apparatus via the opening and secured to the space within the apparatus, and a closed position wherein the optical device cant be removed from the apparatus via the opening.
22. An apparatus according to any of claim 18, wherein the housing and the inner housing, comprises a common wall comprising an opening configured to receive the optical device.

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23. An apparatus according to claim 22, wherein housing further comprises a door hingedly connected to the housing, wherein the door is configured to move between a first position, where the optical device can be inserted into the apparatus and secured to the space within the apparatus, and a closed position wherein the optical device cant be removed from the apparatus.
24. A kit comprising an apparatus according to any preceding claim and an optical device.

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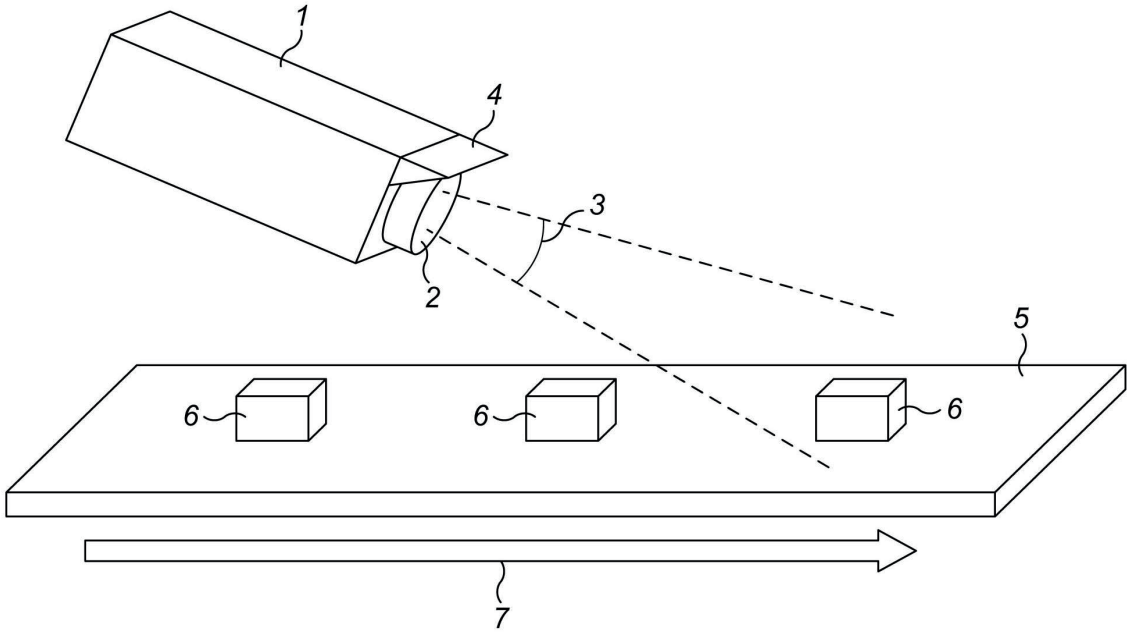

FIG. 1
(Prior Art)

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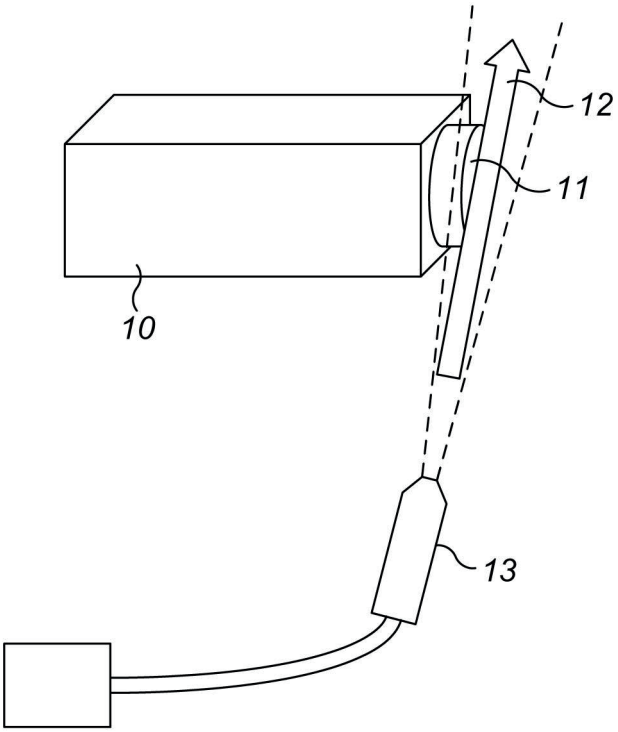

FIG. 2
(Prior Art)

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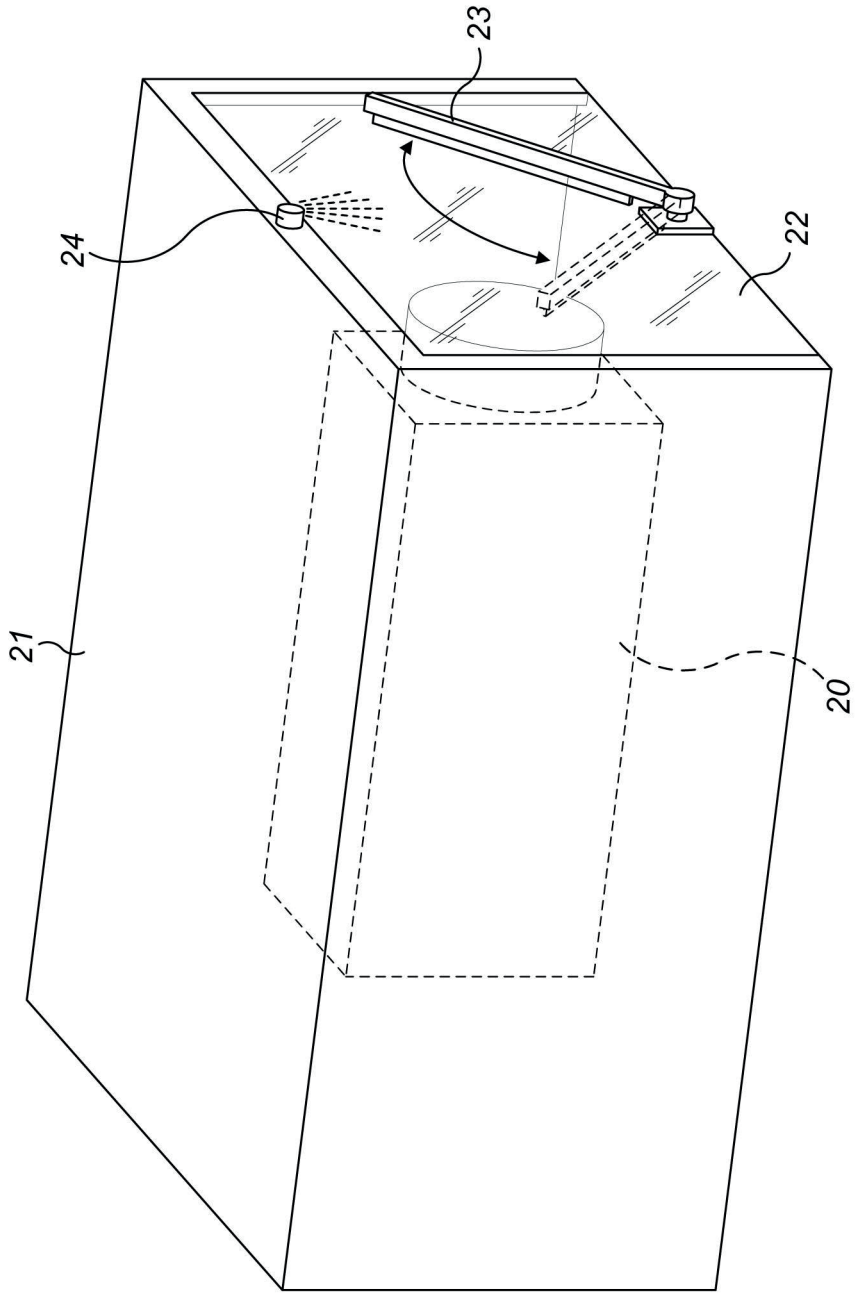

FIG. 3
(Prior Art)

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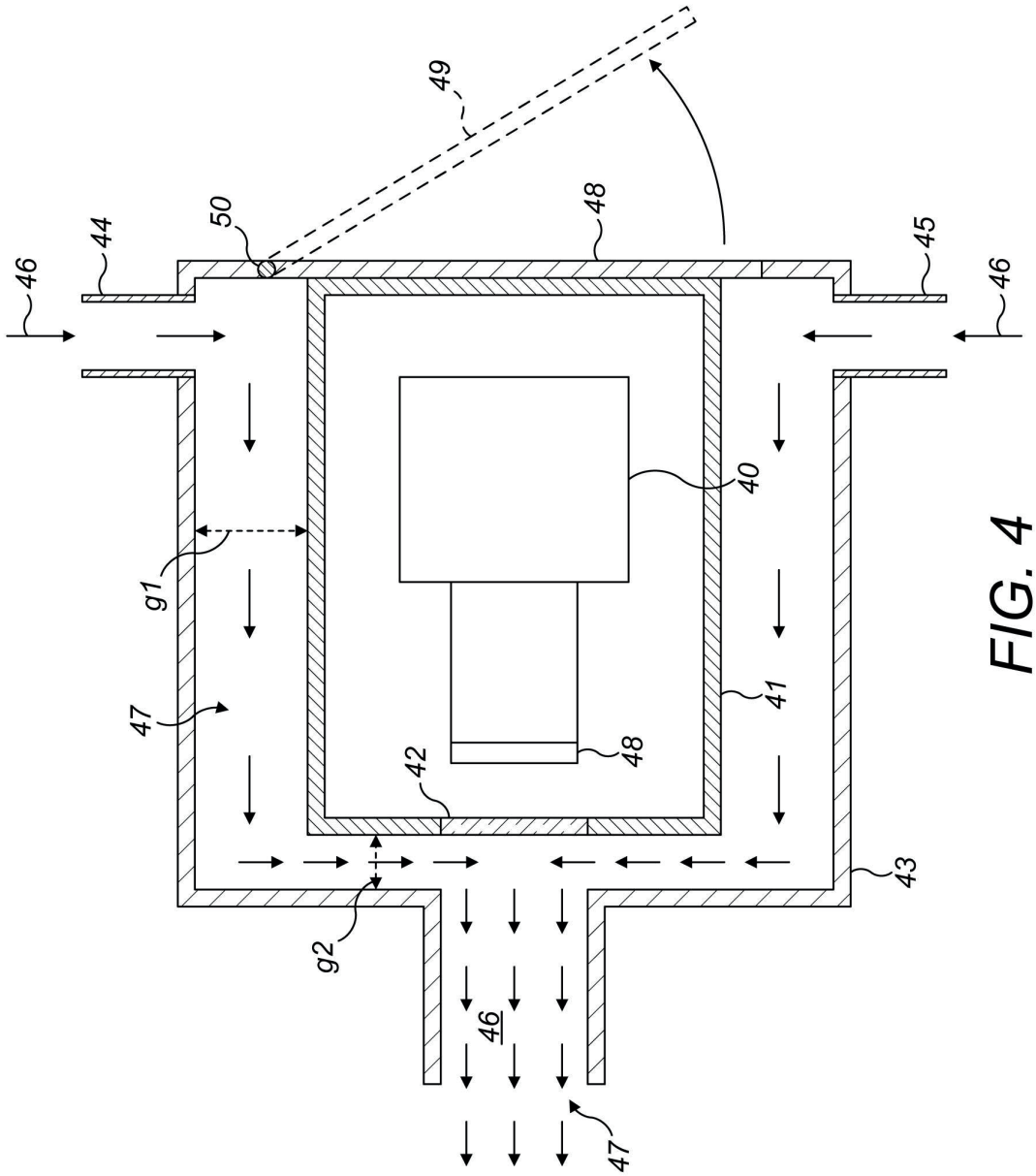

FIG. 4

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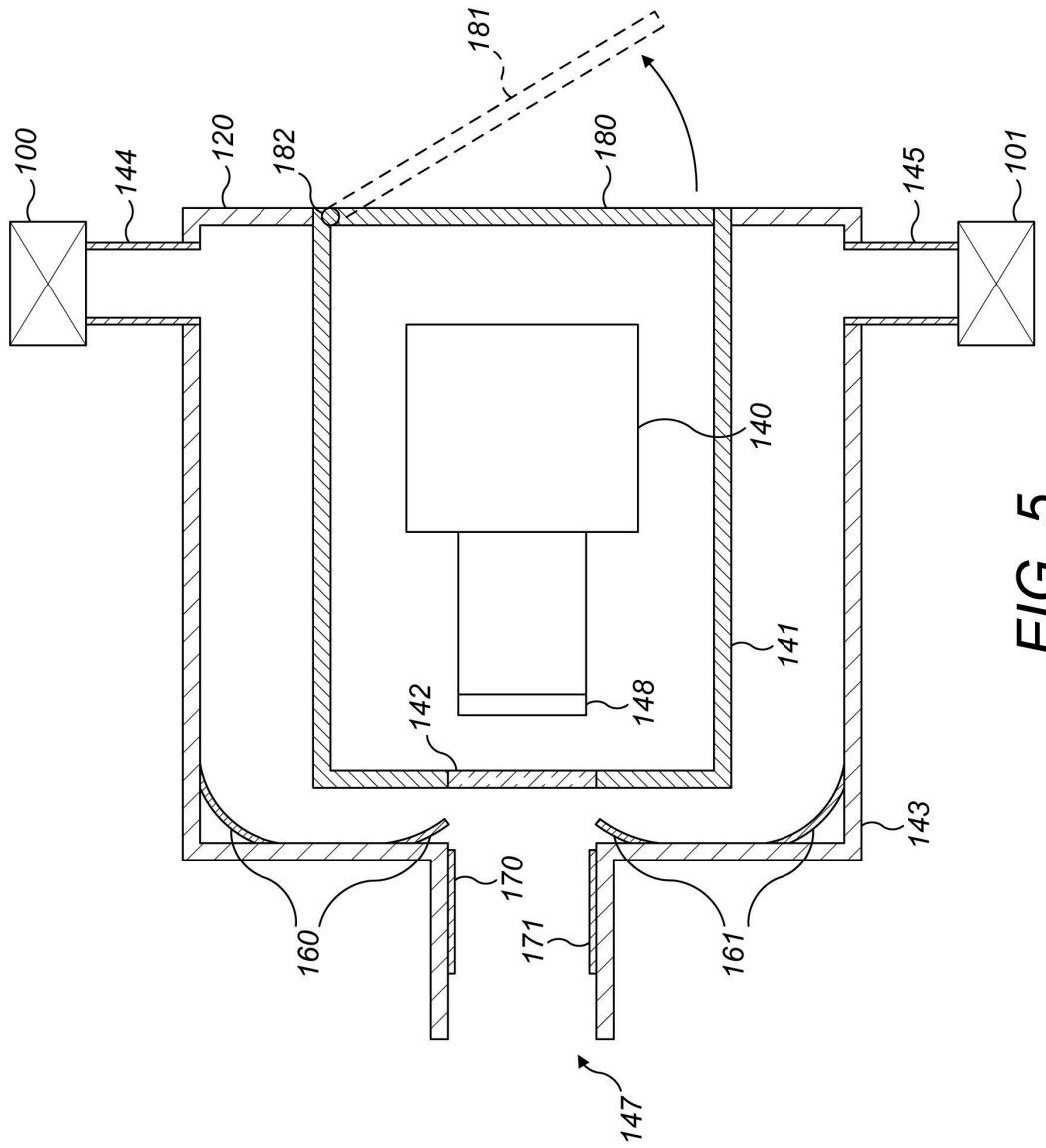

FIG. 5

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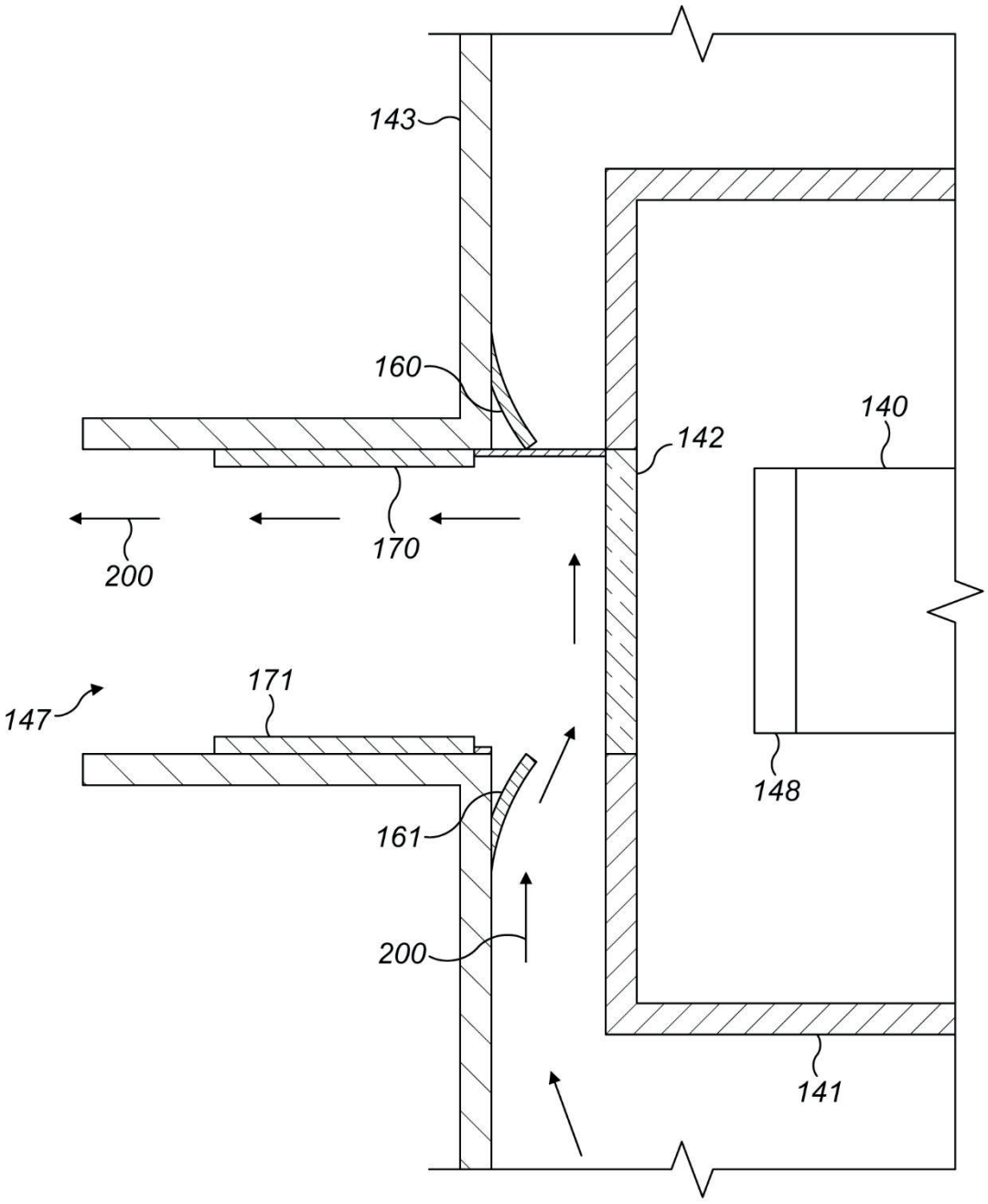

FIG. 6