Final Diploma

Patent
Examination
Board

FD2 Drafting of Specifications

Thursday 30 October 2025

10:00 to 14:25 GMT

Examination time: 4 hours 25 minutes plus 10 minutes upload time

The 4 hours 25 minutes is allocated as follows:
10 minutes – Downloading and printing the question paper;
4 hours – Answering the questions;
15 minutes – Three screen breaks of 5 minutes each.

At 14.25 you MUST immediately stop answering the questions. You then have **10 minutes** in which to upload your Answer document to the PEBX system.

You MUST upload your Answer document to the PEBX system by 14.35. After 14.35 you will not be able to upload it and your examination will be void.

INSTRUCTIONS TO CANDIDATES

1. The whole assessment task is to be attempted.
2. The marks to be awarded are given at the end of the assessment task.
3. The total number of marks available for this paper is 100.
4. You must use the Answer document for your answers.
5. Do not attempt to change the font style, font size, font colour, line spacing or any other pre-set formatting.
6. Start each part of your answer on a new page. Press the control key and the enter key simultaneously to begin a new page.
7. Do not state your name anywhere in the answers.
8. This question paper consists of **18 sheets**, including this sheet, and comprises:
   Assessment task (1 sheet)
   Client letter (4 sheets)
   Doc A – Client drawings (6 sheets)
   Doc B – Client drawings- annotated version (6 sheets) which are included in the answer sheet to use in your answer if you wish.

AT THE END OF THE EXAMINATION

9. Save your Answer document and any hand-annotated drawings to your hard drive. Then follow the instructions for uploading your document onto the PEBX system.

Assessment task

Your client sends you the correspondence listed on the Instructions to Candidates sheet regarding a new idea.

Your task is to prepare a complete patent specification that is ready for filing at the UK Intellectual Property Office. The specification should be drafted with a view to obtaining a UK patent.

Note the following:

a) You should assume that the client's description of the prior art in the field is complete.
b) You should not make use of any other prior art or special knowledge that you may have of the subject matter concerned.
c) You should also assume that the client's description of the device and its operation is accurate, i.e. that the device works as described.

Allocation of marks

Introduction and Description: 45 marks
Claims: 50 marks
Abstract: 5 marks
Total: 100 marks

Client Letter

As you know, I own a number of large factories for making, processing and packing various food and consumer items. We have automated as many of our production processes as possible to keep down our labour costs, which means we now have some very complicated robotic production lines. These 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 attached drawing I've labelled **Figure 1**) or to confirm that packaging has been correctly applied to an item.

Many of the industrial processes we perform generate steam, dust or fumes, etc. in quite large quantities. Although we have fume extraction systems and manual cleaning takes place throughout the day, there can still be a significant build-up of contaminants on items located around the factory. We've found this is particularly a problem for the video cameras installed to monitor many of our automated processes. Unfortunately, it's a daily event for the build-up of contamination on the lens of such a camera to 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 be automatically shut down until an engineer is able to establish which camera is dirty and manually clean it. This loss of production time is proving costly.

After we installed our automated production systems, we did speak to our camera supplier about this issue, and they outlined to us some potential solutions that were already known and on the market. The cameras already came fitted with a small visor on top, but one of the known solutions to prevent the accumulation of dirt was to try to shield the camera by placing more and/or larger visors around it. They also mentioned one of their competitors sold 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). However, we found that all these known shields didn't catch all of the dirt and in certain cases (especially when using a simple tube) actually provided pockets of space where more dirt could accumulate over time. These extra shielding components also made it much more difficult to access the camera lenses to manually clean them.

The camera supplier explained to me that it had also been publicly disclosed to install 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. Although we did try this approach, we found contaminants would often be picked up in the airflow and deposited on the camera lens. In particular, we found that droplets of oily material would be carried by the air towards the camera lens at high speed and would then firmly stick to the lens, causing an oily build-up that was often worse than the contamination encountered without any airflow. I attach a drawing (**Figure 2**) of such an arrangement that I found in a published article.

Cont…

As these known solutions didn't really seem to help us much, I've devised a new apparatus that fully protects the cameras in my factories from getting contaminated. I'm going to talk about my ideas at a public meeting of a local business group tomorrow, so please could you file a UK patent application for me before that meeting. Please limit the number of claims you include in such an application to avoid the need to pay any additional claims fees.

As you can see from **Figure 4** of my drawings, the idea is to put the camera inside an inner box. This inner box houses the camera and has a clear glass window at the front, near the camera lens, to allow the camera to image objects through the glass window. This inner box is then placed inside a slightly bigger, outer box. Please note that, in use, the inner box is firmly secured to the outer box but I haven't shown the various fixings etc. that secure the boxes together in my drawings for clarity. This outer box has inlets at the top and bottom for receiving compressed air, or indeed any gas, and a large tubular opening or outlet at the front for expelling that gas. The opening is also positioned so that it is aligned with the clear window of the inner box, to allow the camera to 'see' out of the apparatus and thereby collect images of externally located objects. Light thus reaches the camera by passing along the tubular opening in the outer box and through the optically transparent glass window of the inner box.

Now, to keep the window clean, you can see that I've provided a gap between the inner and outer boxes. When you pump air into this air gap via the inlets, it travels along the gap to the opening at the front of the outer box, from which it is then expelled (as shown by the arrows). For compactness, you obviously want the outer box to be as small as possible, but the gap between the inner and outer boxes does need to be wide enough to carry the required volume of air to the opening. I should mention that connecting the inlets to one of the compressed air supplies that already exist in our factories seems to be the easiest option to provide the necessary supply of clean air, and we made this connection to the compressed air supply via a pressure regulator so we could set and maintain the required flow rate of air. It would, however, be equally possible to use some kind of dedicated air pump to provide the air supply, provided it produces air that is clean enough (e.g. by including an appropriate filter to remove any contaminants). Alternatively, a pressurised bottle of air or any other suitable gas could be used.

As you can see from the arrows in my **Figure 4**, the air is expelled from the opening in the outer box. This expulsion of air stops most dust, debris or other contaminants from entering the opening in the first place, which means it doesn't get deposited onto the glass window of the inner box. This has been found to keep the glass window clear over prolonged periods of time. Also, if anything does ever need cleaning, you can simply remove the inner box from the outer box to clean the glass window. I've also applied a transparent, non-stick coating to the outer surface of the glass window that reduces the adhesion of contaminants, which makes it easier to clean if necessary.

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Client Letter

I should also mention that I experimented with many different flow rates of air, and although using a higher airflow rate gives better protection against the ingress of contaminants, it also consumes more compressed air, which in turn requires more electricity to run the air compressor. This led me to include an air acceleration zone as a part of the air path formed inside the apparatus to increase the speed of airflow over the glass window. In particular, as you can see from the drawings, there is a narrow gap (g2) between the inner and outer boxes at the front of the apparatus and a wider gap (g1) provided in the top and bottom regions fed by the inlets. This change in the cross-sectional area of the air gap (by a factor of about two) results in the air speed increasing after the air turns the corner and moves along the narrower gap towards the glass window.

The example shown in **Figure 4** worked pretty well, but I did find that it resulted in some turbulent (uneven) airflow over the window. For that reason, I also included the curved air guides in my second prototype, as shown in **Figure 5**. These curved air guides help guide the flow of air around the corners whilst also restricting the air gap to cause air acceleration. I also found it was useful to be able to start and stop the airflow (e.g. to save air when not needed), so I've added upper and lower shutters that can slide back and forth to block the airflow from the upper and lower inlets respectively. These shutters can both be closed, blocking all airflow, or one or the other of the shutters can be closed so that air flows over the window from only the top or bottom direction. My **Figure 6** shows part of the second prototype with the upper shutter closed, so that airflow from above is prevented. It would also be possible to only include one air inlet and a single shutter.

I've also thought of some other ways my idea could be implemented. In the example shown in **Figure 4**, the inner box is completely enclosed by the outer box. In particular, the back of the outer box is attached by hinges to the rest of the outer box. This allows the outer box to be opened to insert or remove the inner box containing the camera whenever required. However, the inner and outer boxes could instead share a common back wall having a portion that can be opened and closed so you can directly insert the camera into the inner box, as shown in **Figure 5**. Also, although I've used approximately cuboid-shaped boxes, it would of course be possible to use inner and outer housings of any size and shape. I've described using this apparatus to protect one particular type of camera, but it could also be used with other cameras and even different types of optical devices, such as laser devices that emit a light beam, light level monitors, etc. As you can appreciate, you would probably want to match the size of the protection apparatus to the size of the device that is being protected. My **Figure 5** also shows the air filters that I added to ensure any contaminants in the compressed air supply are removed before the compressed air is injected into the apparatus.

Turning to the commercial situation, I've already made a number of these devices for my factories and plan to install them very shortly. I'm also hoping that I will be able to license my idea or even sell this apparatus to other industrial factory owners that are probably facing the same problem as me.

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I was also thinking about whether my existing camera supplier might be interested in being able to offer this solution for sale alongside their cameras. I guess they could even modify the shape of some of their camera units to act as an inner box, with the camera lens effectively forming the glass window, or I could sell an outer box that is shaped to provide the necessary air gap when one of their existing cameras is located inside it. The camera could then be placed directly inside the outer box with the air gap formed between the camera and the outer box providing the channel that extends from the air inlets to the opening to carry the flow of air for keeping the camera lens clean.

Finally, before I forget, I should also mention that I saw a different solution to a similar problem at a public trade show the other week that uses a mechanical wiper (like the windscreen wiper on a car) to clear debris. In that apparatus, the camera was placed inside a sealed box with a clear window that is wiped by the wiper. Nozzles near the box were used to squirt a cleaning liquid onto the outside of the window. This had been used for outdoor security and surveillance cameras quite successfully, but we didn't think dispensing a cleaning liquid was really appropriate inside a factory setting where food etc. may be present. Also, the wiper could scratch the window over time. However, I thought it was probably best to mention this to you. I have also included a **Figure 3** that shows this known arrangement.

Document A (Annotated Drawings)

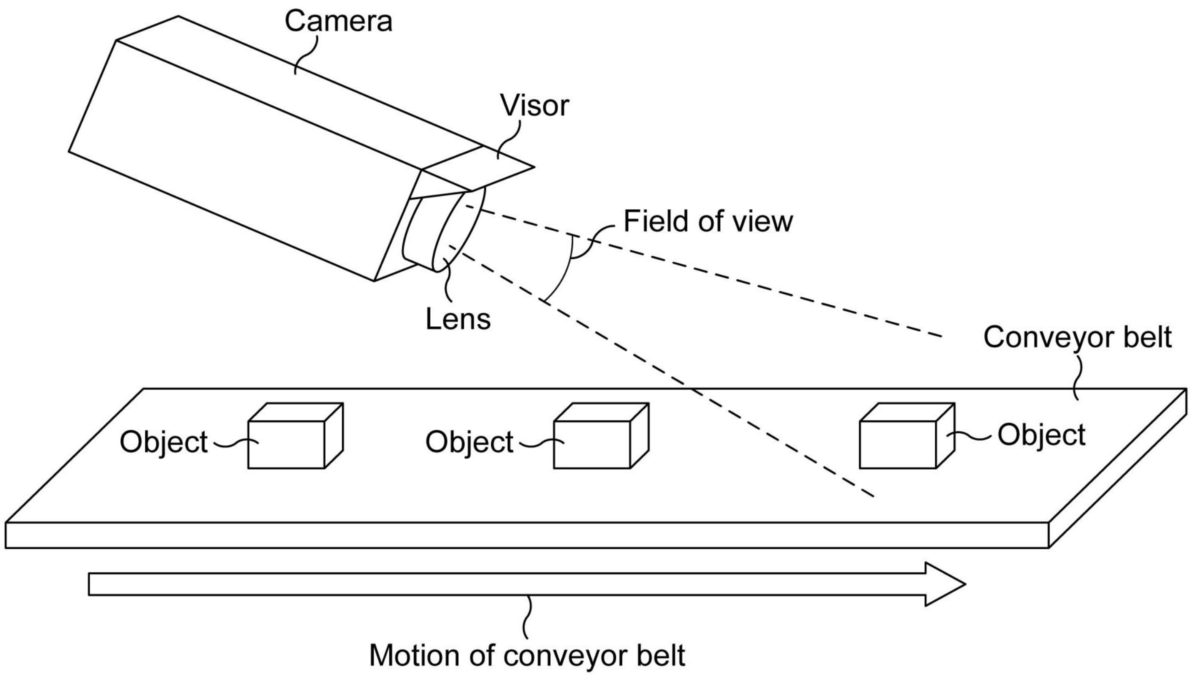

FIG. 1
(Prior Art)

Document A (Annotated drawings)

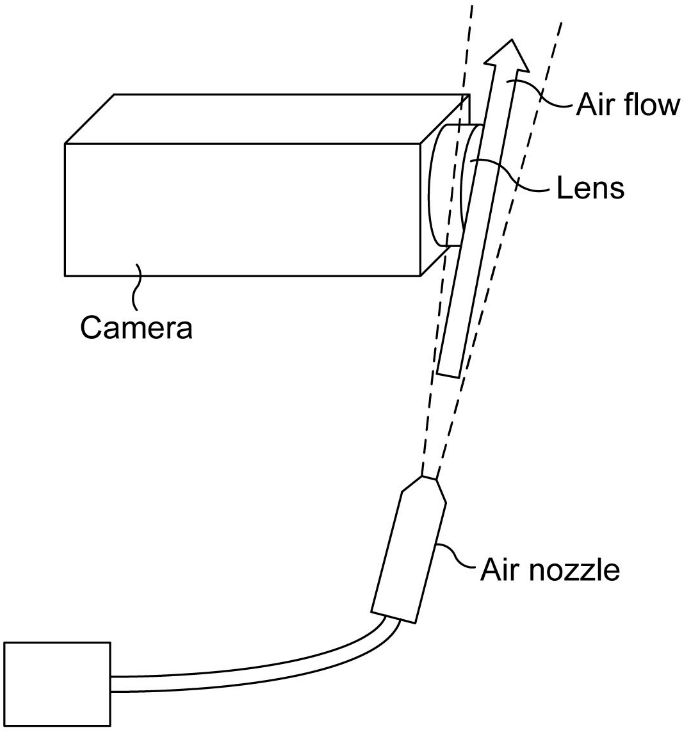

FIG. 2
(Prior Art)

Document A (Annotated drawings)

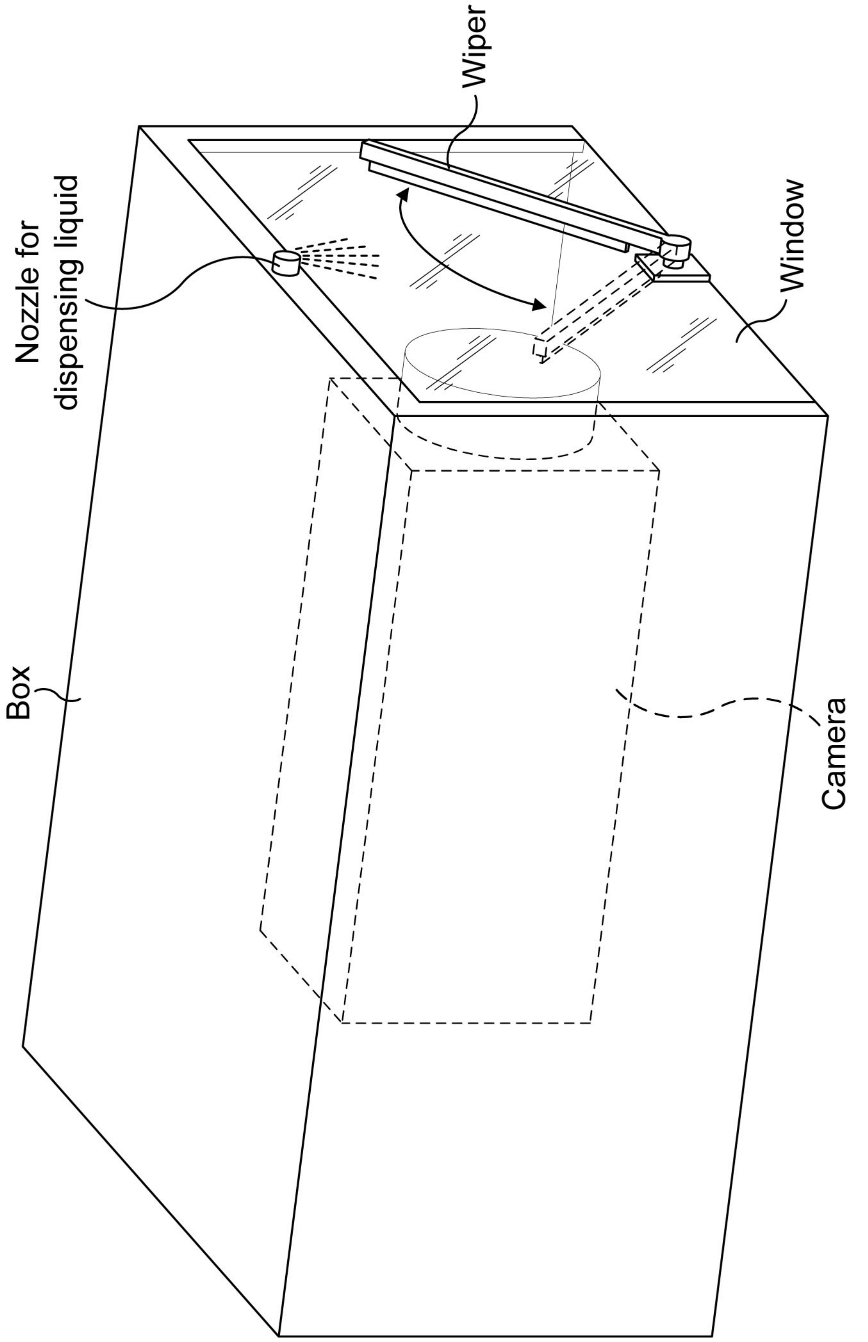

FIG. 3
(Prior Art)

Document A (Annotated drawings)

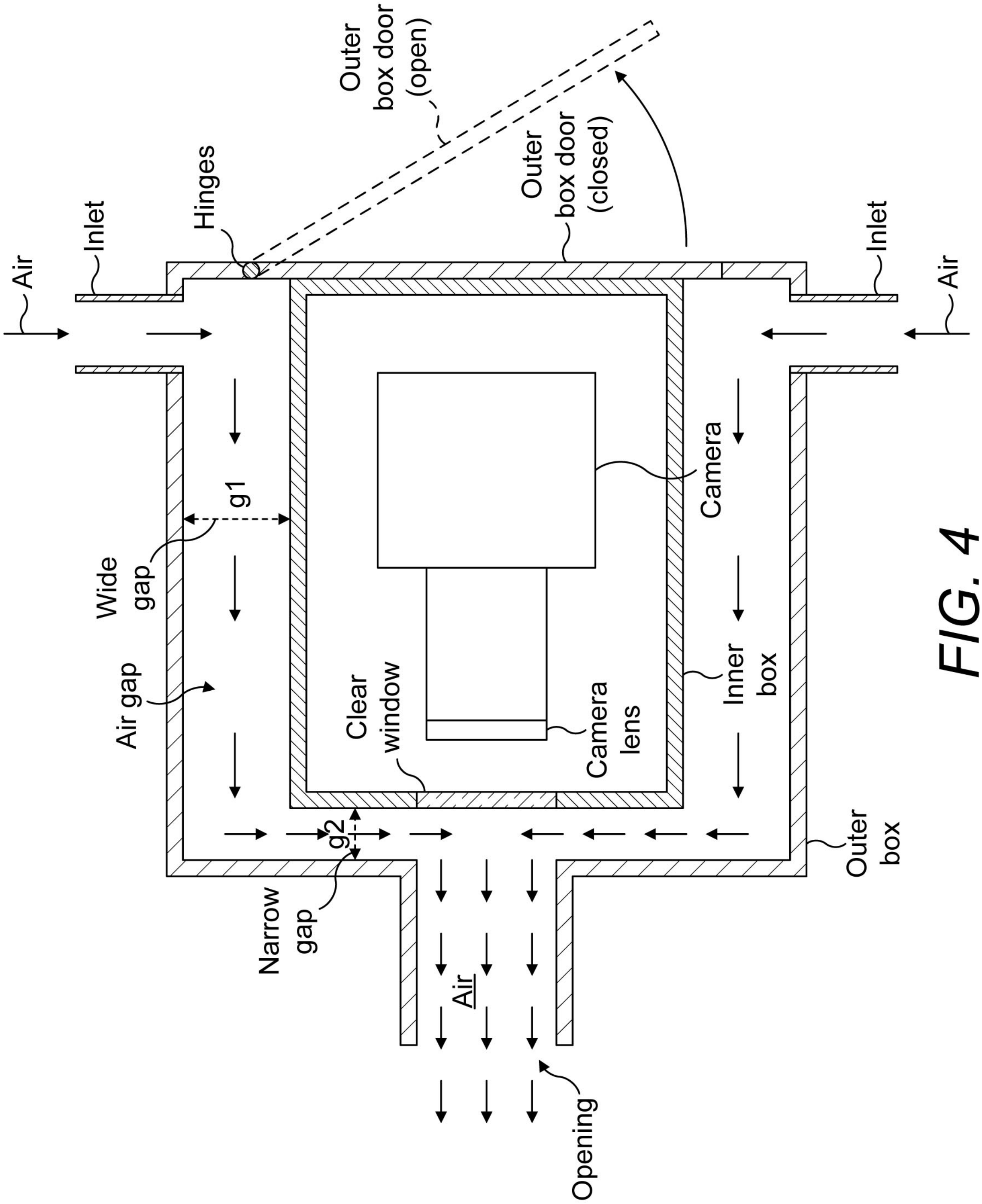

FIG. 4

Document A (Annotated drawings)

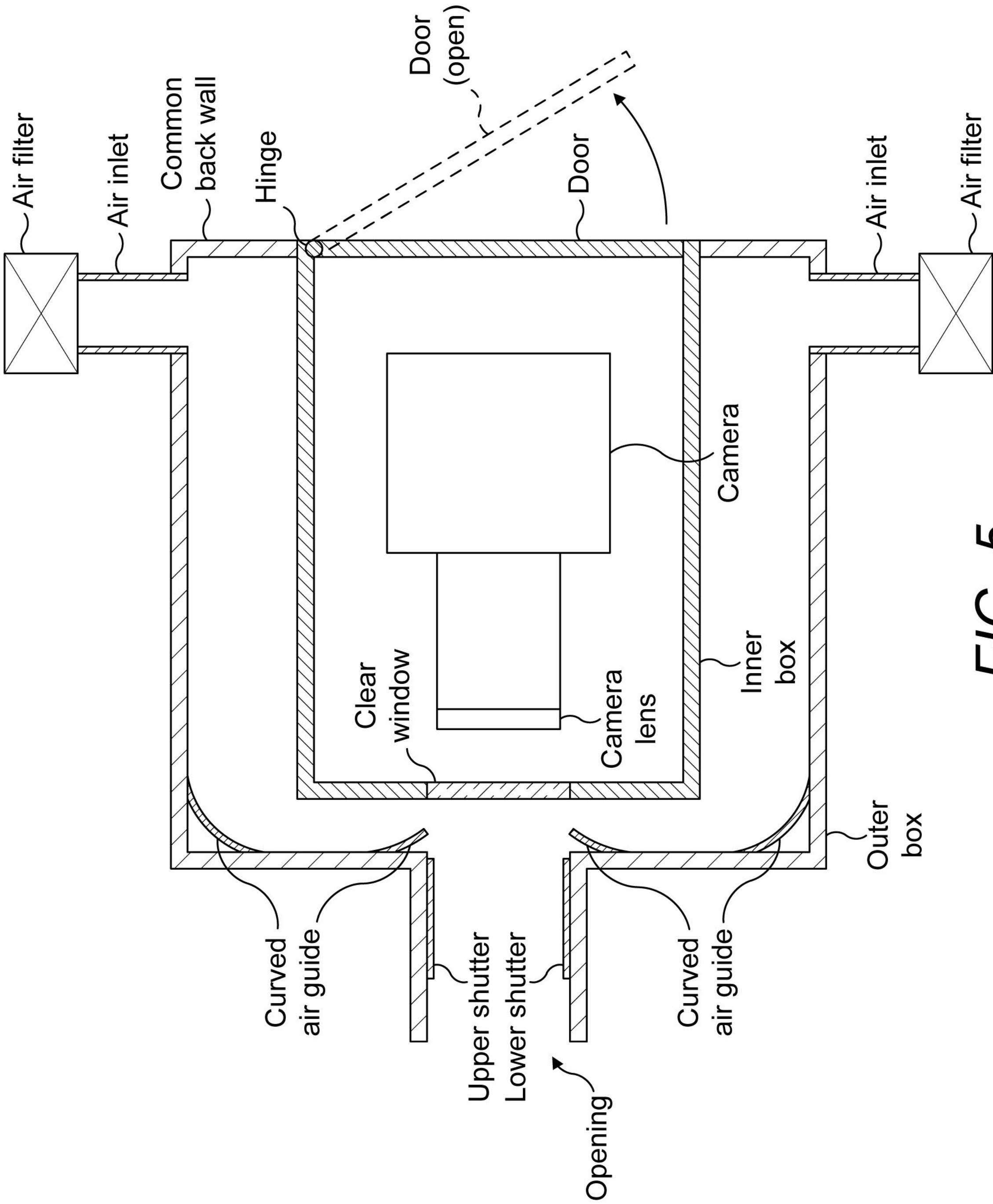

FIG. 5

Document A (Annotated drawings)

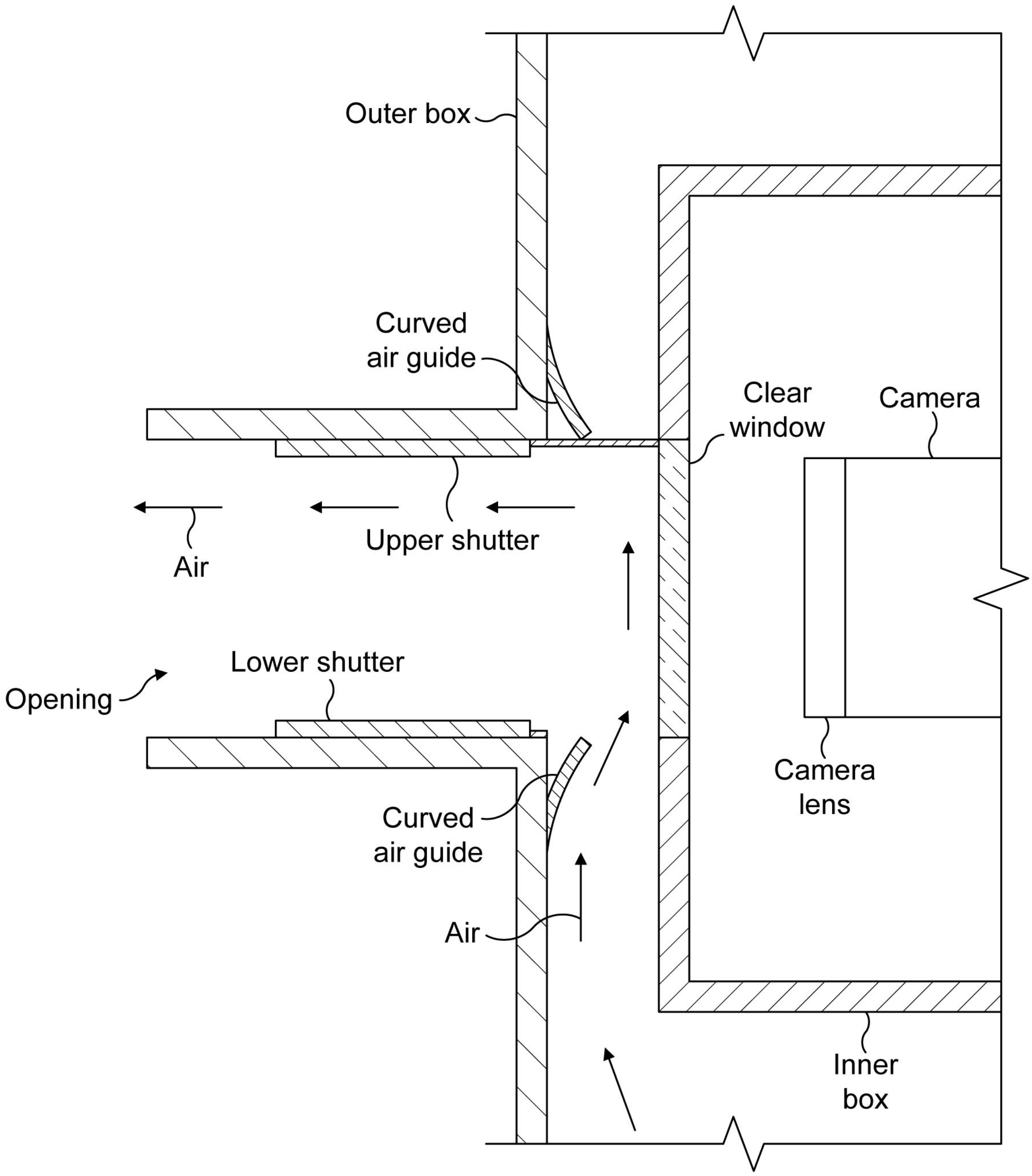

FIG. 6

Document B (Unannotated drawings)

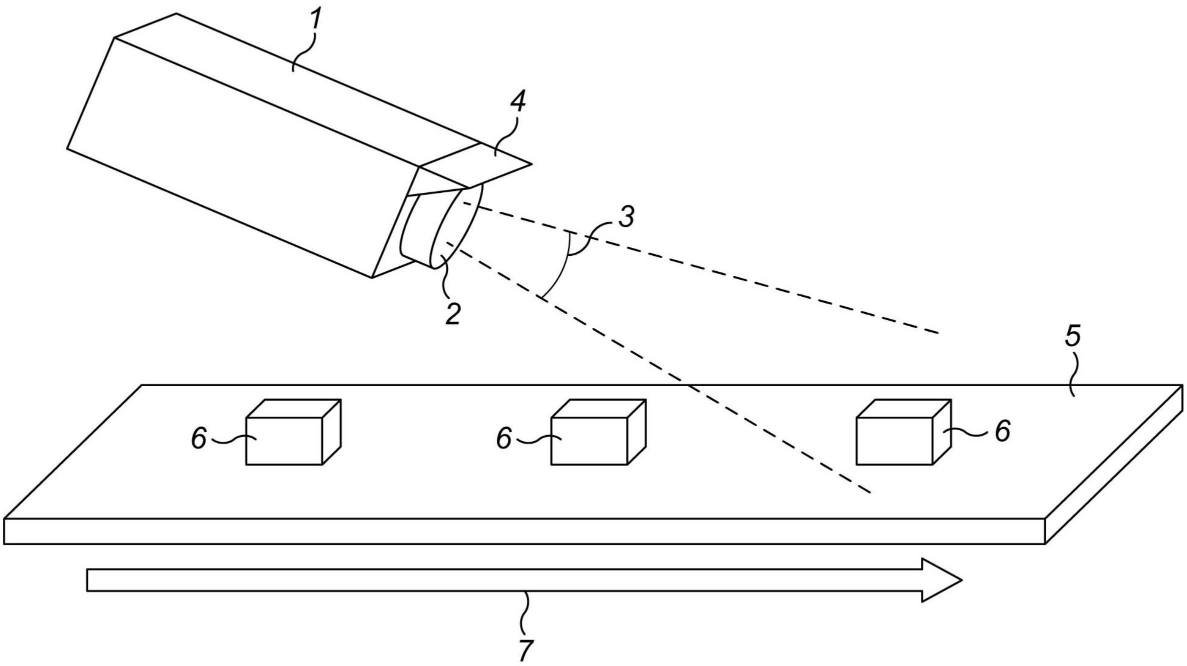

FIG. 1
(Prior Art)

Document B (Unannotated drawings)

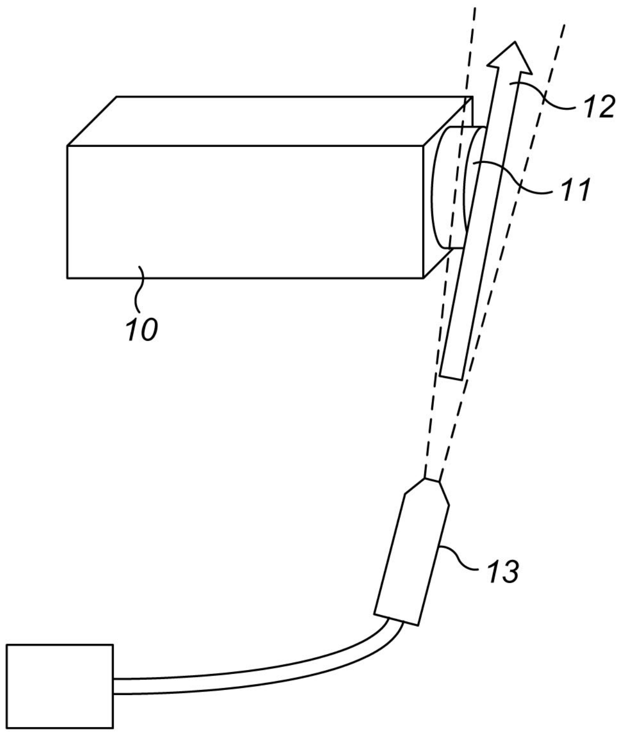

FIG. 2
(Prior Art)

Document B (Unannotated drawings)

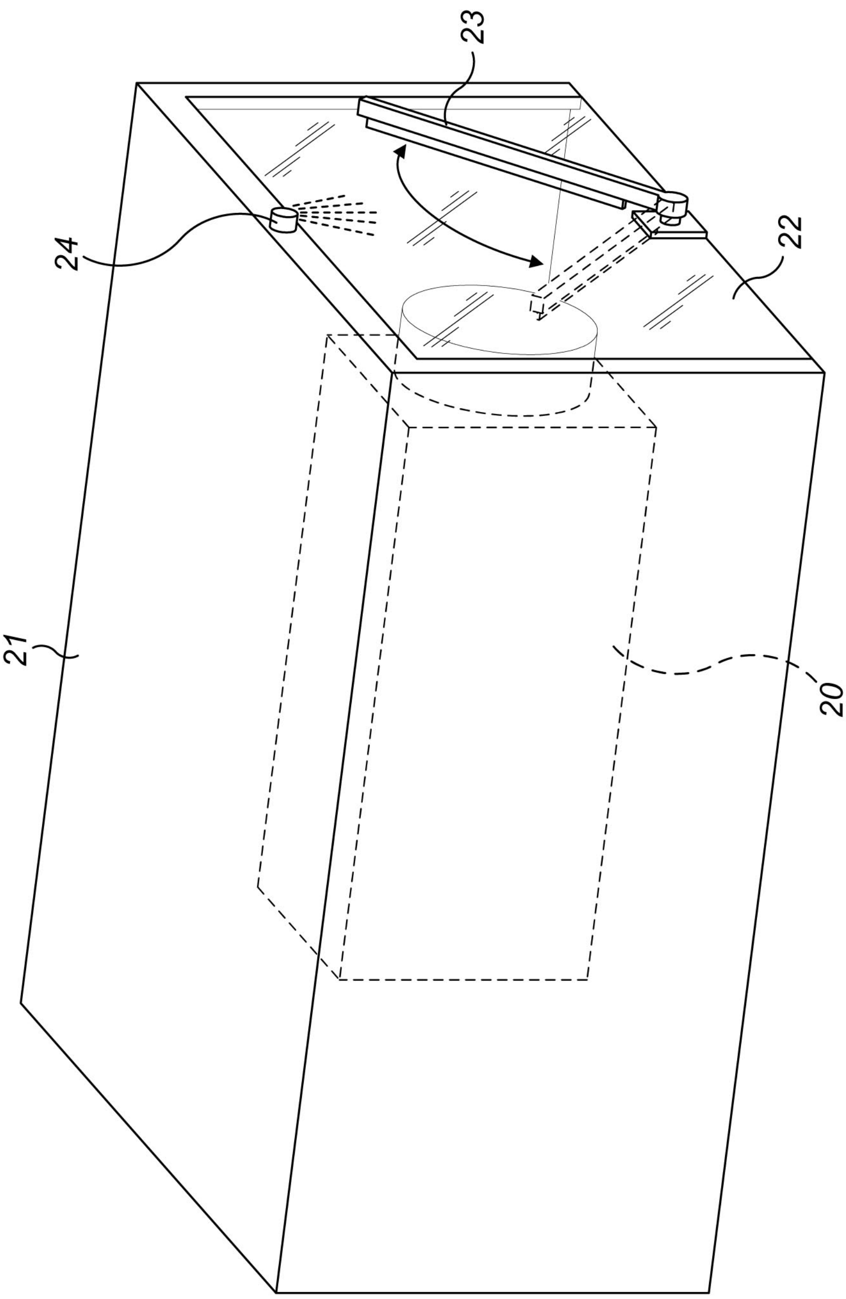

FIG. 3
(Prior Art)

Document B (Unannotated drawings)

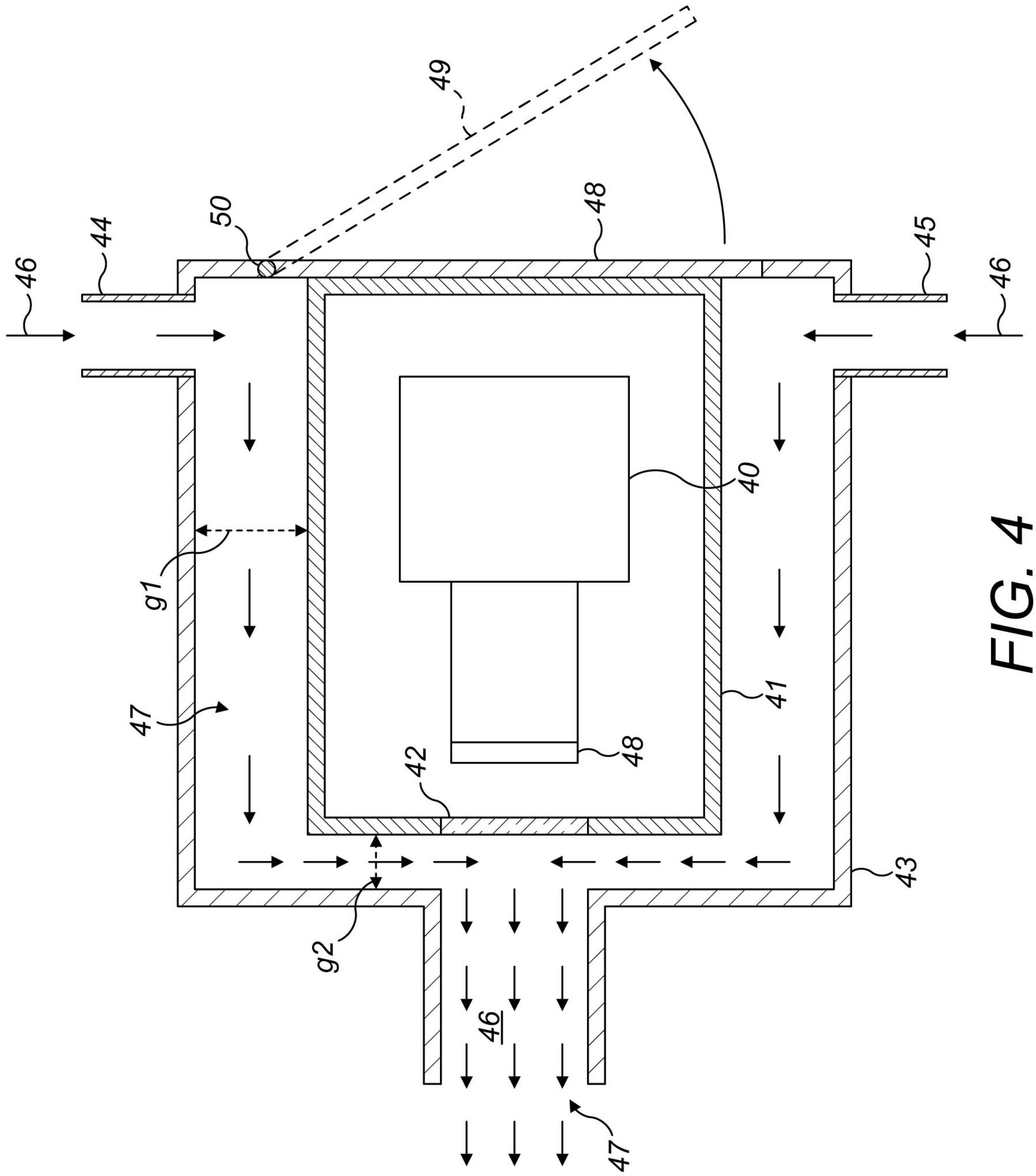

FIG. 4

Document B (Unannotated drawings)

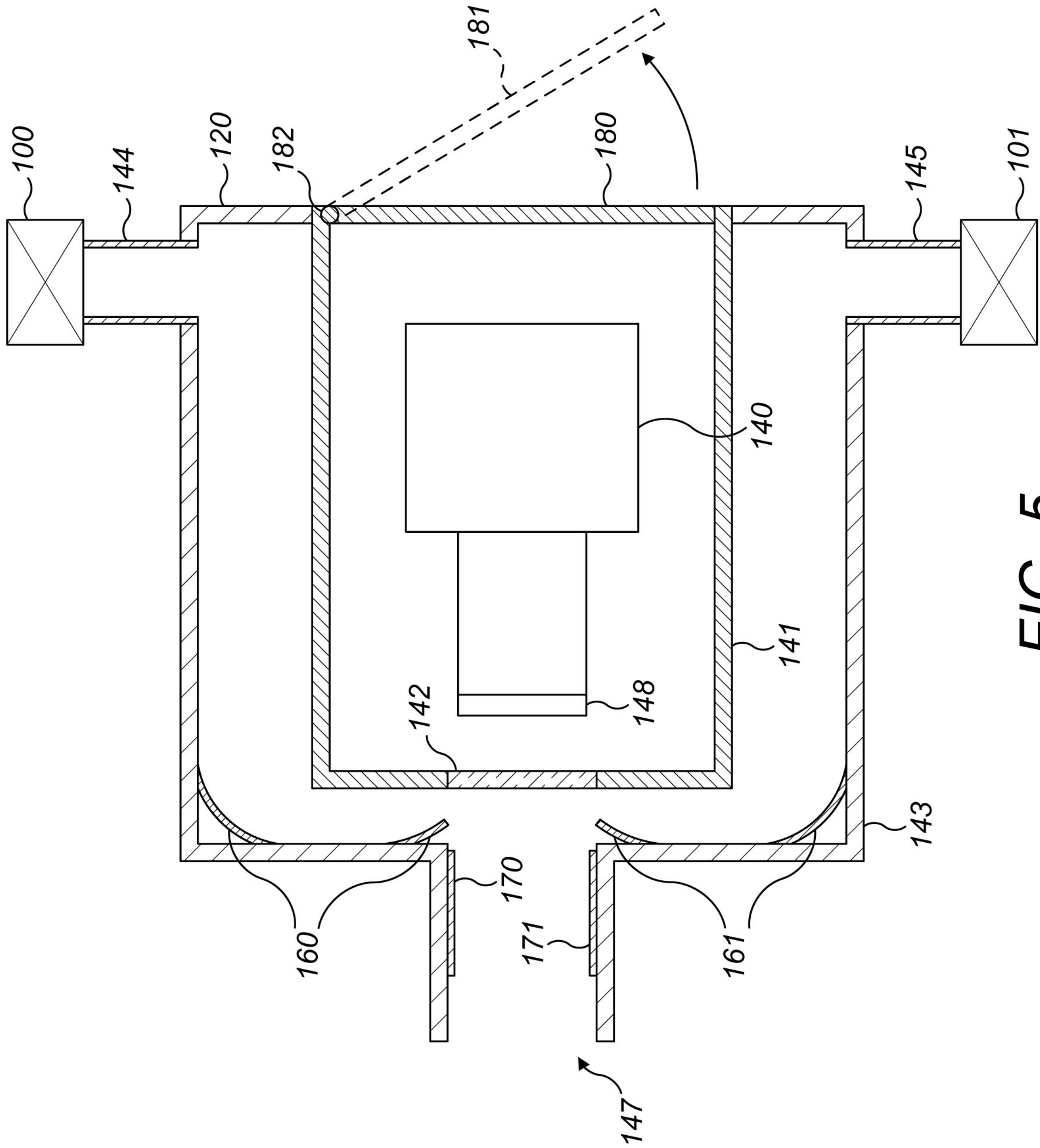

FIG. 5

Document B (Unannotated drawings)

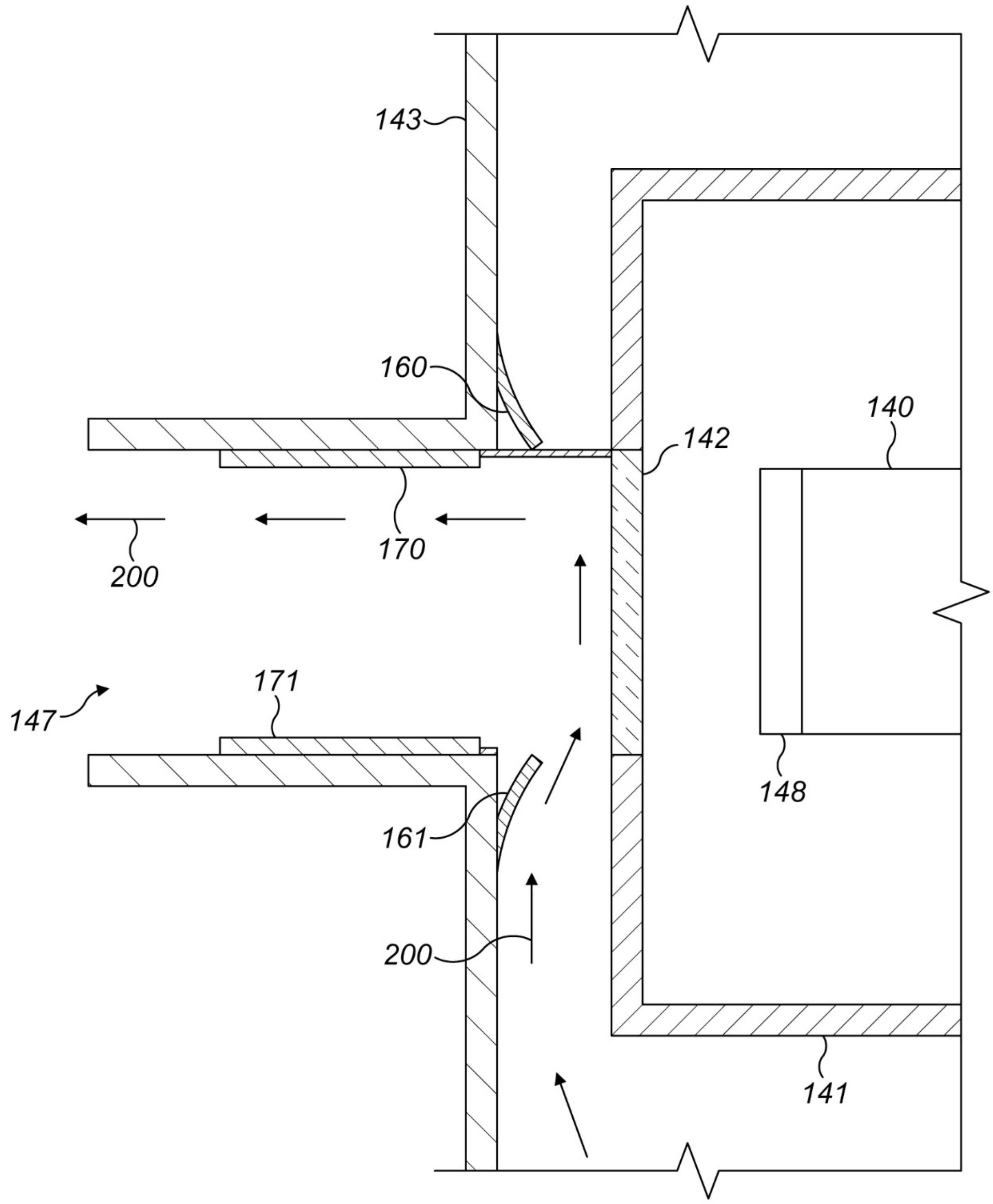

FIG. 6

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