

May 23, 1961

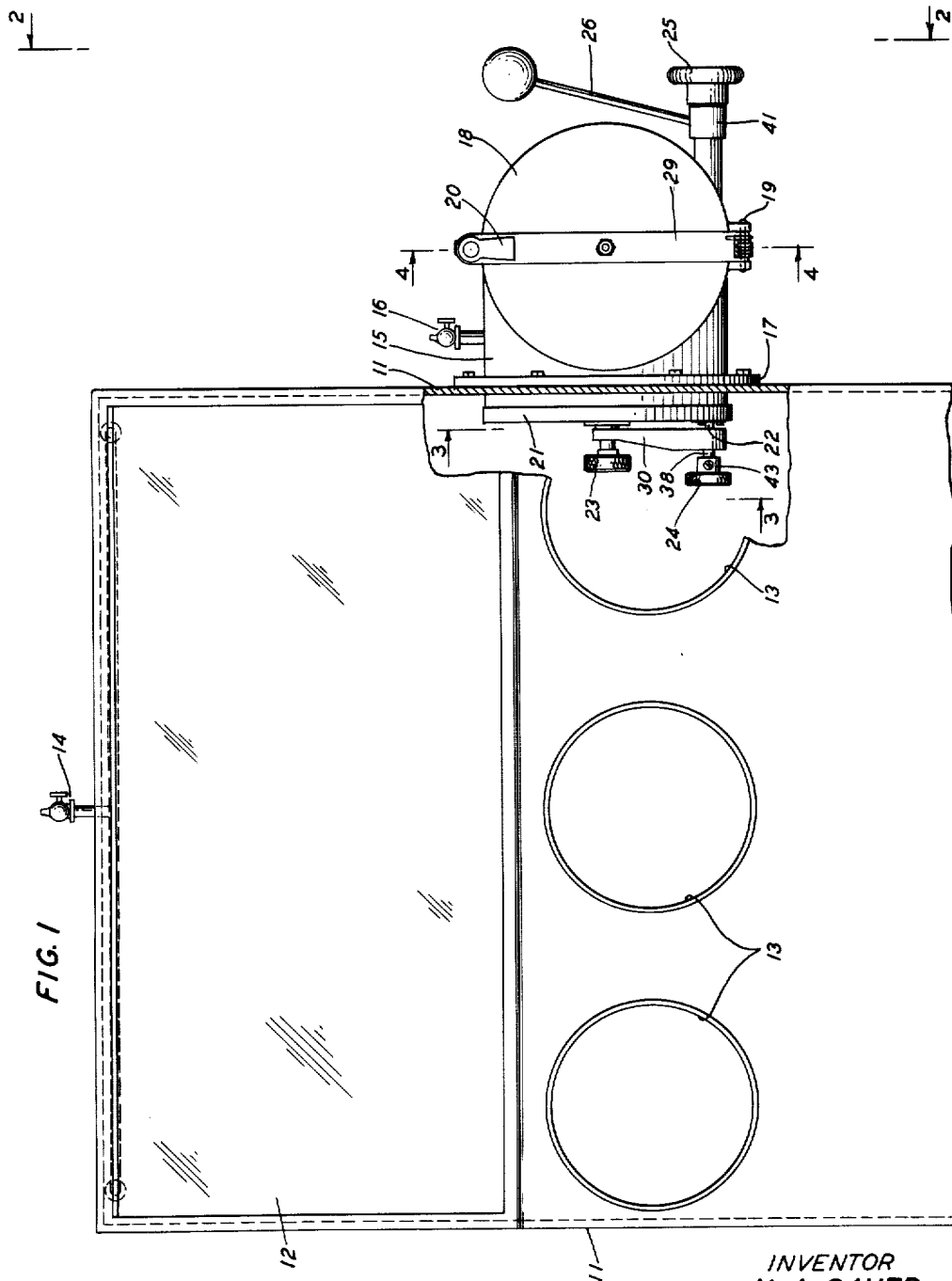
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2,985,497

CONTROLLED ATMOSPHERE CABINET

Filed Nov. 26, 1958

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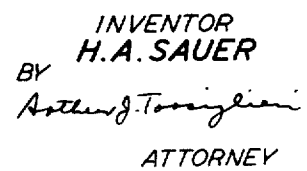


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CONTROLLED ATMOSPHERE CABINET

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May 23, 1961

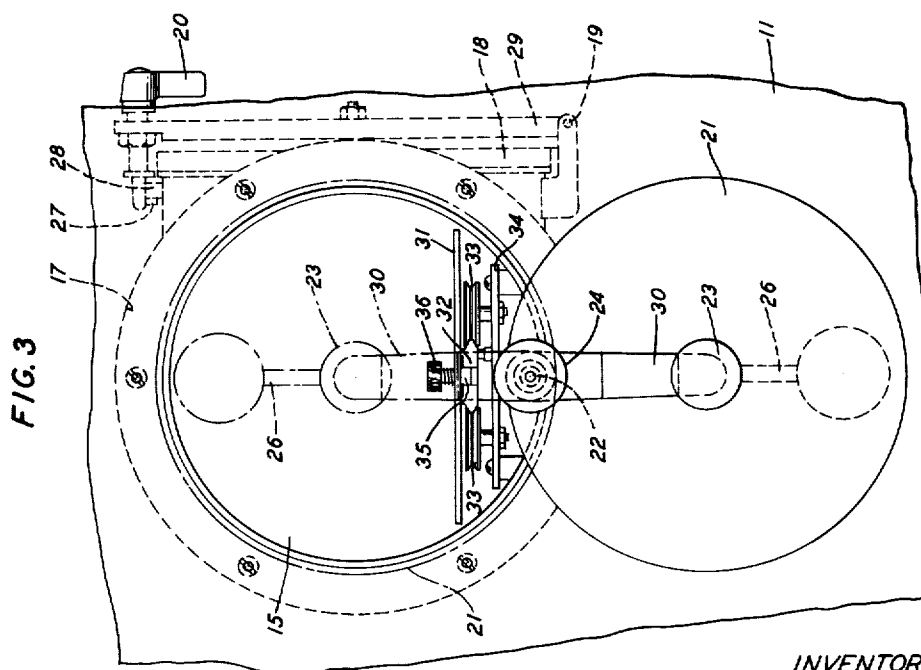
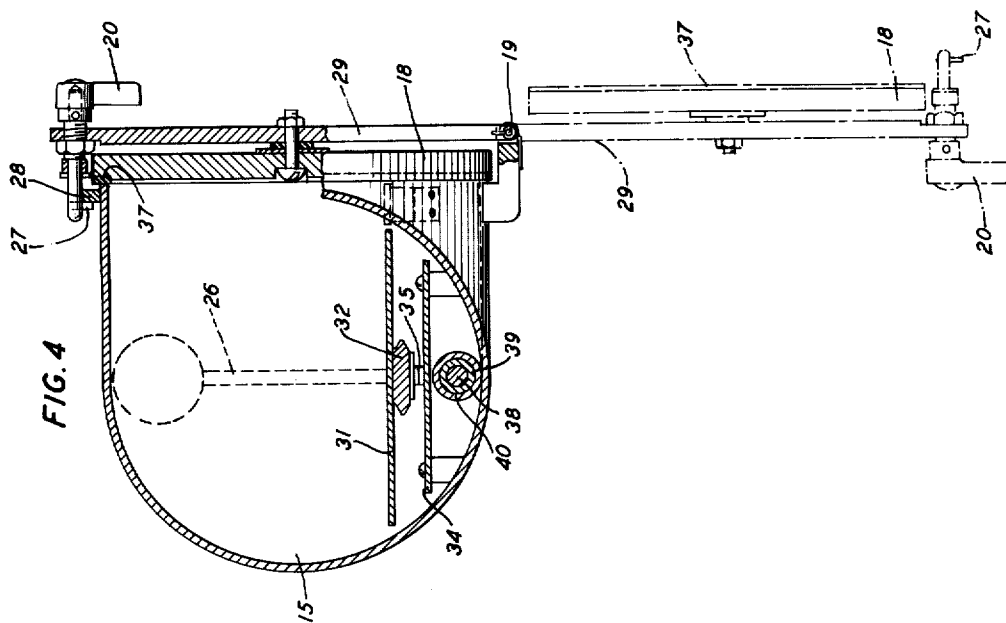
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Filed Nov. 26, 1958

4 Sheets-Sheet 3



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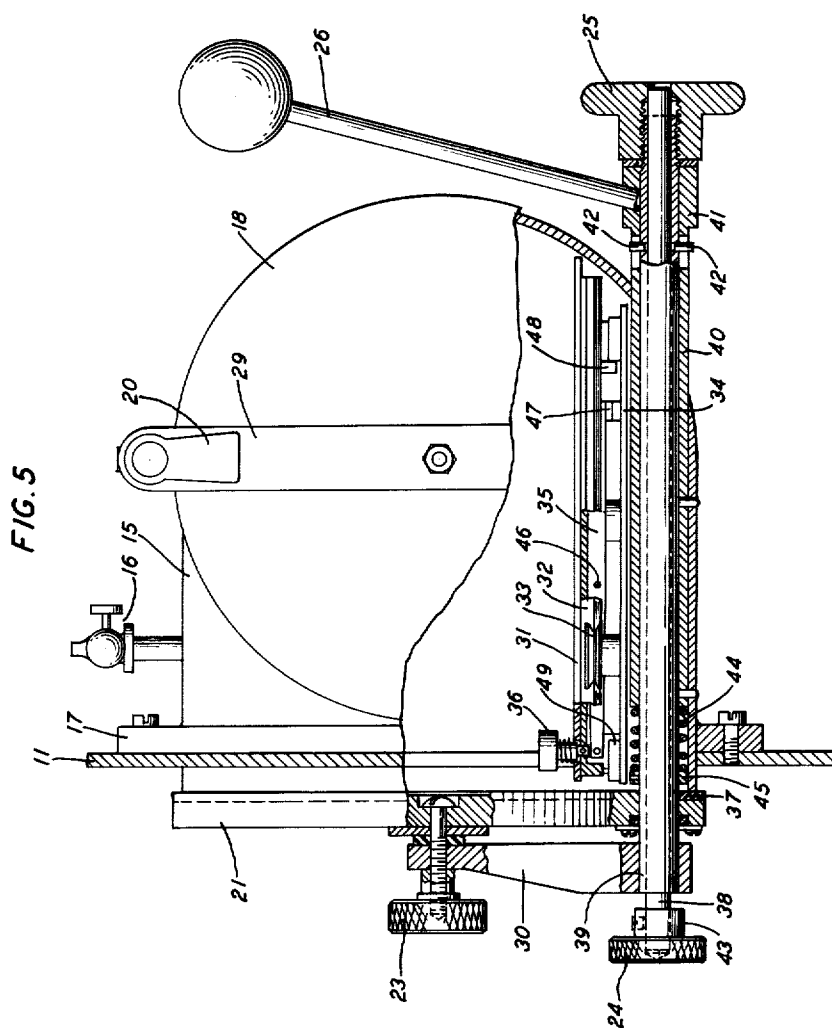
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Filed Nov. 26, 1958

4 Sheets-Sheet 4



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2,985,497

CONTROLLED ATMOSPHERE CABINET

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Filed Nov. 26, 1958, Ser. No. 776,516

6 Claims. (Cl. 312—311)

This invention relates to controlled atmosphere cabinets, and relates particularly to controlled atmosphere cabinets having an air lock.

Many techniques in modern technology, both in industry and in the research laboratory, require the handling of materials which are sensitive to their environment and which must be kept in an artificial environment, or which are dangerously toxic and must be isolated and handled apart from other objects or living beings. It has long been known in the art to handle such materials in sealed cabinets, variously known as "controlled atmosphere cabinets," "isolation cabinets," or "dry boxes," for example. These usually comprise a gas-tight metal frame usually with transparent panels of glass or plastic sealed therein to permit inspection of the interior of the cabinet. One or more integral flexible members, commonly rubber gloves, are sealed over openings in the metal frame. By insertion of his hands within the gloves, a worker may have access to the cabinet to manipulate objects therein without disrupting the sealed nature of the cabinet and upsetting the conditions therein. In this way, work may be carried out safely and easily in a vacuum, or in artificial atmospheres which are toxic, reactive, inert, dry, wet, etc.

To permit the insertion or removal of objects from the cabinet during the course of work without disrupting the conditions prevailing in the cabinet, cabinets in the prior art have often been equipped with air lock devices. These comprise a double-doored chamber, one door of which opens into the outside environment, and the second door of which enters into the cabinet. By using alternate doors into the chamber, and changing the environment of the chamber (if necessary) to match that of either the cabinet or the outside environment, access to and from the cabinet with a minimum disturbance of the conditions therein can be had.

The construction of such air locks has not often been such as to consider the problems of the worker who must repeatedly handle objects through the air lock. The air lock chamber often extends in one direction from a side of the cabinet in such a manner that a worker cannot exchange an object between the air lock and the outside environment with one hand while at the same time keeping the other hand extended into the cabinet.

Further, the inner door of the air lock chamber is usually designed to swing open into the cabinet. When frequent use of the air lock is made, the effective interior space of the cabinet is cut down by the amount of space needed to give the door free play. Often the closing of the door is cumbersome, requiring both hands of the operator within the cabinet, and no provision for closing of the inner door from outside the cabinet is provided.

Accordingly, an object of the present invention is a cabinet having an improved air lock.

Another object of the invention is a cabinet having an air lock with easy access which can conveniently be

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operated with one hand outside and one hand inside the cabinet.

Still another object of the invention is a cabinet having an air lock whose operation takes a minimum of space from that available within the cabinet.

A fourth object of the invention is a cabinet having an air lock, the inner door of which can be operated from outside the cabinet.

The aforementioned objects of the present invention are achieved by a cabinet having an air lock, one feature of which is the extension of the air lock from the cabinet in more than one direction.

Another feature of the invention is an air lock having an inner door which opens by rotation of the door in the plane of the door around an axis perpendicular to that plane.

A third feature of the present invention is a control which permits easy closure of the inner door of the air lock of the cabinet from outside the cabinet and air lock.

Other objects and features of the invention will become apparent from the accompanying figures showing specific embodiments of the invention.

Fig. 1 is a front elevation, partly in section, of a cabinet and an air lock according to the invention;

Fig. 2 is a side elevation of the cabinet and air lock of Fig. 1;

Fig. 3 is a sectional view of the air lock taken along line 3—3 of Fig. 1;

Fig. 4 is a sectional view of the air lock taken along line 4—4 of Fig. 1;

Fig. 5 is a front elevation, partly in section, giving a detailed view of those portions of the air lock which function to operate the inner, or cabinet, door thereof from inside and outside the cabinet.

Fig. 1 is a front elevation, partly in section, showing a cabinet or "dry box" comprising cabinet frame 11, conveniently made of metal, with transparent window 12 mounted tightly therein. One or more apertures 13 are provided in the wall of frame 11. Rubber gloves, not shown, are sealed across apertures 13 to permit an operator to extend his hands and arms within the cabinet while maintaining a seal at apertures 13. Entry 14 conveniently comprising metal tubing and a stopcock gives access to the cabinet for introducing or removing gases. Other entries, not shown, may be provided for leading gas, water, or air into the cabinet, for a pressure gauge, for humidification, temperature control facilities, power and light receptacles, or for other purposes and devices which may be found convenient.

The main body of the air lock chamber 15, which is made of a rigid gas-tight material, conveniently a metal such as steel, is equipped with entry 16, conveniently comprising a metal tube and stopcock. Other entries (not shown) may be made into chamber 15 for providing additional stopcocks, pressure gauges, and so forth. Chamber 15 is pictured in this embodiment as tubular, although any convenient cross-sectional shape or shapes may be used. Chamber 15 is bolted to frame 11 through flange 17 flush with frame 11. Chamber 15 leaves frame 11 perpendicular to frame 11, but bends at an angle, here conveniently shown as a 90 degree angle, toward the front of frame 11. By angling to the front of frame 11, easy access to outer door 18 of chamber 15 is achieved from the front of the cabinet. The two arms of chamber 15 need not be rectangularly disposed, although this has been found convenient, but may be constructed to include an angle less than or greater than a right angle, but less than 180 degrees. Similarly, the absolute and relative length of the two arms of chamber 15 is not critical. For the convenience of a worker using the air lock, who desires to keep one hand inside the cabinet and the other

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hand outside, a chamber with short arms of equal length, in a rectangular disposition, has been found most desirable. Outer door 18, conveniently of metal or transparent glass or plastic, is hinged on hinge 19 so that door 18 swings outward and downward to open. Door 18 is held shut, or opened, by means of locking knob 20. A solid connecting member 29, bolted to door 18, runs between knob 20 and hinge 19.

Chamber 15 is also equipped with inner door 21, conveniently of metal or a transparent glass or plastic, leading into the cabinet. Door 21 rotates in a plane perpendicular to the plane of the figure about a point 22. Knobs 23 and 24 permit operation of door 21 from within the cabinet. Knob 25 and lever 26 permit operation of door 21 from outside the cabinet. The detailed operation of knobs 23, 24, and 25, and lever 26 is described in Fig. 5.

Doors 18 and 21 and flange 17 may be faced with annular rings (not shown in Fig. 1) of a compressible material such as cork to facilitate making gas-tight seals between doors 18 or 21 and chamber 15 and between flange 17 and frame 11.

In Fig. 2 is shown the cabinet of Fig. 1 in side elevation. Frame 11, window 12, apertures 13, entries 14 and 16, chamber 15, flange 17, door 18, hinge 19, locking knob 20, knob 25, lever 26, and connecting member 29 are visible. Door 18 is flush with chamber 15, except for a suitable compressible washer (not shown in Fig. 2) between the two. Locking and unlocking of door 18 is accomplished by rotation of locking knob 20 to catch or disengage pin 27 with member 28 tightly affixed to chamber 15.

Fig. 3 is a sectional view along line 3—3 of Fig. 1 which shows in greater detail the structure of the air lock. Door 21 is shown in both the closed position and the open position in which it is swung in its own plane around point 22. Either knob 23, inside the cabinet, or lever 26, outside the cabinet, can be used to move door 21. The functioning of lever 26, and of knobs 23 and 24 which are joined by solid connecting member 30, is shown in greater detail in Fig. 5. Fig. 3 shows movable platform 31 mounted in chamber 15. Platform 31, to which tracking rail 32 is joined, is adapted to move horizontally from chamber 15 in and out of the cabinet. This movement is guided by tracking rail 32, with double beveled edges, running between opposing pairs of wheels 33 (one pair shown) mounted on a vertical axis and having V-rims to match the edges of tracking rail 32. The assembly is mounted within chamber 15 on stationary platform 34 bolted to the walls of chamber 15. Mounted along the long dimension of tracking rail 32 is brake bar 35, actuated by brake knob 36, details of which are shown in Fig. 5.

Fig. 4 is a sectional view along line 4—4 of Fig. 1. Door 18, with sealing washer 37, is shown in open and closed position, and details of locking knob 20 and the locking mechanism comprising pin 27 and member 28 are visible in detail. The mounting of door 18 on solid connecting member 29, which swings about hinge 19 and in which locking knob 20 is mounted are shown. For greater clarity, movable platform 31, tracking rail 32, brake bar 35, and stationary platform 34 are shown without wheels 33 or brake knob 36 of Fig. 3. The mechanism, comprising central shaft 38, movable tubular member 39, and fixed tubular member 40, by which movement of lever 26 is transmitted to move door 21 (not shown in Fig. 4), is pictured. Details of this mechanism are given in Fig. 5.

Fig. 5 is a front elevation, partly in section, showing details of several portions of the air lock, particularly controls for door 21. Door 21 is shown in closed position, making a gas-tight seal with chamber 15 by means of sealing washer 37 similar to that shown in Fig. 4. Door 21 is bolted through connecting member 30 to knob 23. Movement of knob 23 in a plane perpendicular

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to the plane of Fig. 5 moves door 21 back and forth in its own plane to open or close chamber 15. Door 21 rotates about the long axis of movable tubular member 39, to which member 39 both door 21 and connecting member 30 are tightly joined. Similarly, door 21 can be moved from outside the cabinet (to the right of frame 11 in Fig. 5) by rotation of movable tubular member 39 from outside the cabinet. This movement is provided through the action of lever 26, joined to sliding collar 41. Collar 41 is slotted to receive pins 42, which pins are tightly brazed to movable tubular member 39. Collar 41 is free to move horizontally along tubular member 39 to an extent limited by the length of the slots in collar 41 which receive pins 42. Free rotation of collar 41 about member 39 is prevented by the slot and pin arrangement, however. A torque applied to lever 26 thus will be transmitted by pins 42 to member 39 causing member 39 to rotate about its long axis. Door 21 and connecting member 30 are thus also rotated.

Door 21 is closed from outside the cabinet by screwing threaded knob 25, which is brazed to shaft 38. Knob 25 is threaded on movable tubular member 39 which advances or retreats from knob 25 depending on the sense of rotation of knob 25. By screwing knob 25, tubular member 39 can be moved to the right in Fig. 5, compressing spring 44, which exerts a leftwards directed force on member 39 through collar 45 affixed to member 39. By moving member 39 to the right, connecting member 30 and door 21 joined thereto move to the right, sealing chamber 15. An opposite sense of rotation for knob 25 permits member 39 to move leftwards under the action of spring 44. Door 21 affixed to member 39 also moves left, unsealing chamber 15. Door 21 may also be opened and closed from within the chamber (left of frame 11 in Fig. 5) by rotation of knob 24 to move shaft 38. Knob 25, brazed to shaft 38, then causes an advance or retreat of tubular member 39, producing an action as described above.

Also shown in Fig. 5 is brake bar 35, which is pivoted about pivot 46 such that downward pressure on knob 36 lifts shoe 47 up from contact with stationary platform 34. Movable platform 31 may then be moved freely without friction to the left until pin 48 contacts stop 49. This arrangement permits easy loading of platform 31 through one of either of doors 21 or 18 and easy unloading, after movement of the platform, through the other of doors 21 or 18. Platform 31 slides because of the movement of tracking rail 32 through wheels 33. Three opposing pairs of wheels 33 have been found convenient, of which only one of one pair is shown for clarity in Fig. 5.

Although specific embodiments of the present invention have been shown and described, it is to be understood they are but illustrative, and are not to be construed as limiting the scope and spirit of the invention.

What is claimed is:

1. In a controlled atmosphere cabinet, an air lock comprising a chamber having a movable planar door, entrant on the cabinet, with pivoting means permitting movement of the door by rotation in the plane of the door about a pivot point and means both inside and outside the cabinet for moving the door.

2. In a controlled atmosphere cabinet, an air lock comprising a chamber having two arms which include an angle greater than 0 degrees and less than 180 degrees between them, one arm thereof having a movable planar door, entrant on the cabinet, with pivoting means permitting movement of the door by rotation in the plane of the door about a pivot point and means both inside and outside the cabinet for moving the door.

3. In a controlled atmosphere cabinet, an air lock comprising a chamber having a movable planar door, entrant on the cabinet, with pivoting means permitting movement of the door by rotation in the plane of the door about a pivot point, and means mounted within the chamber

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for moving material between the chamber and the cabinet.

4. In a controlled atmosphere cabinet, an air lock comprising a chamber having two arms which include an angle greater than 0 degrees and less than 180 degrees between them, one arm thereof having a movable planar door, entrant on the cabinet, with pivoting means permitting movement of the door by rotation in the plane of the door about a pivot point, and means mounted within the chamber, accessible from either arm thereof, for moving material between the chamber and the cabinet.

5. In a controlled atmosphere cabinet, an air lock as described in claim 4 having means both inside and outside the cabinet for moving the door.

6. In a controlled atmosphere cabinet, an air lock comprising a chamber having two arms rectangularly disposed, one arm thereof having a movable planar door, entrant on the cabinet, with pivoting means permitting movement of the door by rotation in the plane of the door about a pivot point, means both inside and outside the cabinet

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for moving the door, and means mounted within the chamber and accessible from either arm thereof, comprising a horizontal platform and tracking means, for moving material between the chamber and the cabinet.

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