# United States Patent

**Deckas**

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[54] **CLEAN AIR WORK STATION**


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[52] **U.S. Cl.**.....**55/385**, 55/473, 55/DIG. 29, 98/115 LH

[51] **Int. Cl.** .....**B01d 31/00**

[58] **Field of Search**...98/115 LH, 115, 33 R, 36, 115 SB; 55/40 V, 40 R, 471–473, 385, DIG. 29



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[57] **ABSTRACT**

A clear air work station having a horizontal work surface on which is disposed a bell jar having means for evacuating the jar. Filtered air is delivered horizontally over the region above the work surface and a shield secured to the bell jar prevents the filtered air from engaging the bell jar except for the lower portion of the jar immediately adjacent the work panel. When the jar is raised to get access to the material being worked on within the jar, the shield is simultaneously raised to allow filtered air to flow beneath the jar. By reason of the shield, air turbulence around the jar is eliminated. Since the shield moves with the jar, the total flow of filtered air remains constant regardless of the position of the bell jar.


**8 Claims, 4 Drawing Figures**

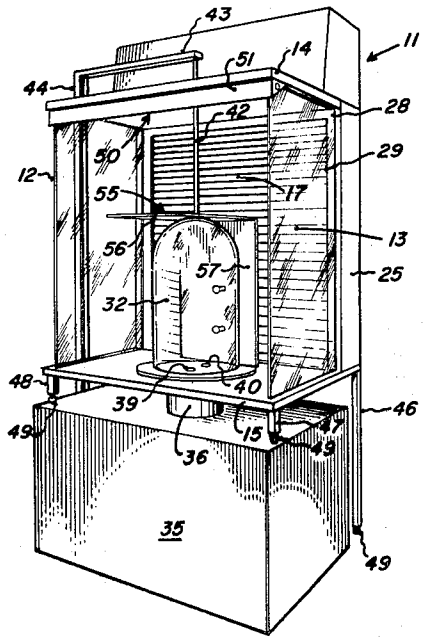


FIG. 1.

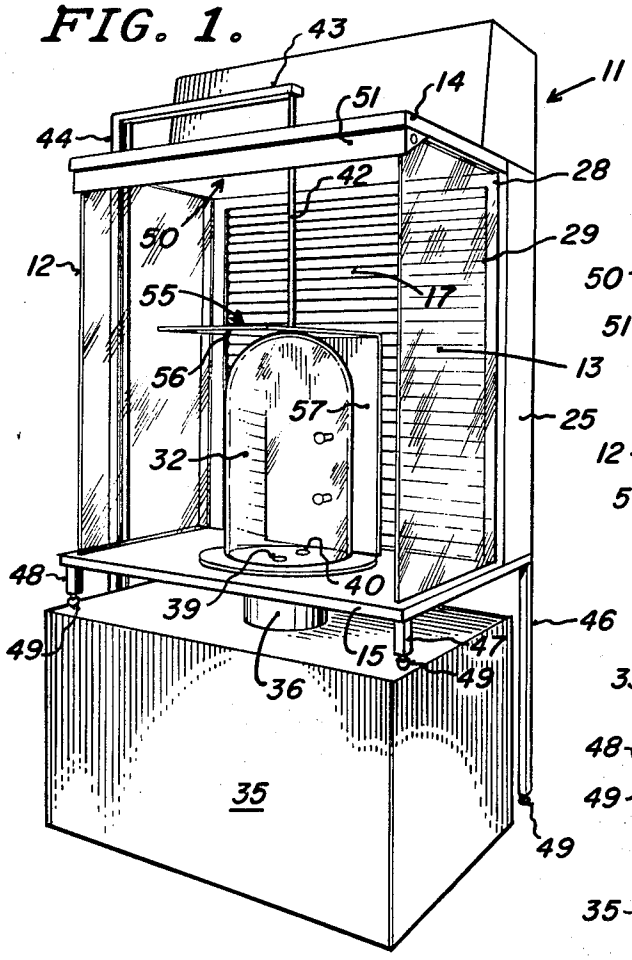
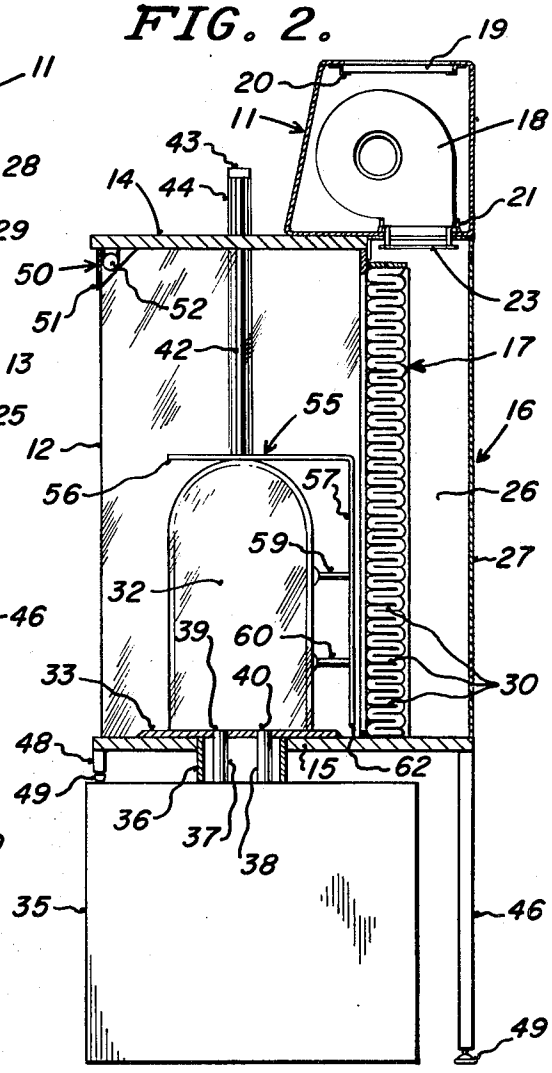



FIG. 2.



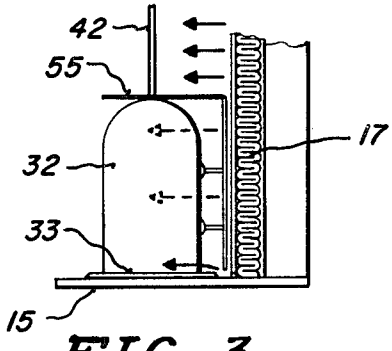




FIG 3

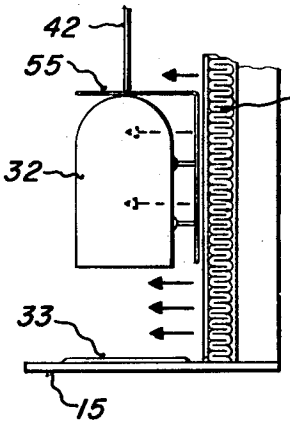



FIG. 4.

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# CLEAN AIR WORK STATION

## BACKGROUND OF THE INVENTION

It is quite old to employ clean air work stations in which air is delivered through a plurality of filters, including one for removing very fine particles, and delivering the air in a predetermined direction over a work surface. By delivering a constant stream of air, and spilling it out of the front of the unit, air in the room is prevented from entering, much as in the case of a room having an air curtain door. It is thus possible to work on articles on the work surface with no danger of dust particles or other foreign matter in the room engaging the articles being worked on. A typical type of work station of this type is shown in my prior U.S. Pat. No. 3,494,112, dated Feb. 10, **1970**.

Where a relatively large object, such as an inverted bell jar, is placed on the work surface, it is difficult to prevent a turbulent condition from resulting. In the aforesaid prior U.S. Pat. No. 3,494,112, this was partially prevented in connection with small objects by providing for delivery of the air in two directions and adjusting the relative amounts of air delivered in the two directions so as to "tune" the resultant air stream to reduce as much as possible the tendency for eddy currents to be produced. The previous arrangement works very well with small objects, the position of which is not substantially changed during the work operation. With large objects, however, which must be raised and lowered, as is the case with bell jars, it does not work out too satisfactorily to have such a tuned air stream. This is particularly true if the object is cylindrical so that the air tends to follow the curved surface of the object and thus create eddy currents.

## SUMMARY OF THE INVENTION

The present invention is concerned with a clean air work station of the type discussed above in which the problem of turbulence about the object is prevented by interposing a shield over most of the area between the filter and the object, the shield being moved when the object is raised to permit air to sweep over the surface of the work bench beneath the object. Preferably, the shield does not extend entirely down to the surface of the work bench so that there is always a flow of air immediately above the surface of the work bench to keep the work bench free of dust particles.

In the preferred form of the invention, the object disposed on the work surface is an inverted bell jar with provision for evacuating the same and carrying on desired processes such as vacuum disposition within the bell jar. The shield is preferably secured to the bell jar so that when the bell jar is raised, the shield is likewise raised. The air is delivered in a generally horizontal direction through filter means which extends over a vertical distance including the complete distance of travel of the bell jar. Thus, the total impedance to flow of the filtered air offered by the bell jar and shield remains constant and the total flow of filtered air likewise remains constant.

The shield is preferably in the form of an angular plate having a substantial vertical leg extending between the bell jar and the filter and a horizontal leg extending above and secured to the jar.

Various other objects of the invention will be apparent from a consideration of the accompanying specification, claims and drawing.



## BRIEF DESCRIPTION OF THE DRAWING

FIG. **1** is a perspective view of my improved work station;

FIG. **2** is a side view of the work station with portions thereof being shown in vertical section;

FIG. **3** is a schematic view of a portion of my work station showing the path of air flow when the bell jar is in its lowermost position; and

FIG. **4** is a similar schematic view showing the path of the air flow when the bell jar is in its raised position.

## DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring first to FIGS. **1** and **2** of an drawing, the work bench comprises a cabinet having an upper hood section **11** and side panels **12** and **13** disposed between a top panel **14** and a work panel **15**. The work panel **15** not only provides the work surface but also supports the side panels **12** and **13**, the top panel **14**, the upper hood section **11** and a plenum chamber **16**, in front of which is disposed a main filter means **17** through which filtered air is delivered in a generally horizontal direction. Mounted in the upper hood section **11** is a blower **18** driven by a electric motor forming a part thereof. The blower draws in air through a prefilter **19** held in a frame **20** disposed around the edge and beneath an opening in the upper wall of the hood **11**. The prefilter may be formed of relatively porous material to remove dust particles of the type commonly removed by filters such as those employed in connection with home furnaces. The blower **18** is preferably provided with a rubber skirt **21** around the mouth of the blower. Also supported from the blower **18** is a diffuser plate **23** consisting of a perforated screen. The entire upper hood assembly **11** including the blower **18** is supported on the upper panel **14**. The blower should have a capacity of delivering air at a velocity of from 20 to 140 feet per minute and should have a capacity of from 20 to 140 feet per square foot of filter face. The air is delivered by the blower into the plenum chamber **16**.

The plenum chamber **16** comprises solid side walls **25** and **26**, a solid back wall **27** and a front wall **28** which has an opening **29** therein extending over substantially the full area of the front wall **28**. The filter **17** is a laminar filter of the type commonly referred to as a micro filter capable of removing extremely fine particles. The filter should preferably be capable of 99.97 efficiency when tested with 0.3 micron dioctothalate smoke. The filter should preferably have a static pressure drop of less than one inch water (gauge pressure), when operating at a flow through the filter of 100 feet per minute. Filters of the type described above are obtainable from several sources, one available source being the Cambridge Filter Corporation of Syracuse, New York, where such filters are sold under the trademark "Absolute." These filters are accordion folded between directional dividers **30**. As a result of the laminar construction and the dividers, the air moves through the filters in a horizontal direction. Because the filter extends for practically the full height of the distance between the work panel **15** and the top panel **14**, this air flow takes place over the entire volume enclosed between the top and bottom panels **14** and **15** and the side walls **12** and **13**.

Disposed on the work surface formed by the work panel 15 is a bell jar assembly consisting of an inverted bell jar 32 and a plate 33 with means for forming an airtight seal between the bell jar and the plate 33. The bell jar 32 and the plate 33 are associated with a housing 35 containing means for evacuating the bell jar and performing other steps on work pieces within the bell jar. For example, the apparatus within chamber 35 may be employed for introducing a material in vaporous form which it is desired to deposit on the objects within the bell jar. The housing 35 and the apparatus therein is connected to the plate 33 upon which the bell jar 32 rests by a tubular housing 36 through which extends a plurality of tubes 37 and 38 which extend from the housing 35 through openings 39 and 40 in the base plate 33. The tubular housing 36 extends through an opening in the work table 15 of a size to accommodate the housing 36. The conduit 37 may, for example, be used for evacuating the bell jar while the conduit 38 may be used for introducing a vaporous substance to be deposited upon the parts being worked on.

Means is provided for raising and lowering the jar 32. This consists of a rod 42 secured at its lower end to jar 32. The rod 42 passes through an opening in the upper panel 14 and is secured to a horizontal crane arm 43. The crane arm 43 is secured to a vertically movable bar 44 which may be raised and lowered by any suitable means (not shown). For example, the bar 44 may be connected by a rack and pinion to a motor mechanism within the housing 35 so that the bell jar may be raised or lowered by the operation of a suitable switch accessible outside of the housing 35 and controlling the operation of the motor operating the rack and pinion assembly.

The work panel 15 of the cabinet of the clean air work station is supported at its back by a pair of rear legs 46 (only one of which appears in the drawing). Legs 46 are relatively long and are adapted to rest on the floor. At the front of the work panel 15, there are a pair of relatively short legs 47 and 48 which are designed to rest upon the cabinet 35. Each of the legs 46 and each of the legs 47 and 48 are provided at their bottom with adjustable floor guides 49 to enable the height of the table 15 to be adjustable at each of its four corners and thus to level the work panel 15 and the mechanism supported thereby.

Secured to the under wall of the top panel 14 is a light assembly 50 comprising a triangular shield 51 and a light 52 which may take the form of a fluorescent lamp with a suitable ballast unit (not shown). Such a light assembly will thoroughly illuminate the work area between the upper and lower panels and the side walls 12 and 13.

In the structure described so far, there would be a tendency for the horizontally directed, filtered air passing through the prefilter and the final filter 17 to strike the bell jar 32 and follow a curved path around it in such a manner as to create eddy currents. It will be readily seen that it would be possible under such circumstances for air in the room in which the clean air work station is located to be drawn into the space around the bell jar. This would result in dust being introduced despite the filtering. To avoid this problem, I provide a shield 55 which may be formed of sheet metal and which comprises a horizontal leg 56 and a vertical leg 57. The vertical leg 57 may be maintained in suitably spaced relationship with respect to bell jar 32 by two rods 59 and 60 which are secured in any suitable manner to the bell jar and are secured to the vertical leg 57 of the shield. The horizontal leg 56 extends over the top of the bell jar and has an opening therethrough, through which passes the rod 42 which raises and lowers the bell jar. The vertical leg 57 of the shield extends downwardly for substantially the full vertical extent of the bell jar 32. The lower end 62, however, is spaced somewhat above the upper work surface of the work panel 15 so that a certain amount of air may pass beneath the lower edge of the rear leg 57. The purpose of this will be explained later. It will also be noted that both the horizontal leg and the vertical leg 57 of shield 55 have a width greater than the diameter of the bell jar 32 so that they extend slightly beyond the bell jar both in the back and over the top thereof.

As a result of the shield 55, the air passing horizontally through the laminar filter 17 is deflected by shield 55 and does not engage the bell jar 32, except at the bottom thereof. In other words, that portion of the work area occupied by the bell jar, with the exception of the extreme lower portion thereof, is blocked off by the shield 55. As a result, there is no tendency for the air to circle around the bell jar and create the eddy currents that would otherwise be caused by reason of the circular nature of the bell jar.

The reason for the lower end 62 of the back leg 57 of shield 55 being spaced above the work surface is that it is desirable that the area immediately adjacent the lower end of the bell jar be continuously swept with filtered air so that when the bell jar 32 is raised, there is no likelihood of any dust or other foreign matter being present on the top surface of the plate 33. While it is true that this small amount of air does engage the circular bell jar 32, the amount of this air thus circling the bell jar 32 is so small that any tendency for it to creat eddy currents is relatively minimal.

When the process being conducted under vacuum within the bell jar 32 is completed, the mechanism actuating the vertical bar 44 and the crane arm 43 is actuated to raised the rod 42 and the bell jar 32. Shield 55 is likewise raised since shield 55 is supported by bell jar 32 and is secured thereto by rods 59 and 60. As the shield 55 is raised along with bell jar 32, filtered air passes beneath the bell jar keeping the parts within the bell jar 32 swept with filtered air. At the same time, since the shield moves upwardly with the bell jar, the upward movement of the bell jar creates no turbulent effect in the upper portion of the work space.

The action of the shield 55 is diagrammatically illustrated in FIGS. 3 and 4 in which only a small portion of the clean air work station is shown. Arrows have been employed in these figures to designate the direction of air flow through the filter 17. Where the air flow takes place over the entire width of the work space, the arrow appears in solid lines. Where, however, the air flow only takes place on either side of the bell jar 32, the arrow is shown in dotted lines. FIG. 3 shows the manner in which the air flows when the bell jar is in its lowered position in which a vacuum is being maintained. FIG. 4 shows the position in which the bell jar is maintained when it is in its raised position. It will be noted from FIG. 3 and by observing the arrows indicat-

ing the path of flow that except at the bottom of the bell jar, no air flow takes place in the area occupied by the bell jar. There is, however, air flow at the bottom to sweep the work table **15** of any possible foreign particles. When the bell jar is raised, however, the shield **55** is likewise raised and air can flow through the filter **17** beneath the jar, over the full width of the work area.

It will also be noted from the various figures of the drawing that the filter **17** extends upwardly to a point above the travel of the uppermost end of the bell jar **32** and shield **55** with respect to filter **17** is shifted. Thus, the movement of bell jar **32** and shield **55** affects in no way the total air flow through filter **17** so that the air flow remains constant at all times.

While I have shown and described the invention in connection with the bell jar, it is to be understood that it is equally applicable to any large object which normally rests upon the work surface and which it may be necessary to raise at times above the work surface.

It will be seen that I have provided a clean air work station in which a large object, such as a bell jar may be resting on a work surface or may be resting above it and in which means are provided to prevent the object from creating a turbulent effect such as to draw in room air into the work space. It will further be seen that this is accomplished by a very simple arrangement in the form of a shield which is secured to and movable with the object. While the shield prevents direct impingement of the air on the bell jar or other object over most of the area thereof, a small portion adjacent the work surface is allowed to engage the bell jar to make sure that the supporting surface adjacent the bell jar is at all times swept with filtered air. In general, while I have shown a specific embodiment of my invention, it is to be understood that this is for purposes of illustration only and the invention is to be limited solely by the scope of the appended claims.

I claim as my invention:

**1.** A clean air work station comprising:

a cabinet having a horizontal work panel disposed above the floor and forming a horizontally disposed work surface,

said cabinet having a portion extending substantially vertically behind and above said work surface and having a chamber therein forming a plenum chamber with an opening in the front of said chamber,

laminar filter means secured in said opening directing in a generally horizontal direction any air flowing therethrough,

means associated with said cabinet for forcing air into said plenum chamber and out through said filter means,

an object disposed on said work surface and projecting a substantial distance thereabove,

means for raising said object above said work surface,

a shield disposed between said filter means and said object for substantially preventing the air passing through said plenum chamber from engaging said object and thus creating turbulent air flow in the space adjacent said object,

and means effective when said object is raised to cause said shield to be moved with respect to said filter means to allow filtered air to flow through the space above said work surface and beneath said object.

**2.** The work station of claim **1** in which the object is a bell jar.

**3.** The work station of claim **1** in which the shield when in its operative position is spaced slightly above said work surface for allowing limited air flow to engage said object immediately above said work surface to sweep said work surface free of foreign particles.

**4.** The work station of claim **1** in which said shield has a vertical portion extending between said inverted chamber and said filter means and a further portion extending at least partially over said chamber.

**5.** The work station of claim **1** in which said opening and said laminar filter means extend upwardly to a point above the uppermost point of movement of said object so that even when said object is in its uppermost position filtered air flows across the top thereof.

**6.** The work station of claim **5** in which said shield is secured to said inverted chamber and is movable therewith so that as said object is raised said shield is likewise raised to maintain constant the total obstruction presented by said object and said shield to the flow of filtered air.

**7.** The work station of claim **1** in which the object is a bell jar and in which there is means disposed beneath said work surface for evacuating said bell jar for performing therein operations on work pieces which operations must be performed under a vacuum.

**8.** The work station of claim **7** in which the shield is in the form of an angular plate having a substantially vertical leg extending between said bell jar and said filter means and a horizontal leg extending above and secured to said jar to support said shield on said jar.

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