

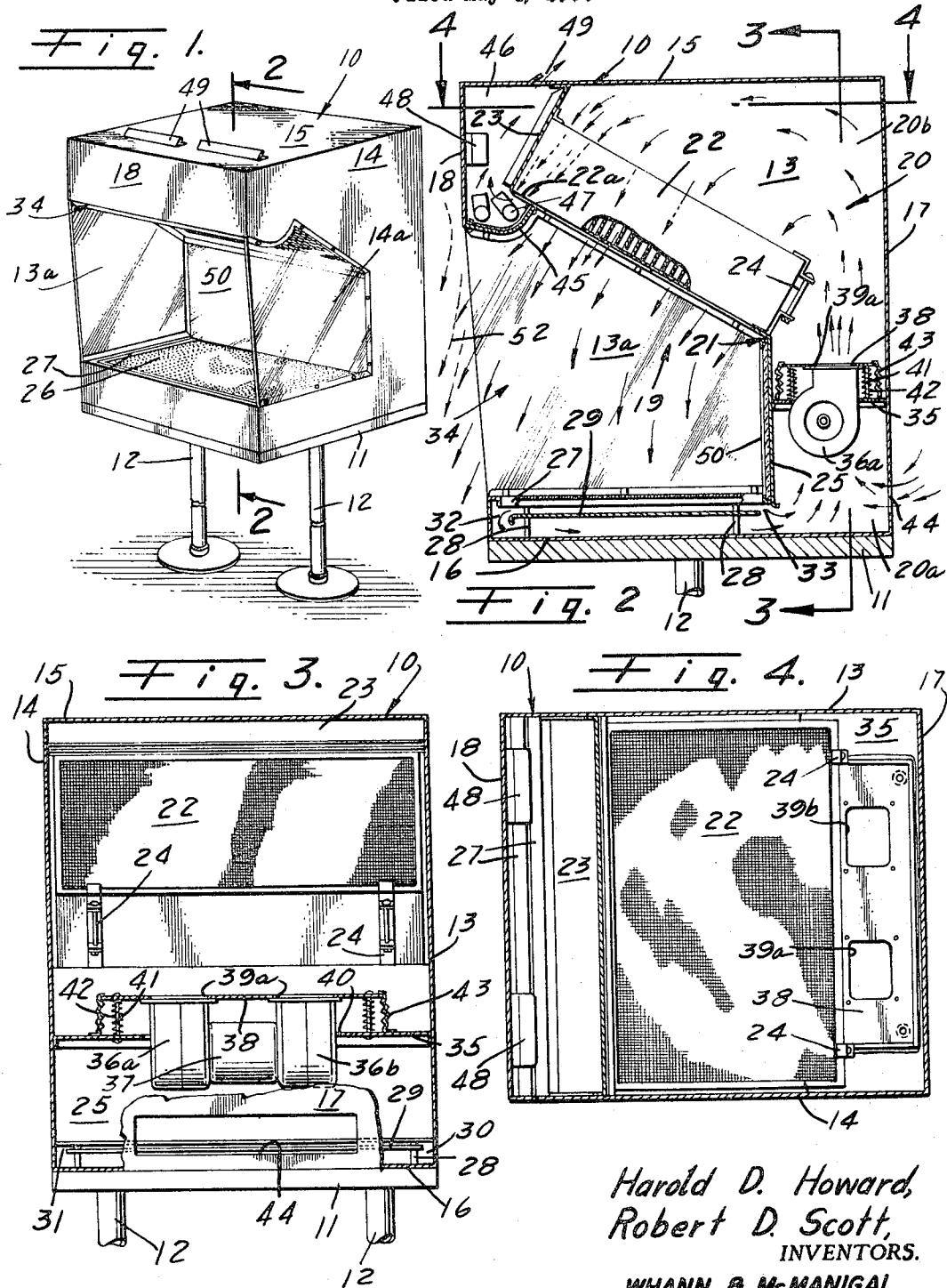
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ANTICONTAMINANT WORK BENCH

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ANTICONTAMINANT WORK BENCH

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The present invention relates generally to the elimination of environmental contamination in working areas such as clean rooms and the like, and is more particularly concerned with a portable, self-contained work bench unit having an environmental controlled working area or space which is directly accessible to an operator.

Heretofore, anticontaminant work bench units of the character described herein have in the main embodied arrangements which are basically objectionable in that the environment controlling medium, such as air, is supplied from ambient contaminated room air which is filtered or otherwise treated, conducted to the "clean" working area, and from which it is then discharged together with any contaminating matter back into the room. Having in mind the inherent disadvantages of the present units in this respect, the present invention proposes to provide an arrangement which utilizes a self-contained closed circulatory system for the environment controlling fluid medium. As thus arranged, little if any contaminated fluid will be returned to the room, and the room air will be utilized as a source of supply for make-up to supplement the circulated medium.

The prior devices have also been objectionable in that the clean air entered the work space or area from the back and was discharged into the room through the operator's access opening to the work area. The operator was thus continuously subjected to a draft which was not only distracting, but also created a health hazard. In applicants' arrangement, the cleaned fluid, such as air, enters the top of the work space and is removed from the bottom of the work space in such a manner that the contaminated fluid will not be discharged onto the operator, nor will the operator be subjected to objectionable drafts.

A further object is to provide a noncontaminate work bench unit in which a portion of the clean air or other environmental control fluid is discharged at an angle across the front access opening to the working space so as to provide an air curtain of clean air which will act as a protective shield against flow of ambient room air into the work space, and at the same time the movement of the shield forming air will set up a flow of room air at the entrance in a direction which will tend to carry the room air away from the access opening, while permitting free access of the operator to the working space.

A further object is to provide in a unit of the character described a substantially closed circulatory path for the environmental controlling fluid, which includes the working space, and wherein the flow may be varied with respect to different parts of the work chamber, and which will permit the flow to be more concentrated at the front access opening of the working space.

A further object of the invention is to provide an improved fluid circulating means which is spring mounted in the circulatory flow path of the environment controlling fluid, this mounting being such that objectionable vibrations will be materially reduced.

Other objects of the invention are to improve the psychological and physical working conditions with respect to the work space. One of these is to provide a work space in which the configuration is such that the access opening at the front of the work space will be of materially greater area than the back closure of the

work space, whereby greater freedom will be permitted the operator to accomplish the various movements required in the work space without being impeded in such movements. Another innovation is to provide illuminating means at the top of the access opening, the illuminating components being cooled by a portion of the delivered clean air, thus making the environment at the access opening more comfortable for the operator. Further, the back closure of the work space carries a reflecting mirror which will reflect light from the illuminating means onto the back side of articles in the work space and also facilitate the operator's viewing indirectly the back side of these articles while performing various operations thereon. This is an especially desirable innovation over the arrangements of previously objectionable units in which the operator had to look directly at the filter mounted in the back wall of the work space.

Another object resides in the provision of a removable floor or bottom in the work space, which facilitates the recovery of small members which might be dropped and inadvertently passed through openings in the floor.

It is also an object to provide a unit of the character described in which the side panels of the work space are removable to permit the side-by-side connection of units to form an extended working space to accommodate progressive operations by a plurality of operators, each space being individually served by its built-in filter system and fluid circulating duct.

Further objects of the invention will be brought out in the following part of the specification, wherein detailed description is for the purpose of fully disclosing the invention without placing limitations thereon.

Referring to the accompanying drawings, which are for illustrative purposes only:

FIG. 1 is a perspective view of an anticontaminant work bench embodying the features of the present invention;

FIG. 2 is an enlarged transverse section taken substantially on line 2—2 of FIG. 1, and showing the cooperative relationship of the various parts of the unit;

FIG. 3 is a fragmentary back view with portions of the back wall cut away, and including a vertical section taken substantially on line 3—3 of FIG. 2; and

FIG. 4 is a horizontal top sectional view taken substantially on line 4—4 of FIG. 2.

Referring generally to the drawings, for illustrative purposes, the anticontaminant work bench of the present invention is disclosed in FIG. 1 as generally comprising a box-like housing, as generally indicated by the numeral 10, which is supported upon a platform 11 or other suitable elevated support, the platform being in this case supported in an elevated position by means of floor pedestals 12—12.

More specifically, the housing 10 is formed to provide spaced side walls 13 and 14, a top wall 15, bottom wall 16, back wall 17 and front wall 18.

The space enclosed by the housing 10 is divided into a work area or space chamber 19 and a fluid conducting duct system 20, by means of a transversely extending partition structure 21 which will be subsequently described in detail.

As best shown in FIG. 2, the top of the work chamber 19 is formed by a portion of the partition structure 21 which contains a sub-micron particle filter 22 that extends between the housing side walls 13 and 14 and is supported in a forwardly upwardly inclined position substantially at an angle of the order of substantially 32° to the horizontal. The forward end of the filter is supported in a transversely extending baffle wall 23, this baffle wall being rearwardly spaced from the upper margin of the front wall 18.

The back end of the filter 22 is secured by clamp members 24—24 to the upper margin of a transversely extending baffle wall 25 of the partition structure and which forms a rear closure for the work chamber 19.

The bottom of the work chamber is composed of an elevated plate member 26 which is composed of a suitable foraminate material contained within a marginal peripheral metal frame 27 by means of which it may be removably supported as a unit to form the working surface of the work chamber 19. The plate 26, for example, may be of a plastic or other suitable material which is pierced with small holes of the order of .115" diameter and arranged in a pattern which will produce about 40% open area in the plate. This plate is shown in FIG. 2 as being supported in an elevated position on a plurality of upstanding pin or post members 28 which extend through and support a nonforaminate baffle 29 in an intermediate spaced position between the plate member 26 and the bottom wall 16 of the housing. As thus supported, peripheral gaps or slots may be formed as indicated at 30 and 31 along the sides of the work chamber, at 32 at the front of the work chamber, and 33 at the back or rear of the work chamber. It will be apparent that by relatively proportioning the areas of these gaps, flow of air or other fluid, as will hereinafter be more fully explained, from the work chamber 19 may be regulated so as to more or less concentrate and proportion the flow in different portions of the work chamber.

As clearly shown in FIGS. 1 and 2, the mounting of the filter 22 in a forwardly and upwardly inclined position produces a very desirable and improved configuration for the working chamber which results in the formation of an enlarged entrance at opening 34 at the operator's position at the front of the housing. As thus arranged, the operator has more freedom of movement to perform the required operations within the work chamber.

Provision is made for circulating an environment controlling fluid of desired composition, and which may simply comprise air, through the work chamber, this fluid entering through the filter 22 and leaving through the bottom of the work chamber via the plate member 26. This circulation is by means of the duct system 20. As shown in FIG. 2, a transversely extending baffle wall 35 is mounted rearwardly of the baffle 25 and extends between it and the back wall 17 of the housing, the ends of the wall extending to the respective side walls 13 and 14. The baffle wall 35 is peripherally sealed and divides the duct system into an inlet chamber 20a which communicates with the bottom of the work chamber 19, and an outlet chamber 20b which communicates with the top of the work chamber 19 through the filter 22.

For moving the fluid through the duct system, suitable apparatus is provided which in the present instance comprises dual blowers 36a and 36b that are driven by a common motor power source 37. The blower scrolls have their discharge ends connected with a supporting plate 38 in such a manner that outlet fluid from the blowers will pass through discharge ports 39a and 39b respectively into the outlet chamber 20b. The blower unit extends downwardly through an opening 40 in the baffle wall 35 so that vibrations of the unit will not be carried directly to the wall. As shown, the supporting plate 38 is resiliently mounted on a plurality of guide pins 41 having surrounding coiled springs 42, each spring extending between the baffle wall 35 and the supporting plate 38. These springs thus form a resilient support and prevent the vibrations from being carried to the work bench structure. The periphery of the plate 38 is sealed with respect to the baffle wall 35 by means of a flexible peripheral apron 43 of plastic or other suitable material.

As thus described, the work bench of the present invention includes a closed circulatory system for the environment controlling fluid, wherein the major portion of the fluid is utilized over and over and is not dis-

charged into the surrounding room area as in the formally available devices. During this operation, it may be necessary to supply a relatively small amount of make-up air from the surrounding ambient atmosphere. Provision is made for supplying make-up air to the inlet chamber 20a by providing an inflow opening 44 in the back wall of the housing, as shown in FIG. 3. By varying the size of this opening, the percentage of make-up air may be varied to suit particular installations and operations.

It is an important general aspect of the present invention that the work space shall be well and efficiently illuminated and that the operator shall not be subjected unduly to physical or psychological strain when working and performing operations within the work chamber. In carrying out this phase of the invention, it is proposed to provide illuminating means at the top of the entrance opening 34, and position it so that the illumination therefrom will be shielded from direct impingement upon the eyes of the operator, and further utilize this illumination for indirectly lighting and illuminating the object and work generally both directly and indirectly so that the back sides of the work may be illuminated. More specifically, as best shown in FIG. 2, there is provided below the upper end of the filter 22, a light transmitting panel 45 which is supported between the side walls of the housing, and has its lateral edges terminating respectively at the front wall 18 of the housing, and at the upper end of the filter 22 along a locus line which is inwardly spaced from the upper end of the filter so as to provide a filter end portion 22a through which a portion of the filter discharge will enter a lighting chamber 46 which is formed by the light transmitting panel, the upper portion of the housing front wall 18, the baffle wall 23 and the front marginal portion of the housing top wall 15. The lighting chamber contains one or more elongate fluorescent tubes 47, which are placed adjacent the light transmitting panel 45, as well as the necessary auxiliary devices such as the ballast units 48. These lighting units generate an appreciable amount of heat, and in the absence of cooling would become a source of inconvenience to the operator working within the work chamber 19. However, by utilizing a portion of the filter discharge taken from the filter portion 22a, and conducting this over the illuminating tubes and other devices in the lighting chamber and discharging the air through one or more outlet louvers 49 in the top wall 15 of the housing, it is possible to keep this portion comfortably cool.

It will be further observed that with the illuminating tubes in this position, light rays will be conducted away from the operator and onto the work within the work space. Provision is further made for efficiently utilizing these rays to indirectly illuminate the back side of the work by providing a suitable reflecting surface, such as a mirror 50 on the forward surface of the baffle wall 25. This mirror not only reflects the light from the illuminating source, but also permits an operator to visually observe the back side of the objects which are normally obscured from direct vision.

Additional side lighting is obtained in the work space by providing transparent wall sections 13a and 14a respectively in the housing side walls 13 and 14. These transparent wall panel sections are removably mounted, and when removed permit the mounting of a plurality of housings 10 of separate bench units in side-by-side connected alignment so as to provide an elongate work space within which successive operations may be performed under noncontaminant conditions. Each of the work stations thus has its own self-contained fluid circulating system.

One of the most outstanding and important features resulting from the operation of the work bench of the present invention is due to the manner in which the environmental control fluid is discharged into the top portion of the work chamber 19. Due to the inclination of the filter 22, the fluid discharge adjacent the light trans-

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mitting panel 45 will be directed at an angle such that this portion of the fluid discharge will travel outwardly and downwardly through the entrance opening 34 in a manner to form a curtain of clean air which is interposed between the outside surrounding space and the space within the work chamber 19, thus serving to prevent contamination of the work space by surrounding room air. The path of this air curtain is illustrated by the direction of the arrow as indicated by the numeral 51. The movement of fluid in this screen portion is in a direction such that room air, as indicated by the dashed line arrows 52, will be deflected outwardly and away from the entrance opening 34 of the work chamber. Both the room air and the protective curtain air move in a downward direction across the front of the housing 10 and are not blown directly onto or into the face of the operator. As will be evident, this air curtain substantially separates the work compartment 19 from the surrounding room and there is only a minimum of contaminated air discharged into the surrounding room.

From the foregoing description it is believed that it will be readily appreciated that the delineated objects of the invention will be readily accomplished by the described structure.

Various modifications may suggest themselves to those skilled in the art without departing from the spirit of our invention, and, hence, we do not wish to be restricted to the specific form shown or uses mentioned, except to the extent indicated in the appended claims, wherein various portions have been separated for clarity of reading and not for emphasis.

We claim:

1. The combination providing an anticontaminant working space, comprising:

- (a) housing means defining a working chamber having a top wall structure including an air filter having a front face area with fluid flow discharge openings therein extending across substantially the entire width of said chamber;
- (b) bench means including a top working surface having openings therein, said working surface being positioned in the working chamber below the area having the fluid flow discharge openings therein and providing with said top wall structure an access opening to the bench top working surface;
- (c) duct means defining a fluid flow path exteriorly of said working chamber and having end connections in communication respectively with said discharge openings of the top wall structure and said bench top working surface openings;
- (d) means for moving a fluid in said path and through said working chamber between said top wall structure and the bench top working surface; and
- (e) said filter front face area having at least a portion thereof inclined with respect to the bench top working surface so that a portion of the discharged fluid will be directed through the access opening and form an air curtain extending thereacross.

2. The invention as defined in claim 1, wherein said

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filter front face area is inclined upwardly and forwardly with respect to the bench top working surface.

3. An anticontaminant work bench unit, comprising:

- (a) a box-like housing having front, rear, top, bottom and side walls, said front wall having an opening extending substantially throughout its width, the upper edges of said opening being spaced from said top wall;
- (b) a work chamber in said housing, said opening providing the entrance to said work chamber;
- (c) a perforated work plate forming the bottom of said chamber, said plate extending rearwardly from the lower edge of said opening to points spaced from the rear wall;
- (d) a baffle division wall extending upwardly from said points;
- (e) an air filter positioned in the upper portion of said housing between said baffle and front wall with the front end thereof in spaced relation to said front wall, said filter having a substantially planar lower discharge face extending from the upper end of said baffle upwardly and forwardly at an obtuse angle thereto toward said front wall but terminating short thereof;
- (f) illuminating means positioned in said space between the upper end of the filter and the front wall but below said plane of the discharge face;
- (g) the spaces below said work plate, the space to the rear of said baffle, the space above said filter, and the work chamber space being in communication with each other and forming an air circulating path; and
- (h) an air circulating blower in said path and providing forced circulation of said air through said filter downwardly toward said work plate throughout the width of the opening.

4. The invention as defined in claim 3, wherein a mirror is positioned on the front face of said baffle wall.

5. The invention as defined in claim 3, wherein the space at the upper end of the filter including the illuminating means is in air circulating communication with said air circulating path.

6. The invention as defined in claim 3, wherein the said blowers are positioned in the space between the baffle wall and the rear wall of the housing.

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