May 17, 1966 A. K. BAKER 3,251,177

DUST-FREE BENCH

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FIG.1

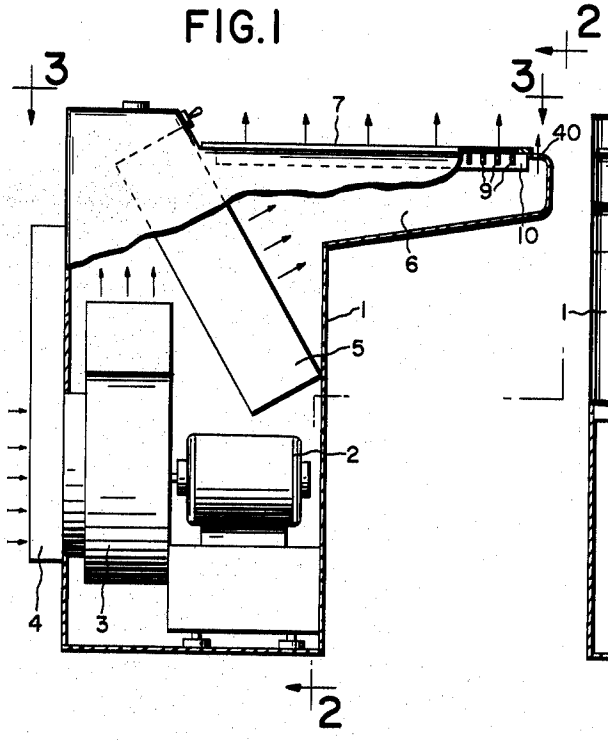


FIG.2

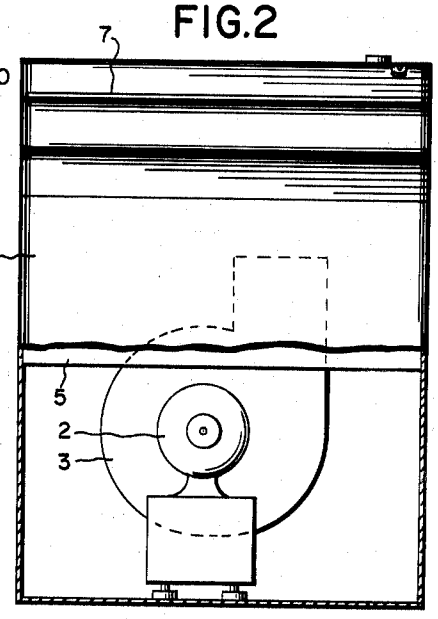


FIG.3

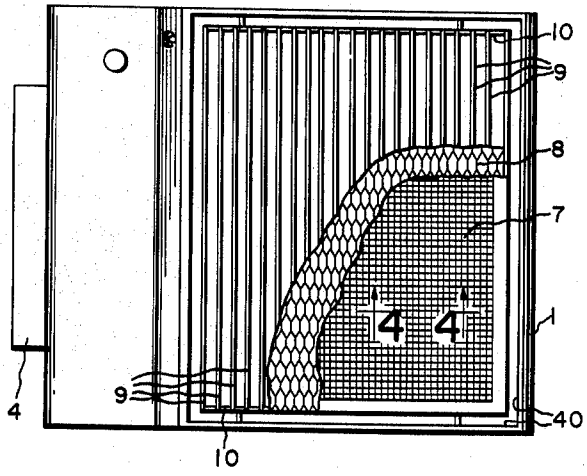
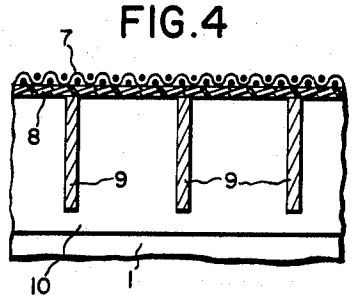


FIG.4



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FIG.5

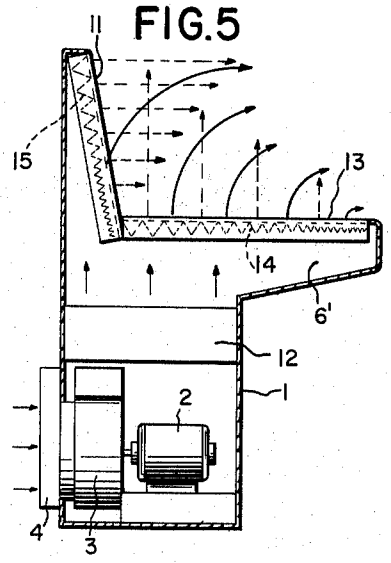


FIG.6

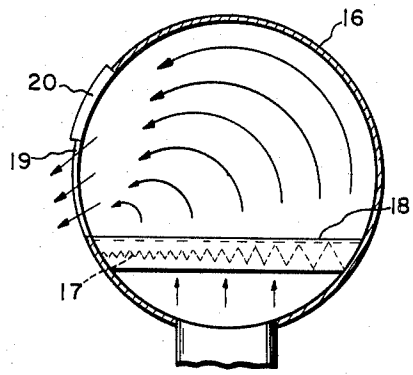


FIG. 7

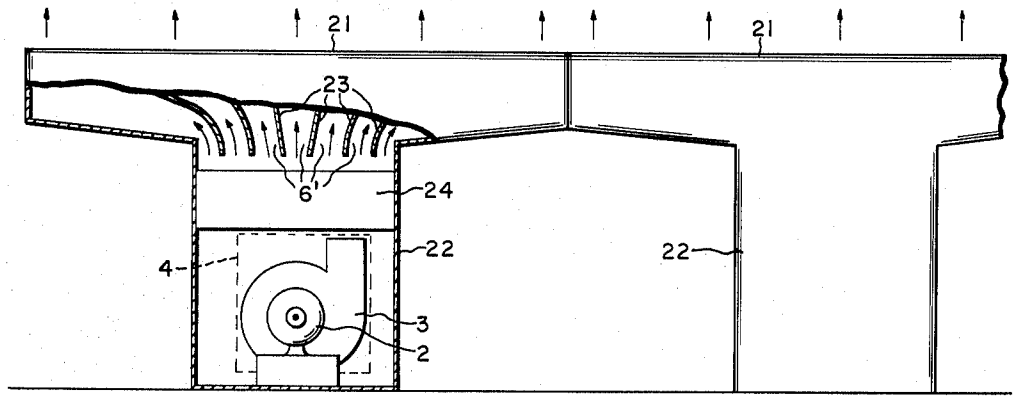


FIG.8

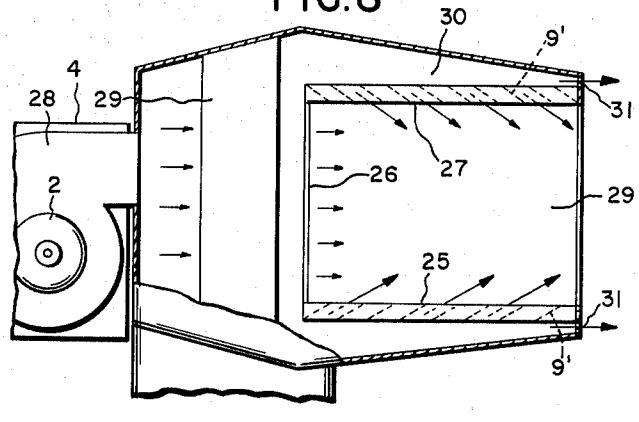




FIG. 9

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DUST-FREE BENCH

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3 Claims. (Cl. 55—385)

This invention relates generally to dust-free benches, and has reference more particularly to a novel bench of this character that provides clean air over the entire upper working surface of the bench, the air moving upwardly from the working surface so as to prevent dust or other particles from falling thereon.

Dust-free benches as heretofore constructed generally provide for the movement of air substantially transversely over the upper surface of the bench, flowing as from the back thereof or from above, but such prior type benches do not prevent the lodging of dust on the bench surface, nor does such transversely moving air necessarily remove dust that may be upon the surface of the bench or from the work thereon, particularly if the specific gravity of the dust is high.

The principal object of the present invention is to provide a novel dust-free bench that is so constructed and arranged as to direct absolutely filtered air upwardly through the bench surface, thereby maintaining a zone of dust-free air over the surface of the bench and for a definite volume above the same, whereby any dust or dirt tending to fall upon the bench or upon articles being worked upon is carried away and removed from the bench and from the articles thereon.

A feature of the present invention is to provide a novel bench of the above character that produces a vertical cube of clean air over the working area of the bench, said bench being adapted for use without the necessity of employing hoods or enclosures which make it difficult to get to the work readily and also eliminates use of access windows and eye loupes.

Another feature of the present invention is to provide a novel bench of the above character that enables ready access to all portions of the top of the bench from the front or sides of the bench, thereby enabling the worker to get closer to his work, said bench eliminating the use of overhead lights and the consequent glare and providing plenty of knee space for the workers and enabling assembly line work where desired.

Another feature of the present invention is to provide a novel bench of the above character that can provide a differential flow of air, as where a central sheath of air moves at a lower velocity and a surrounding sheath of air moves at a higher velocity, whereby dust is prevented from getting anywhere near the bench proper.

These and other features and advantages of the present invention will become more apparent after a perusal of the following specification taken in connection with accompanying drawings wherein:

FIG. 1 is a side elevation with parts broken away of the novel dust-free bench of the present invention;

FIG. 2 is a view in front elevation of the bench broken away along line 2—2 of FIG. 1;

FIG. 3 is a plan view of the structure of FIG. 1 with a large portion of the top structure broken away;

FIG. 4 is an enlarged fragmentary section taken along lines 4—4 of FIG. 3;

FIG. 5 is a figure similar to FIG. 1 showing schematically a somewhat modified construction;

FIG. 6 is a schematic sectional view showing another modified construction;

FIG. 7 shows schematically a plurality of benches arranged in a line incorporating the novel features of the present invention and employs features of the bench structure of FIG. 1;

FIG. 8 is a partial sectional view of still another modified structure, and

FIG. 9 is an enlarged sectional view of the variable resistance filter used in FIGS. 5 and 6.

Similar characters of reference are used in the above figures to designate corresponding parts.

Referring now to FIGS. 1 through 4, reference numeral **1** designates a bench housing or casing providing an interior chamber having a motor **2** in the lower portion thereof positioned for driving a blower **3** that sucks air in through a primary or rough filter **4** that may be of spun glass. The blower **3** directs the air upwardly and adjacent to a second and preferably fine or positive filter **5** that may be a mechanical filter having a filtering material composed of cellulose glass material, for example. From the filter **5** the air flows as shown by the arrows to a space or plenum chamber **6** positioned below the apertured top of the bench. The plenum chamber and bench top extend outwardly in front of the lower portion of housing **1** to provide leg room for the worker therebelow. The bench working surface comprises an upper screen **7** which may be 30 mesh stainless steel shown resting upon expanded metal such as diamond grid aluminum lath or other lath **8**, which in turn rests upon mutually spaced transverse bars or vanes **9** as of aluminum arranged vertically on edge that are supported at their ends upon bars **10** supported upon but detachably attached to the upper inner side walls of the housing **1**. The transverse bars or vanes **9** are arranged on edge with their sides extending vertically so as to direct air upwardly in use as will further appear. The working top of the bench thus constituting screen **7**, lath **8**, and metal bars **9** and **10** are removable as a unit from the casing **6** when desired.

Thus, in use, the air leaving the second filter **5** flows into the plenum chamber **6** and upwardly through the working top of the bench, the bars **9** which may be of aluminum serving to direct the air upwardly. In actual practice, a bench having a work surface of 18 by 24 inches may have 500 cubic feet or more of air per minute flowing upwardly through its top surface so that dust, dirt, and other foreign objects are prevented from lodging upon the bench top, whereby work placed on top of the bench is maintained clean and free from dust. Since the bench does not have any hood or cover, all parts thereof are easily accessible and work can be moved thereover in a continuous-flow manner, if desired. Experience has shown that even though a relatively large volume of air flows through the upper surface of the bench continuously in use, no ill effects are felt by the workers. The workers like the bench not only because by eliminating boxed enclosures, it enables them to get to all parts of the bench top readily and to easily place objects on the bench and take them off, but in addition glare of overhead lights customarily in closed-type benches is eliminated, i.e. those having hoods or covers.

Dirt generated by assembly operations is almost immediately blown away from the critical work area and the steady large supply of clean air prevents outside contamination and prevents such contamination from being carried back into the area by eddy currents, which often happens with covered benches or co-called "clean" benches. The novel bench is especially desirable for handling large bulky equipment or some continuous flow operations since each of the bench units purifies its own large volume of air in any room in which it is located, giving a thorough air overhaul every few seconds without changing the room in any other way or necessitating the use of special equipment and clothing, and thus greatly decreasing the dust count in the room. Any floating airborne debris will not drop down into the working surface. For example, tests with cigarette ashes will show that they hover high

above the work area. In some installations it is desirable to provide high velocity air around the periphery of the screen 9, in which case openings are provided as at 40.

In the form of the invention shown in FIG. 5, the structure is similar to the earlier figures except that the bench is provided with an inclined back 11 that has a screen or grating at its front so that air can flow outwardly through this back toward the front of the bench as well as upwardly through the perforated top of the bench. As a further refinement, this bench is designed for a differential or graduated air flow from the upper surface and from the back 11. The rough filtered air from blower 3 passes through a fine filter 12 shown disposed horizontally of the chamber of the casing 1 and from thence into the plenum chamber 6' which extends beneath the bench top 13 and beneath the inclined back 11. In addition to the gratings such as those in the earlier figures, the bench top 13 is provided with variable resistance filter 14 below the grating 9. The back 11 is also shown provided with a variable resistance filter 15. These filters are formed with bellows-like folded material 31 (see FIG. 9) wherein the folds as of the bench top are relatively small at the front of the bench and get progressively bigger towards the rear of the bench, whereby the air flow and hence the air velocity through the top 13 of the bench increases progressively from the front towards the back thereof. The bigger folds at the rear of the bench provide a great deal more surface area than the small folds at the front and while the air velocity per unit of filter area is the same, a great deal more air exudes from the rear of the bench top than from the front, due to the greater filter area there, so that the greater volume of air escaping at the rear of the bench top creates a higher velocity of air flow at the rear. The velocity of the upward flow of air increases progressively from the front towards the rear of the bench top due to progressively increasing filter area.

Similarly, the filter 15 of the variable flow unit type of the bench back 11 has its folds increasing in dimensions progressively from the bottom toward the top thereof whereby the flow of air through the back 11 increases progressively from the bench top 13 to the top of the back. Thus, the velocity of the air leaving the bench back 11 above the bench increases with the distance above the top 13, and since the air from the back 11 combines with the air from the top 13 the air factors combine to produce a high velocity sheath of air well above the bench, the velocity actually increasing with distance from the top, thus effectively preventing dust or dirt from approaching the upper surface of the bench. Actually, the air from the top 13 and the back 11 combine to form a curved trajectory as shown by the solid arrowed lines in FIG. 5. Thus the air is given a forward motion as well as an upward motion so that any dust on the work or worker is blown toward the back of the worker and away from him. Selective directions for flow can be achieved suitably arranging the variable flow filters 14 and 15.

Somewhat similar results are effected in FIG. 6 as compared with FIG. 5 and employing a curved hood 16, providing a working chamber therewithin over the bench 18. However, in this case a single absolute filter 17 of the undulating type with progressively larger bellows starting from the front toward the rear of the bench 18 produces a flow of air as shown by the arrows in FIG. 6, this air escaping through the forward work opening 19. In this structure a window 20 is provided. The higher velocity air adjacent the upper edge of window 19 prevents eddy currents from driving dust into the interior of the hood.

The novel bench of the present invention may be arranged for continuous operations, such as shown in FIG. 7, where work can be passed continuously over successive benches or where it is desired to have a long working bench for any purpose with a number of workers disposed therealong. In this structure the top 21 of the bench constructed as in the earlier figures is continuous in effect. This is accomplished by abutting adjoining benches 22 together, leg room being provided between the successive benches by the overhanging plenum chambers 6'. The benches can be provided with any of the filters shown in FIGS. 5 and 6 if desired, and since these bench tops are shown wider than the casing 22, mutually spaced curved vanes 23 are employed in the plenum chambers 6' for directing the air so as to obtain constant flow from all parts of the top of the bench. The filter 24 may be a fine filter or it may be an absolute filter, depending upon the use. The curved vanes 23 may also be said to aid in directing the air flow in the other benches provided herein, if desired.

In the structure shown in FIG. 8, means are provided for directing air not only through the top 25 of the bench but also through a perforated back wall 26 and through an upper top wall 27, and through the side walls, if desired, such air being directed from a blower 28 through filter 29 into the hood plenum chamber 30 surrounding the bench working space 29. In the case of bench top 25 and the top wall 27, the bars 9' are slanted as shown in dotted lines so as to direct the air at an angle, thereby producing higher velocity air adjacent the surface of the bench top 25 and adjacent the surface of top wall 27, thereby preventing any possibility of eddy currents tending to draw air into the work chamber 29, any work within this chamber being thoroughly washed with air continuously from below, from the back and from above.

In some instances a high speed sheath of air is desired to surround the lower velocity air leaving working space 29. In such case, openings 31 may be provided in the plenum chamber 30 surrounding the working space 29. By reversing the direction of motors 2 the benches can be used to create suction on their upper surfaces to remove solder fumes, for example.

Since many changes could be made in the above construction of the novel dust-free bench of this invention and many apparently widely different embodiments of this invention could be made without departing from the scope thereof, it is intended that all matter contained in the above description or shown in the accompanying drawings shall be interpreted as illustrative and not in a limiting sense.

What is claimed is:

1. A dust-free bench comprising, a bench housing, an intake primary filter carried by said housing for filtering air entering into said housing from the exterior thereof, a blower means within said housing for forcing external air through said filter, said housing having a horizontal perforated working bench top with a portion thereof extending longitudinally outwardly from the main body of said housing to provide clear leg room for workers therebelow, said bench top comprising a plurality of transversely extending mutually spaced bars arranged on edge having vertical sides, expanded metal lath covering said mutually spaced bars and a work supporting screen mounted upon said expanded metal lath, whereby said bench top is vertically perforated throughout the working area thereof, said housing providing a plenum chamber beneath said bench top communicating with said blower means, and a secondary filter within said plenum chamber for filtering air passing therethrough, said bench top bars, lath and screen being removable for access to said secondary filter, said blower means serving to force filtered air from said primary filter through said secondary filter and upwardly through said plenum chamber and vertically through said perforated bench top to thereby remove dust, dirt and other small foreign objects from said bench top, and preventing such objects from lodging upon the same in use or upon the work resting thereon.

2. A dust-free bench as defined in claim 1 wherein said

secondary filter is a variable resistance filter comprising folds of progressively larger dimensions going from the front towards the rear of said bench top and positioned within said plenum chamber beneath said bench top for producing a variable flow of air upwardly through said bench top, whereby the velocity of air pressure through said bench top increases progressively from the front towards the rear of the bench.

3. A dust-free bench as defined in claim 1 wherein said bench housing is provided with a hollow back portion including a perforated front wall above said bench top communicating with said plenum chamber, said back portion having a variable resistance filter therein, whereby the combined air flow from said bench top and back portion in use produce variable velocity air flow above said bench top resulting in a higher velocity curtain of air well above said bench moving forwardly thereof.

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