Oct. 21, 1969 J. MADL, JR 3,473,461

DAMPER-PROVIDED AIR-PASSING FLOOR STRUCTURE

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Fig. 2.

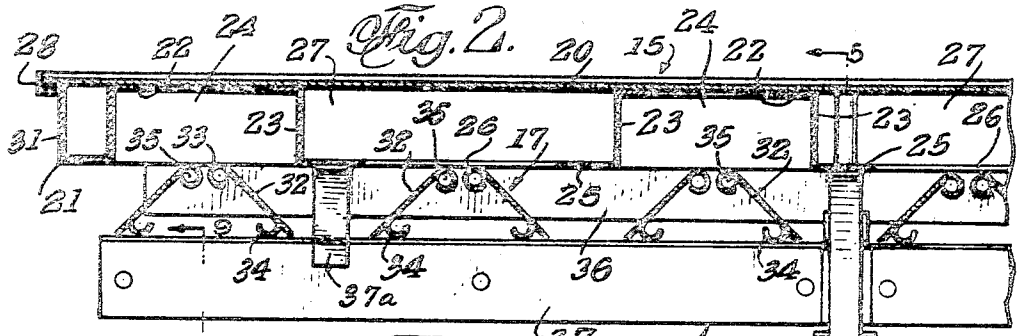


Fig. 3.

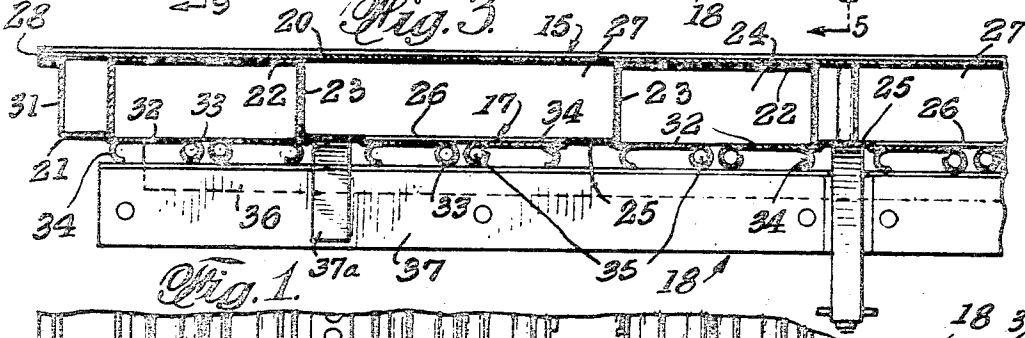
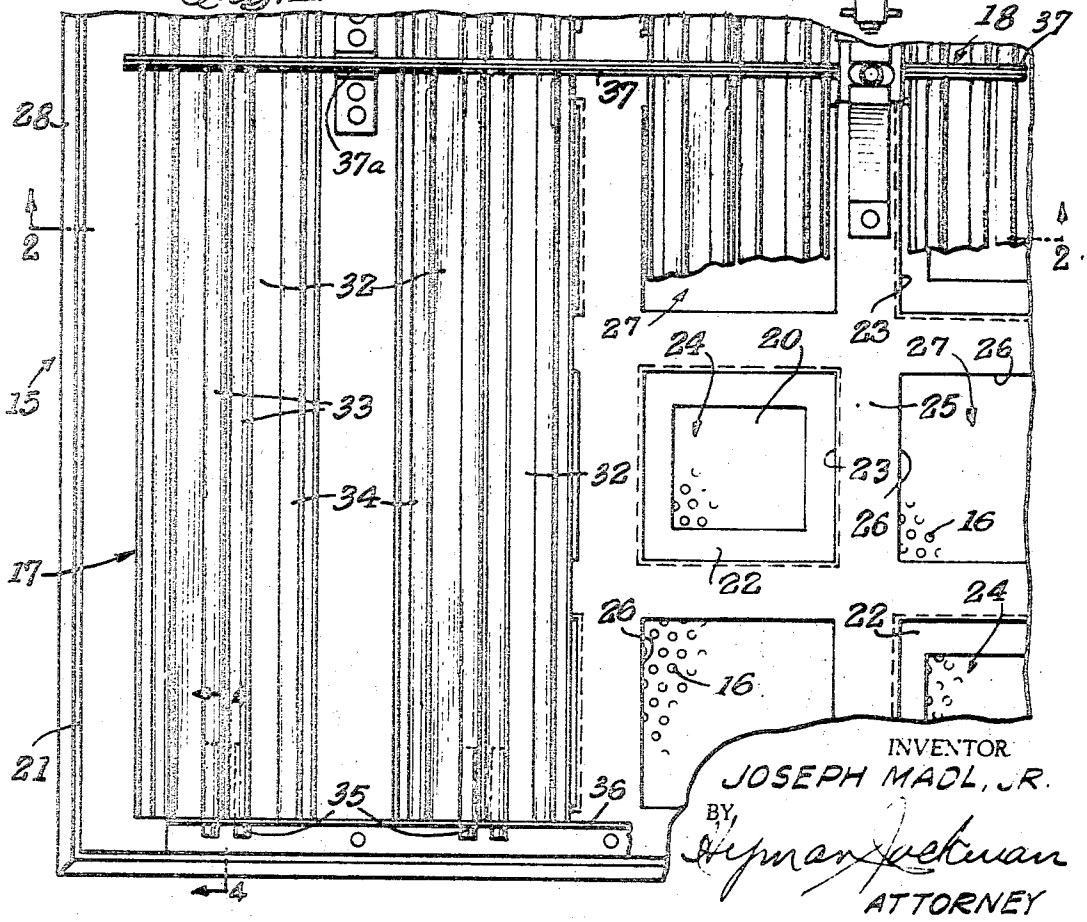


Fig. 1.



INVENTOR
JOSEPH MADL, JR.
BY
Hyman Pekman
ATTORNEY

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Fig. 4.

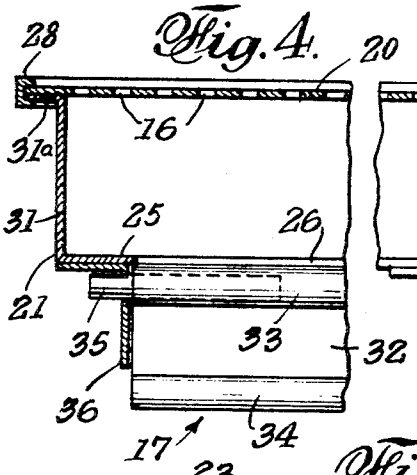


Fig. 5.

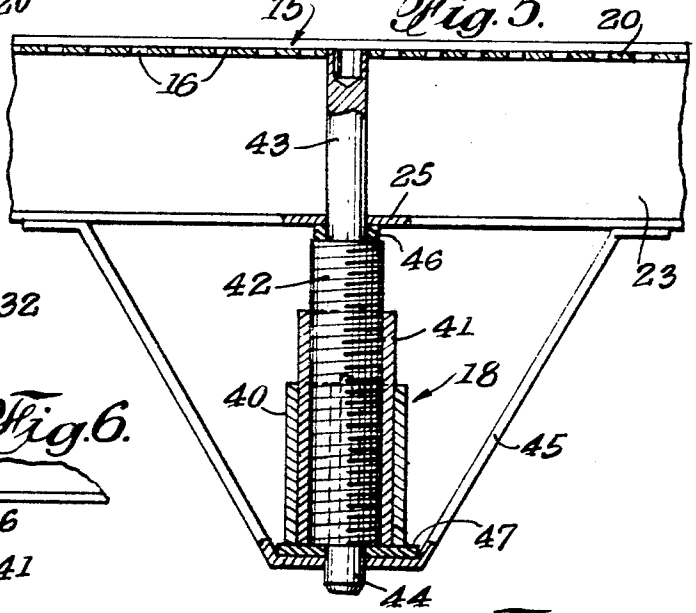


Fig. 6.

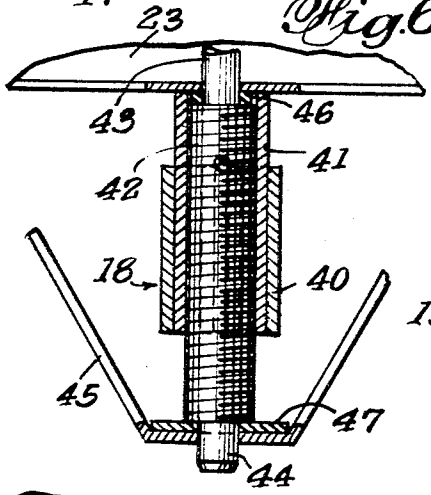


Fig. 8.

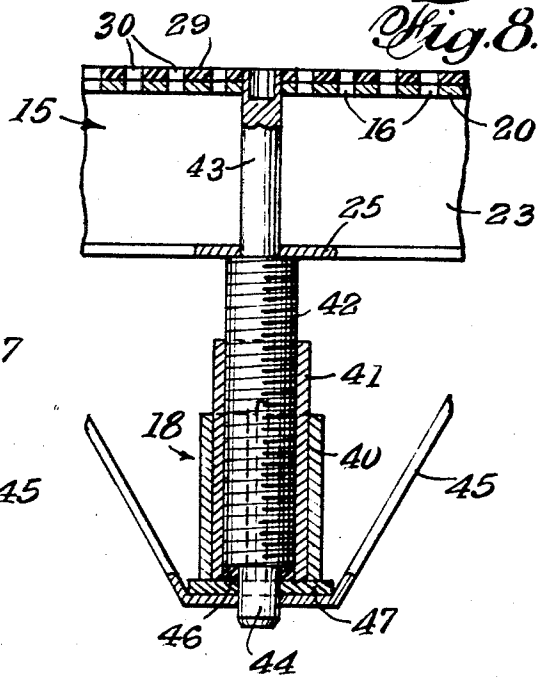


Fig. 7.

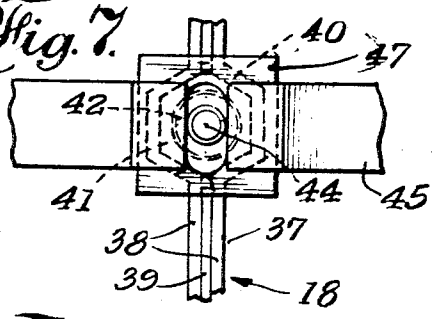
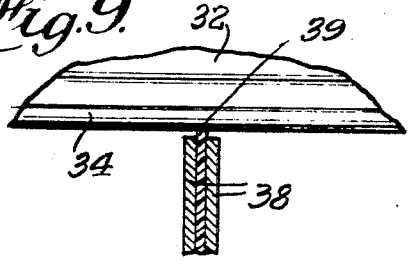


Fig. 9.



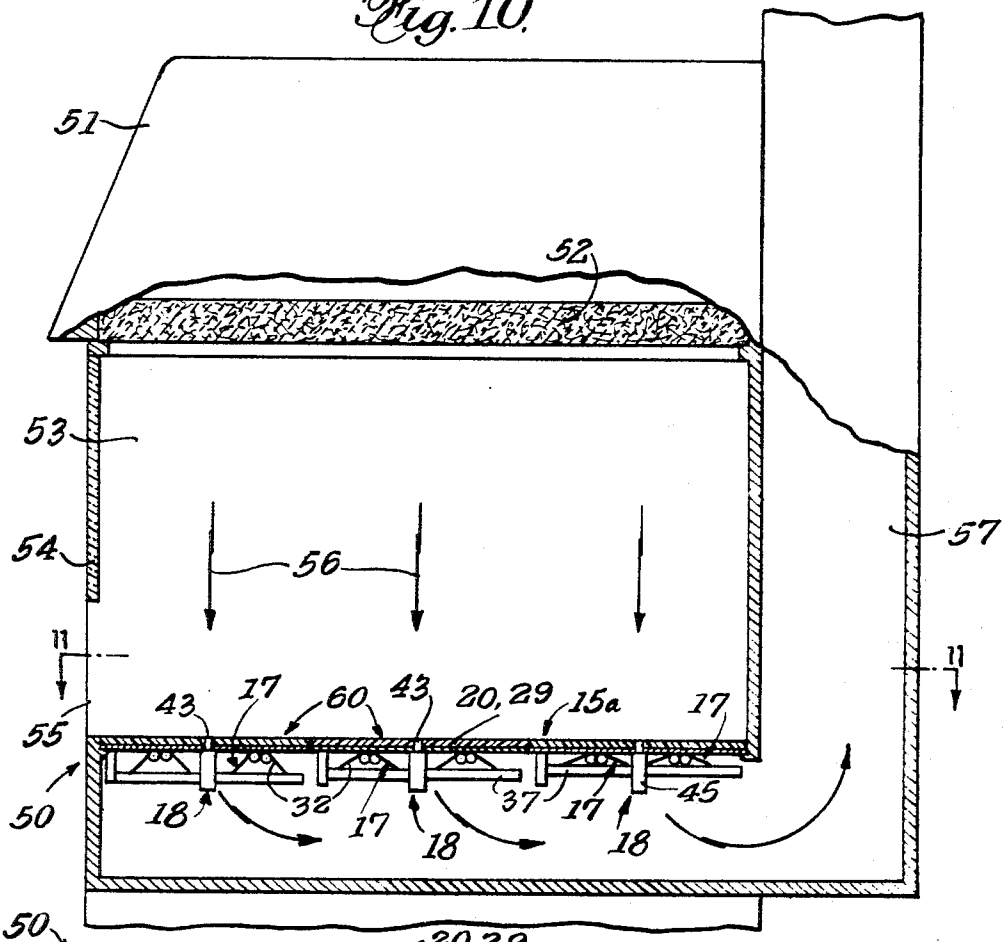
INVENTOR.
JOSEPH MADL, JR.
BY
Hyman Feldman
ATTORNEY

Oct. 21, 1969 J. MADL, JR 3,473,461

DAMPER-PROVIDED AIR-PASSING FLOOR STRUCTURE

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Fig. 10.



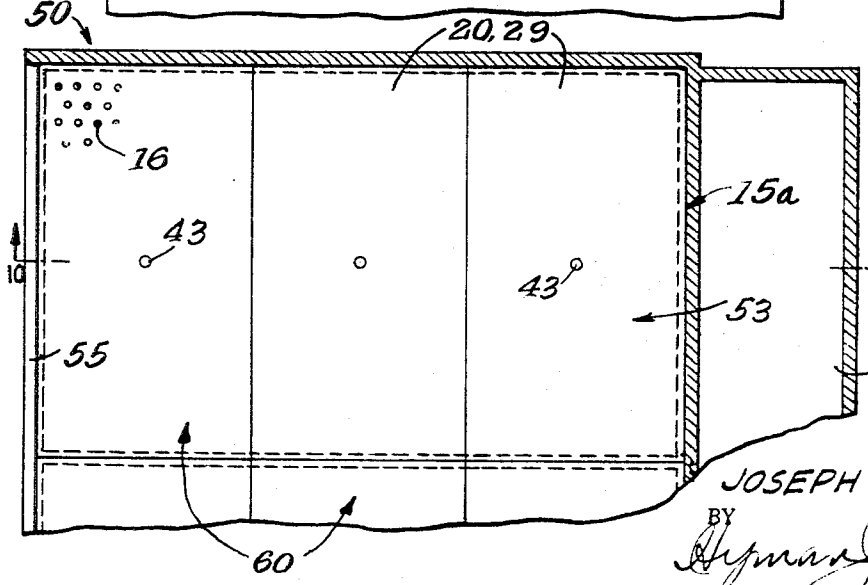


Fig. 11.

INVENTOR
JOSEPH MADL, JR.
BY
Hyman Jackman
ATTORNEY

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3,473,461

DAMPER-PROVIDED AIR-PASSING FLOOR STRUCTURE

Joseph Madl, Jr., 990 Volante Drive, Arcadia, Calif. 91006

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Int. Cl. F24f 7/00
U.S. Cl. 98—31 8 Claims

ABSTRACT OF THE DISCLOSURE

A floor for passing air flow from the area thereabove to the space therebeneath for removal therefrom, said floor being provided with pivotally mounted dampers that, from a normally downwardly angled air-passing position, are movable, by means adjustably regulatable from above the floor, to retracted positions that restrict air flow, the latter means, if desired, comprising a plurality of individually regulatable mechanisms.

BACKGROUND OF THE INVENTION

The present invention, while falling into the same general field as the applicant's patent, entitled "Elevated Floor for Clean Room," issued Jan. 30, 1968, No. 3,366,013, is more particularly adapted for installation in clean work stations, while yet efficient for use as a floor in a clean room. It is an object of the present invention to provide damper means of simplified form and design and also of more compact arrangement to fit more restricted spaces below the floor, thereby enabling low-silhouette design of work stations.

Another object of the invention is to provide damper means in which the components gravitationally seek and retain their adjusted positions and are movable from such positions only when moved by adjustment from above.

This invention also has for its objects to provide such means that are positive in operation, convenient in use, easily installed in a working position and easily disconnected therefrom, economical of manufacture, relatively simple, and of general superiority and serviceability.

The invention also comprises novel details of construction and novel combinations and arrangements of parts, which will more fully appear in the course of the following description, which is based on the accompanying drawings. However, said drawings merely show, and the following description merely describes, preferred embodiments of the present invention, which are given by way of illustration or example only.

SUMMARY OF THE INVENTION

The present invention comprises, generally, a floor component or structure **15** provided with air-passing orifices **16**, damper means **17** carried entirely by said floor structure from the under side thereof, and means **18** for regulating the adjusted position of said means **17**.

BRIEF DESCRIPTION OF THE DRAWINGS

In the drawings, like reference characters designate similar parts in the several views.

FIG. 1 is a fragmentary bottom plan view of a floor structure showing one preferred embodiment of the present invention, with the damper means in open position.

FIG. 2 is a cross-sectional view thereof as taken on the line **2—2** of FIG. 1.

FIG. 3 is a similar view with the damper means in closed position.

FIGS. 4 and 5 are fragmentary cross-sectional views as taken on the respective lines **4—4** of FIG. 1 and **5—5** of FIG. 2.

FIG. 6 is a cross-sectional view similar to FIG. 5, with

the damper means adjusted to the position of FIG. 3.

FIG. 7 is a fragmentary bottom plan view of FIG. 6.

FIG. 8 is a view, similar to FIG. 5, of another preferred embodiment.

FIG. 9 is a fragmentary sectional view as taken on the line **9—9** of FIG. 2.

FIG. 10 is a partly broken and partly vertical sectional view of a work station provided with a floor structure comprising still another preferred embodiment, the plane of section being on the line **10—10** of FIG. 11.

FIG. 11 is a cross-sectional view as taken on the line **11—11** of FIG. 10.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

In the embodiment illustrated in FIGS. 1 through 7 and 9, the floor component **15** is shown as comprising a horizontal top plate **20** in which the orifices **16** are provided, and a sub-floor **21** to which the plate **20** is affixed. Said sub-floor is so formed as to have upper flanges **22** that are provided on the upper end of walls **23** that form rectangular spaces **24**, and a lower horizontal wall **25** at the lower end of the walls **23** and in which rectangular openings **26** are formed in alternating relation with the spaces **24**.

The only portions of the sub-floor **21** that are engaged with the plate **20** are the flanges **23**. All other portions of said plate **20** are unobstructed so air passing through the orifices **16** will enter and pass through the spaces **24**, and air entering the space **27** around the rectangles formed by the walls **23** will pass through the rectangular openings **26**. It will be clear that such flow of air from above may be shut off, if desired, or regulated by fully or partially closing said spaces **24** and **27** from below. In this case, the same is accomplished by mounting the damper means so the components thereof are movable relative to said horizontal wall **25** to either entirely or partly close the lower openings to the spaces **24** and **27**, as desired.

A binding margin piece **28**, shown in FIGS. 1, 2, 3 and 4, may be omitted but is preferably used in instances, as shown in FIG. 8, where a non-metallic top surface liner **29** is applied and affixed to the plate. Said liner is provided with orifices **30** in register with the orifices **16**. A perimeter wall **31** circumscribes the sub-floor. It will be understood that the described floor structure is of rectangular form and may be supported either by the margin piece **28** or the lip **31***a* that fits thereinto, or by marginal portions of the wall **25**.

The damper means **17** is shown as comprising plural pairs of damper vanes **32** that are arranged in parallel relation and transversely spaced to be centered on the longitudinal rows of spaces **24** and **27** of the sub-floor **21**. Each vane **32** is provided with an eye **33** along one longitudinal edge and a curved portion **34** adjacent the opposite edge. A trunnion pin **35** is fixedly fitted in each end of each said eye, the same extending freely through bearing holes in angle members **36** depending from sides of the sub-floor, so the vanes may gravitationally swing around the respective aligned trunnions. In practice the eyes **33** of each pair of vanes are placed close to each other so the space between the vanes is as small as is practicable to minimize air flow therethrough. The width of the vanes is such that, with the mentioned centered position of the vanes, the dampers comprising the pairs thereof, when aligned as in FIG. 3, will close off flow from the spaces **24** and **27** due to the flat engagement of the free edges of the vanes with the wall **25** of the sub-floor.

It is deemed clear, from inspection of FIG. 2, that the flow past the damper vanes from the spaces **24** and **27** is increased as the vanes, from their flow-closing position

of FIG. 3, are allowed to swing downwardly to the position of FIG. 2, for instance, wherein the respective pairs of vanes have the included angle between them reduced from the 180° angle of FIG. 3 to the 90° angle of FIG. 2.

The means **18** for regulating the adjusted flow-controlling position of the damper vanes **32** is best illustrated in FIGS. 5 through 9. Said means is shown as transverse arms **37** which, in this case, are formed of metal strips **38** between which are sandwiched non-metallic (resin plastic) strips **39**. The latter strips are raised above the upper edges of the strips **38** so the portions **34** of the vanes may bear thereagainst, as the vanes swing down on their trunnions **35**, thereby reducing friction. A guide **37***a* for the arms **37** may be provided, as shown.

Said arms **37** are preferably engaged with the portions of the vanes **32** midway between the angles **36**. A polygonal socket **40** is formed midway between the ends of the strips **38** which form the arms **37**, a nut **41** being fixedly fitted in said socket. Said nut is engaged with a threaded stud **42** that is located, as closely as it can be practically effected, at the exact center in both directions of the floor structure **15**, by extending a reduced bearing extension **43** through aligned holes in both the horizontal wall **25** and the plate **20** or, as in FIG. 8, both the plate **20** and the lever **29**. The opposite end of the stud **42** is provided with a pilot stud **44** that extends through a hole in a bracket **45** and which, together with the mentioned aligned holes, holds the stud in vertical operative position. In FIG. 5, thrust bearings **46** and **47**, at opposite ends of the stud **42**, hold the latter against endwise movement with the upper, socketed end of the extension **43** flush with the top face of the plate **20**. In FIG. 6, without altering the stud **42** and its extension **43**, the bearing **46** is placed below the stud, thereby shifting the latter upwardly so the upper end of the extension **43** is flush with the top face of the liner **29**.

It will be clear that rotation of the stud **42** will raise or lower the nut **41** according to the direction of said rotation, and will raise or lower the arms **37** to, accordingly, adjust the air-passing position of the damper vanes **32**.

The floor structure **15***a* of FIGS. 10 and 11 is shown as installed as the bottom of a clean work station **50** which is provided with an upper section **51** that houses air-moving mechanism for the purpose of forcing air through a filter unit **52** and into a work space **53**. The sides and rear of said space are closed. The front is shown with a transparent wall **54** that renders the space visible from in front, so that items in the hands of a person and extended through an opening **55** in the front of the station may be treated or otherwise processed while in the air stream represented by the arrows **56**, and cleaned or kept clean during such procedure.

The floor structure **15***a* passes such air flow as well as any foreign particles or matter entrained in said flow or stream resulting from such procedure. A vent **57** extends from the under side of the floor structure **15***a*. The same may extend upwardly, as shown, or downwardly or laterally, as desired. Such a vent may be subject to suction, if desired.

The vertical movement of the air stream is desired so that all portions of the space **53** are subject to air movement having a minimum of turbulence, thereby to insure as direct a downward movement of impurities, as above mentioned, as it is possible to obtain. Because of the fact that space **53** is open at **55** and because of the differential air pressures between space **53** and the ambient atmosphere, the mentioned vertical curtain of air desired is subject to being disturbed and deleteriously affected.

The present floor structure **15***a*, while based on the above-described structure **15**, embodies the additional feature of providing for regulation of different sections of the floor structure so as to increase or decrease air movement through the orifices of some of the sections to greater or lesser degree relative to the flow through other sections. In this way, the turbulences in space **53** may be eliminated, or at least kept to a low degree.

To this end, the floor structure **15***a* is divided into a plurality of similar sections **60** which combine to form a single floor. The sections **60** may be alike, as shown, or vary or be graduated in size so that regulation may vary in greater or lesser increments. For instance, the sections **60** nearer the opening **55** may be smaller than those farther to the rear, enabling a greater range of variation nearer said opening **55**.

In this case, each section has a floor **20** or **20**, **29** with orifices, as before, and damper means **17** comprising pairs of damper vanes **32**, one or more of said pairs of vanes controlling flow through said floor sections, as hereinbefore described. Each section **60**, accordingly, is provided with damper-regulating means **18** for independent regulation of the pairs of flow-controlling vanes.

While the foregoing has illustrated and described what is now contemplated to be the best mode of carrying out the invention, the constructions are, of course, subject to modification without departing from the spirit and scope of the invention. Therefore, it is not desired to restrict the invention to the particular forms of construction illustrated and described, but to cover all modifications that may fall within the scope of the appended claims.

Having thus described the invention, what is claimed and desired to be secured by Letters Patent is:

1. An air-passing floor structure comprising:

(a) a rectangular floor component having an orifice-provided top plate,

(b) damper means comprising a plurality of pairs of freely pivotal damper vanes each mounted by one longitudinal edge on said component below the top plate thereof, said vanes extending longitudinally along one dimension of the top plate,

(c) said vanes gravitationally swinging on their pivots in a direction away from the top plate and clear of the orifices therein to allow flow of air from above to pass through the orifices and over and beyond the other longitudinal edges of the vanes to the space beneath the floor component, and

(d) adjustable means to engage the latter edges of the vanes to regulate and thereby control the degree of movement of the vanes.

2. An air-passing floor structure according to claim 1 in which the floor component is provided with a subfloor upon which the top plate is mounted, said subfloor having spaces receptive of air passing through the orifices and provided with a bottom wall parallel to the top wall, said damper vanes being adapted to be moved on their pivots by the adjustable means to engage said bottom wall to close said spaces from beneath, thereby to shut off flow of air through the floor structure.

3. An air-passing floor structure according to claim 2 in which each pair of damper vanes is arranged with the pivotally mounted edges thereof in closely spaced parallelism, the vanes thereby being adapted to freely pivot oppositely as controlled by the adjustable means.

4. An air-passing floor structure according to claim **3** in which the adjustable means comprises oppositely extending horizontal arms beneath the damper vanes and in engagement with the mentioned other longitudinal edges of said vanes to control the movement of the vanes according to the adjusted movement of the arms.

5. An air-passing floor structure according to claim **4** in which each vane adjacent the last-mentioned edge thereof is provided with a longitudinal curved portion that engages the adjustable arms, the latter being provided with non-metallic portions at the points of such engagement to lessen friction between the vanes and arms.

6. An air-passing floor structure according to claim 1 in which the top plate is provided with a non-metallic

surface liner provided with orifices that are in substantial register with the orifices of the top plate.

7. An air-passing floor structure according to claim 1 in combination with a work station having an upper work space and a lower vented space with the floor structure located between said spaces, said structure comprising:

(a) a plurality of units in modular arrangement, each independently adjustable to regulate the rate of flow from the upper space to the lower space to thereby vary the flow at different portions of the floor,

(b) the work station, at the front thereof, having an opening connecting the mentioned work space with the ambient atmosphere around the station, and

(c) the mentioned independent regulation of the plurality of units being adapted to minimize turbulence in the flow in said work space.

8. An air-passing floor structure according to claim 1 in combination with a work station having an upper work space and a lower vented space with the floor structure located between said spaces, said structure comprising:

(a) a floor unit having a plurality of independently adjustable damper means to regulate the rate of flow from the upper space to the lower space to thereby vary the flow at different portions of said unit,

(b) the work station, at the front thereof, having an opening connecting the mentioned work space with the ambient atmosphere around the station, and

(c) the mentoned independent regulation of the plurality of damper means being adapted to minimize turbulence in the flow in said work space.

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WILLIAM E. WAYNER, Primary Examiner

U.S. Cl. X.R.

98—42