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Gilbert et al.

[11] **3,860,085**

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[54] **SOUND SUPPRESSION HOOD ASSEMBLY**

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[52] **U.S. Cl.** ..... **181/33 K**, 51/268

[51] **Int. Cl.** **E04b 1/84**

[58] **Field of Search** ..... 181/33 K; 51/1 R, 262 R, 51/268, 241 R

[56] **References Cited**

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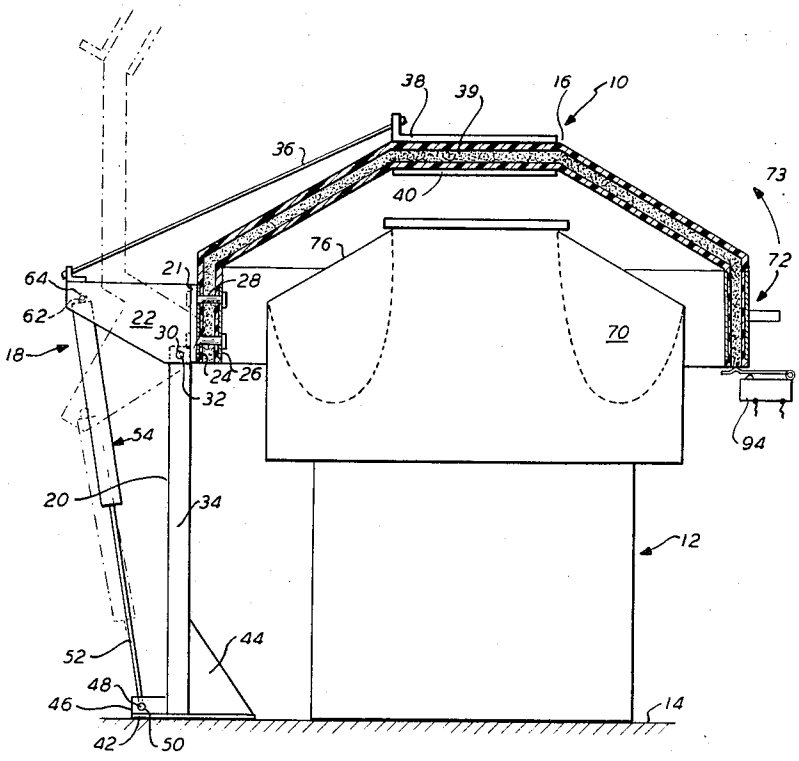
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Assistant Examiner—John F. Gonzales
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[57] **ABSTRACT**

A sound suppression hood assembly for use in reducing ambient noise levels generated by high intensity machinery, such as vibratory finishing machines or the like. The assembly includes a sound absorbing hood adapted to cover at least the upper portion of the sound-generating machine, and means for supporting the hood in pivotable relationship with respect to the machine. The support means is thus adapted for pivoting the hood about a horizontal axis, from a first, substantially horizontal position at which the hood overlies the covered machine portion, to a second or open position, at which the hood is displaced to a more vertical orientation, so as to enable access to the machine by an operator thereof.

11 Claims, 3 Drawing Figures



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FIG. 2

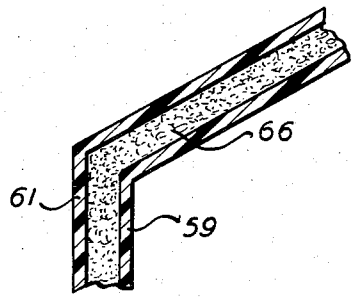


FIG. 1

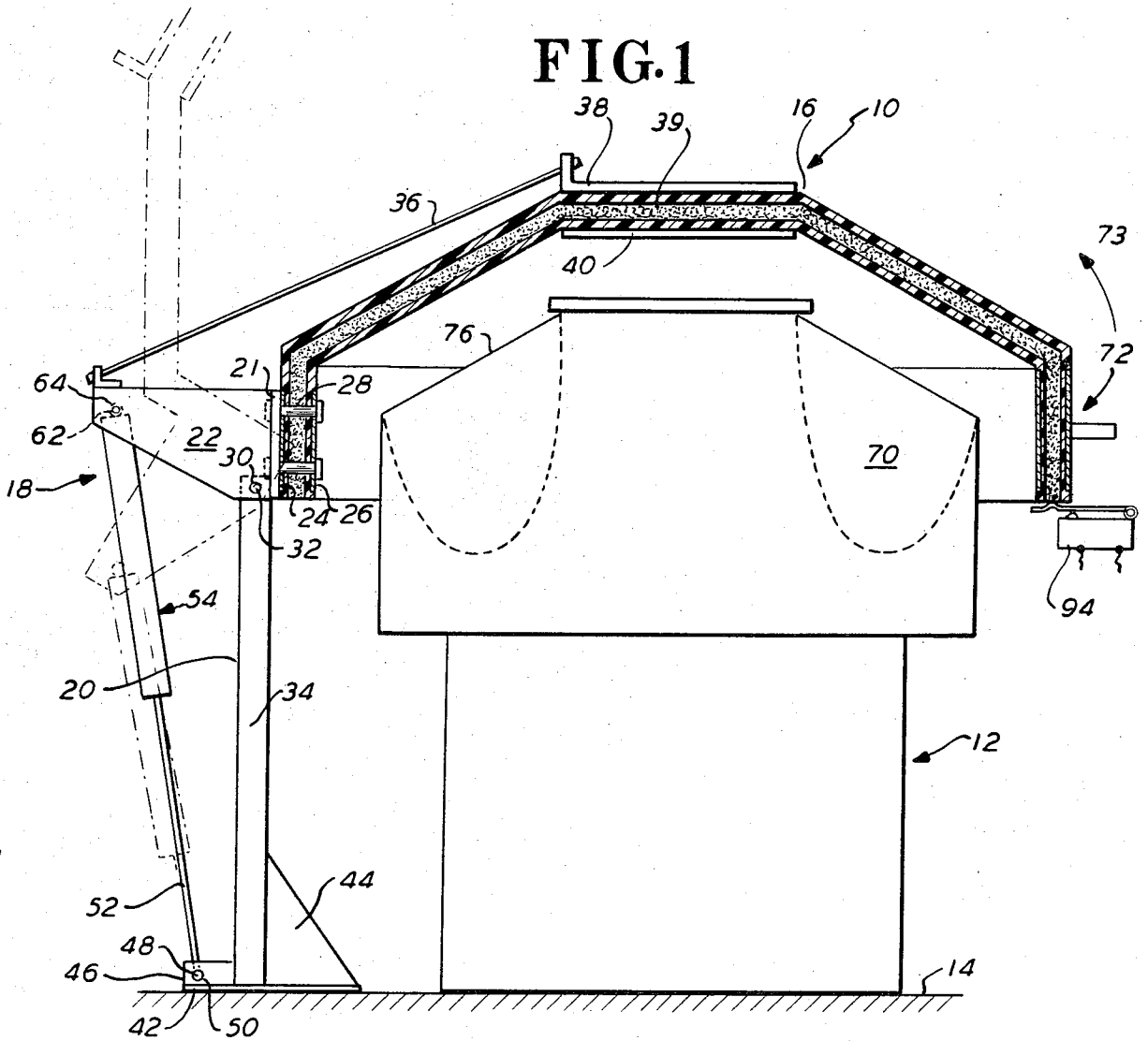
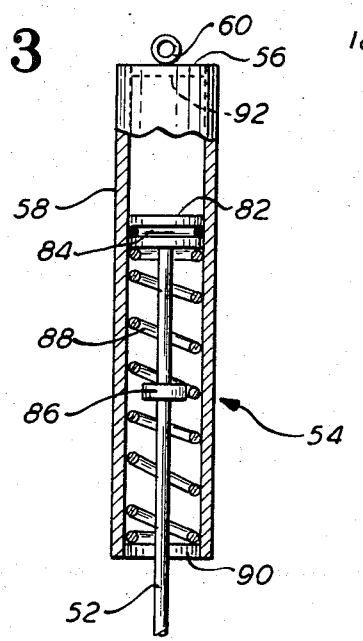


FIG. 3



SOUND SUPPRESSION HOOD ASSEMBLY

BACKGROUND OF INVENTION

This invention relates generally to sound suppression apparatus and methodology, and more specifically relates to apparatus for use in reducing ambient noise levels in the presence of high sound intensity machinery.

Within recent years it has become increasingly recognized that the high sound levels associated with operation of various types of machinery, are not only annoying and psychologically disruptive, but moreover are capable of inflicting semi-permanent or permanent physical damage upon workers and other personnel subjected to such sound — particularly where exposure to such environments is sustained over an extended period. An important consequence of such increasing awareness, is the promulgation by federal and state governments, of laws and regulations limiting the permissible noise levels in environments where personnel are present. The United States Department of Labor, for example, has promulgated such regulations with respect to manufacturing facilities coming within the purview of the Walsh-Healey Public Contracts Act. Such regulations, for example, limit the maximum acceptable noise exposure for an eight-hour shift to 90 dBA (decibels on the A scale of a standard sound level meter).

The present invention although not in any way limited thereto, has particular applicability for use with machinery such as vibratory finishing mills. Devices of this general type are very well known: a type, for example, may be seen in U.S. Pat. No. 3,708,918. Such machines are primarily used for polishing or deburring small metal products, such as hardware, e.g., nuts and bolts, or the like. The said work pieces are commonly provided to a torroidally shaped processing chamber forming part of the machine. This chamber may be accessible from the top of the machine in order that an operator may supply and remove work pieces to be treated in the chamber or observe the operation. A carrier fluid is commonly utilized in the chamber, and most often comprises a liquid with an abrasive material suspended therein, whereby the abrasive materials may act upon the work pieces to effect the deburring and/or polishing operations. As is well known the said finishing operations may be conducted on either a batch or semi-continuous basis.

Machines of the foregoing and similar types (such as e.g., vibratory feeder bowls) or material handlers are well known to generate exceedingly high noise levels during operation thereof. In consequence a need has long existed for effective means which can reduce the ambient noise levels in the vicinity of such machinery. Certain devices have, in the past, been proposed for use in these and in similar high noise-producing environments, which devices, however, are relatively cumbersome and ineffective. For example, in U.S. Pat. No. 3,700,068, a sound reduction device is set forth, which could presumably be used with machinery of the type mentioned herein. The said sound reduction device, basically comprises a sheet plastic canopy, which is draped from an overlying frame member about the machine, the noise production of which is to be muffled. A principal difficulty with arrangements of this type, however, is that access to the said machinery is severely curtailed, and indeed is very cumbersome to obtain in the first instance; and yet such access is a very necessary requirement, since the machine in question must be accessible both for observation purposes, and for removal or supplying of work pieces, of grinding media, or so forth.

In accordance with the foregoing, it may be regarded as an object of the present invention, to provide a sound suppression device which is of simple and sturdy construction, and which is yet effective in greatly reducing the ambient sound intensity of machinery associated therewith.

It is a further object of the present invention, to provide a sound suppression assembly for use in reducing ambient noise levels in the presence of high sound intensity machinery, which may be so associated with the said machinery that ready access to the machinery is enabled for purposes of observation, maintenance, or furnishing of supplies thereto.

It is a yet further object of the invention, to provide a sound suppression assembly for use in reducing ambient noise levels of high sound intensity machinery such as vibratory finishing mills or the like, which may be readily displaced toward and away from the machine to enable access thereto, and which may further be associated with switching means for inactivating the machinery where such access is provided, thereby encouraging safe operation of the said machines, and promoting proper use of the said assembly.

SUMMARY OF INVENTION

Now in accordance with the present invention, the foregoing objects, and others as will become apparent in the course of the ensuing specification, are achieved in a sound suppression hood assembly, which may be associated with high sound intensity machinery, as for example, vibratory finishing mills, feeder bowls, etc. to reduce the ambient noise levels in the vicinity of such machinery. The assembly includes a sound-absorbing hood, which is adapted to cover at least the upper portion of the machinery which is thereby muffled, together with means for pivotably supporting the hood with respect to the machine. The pivot means is adapted for pivoting the said hood about a horizontal axis from a first, substantially horizontal position at which the hood overlies but is in spaced relationship to the covered machine portion, to a second position at which the hood is displaced to a relatively more vertical orientation. This latter (or "open") position enables access to the machinery by an operator thereof.

The support means preferably includes a stand which engages the underlying floor at one side of the machine, and a pivot assembly which is secured to one side of the hood and about an axis of rotation at the stand. Spring or other force biasing means may be provided at the stand and pivot assembly for facilitating displacement of the hood between open and closed positions. The biasing means may thus comprise a rod, together with a spring-biased piston and cylinder assembly, these elements extending between the stand and pivot assembly.

Where the sound suppression assembly is intended for use with apparatus such as vibratory finishing mills, the hood may be configured to cover the upper portion of the said mill when the hood is in its closed position. Upon the hood being displaced to its open position, the access opening to the treatment chamber of the mill may be readily entered by an operator from the top of

the machine, as the hood is then swung completely clear of the top of the said machine.

The hood may be formed of thin plastic skins at its inner and outer surfaces, with an intervening core of sound-absorbant material such as fiberglass, or various synthetic or natural foams, such as polyurethane foam, or so forth.

BRIEF DESCRIPTION OF DRAWINGS

The invention is diagrammatically illustrated, by way of example, in the drawings appended hereto, in which:

FIG. 1 is an elevational, partly schematic view of a sound suppression hood assembly in accordance with the present invention, the said assembly being shown in use with a vibratory finishing machine;

FIG. 2 is a detail cross-section through a portion of the hood of the FIG. 1 assembly; and

FIG. 3 is a longitudinal cross-sectional view through the piston and cylinder portion of the assembly.

DESCRIPTION OF PREFERRED EMBODIMENT

In FIG. 1 herein, an elevational, partly schematic view appears of a sound suppression hood assembly **10** in accordance with the present invention. Assembly **10** is representatively shown in use with a vibratory finishing machine of the general type which has been heretofore been discussed in connection with the "background" portion of the instant specification. The said vibratory finishing machine **12** is thus seen to be emplaced at the floor **14** of a plant or other facility. Because machine **12** is conventional and not per se of the present invention, such machine is set forth in schematic fashion. In consequence of use of the machine **12** a very high sound intensity level would (in the absence of the invention) be encountered in the surrounding portions of the facility.

Assembly **10** comprises a hood **16,** and a hood supporting means **18** which engages hood **16** at one side thereof and is, in turn, emplaced upon floor **14.** Supporting means **18** includes a stand **20** and a pivot assembly **22.** Pivot assembly **22** is engaged with hood **16,** as for example, by being fastened to embedments **24** and **26** which are secured to the rim portion **28** of the hood. Pivot assembly **22** is capable of rotation about an axis **30** which is defined by a pin **32** passing through upright **34,** and through openings in assembly **22.** Assembly **22** may also be secured to hood **16** by means of a rod **36,** which extends from assembly **22** to an embedment **38.** Embedment **38** is fastened to the topmost portion **39** of hood **16,** together with an opposed embedment **40** on the inner side of the said hood. Rod **36** serves a reinforcement function in securing the hood to assembly **22,** and adds rigidity to the relatively bulky structure which includes hood **16** and assembly **22.**

The upright member **34** engages at its bottom end with a floor support plate **42,** which may be a flattened member of rectangular or other shape. A brace **44** extends between upright member **34** and plate **42.** Additional such braces may be present if a given installation so requires. A pair of upright members, one of which is seen at **46,** include openings which journal a pin **50.** The latter serves as an axis **48** for attachment of one end of a rod **52,** which rod end is provided with a transverse hole for receipt of the said pin. Rod **52** is part of a rod, piston and cylinder assembly, generally indicated at **54.** This assembly includes at the upper end **56** of cylinder **58,** a sleeve **60** — which may be welded to the cylinder. A pin **62** passes through openings in assembly **22** and through sleeve **60** so as to form a further axis **64** of rotation.

Hood **16** is of generally bowl-shaped configuration, and as is best seen in FIG. **2,** is comprised of a pair of opposed thin skins **59** and **61,** formed for example of molded fiberglass or of a PVC or other type plastic or so forth. A noise deadening core **66** is interposed between skins **59** and **61,** and in a typical instance may comprise such materials as fiberglass, balsa or other sound deadening material or various sound-absorbing foams as, for example, of natural or artificial rubber, or of other elastomers such as polyurethanes. Typically the thickness of skins **59** and **61** are about three-sixteenths inch, with the intervening core **66** being of the order of about one inch; but the actual thicknesses employed will be a function of the particular application of the invention, and of the degree of sound attenuation sought to be achieved.

The embedments **24, 26, 38** and **39,** previously referred to, may comprise thin metal plates which are molded into skins **59** and **61** during formation of same. The embedments **24** and **26** may be provided with aligned holes and intervening spaces may be present through core **66,** so that threaded fasteners may be passed through the embedments and be used in engaging plate **21** of pivot assembly **22.**

The specific configuration of hood **26** will be in accordance with the environments in which the invention is employed. In an instance such as the present one, the schematically depicted vibratory finishing machine **12,** as has been previously mentioned, is often accessible from the upper or top end thereof whereat the treatment chamber **70** is located. In accordance with the principles of the present invention, it is therefore contemplated that the hood **16** may be either emplaced in the "closed" position shown in FIG. **1** — in which its sound suppression function is maximized —, or alternatively the hood may be pivoted upwardly as indicated by arrow **73** to a more vertical position, at which access to the operating machine may be readily achieved. This "open" position is partially seen in shadow at **16'.** In an arrangement such as that of this type, the open position is fully reached after rotation through an angle of about 60°.

It will firstly be noted in the foregoing connection, that when hood **16** is in its operative or sound-suppressing position as shown in FIG. **1,** the hood, while surrounding the upper portions of machine **12,** is actually spaced from the said machine. The objective of this arrangement is to minimize direct coupling of machine vibrations to the hood, whereby to assure maximization of the muffling properties of the device. It will be further noted that the lateral rim **28** is substantially vertically oriented, and actually extends to a point which is well below the upper cover **76** of machine **12.** It is therefore apparent that the configuration used in FIG. **1** is such as to surround the access portion of the said machine which lies beneath cover **76.** The effectiveness of assembly **10** in rendering sound levels is attested to by typical instances in which ambient sound levels generated by machines such as at **12,** were reduced from 103 dBA to 85 dBA by use of the present invention.

Hood **16** is preferably provided with handle means generally indicated at **72,** which are secured to rim **28** at a position opposed to stand **20.** Embedments, as indi-

cated at 78 and 80 may be secured e.g., by fasteners or by molding, etc. to hood 16 to enable attachment of handle 72.

During operation of assembly 10, the operator may, as desired, grasp handle means 72 to raise the hood to an upper more vertical position to thereby gain access to the machine. In order to enable this operation to be readily carried out, rod, piston and cylinder assembly 54 provides a force-biasing function. In particular it is seen that the said assembly 54 extends between support plate 42 and the pin 62 at pivot assembly 22, and that axes of rotation 48 and 64 are provided at both ends. As best seen in the longitudinal cross-sectional view of FIG. 3, cylinder 58 is closed at its upper end 56. A piston 82 is mounted for movement within cylinder 58, and includes a packing ring 84 of Teflon or the like. The rod 52 secured to piston 82, extends from the cylinder as previously indicated, and carries a stopping shoulder 86, which is fixedly secured thereabout.

In the embodiment illustrated, the biasing force is provided by means of a spring 88 which is present in the space between the underside of piston 82 and a cylinder closing member 90 which slidingly receives rod 52. With hood 16 in the "closed" position shown in FIG. 1, the shoulder 86 will rest against the internal side of member 90, whereby spring 88 is compressed to its maximum, and as the hood is raised — i.e., pivoted about axis 30 — the degree of spring compression is reduced, as is the reaction force at member 90 due to the spring. This in turn gradually reduces the counterclockwise torque about axis 30. At the fully open position 16' (FIG. 1), piston 82 is at or somewhat below inner face 92 of cylinder portion 56. Spring 88 is at all times under some degree of compression. The spring constant is selected in relationship to the geometry (and weight distribution) of assembly 10 so that hood 16 is approximately counterbalanced at all positions — except that within about a 5° arc of the closed (i.e., horizontal) position the geometry (and weight distribution) is such that the clockwise torque about axis 30 (in the sense of the Figures) exceeds the counterclockwise torque, so that hood 16 will not inadvertently be left in a partially open position. The clockwise torque about axis 30 is, of course, principally determined by the weight of hood 16 and by the distance of the center of gravity of the hood from axis 30 at a given hood position.

It should be understood that the spring biasing means illustrated for use with the present pivoted assembly 22 may be replaced by other force-biasing means as, for example, by pneumatically-actuated rod, piston and cylinder arrangements. It should also be evident that in these latter instances a completely automatic operation can be provided for opening and closing the hood — which is to say that the entire force for pivoting the said hood among its positions may be provided by the pneumatic piston and cylinder arrangement.

According to a further aspect of the present invention a limit switch, schematically suggested at 94 may serve to enable operation of machine 12. In particular, assuming by way of example, that switch 94 is a normally-off microswitch, which in turn actuates power relays or the like to enable power to machine 12, it will be evident that the said machine may only operate when hood 16 is fully lowered to its FIG. 1 position — at which point contact with the said microswitch is made. This arrangement not only assures that machine 12 will only be operated when full advantage is being taken of the sound-absorbing properties of assembly 10, but moreover serves a safety function. In particular, assuming that access to operating components of the machine may not be had unless the hood is displaced to a more vertical position, it will be evident that any attempt to reach the operating portions or the machine will necessitate upward pivoting of the hood, which, in turn, will disable operation of the said machine.

While the present invention has been particularly set forth in terms of a specific embodiment thereof, it will be understood that numerous variations upon the invention are now enabled to those skilled in the art, which variations yet reside within the scope of the present teaching. The hood 16, for example, is in no way limited to a cylindrical or spherical geometry, but may be of generally rectangular or other shape when the requirements of the machine with which the hood is employed, so demand; provided only that the concave portion of such hood are appropriately directed for interaction with the said machine. Accordingly the invention is to be broadly construed and limited only by the scope and spirit of the claims now appended hereto.

We claim:

1. A sound suppression hood assembly for use in reducing ambient noise levels in the presence of high sound intensity machinery, comprising in combination:

a sound-absorbing hood adapted to cover at least the upper portion of a floor-supported high sound intensity machine;

stand means including an upright and means supporting said upright with respect to said floor, for pivotably supporting said hood with respect to said machine; a pivot assembly being secured between one side of said hood and said stand means; and force biasing means being provided at said stand means and pivot assembly, for counterbalancing said hood weight to facilitate pivoting of said hood back and forth between a first substantially horizontal position at which said hood overlies but is in spaced relationship to said covered machine portion, and a second, open position at which said hood is displaced to a more vertical orientation, to enable access to said machine by an operator thereof, said upright and said support means for said upright both being positionable to one side of said machine whereby access to said machine is substantially unimpaired when said hood is in said open position, and said stand means being spaceable substantially in its entirety from said machine, whereby direct coupling of machine vibrations to said hood is minimized.

2. Apparatus in accordance with claim 1, wherein said hood comprises opposed thin skins and an intervening sound-absorbing core.

3. Apparatus in accordance with claim 1, wherein said biasing means comprises a rod, piston and cylinder assembly, extending between said stand means and said pivot assembly.

4. Apparatus in accordance with claim 5, wherein said piston is biased by a spring.

5. Apparatus in accordance with claim 1, further including handle means secured to said cover and projecting externally therefrom, for grasping by said operator, whereby to enable operator-activated movement of said cover between said first and second positions.

6. Apparatus in accordance with claim 1, wherein said hood is of generally bowl-shaped configuration, and comprises opposed plastic skins and an intervening noise-absorbing core.

7. In combination with a floor-supported vibratory finishing machine of the type including a treatment chamber and chamber access means at the top of said machine; a sound suppression hood assembly, comprising in combination:

a sound absorbing hood configured to surround at least the upper portion of said vibratory finishing machine including the said chamber access means; and

means for supporting said hood in pivotable relationship with respect to the upper portion of said machine, said means being adapted for pivoting said hood about a horizontal axis from a substantially horizontal position at which said hood overlies but is in spaced relationship to the upper portion of said finishing machine, to a second, open position at which said hood is displaced to a more vertical position, to enable an operator to utilize the said access means for said treatment chamber.

8. Apparatus in accordance with claim 7, wherein said support means comprises a stand engaging the underlying floor at one side of said finishing machine; and a pivot assembly secured to one side of said hood and to an axis of rotation at said pivot assembly.

9. Apparatus in accordance with claim 8, further including force biasing means at said stand and pivot assembly, for facilitating displacement of said hood between said first and second positions.

10. Apparatus in accordance with claim 9, wherein said cover is of generally bowl-shaped configuration, and comprises opposed thin plastic skins and an intervening sound absorbing core structure.

11. A sound suppression hood assembly for use in reducing ambient noise levels in the presence of high sound intensity machinery, comprising in combination:

a sound-absorbing hood adapted to cover at least the upper portion of a floor-supported high sound intensity machine;

means for pivotably supporting said hood with respect to said machine, said means being adapted for pivoting said hood from a first substantially horizontal position at which said hood overlies but is in spaced relationship to said covered machine portion, to a second, open position at which said hood is displaced to a more vertical orientation, to enable access to said machinery by an operator thereof; and

switching means activated by the pivotable movement of said hood, to disable electrical power to said high sound intensity machine when said hood is pivoted upwardly from said first position, whereby to enable safe access to said machine and to assure proper utilization of said hood.

* * * * *