

[54] NOISE ATTENUATING KIT

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181/33 P; 83/701, 859, 860; 84/81

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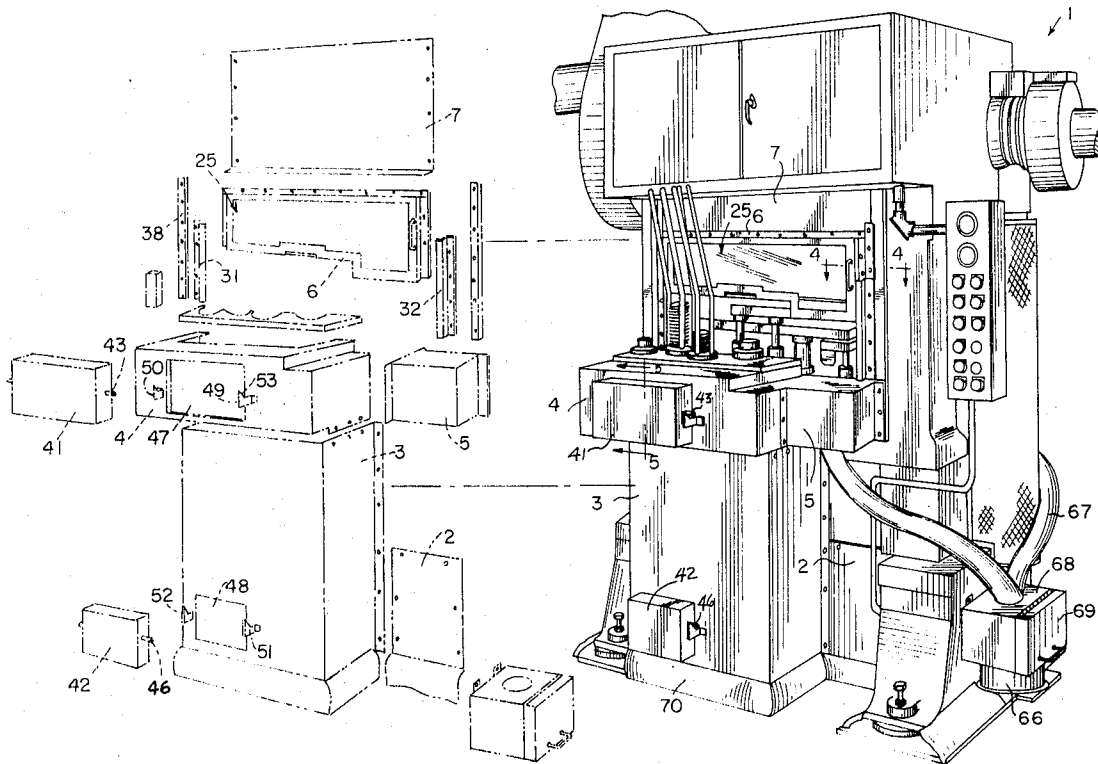
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ABSTRACT

A noise abatement housing designed to be fitted on to a noise producing machine. Sound attenuating panels are mounted at the outside of the machine and attached to major structural elements of the machine. Sound attenuating devices are placed at some orifices of the machine and about some structural noise producing elements.

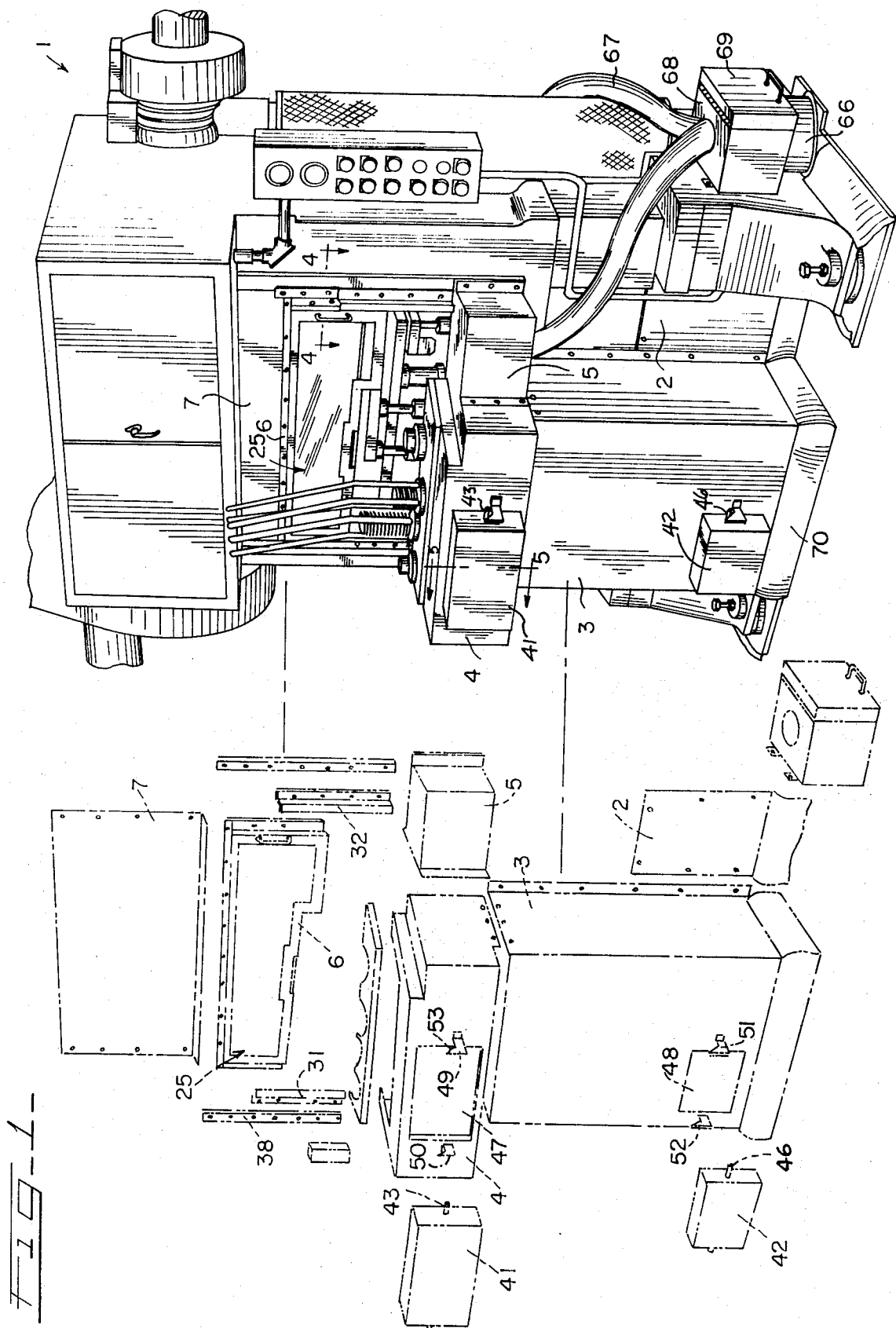
17 Claims, 7 Drawing Figures



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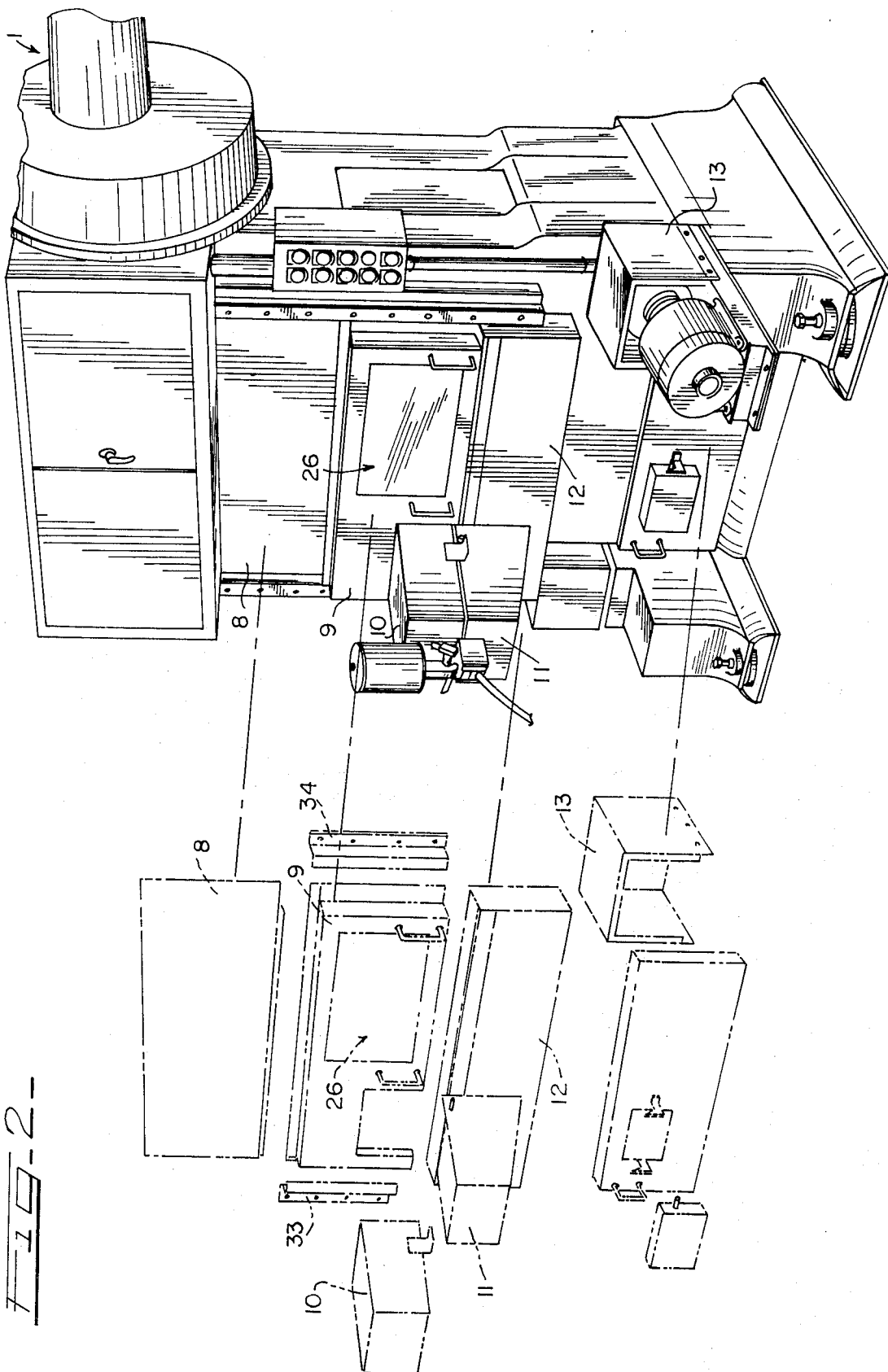
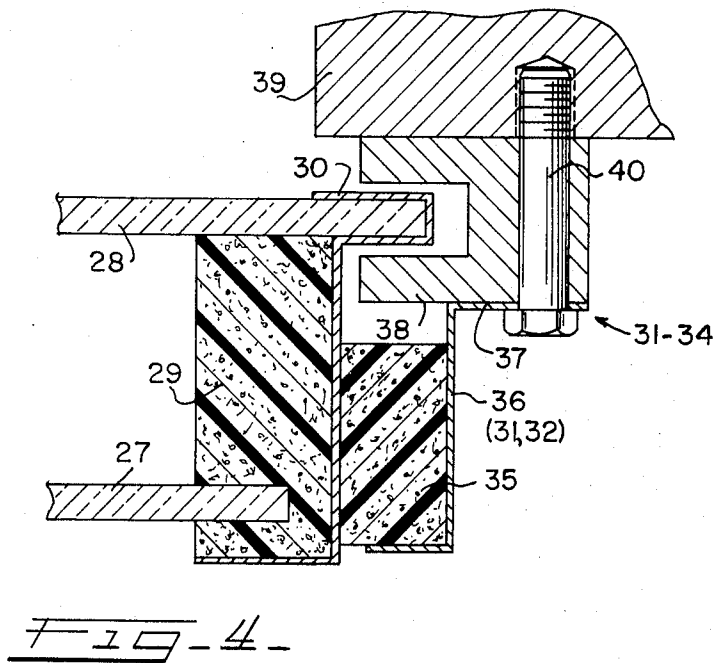
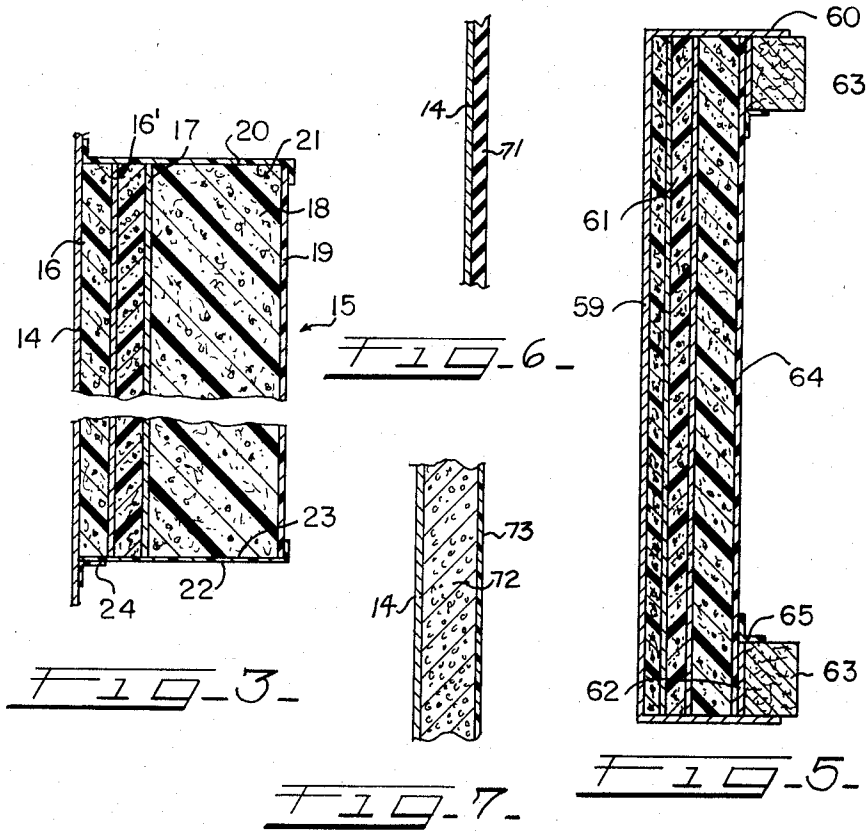


Fig. 2--



NOISE ATTENUATING KIT

The housing of this invention relates to sound reducing devices and more particularly to devices for attenuating sound which emanates from an industrial machine.

Passage of the Walsh-Healy Act and Occupational Health and Safety Act has imposed restrictions on the level of permissible industrial noise.

In the prior art, a number of devices have been used to enclose a noise producing machine. By and large, these devices have been in the nature of a sound proof room or total enclosure. The shell of the enclosure is usually lined with sound absorbing materials to form a sound barrier. The enclosure and sound absorbing materials totally surround the machine and form a sort of protective shell about the machine. This enclosure protects those outside the sound barrier but does not protect any person inside the barrier.

The enclosures are usually cumbersome. Sound reduction may be further accomplished by engineering and redesign of the machine itself but in many cases this is difficult to achieve. Most of the full enclosures are expensive and when the machine is moved from place to place, the entire enclosure, walls, mounting brackets and framework must be disassembled and set up at the new location. This complexity results in higher labor cost and longer time for installation. Further, the full enclosure takes up considerable extra space about the machine. Access to the machine is limited and difficult because one must remove the enclosure or work within the walls of the enclosure to repair or maintain the machine.

Many times the machine requires attention for smooth running and the operator must put his hand and arm inside the working area of the machine. If he is incapacitated for any reason, he cannot be seen or heard by anyone in the vicinity. For this reason, normal safety precautions require two men inside the full enclosure at one time.

The enclosures described above are currently used in connection with grinding machines as well as punch presses and other machines which generate excessive noise levels.

It is a principal object of our device to reduce the noise level in the areas surrounding machines to alleviate damage to the operators' hearing. It is another object of our device to provide safety shields around moving parts to further protect the operator against injury.

It is another object of our invention to provide a compact regularly demountable sound reducing system for any straight sided press which produces excessive noise levels.

The above and other objects, teachings and advantages of the present invention will become more readily apparent from the following description, reference being made to the appended drawings in which:

FIG. 1 is a front view of the machine showing the sound attenuating kit detached and in phantom lines;

FIG. 2 shows a back view of the machine showing the sound attenuating kit detached and in phantom lines;

FIG. 3 shows a cross-sectional view of a panel with sound attenuating system;

FIG. 4 shows a cross-sectional view of a guide and slidable panel taken along the line 4-4 of FIG. 1; and

FIG. 5 shows a cross-sectional view of an access door;

FIGS. 6 and 7 each show another embodiment of a sound attenuating system.

In providing a sound attenuating kit for a machine of any appreciable size, several problems become readily apparent. First, the moving parts of the machine must be accessible to the outside for repair or maintenance. Secondly, the noise producing areas of the machine must have a sound attenuating barrier placed between them and the observer. Thirdly, access doors must be effectively sound proof. Fourth, the sound proofing should be accomplished without materially increasing the size of the machine. Fifth, the sound proofing should be made an integral part of the machine as far as possible. Sixth, the sound proofing should act as safety shields where required.

The front view of the machine illustrated in FIG. 1 shows in the background the machine with the sound attenuating kit assembled onto the machine 1. This sound attenuating kit has a number of panels or housings 2 through 7 which are fastened to the major frame members of the machine. These panels are shown in phantom lines as moved away from the machine. The panels have a hard surface and are made from standard paneling such as sheet metal, fibre glass or any high density material.

The rear view of the machine is shown in FIG. 2. Panels or housings 8 through 13 are shown in phantom lines as moved away from the machine.

A typical cross-sectional view of a panel with the sound attenuating system is shown in FIG. 3. The outer panel 14 of hard material acts as an exterior shield and reinforcement.

Fastened to the outer panel 14 on the inside is a combination of materials to provide a sound attenuating system 15. Next to the panel is an adhesive 16 which bonds the sound attenuating materials to the panel. The sound attenuating material may include several layers 16' and 17 of thin sheet lead. The inside layer 18 of the sound attenuating system is polyurethane foam or the like which has sound absorbing characteristics. A protective skin 19, such as mylar, is stretched over the inner most surface to eliminate contamination. Protective skin 19 does not detract from the noise attenuating properties of the system. The side edges 20 may be protected with a latex neoprene liquid coating 21 as shown at the top of FIG. 3. The latex neoprene provides a skin 21 over the edge of the sound attenuating system and adheres to hard surface 14 and to protective skin 19.

Optionally, the side edges 22 may be protected by a tape 23 impervious to oil, such as mylar. This tape is bonded to the protective skin 19. For the tape to metal seal as shown at the lower part of FIG. 3, we use the latex neoprene liquid coating 24. Latex neoprene combines the properties of flexibility, bonding ability between different materials, and resistance to the passage of oil and other contaminants. By use of side sealing, we prevent the wicking of oil or other contaminants through the edges which would otherwise be exposed. This safety feature eliminates the possibility of flash fires. This protective skin is then sealed against the hard surface panel to completely encapsulate the sound attenuating system. This protects against oils, dirt and any other contaminant.

The window panels 25 and 26 (FIGS. 1, 2 and 4) are made up of one or more sheets 27 and 28 of transparent plates such as safety glass or acrylic. When two or more sheets are used, vacuum or air is provided be-

tween the sheets. A noise absorbing material 29 is placed between the sheets and around their perimeter to provide a spacer and noise attenuator. In this type window panel, we have a metal frame 30 to provide some compression of the absorbing material for effective sealing. This type window is part of a slidable sound attenuating panel 9 and 25. This slidable panel acts as a sound attenuating panel, as an operator's safety shield and as an access panel. This panel replaces a transparent shield which was formerly used as a safety device for the operator.

The slidable panel 9 operates in guides 31 through 34 which are mounted on the frame of the press on right and left. Each guide (FIG. 4) has an adjustable noise seal as part of its structure. The sealing material 35 is a material having the characteristic of noise attenuation and good wearing characteristics, such as a felt or neoprene sponge of medium or firm grade. The sealing material is pressed against the side of the slidable panel to form a sound seal. The sealing material is bonded to a long "Z" shaped metal element 36. The bottom leg 37 of the "Z" is attached to a "U" shaped guide in which the slidable panel 30 operates. The "U" shaped guide is in turn mounted on the frame 39 of the press by a pin 40.

An upper access door 41 and a lower access door 42 as shown in FIG. 1 is provided for maintenance and repair. Pins 43 and 46 extend from the edge of each access door. The access ports in the supporting panel elements 4 and 5 have right and left angle pieces 49 to 52 on the panel elements near the access port. These angle pieces cooperate with the pins and have cam surfaces. Each cam surface 53 cooperates with a matching pin projecting from the door so that as the door slides downward under the influence of gravity, it is urged against the rim of the access port. In this way, the sealing material which is used for sound proofing between the door and the rim of the access port is compacted for a better sound seal. As the material wears or compresses, the door adjusts to the change in seal thickness by sliding somewhat further down on the cam and provides always a sound proof seal around the rim of the access port. Felt or neoprene sponge may be used here for the sealing material and is mounted in strips around the edge of the door.

The shell of the door as shown in FIG. 5 has a rectangular panel 59 with an upturned edge 60 around its periphery. This edge extends at right angles to the panel. The panel and upturned edge form a sort of container. A sound attenuating material 61 is placed inside of the container and fills the container. The upturned part of the edge is folded inwardly as an inwardly projecting rim 62 to form a "U" shaped channel about the periphery of the door. A strip 63 of sound absorbing material such as felt is mounted on the rim and extends completely around the edge of the door. The protecting skin 64 of the sound attenuating skin is bonded to the rim by a latex neoprene bead 65.

A similar type access door is shown in the bottom of the lower panel.

Since this sound attenuating kit in its broad form is meant to be applicable to a variety of machines of varying noise levels, sound attenuating systems of different types may be used to give the desired noise reduction.

Desired characteristics of a sound attenuating material are high sound attenuation, either by providing high transmission loss, high absorption or a combina-

tion; ease of application to panel; ability to increase the transmission loss of the outer panel itself; high bonding qualities to the inner surface of the outer panel; durability; resistance to contaminants such as oils, dirt, and other materials; non-flammability.

Two modes of approach to this problem are set forth below.

FIG. 6 shows the application of a layer 71 of a dense damping compound to the inside surface of the outer panel 14. This layer is easy to apply since it can be painted or sprayed on the panel. This eliminates the need for pre-fabrication of the sound attenuating system and adhesively bonding it to panel 14. The minimum thickness of this layer should be about the same thickness as the panel. The effectiveness of the layer increases with its thickness. The effect of this layer is to increase the noise transmission loss across the dense damping compound combined with the panel. In addition, the use of this dense damping compound makes the noise transmission loss more uniform across the audible frequency range by eliminating the coincidence effect. The panel is a good transmission loss material except at the frequencies where the coincidence effect occurs. The elimination of this effect allows us to maintain the noise attenuating properties of the panel across the entire audible frequency range. Thus transmission loss across the compound and the panel is increased. A material such as Antiphon D-444 marketed by Scason, Inc. of Norwalk, Connecticut has the desired characteristics as listed above. This material is a polymeric mastic material which is an aqueous dispersion of synthetic resins and fillers.

The system shown in FIG. 7 consists of a dense sprayable or paint-on insulation material 72. This system has similar noise attenuating characteristics to those described for the system in FIG. 6. In addition, this system has high sound absorption characteristics, which reduce reverberation build-up within the enclosure by eliminating reflections from the panel. A sprayed-on glaze 73 improves resistance to contamination and maintainability. A material such as "Mono-Therm" sold by Mono-Therm Insulation Systems, Inc. of Oakdale, California meets the requirements for this approach. "Mono-Therm" is a cellulosic material.

The means of attachment between panels and frame members may be by nuts, bolts, or any other means appropriate to the particular circumstances.

The machine shown in FIG. 1 has an upper panel 7 and a slidable panel 25 which slides along the upper panel to allow access to the working area. The working area of the machine is that area where the male and female dies contact to make a punch press operation. Noise attenuating panels 5 are put around the feed area. This reduces the noise level coming from handling the blanks as they are being transported to the working area. Finally, an elongated panel 4 bent into a "U" shape is mounted at the lower front of the machine to absorb noise from the drive shaft and drive chain.

A scrap container 66 is shown as sitting on the floor beside the machine. A scrap chute 67 extends outside of the machine and extends to just above the container. Air escaping through the chute carries considerable noise from the working area. The scrap container has a housing 68 over it which extends almost to the floor. This housing is lined with sound absorbing material. The sound absorbing material which lines the housing absorbs the noise which travels down the scrap chute

as well as the noise which is made by the scrap in falling into the scrap container 66.

One side of the scrap container housing forms a lid 69 which can be opened for insertion or removal of the scrap container from the housing.

A skirt 70 made of a resilient material such as rubber or leaded rubber is used as a seal which extends from the lower panels to the floor. This material forms an adjustable sound deadening barrier around the bottom of the machine and closes another path through which the noise of the machine could escape to the surrounding area.

A rear view of the apparatus is shown in FIG. 2. This is sound proofed in a similar manner to the apparatus depicted in FIG. 1. The complete sound attenuating system, the rear slidable noise attenuating panel 9, angled guide means and all other essential elements with analogous functions are the same as the front sliding panel. To the left of the sliding panel is a cover or housing encasing a feed mechanism.

The advantages of this invention are sound abatement; reduction of noise to acceptable levels; the sound abating system is structured to be an integral part of the machine; the sound attenuating kit need not be dismantled when relocating the machine; sound attenuating panels are mounted on frame members; a three function sliding panel and an improved scrap container having a sound abating enclosure; minimize cost of attenuating kit manufacture; minimize man hours for installation of kit; provide visibility required for machine operation and maintenance; provide accessibility required for normal maintenance and repair; no additional floor space is required for sound proofing the machine; the noise attenuating kit also provides safety shields where required; and kit materials are protected against contamination to prevent fire hazard.

The foregoing is a description of an improved embodiment of the invention, and it is applicants' intention in the appended claims to cover all forms which fall within the scope of the invention.

We claim:

1. A noise abatement system for a machine comprising:

sound attenuating panel means extending between frame members of said machine enclosing parts of said machine and having open areas between some of said panel means;

slidable sound attenuating panel means closing the open areas between fixed panels and extending adjacent to the working area of the machine whereby the slidable panel provides access to the working area, noise protection and object protection to the operator; and

said sound attenuating panels means comprises:

a flat backing member; and

a sound attenuating system coextensive with said backing member and attached to said backing member.

2. A noise abatement system for a machine as set forth in claim 1 comprising:

a skirt made of a resilient material and extending from the bottom of said sound attenuating panels to the floor whereby noise proceeding around the bottom of said panels is attenuated before it proceeds from the area of said machine.

3. A noise abatement system for a machine as set forth in claim 1 further comprising:

at least one passageway through some of said sound attenuating panel means;

first angle means having a first flat leg mounted on said broad surface of said sound attenuating panel adjacent each passageway and having a cam surface on the upper surface of the second flat leg of said angle means;

second angle means having a first flat leg mounted on said broad surface of said sound attenuating panel adjacent each passageway and on the opposite side of said passageway from said first angle means and having a cam on the upper surface of the second flat leg on said angle means; doors having resilient strip material on one side of each of said doors adjacent the periphery of said doors; and

at least two pins projecting from opposed edges of said doors whereby said doors are urged toward said panel when said doors are placed in said panels and said pins engage said cams and urge said doors against said panels.

4. A noise abatement system for a machine as set forth in claim 1 in which said sound attenuating system comprises:

a sound attenuating sheet coextensive with said backing member and having a first and a second flat side;

a protective skin means attached to said second flat side of said sound attenuating sheet; and

a protective side edge means attached around the side edges of said sound attenuating sheet.

5. A noise abatement system for a machine as set forth in claim 4 in which said protective side edge means comprises:

a flexible protective coating made of a material such as a latex neoprene compound spread thinly over said side edge in the area between said protective skin means and said flat backing member.

6. A noise abatement system for a machine as set forth in claim 5 in which said protective side edge means comprises:

a plastic tape impervious to oil, bonded to said protective skin means, extending to said flat backing member,

a latex neoprene coating applied to said tape and said backing member to bond said tape to said backing member;

7. A noise abatement system for a machine as set forth in claim 1 in which said sound attenuating system comprises:

a dense sprayable damping compound adhering to the back of said panel.

8. A noise abatement system for a machine as set forth in claim 7 in which said sprayable adherent compound comprises:

a material such as "ANTIPHON D-444".

9. A noise abatement system for a machine as set forth in claim 1 in which said sound attenuating system comprises:

a dense sprayable thermal insulating material which is adherent to the back of said panel.

10. A noise abatement system for a machine as set forth in claim 7 in which said sprayable adherent thermal insulating material comprises:

a material such as "MONO-THERM".

11. A noise abatement system for a machine as set forth in claim 1 in which said slidable sound absorbing panel means comprises:

a panel guide means having a "U" shaped member attached to said frame members and adapted to cooperate with said slidable panel means to restrict the movement of said panel to a path to open and close the opening in said fixed panel means.

12. A noise abatement system for a machine as set forth in claim 11 in which said panel guide means further comprises:

a "Z" shaped strip mounted on said guide means; and
a felt strip mounted between said "Z" strip and said slidable panel whereby noise is stopped from leaking between said guide means and said slidable panel.

13. A noise abatement system for a machine as set forth in claim 1 further comprising:

an enclosure mounted on said machine and having five closed sides and one open side for receiving a scrap container;
sound proofing material attached to and coextensive with the closed sides of said enclosure; and
a passageway in a closed side of said enclosure for receiving a scrap chute whereby the noise from said chute and said scrap container is absorbed by the sound proofing material inside of said enclosure.

14. A noise abatement system for a machine as set forth in claim 13 further comprising:

a lid in the side of said enclosure whereby the scrap bucket may be removed from said enclosure.

15. A noise abatement system for a machine comprising:

sound attenuating panel means extending between frame members of said machine and enclosing operating parts of said machine;

openings in said panel means to provide access to the machine inside of said panels means;

doors having resilient strip material on one side of each said door adjacent the periphery of said doors;

at least two pins projecting from opposed edges of said doors; and

paired means each having a cam surface attached to said panel means in opposed positions adjacent each opening in said panel means whereby said pin means cooperates with said cam surface to urge said panel under the influence of gravity to press said resilient strip material against said panel means and form a sound proof seal.

16. A noise abatement system for a machine as set forth in claim 15 in which said slidable panel further comprises:

a transparent plate means mounted in said panel whereby the working area of said machine may be viewed from outside said machine.

17. A noise abatement system for a machine as set forth in claim 15 in which said sound attenuating panel means further comprises:

a sound attenuating sheet coextensive with said backing member and having a first and a second flat side;

means attaching said first flat side to said flat backing member;

a protective skin means attached to said second flat side of said sound attenuating sheet; and

a protective side edge means attached around the side edges of said sound attenuating sheet.

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