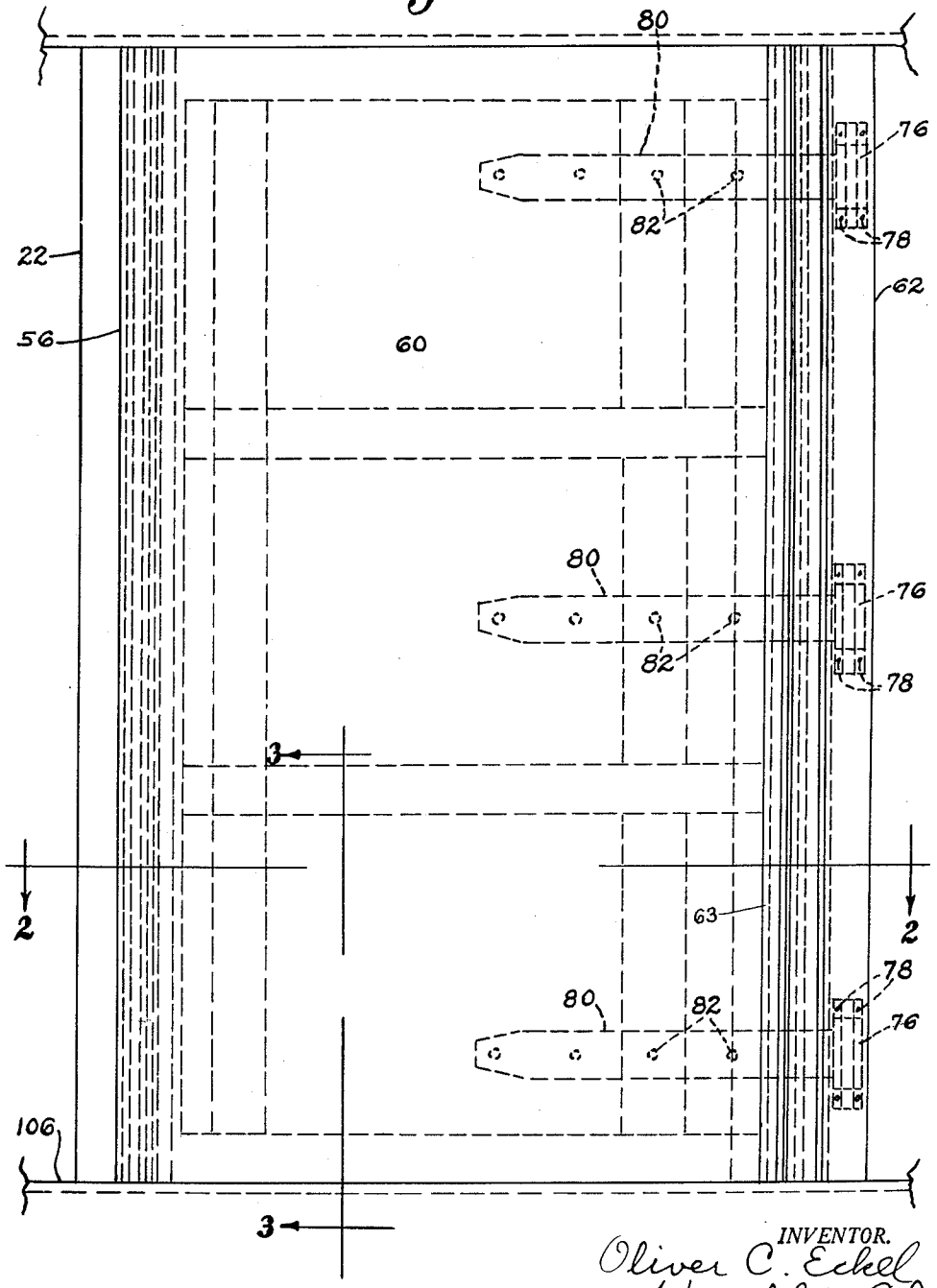
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DOOR FOR ATTENUATING SOUND

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Fig. 1.

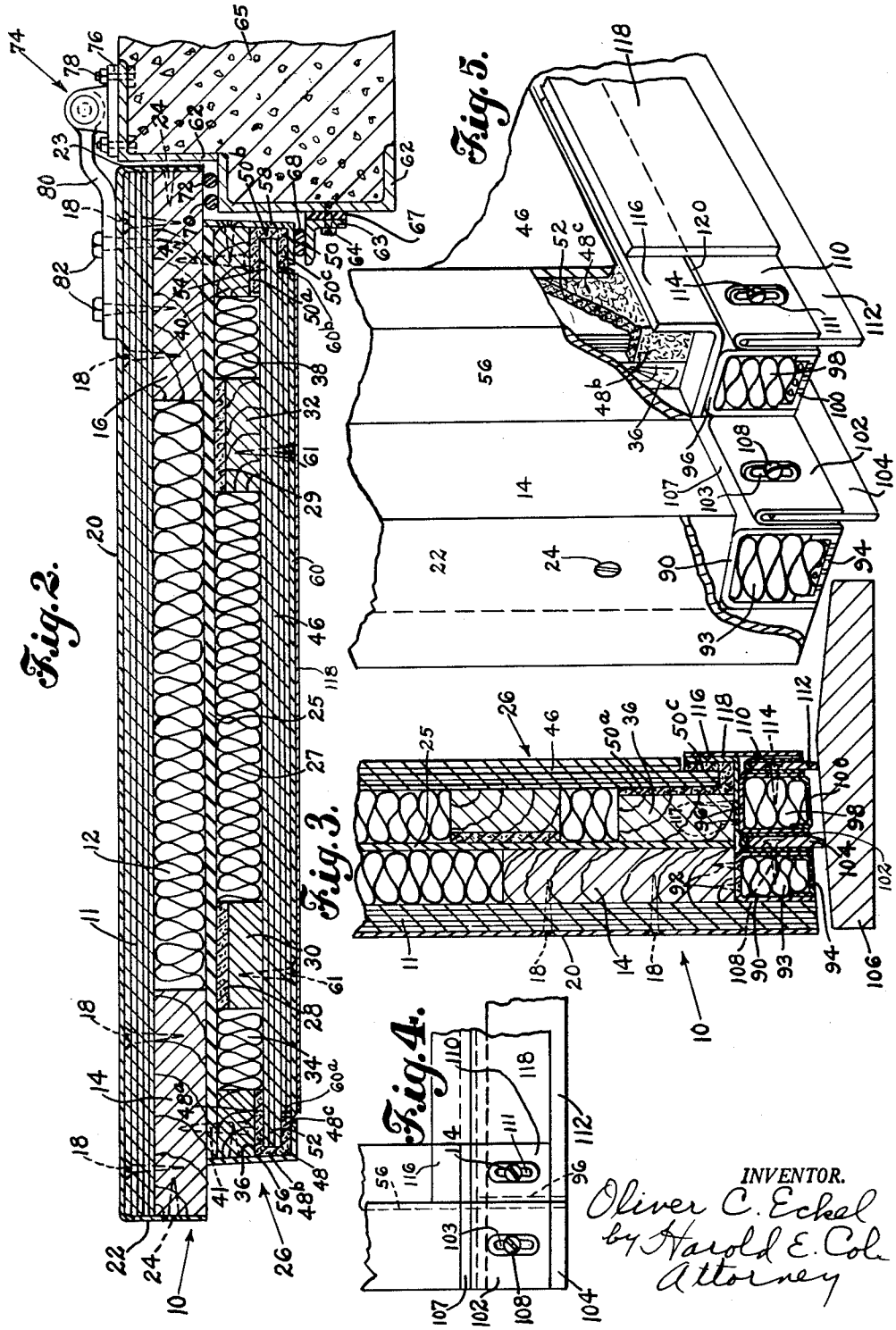


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DOOR FOR ATTENUATING SOUND

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10 Claims. (Cl. 181—33)

This invention relates to a sound attenuating door for use especially where sound vibrations are voluminous, as where jet engines are tested.

One object of my invention is to provide a door with a panel assembly attached in such a manner, that it is decoupled from the main door structure, so that its motion, under excitation from sound waves, is not structurally transmitted to the remainder of the door body.

Another object is to provide said panel assembly with resilient mounting means that permits a floating movement of the panel assembly, and thus materially attenuates transmitted sound.

Still another object is to so construct my door that the degree of compliance of said panel assembly approaches the compliance of air, to thus achieve sufficient isolation to attain effective acoustic attenuation.

A further object is to provide my door with a limp septum member of high surface density (having mass without rigidity) to thereby further control transmitted sound.

A still further object is to provide an acoustical muffler for the gap between the bottom of the main door body and the threshold or floor, to thus attenuate low frequency sound that would otherwise pass through bottom sealing members in the clearance space between the door and said threshold or floor.

The foregoing and other objects which will appear as the nature of the invention is better understood, may be accomplished by a construction, combination and arrangement of parts such as is disclosed by the drawings. The nature of the invention is such as to render it susceptible to various changes and modifications, and therefore, I am not to be limited to the construction disclosed by the drawings, nor to the particular parts described in the specification; but am entitled to all such changes therefrom as fall within the scope of my claims.

In the drawings:

FIG. 1 is an elevational view of my door, looking at the inner surface thereof.

FIG. 2 is an enlarged sectional view taken on the line 2—2 of FIG. 1.

FIG. 3 is an enlarged sectional view taken on the line 3—3 of FIG. 1.

FIG. 4 is a fragmentary, rear elevational view showing the means for sealing my door at a floor or threshold.

FIG. 5 is an enlarged, perspective view partly broken away, to show the lower portion of my door and the said sealing means at the outer and inner bodies thereof.

As illustrated, my door has an outer body portion **10** embodying a plywood panel **11**, next to which is sound absorbing material **12** such as heavy, dense mineral wool, and at opposite ends of said outer body there are wood frames **14** and **16**. Screws **18** hold the latter to said panel **11**. A metal cover of sheet metal **20** covers the outer face of said panel and angular portions **22** and **23** thereof continue and cover opposite ends of said panel **11** as well as opposite outer sides of said wood frames **14** and **16**. Screws **24** hold said cover **20** to panel **11** and they enter frames **14** and **16**.

Next to said outer body **10** is a limp septum sheet **25** of a high density material such as rubber, which may be loaded with iron or lead in small particles or in powdered form. This septum serves to reduce the sound energy transmitted through my door and also the vibration between two like materials.

Next to said septum is an inner body portion **26** having sound absorbing material **27** similar to said material **12**, and at opposite ends of the latter are relatively thin layers **28** and **29** of a non-bonding material such as felt or fiber glass. Also at opposite ends of said septum **25**, and next to said layers **28** and **29** are stiffening or wood frames **30** and **32**. Beyond the left end of said wood frame **30** is sound absorbing material **34** and laterally beyond that is a wood end frame **36**. Laterally beyond said wood frame **32** is sound absorbing material **38** and laterally beyond that is a wood end frame **40**. Screws **41** hold said end frames **36** and **40** respectively to wood frames **14** and **16** thus fastening the outer body **10** to inner body **26**.

An acoustically floating panel **46**, that is resiliently separated from other parts of the door, lies next to said sound absorbing material **27**, **34** and **38** and is attached to frames **30** and **32**, and overlies said frames **36** and **40**. At opposite ends of said panel **46** are channel-shaped resilient retainers **48** and **50** made of sponge rubber or the like which isolate said panel **46**. Each said retainer **48** and **50** has, respectively a relatively long portion **48***a* and **50***a*, an end portion **48***b* and **50***b*, and a relatively short portion **48***c* and **50***c* spaced from said long portions **48***a* and **50***a*. In the latter-mentioned spaces, reduced or cut-away ends **52** and **54** of said panel **46** extend into the spaces provided by said channel-shaped, resilient members **48** and **50** respectively.

Metal angle covers **56** and **58** cover opposite ends of said inner body **26** and extend in front of the latter, covering the outer surfaces of said retainer short portions **48***c* and **50***c* respectively. A cover **60** extends from the ends of said retainer short portions **48***c* and **50***c* across the face of said panel **46** and at opposite ends **60***a* and **60***b* it bends inwardly and enters recesses in said panel **46**. Screws **61** attach said cover **60** and panel **46** to said wood frames **30** and **32**. Said panel **46** with its cover **60** and said stiffening frames **30** and **32** form a panel assembly.

My door is shown attached at one end to a multi-angled frame **62** attached to a concrete wall **65**. A slotted, angular stop member **63** is held by a screw **64** that screw-threadedly connects with said frame **62** and through said slotted stop member **63**. A gasket **67** is between said angular frame **62** and stop member **63**. Another gasket **68** is between said metal cover **60** and said stop member **63**. Two gaskets **70** and **72** are between said multi-angled frame **62** and said wood frame **16**, serving as a seal, thereby reducing sound transmitted through clearance space, when the door is in closed position. Said gaskets are made of soft, compliant material.

A hinge member **74** is attached to said frame as by screws **78** that are welded to frame **62** and extending through a pintle base **76**. A hinge arm **80** movably extends to said outer body portion **10**, being attached by screws **82** to said wood panel **11**.

The lower part of said outer body **10**, as shown in said FIGS. 3, 4 and 5, has a metal, U-shaped holder **90** attached by screws **92** to said wood frame **14**, and within which is a cavity filled with sound absorbing material **93**. A perforated, bottom metal cover **94** extends tightly into said holder **90** and serves as the bottom for a portion of said outer body **10**. Another metal, U-shaped holder **96** forms a continuation of said inner body **26**, and it has a cavity filled with sound absorbing material **98** therein. A perforated, bottom metal cover **100** extends tightly into this holder **96** and serves as a bottom for a portion of said holder **96**. Thus these sound absorbing materials **93** and **98** provide an acoustical muffler in a gap between the bottom of the inner and outer body portions and the threshold or floor.

Between said holders **90** and **96** is a narrow U-shaped

holder 102, into which extends resilient sealing member 104 made of rubber or the like, and which extends below the door main body, making rubber contact with a floor or threshold 106. A pin member shown as a screw 108 extends through a slot 103 in holder 102 and it holds said sealing member 104, said holder 102 and said holder 90 together. Between said holder 102 and the bottom of said wood frame 14 is a clearance space 107.

Outside said holder 96 is a narrow U-shaped holder 110 into which extends another resilient sealing member 112 made of rubber or the like, and which extends below the door main body and contacts said threshold 106. A pin member shown as a screw 114 extends through a slot 111 in holder 110 and it holds said sealing member 112, said narrow holder 110 and said holder 96 together.

An angle member 116 extends from outside said retainer short portion 48c across the inner closed end of said holder 96, and attaches to frame 36 by screws 117. A straight cover member 118 of metal covers the outer portion of said angle member 116 to which it is welded, and also covers the exterior portion of said narrow holder 110. There is a clearance space 120 between said holder 110 and said angle member 116.

What I claim is:

1. A door for attenuating sound comprising an outer body portion, an inner body portion, means attaching said body portions together, said inner body portion embodying sound absorbing material, two frame members spaced apart intermediate opposite side extremities of said inner body and at opposite side extremities of said material, yielding material next to and interiorly of said frame members, a panel opposite and exteriorly of said frame members and sound absorbing material, means attaching said panel to said frame members, resilient retainers at opposite side extremities of said panel having openings, opposite side extremities of said panel extending into said openings, and a reslient septum sheet between said inner and outer body portions in contact with portions of said panel assembly.

2. A door for attenuating sound comprising an outer body portion, an inner body portion, means attaching said body portions together, said inner body portion embodying sound absorbing material, a panel assembly embodying two frame members spaced apart intermediate opposite side extremities of said inner body and at opposite side extremities of said material, yielding material next to and interiorly of said frame members, a panel opposite and exteriorly of said frame members and sound absorbing material, means attaching said panel to said frame members, and resilient retainers at opposite side extremities of said panel having openings, opposite side extremities of said panel extending into said openings, said inner body portion also embodying two other frame members at opposite sides of said inner body and laterally outward of the first-mentioned two frame members, portions of said resilient retainers being in contact with said two other frame members.

3. A door for attenuating sound comprising an outer body portion, an inner body portion, means attaching said body portions together, said inner body portion embodying sound absorbing material, a panel assembly embodying two frame members spaced apart intermediate opposite side extremities of said inner body and at opposite side extremities of said material, yielding material next to and interiorly of said frame members, a panel opposite and exteriorly of said frame members and sound absorbing material, means attaching said panel to said frame members, and resilient retainers at opposite side extremities of said panel having openings, opposite side extremities of said panel extending into said openings, said inner body portion also embodying two other frame members at opposite sides of said inner body and laterally outward of the first-mentioned two frame members, portions of said resilient retainers being in contact with said two other frame members, other sound absorbing materials at points adjacent opposite sides of said inner body and laterally outward of the first-mentioned two frame members.

4. A door for attenuating sound comprising an outer body portion, an inner body portion, means attaching said outer and inner body portions together, a sealing member, first means attaching said sealing member to said outer body portions, another sealing member, second means attaching said other sealing member to said inner body portion, said sealing members extending below both said body portions, each said body portion embodying sound absorbing material laterally opposite said sealing members, third means retaining said sound absorbing materials, said first means and second means each having a slot therein, and pin members attaching said sealing members to said first means and second means and attached to said third means, said pin members extending through said slots whereby said sealing members may be moved to a predetermined position.

5. A door for attenuating sound comprising an outer body portion, an inner body portion, means attaching said body portions together, said inner body portion embodying sound absorbing material, two frame members spaced apart intermediate opposite side extremities of said inner body and at opposite side extremities of said material, yielding material next to and interiorly of said frame members, a panel opposite and exteriorly of said frame members and sound absorbing material, means attaching said panel to said frame members, resilient retainers at opposite side extremities of said panel having openings, opposite side extremities of said panel extending into said openings, a resilient septum sheet between said inner and outer body portions in contact with portions of said panel, a sealing member, means attaching said sealing member to said outer body portion, another sealing member, means attaching said other sealing member to said inner body portion, said sealing members extending below both said body portions, each said body portion embodying sound absorbing material laterally opposite said sealing members, and means retaining said sound absorbing materials.

6. A door for attenuating sound comprising an outer body portion embodying a first U-shaped holder, an inner body portion embodying a second U-shaped holder, means attaching said outer and inner body portions together, a sealing member, means attaching the latter to said first U-shaped holder, another sealing member, means attaching the latter to said second U-shaped holder, said sealing members extending below both said body portions, each said body portion embodying flexible, sound absorbing material laterally opposite said sealing members and in said U-shaped holders, and means retaining said sound absorbing materials in said holders.

7. A door for attenuating sound comprising an outer body portion embodying a first U-shaped holder, an inner body portion embodying a second U-shaped holder, means attaching said outer and inner body portions together, a third U-shaped holder, a sealing member extending into said latter holder, a pin member attaching said third holder and said sealing member to said first U-shaped holder, a fourth U-shaped holder, another sealing member extending into said fourth holder, a pin member attaching said fourth holder to said second U-shaped holder, said sealing members extending below both said body portions, each said body portion embodying flexible, sound absorbing material laterally opposite said sealing members and in said first and second U-shaped holders, and means retaining said sound absorbing materials in said holders, said third and fourth holders each embodying a slot therein whereby the positions of said pin members in said slots may be adjusted to thereby adjust the positions of said sealing members relative to said body portions.

8. A door for attenuating sound comprising an outer body portion, an inner body portion, both said body por-

tions embodying sound absorbing material, and a limp septum sheet between said body portions, each of said body portions embodying a firm panel exteriorly of said sound absorbing materials of both said body portions, said inner body portion embodying channel-shaped, resilient retainers at opposite side extremities of said inner body portion panel having openings, the opposite side extremities of said latter panel extending into said openings.

9. A door for attenuating sound comprising an outer body portion, an inner body portion, narrower than said outer body portion, said outer body portion overlapping said inner body portion at opposite sides, both said body portions embodying sound absorbing material, and a limp septum sheet of high density rubber material between said body portions and said sound absorbing materials and adjacent the latter extending substantially the full width and height of said inner body portion, each of said body portions embodying a firm panel exteriorly of said sound absorbing materials of both said body portions, said inner body portion embodying channel-shaped, resilient retainers at opposite side extremities of said inner body portion panel and having openings, the opposite side extremities of said latter panel extending into said openings.

10. A door for attenuating sound comprising an outer body portion, an inner body portion, means attaching said outer and inner body portions together, a sealing

member, means attaching said sealing member to said outer body portion, another sealing member, means attaching said other sealing member to said inner body portion, said sealing members extending below and outside both said body portions, each said body portion embodying sound absorbing material laterally opposite said sealing members, and means embodying a cover retaining said material in each said body portion, each said cover having perforations therein.

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