

- [54] **SOUND INSULATING BLOCK**
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- [51] **Int. Cl.**..... E04b 1/84, E04b 17/00
- [58] **Field of Search** ..... 52/405, 145, 606, 144, 52/437, 438; 181/33 R, 33 G

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[57] **ABSTRACT**  
 This invention relates to a sound insulating building block that insulates, absorbs or irregularly reflects incident sound waves. The block contains a cover therein. The cover contains a sound absorbing plate formed into a plate shape of mineral fibers such as glass wool or asbestos or other ordinary fibers additionally attached to the mineral fibers. The sound absorbing plate is inserted into the cover in tight contact with the inside of the cover and the cover is then received into an open block made of mineral matter such as concrete and having side plates on the circumference. The cover is provided on its facing panel with slits or holes designed to face the open portion of the block.

**10 Claims, 11 Drawing Figures**

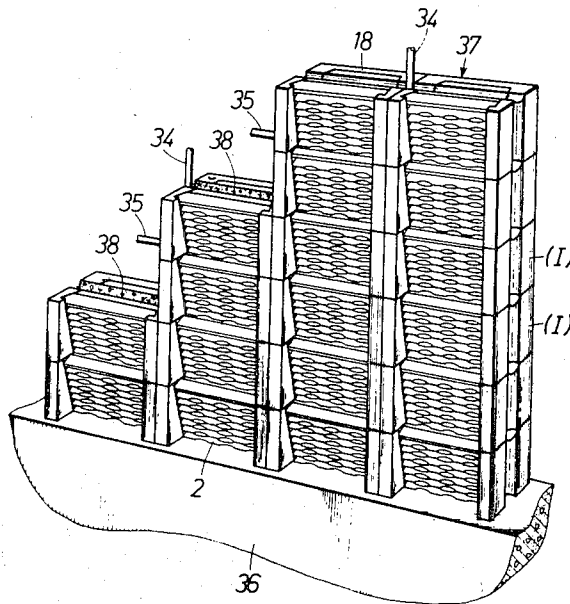


FIG. 1

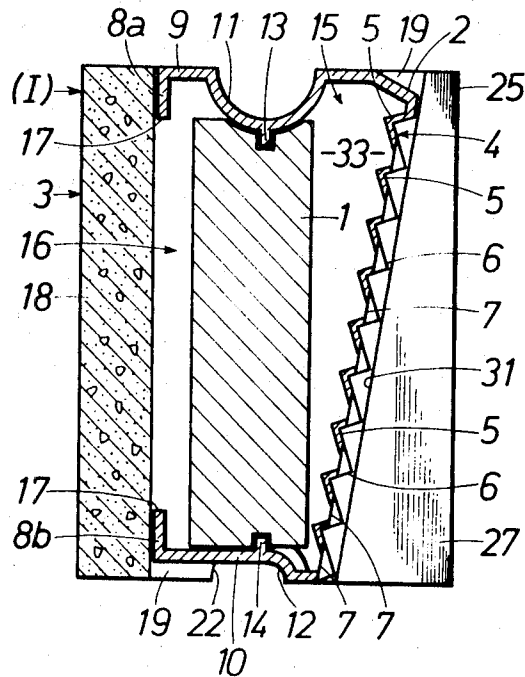


FIG. 2

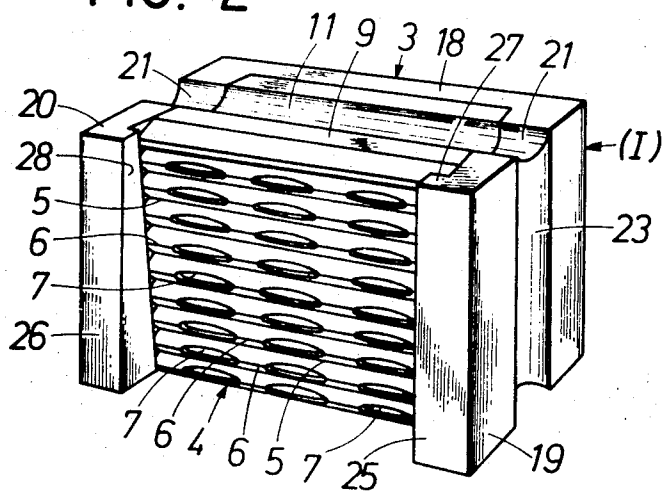


FIG. 3

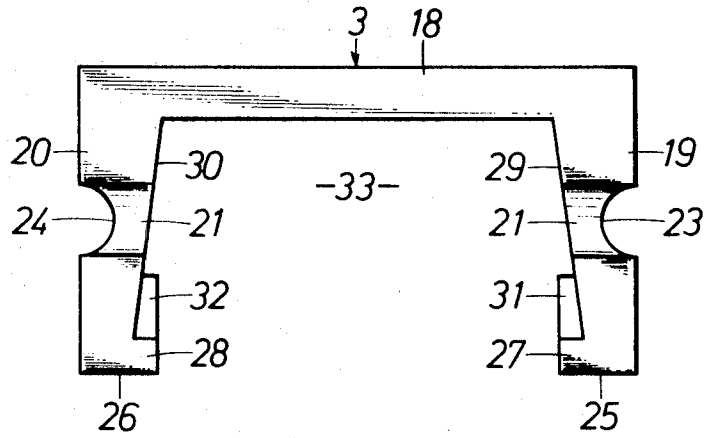


FIG. 4

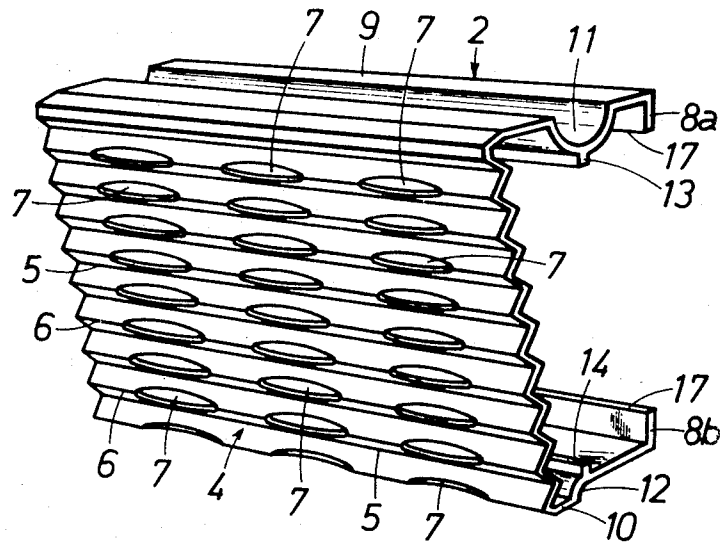


FIG. 5

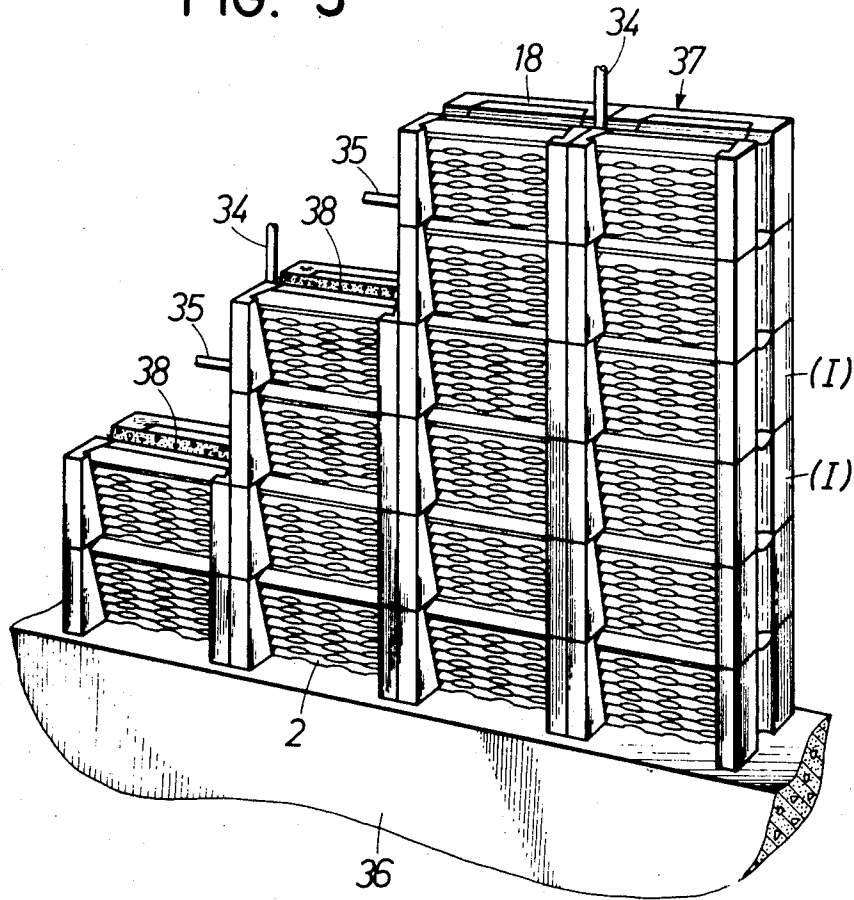


FIG. 6

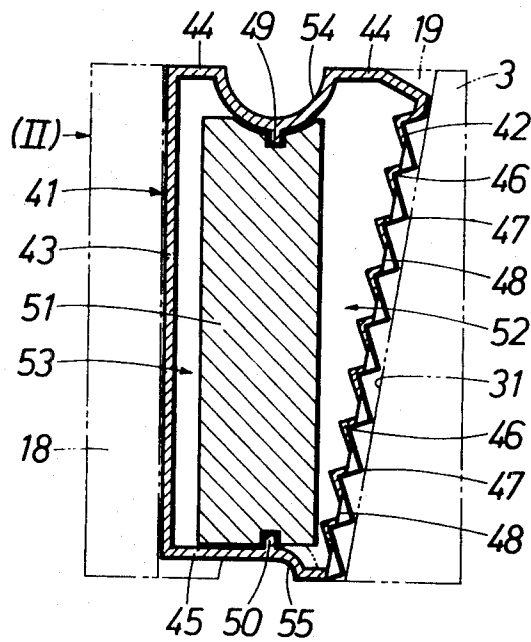


FIG. 7

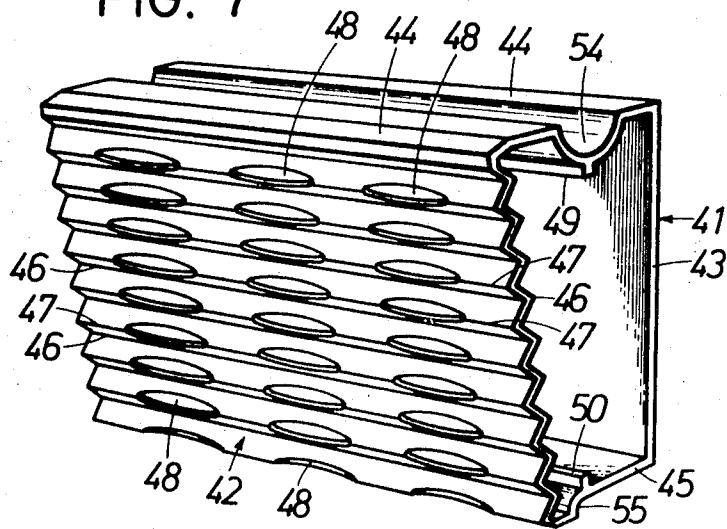


FIG. 8

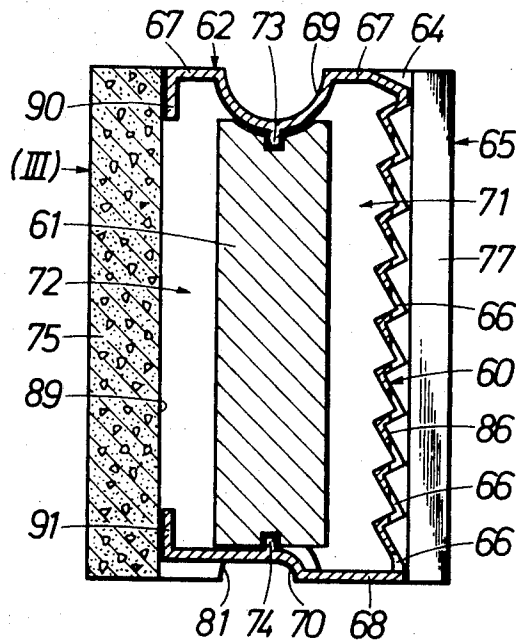


FIG. 9

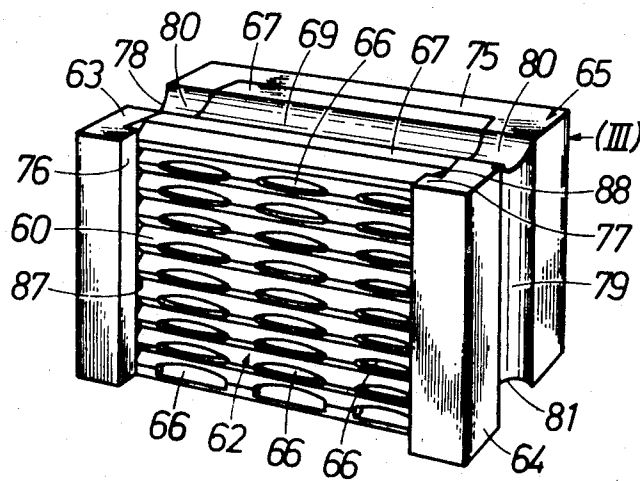


FIG. 10

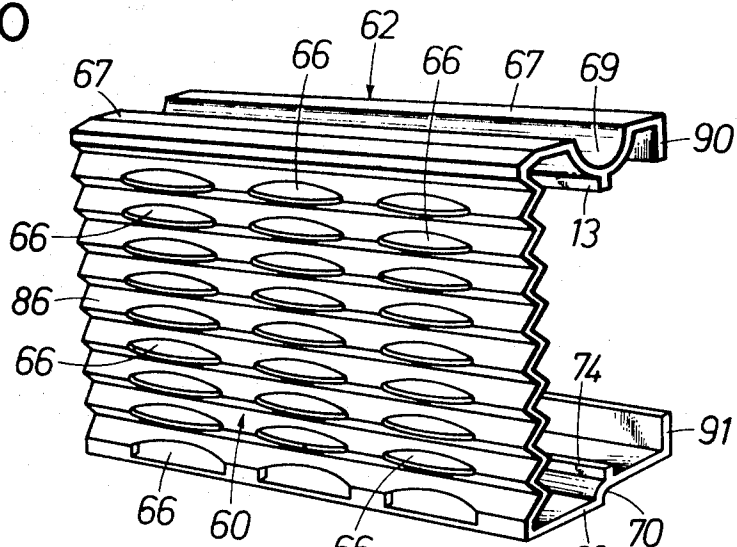
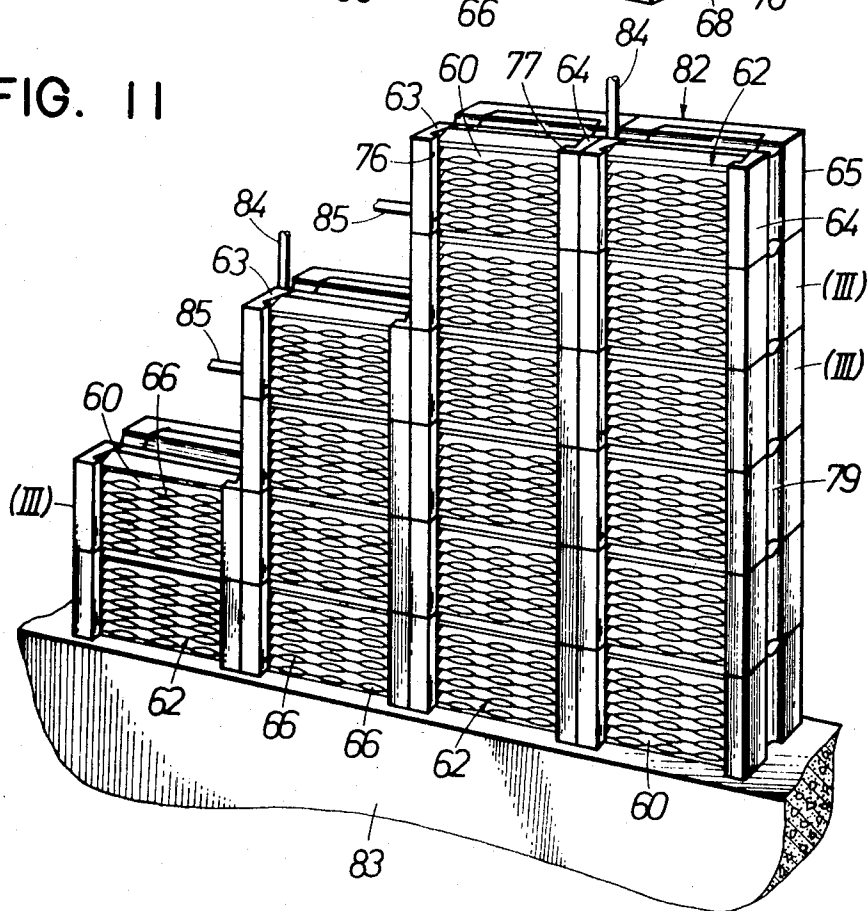


FIG. 11



## SOUND INSULATING BLOCK

## BACKGROUND OF THE INVENTION

A conventional type concrete block is not designed to be one of the type from which sound insulating effects can be expected, and researches have been made into the block of the type in which slits are formed in the surface of the block or a sound absorbing material is inserted into the slits, but the block of the type described is not sufficient in sound insulating effect because there is directivity in sound absorbing frequency. In view of this fact, the invention is designed to provide a sound insulating block having sound absorbing and insulating ability by fitting a cover into the block in such a manner that a sound absorbing plate is inserted into the cover so as to form air layers in front and back of the sound absorbing plate and the cover is formed on the surface with slits or holes and that thereafter that side of the cover having said slits or holes formed therein may face the open portion of the block. The invention makes it possible to sufficiently attain an object of insulating noises by surrounding a place of noise source such as an expressway, machinery and tools in various factories, cleaning tower, boiler burner, butchery, construction site, etc., with a sound insulating wall assembly of the blocks of the type described.

## SUMMARY OF THE INVENTION

The cover employed in the invention is of a construction in which a top plate and a bottom plate formed parallelly and integrally with one side of a facing panel in a relation at right angles with the one side of the facing panel or somewhat inclined from right angles therewith, said facing panel being irregular in surface and having a multiplicity of slits or holes formed therein, said both top and bottom plates being formed on their opposing inside surfaces with projections for supporting a sound absorbing plate. Said facing panel and sound absorbing plate are either in contact with each other or have a space therebetween with a space provided between the sound absorbing plate or a back wall. The block is made of concrete and other material capable of being hardened in such a manner that the main wall is formed integrally on both sides with side walls to form a U-shape block open both on the upper and lower sides and on one lateral side. Into this block is inserted the cover holding said sound absorbing plate therein. The cover is received into the block in such a relation in which the facing panel having slits or holes therein faces the side opening of the block.

## BRIEF EXPLANATION OF THE DRAWINGS

FIG. 1 is a sectional view of an I-type sound insulating block constructed by use of a cover having an inclined facing plate;

FIG. 2 is a perspective view of FIG. 1;

FIG. 3 is a plan view of a U-shaped block;

FIG. 4 is a perspective view of the cover;

FIG. 5 is a perspective view of a wall constructed of said insulating blocks laid one over another;

FIG. 6 is a sectional view of an II-type sound insulating block in which a back panel of a cover is used, said cover being formed into a box shape of one piece;

FIG. 7 is a perspective view of the cover used in the block shown in FIG. 6;

FIG. 8 is a sectional view of an III-type sound insulating block using a cover in which a facing panel and a back panel are formed in a parallel relation to each other;

FIG. 9 is a perspective view of the sound block in FIG. 8;

FIG. 10 is also a perspective view of the sound insulating block in FIG. 8; and

FIG. 11 is a perspective view of a sound insulating wall constructed of said II-type sound insulating blocks laid one over another.

## DESCRIPTION OF PREFERRED EMBODIMENTS

## EXAMPLE 1

In FIGS. 1 through 5 is shown an I-type block.

This block is a sound insulating block constructed in the manner that a sound absorbing plate 1 is fixed inside a cover 2 and the cover 2 is then tightly closed in a block 3. As shown in FIGS. 1 and 4, the facing panel of the cover 2 is formed into a wavelike or zigzag surface having dents 5 and raised portions 6, and the raised portions 6 or dents 5 each are formed with a slit 7. The facing panel may be formed to have suitable dents and raised portions such as those of a wavelike or zigzag shape. And the slit 7 may be round, oblong, square or the like in shape and regular or irregular also in arrangement. The facing panel is integrally formed on the upper portion with a top plate 9 and on the lower portion with a bottom plate 10 at approximately right angles with the facing panel, said top plate 9 and bottom plate 10 being integrally provided at their ends with back plates 8a and 8b, like edge plates, facing inwardly so as to oppose each other and being at right angles with the top plate 9 and bottom plate 10. The facing panel 4 thus formed is provided between the top plate 9 and the bottom plate 10 in such a manner that it is progressively reduced in space toward said vertical back plates 8a and 8b, and the bottom plate 10 is smaller in width than the top plate 9. And the top plate 9 and bottom plate 10 are provided on the respective outsides with filler grooves 11, 12, and are formed on their insides with projections 13 and 14 in an opposing relation. The projection 14 is preferably rail-shaped. A sound absorbing plate to be received therein is a plate-like material made of mineral matter such as glass wool or asbestos or of other fibers mixed therewith with glue partially added thereto, and the plate-like material is formed into a suitable shape and thickness, and inserted between the projections 13 and 14 of said cover and held resiliently inside the cover 2, as shown in FIG. 1. Spaces 15 and 16 are formed in front and back of the sound absorbing plate 1 or the space 16 alone in back of the plate to increase the sound absorbing effect. Between the opposing edges 17 of two back plates 8a and 8b is provided an opening large enough to permit easy fitting of the sound absorbing plate 1. As shown in FIGS. 1 through 3, the block 3 that receives the cover therein is formed of concrete into a U-shape with a main body wall 18 and side walls 19 and 20. Filler grooves 21, 22 and 23, 24 are formed transversely on the top and bottom and longitudinally on the lateral sides of the side walls. And said side walls 19 and 20 are formed at the ends 25 and 26 thereof with support portions 27 and 28 projecting inwardly in an opposing relation to each other and the inside walls 29, 30 of the side walls 19, 20 are inclined toward the main wall 18 in such a manner that the walls 29, 30 are progressively



reduced in distance between each other, and the support portions 27, 28 also are so formed that they may have inclined portions 31, 32 progressively increasing in depth downward along the side walls 19, 20, thus the inside of the block 3 defining a fitting part 33.

When the cover 2 thus fitted with the sound absorbing plate 1 is inserted into the fitting part 33 from above the block 3, the cover 2 drops in along the inside walls 29, 30 and inclined portions 31, 32, and is mounted with ease. The filler groove 11 of the cover 2 mounted and the filler grooves 21, 22 of the block 3 are mated with each other to form a transversely continued filler groove. Into the formed filler grooves 23, 24 and 11, 12, and 21, 22 as shown in FIG. 5, are inserted longitudinal iron bars 34 and transverse iron bars 35 and is then poured mortar 38 and thus the blocks 3 are successively laid one over another on a foundation 36 to construct a sound insulating wall 37 of a desired height.

The sound insulating block 1 formed as described above, if produced sound strikes against the facing panel 4 of the I-type block, permits the sound to be divided into one component that passes through most of the slits 7 and another that is irregularly reflected by the decreased surface area of the facing panel 4. The sound wave that passes through the slits 7 is absorbed by the sound absorbing plate 1. Since the sound absorbing plate is made of glass wool or mineral fibers, etc. excellent in absorption efficiency as described, it effectively absorbs the sound produced particularly at high frequency, and furthermore the air layers in the spaces 15 and 16 formed in front and back of the cover 2 or that in the space 16 alone is especially for absorbing the low frequency sound produced, thus the block absorbs the sound produced over each frequency area as a whole.

The transmitted sound that was damped by its passage through the sound absorbing plate 1 strikes against the main wall 18 of the block 3 through the rear space 16, and part of the sound that strikes against the wall 18 is reflected and absorbed once more by the sound absorbing plate 1 through the air layer in the space 16. Tests have demonstrated that this sound absorbing mechanism could decrease a noise level by about 5 to 7 dH. Also, since the block 3 is made of a material of high density such as concrete, it can sufficiently insulate transmitted sound by the combined effects of the sound absorbing plate 1 and the air layer spaces 15 and 16. Namely, sound energy is greatly damped by a synergic effect of a sound absorbing mechanism and a sound insulating mechanism. And a small quantity of sound wave that does not pass through the slits of the facing panel 4 is scattered and lost by irregular reflection, because the surface of the panel 4 provides wavy shaped or zigzag irregularities and is as a whole mounted slantly.

As described above, the sound absorbing wall made of sound insulating blocks shown in FIG. 5 decreases the spread of noises with respect to the outside insulated. If, as conventionally, this sound insulating wall is formed of rigid material such as concrete, brick, stone, metal, etc., a sound pressure level on the sound source side is increased 5 to 7 dH by reflection of sound waves upon the wall surface and ground surface, thus the sound source spreads. When a reflection surface is not wavy shaped or irregular but is simply flat, this value tends to become further increased. The sound absorb-

ing mechanism of the sound insulating block of the invention is aimed at such a point, and not only because the sound absorbing mechanism and sound insulating mechanism provided in the direction of sound source limits apparently an increase of a noise level on the sound receiver side, but also because the facing panel 4 of the cover 2 is wave-shaped and is generally inclined, the sound produced is dispersed and lost by irregular reflection and is not reflected centrally upon a specified point. Furthermore, the irregular surface of the facing panel 4 of the cover 2 prevents entering of rain and snow, and the rain and snow entering by any chance can be prevented from entering further inside by forming the projection 14 of the bottom plate 10 into a rail shape and are allowed to be drained through the slits 7 formed in the lowermost portion of the panel 4. And the wave shape of the facing panel 4 comes into fit contact with the inclined portions 31, 32 of the support portions 27, 28 of the block 3 to bring the panel 4 into effective engagement with the block 3, thus preventing the deformation of the cover 2 in cooperation with the projections 13 and 14. The air space layers in the spaces 15 and 16 provided in front and back or the air layer in the space 16 alone of the cover 2 efficiently absorbs low sound. The sound absorbing plate 1 supported between the top and bottom plates is provided so as to have a suitable degree of resilience, and therefore, it is of great use in sound absorbing effect, and provides easy access to replacement. In order to support the cover 2 by protrudingly forming the support portions 27, 28 in the side walls 19, 20 of the block 3 in the embodiment illustrated, it is easy from a point of design to form longitudinal grooves (not shown) and fit the cover therein, instead of the support portions 27, 28.

#### EXAMPLE 2

In FIGS. 6 and 7 is shown a sound absorbing cover for use in a II-type block. In this sound insulating cover 41, a back panel 43 is one piece made by connecting with each other the back plate 8a and 8b of the cover 2 of asbestos sheet, cement sheet, metal such as iron, lead in the preceding example or is made of other heavy material plate in such a manner as to connect the back plates 8a and 8b with each other. Other construction and structures are the same as those shown in the preceding example. Namely, the cover 41 is made of a facing panel 42, back panel 43, top plate 44 and bottom plate 45, all of which are formed into one whole solid body having both open sides. The facing panel 42 is a wave-shaped plate having dents 46 and raised portions 47 and is formed with slits 48. The facing panel 42 is inclined with respect to vertical back panel 43 in such a manner that the space between the panels 42 and 43 is progressively narrowed downward. A sound absorbing plate 51 is fitted resiliently between projections 49 and 50 provided in an opposing relation inside the top plate 44 and bottom plate 45, and spaces 52, 53 are provided in front and back of the sound absorbing plate 51 or space 53 alone in back of the plate 51. The projection 50 of the bottom plate 45 preferably is rail-shaped. On the surfaces of the top plate 44 and bottom plate 45 are formed filler grooves 54 and 55 so as to permit filling the grooves 54 and 55 with steel rods and concrete for connecting blocks each containing the cover 41. The back panel 43 may be made of a thicker material, when necessary. As shown in FIG. 6, the

cover 41 thus formed is fitted in the block 3 made of concrete shown in the preceding example to produce a II-type sound insulating block, or to construct a sound insulating wall assembly by attaching said insulating blocks to the noise insulating side of the wall already constructed. The action and effect brought about by the insulating block thus produced are the same as those mentioned in the preceding example 1, and hence detailed explanation is omitted.

### EXAMPLE 3

A III-type sound insulating block will be described with reference to FIGS. 8 through 11. According to this sound insulating block, the block and space therein are square in shape and a cover to be inserted into the space has no such inclined plane as the two preceding examples had, but is vertical and box-shaped. Furthermore, the sound insulating block itself is formed square or rectangular box-shaped. Other structures are the same as those in the previous examples.

In FIG. 8, a sound insulating plate 61 is fitted in a cover 62, and said cover is closely fitted in a U-shaped block 65 having side walls 63, 64 on both sides to form a II-type sound insulating block. The facing panel 60 of the cover 62 has an irregular surface 86 on which slits or holes 66 are formed so as to be of use for absorption of sound. The facing panel 60 is formed at its upper and lower ends with a top plate 67 and a bottom plate 68 extending from the upper and lower ends of the panel 60 respectively at right angles with the plates 67 and 68. The top and bottom plates are provided at their respective ends with back edges 90 and 91, said edges extending from the ends of the top and bottom plates 67 and 68 at right angles with the plates 67 and 68 and in an opposing relation with each other and having an opening therebetween. The top plate 67 and bottom plate 68 are formed with filler grooves 69, 70. The filler grooves 69 and 70 are formed inside respectively with rail-shaped projections 73 and 74 in an opposing relation. The sound absorbing plate 61 is supported by the projections 73 and 74 in such a manner that there are provided spaces 71, 72 in front and back of the plate 61 or space 72 alone to retain air therein. As shown in FIGS. 8 and 9, a U-shaped block 65 is of material of high density such as concrete and is U-shaped so as to have side walls 63 and 64 at right angles with a main wall 75. The side walls 63, 64 are formed inside the ends thereof with upright support portions 76, 77 in an opposing relation and the support surfaces 87, 88 of the inside walls of the support portions 76, 77 are substantially parallel to the inside surface 89 of the main wall 75, thus defining a square box-shaped container-like space portion inside the block. The support portions 76, 77 may be grooves longitudinally formed from a point of design. Also, the side walls 63 and 64 are provided on both side surfaces and on the top and bottom surfaces with filler grooves 78, 79 and 80, 81 respectively. The cover 62 is firmly fitted into the U-shaped block 65 to thereby form a III-type sound insulating block. In order to construct a sound insulating wall 82 shown in FIG. 11 by use of the square box-shaped III-type sound insulating blocks of the invention thus formed, the blocks are laid one over another on a foundation 83 and steel bars 84, 85 are inserted and mortar is filled in the grooves of the blocks assembled. Since this III-type sound insulating block is square in shape, it is easy to construct and is strong. And this insulating

block also brings about the same action and effect as the blocks shown in the preceding examples. The air layer in the space portions 71, 72 formed in front and back of the sound absorbing plate or that in the space 72 portion alone formed in back thereof serves as a resilient body and absorbs mainly sound produced in a low frequency area, and accordingly absorbs, as a whole, sound produced over each frequency area. Other actions and effects are the same as those mentioned in Example 1.

I claim:

1. A sound-insulating building block comprising:
  - a. a thick walled structural support member of sound-insulating material having a main wall and two side walls defining a compartment with three open sides;
  - b. a thin walled panel member having a main side and upper and lower sides and inserted in and cooperating with said support member to enclose said compartment, said main side having a plurality of apertures therein to permit the passage of incident sound waves into said compartment; and
  - c. a partition member of sound-absorbing material spanning the upper and lower sides of said panel member within said compartment and defining respective air spaces between its opposite surfaces and the main side of said panel member and the main wall of said support member.
2. A block as in claim 1 wherein said main side of said panel member has a zigzag surface with said plurality of apertures formed in the outermost edges thereof to permit the passage of all incident sound waves into said compartment.
3. A block as in claim 1 further comprising means on the outer ends of said side walls of said support member for holding said panel member in cooperation therewith.
4. A block as in claim 1 further comprising means on the inside of said upper and lower sides of said panel member for holding said partition member upright in said compartment.
5. A block as in claim 1 wherein said main side of said panel member is inclined with respect to said main wall of said support member.
6. A block as in claim 1 wherein said two side walls of said support member and said upper and lower sides of said panel member are formed with cooperating filler grooves for receiving steel setting bars and filling mortar.
7. A block as in claim 1 wherein the inner surfaces of said two side walls of said support member taper outwardly from said main wall and the upper and lower sides of said panel member taper inwardly from said main side.
8. A block as in claim 1 wherein said support member is of concrete and said partition member is a mineral fiber.
9. A composite structure composed of a plurality of stacked sound-insulating building blocks, each of said blocks comprising:
  - a. a hollow box-shaped structural member of sound-insulating material having a main wall and two side walls and openings in the upper, lower and one lateral surface thereof;
  - b. a cover member having a top plate, a bottom plate and a facing plate respectively fitted in said openings in the upper, lower and one lateral surface of

said structural member and cooperating therewith to enclose the interior thereof, said facing plate having apertured means for permitting the passage of all incident sound waves into said interior;

- c. a sound-absorbing panel member fitted between said top and bottom plates within said interior and defining respective air spaces between its opposite surfaces and said facing plate and said main wall of said structural member; and
- d. said two side walls of said structural member and said top and bottom plates of said cover member being formed with cooperating filler grooves for receiving filling mortar to connect adjacent ones of said blocks.

- 10. A sound-insulating building block comprising:
  - a. a thick-walled support member of sound-insulating

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- material having a main wall and two side walls;
- b. a thin-walled box-shaped compartment member fitted in said support member and having a top plate, a bottom plate and two facing plates with one of said facing plates disposed against said main wall and the other of said facing plates having a plurality of apertures therein and the open ends of said compartment member disposed against said side walls defining a hollow compartment enclosed by said support member and said compartment member; and
- c. a panel of sound absorbing material disposed in said compartment and spaced from said main wall and said apertured facing plate defining respective air spaces therebetween.

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