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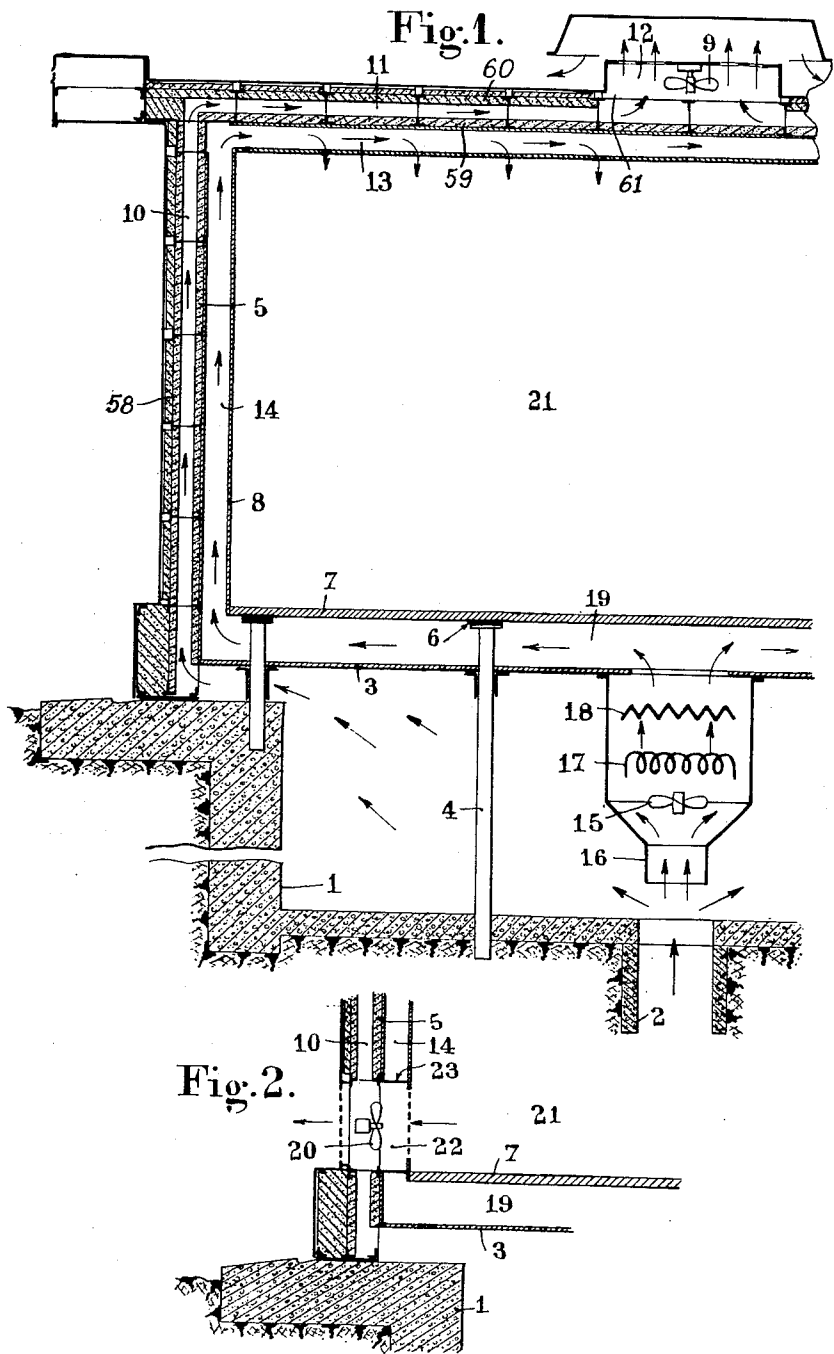
J. L. CLAUDE

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SOUND-ABSORBING AND HEAT-RESISTING WALL CONSTRUCTION

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3 Sheets-Sheet 1



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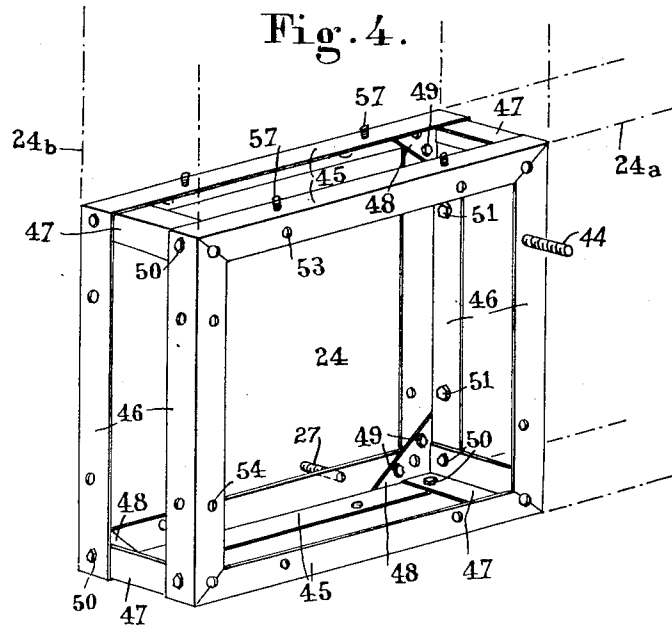
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**SOUND-ABSORBING AND HEAT-RESISTING
WALL CONSTRUCTION**

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6 Claims. (Cl. 98—31)

This invention relates to an improved wall construction designed for controlling temperature and sound: The walls utilized in this construction consist of multiple parallel surfaces so arranged as to permit the direct formation of two separate air circulation circuits between some of these surfaces, the first circuit nearer to the outer surface consisting preferably of air taken from a zone protected against temperature changes, the other circuit being very close to the innermost wall of the construction and consisting of conditioned air, preferably one fraction of the air utilized in the first circuit after correcting its temperature and if desired its moisture content.

The lower floor, the vertical walls and the roofing are preferably arranged according to the principle broadly set forth in the preceding paragraph, but in certain cases the invention may be applied only to the construction of vertical walls and partitions.

According to a first and recommended form of embodiment a commercial, industrial or residential building is constructed which comprises two peripheral spaces highly insulated from each other from the dual point of view of heat and sound, an air circulation at a suitable mean temperature between the outer space and the inner space being produced to keep the inner space in a constantly temperate atmosphere; under these conditions, the air-conditioning of the building is made considerably easier and more economical.

This object as well as a satisfactory insulation between the two spaces may be obtained provided that no connection exists between these spaces which consists of highly heat-conducting elements such as massive metal or concrete elements, which actually amounts to the suppression of any conventional metal or concrete framework likely to constitute a direct connection between the two spaces, and to the use as means for interconnecting the inner and outer spaces only members of such character, shape and section that the maximum resistance to the transmission of heat and sound is obtained.

To this end, the form of construction selected according to this invention with a view to eliminating the conventional frameworks is based on the use of self-contained or unitary blocks of relatively reduced weight and overall dimensions so that their transport and handling are facilitated considerably, the assembly work being particularly easy, fast and adapted to be performed even by unskilled hands, and in addition each block can be disassembled very rapidly without interfering with any of the adjacent blocks, each block comprising two spaces separated by heat and sound resisting elements; finally, two independent air circulations are formed through these spaces.

These blocks consist of properly selected elements whereby each of them has a well-defined function for which it offers the characteristics most consistent with the purpose contemplated.

Besides, in addition to the inherent mechanical or insulating properties which must be found in these elements, the latter must be capable of meeting specific conditions on which their selection is at least partly based (resistance to certain climatic conditions and atmospheres, fire-proofness, considerations of appearance, cost, weight, wear, etc.)

Due to the great variety of basic elements that can be used in this form of construction without departing

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from the invention, it is possible to construct structures meeting the most diversified requirements.

These elements are subsequently assembled to constitute a block by using methods whereby all their inherent properties and therefore their efficiency can be preserved in the final construction.

In order to afford a clearer understanding of this invention and of the manner in which the same may be carried out in practice, reference will now be made to the attached drawings forming part of this specification and illustrating diagrammatically by way of example a few forms of embodiment of the invention. In the drawings:

FIGURE 1 is a fragmentary vertical section showing a one-story building construction made in accordance with the teachings of this invention.

FIGURE 2 is a similar view of a detail.

FIGURE 3 is a sectional view of a separate block.

FIGURE 4 is a perspective view showing the frame structure of a block according to the invention and the manner in which this frame is rigidly secured to identical frames in the construction of a wall according to this invention.

In the construction illustrated in FIG. 1, the foundations 1 constitute an air tank into which opens a duct 2 feeding air at a temperature constantly approximating 50° F. in all seasons. This air may be extracted either from a well sunk in a porous ground or from a cellar or an underground gallery or like ventilating course, or simply from a low-cost heat exchanger operating for example by causing air to circulate along a coil in which water from a well or from the town supply system is circulated, provided that the latter delivers water at a suitable temperature.

The air shaft (which may also consist, if desired, of one portion of the water-supply well) may extend directly through the foundations.

The floor comprises two superposed horizontal portions. The lower portion 3 is carried by columns 4 sunk in the foundations and the upper portion 7 rests on these columns through the medium of supports 6 consisting of conventional devices having a certain resiliency and adapted notably to reduce the transmission of noise and vibration, and to prevent the exchange of heat between the two floor portions.

The lower floor portion 3 is connected to the intermediate partition 5 of the walls of the construction, and the upper floor portion 7 is connected to the inner partition 8 of the walls.

Air at a temperature of about 50° F. as supplied from the duct 2 is thus induced either by natural draft or by means of a fan 9 disposed at the top of the construction firstly through the free space left between the foundations and the lower portions 3 of the floor, then along the vertical duct 10 formed internally of the wall, and finally along the roof duct 11, said ducts consisting of the hollow or free passage formed between the intermediate partition 5 and the outer partition 58, and of the corresponding passage formed between the horizontal partitions 59 and 60, the latter being furthermore formed with an aperture 61. As already stated, the roofing may be constructed from the same blocks as the walls in order to provide on the one hand an outer duct 11 connected to the outer vertical duct 10 of the walls, and on the other hand an inner circulation duct 13 between the horizontal partitions 59 and 62 connected to the inner vertical duct 14 of between the intermediate and inner partitions 5 and 8, and a circulation 19 between the floor partitions 7 and 3.

The circulation of conditioning air in the inner vertical duct 14 may be either natural or forced. In this last case the fan 15 provides a pressure circulation. This air (taken preferably from the constant-temperature air sup-

ply) is conditioned by using conventional means such as a device 16 comprising on the one hand a cooling chamber 17 and on the other hand a reheater 18, this device being controlled automatically by control and servo means also of any known and conventional type.

The conditioned air circulates through the space 19 between the lower floor portion and the upper floor portion, then in the inner space 14 of the walls and in the space 13 of the ceiling from which it finally penetrates into the rooms 21 through apertures provided to this end in the ceiling or in the upper portion of the inner partition of walls 8.

Used air is exhausted through suction fans 20 located at the lower portion of the room 21 as shown in FIG. 2, in blocks 22 isolated from the adjacent blocks by airtight panels 23.

As the two separate air streams thus established for assisting in maintaining in the rooms a very comfortable atmosphere under rational and economical conditions are distributed very uniformly throughout the surfaces of the walls and partitions, and as an easy access is permitted to the corresponding circuits at any point thereof, these circuits may be equipped if desired with means for controlling and if desired correcting the characteristics of the air circulated therein.

Of course, the form of construction described hereinabove constitutes a mere example of the manner in which the invention may be carried out and shows the essential features thereof; thus, many modifications and alterations may be brought thereto without departing from the spirit and scope of the invention as set forth in the appended claims.

According to a first modification, the air circulation taking place vertically in the preceding example may be effected horizontally, the passage from one row of blocks to the next upper row of blocks taking place at one end of the row.

According to another modification, the roofing may be designed according to any conventional and known construction, provided that an insulating lining is applied directly under the outer partition and that an empty space is provided between this outer partition and the ceiling to permit the circulation of constant-temperature insulating air.

In this case, the conditioning air would penetrate into the rooms only at the upper portions of the walls.

To permit this construction, the blocks used therefor and illustrated by way of example only in FIG. 3 comprise:

(1) A rigid frame 24 for example of the type illustrated in FIG. 4 which may be of metal, plastic or any other suitable material, the function of this frame consisting in imparting the necessary rigidity and strength to the construction. These frames are assembled with one another by any suitable mechanical means such as spot welding, riveting, bolting, screwing, or by using eyelets or the like (but excluding any permanent binding such as resins, hydraulic binders or the like) so that the blocks may easily be disassembled when necessary. In the form of embodiment shown in FIG. 4, each frame 24 has substantially the shape of a rectangular prism the twelve edges of which are materialized by angle sections, whereof four sections 45 are spaced longitudinally to the panel, four sections 46 are spaced vertically to the panel and the four last ones 47 are spaced transversely to the panel. As shown, the angle sections 45, 46 are cut to form 45-degree bevels matching together to form the two major rectangular faces of the panel which are to face the inner and outer walls respectively of the block to be formed by this structure in combination with, and by rigid fixation to, the other elements to be described hereafter. Each angle of each of these two rectangular faces is stiffened by a gusset 48 secured by electric welding spots 49. The other four angle sections 47 have their ends cut at right angles and act as distance-

pieces between these two main rectangular faces by engaging the angles of these rectangular faces with their ends. The assembly is subsequently stiffened by electric welding spots 50 securing the flanges of angle sections 47 to the flanges of angle sections 45 and 46. The horizontal flanges of angle sections 45 and the flanges of angle sections 46 welded on sections 47 are perforated to permit the fixation by means of bolts 51 of a frame 24a or by means of bolts 57 of a frame 24b either laterally of, or above the first frame 24. This frame 24 is also provided with holes 53, 54 formed through the flanges of angle sections 45 and 46 respectively which constitute the major faces of the frame. These holes permit the fixation on these faces, by means of bolts, screws or any other suitable members, of the other elements described hereafter and adapted to constitute, by mounting on this frame, the construction block according to the invention.

(2) A panel 25 constituting the outer face of the block. Preferably, this panel is of moderate thickness and may consist of metal, plastic, fibre and cement agglomerate, and even wood, ceramic or any other suitable material, its function consisting in forming a weather-resisting, sealing surface of pleasant appearance.

(3) A rigid panel 26 consisting for example of a flat sheet of material such as plywood, wooden fibre agglomerate, fibro-cement, thermosetting plastic, etc.

This outer panel 25 is secured on the panel 26 through any suitable and conventional method, such as gluing, riveting, etc.

Finally, the panel 26 itself is secured on one face of the frame 24 by means of distance-pieces 27 of a good sound and heat insulating material (for example plastic), these distance-pieces being firstly secured by screws 28 on the panel 26 and then by screws 29 on the outer face of the frame.

(4) A panel 30 consisting of a material having a high sound and thermal resistance which is disposed between the outer face of frame 24 and the panel 26 consisting for example of pure expanded cork, polyvinyl foam, expanded polystyrene, vegetable or inorganic fibres agglomerated by means of a suitable polymerized binder, porous ceramic material, etc.

(5) A hollow section member 31 also made of a material having a low heat and sound conductivity, which is secured simply by gluing on the edges of two adjacent frames. This section member carries a bar 32 also of heat and sound insulating material which is formed with a projecting rib, as shown. On either side of this bar is a flexible strip 33 acting as a sealing band and engaged to this end by the edges of the outer panels 25.

If desired, the bar 32 may be dispensed with and in this case the sealing strip 33 bears directly on the section member 31, as the essential purpose of the bar 32 is to permit a variation in the thickness of the insulating panel 30 while utilizing the same elements for making the member 31.

(6) A panel 34 of adequate heat and sound insulating material, which consists actually of two half-panels force-fitted in the space between the two flanges of the angle member constituting the outer face of the frame; if necessary, these half-panels may be held in position by gluing on the frame.

All the component elements described in paragraphs (1) to (6) hereinabove constitute a first, very efficient sound and heat barrier.

This efficiency is particularly noticeable in the case of the assembly described hereinabove with reference to FIG. 1, due to the combination of rigid and flexible cellular elements secured without the assistance of massive binders or fastening members on their supports.

(7) A panel 35 made of adequate heat and sound resisting material (for example wood, plywood, fibro-cement, miscellaneous agglomerates, etc.) secured by any suitable and conventional means (such as insulating or

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metal bolts 37, metal eyelets, etc.) on the flanges of the inner face of the frame 24.

According to a modified form of embodiment, the isolation of the panel 35 from the constant-temperature air circulating along the medial plane of the frames may be reinforced by providing a panel 36 similar to the panel 34 and also made of two halves like this panel.

(8) Another, inner panel 38 (preferably of moderate thickness) consisting as desired of a heat and sound insulating or conducting material, at will, its function consisting in forming the inner wall of the residential, commercial or industrial room (thus wood, plywood as well as pressed vegetable or mineral fibres, ceramic, metal, cement-bound agglomerates, plastic, constitute adequate materials to this end), this panel being adapted to receive any desired decoration before or after its assembly.

This innermost panel may be secured for example with the assistance of split male members 39 of adequate resiliency which fit with the minimum of clearance in distance-pieces 40 similar to the distance-pieces 27 described hereinabove, these male members being formed at their inner ends with head members 41 fastened by preferably flat-head screws 42 flush with the inner surface of the panel and adapted to be provided or not with a decorative projecting element 43.

The first arrangement proposed hereinabove is particularly suitable when, for the sake of appearance, the inner panel 38 must have a projection-free surface for example when it is contemplated to cover this panel with decorative panels, or with glued fabric, paper, plastic sheets or the like.

The distance-pieces 40 are secured on the panel 35 by bolts 44.

The innermost panel 38 may be removed by suction or by using an electromagnetic tray as the head members 41 may consist of steel acting as pole pieces adapted to be attracted by the electromagnets of the panel-removing tray placed in front thereof.

Finally, a flexible joint 45 of plastic or rubber, or a rigid joint of wood, metal, plastic or other suitable material may be disposed between the different panels 38 of adjacent blocks; if desired, this joint may participate in the styling and decoration of the room.

The space defined between the panels 35 and 38 is provided for the customary building equipment ducts and lines (for water, electric power, telephone, etc.) and also for the direct distribution of conditioned air without using auxiliary ductwork. As already explained hereinabove the space formed between the panels 34 and 36 is used for circulating insulating air, that is, constant-temperature air.

The metal frames may be constructed on a commercial basis, for example in a completely automatic manner, this method of manufacture being applicable to a great range of block dimensions thereby permitting the performing of many varied architectural schemes.

These frames may be cast directly or formed from sheet material cut and bent, or also from sections assembled by means of gussets or any other conventional method.

Finally, these frames may be assembled to constitute the rigid framework of the blocks according to any suitable process, provided that the selected process does not lead to the use of massive elements interconnecting the two frames constituting the rigid structure of a block, so that the blocks may be easily and rapidly assembled and disassembled.

The above-described forms of embodiment are given by way of example and should not be construed as limiting the invention as many modifications and alterations may be brought thereto with a view to assemble the elements forming part of the structure, without departing from the spirit and scope of the invention as set forth in the appended claims.

What I claim is:

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1. In a building structure having sound-absorbing and heat insulated side walls above grade, a ceiling structure jointly with said side walls defining at least one room, and means supporting said walls, each of said side walls comprising, an outer wall and an inner wall spaced from each other and a partition between said outer and inner walls spaced therefrom and jointly therewith defining an inner and an outer passageway, said inner wall terminating above said supporting means, said inner and outer passageways being without communication with each other, said ceiling structure comprising an inner partition, an outer partition spaced from said inner partition and another partition between said inner and outer partitions jointly defining two passageways without communication with each other and each in communication with a respective one of said inner and outer passageways of each of said side walls, means to define an air inlet for each side wall outer passageway at the lower end of its respective partition, means to define an air inlet for each inner passageway at the lower end of the respective inner wall defining said inner passageway, means to supply air at a substantially constant moderate temperature to each outer passageway of each side wall through its respective last-mentioned air inlet, said outer partition of said ceiling structure having an opening for allowing said air supplied to the outer passageways of the side walls to flow out of said opening, means to exhaust said air supplied to said outer passageways out of said opening, said ceiling inner partition having openings for allowing air to flow out of said inner passageways of the side walls into said room, heat transfer means to provide conditioned air under at least some pressure into said inner passageways through the respective air inlet at the lower end of the inner walls thereby to provide conditioned air entering said room through said ceiling inner partition openings, and means to at least selectively exhaust to atmosphere the air out of said room at a lower level out through an inner and outer wall of a side wall and the partition therebetween.

2. In a building structure according to claim 1, in which said side walls comprise a plurality of building blocks, each building block comprising an assembly frame of prismatic configuration having six rectangular faces, two of said faces comprising vertical faces one inside the structure and the other facing outwardly of the structure, the other faces comprising two upstanding end faces and two horizontal faces, said assembly frame comprising angle sections rigidly secured to one another and disposed along the edges of said blocks, said frame angle sections having holes for receiving means therein for detachably joining next adjoining blocks forming said side walls, said holes being disposed for joining the blocks along their end and horizontal faces, means on each block for detachably mounting inner panels forming said inner wall of each side wall on said blocks in assembly, and for each block an inner panel detachably mounted on the last-mentioned means.

3. In a building structure according to claim 2, in which each of said building blocks comprises an outer panel of heat insulating material secured parallel to said rectangular face facing outwardly of said structure, a second upstanding panel of heat insulating material mounted parallel to said outer heat insulating panel and spaced therefrom and mounted intermediate the outer panel and said inner panel and spaced therefrom, means on each block for fastening the outer panel thereof parallel to and spaced from said outer facing, and said panels having the same peripheral dimensions of said vertical faces.

4. In a building structure according to claim 3, in which said fastening means on each block comprises rigid, tubular distance pieces made of a heat insulating material mounted on said frame extending inwardly said distance pieces having a bore in alignment with some of said holes in said frame angle sections, fasteners in said distance

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pieces fastening said outer panel of heat insulating material on said frame assembly, said means for detachably mounting said inner panels comprising other tubular distance pieces on each block made of heat insulating material longer in axial length than the first-mentioned distance pieces and, fasteners on each block cooperative with said other distance pieces for detachably mounting a respective one of said inner panels.

5. In a building structure according to claim 4, in which each of said building blocks comprises a first porous plate of heat and sound insulating material disposed outwardly of said outer panel of heat-insulating material and parallel thereto, and a second porous plate of heat insulating and sound absorbing material disposed parallel to and inwardly of said second panel of heat insulating material.

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6. In a building structure according to claim 5, in which each plate comprises a third plate of heat insulating and sound absorbing material disposed inwardly and parallel to said face facing outwardly of the structure and disposed substantially against said last-mentioned face.

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