Jan. 31, 1967 G. K. RAIDER 3,301,163

COFFER TYPE VENTILATING CEILING STRUCTURE

Filed July 13, 1964 5 Sheets-Sheet 1

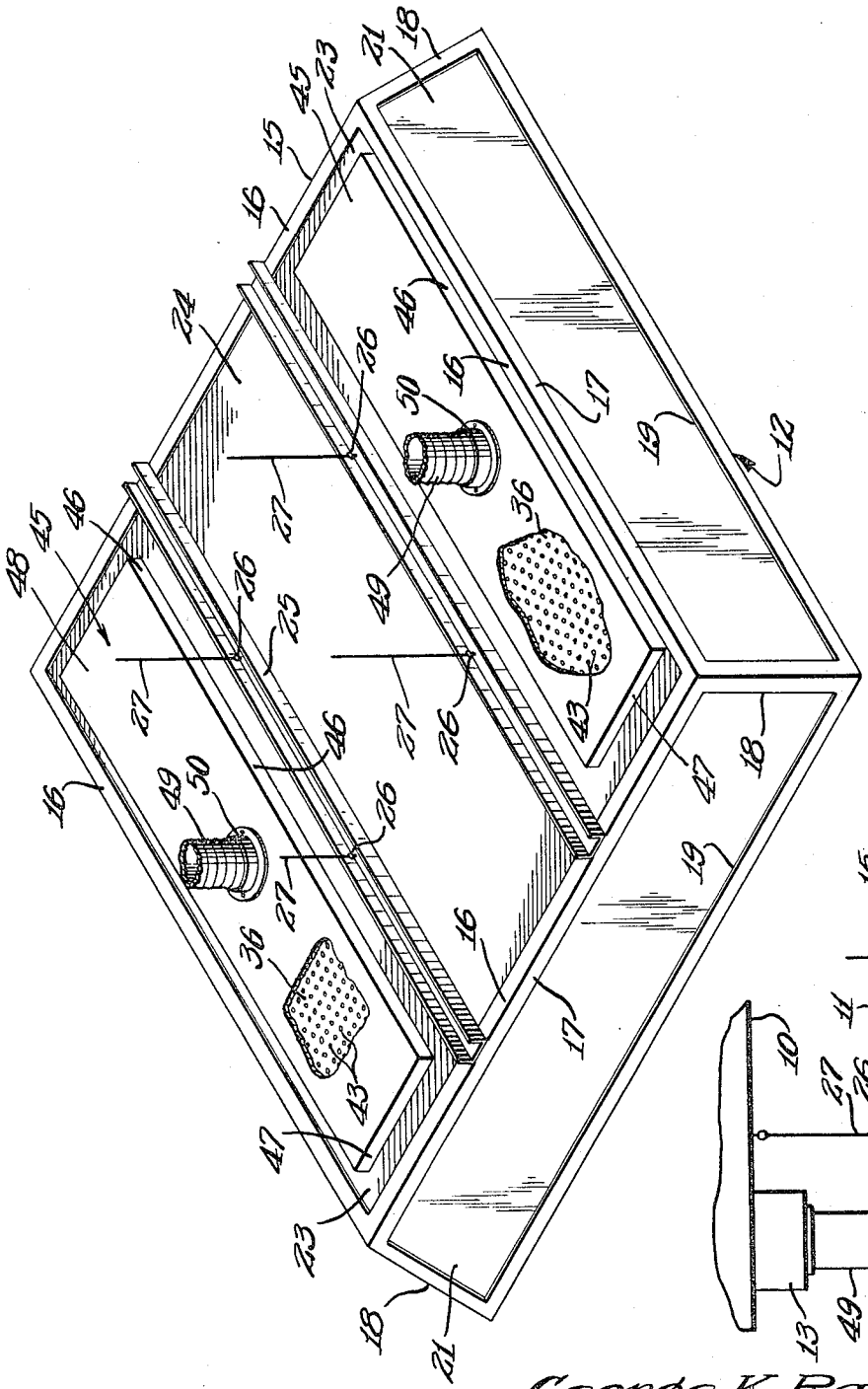


Fig. 1

Fig. 2

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Jan. 31, 1967 G. K. RAIDER 3,301,163

COFFER TYPE VENTILATING CEILING STRUCTURE

Filed July 13, 1964 5 Sheets-Sheet 2

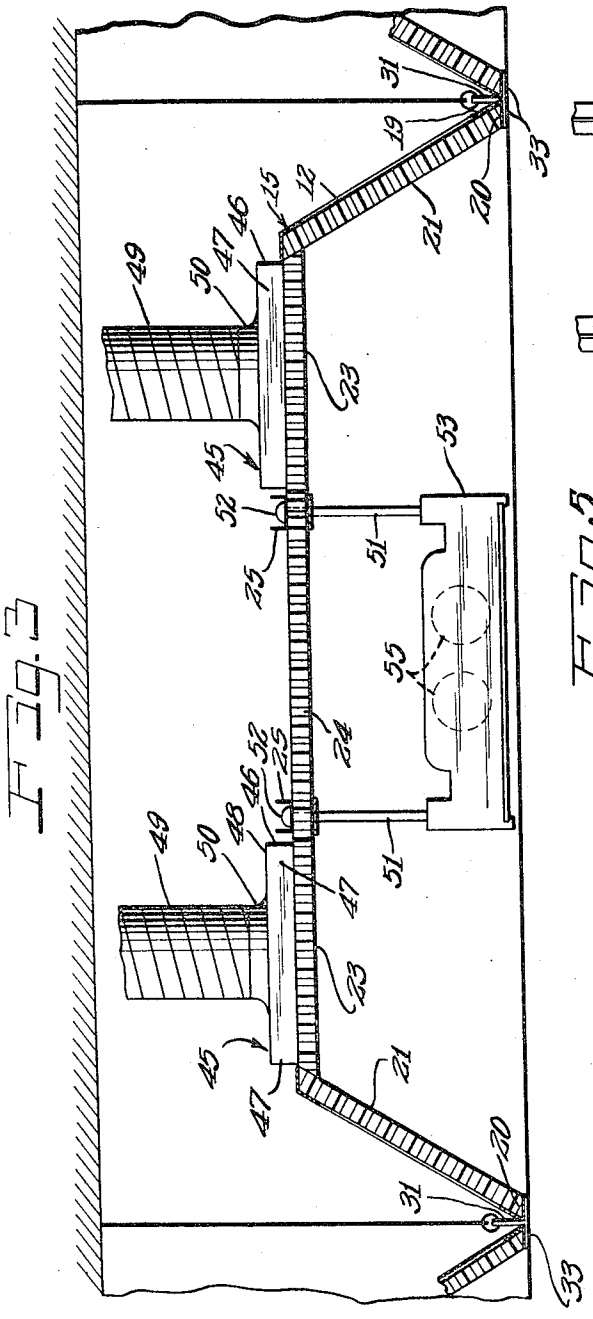


Fig. 3

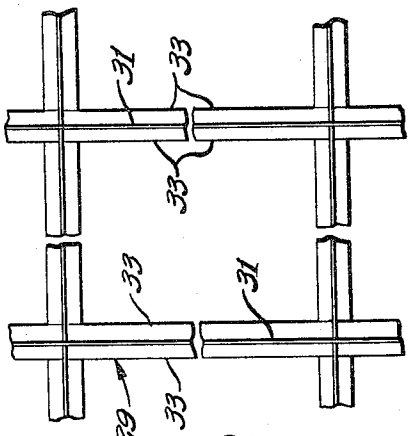


Fig. 5

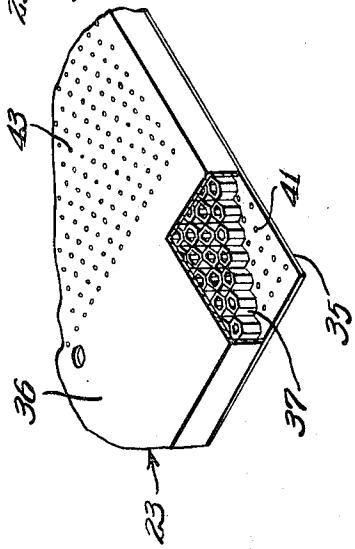


Fig. 4

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COFFER TYPE VENTILATING CEILING STRUCTURE

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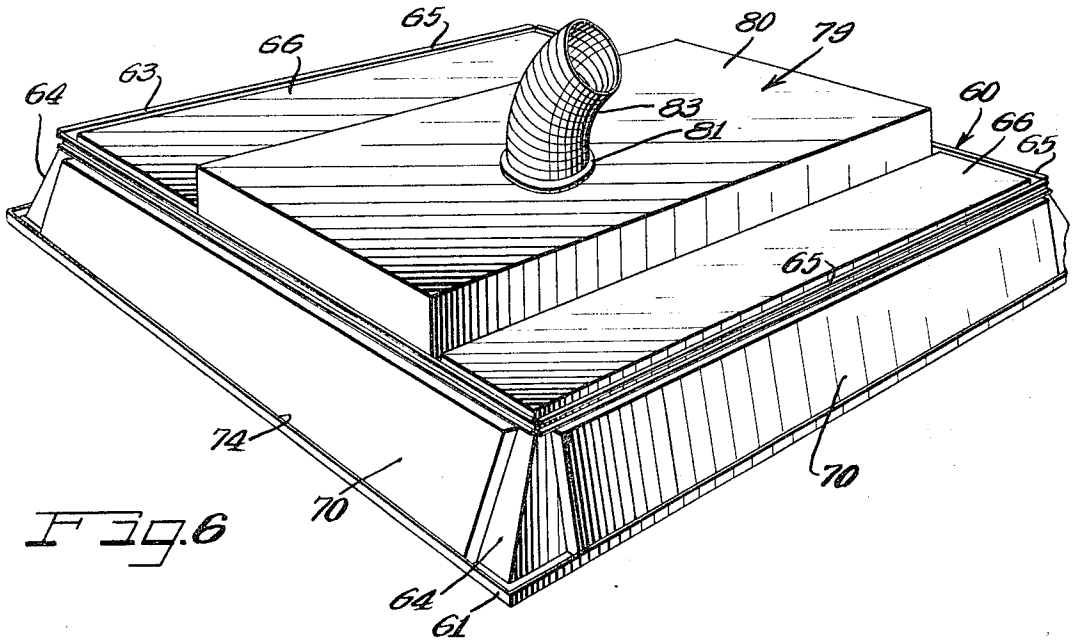


Fig. 6

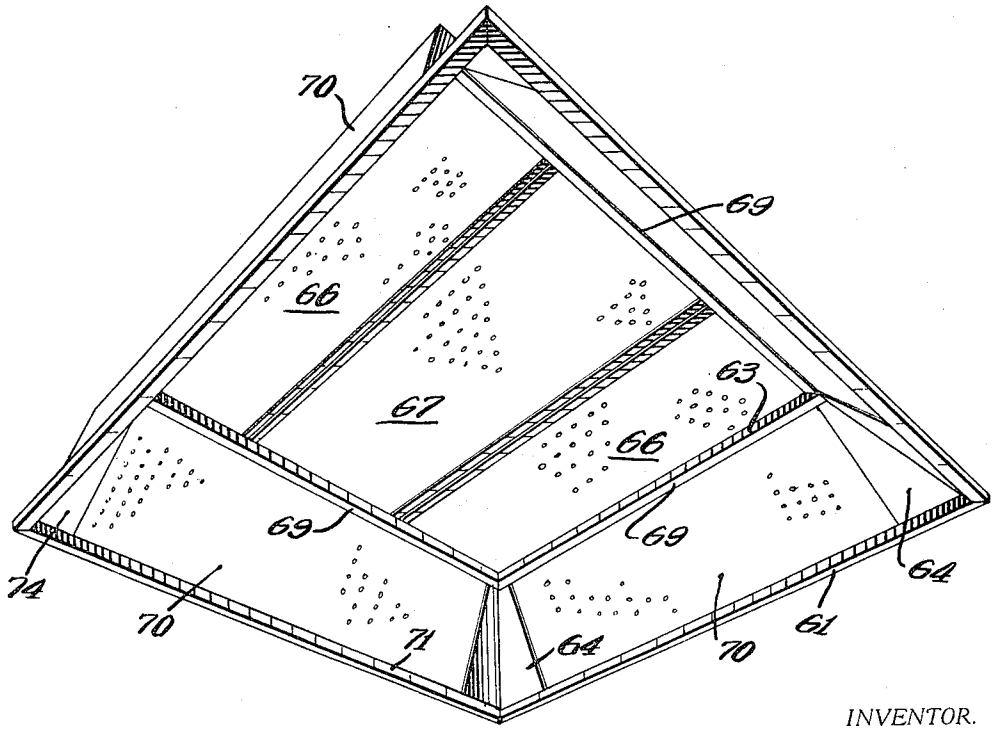


Fig. 7

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COFFER TYPE VENTILATING CEILING STRUCTURE

Filed July 13, 1964 5 Sheets-Sheet 4

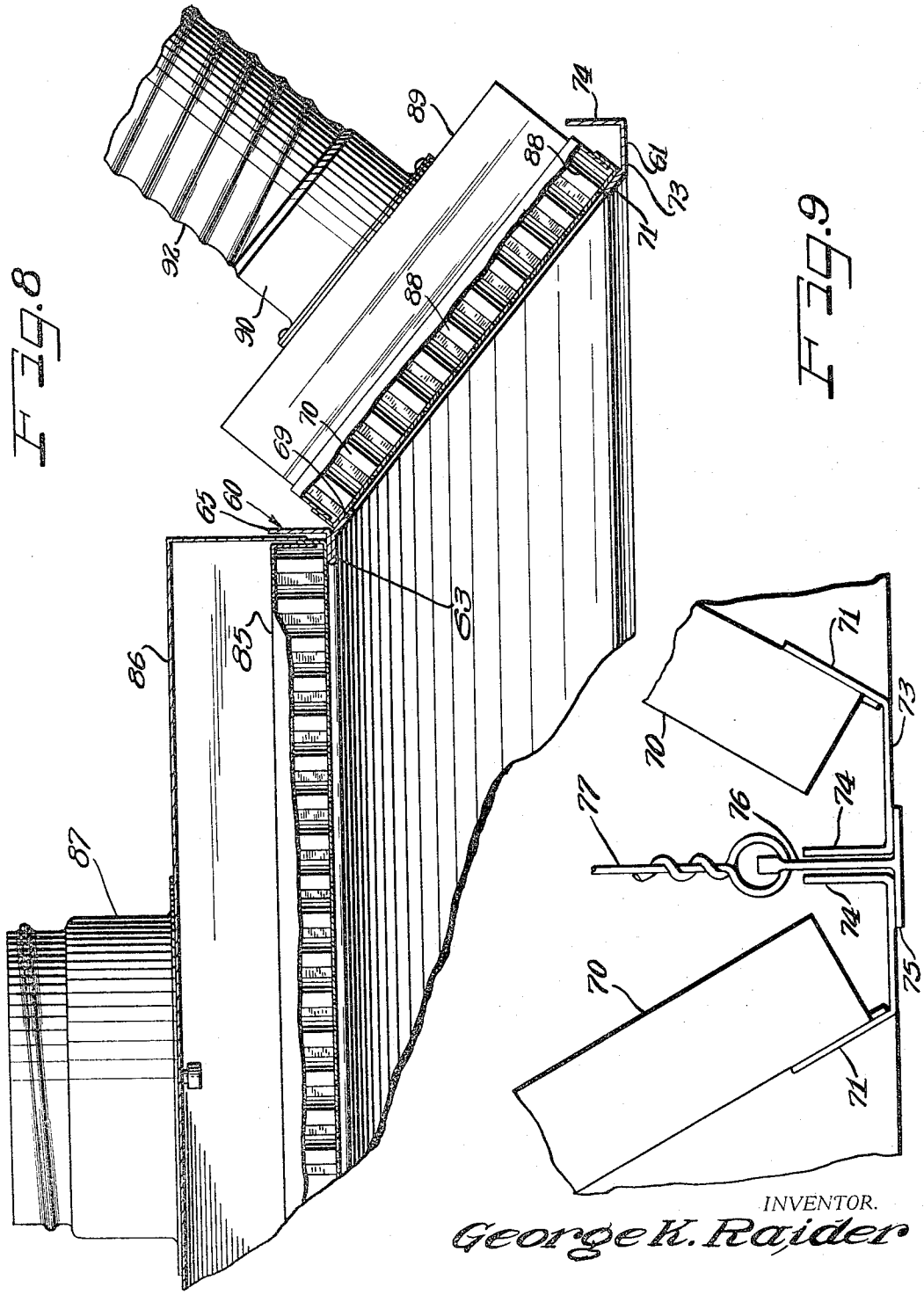


FIG. 8

FIG. 9

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Jan. 31, 1967 G. K. RAIDER 3,301,163

COFFER TYPE VENTILATING CEILING STRUCTURE

Filed July 13, 1964 5 Sheets-Sheet 5

FIG. 10

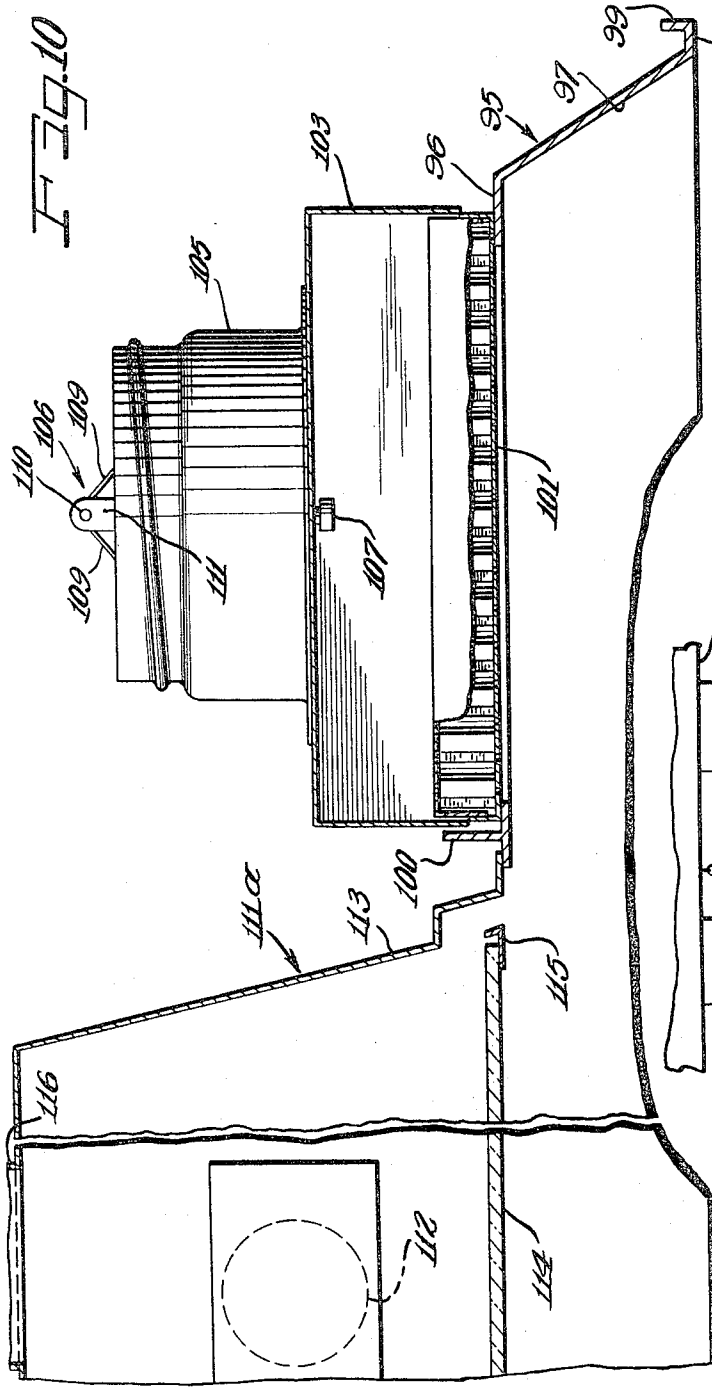
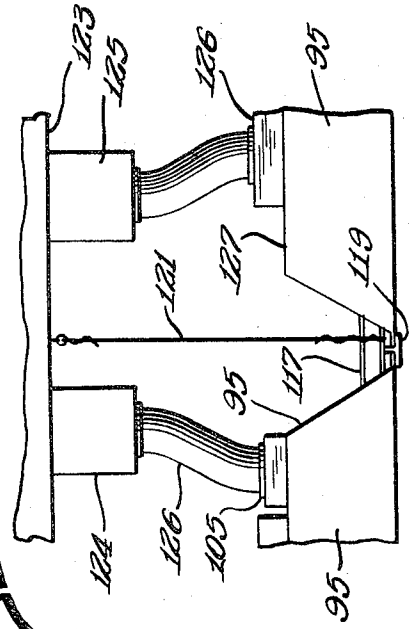


FIG. 11



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3,301,163
COFFER TYPE VENTILATING CEILING STRUCTURE

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Filed July 13, 1964, Ser. No. 382,025
8 Claims. (Cl. 98—40)

This invention relates to improvements in false ceilings and more particularly relates to a ventilating and sound absorbing false ceiling structure in which coffer units form an entire false-ceiling structure and may serve as ventilating, sound absorbing and light units.

In accordance with the principles of the present invention, individual coffer frames, framing sound absorbing panels, in which certain of the panels are perforated to accommodate the passage of air therethrough, and in which lighting fixtures may take the place of or may be disposed beneath certain other of the panels are placed throughout an entire false ceiling structure and form a coffer ceiling, used for sound absorbing purposes as well as ventilating and lighting purposes. The perforated panels of the coffer units may form the tops and sides of the units and can be used either for air supply or air return and may be connected with air supply and return ducts extending along the space above the false ceiling and beneath the ceiling of the room. The coffer units are readily adapted to any system of ceiling suspension.

It is an object of the present invention, therefore, to provide a false ceiling structure in the form of a coffer ceiling in which the coffer units can be used for sound-deadening, ventilation and illumination of a room.

Another object of the present invention is to provide a coffer ceiling having a plurality of coffer units, the tops and sides of which may be made from a sound deadening air diffusing material, for the passage of air therethrough, for ventilating or air conditioning purposes.

A further object of the invention is to provide a grid structure suspended from a ceiling in which the openings in the grid structure form supports for coffer units spaced about the ceiling for the entire area thereof, and in which the coffer units serve as illuminating and ventilating units and may be used to supply air to and withdraw air from a room.

A still further object of the invention is to provide a new and improved coffer unit to be assembled to form a false coffer ceiling, in which the unit has a top surface formed of sound absorbing and air diffusing panels having perforations leading through the tops and bottoms thereof and enclosed at their top surfaces by plenums supplying ventilating air through the units.

A further object of the invention is to provide a novel and improved form of coffer structure for assembly into a false ceiling in which the coffer structure includes a top wall and side walls formed from sound absorbing panels in which certain of the sound absorbing panels are perforated through the tops and bottoms thereof to accommodate the passage of air therethrough and certain other of the panels are perforated along their bottom walls for sound absorbing purposes only and form reflectors for lighting units.

Still another object of the invention is to provide a coffer unit having sound absorbing panels extending therealong perforated through the tops and bottoms for the passage of air therethrough, in which the sound absorbing panels are separated by a light fixture having a diffusion glass flush with the bottoms of the sound absorbing panels to enable the coffer frame to be used for both lighting and ventilating purposes.

These and other objects of the invention will appear

from time to time as the following specification proceeds and with reference to the accompanying drawings wherein:

FIGURE 1 is a perspective view of a coffer unit constructed in accordance with the principles of the present invention looking at the top of the unit, with certain parts broken away and in section in order to illustrate the air diffusing means in the form of sound absorbing panels having perforations leading therethrough;

FIGURE 2 is a fragmentary diagrammatic view illustrating a form of suspension means for the coffer unit from a ceiling;

FIGURE 3 is a fragmentary diagrammatic sectional view taken through the portion of a coffer ceiling and illustrating a form of coffer unit constructed in accordance with the principles of the present invention;

FIGURE 4 is a fragmentary perspective view with parts broken away and shown in section in order to illustrate certain details of a sound absorbing and ventilating panel unit which may be used with the coffer unit;

FIGURE 5 is a generally diagrammatic fragmentary view of a form of T-rail grid work which may form a support for the coffer units;

FIGURE 6 is a perspective view of a modified form of coffer unit constructed in accordance with the principles of the present invention, and looking at the unit from the top thereof;

FIGURE 7 is a perspective view of the unit shown in FIGURE 6 looking at the unit from the bottom thereof;

FIGURE 8 is a fragmentary transverse sectional view taken through still another form of coffer unit constructed in accordance with the principles of the present invention;

FIGURE 9 is a generally diagrammatic view diagrammatically showing a form of suspension means supporting the adjacent ends of the coffer units of FIGURE 8.

FIGURE 10 is a fragmentary vertical sectional view illustrating a modified form of coffer unit embodying a lighting fixture as a part of the unit between the sound absorbing and ventilating panels of the unit; and

FIGURE 11 is a generally diagrammatic view illustrating the suspension means for the adjacent ends of two coffer units and the air supply and return connections thereto.

The structure of the present invention is particularly adapted to be used in combination with the ceiling of a space to be ventilated. The exemplary disclosure described herein shows a false coffer ceiling construction in which the normal ceiling is shown in FIGURE 2 at **10** and a false coffer ceiling structure is shown generally at **11**, and constitutes a plurality of individual coffer units **12** suspended from the false ceiling in end to end and side to side relation with respect to each other throughout the entire area of the ceiling. The coffer units may function as acoustical units, as air handling-acoustical units and as air handling-acoustical and lighting units.

Extending into the space between the ceiling **10** and the false ceiling **11** is an air supply duct **13**, which is adapted to be connected to a suitable source of supply of ventilating air under pressure. Air return ducts may also be provided or the space between the ceiling **10** and the false ceiling **11** may be used as a plenum to return air to a temperature conditioning means or a ventilating source.

In the form of the invention illustrated in FIGURES 1 and 3, the coffer unit **12** is shown as being in the form of a rectangular open coffer frame **15**, which may be square in plan view, where the coffer structure is used to form a coffer ceiling. The top of the coffer frame **15** is shown as being formed from angles having horizontal legs **16** and depending legs **17** extending angularly downwardly and outwardly therefrom. The horizontal and vertical legs join at the corners of the frame and angles **18** extend downwardly from the corners at the angles of the de-

pending legs 17 and are connected together at their lower ends by metal strips 19 having inturned ends or flanges 20 (FIGURE 3) forming supports for acoustical side panels 21.

The side panels 21 extend upwardly along the angles 18 to the undersides of the horizontal legs 16 and are abutted at their inner sides by ventilating and acoustical panels 23, 23, having an acoustical panel 24 disposed therebetween. The panels 23 and 24 are suitably mounted on the depending legs 17 of the open coffer frame 15 and are supported at their inner ends on channels 25, 25, shown as extending across the open frame structure, and as being supported at their ends on the horizontal legs 16 thereof.

The channels 25, 25 are shown in FIGURE 1 as opening upwardly and as having eye-bolts 26, 26 and extending upwardly from the webs thereof, forming connectors for suspension members such as wires 27, 27 suspending the coffer frame from the ceiling 10 in a suitable manner.

In FIGURES 3 and 5, I have shown a modified form of support for the coffer frame 15 which may be in addition to the channels 25 and suspension members 27 or which may form the entire support for the coffer units. The support means shown in FIGURES 3 and 5 comprises a grid 29 formed from a series of T-rails welded or otherwise connected together and having vertically extending stems 31 having suspension members 32 connected thereto, for suspending the grid structure from a ceiling. The T-rails also have oppositely extending horizontal legs 33 extending in opposite directions from the bottoms of the stems 31. Each horizontal leg 33 is shown in FIGURE 3 as being engaged by and supporting an inturned end 20 of a bottom connecting strip 19. The T-rail grid structure thus may be suspended beneath a ceiling and extend for the entire area thereof and form a support for a plurality of individual coffer units enabling the coffer units with said T-rails to form a false coffer ceiling. The horizontal legs 33, 33 conceal the joints between the coffer units and the T-rail grid structure simplifies the assembly and disassembly of the coffer units.

It will be understood the T-rail suspension is only exemplary of one form of ceiling suspension which may be used to support the coffer units. Other suspension systems can also be readily and advantageously employed.

The panels 21, 23 and 24 may be similar to the panels shown and described in application Serial No. 278,894, filed by Lester Burns and George K. Raider on May 8, 1963, and entitled, "Combination Acoustic Ceiling Panel and Air Diffuser," now Patent No. 3,200,734, issued August 17, 1965.

A panel 23 is partially shown in FIGURE 4 as comprising spaced plate members 35 and 36 having a semi-rigid honeycomb core 37 disposed therebetween and secured to said plate members. Sound-deadening material (not shown) may be placed in the individual cells of the honeycomb core 37, to absorb the sound waves. The plate 35 is provided with a plurality of perforations 41 leading therethrough for absorbing sound. The plate 36 is provided with a plurality of similar passages or perforations 43 to accommodate air to pass therethrough and through the perforations 41 in the plate 35 and to be diffused as its passes through said perforations and honeycomb core and sound diffusing material container therein.

The panel 24 is like the panels 23 except the bottom plate only of said panel is perforated and the top plate forms a closure for the honeycomb core. Sound waves thus pass through the perforations in the bottom plate (not shown) and honeycomb core, and strike the top plate of the panel (not shown) which acts as a sound deflector and deflects the sound back through the sound-deadening material in the honeycomb core toward the perforated bottom plate 35. The side panels 21, 21 may also be like the panel 24 and the inner plate portions only are perforated, the outer plate portions acting as sound wave deflectors.

A plenum 45 extends over the perforated portion of each top plate 36 and is in the form of a sheet metal structure having side walls 46 and end walls 47 extending downwardly from a top wall 48 forming the top of the plenum. An air duct 49 has communication at its lower end with an inlet fitting 50, forming an inlet opening through the top wall 48 for supplying air to said plenum for discharge through the perforations 43 and 41 of the plates 36 and 35, for ventilating or heating and cooling a room. Valve means (not shown) of a conventional form may be provided in the inlet fitting 50.

While the two fittings 50 are described as inlet fittings, it should be understood that one may be an inlet fitting and the other may be a return air fitting, if desired.

Suspension bolts 51 are shown in FIGURE 3 as extending through the channels 25 and as having heads 52 abutting the webs of said channels. The suspension bolts 51 may be at each end of each channel 25 to form a support for a lighting fixture 53 spaced beneath the panel 24 and diagrammatically shown in FIGURE 3 as being a fluorescent light fixture carrying two parallel spaced gas glow tubes 55 commonly called fluorescent tubes, mounted in the fixture at their ends, in a conventional manner.

The coffer unit 12 shown in FIGURES 1 and 3 may thus form one unit of the coffer ceiling and may supply ventilating air into a room and may also be used to illuminate the room. In certain cases, however, the fixture 53 may be dispensed with, in which case the panel 24 will serve merely as a sound-deadening panel, while the panels 23 will serve to supply air to the room or to supply air to and withdraw air from the room.

FIGURES 6, 7, 8 and 9 illustrate a form of coffer unit and support particularly adapted for air distribution, but which may also be used for lighting and air distribution. In this form of the invention, I have shown a rectangular coffer frame 60 having a lower rectangular frame member 61 and an upper rectangular frame member 63 spaced thereabove and inwardly therefrom. The frame member 63 is supported on the frame member 61 by metallic corner supports 64 generally angular in form and converging toward their upper ends and extending angularly upwardly and inwardly from the corners of the frame member 61 and welded or otherwise secured at their ends to the frame members 63 and 61.

The frame member 63 has a vertically extending flanged portion 65 extending thereabout and forming a rectangular retainer for outer panels 66 and an inner panel 67. The rectangular frame member 63 also has an inclined flange 69 extending thereabout and angularly downwardly and outwardly therefrom at the angle of inclination of the corner members 64 and forming supports for side panels 70. The side panels 70 are supported at their lower end on angular lips 71 extending angularly inwardly and upwardly of the lower rectangular frame 61 and forming a part thereof and inclined at the angle of inclination of the inclined flanges 69. The lips 71 terminate at their lower ends into a horizontal support portions 73 for the coffer unit which in turn terminate in upwardly extending flanged portions 74 of the coffer unit. The horizontal support portions 73 are shown in FIGURE 9 as being supported on the oppositely extending horizontal legs 75 of a T-rail 76. The T-rail 76 may be a part of a T-rail grid structure suspended from the ceiling on suspension members 77.

In the form of the invention illustrated in FIGURES 6 and 7, the panels 66, 66 and 70, 70 are sound-deadening panels, like those shown in FIGURES 1 and 3, and are similar to the panel shown in FIGURE 4 except the outer plate of the panel is closed, while the inner plate is perforated. The detailed structure of the panels, therefore, need not be repeated.

The panel 67 may be like the panel shown in FIGURE 4 and both the top and bottom plates of the panel are perforated to accommodate the passage of air therethrough. The panel 67 is shown in FIGURE 6 as having

a plenum **79** extending over the top thereof and having a top wall **80** spaced above said panel. An air inlet fitting **81** is shown as extending upwardly of the top wall **80** and as having a flexible conduit **83** connected thereto and extending upwardly therefrom for connection with a source of supply of air under pressure, to supply air to the plenum **79** for discharge through the perforated sound-deadening and air diffusing plate **67**. While the conduit **83** is herein described as being connected to a source of supply of air under pressure, it could as well be connected to a return to withdraw air from the room through the panel **67**, plenum **79** and conduit **83**.

In FIGURE 8, I have shown a section through the coffer structure of FIGURES 6 and 7 in which a top panel **85** is supported on the rectangular frame **63** and disposed at one side of said frame. The panel **85** may be like the panels **24** and **67** and the top and bottom plates thereof are perforated to accommodate the passage of air therethrough. A plenum **86** extends along the top of the panel **85** and has an air inlet fitting **87** leading thereinto for connection with a source of supply of air under pressure under the control of suitable valve means (not shown).

A side panel **88** is also shown as extending along one side of the frame and as being supported on the flange **69** at its upper end portion and on the lip **71** at its lower end portion. The side panel **88** may also have top and bottom perforated plates to accommodate the passage of air therethrough and has a plenum **89** extending thereover. The plenum **89** is shown as having an air fitting **90** extending from the outer side thereof and having a flexible conduit **92** having communication therewith and extending therefrom. The conduit **92** may be connected with the return for withdrawing air from the room.

It should be understood that while the panel **85** is described as an air supply panel and the panel **88** is described as an air return panel, that the panel **88** may be an air supply panel as well, while the panel **85** may be an air return panel, if desired.

In FIGURES 10 and 11, I have shown a fragment of a coffer frame **95** in transverse section. The coffer frame **95** like the coffer frames **15** and **60** is generally rectangular in form and has an open horizontal top portion **96** having side walls **97** extending angularly downwardly and outwardly therefrom. The side walls **97** terminate at their lower ends into a rectangular horizontally extending rim **98** having a flange **99** extending vertically of the margin thereof. In this particular form of the invention the side walls **97** are solid throughout the length thereof, although they may be formed to support sound absorbing panels as in the forms of the invention shown in FIGURES 1 to 9.

The open top portion **96** of the coffer frame **95** has spaced T-rails **100** extending thereacross. Each T-rail **100**, as shown in FIGURE 10 forms a support for the inner end of an acoustical sound-deadening panel **101**, like the panels **23**, **85** and **88** and perforated on both sides thereof to accommodate the flow of air therethrough.

A plenum **103** extends across the top of the panel **101** and has an air supply duct **105** leading upwardly therefrom. The air supply duct **105** has a conventional air valve **106** mounted therein and adjusted by an adjusting screw **107**. The air valve **106** includes a pair of wings **109** pivoted for movement about a common pivot pin **110** pivotally mounted at its ends in bracket members **111**. The wings **109** are adjusted toward and from the inner periphery of the inlet fitting **105** to vary the air flow through said inlet by turning movement of the adjustment screw **107**, as in the aforementioned application Serial No. 278,894.

The T-rails **100** also form supports for a light fixture **111***a* of the troffer light type having fluorescent tubes **112** extending along an inverted trough **113**. A glass or lens **114** is supported beneath the fluorescent tubes **112** on support members **115** extending along the fixture **111** and suitably supported thereon at its ends. The support members **115** are spaced inwardly of the walls of the fixture to accommodate the flow of air thereby. The light fixture has an outlet opening **116** leading from the top thereof, which may be connected to a return duct (not shown) to withdraw spent air in the spaces between the support members **115** and inner walls of the fixture. A panel **101**, plenum **103** and air supply fixture **105** may be mounted on the coffer frame **95** on the opposite side of the light fixture **111** from the panel **101** and plenum **103** shown in this figure.

As shown in FIGURE 11, support channels **117** extend across the tops of T-rails **119** and form supports for said raisl. Suspension means, such as suspension wires **121** are connected between a ceiling **123** and the support channels **117**, to form a support therefor. The T-rails **119** in turn support coffer frames **95**, **95** at opposite sides thereof. The air supply inlet **105** is diagrammatically shown in FIGURE 11 as being connected with an air supply duct **124**, extending along the bottom of the ceiling **123**, as by a flexible conduit **126**. A parallel spaced air supply duct **125** extends along the bottom of the ceiling **123** for supplying air to a plenum **126** of a next adjacent coffer unit **127**. The duct **125** may be a return duct as well as a supply duct and may also have communication with a lighting fixture, like the troffer light fixture **111**, if desired.

It will be appreciated that I have shown a number of forms and arrangements of coffer units which may make up a coffer ceiling and that certain units may be air supply units, while certain other units may be air return units and as in several of the present disclosures, certain units may be air supply units and air return units in addition to lighting units.

While I have herein shown several forms in which the invention may be embodied, it may readily be understood that various variations and modifications in the invention may be attained without departing from the spirit and scope of the novel concepts thereof.

I claim as my invention:

1. For use in a ventilating system in combination with a wall or a ceiling of a space to be ventilated having an inner wall spaced interiorly of said wall or ceiling, said inner wall having a plurality of openings therein,

the improvement of a coffer type ceiling module for mounting in each of said openings,

each said module comprising upper and lower rectangular frames of complementary shape but of different size and legs disposed angularly therebetween at the corners thereof to secure said frames in firm assembly with one another,

a top panel in said upper frame, and

a panel in each side wall between said upper and lower frames,

whereby said panels together with one another and said frames form an inverted recessed coffer unit adapted to form a ceiling component of a space,

each said panel formed by a flat member comprising acoustical material for absorbing sound from the space and having air passages formed therein over a substantial extent thereof for diffusion of air directly through said panels into or out of the space, and

means forming a ventilating circuit including said coffer unit and the space for directing air through said coffer type ceiling module as an air outlet to or an air return from the space.

2. The invention of claim **1** and further characterized by

a lighting fixture mounted on said top panel and positioned in the recessed coffer unit,

thereby to adapt the coffer unit as a source of illumination for the ceiling construction.

3. The invention of claim **1** and further characterized by