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Stone et al.

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[54] **MODULAR HEATING, LIGHTING AND VENTILATING UNIT**

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[51] **Int. Cl.²** **H05B 1/00;** F24F 7/02; F24H 9/02

[58] **Field of Search** .... 219/359, 360, 361, 366–371, 219/377, 380, 213, 220, 343, 342, 474; 240/47, 9 A, 78 CF, 78 HA, 78 H, 2 V, 2 W; 98/40 D, 40 DL, 43

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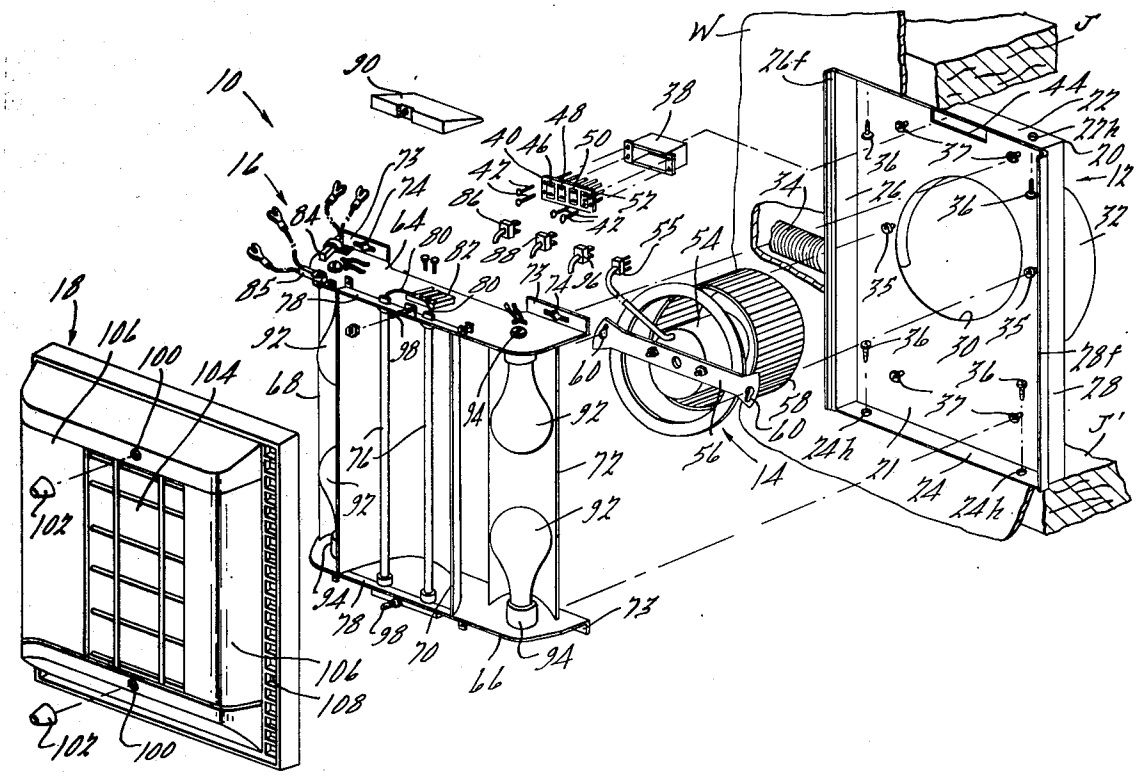
[57] **ABSTRACT**

A modular ceiling ventilator has a housing module adapted to lodge in the ceiling of a room between parallel spaced ceiling members, a blower module removably mounted on the housing module and supporting a blower within the air discharge housing of the housing module, an accessory module removably mounted on the housing module for providing one of more accessory functions such as illumination and/or heating, and a grille module removably mounted on the accessory module and covering the ceiling opening within which the ventilator is contained. An electrical receptacle box is provided on the housing module and both the blower and the accessory element(s) of the accessory module terminate in electrical plugs which plug into corresponding receptacles in the receptacle box.

24 Claims, 4 Drawing Figures



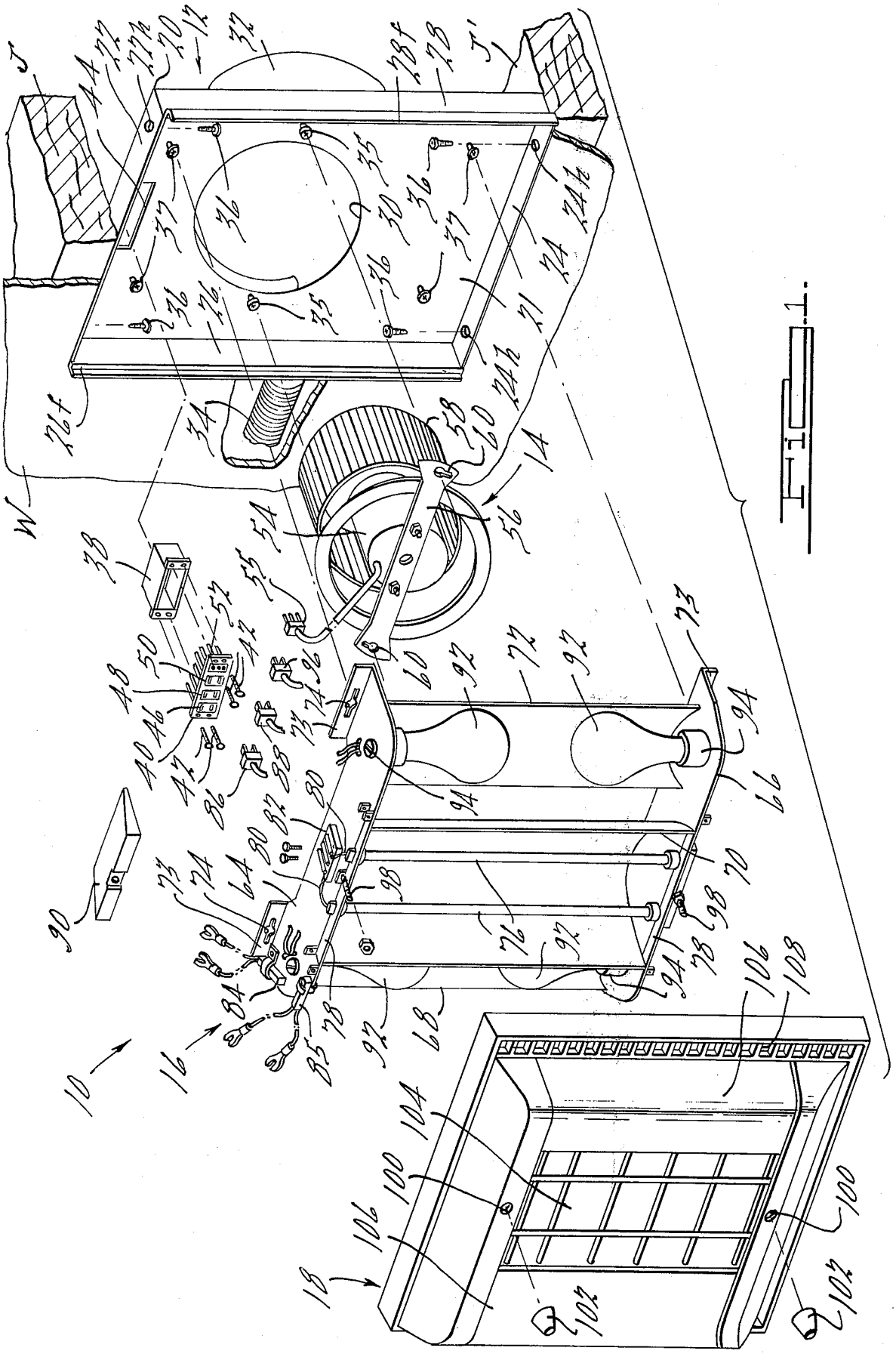
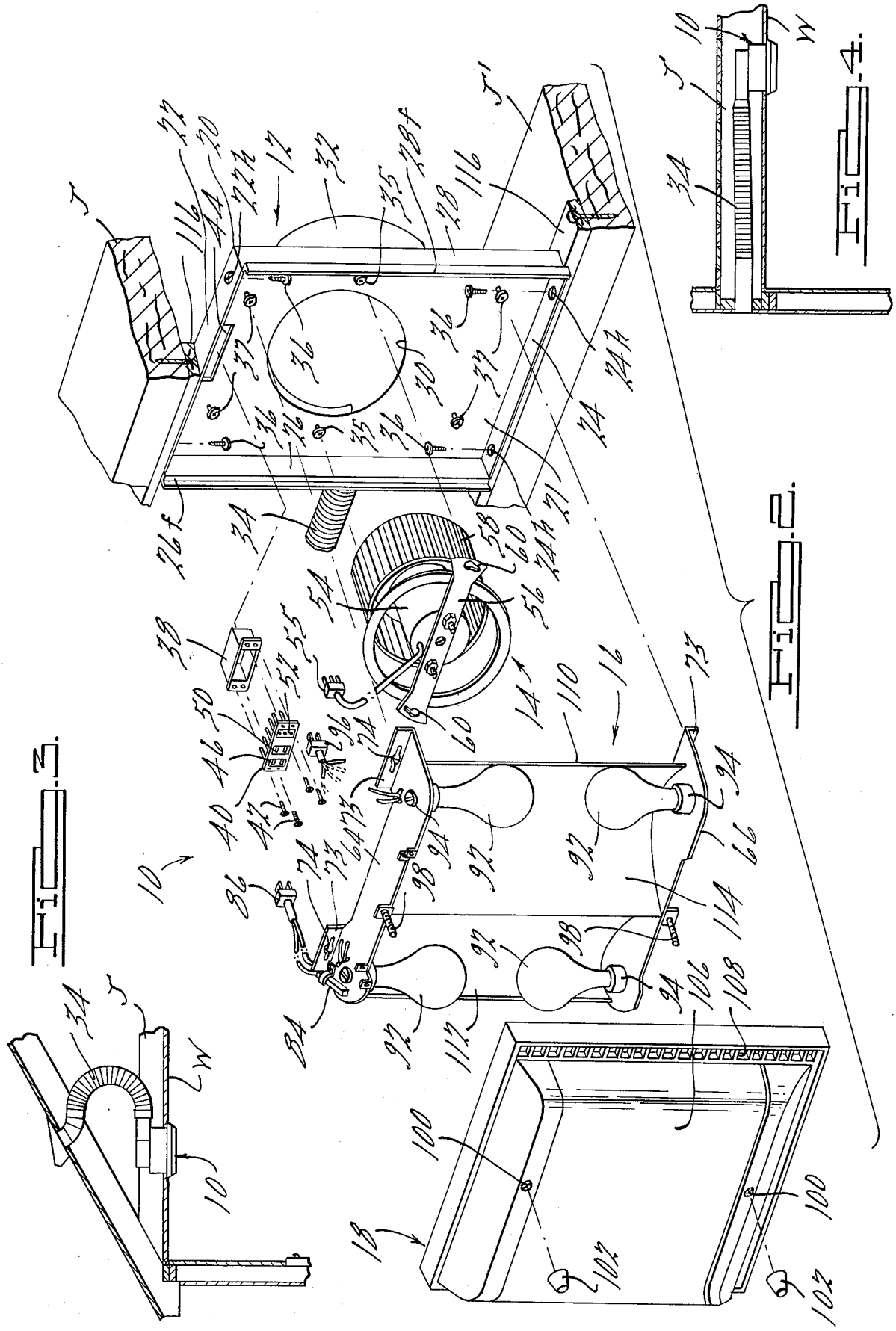


Fig. 1.



MODULAR HEATING, LIGHTING AND VENTILATING UNIT

BACKGROUND AND SUMMARY OF THE INVENTION

The present invention relates to ceiling ventilators and in particular to ceiling ventilators which in addition to performing a ventilating function also perform an accessory function such as lighting, heating, etc.

In ventilators of the type to which the present invention relates it is typically desirable to attain ease of installation, accessibility of components for service, and at the same time make the ventilator as compact as possible. Generally speaking, many prior art ventilators lack vertical compactness often requiring rather deep clearance in the ceiling and/or extending several inches below the ceiling. Furthermore, many prior ventilators are not susceptible to easy installation, often requiring extensive modification to the ceiling. Likewise, the components are often difficult to remove and install thereby making service of the unit difficult.

In contrast to the prior art, the present invention provides a ceiling ventilator including a ventilating function and at least one accessory function which: is especially vertically compact; can be mounted in a ceiling between the ceiling joists; requires only that a rectangular opening be cut in the ceiling between ceiling joists; is of modular construction comprising four individual modules which are removably mounted together; has components thereof highly accessible for service when such is needed; and is all in all a better ventilator than has heretofore been available.

The foregoing features of the invention along with additional advantages and benefits thereof will be seen in the ensuing description and claims which are to be taken in conjunction with the accompanying drawings. The drawings illustrate preferred embodiments of the invention in accordance with the best mode presently contemplated for carrying out the invention.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is an exploded perspective view of a ceiling ventilator embodying principles of the present invention.

FIG. 2 is an exploded perspective view of another ceiling ventilator embodying principles of the invention.

FIG. 3 is a view illustrating one typical installation of the ventilator in a building.

FIG. 4 is a view illustrating another typical installation of the ventilator in a building.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

In FIG. 1 a ventilator **10** according to the present invention is shown in an exploded view to best illustrate the four modules which constitute the ventilator, namely: a housing module **12,** a blower module **14,** an accessory module **16,** and a grille module **18.** Since ventilator **10** is intended to mount in the ceiling of a room to be ventilated, it will be appreciated that when one views FIG. **1,** he will understand that the up direction is toward the upper right hand corner of the drawing. Housing module **12** comprises a housing **20** of generally rectangular overall shape having a rectangular horizontal central wall **21,** four vertical side walls **22,** 24, 26, 28 extending downwardly from the four sides of

horizontal wall **21,** and horizontal right angle flanges **26***f* and **28***f* extending along the bottom edges of side walls **26** and **28** respectively. A relatively large circular opening **30** is provided in horizontal central wall **21** and an air discharge enclosure **32,** leading to a discharge duct **34,** covers opening **30** above central wall **21.** In accordance with certain novel aspects of the present disclosure, housing **20** is arranged to be especially readily mountable in the ceiling of a room either in an existing ceiling or in a ceiling under construction. Hence, it will be particularly noted that housing **20** is dimensioned to fit snugly between parallel spaced ceiling members J and J′ (i.e., the ceiling joists) with side walls **22** and **24** being in juxtaposition to the respective ceiling members J, J′. The ceiling wall W requires only a rectangular cutout to permit ventilator **10** to fit in the ceiling between the joists. Flanges **26***f*, 28*f* overlap the margin of ceiling wall W immediately adjacent the rectangular cutout therein and abut ceiling wall W to accurately locate housing **20** vertically with respect to the ceiling. A pair of holes **22***h*, 24*h* are provided in each side wall **22, 24** respectively and housing **12,** once properly located in the ceiling, is secured by passing fasteners such as nails or screws **36** through holes **22***h*, 24*h* into ceiling members J, J′. It will be noted that in accordance with further inventive features, housing **12** provides a rectangular compartment which is relatively shallow in the vertical direction in comparison to the horizontal dimensions of the compartment. This contributes to the vertical compactness of the ventilator. With housing **12** thus mounted in the ceiling, the remaining modules can thereafter be readily mounted thereon. For such mounting a pair of screws **35** are threaded into central wall **21** on diametrically opposite sides of opening **30** for mounting of blower module **14** and four screws **37** are threaded into central wall **21** in a rectangular pattern for mounting of accessory module **16.** Although shown exploded away from housing module **12,** an electrical outlet box **38** and a cover **40** are removably mounted on housing module **12** by fasteners **42.** A rectangular cutout **44** is provided in central wall **21** immediately adjacent side wall **22,** and outlet box **38** extends through cutout **44** beyond central wall **21** with screws **42** passing through cover **40** and the side flanges of outlet box **38** to secure the same to wall **21.** Mounted on cover **40** and contained within outlet box **38** are four electrical receptacles **46, 48, 50** and **52** which are mateable with electric plugs (to be described later) associated with the other two modules **14** and **16.** Wiring from receptacles **46, 48, 50** and **52** passes through a suitable opening in outlet box **38** and leads to a control switch (not shown) which controls the operation of the ventilator. The control switch and electrical control circuit for the ventilator form no part of the present invention and details thereof are omitted from the present disclosure. It will be noted that the particular mounting arrangement and location of outlet box **38** on central wall **21** facilitates the mounting of housing **20** in the ceiling by avoiding any interference with the ceiling members, yet (as will be seen better from subsequent description) permits convenient access for mating the plugs with the receptacles and permits of convenient connection with wires from the control switch to the receptacles.

Blower module **14** comprises an electric motor **54** affixed to a mounting bracket **56** and a squirrel cage blower **58** affixed to the shaft of motor **54.** Mounting

bracket 56 is provided with a pair of openings 60 on diametrically opposite sides thereof via which blower module 14 mounts on housing module 12. Openings 60 register with screws 35 so that when blower module 14 is assembled to housing module 12 enlarged portions of the openings 60 pass over the heads of screws 35. The module 14 is then indexed in the counter clockwise direction as viewed in the drawing to move the reduced portions of the openings 60 onto the shanks of the screws 35. The module 14 thereby becomes supported on module 12 permitting the installer to free his hands for tightening screws 35 to secure module 14 to module 12. With module 14 thus mounted, motor 54 and squirrel cage 58 are supported within the air discharge enclosure 32. After mounting of blower module 14, a plug 55 leading from motor 54 is plugged into receptacle 52.

Accessory module 16 is next assembled onto housing module 12. Accessory module 16 comprises a pair of spaced parallel side panels 64 and 66 and three parallel, downwardly concave, spaced apart reflector panels 68, 70 and 72 extending between the side walls 64, 66. Mounting flanges 73 are turned outwardly of the side walls 64 and 66 respectively at the four corners of module 16. Openings 74 are provided in mounting flanges 73 and form a rectangular pattern which matches the rectangular pattern of screws 37 in central wall 21 of housing 20. Accessory module 16 is mounted on housing module 12 by passing the enlarged central circular portions of openings 74 over the heads of screws 37 and then positioning module 16 to bring the shanks of the screws 37 within the reduced radially slotted portions of openings 74. Module 16 thereby becomes supported on module 12 permitting the installer to free his hands for tightening screws 37 to secure module 16 to module 12. Thus it will be noted that the mounting arrangement for both modules 14 and 16 is especially convenient for the installer.

A pair of quartz tube heater elements 76 are removably mounted on side panels 64 and 66 by means of mounting brackets 78. Heater elements 76 are disposed centrally of module 16 and are enveloped from above by the central reflector panel 70. Each end of each heater element 76 terminates in a lead 80 and these connect to appropriate terminals of terminal connector blocks 82 mounted on the side panels 64, 66 and protected by covers 90. Additional electrical circuit elements 84 and 85, which form no part of the present invention, may also mount on accessory module 16 as illustrated and can connect via leads to appropriate terminals on a terminal connector block 82. Plugs 86 and 88 provide electrical connection from terminal connector block 82 to receptacles 48 and 50. A plurality of four incandescent lamps 92 also mount on accessory module 16. Lamps sockets 94 for lamps 92 mount on side panels 64, 66 with the axes thereof being horizontal so that the lamps 92 also have their axes horizontal. When screwed into the sockets, the lamps are beneath the outside reflector panels 68, 72. Electrical lead wires run from each socket 94 and terminate in a plug 96 which plugs into receptacle 50. With accessory module 16 mounted on housing module 12, side panel 64 clears the receptacles 46–52 to permit the respective plugs to be engaged and disengaged with the receptacles. Furthermore, it will be noted that an appreciable portion of accessory module 16 is contained within housing 20 above the level of ceiling wall W, and this contributes to the minimization of the vertical dimension of the ventilator. This vertical compactness is due in part to the horizontal mounting of the heater rods 76 and the lamps 92 parallel to the reflector elements 68, 70 and 72. Accessory module 16 also is bounded by the side walls 22, 24, 26, 28 of housing 20 and spaces are provided via which air can be drawn around the accessory module to pass through opening 30 and into air discharge enclosure 32 for discharge via duct 34.

Grille module 18 provides a functional yet decorative cover for the ventilator after the modules 12, 14 and 16 have been assembled into the ceiling. Grille module 18 is removably mounted on accessory module 16 via studs 98 which pass through holes 100 in grille module 18, threaded caps 102 being threaded onto studs 98 to secure grille module 18 thereon. In the finished ventilator, grille module 18 has a centrally located grille work 104 directly beneath heater elements 76 so that heat can be radiated therethrough into the room when the elements 76 are energized. Grille module 18 further includes translucent lenses 106 beneath lamps 92 and side ventilating openings 108 alongside the lenses 106. When blower 54 operates, room air is drawn through grille work 104 and openings 108 to flow around accessory module 16 and through opening 30 into air discharge enclosure 32 for discharge via duct 34.

FIG. 2 illustrates a further embodiment of the invention which has only ventilating and lighting, the heating function being omitted. The construction is very similar to that of ventilator 10 and hence, like components are identified by like numerals and need not be discussed again. A major difference in the two embodiments is that in the embodiment of FIG. 2, accessory module 16 has only a single central panel 110 shaped to provide a pair of downwardly concave reflecting surfaces 112, 114 to reflect the light from lamps 92. Circuit element 84 terminates in a plug 86 which mates with receptacle 46. It will also be noted that in the FIG. 2 embodiment grille module 18 lacks the central grille work 104.

FIGS. 3 and 4 illustrate typical installations of a ventilator in a building. In FIG. 3 ventilator 10 mounts in the ceiling and the exhaust duct 34 exhausts through the roof of the building, while in FIG. 4 the exhaust duct exhausts through the wall of the building.

In light of the foregoing detailed description, it can be seen that a compact, easily installable ceiling ventilator has been provided. It will be appreciated, of course, that the switch for the ventilator is typically wall mounted on a side wall of the room and that the wiring is such that the switch can control the three functions of ventilating, heating and lighting in fashions known in the art. Furthermore, as mentioned earlier, the unit is intended for mounting between spaced ceiling joists and such joists are typically two by six's on sixteen inch centers providing a standardized distance between adjacent joists. As shown in FIG. 2, one or more furring strips 116 can be fastened to the joists to provide the requisite spacing distance for housing module 16 in the event that the spacing between the ceiling joists is greater than the standardized distance.

It is to be understood that the foregoing description is that of a preferred embodiment of the invention. Various changes and modifications may be made without departing from the spirit and scope of the invention as defined by the appended claims.

We claim:

1. A modular ceiling ventilator for a room comprising: a housing module adapted to lodge in the ceiling

of a room and to fit snugly between parallel spaced ceiling members; a blower module comprising an electrical blower means operable to move air; means for removably mounting said blower module on said housing module; an accessory module comprising an accessory means operable to provide an accessory function; means for removably mounting said accessory module on one of said first two named modules; air inlet and outlet means operable to enable air flow from the inlet means to the outlet means upon operation of said blower means; a grille module; said air outlet means being provided on the housing module and said air inlet means being provided in the grille module; means removably mounting said grille module on one of said first three named modules; said modules being arranged and constructed such that said ventilator exhausts air from the room when said blower means operates, said accessory module and said blower module being so constructed and positioned relative to each other and the housing module such that air drawn into the housing module through the air inlet means can flow through the blower module to the air outlet means; and wherein said housing module comprises a rectangular housing comprising a rectangular horizontal central wall, and four vertical side walls projecting downwardly from the edges of said horizontal central wall, one pair of diametrically opposite side walls being arranged for juxtaposition with the parallel spaced ceiling members and including openings therein via which the housing may be mounted to the ceiling members, and wherein said horizontal wall includes a centrally located opening therein and said housing module includes an air discharge enclosure above said opening, said air discharge enclosure having provided therein said air outlet means, said blower module being removably mounted on said horizontal central wall with said blower means supported within said enclosure, and wherein said accessory module comprises a central panel means disposed below said opening and a pair of spaced apart side panel means extending upwardly from said central panel means for mounting said accessory module on said central horizontal wall, and means for securing the side panel means to the central horizontal wall, said accessory module and said housing module being arranged and constructed to provide space therebetween via which air can flow around at least a portion of the periphery of said accessory module to enter said opening when said blower means operates.

2. A modular ceiling ventilator as claimed in claim **1** wherein said side panel means includes a plurality of mounting flange means thereon, and means defining an opening in each said mounting flange means, said means for removably mounting said accessory module on said housing module comprising a plurality of fastening means on said central horizontal wall, each said fastening means passing through a corresponding one of said mounting flange means openings and securing the corresponding mounting flange means to said central horizontal wall.

3. A modular ceiling ventilator as claimed in claim **2** wherein at least one of said fastening means comprises a headed fastener and the corresponding one of said mounting flange means openings has an enlarged portion larger than the head of said one fastener and a reduced portion larger than the shank of said one fastener but smaller than the head of said one fastener whereby when said accessory module is being assembled to said housing module the enlarged portion of said one mounting flange means opening may be passed over the head of said one fastener and the accessory module then positioned to bring the shank of the fastener into the reduced portion of said one mounting flange means opening with the head of said one fastener supporting the corresponding mounting flange means so as to thus provide support of the accessory module on the housing module during assembly.

4. A modular ceiling ventilator as claimed in claim **3** wherein said accessory module is of generally rectangular shape and is bounded horizontally by said side walls of said housing.

5. A modular ceiling ventilator as claimed in claim **3** wherein said accessory means mounts on at least one of said side panel means of said accessory module.

6. A modular ceiling ventilator as claimed in claim **5** wherein said accessory means is a quartz tube heater element extending between said side panel means.

7. A modular ceiling ventilator as claimed in claim **5** wherein said accessory means is a lamp mounted on one of said side panel means.

8. A modular ceiling ventilator for a room comprising: a housing module adapted to lodge in the ceiling of a room and to fit snugly between parallel spaced ceiling members; a blower module comprising an electrical blower means operable to move air; means for removably mounting said blower module on said housing module; an accessory module comprising an accessory means operable to provide an accessory function; means for removably mounting said accessory module on one of said first two named modules; air inlet and outlet means operable to enable air flow from the inlet means to the outlet means upon operation of said blower means; a grille module; said air outlet means being provided on the housing module and said air inlet means being provided in the grille module; and means removably mounting said grille module on one of said first three named modules; said modules being arranged and constructed such that said ventilator exhausts air from the room when said blower means operates, said accessory module and said blower module being so constructed and positioned relative to each other and the housing module such that air drawn into the housing module through the air inlet means can flow through the blower module to the air outlet means; and wherein said housing module comprises a rectangular housing comprising a rectangular horizontal central wall and four vertical side walls projecting downwardly from the edges of said horizontal central wall, one pair of diametrically opposite side walls being arranged for juxtaposition with the parallel spaced ceiling members and including openings therein via which the housing may be mounted to the ceiling members, wherein said accessory module comprises central, downwardly concave panel means and spaced apart side panel means projecting upwardly of said central panel means for mounting said accessory module on said central horizontal wall and means for securing the side panel means to the central horizontal wall.

9. A modular ceiling ventilator as claimed in claim **8** wherein said accessory means mounts on said side panel means and is disposed between said central panel means and said grille module.

10. A modular ceiling ventilator as claimed in claim **8** wherein said side panel means comprises a plurality

of mounting flange means thereon via which said accessory module mounts to said central horizontal wall.

11. A modular ceiling ventilator as claimed in claim **10** wherein each said mounting flange means comprises means defining an opening therein, said means for removably mounting said accessory module on one of said first two named modules comprising a plurality of fastening means on said horizontal central wall registering with each mounting flange means opening, each said fastening means passing through the registering mounting flange means opening and securing the corresponding mounting flange means to said horizontal central wall.

12. A modular ceiling ventilator as claimed in claim **11** wherein each said fastening means comprises a headed fastener and each said mounting flange means opening has an enlarged portion larger than the head of the corresponding fastener and a reduced portion larger than the shank of the corresponding fastener whereby the mounting flange means can mount to said horizontal central wall by passing the head of each fastener through the enlarged portion of each mounting flange means opening and then positioning the accessory module to bring the reduced portion of each mounting flange means opening into the shank of each fastener.

13. A modular ceiling ventilator as claimed in claim **12** wherein the enlarged portion of each said mounting flange means opening is in the form of a circular hole larger than the head of the corresponding fastener and the reduced portion of each said mounting flange means opening comprises at least one radially extending slot extending radially outwardly from the corresponding circular hole, all said radially extending slots being parallel with each other.

14. A modular ceiling ventilator as claimed in claim **13** wherein said mounting flange means openings and the corresponding fasteners are arranged in matching rectangular patterns.

15. A modular ceiling ventilator as claimed in claim **8** wherein said central concave panel means comprises a plurality of three parallel spaced concave panels, said accessory means comprising a heater element disposed between the central one of said concave panels and said grille module, said ventilator further including additional accessory elements between the other two concave panels and said grille module.

16. A modular ceiling ventilator as claimed in claim **15** wherein said additional accessory elements comprise lamps mounted on said side panel means.

17. A modular ceiling ventilator as claimed in claim **16** wherein said lamps have their axes horizontal and said heater element is also horizontal.

18. A modular ceiling ventilator as claimed in claim **8** wherein said central concave panel means comprises at least one downwardly concave reflecting surface and said accessory means comprises a plurality of incandescent lamps mounted horizontally on said side panel means, each of said lamps being disposed between said reflecting surface and said grille module.

19. A modular ceiling ventilator for the ceiling of a room comprising: a housing module adapted to mount in the ceiling of a room comprising a housing having a horizontal central wall provided with an opening therein; an air discharge enclosure on said horizontal central wall over said opening and vertical side wall means extending downwardly from the periphery of said horizontal central wall via which said housing module mounts in the ceiling; a blower module comprising an electrical blower means operable to move air removably mounted on said horizontal central wall with said blower means supported within said enclosure; an accessory module comprising a central panel means below said opening and vertical side panel means extending upwardly from said central panel means to said horizontal central wall; and wherein said accessory module includes quartz tube heater element and a lamp and means for energizing said heater element and lamp, means for removably mounting said accessory module on said horizontal central wall; air inlet and outlet means operable to enable air flow from the inlet to the outlet upon operation of said blower means; and a grille module removably mounted on and covering said accessory module, said air outlet means being provided on the housing module and said air inlet means being provided in the grille module, and said accessory module and said blower module being so constructed and positioned relative to each other and the housing module such that air drawn into the housing module through the air inlet means can flow through the blower module to the air outlet means has been inserted after "module".

20. A modular ceiling ventilator as claimed in claim **19** wherein said vertical side wall means includes a pair of spaced parallel vertical side walls for respective juxtaposition with respective parallel spaced ceiling members, said side walls including openings therein via which said housing may be mounted to the ceiling members.

21. A modular ceiling ventilator as claimed in claim **19** wherein said accessory module comprises said heater element and lamp mounted on said vertical side panel means and disposed between said central panel means and said grille module.

22. A modular ceiling ventilator as claimed in claim **19** including an electrical receptacle means on said central wall, said blower means and said heater element and lamp terminating in plug means which plug into said electrical receptacle means.

23. A modular ceiling ventilator as claimed in claim **19** wherein said horizontal central wall and said vertical side wall means form a compartment which is relatively shallow in comparison to its length and breadth and wherein an appreciable vertical portion of said accessory module is contained within the compartment thus defined.

24. A modular ceiling ventilator as claimed in claim **23** wherein the compartment thus defined is disposed above the room surface of the ceiling.

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