April 14, 1964 P. B. MOORE 3,128,610

AIR CONDITIONING UNITS

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Fig. 1.

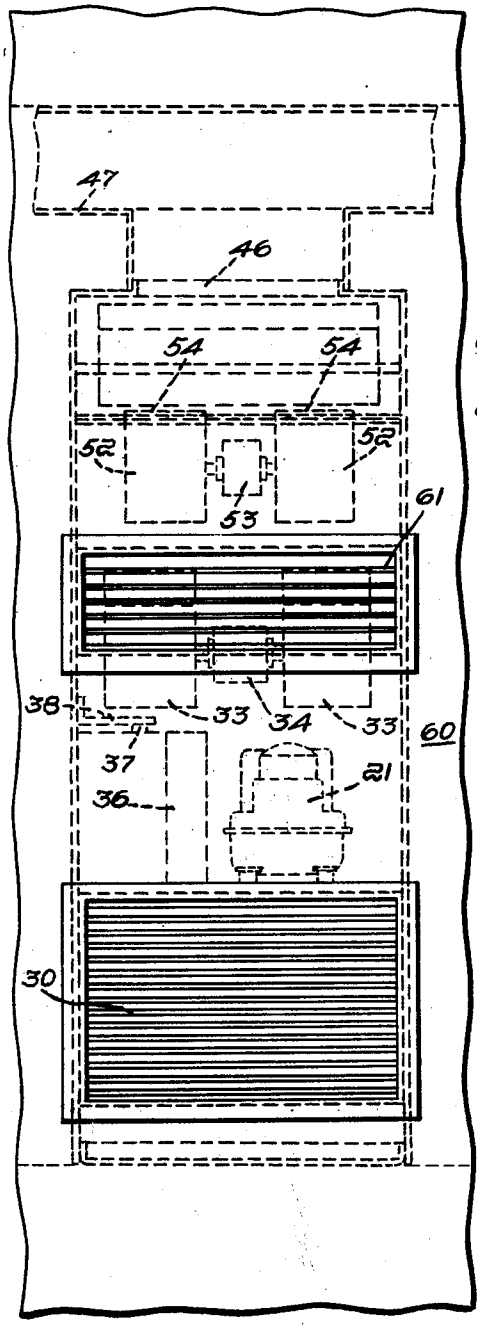
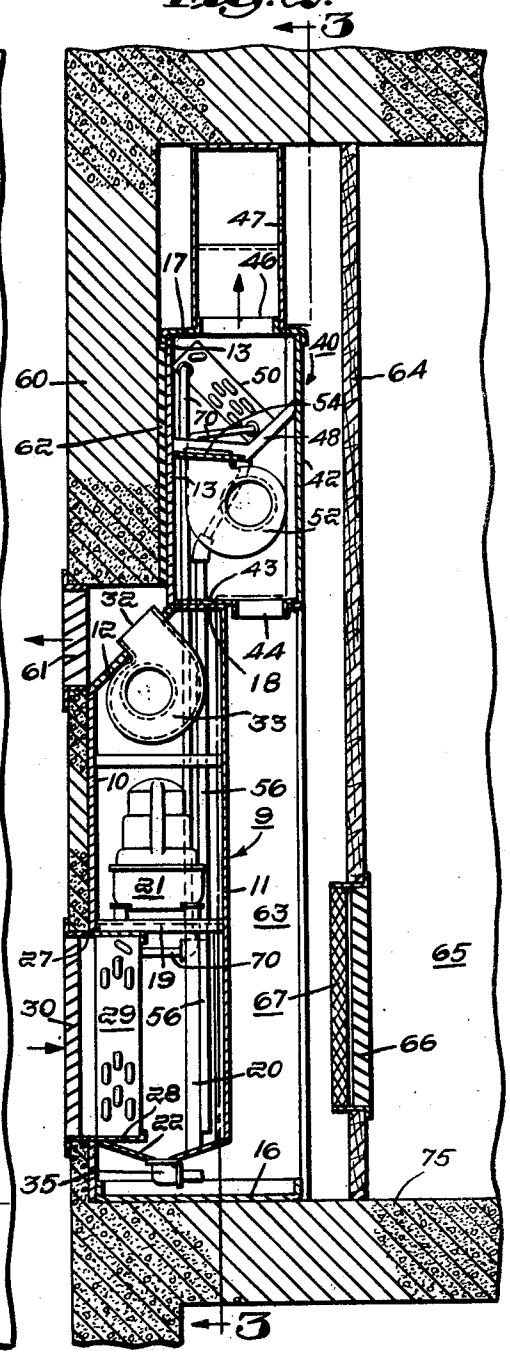


Fig. 2.



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Fig. 3.

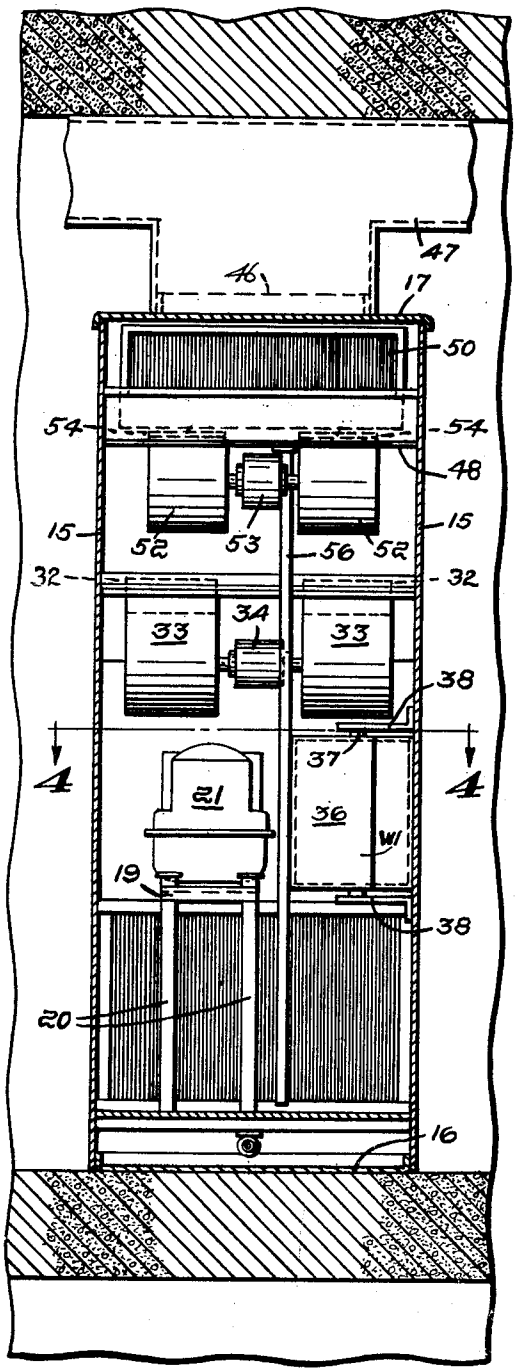


Fig. 5.

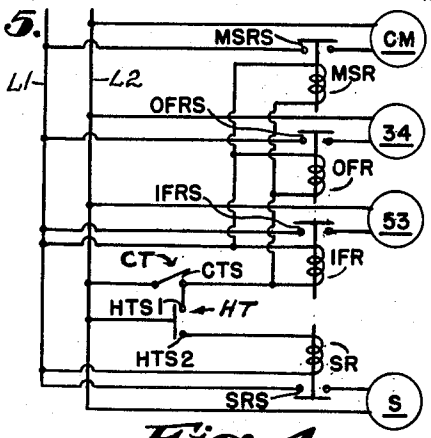


Fig. 4.

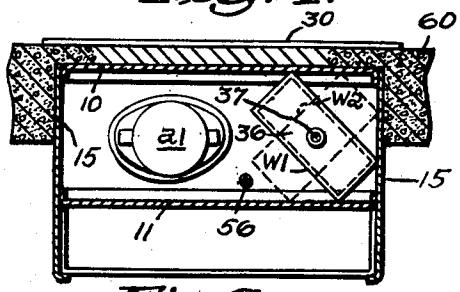
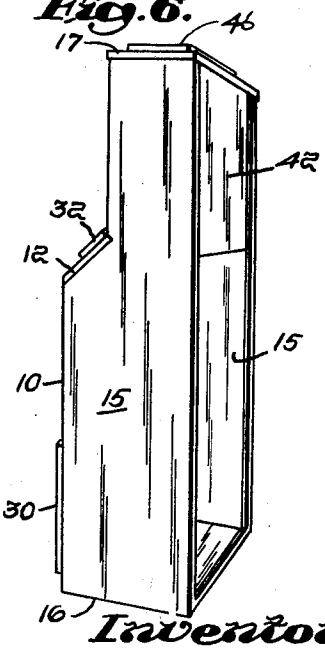


Fig. 6.



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AIR CONDITIONING UNITS

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8 Claims. (Cl. 62—263)

This invention relates to self-contained air conditioning units such as air coolers and heat pumps.

An air conditioning unit embodying this invention requires minimum floor space, and can be installed in many locations, such, for example, as partially coved in an exterior wall of a building, on a porch or balcony of a building, or within an equipment closet of a building. The inner and outer walls of the unit are removable for providing access to its equipment from either the inside of a building or from the outside of a building, depending upon the type of installation.

In one embodiment of this invention, an air conditioning unit is constructed in two sections, a lower, generally rectangular, outdoor air section containing an outdoor air, heat exchange coil, a pair of centrifugal fans, a refrigerant compressor and a control box, and an upper, rectangular, indoor air section containing an indoor air, heat exchange coil and a pair of centrifugal fans. The indoor air section instead of being located directly above the outdoor air section, is off-set so that its inner and outer end walls are spaced inwardly from the inner and outer end walls respectively, of the outdoor air section. This leaves an outer space above the outer portion of the top of the outdoor section into which the fans of the outdoor section can discharge, and from which the discharged outdoor air can be directed through a duct extending horizontally outward, or through a duct extending vertically above the outdoor air section. This also leaves an inner space below the inner portion of the bottom of the indoor air section which has a recirculated air inlet opening therein, for a recirculated air plenum chamber. The unit has side walls which with the inner end wall of the outdoor section, the bottom of the unit, and the inner portion of the bottom of the inner section, form sides of the plenum chamber, the side of the chamber opposite the outdoor section being open, permitting a recirculated air grille to be placed in a partition or door of a building near the top of the plenum chamber for a high return, or near its bottom for a low return.

The outer end wall of the outdoor section has an outdoor air inlet opening therein, and is removable for providing access to the equipment within the outdoor section from that end. The inner end wall of the outdoor section is also removable for providing access to the equipment within the outdoor section from its inner end. Both end walls of the indoor section are removable for providing access to the equipment within the indoor section.

An object of this invention is to provide an air conditioning unit that is suited for location at many different parts of a building.

Another object of this invention is to conserve the space occupied by an air conditioning unit.

This invention will now be described with reference to the annexed drawings, of which:

FIG. 1 is a view from the outside of a building of the outdoor air inlet and outlet grilles of an air conditioning unit embodying this invention, with the outlines of the unit and its equipment shown by dashed lines;

FIG. 2 is a side section of the unit, showing its outdoor section partially coved within a building wall;

FIG. 3 is a section along the lines 3—3 of FIG. 2;

FIG. 4 is a section along the lines 4—4 of FIG. 3;

FIG. 5 is a circuit schematic showing the electrical controls of the unit, and

FIG. 6 is a reduced scale, projected view of the unit.

The unit has a lower, vertically extending, outer end wall **10**, an intermediate, inwardly slanted, outer end wall **12**, and has an upper, vertically extending, outer end wall **13** offset inwardly of the wall **10**. The unit has similar side walls **15**, a bottom wall **16** and a top wall **17**.

Outdoor air section **9** of the unit has the wall **10** as its outer end wall, has the slanted wall **12** as part of its top wall, the other part of which is formed by a horizontally extending wall **18**. The section **9** has an inner end wall **11** opposite and parallel to the wall **10**. The side walls **15** of the unit form the side walls of the section **9**. A drain pan **22** forms the bottom of the section **9**. The pan **22** has a drain connection **35**. Supported within the section **9** on spaced-apart, horizontally extending angles **19** and vertically extending legs **20** is a refrigerant compressor **21**. Supported within the section **9** between the inner portions of an upper flange **27** and a lower flange **28** is an outdoor air coil **29**. The wall **10** has an opening containing an outdoor air inlet grille **30** aligned with the coil **29** and extending between the outer portions of the flanges **27** and **28**. Extending through the slanted wall **12** are outlets **32** of a pair of spaced-apart centrifugal fans **33** within the section **9**, and which are driven by an electric motor **34** located midway between the fans.

A rectangular, metal control box **36** is located within the section **9** alongside the compressor **21**, and is supported for rotation on a vertically extending shaft **37** from flanges **38** extending inwardly from one of the walls **15**. The box **36** contains compressor motor starter relay MSR, relay OFR for the outdoor fan motor **34**, relay IFR for an indoor fan motor and a relay SR for a solenoid S of a reversal valve which is not shown, when the unit is a heat pump. These relays are shown by FIG. 5 of the drawings. The shaft **37** is hollow for receiving the wires which are not shown, to the equipment within the control box **36**. The control box has removable side walls W1 and W2.

Indoor air section **40** of the unit has as its outer end wall, the wall **13**, and has a vertically extending, inner end wall **42** opposite and parallel to the wall **13**. The section **40** has a horizontally extending bottom wall **43** having an outer portion on the wall **18**, and having a recirculated air inlet opening **44** in its inner portion. The walls **15** form the side walls of the section **40**, and the wall **17** forms its top wall. The wall **17** has an air outlet opening **46** therein connected to an overhead, air distributing duct **47**. A drain pan **48** extends between the walls **13** and **42**, and supported from and above the pan **48** is a slanted, indoor air coil **50**. Supported from the pan **48** between the latter and the bottom wall **43** of the section **40** are two spaced-apart, centrifugal fans **52** driven by an electric motor **53** located midway between the fans **52**. Outlets **54** of the fans **52** extend through the bottom of the pan **48**. The pan **48** is connected by a drain pipe **56** to a space slightly above the drain pan **22**, so that condensate from the indoor air coil **50** when it is acting as an air cooler can be drained into the pan **22** and then to waste through the drain connection **35**.

The outer and inner walls **10** and **11** respectively, of the outdoor air section **9**, and the outer and inner walls **13** and **42** respectively, of the indoor section **40** are removable for providing access to the equipment within the two sections from either front or back depending upon the type of installation. In the installation shown by FIGS. 1–4 of the drawings, the section **9** is partially coved in an exterior wall **60** of a building, with the bottom wall **16** of the unit on a floor **75** inside the building. The outdoor air grille **30** is in an opening in the wall **60**. There is an outdoor air outlet grille **61** in another opening in the wall **60** opposite the fan outlets **32**. A mat **62** of heat insulation spaces the end wall **13** from the adjacent inner surface of the wall **60**.

There is a plenum chamber 63 formed in the space between the inner portions of the side walls 15, and between the air inlet opening 44 and the bottom wall 16 of the unit. The chamber 63 has an open inner end opposite the wall 11 which forms its outer end.

A wooden panel 64 which may be a door, separates the unit from indoor space 65, and has an opening in its lower portion opposite the open inner end of the plenum chamber 63 which contains a recirculated air inlet grille 66 with an air filter 67 at its inner side.

Tubing 70 connects the compressor 21 and the indoor air coil 29 and indoor air coil 50 in a conventional refrigerant circuit which may be a heat pump circuit such as is shown in FIG. 6 of the R. F. Lauer Patent No. 3,045,448.

FIG. 5 of the drawings shows the electrical control circuit of the unit. Compressor motor CM of the compressor 21 is connected directly to electric supply line L2, and through switch MSRS of relay MSR to electric supply line L1. The outdoor fan motor 34 is connected directly to the line L2 and through switch OFRS of relay OFR to the line L1. The indoor fan motor 53 is connected directly to the line L2 and through switch IFRS of relay IFR to the supply line L1. A solenoid S used for adjusting the refrigerant reversal valve which is not shown, of the unit when the latter is a heat pump, is connected directly to the line L2 and through switch SRS of a relay SR to the supply line L1. The relays MSR, OFR and IFR are connected directly to the supply line L1, and through switch CTS of cool thermostat CT to the supply line L2, so that when the thermostat CT calls for cooling, it energizes the relays MSR, OFR and IFR which close their switches MSRS, OFRS and IFRS respectively, which energize the compressor motor CM, the outdoor fan motor 34, and the indoor fan motor 53 respectively.

A heat thermostat HT is connected directly to the supply line L2, and has a switch HTS1 connected to the switch CTS so that when the heat thermostat HT calls for heat, the compressor and fan motors are energized. The heat thermostat HT has another switch HTS2 which connects the solenoid relay SR to the supply lines L1 and L2 when the thermostat HT calls for heat, causing the relay SR to close its switch SRS to connect the solenoid S to the supply lines, following which, the solenoid adjusts its associated reversal valve to its air heating position.

The wall 11 of the outdoor section 9 is removable for providing access to the compressor 21 and the other components within the section 9 from indoors. At the time of installation, the control box 36 is rotated about its shaft 37 to the full line position shown by FIG. 4 so that when the wall 11 of the outdoor section is removed for providing access from indoors, the side wall W1 of the box 36 can be removed for providing access from indoors to the relays and other equipment within the control box 36.

The unit can also be mounted within an equipment closet or on a porch or balcony with access from outdoors, in which installations, the wall 10 of the outdoor section can be removed for providing access to the interior of the outdoor section. At the times of such installations, the control box 36 would be rotated about the shaft 37 to the dashed-line position of FIG. 4 so that its side wall W2 can be removed for providing access from outdoors to the components within the control box.

When the unit is mounted in an equipment closet or on a porch or balcony, an outdoor air discharge duct can be connected to the outlets 32 of the outdoor air fans 33, and placed, due to the off-set of the indoor air unit 40, vertically above the fan outlets 32, thus conserving space.

Due to the open inner side of the plenum chamber 63 extending from the bottom of the unit of the recirculated air inlet 44 of the indoor section, the panel 64 of FIG. 2 can be provided with a low recirculated air grille 66 as shown, or can be provided with a high recirculated air grille without change in noise or efficiency.

In operation, the outdoor air fans 33 draw outdoor air into the outdoor air section 9 through the grille 30, through the outdoor air coil 29, over the compressor 21 and control box 36, and discharge the air through the grille 61 back to outdoors. The indoor fans 52 draw indoor air from the indoor space 65, through the grille 66 and filter 67 into the plenum chamber 63 from which it passes through the opening 44 into the indoor air section 40, passing within the latter through the indoor air coil 50 and then through the outlet opening 46 into the distribution duct 47.

What is claimed is:

1. An air conditioning unit comprising a lower outdoor air section having upwardly extending outer and inner ends; an upper indoor air section having upwardly extending outer and inner ends, on said outdoor section; said outdoor section having a top portion spaced outwardly from the bottom of said outer end of said indoor section, said indoor section having a bottom portion spaced inwardly from the top of said inner end of said outdoor section, said outer end of said outdoor section having an outdoor air inlet opening in its lower portion, said top portion of said outdoor section having an outdoor air outlet opening therein; a heat exchange coil, a refrigerant compressor, and a fan within said outdoor section, said fan being positioned to draw outdoor air through said inlet opening, to move the outdoor air through said coil and over said compressor, and to discharge the outdoor air through said outlet opening; said bottom portion of said indoor section having a recirculated air inlet opening therein, the top of said indoor section having a conditioned air outlet opening therein; an indoor air heat exchange coil, and an indoor air fan within said indoor section, said indoor fan being positioned to draw indoor air through said recirculated air opening, to move the indoor air through said indoor coil, and to discharge the indoor air through said conditioned air outlet opening, said coils and said compressor being connected in a closed refrigeration circuit.

2. An air conditioning unit as claimed in claim 1 in which said unit has a bottom below said sections, in which said sections have common side walls with inner ends at and below said inner end of said indoor section and forming with said bottom of said unit and said bottom portion of said indoor section, a plenum chamber having an open inner end below said inner end of said indoor section.

3. An air conditioning unit as claimed in claim 2 in which said outdoor section has a drain pan at its bottom, in which said indoor section has a drain pan below said indoor coil, and in which a drain pipe is provided within said unit for draining water condensed on said indoor coil and falling into said last mentioned drain pan, into said first mentioned drain pan.

4. An air conditioning unit as claimed in claim 1 in which said outdoor section has a drain pan at its bottom, in which said indoor section has a drain pan below said indoor coil, and in which a drain pipe is provided within said unit for draining water condensed on said indoor coil and falling into said last mentioned drain pan, into said first mentioned drain pan.

5. An air conditioning unit comprising a lower outdoor air section having a vertically extending, outer end wall, having a vertically extending, inner end wall opposite and spaced from said outer wall and having an upper portion extending upwardly beyond the upper end of said outer wall, said section having a top wall portion extending from the top of said inner wall horizontally towards and part way to said outer wall, and having a slanted top wall portion extending from the outer end of said top wall portion to the top of said outer wall, said slanted portion having an outdoor air outlet opening therein, said outer wall having an outdoor air inlet opening in its lower portion, an outdoor air heat exchange coil within said section opposite said inlet opening, an outdoor fan within said section between said coil and said

outlet opening, a refrigerant compressor within said section between said fan and coil, said fan being positioned to draw outdoor air through said inlet opening and coil and over said compressor and to discharge the outdoor air through said outlet opening; an indoor air section having vertically extending, spaced-apart, outer and inner end walls off-set horizontally inward of said outer and inner end walls respectively of said outdoor section, said indoor section having a bottom wall with an outer portion on said first mentioned top wall portion of said outdoor section and having an inner portion with a recirculated air inlet opening therein spaced inwardly of said inner wall of said outdoor section, said indoor section having a top wall with a conditioned air outlet opening therein, said unit having side walls forming the side walls of said sections, an indoor air heat exchange coil within said indoor section below said conditioned air outlet opening, and an indoor air fan within said indoor section between said indoor coil and said recirculated air inlet opening and positioned to draw indoor air through said recirculated air inlet opening and to move the indoor air through said indoor coil and to discharge the indoor air through said conditioned air outlet opening, said coils and said compressor being connected in an closed refrigeration circuit.

6. An air conditioning unit as claimed in claim 5 in which said unit has a bottom wall below said outdoor section and which extends below said inner portion of said bottom wall of said indoor section, and in which said

side walls of said outdoor section extend inwardly beyond its said inner end wall with their inner ends below said inner wall of said indoor section and forming with said bottom wall of said unit and said inner portion of said bottom wall of said indoor section, a plenum chamber having an open inner end below said inner end wall of said indoor section.

7. An air conditioning unit as claimed in claim 6 in which said outdoor section has a bottom wall formed as a drain pan, in which there is provided within said indor section below said indoor coil, a drain pan, and in which a drain pipe is provided within said unit for draining water from said last mentioned drain pan into said first mentioned drain pan.

8. An air conditioning unit as claimed in claim 5 in which said outdoor section has a bottom wall formed as a drain pan, in which there is provided within said indoor section below said indoor coil, a drain pan, and in which a drain pipe is provided within said unit for draining water from said last mentioned drain pan into said first mentioned drain pan.

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