

July 19, 1960

I. L. GOULD ET AL  
AIR CONDITIONER

2,945,362

Filed May 6, 1957

6 Sheets-Sheet 1

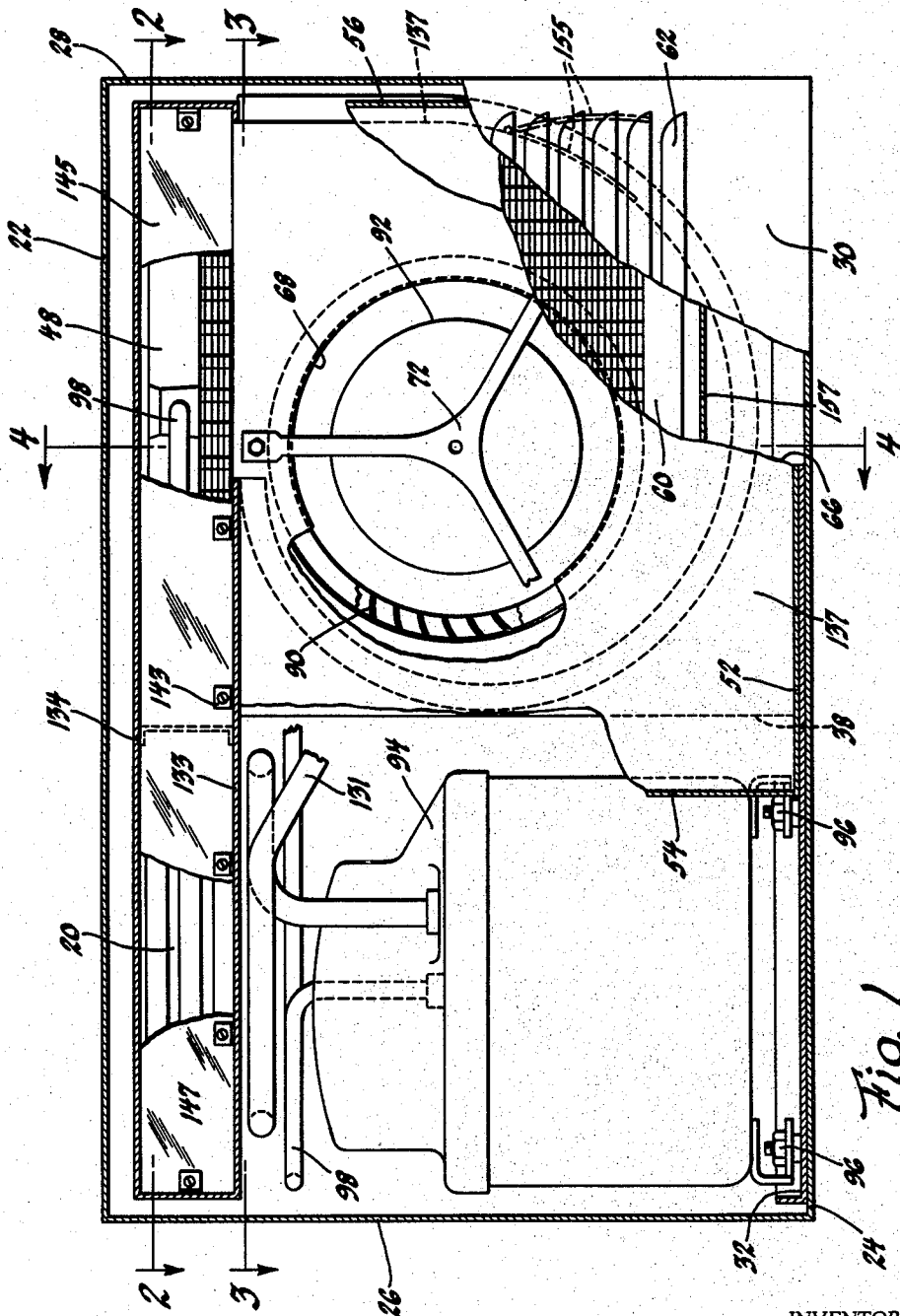


Fig. 1

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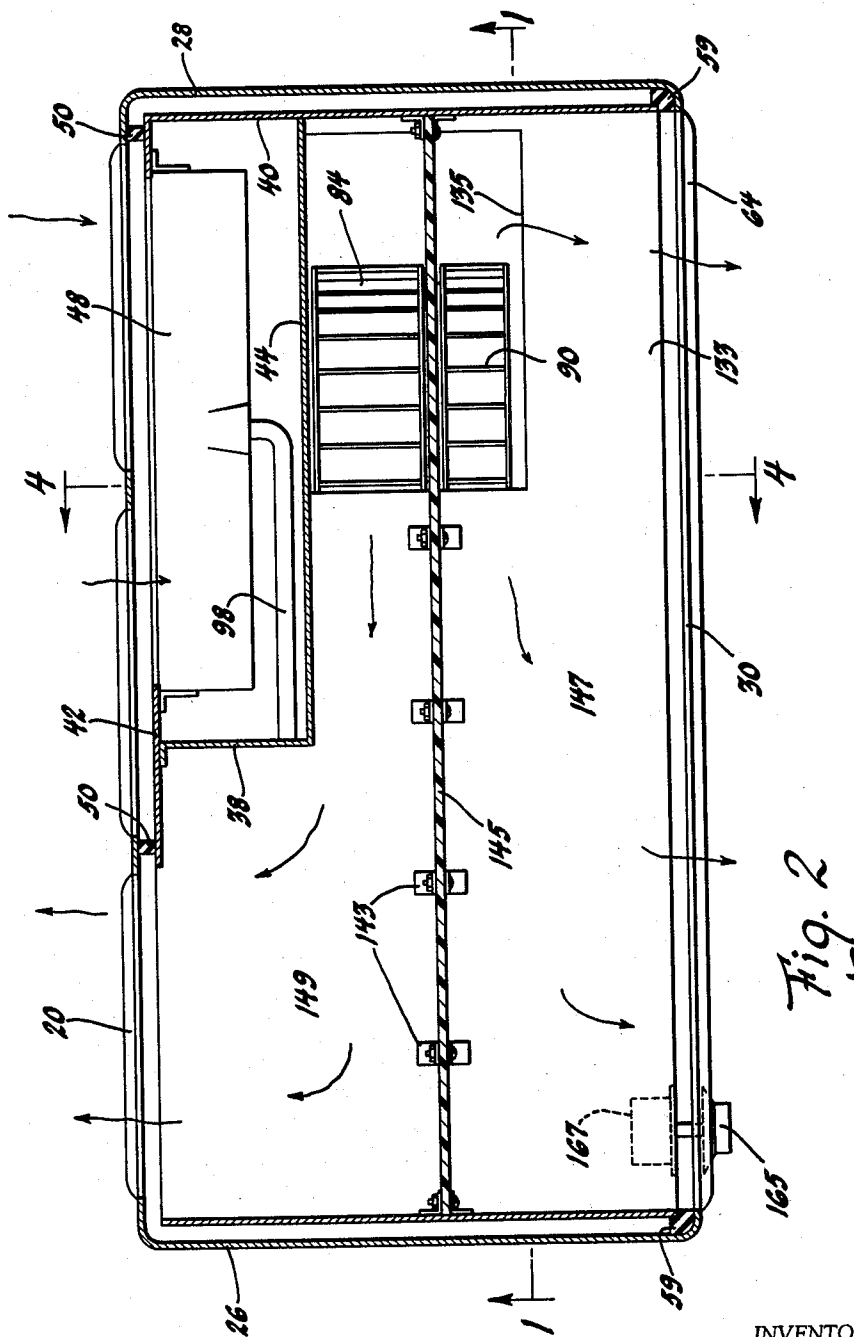
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6 Sheets-Sheet 2



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AIR CONDITIONER

6 Sheets-Sheet 3

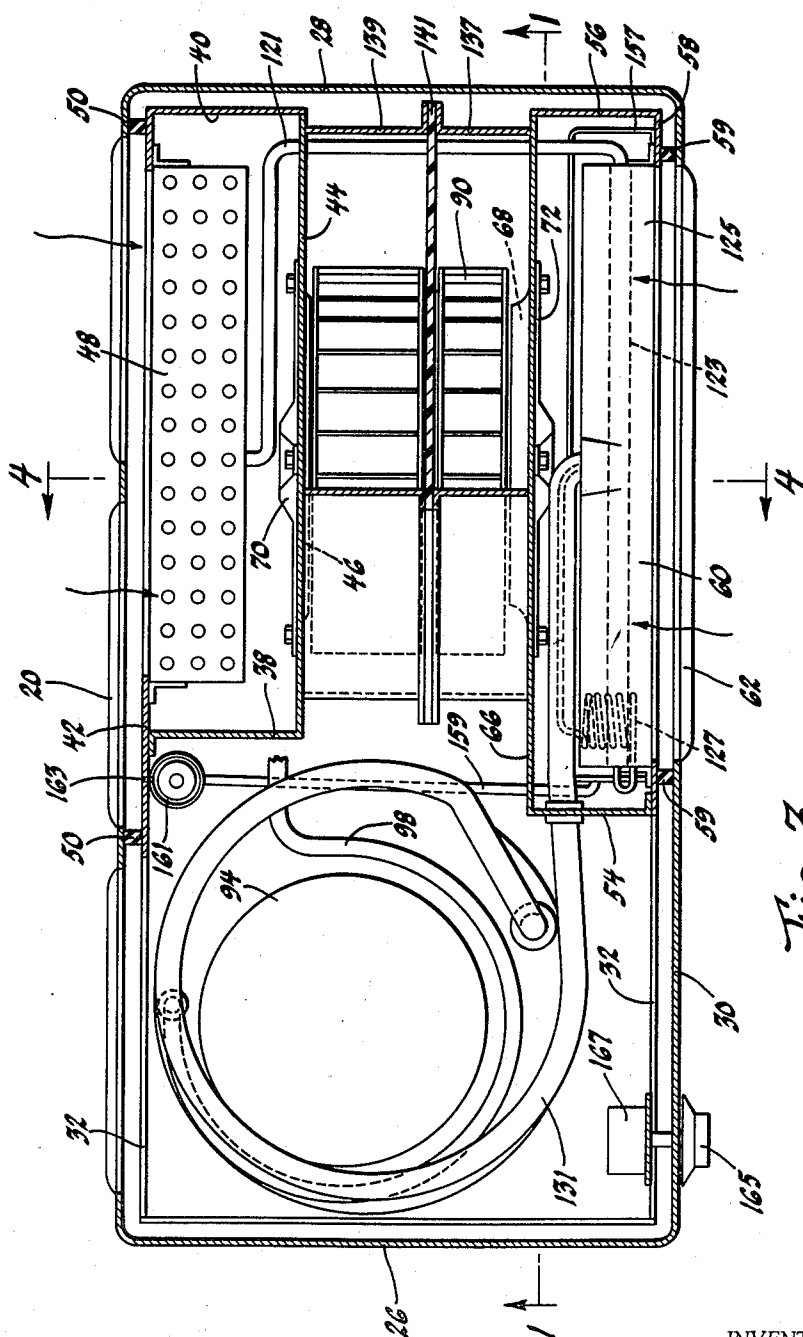


Fig. 3

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6 Sheets-Sheet 4

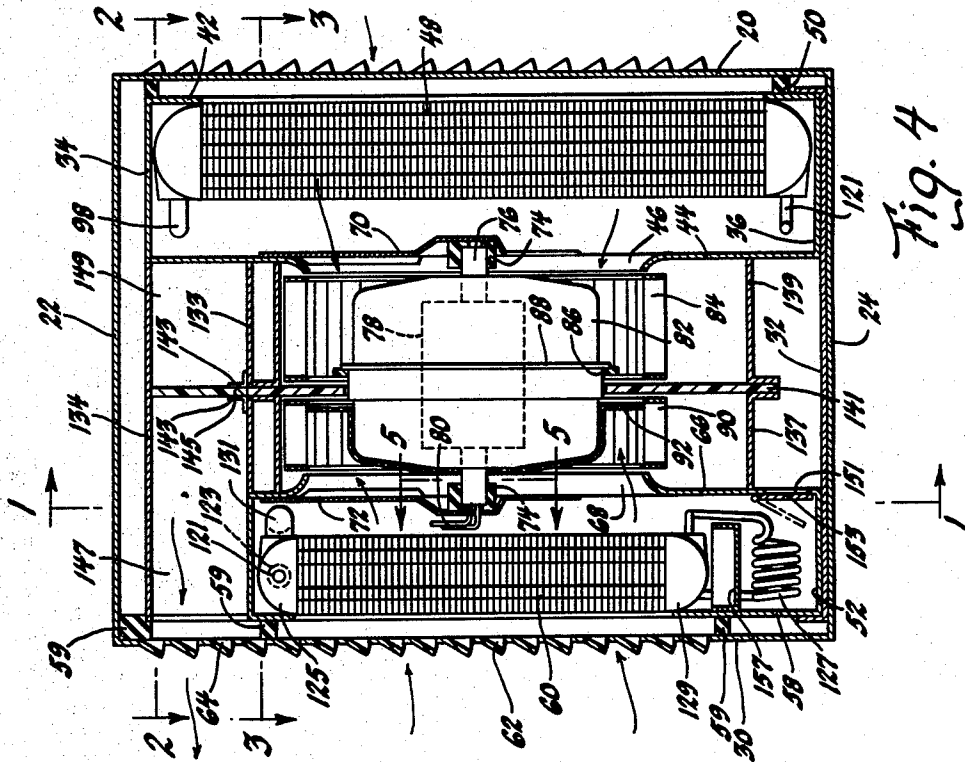


Fig. 4

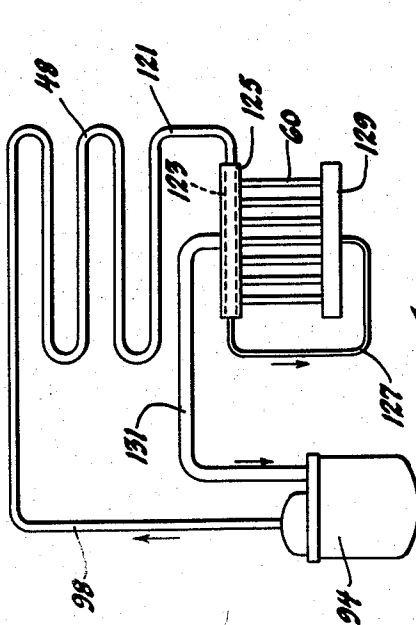


Fig. 6

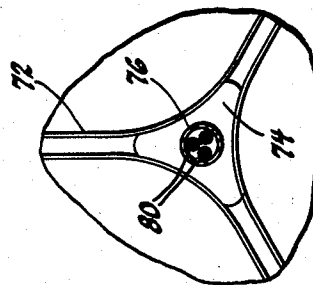


Fig. 5

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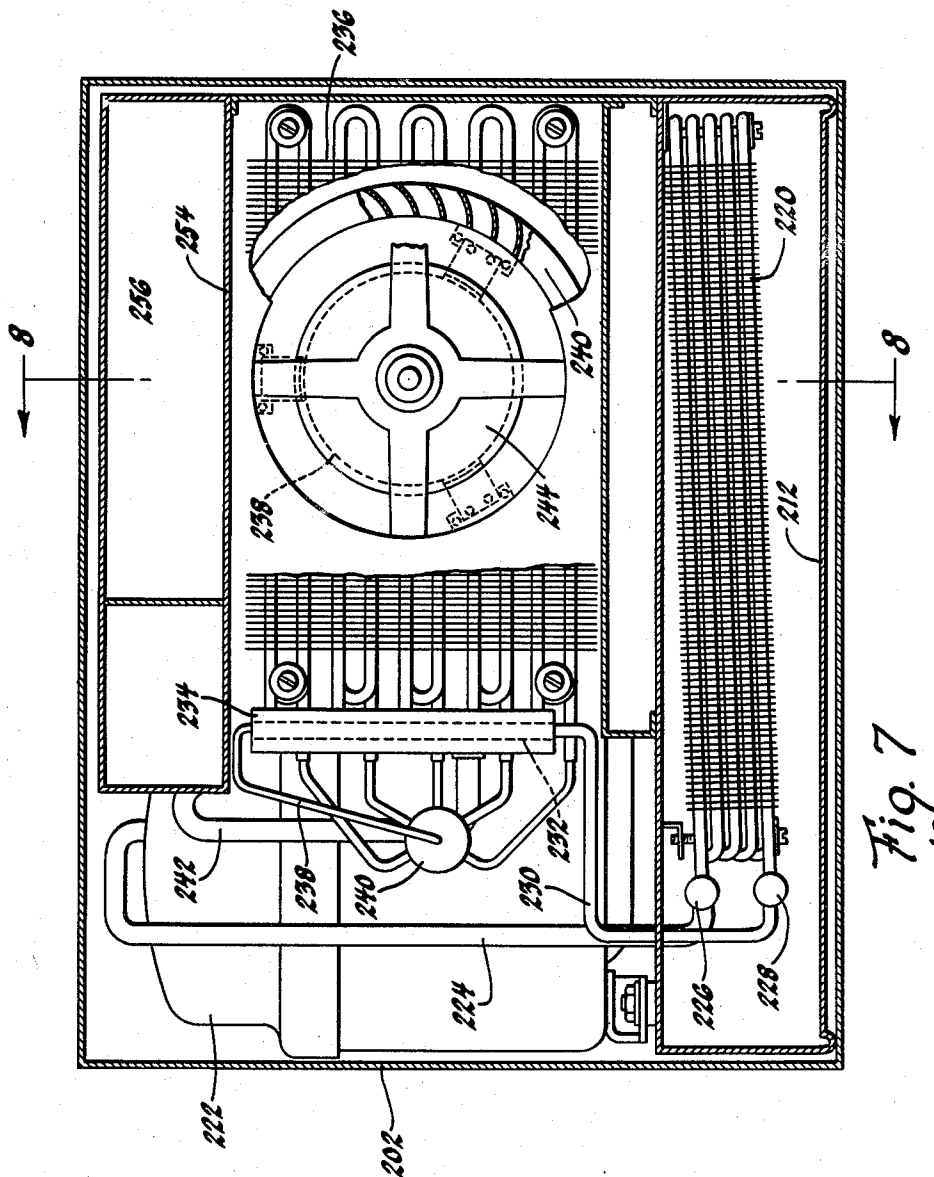
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6 Sheets-Sheet 5



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6 Sheets-Sheet 6

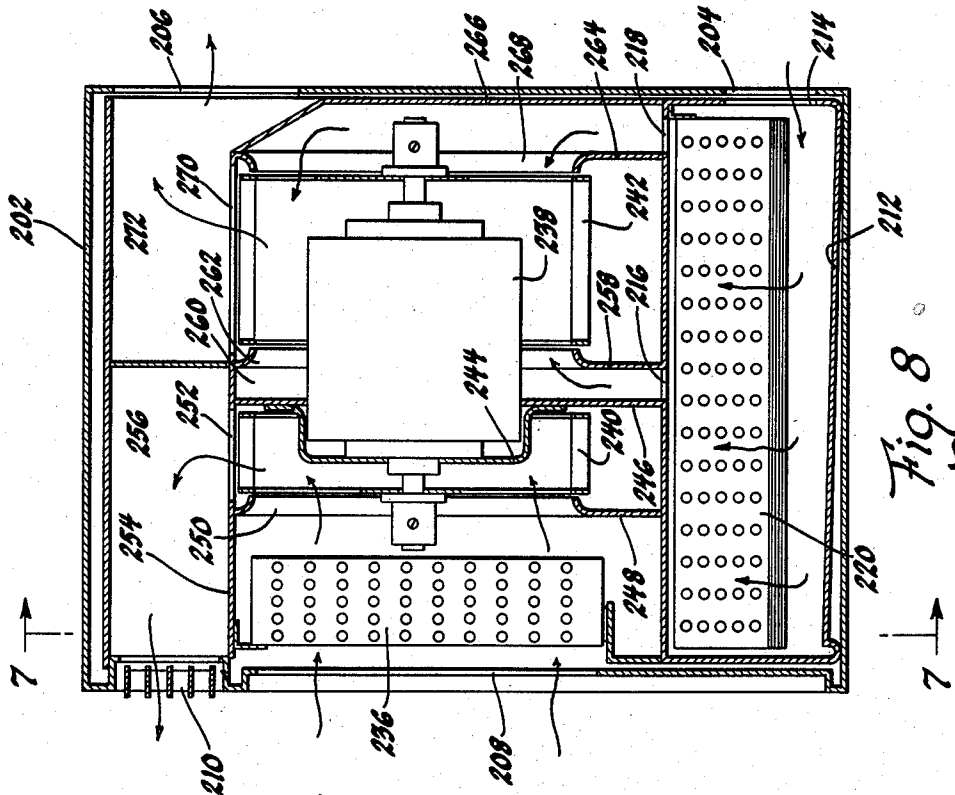


Fig. 8

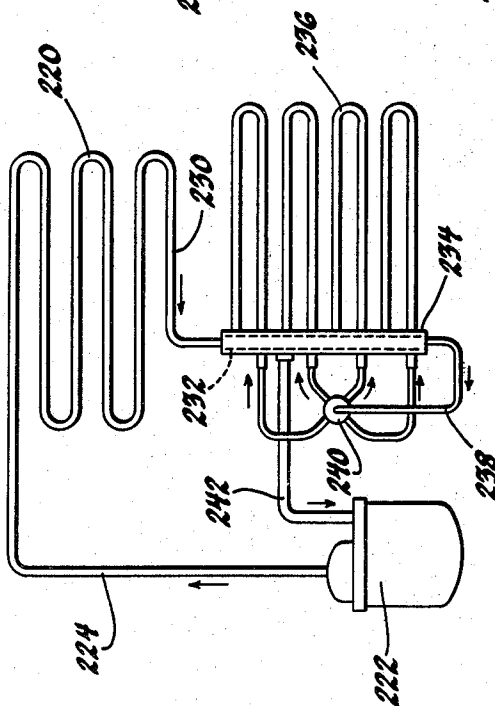


Fig. 9

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2,945,362

## AIR CONDITIONER

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7 Claims. (Cl. 62-429)

This invention relates to refrigerating apparatus and more particularly to thin window type air conditioning apparatus.

The first widely sold window air conditioners were flat, wide and long so that they projected inside the window and outside the window considerable distances. Even in the smaller sizes the projection was more than a foot in each direction. This provided sufficient space for large evaporators, condensers, fans, and for air flow. There have been increasing objections to this amount of projection and new, compact, thin type conditioners have been introduced which are slightly higher and wider but much thinner, so that the projection is much less.

It is an object of this invention to provide a thinner window type, large capacity air conditioner which is compactly arranged, with the maximum use of space and the free flow of indoor and outdoor air.

It is another object of this invention to provide a thinner window type air conditioner with a compact, dual fan arrangement which is quiet, efficient and inexpensive.

It is another object of this invention to provide an efficient, compact refrigerating system for thin window air conditioners.

These and other objects are attained in the form shown in the drawing in which a thin, compact cabinet shell is provided with a room air inlet and an outdoor air inlet on opposite sides. The chassis is slidably mounted within the cabinet shell and is provided with a base which supports the evaporator in the room air inlet and the condenser in the outdoor air inlet. The chassis also supports a dual squirrel cage centrifugal fan driven by a single motor located entirely within the dual cages. The cages and the surrounding discharge scroll are split and separated by plastic insulating material so that one side is adjacent to and draws the air through the evaporator and the opposite side is adjacent to and draws the air through the condenser. The scroll discharges upwardly into plenum chambers located on opposite sides of a dividing wall of insulating material which discharge the room air back into the room and the outdoor air outside. The condenser and evaporator and fans are located at one end of the chassis, providing sufficient room for the sealed motor compressor unit in the opposite end. In the second form of the invention, the condenser is located within the base of the chassis, but the side-by-side dual fan arrangement is also used in this instance.

Further objects and advantages of the present invention will be apparent from the following description, reference being had to the accompanying drawings, wherein a preferred form of the present invention is clearly shown.

In the drawings:

Figure 1 is a vertical sectional view of one form of improved window conditioner taken substantially along the lines 1-1 of Figs. 2, 3 and 4;

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Figure 2 is a horizontal sectional view taken along the lines 2-2 of Figures 1 and 4;

Figure 3 is a horizontal sectional view taken along the lines 3-3 of Figures 1 and 4;

Figure 4 is a vertical sectional view taken along the lines 4-4 of Figures 1, 2 and 3;

Figure 5 is a fragmentary sectional view taken along the lines 5-5 of Figure 4;

Figure 6 is a diagrammatic view of the refrigerating system embodied in Figures 1-4;

Figure 7 is a vertical sectional view of another form of the invention, taken along the lines 7-7 of Figure 8;

Figure 8 is a transverse vertical sectional view taken along the lines 8-8 of Figure 7; and

Figure 9 is a diagrammatic view of the refrigerating system embodied in Figures 7 and 8.

Referring now to the drawings and more particularly to Figs. 1-4, there is shown a thin box-shaped cabinet shell including a rear wall 20 provided substantially throughout with louvers, a top 22, a bottom wall 24, and end walls 26 and 28 which may be made as a unit. In addition, there is provided a front wall 30 which may be removable so that the refrigerating system may be slid into the shell and thereafter the front is fastened in place. The chassis includes a base pan 32 normally resting upon the bottom 24 and having turned up flanges. At one corner of the base pan 32 is mounted an assembly which includes an enclosure containing a top wall 34, a bottom wall 36, side walls 38 and 40, an outer face 42 and an inner ring 44 provided with a substantially central opening 46. This assembly forms the enclosure for the condenser 48. This enclosure is sealed to the rear wall 20 by a suitable sponge rubber seal 50 extending around its perimeter between the face 42 and the wall 20, as shown in Figs. 2, 3 and 4.

Upon the opposite side there is an evaporator enclosure including a bottom wall 52, side walls 54 and 56, and a front face 58 having a large opening in which is positioned the evaporator 60. The front wall 30 is provided with louvers 62 in front of the evaporator 60 and also louvers 64 extending completely across the top of this wall 30. The evaporator enclosure also includes the inner ring 66 provided with an inlet aperture 68. The front face 58 is provided with a perimeter seal 59 of sponge rubber extending into contact with the front wall 30.

Located directly between the condenser 48 and the evaporator 60 is a dual squirrel cage type centrifugal fan having the motor 78, 82 entirely within the dual fan in a free flowing space saving arrangement. In the form shown in Figs. 1-6 the rings 44 and 66 are provided with three-armed formed sheet metal spiders 70 and 72 which have their arms flanged. The intersection of the flanges supports a triangular shaped rubber mounting 74 receiving the ends of a stationary shaft 76. The shaft 76 connects directly to a stationary wound inner element 78. The electric current for the inner element is supplied through conductors 80 extending through a hollow portion of the shaft 76. The outer portion 82 of the motor rotates. The condenser squirrel cage fan 84 is connected at its inner face through an insulating ring 86 to the flange 88. The evaporator fan 90 has its inner face connected by the hat-shaped support 92 of insulating material to the outer element 82 of the fan, as shown in Fig. 4. The hat-shaped element 92 covers the one end of the motor and insulates the motor from the room air flow.

The sealed motor-compressor unit 94 is fastened to the base 32 by four resilient mountings 96. This unit discharges through the conduit 98 into the top of the condenser 48. The bottom of the condenser 48 is connected by a conduit 121 to a finned heat exchange tube 123 extending through and within the top header 125 of the

evaporator 60. The opposite end of this finned heat exchange tube 123 is connected by the capillary tube 127 to the bottom header 129 of the evaporator 60. The interior of the top header 125 surrounding the tube 123 is connected by the suction conduit 131 to the suction inlet of the sealed motor-compressor unit 94.

Extending over the sealed motor-compressor unit, the evaporator and the fans is a horizontal partition wall 133. This wall 133 is spaced below the top inner wall 134 and is cut out to receive the condenser enclosure. It also has a cut-out opening 135 over the fans. The evaporator fan 90 is surrounded by a scroll discharge section 137 while the condenser fan 84 is surrounded by the scroll discharge section 139. These scroll sections are separated by a vertical wall 141 of plastic insulating material extending substantially to the periphery of the outer portion 82 of the motor. The scroll sections 137 and 139 have outwardly turned flanges which are fastened together through the separating wall 141. The scrolls extend into sealing contact with the walls 44 and 66 and also with the upper horizontal wall 133. The horizontal wall 133 is provided with dual angle brackets 143 which support a vertical partition 145 dividing the space above the horizontal wall 133 and below the top wall 134 into an evaporator plenum chamber 147 and a condenser discharge plenum chamber 149. This wall 145 is preferably of plastic insulating material aligned with the wall 141 and sealed thereto.

By this arrangement, when the window unit is placed in a window with the wall 20 on the outside and the wall 30 on the inside, outdoor air is drawn through the louvers in the wall 20 through the condenser 48 and through the flanged opening 46 into the interior of the fan wheel 84 around the outer portion 82 of the motor which revolves with the wheel 84. The outdoor air is discharged centrifugally from the fan wheel 84 into the discharge scroll 139 and passes upwardly through the condenser side of the opening 135 and the condenser plenum chamber 149 to be discharged outside through a portion of the louvers in the wall 20.

The room air is drawn through the louvers 62 in the wall 30 directly in front of the evaporator 60. The air then passes through the evaporator 60 and the opening 68 in the ring 66 around the insulating support 92 into the interior of the evaporator fan wheel 90. This air is discharged through the evaporator fan discharge scroll section 137 and through the evaporator side of the opening 135 into the evaporator plenum chamber 147. This cooled air then discharges from chamber 147 through the louvers 64 extending across the top of the front wall 30 back into the room.

Fresh air is provided by an opening 151 in the wall 66 beneath the scroll 137 which may be closed by a door 153. This allows air from the compartment containing the motor-compressor unit 94 to flow through the opening 151 behind the evaporator 60 and into the fan wheel 90. For exhausting air, the evaporator scroll 137 is provided with a hinged door 155 which covers or uncovers an opening in the scroll at a high pressure point, so that some air will be discharged by the evaporator fan into the space beneath the scroll which communicates with the outside through the compartment containing the motor-compressor unit 94.

If the air in the room is humid, the evaporator 60 will cool this air sufficiently to cause moisture to condense on its surfaces. This moisture will drain and collect in the receptacle 157 beneath. This receptacle 157 is provided with a drain tube 159 connecting with a motor driven atomizer 161 which discharges through the slot 163 into the outside atmosphere.

The refrigerating system and the fans are controlled by the knob 165 on the front of the cabinet mounted on a knob shaft connecting with the control mechanism 167 within the shell.

In the form shown in Figs. 7-9, the outer shell 202 is somewhat similar and includes a lower inlet outdoor air

opening 204 extending across the bottom of the outer face, and an outdoor air discharge opening 206 extending across the upper face of the outer wall. The outer shell 202 also includes a large inlet opening 208 connecting directly with the evaporator and a room air discharge opening 210 discharging the cooled air back into the room.

The chassis includes a base 212 in the form of a hollow, flat box having an inlet opening 214 registering with the opening 204 and outlet openings 216 and 218 in its upper wall. Within the base 212 is located the slightly inclined, generally horizontal condenser 220 having upwardly extending passages between the upright fins. This condenser is spaced well above the bottom of the base 212 so that the condenser air can flow beneath the condenser 220 and then upwardly through the condenser 220 to the openings 216 and 218 leading to opposite sides of the condenser fan 242. The sealed motor-compressor unit 222 is resiliently mounted on top of the base 212 and has a discharge conduit 224 connecting with the upper header 226 of the condenser 220.

The lower header 228 of the condenser is connected by the conduit 230 to the heat exchange tube 232 located in and extending through the discharge header 234 of the evaporator 236. The opposite end of this finned heat exchange tube 232 is connected by the capillary tube 238 to the distributor 240, in turn connected by four capillary tubes to various groups of tubes in the evaporator 236, all of which discharge into the discharge header 234. The interior of the discharge header 234 is connected by the suction conduit 242 to the suction inlet of motor-compressor unit 222.

The inlet opening 208, the evaporator 236, the fan motor 238, evaporator fan 240 and the condenser fan 242 are located in alignment with each other. The fan motor 238 has a conventional stationary outer portion supported by the hat-shaped support 244 and the vertical wall 246. This fan motor 238 has shafts on both ends connecting with the outer faces of the evaporator and condenser fans 240 and 242. The wall 246 divides the room air from the outdoor air and forms one side of the discharge scroll for the evaporator fan 240. The opposite side 248 of the discharge scroll is provided with the inlet 250 for the evaporator fan 240. The evaporator fan 240 and its scroll discharge through the opening 252 in the horizontal wall 254 providing a compartment above the evaporator 236 and the fans 240 and 242 forming a room air plenum chamber 256 discharging through the discharge opening 210 and back into the room.

The condenser fan discharge scroll has its inner side 258 separated from the dividing wall 246 to provide a vertical passage 260 communicating with the inlet opening 262 in the wall 258. The outer side 264 of the condenser fan discharge scroll is spaced away from the closed wall portion 266 extending upwardly from the outer edge of the base 212 to provide a vertical passage leading to an opening 268 in the wall 264. This provides openings 262 and 264 into the opposite sides of the condenser fan blower wheel 242 to provide efficient movement of air to the upper discharge opening 270 in the top wall. The opening 270 discharges into the outdoor air plenum chamber 272 discharging through the opening 206 into the outdoor air. This arrangement also provides a compact, efficient, thin window unit.

While the form of embodiment of the invention as herein disclosed constitutes a preferred form, it is to be understood that other forms might be adopted, as may come within the scope of the claims which follow.

What is claimed is as follows:

1. Air conditioning apparatus including a casing having a first wall adapted to be exposed to outside air and a second wall on the opposite side of the casing adapted to be exposed to inside air, said first and second walls each having air inlets located substantially opposite each other, an evaporator located in series with the inlet in said second wall and a condenser located in series with

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the inlet in said first wall, a set of blower wheels fastened together, heat insulating means between said blower wheels, one of said wheels having its interior communicating with the inside face of said evaporator and the other having its interior communicating with the inside face of said condenser, a dividing means of heat insulating material in a plane between said wheels and separating the discharge of the wheels, a discharge scroll section for each of said wheels located on opposite sides of said dividing means, said casing having discharge outlets communicating with each of said scroll sections, and means for driving said blower wheels.

2. Air conditioning apparatus including a casing, a dividing wall in said casing dividing the room air from the outdoor air, said wall having an opening therein, a set of blower wheels fastened together with heat insulating means between the wheels located in said opening with one wheel on one side and the other wheel on the opposite side of said dividing wall, a motor within said blower wheels having a rotatable exterior fastened to said wheels and a stationary interior, evaporating means in the room air side of said casing and dividing wall, condensing means in the outdoor air side of said casing and dividing wall, said casing being provided with air flow structure connecting one wheel in series with the condensing means and the other wheel in series with the evaporating means, said casing being provided with means for supporting the stationary interior of the motor.

3. Air conditioning apparatus including a casing having a first wall adapted to be exposed to outside air and a second wall on the opposite side of the casing adapted to be exposed to inside air, said first and second walls each having air inlets located substantially opposite each other, an evaporator located in series with the inlet in said second wall and a condenser located in series with the inlet in said first wall, a set of blower wheels rotatable upon a substantially horizontal axis extending between the evaporator and condenser and having their interiors communicating with the interior sides of said evaporator and condenser, means for driving said blower wheels, upright dividing means extending between said blower wheels and beyond dividing said casing to separate the outside air from the room air, a horizontal wall extending within and beneath the top of said casing above said blower wheels forming a discharge chamber, a discharge scroll surrounding the blower wheels discharging upwardly, said horizontal wall having an opening communicating with the discharge scroll surrounding the blower wheels, an upright dividing wall in said discharge chamber extending over said opening and said dividing means for separating the air drawn from the condenser and evaporator, said casing being provided with outlets from said discharge chamber on each side of said dividing wall.

4. Air conditioning apparatus including a casing having a first wall adapted to be exposed to outside air and a second wall on the opposite side of the casing adapted to be exposed to inside air, said first and second walls each having air inlets located substantially opposite each other, an evaporator located in series with the inlet in said second wall and a condenser located in series with the inlet in said first wall, a blower housing located directly between said condenser and evaporator having an inlet on one side communicating directly with the adjacent side of the evaporator and an air inlet on the opposite side communicating directly with the adjacent side of the condenser, a motor within said housing having a stationary inner portion and a rotatable outer portion, said blower housing having means supporting said stationary inner portion, blower wheels and heat insulating means between the blower wheels fastened to said rotatable outer portion, and dividing means of heat insulating material dividing said blower housing and the interior thereof extending between said blower wheels to separate the

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outside and the inside air, and separate discharge means for the two portions of the blower.

5. Air conditioning apparatus including a longitudinal casing having a first wall extending lengthwise of the casing adapted to be exposed to outside air and a second wall extending lengthwise of the casing on the opposite side of the casing adapted to be exposed to inside air, said first and second walls each having adjacent one end thereof air inlets located substantially opposite each other, an upright evaporator located parallel to said second wall and in series with and directly adjacent to the inlet in said second wall and a condenser located parallel to said first wall and in series with and directly adjacent to the inlet in said first wall, a set of blower wheels adjacent each other rotatable upon a substantially horizontal axis substantially perpendicular to said first and second walls extending between and directly adjacent to the evaporator and condenser and having their interiors communicating with the interior sides of said evaporator and condenser, means for driving said blower wheels, upright dividing means extending between said blower wheels and beyond dividing said casing to separate the outside air from the inside air, said casing being provided with inside and outside air outlets, said blower wheels having a discharge scroll in sections on and in contact with opposite sides of said dividing means with one section connecting with said inside air outlet and another section connecting with said outside air outlet, and a motor-compressor unit located in said casing within the end opposite to said blower wheels and beyond said evaporator.

6. Air conditioning apparatus including a longitudinal casing having a first wall extending lengthwise of the casing adapted to be exposed to outside air and a second wall extending lengthwise of the casing on the opposite side of the casing adapted to be exposed to inside air, said first and second walls each having adjacent one end thereof air inlets located substantially opposite each other, an upright evaporator located parallel to said second wall and in series with and directly adjacent to the inlet in said second wall and a condenser located parallel to said first wall and in series with and directly adjacent to the inlet in said first wall, a set of blower wheels adjacent each other rotatable upon a substantially horizontal axis substantially perpendicular to said first and second walls extending between and directly adjacent to the evaporator and condenser and having their interiors communicating with the interior sides of said evaporator and condenser, means for driving said blower wheels, upright dividing means extending between said blower wheels and beyond dividing said casing to separate the outside air from the inside air, said casing being provided with a horizontal wall over said evaporator between said upright dividing means and said second wall to provide a discharge chamber, said second wall having a discharge opening above said horizontal wall communicating with said discharge chamber, the blower wheel adjacent said evaporator being provided with a discharge scroll discharging through said horizontal wall into said discharge chamber, said casing being provided with an outside air outlet, said blower wheel adjacent said condenser being provided with a discharge scroll for delivering air to said outside air outlet, and a motor-compressor unit located in said casing within the end opposite to said blower wheels and beyond said evaporator.

7. Air conditioning apparatus including a rectangular box-shaped casing having a first upright wall extending lengthwise of the casing adapted to be exposed to outside air and a second upright wall extending lengthwise of the casing on the opposite side of the casing adapted to be exposed to inside air, said casing also having top and bottom and end walls, said first and second walls each having adjacent one end thereof air inlets located substantially opposite each other, an upright evaporator located parallel to said second wall and in series with and directly adjacent to the inlet in said second wall, a con-

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denser located parallel to said first wall and in series with and directly adjacent to the inlet in said first wall, a set of blower wheels adjacent each other rotatable upon a substantially horizontal axis substantially perpendicular to said first and second walls extending between and directly adjacent to the evaporator and condenser and having their interiors communicating with the interior sides of said evaporator and condenser, means for driving said blower wheels, a horizontal wall extending between said first and second walls and said end wall beneath said top wall and above said evaporator and said blower wheels, upright dividing means extending between said blower wheels and beyond dividing said casing to separate the outside air from the inside air, said blower wheels having discharge scrolls on opposite sides of said dividing means, said horizontal wall having an opening therein connecting with the discharge portion of said scrolls, upright dividing wall extending between said horizontal wall and the top wall and between the end walls to divide the space between the horizontal wall and

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the top wall, said upright dividing means and upright dividing wall cooperating to keep the outside air and the inside air separated, said casing having an inside air discharge opening in said second wall above said horizontal wall and outside air opening in said first wall communicating with the space above said horizontal wall on the condenser side of said upright dividing means and wall, and a motor-compressor unit located in said casing within the end opposite said blower wheels beneath said horizontal wall.

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