Sept. 20, 1960 J. BRANNICK 2,952,995

AIR CONDITIONER WITH COMPACT CENTRIFUGAL FAN ARRANGEMENT

Filed May 23, 1958 4 Sheets-Sheet 1

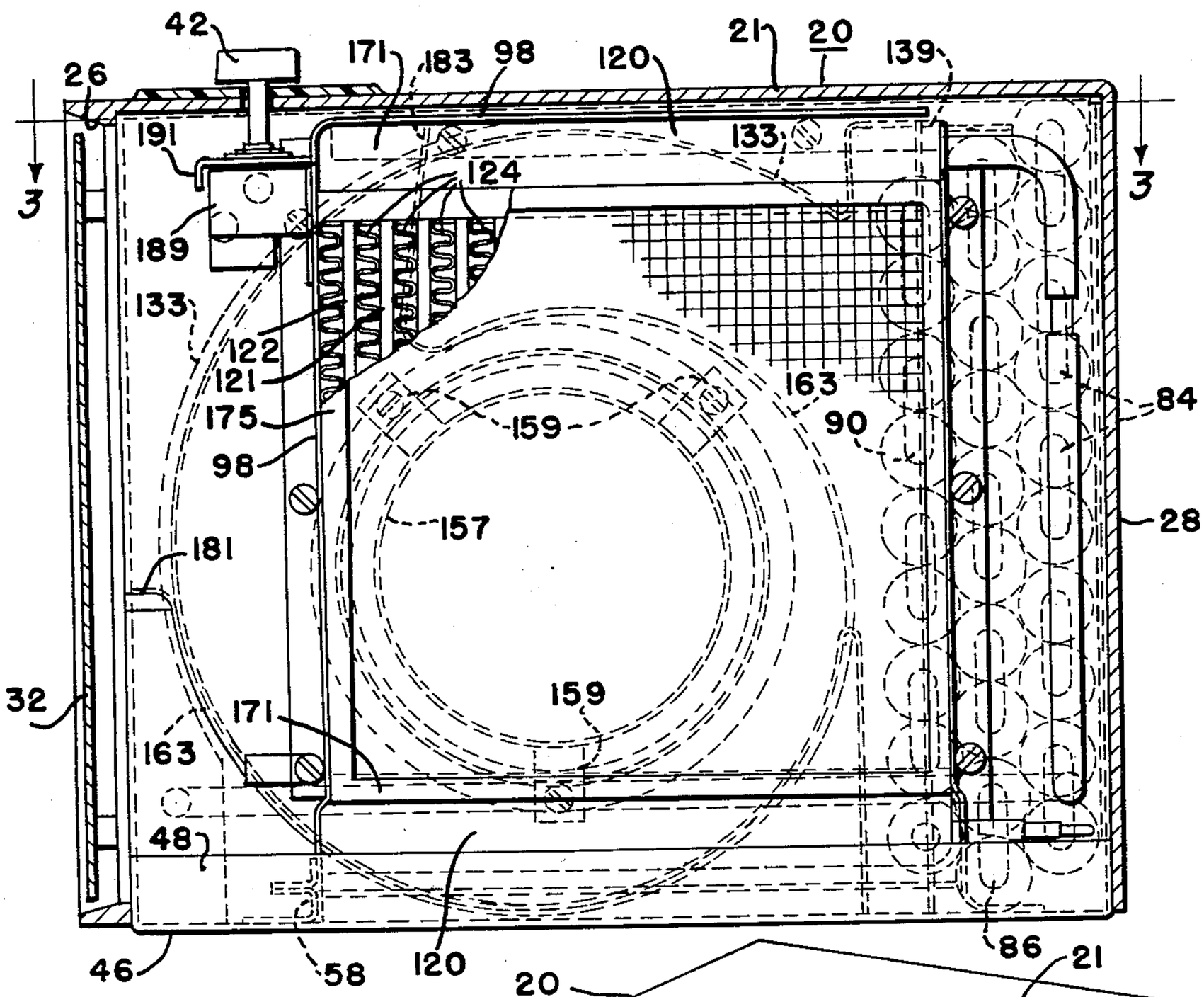

Fig. 4

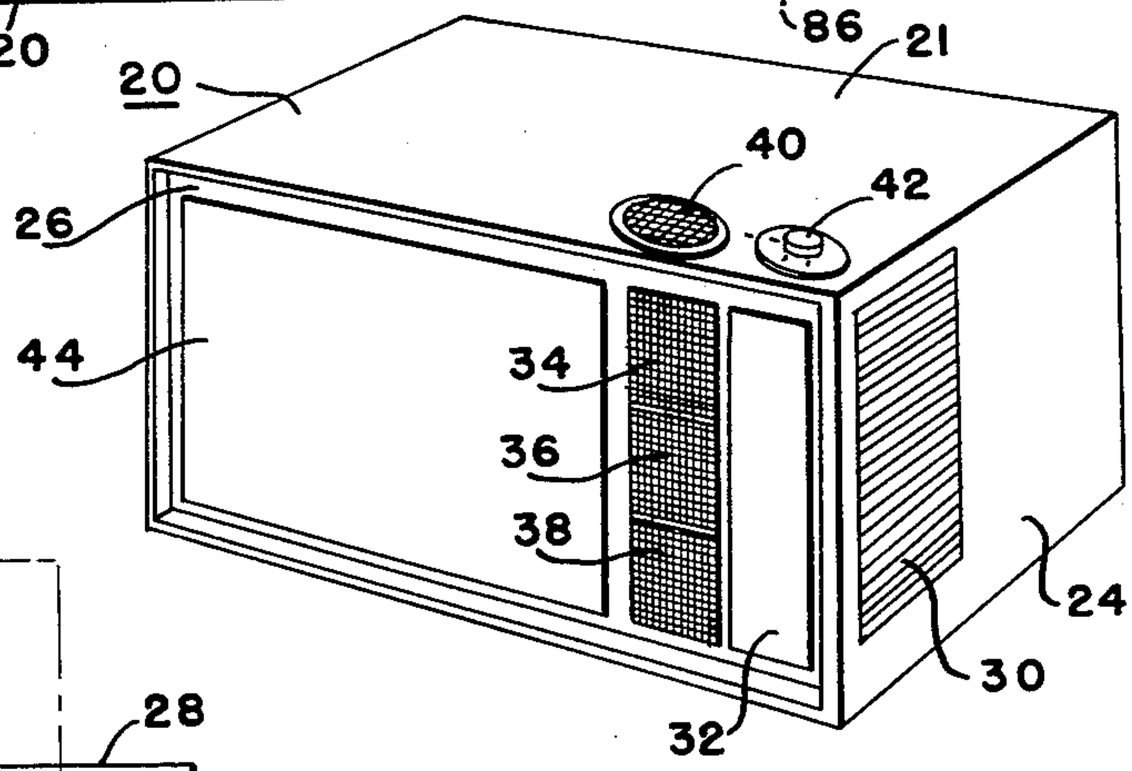

Fig. 1

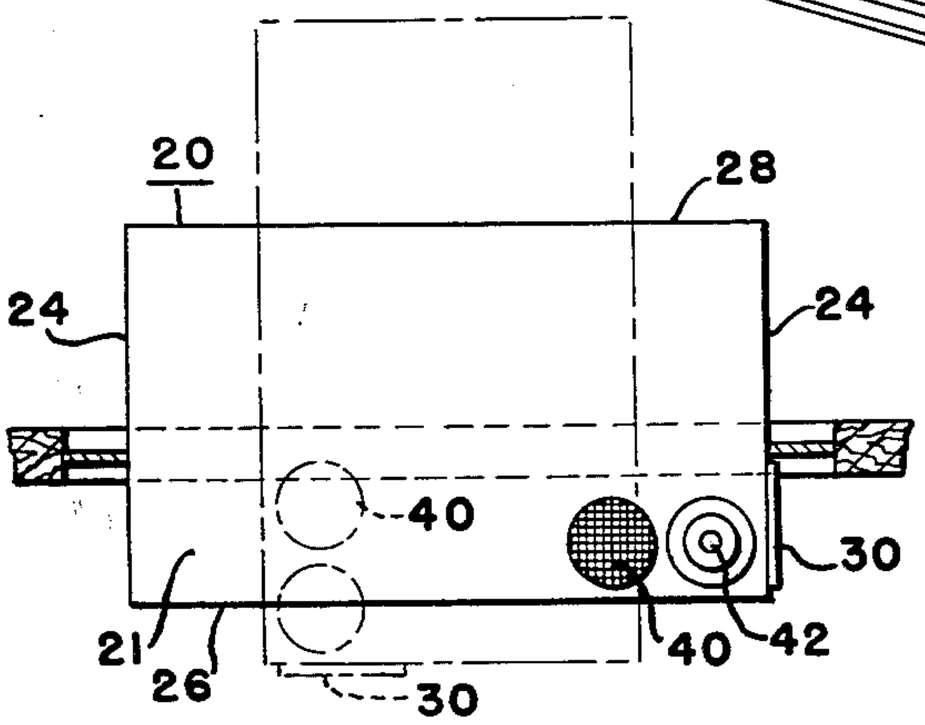

Fig. 6

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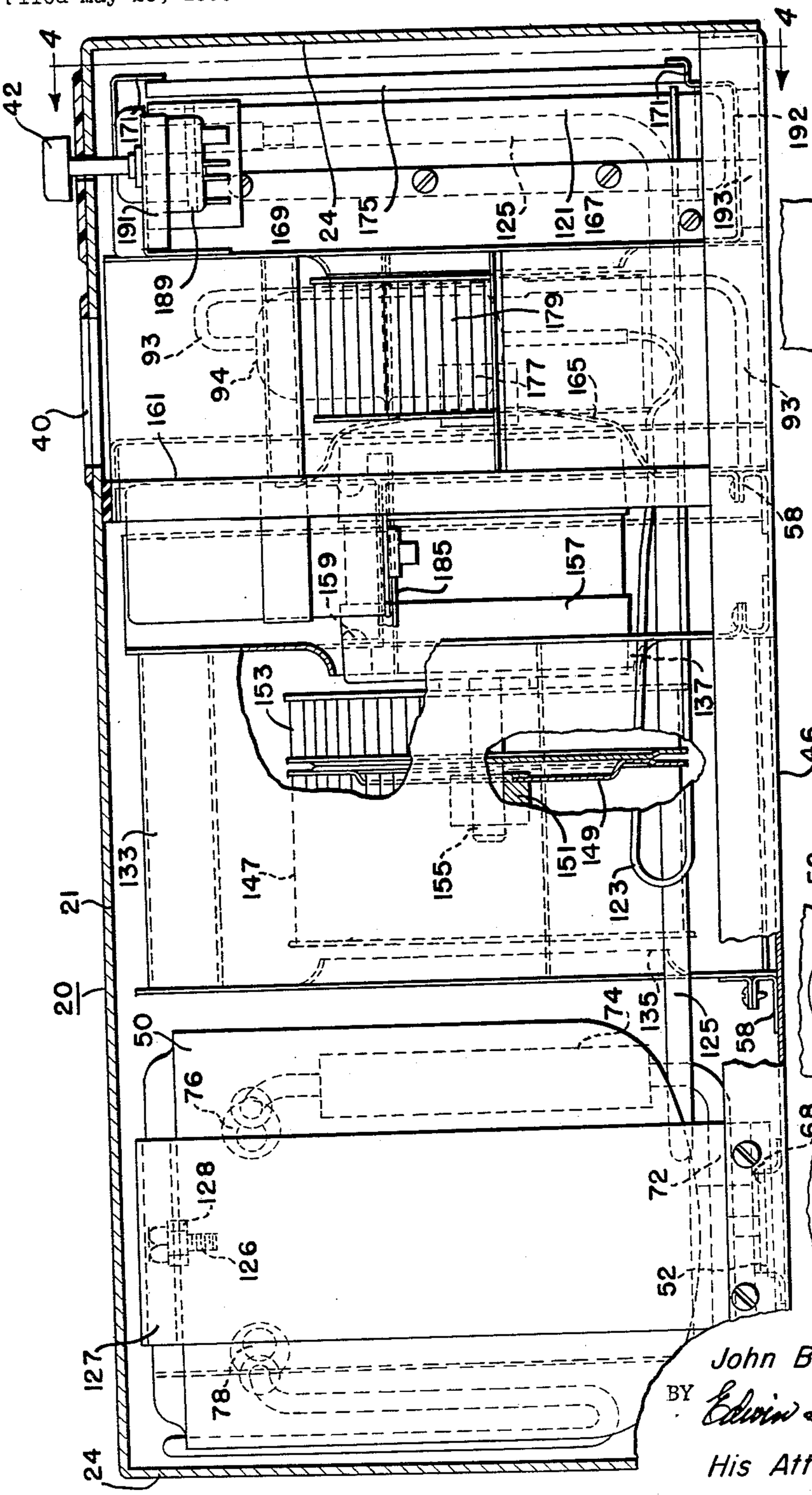
AIR CONDITIONER WITH COMPACT CENTRIFUGAL FAN ARRANGEMENT

Filed May 23, 1958 4 Sheets-Sheet 2



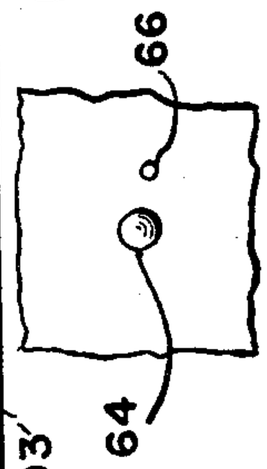


Fig. 9

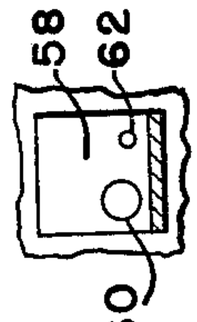


Fig. 10

Fig. 2

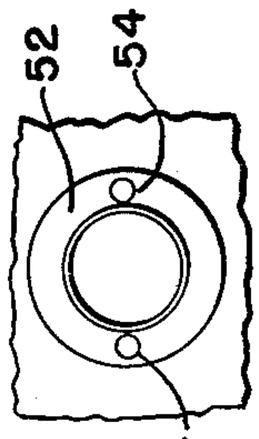


Fig. 8

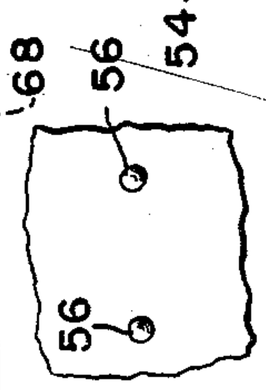


Fig. 7

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AIR CONDITIONER WITH COMPACT CENTRIFUGAL FAN ARRANGEMENT

Filed May 23, 1958 4 Sheets-Sheet 3

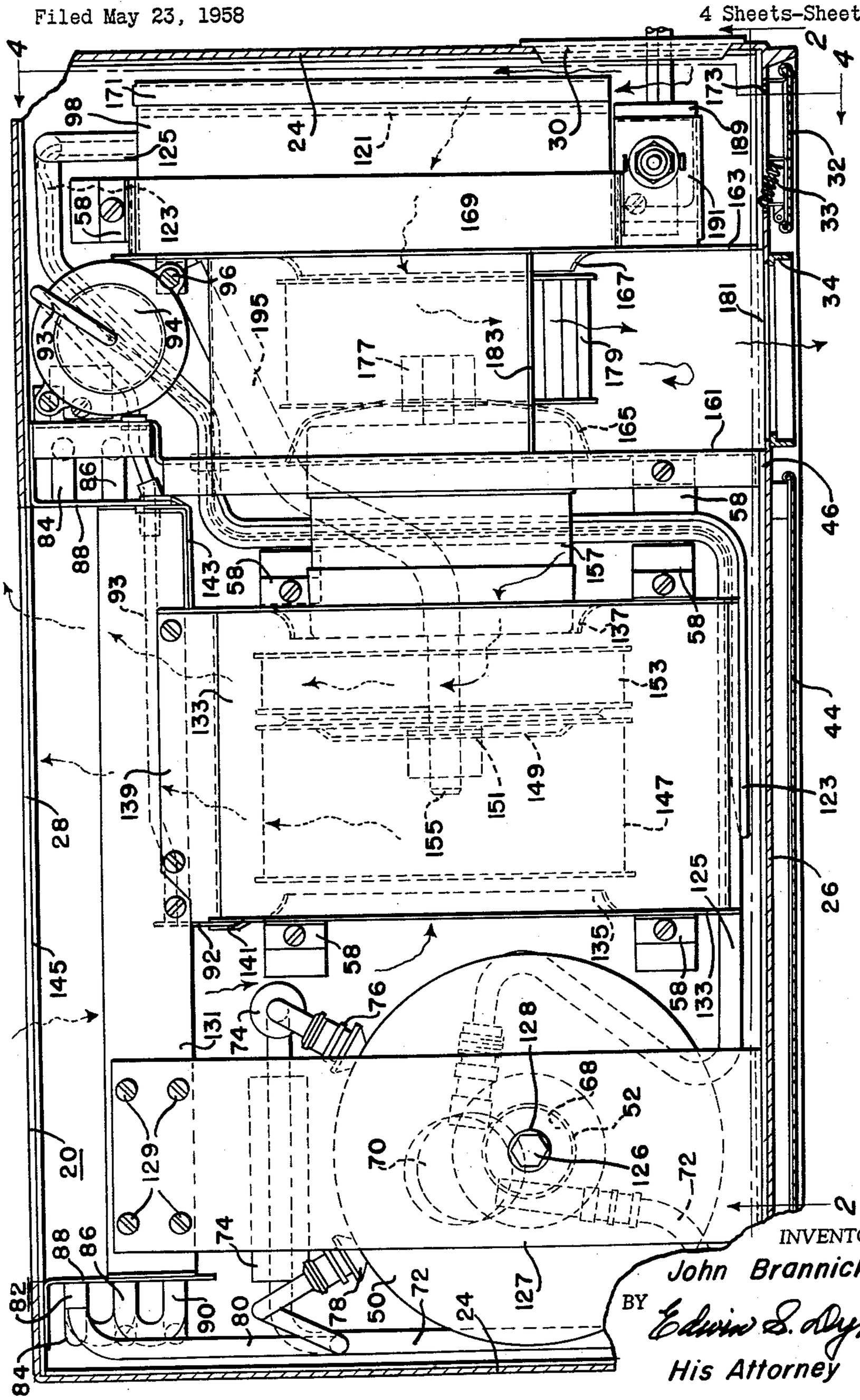

Fig. 3

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AIR CONDITIONER WITH COMPACT CENTRIFUGAL FAN ARRANGEMENT

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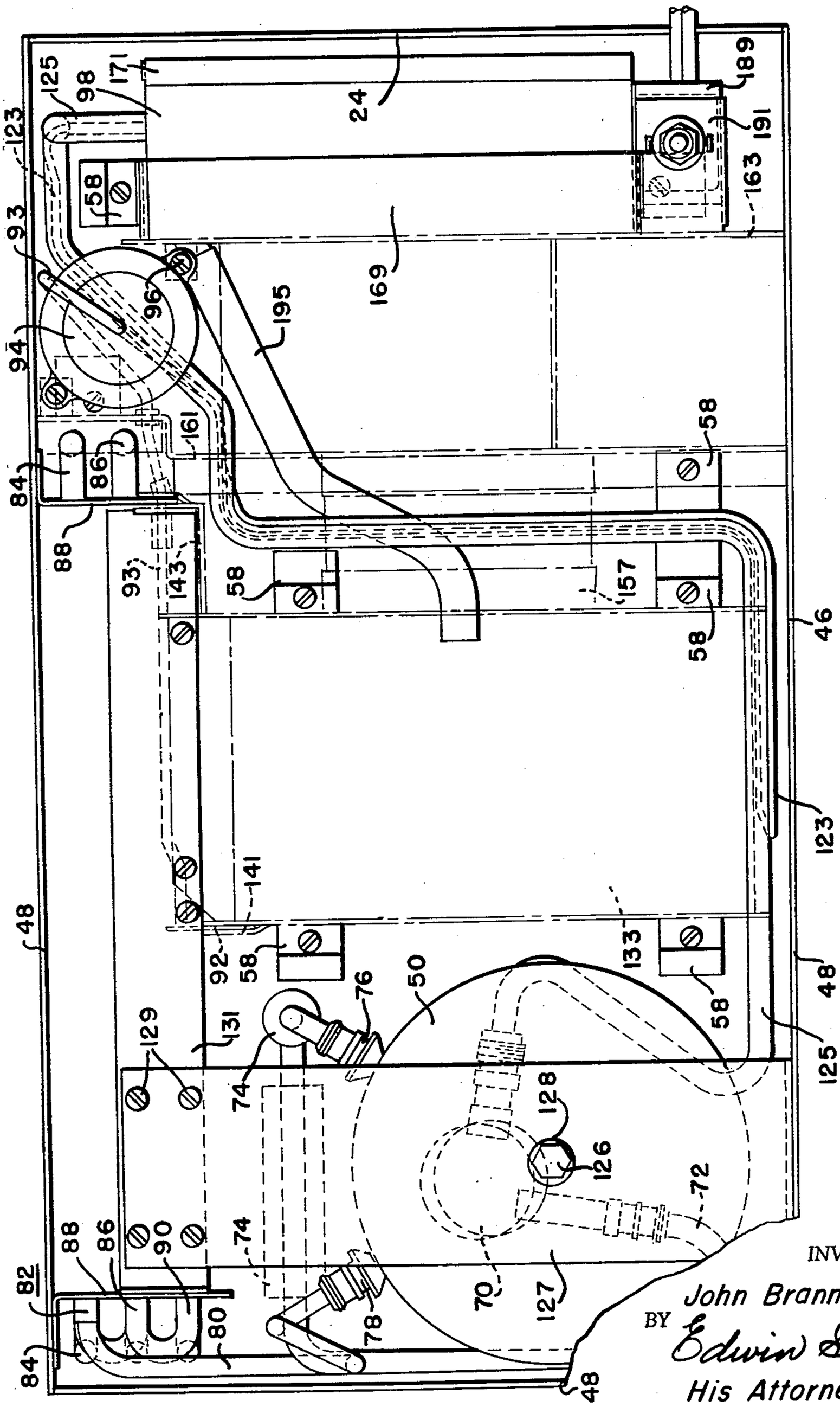

Fig. 5

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AIR CONDITIONER WITH COMPACT CENTRIFUGAL FAN ARRANGEMENT

John Brannick, Detroit, Mich., assignor to General Motors Corporation, Detroit, Mich., a corporation of Delaware

Filed May 23, 1958, Ser. No. 737,297

6 Claims. (Cl. 62—295)

This invention pertains to refrigerating apparatus and especially to window air conditioners.

Window air conditioners have certain objectionable aspects. They take up some window space, cutting off light and vision. They also extend into the room or outside the window or both. These projections are objectionable and often out of harmony with the surroundings.

It is an object of this invention to provide a compact window air conditioner of adequate capacity which will take a smaller part of the window area and project a smaller distance into the room or to the outside.

It is another object of this invention to provide a window air conditioner in which the base is impervious and also serves as the condensate pan and has special locating dimples thereon for properly locating and fastening a unitary refrigerating system and a blower unit and to enclose these units by a cover fitting over both units onto the base.

It is another object of this invention to provide a window air conditioner in which the air inlets and outlets are so located that the conditioner may be placed in a double hung window with the long faces parallel to the pane but which also can be placed perpendicular to the panes in a casement window.

These and other objects are attained in the form shown in the drawings in which a sheet aluminum or steel base pan has turned up edges so as to collect condensate. The base pan has raised locating dimples receiving mounting brackets welded or brazed thereon. These mounting brackets support a unitary refrigerating system including the evaporator of the pin fin type located parallel to one end wall while the condenser is located parallel to and adjacent one of the long wall faces. The condenser blower is located between and near the middle of the long faces and draws air through one-half of the condenser and is opposite and discharges the air through the other half of the condenser. The sealed motor-compressor unit is placed in a corner between one-half of the condenser and its blower.

The blower unit is separate from the refrigerating system and includes the condenser blower, the evaporator blower which is located between the evaporator and the condenser blower, and a common driving motor supported and located between the two blowers. The partition wall separating the room air from the outside air in the conditioner forms the side of the evaporator blower nearest the condenser blower. The room air inlets and outlets are provided in the corner diagonally opposite the condenser so that the unit can either be placed in a double hung window with the long faces parallel to the pane, or for a casement window it may be turned with the long faces perpendicular to the panes with the corner containing the room air inlets and outlets located within the room while the remainder of the unit includes the condenser. The motor compressor unit and the condenser blower are located outside the room. A casing forming the top, end and face walls fits over the base pan to complete the unit. A filter is slidably mounted on the front face of the evaporator and is removable through a vertical door located in the room air inlet and outlet corners of the cabinet.

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 embodiment of the present invention is clearly shown.

In the drawings:

Figure 1 is a perspective view of a window air conditioner embodying one form of my invention;

Figure 2 is a vertical sectional view of the conditioner as shown in Figure 1;

Figure 3 is a horizontal sectional view of the conditioner shown in Figures 1 and 2;

Figure 4 is an end vertical sectional view of the conditioner shown in Figures 1–3;

Figure 5 is a view somewhat similar to Figure 3 but without the casing showing the refrigerating system in full lines while the blower unit assembly is shown in dotted and dash lines so as to show the separateness of the two units;

Figure 6 is a horizontal sectional view through a window showing the normal position with the long faces parallel to the window in full lines while the perpendicular position of the conditioner is shown in dotted and dash lines;

Figure 7 is a fragmentary view of the base pan showing the dimples provided for locating the lower motor-compressor unit support;

Figure 8 is a fragmentary plan view showing the motor-compressor unit lower support mounted over the dimples shown in Figure 7;

Figure 9 is a fragmentary plan view of a portion of the base showing two locating dimples of different size provided for the mounting bracket; and

Figure 10 is a fragmentary plan view of a portion of base showing the mounting bracket applied to the dimples shown in Figure 9.

Referring now more particularly to Figure 1, there is shown a ¾ H.P. window air conditioning unit only 10$\frac{9}{16}$" high, 13$\frac{9}{16}$" wide and 23$\frac{1}{16}$" long. It is provided with an outer casing **20** having a top wall **21**, end walls **24**, a front wall **26** and a rear wall **28**. The end wall **24** shown has a room air inlet and grille **30** adjacent the near corner. On the face **26** adjacent the near corner there is provided a vertically hinged door **32** which is spaced away from the door opening **173** so that it allows the in-flow of air through the door opening in the closed position while it conceals the door opening. The filter can be installed and removed through the opening **173** by opening the door **32**. This door **32** is held closed normally by a tension spring **33**.

At the side of the door **32** on the front face **26** are three rectangular grilles **34**, **36** and **38**. The two upper grilles **34** and **36** are room air discharge grilles and have directional passages therethrough. They may be removed and reinserted in different positions so as to direct the air in any one of four different directions. The lower grille **38** is a room air inlet grille. The top wall **21** adjacent to the grille **34** is likewise provided with a room air discharge grille **40** which, however, is circular in shape and directional. It may be rotated to direct the air in any desired direction. Between the grille **40** and the grille **30** in the top wall **21** there is provided a control knob and dial **42** for controlling the air conditioning unit. Between the grilles **34–38** inclusive, and the remote end of the cabinet **20** there is provided a removable decorative panel **44** for matching the door **32** to provide an attractive appearance to the cabinet.

The condenser opening **145** is provided upon the rear face **28** of the cabinet directly opposite the panel **44.**

When the cabinet is placed in the window with the front **26** either parallel or perpendicular to the window, the inlet **30**, the door **32**, and the grilles **34–40** inclusive, must be inside the window exposed to the interior of the room as illustrated in Figure 6 by the full and dot and dash lines. The condenser opening **145** on the opposite face **28** must be exposed to the outside atmosphere. This allows the cabinet **20** to be moved forwardly into the room from the position as shown in Figure 6 as far as desired as long as the condenser opening is provided with communication with the outside.

The casing **20** fits over a base pan **46** having turned-up flanges **48** on all its edges. To avoid putting holes into the base pan, the parts are mounted upon brackets located by impervious dimples formed in the base and projecting upwardly. For example, the lower mounting for the motor-compressor unit **50** includes a flanged ring **52** (see Figure 8) having a set of locating apertures **54** which fit over the upwardly projecting dimples **56** provided at the proper location in the base pan **46**. The ring **52** is therefore located by the dimples **56** accurately without difficulty and held in place by brazing or welding.

The mounting brackets **58** which are J-shaped in cross section are used for supporting the blower unit as well as the evaporator. These mounting brackets **58** are made identical and are located and oriented by having a large locating hole **60** and a small locating hole **62** in their large bottom surface. Properly located large and small dimples **64** and **66** are provided at suitable places in the base pan **46** for properly locating and orienting each of these support brackets **58**. These brackets after being properly located are welded or brazed to the base pan **46** at the same time as the ring **52**. This particular mounting system provides ease of fabrication and assembly and insures accurate location of all the supports and the parts thereof.

After the mounting ring **52** and the brackets **58** are welded or brazed to the base pan **46** the complete refrigerating system shown in full lines in Figure 5 is then mounted thereon. The motor-compressor unit **50** has a rubber disc **68** provided at its lower end which fits within the flanged ring of the support **52** to provide a simple coaxial vibration absorbing mounting. The motor-compressor has a discharge member **70** to which connects a tube **72** connecting with a super heat removing coils **74** through which the compressed gases pass to cool them before they are returned through the connection **76** to the upper portion of the sealed unit. After circulating through the sealed unit **50**, this compressed gas is removed to the connection **78** which connects through the tubing **80** with the condenser proper **82**.

The condenser **82** includes a first pass **84** nearest the rear face and a second pass **86** both of which extend between the two flanged condenser end supports **88**. A third pass **90** is also provided which, however, terminates at a middle dividing wall **92**. The end plates **88** of the condenser **82** are L-shaped and have their outwardly facing flanges fastened to the adjacent flanges **48** of the base pan **46**. The bottom of the third pass **90** of the condenser **82** is connected by a small liquid tube **93** to a filter dryer unit **94** connected by the screw **96** to a bracket provided on the shell **98** surrounding the evaporator **121**. The filter dryer **94** drains into another capillary tube **123** which is soldered to the suction line **125** extending from the outlet of the evaporator **121** to the inlet of the motor-compressor unit **50**.

After these parts are fastened in place, an inverted L-shaped bracket **127** is fastened over the motor-compressor unit **50** with its lower end being fastened to the front portion of the flange **48** while its rear upper end portion is fastened by the screws **129** to the condenser shell **131** extending across the top of the condenser **82**. The bracket **127** has an aperture provided with a rubber grommet **128** receiving a screw **126** threaded into the center of the top of the sealed unit **50** to provide an upper

coaxial vibration absorbing mounting for the unit **50**. The refrigerating system so installed can then be tested for leaks and satisfactory operating characteristics before final assembly. In fact, the refrigerating system may be tested for leaks prior to its fastening to the base pan **46** if desired.

Provided as a second major component or unit is the blower assembly. This includes the condenser blower casing **133** of the centrifugal scroll type having inlets **135** and **137** on its opposite faces and a discharge portion **139** fastened to the top shell **131** of the condenser **82**. The discharge portion of the condenser blower casing **133** is provided with a forked vertical edge **141** on its left side which fits tightly the vertical center strip **92** of the condenser **82**. This makes it possible for a tight seal to be obtained by sliding the forked edge **141** onto the strip **92** to keep separate the air flowing from the outside through the three pass portion of the condenser **82** to the inlets **135, 137** from the air discharged through the two pass portion. The discharge portion **139** at its opposite edge has an extension **143** provided with a forked or sealing edge engaging the adjacent end support **88** of the condenser **82**. This arrangement assures an efficient circulation of air through the large opening **145** in the rear face **28** of the cabinet **20** and through the three pass portion of the condenser **82** around the sealed motor-compressor unit **50** and in through either of the inlets **135** or **137** into the blower casing **133**.

Within the blower casing **133** there is provided a relatively wide squirrel-cage type centrifugal blower wheel **147** having its open side adjacent the inlet **135** and having a closed side **149** connected to the hub **151**. A second narrow centrifugal blower wheel **153** is provided at the side of the blower wheel **147** and has its open side directly adjacent the inlet **137**. The closed side of this narrow blower wheel is likewise fastened to the hub **151**. The hub **151** is connected to one end of motor shaft **155** of a double ended shaft electric motor **157** one end of which projects through the opening **137** in the condenser blower housing **133**. The narrow blower wheel **153** is provided for insuring that an adequate flow of air will flow around the blower motor **157** passing between it and the periphery of the opening **137** to keep it properly cool.

The blower wheels both discharge through the outlet **139** of the condenser blower scroll **133** through the two pass portion of the condenser **82** between the center divider strip **92** and the end portion **143**. The arrangement of drawing the air first through the three pass portion of the condenser and then discharging the air through the two pass portion of the condenser provides the base conditions for the operation of the blower noted to get the greatest cooling effect of the condenser.

The condenser blower scroll **133** is connected by three wide U-shaped brackets **159** to a partition or dividing wall **161** which extends between the base pan **46** and the casing **20** to seal and divide the condenser air compartment containing the motor-compressor unit **50**, the condenser **82**, and the condenser blower scroll **133** as well as the fan motor **157** from the room air compartment containing the evaporator **121**, the air filter **175** and the evaporator blower scroll **163**. The partition wall **161** forms the adjacent side of the evaporator blower scroll **163** and is provided with a plastic insert **165** projected toward the evaporator **121** to provide room for the adjacent end of the blower motor **157**. The evaporating blower scroll **163** has a single inlet **167** communicating with the inner face of the evaporator **121**. The evaporator blower scroll **163** is provided with a shroud **169** connecting directly with the evaporator shell **98**.

The evaporator shell **98** is provided with the slideways **171** on the face opposite the evaporator blower scroll **163** which are aligned with the door opening **173** behind the door **32** so that the filter **175** may be readi-

ly removed and replaced merely by opening the door **32** and pulling out the filter **175** directly therethrough.

The evaporator **121** has upper and lower headers **120** connected by thin wide vertical ducts **122** containing corrugated wire fins. Between the ducts **122** are the corrugated wire fins **124**. This construction makes it possible to obtain adequate heat transfer within the dimensions of 9 11/16" high by 8 5/16" wide and 1¾" thick for a ¾ ton window unit, allowing the evaporator to be located parallel to the end walls **24**. This makes possible the compact arrangement.

The adjacent end of the shaft of the motor **157** projects through the portion **165** of the partition wall **161** and fastens to the hub **177** of the evaporator blower wheel **179**. The evaporator blower scroll **163** has a lip **181** turned forwardly and provided with a seal and an upper lip **183** turned upwardly and provided with a seal. The side of the scroll **163** is also sealed to the front wall **46** thereby providing a sealed discharge chamber at the outlet of the evaporator blower casing communicating with the room air discharge grilles **34**, **36** and **40**. The room air is drawn in through the room air inlet grilles **30** and **38** and through the door opening **173** into the interior of the room air compartment and then passes through the filter **175**, the evaporator **121**, the shroud **169**, and the inlet **167** into the evaporator blower wheel **179** from which it is discharged through the scroll **173** and its discharge outlet between the lips **181** and **183** through the grilles **34**, **36** and **40** into the room.

The motor **157** is provided with straps **185** parallel to its axis which are fastened and supported by blocks of an elastomer such as natural or synthetic rubber which are bonded to the straps **185** and the brackets **159** to provide a resilient mounting for the motor **157**. The control for the refrigerating system is provided by the switch **189** which is mounted on an extension **191** of the evaporator shell **98**. This switch **189** provides an electrical connection from the source of electrical supply to the motor compressor unit **50** and the blower motor **157** and also the controls for the sealed motor-compressor unit **50**. These controls are preferably mounted on the partition wall **163**. The partition wall **163** may be provided with suitable elastomeric sealing strips between its periphery and the casing **20**.

The conditioner is compact particularly by the arrangement of parts as disclosed herein aided by the use of the so-called pin fin type of evaporator which in reality is a corrugated wire fin type. The entire interior of the unit is made accessible merely be removing the casing **20**. To keep the conditioner light in weight, the evaporator, base pan, casing, blower housings and the sheet metal partition may be made of aluminum.

Beneath the evaporator **121**, the shell **98** is formed into a drip pan **192** which rests on a block of foam plastic insulation **193**. This drip pan **192** is drained by a tube **195** of an elastomer such as rubber or plastic extending on the base pan **46** to the condenser blower scroll **133** which is provided with bottom inlets so that the condensate will flow into its interior. The air movement within the scroll is sufficient to pick up the condensate and carry it to the adjacent portion of the condenser **82** upon which it will be evaporated into the air being discharged from the scroll **133** through the condenser **82** to the outside atmosphere.

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. An air conditioner including a casing adapted to be positioned at a window of a space to be conditioned, a partition wall dividing said casing into a condenser air compartment and an evaporator air compartment, an evaporator centrifugal fan scroll having one side integral with said partition wall and an inlet opening in the opposite side, an evaporator parallel and adjacent to said opposite side and a shroud extending around said evaporator connecting with said inlet, a double-ended fan motor located on the opposite side of said partition wall, a condenser fan scroll spaced from and connected to said partition wall, said casing having a vertically elongated discharge grille means on the same side of said partition wall at one side of said evaporator fan scroll, said evaporator fan scroll having its discharge portion extending to and connecting with said grille means, a centrifugal fan in each of said scrolls connected to the opposite ends of said fan motor, a condenser connected in series with said condenser fan, a motor-compressor unit operatively connected to said evaporator and condenser, and flow control means operatively connecting said condenser and evaporator.

2. An air conditioner for a room including a rectangular box shaped casing having a room air inlet opening in a small side thereof and a room air outlet, an upright evaporator adjacent said small side thereof, said casing having in a long vertical side a long upright opening and a door pivoted on a vertical axis for closing said opening, said evaporator being provided adjacent its inlet face a set of upper and lower slideways substantially aligned with said upright opening, an upright air filter slidable in an upright position into and out of said slideways through said upright opening, means for circulating air from the room through said room air inlet and said filter and said evaporator and said outlet, and refrigerant liquefying means for supplying liquid refrigerant to and withdrawing evaporated refrigerant from said evaporator.

3. An air conditioner for a room including a rectangular box shaped casing having a room air inlet opening in a small side thereof and a room air outlet, an upright evaporator adjacent said small side thereof, said casing having in a long vertical side a long upright opening and a door for closing said opening, said evaporator being provided adjacent its inlet face a set of upper and lower slideways substantially aligned with said upright opening, an upright air filter slidable in an upright position into and out of said slideways through said upright opening, means for circulating air from the room through said room air inlet and said filter and said evaporator and said outlet, and refrigerant liquefying means for supplying liquid refrigerant to and withdrawing evaporated refrigerant from said evaporator, said door being spaced away from said upright opening a slight distance to provide an additional room air inlet.

4. An air conditioner including a casing adapted to be positioned at a window of a space to be conditioned, a partition wall dividing said casing into a condenser air compartment and an evaporator air compartment, an evaporator centrifugal fan scroll having one side integral with said partition wall and an inlet opening in the opposite side, an evaporator parallel to said opposite side and a shroud extending around said evaporator connecting with said inlet, a double-ended fan motor located on the opposite side of said partition wall, a condenser fan scroll spaced from and connected to said partition wall, an upright condenser at one side of said condenser fan scroll and fastened to said scroll, a base supporting said casing and said wall and said evaporator and condenser, an upright sealed motor-compressor unit having a resilient mounting of elastomeric material between it and the base, a member having one end fastened to the base and the other end fastened to the upper portion of said condenser and having an intermediate portion extending over said sealed unit, and a resilient mounting of elastomeric material between and connecting said intermediate portion and the upper portion of said sealed unit.

5. An air conditioner including an impervious base pan having upwardly extending locating dimples, a refrigerat-

ing system having supports provided with apertures fitting over some of said locating dimples on said pan, said supports being bonded to said pan, said system including a condenser and an evaporator, a blower unit having supports provided with apertures fitting over other of said locating dimples, the supports of said blower unit being bonded to said pan, said blower unit having a fan for circulating air in heat transfer with said evaporator, and means for circulating a cooling medium in heat transfer with said condenser.

6. An air conditioner including a box-shaped casing adapted to be positioned at a window of a space to be conditioned, a partition wall dividing the interior of said casing into a condenser air compartment and an evaporator air compartment, a thin upright condenser extending adjacent and parallel to one upright wall of said casing transverse to and upon one side of said partition wall, said one upright wall being open substantially coextensive with said condenser, a centrifugal fan and motor having located in said condenser air compartment

with their axes at one side of and parallel to said condenser, a condenser centrifugal fan scroll surrounding said centrifugal fan and having a discharge outlet extending directly to and connecting with the inner upright face of said condenser for discharging air directly through said condenser and having an axial inlet for drawing air from said condenser air compartment, an evaporator and evaporator fan means in said evaporator air compartment, refrigerant flow control means connecting said condenser and evaporator, and a motor compressor unit operably connected to said evaporator and condenser.

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