Nov. 26, 1935. C. M. WOOLLEY 2,022,332

AIR CONDITIONING HEATING CABINET

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Fig. 1.

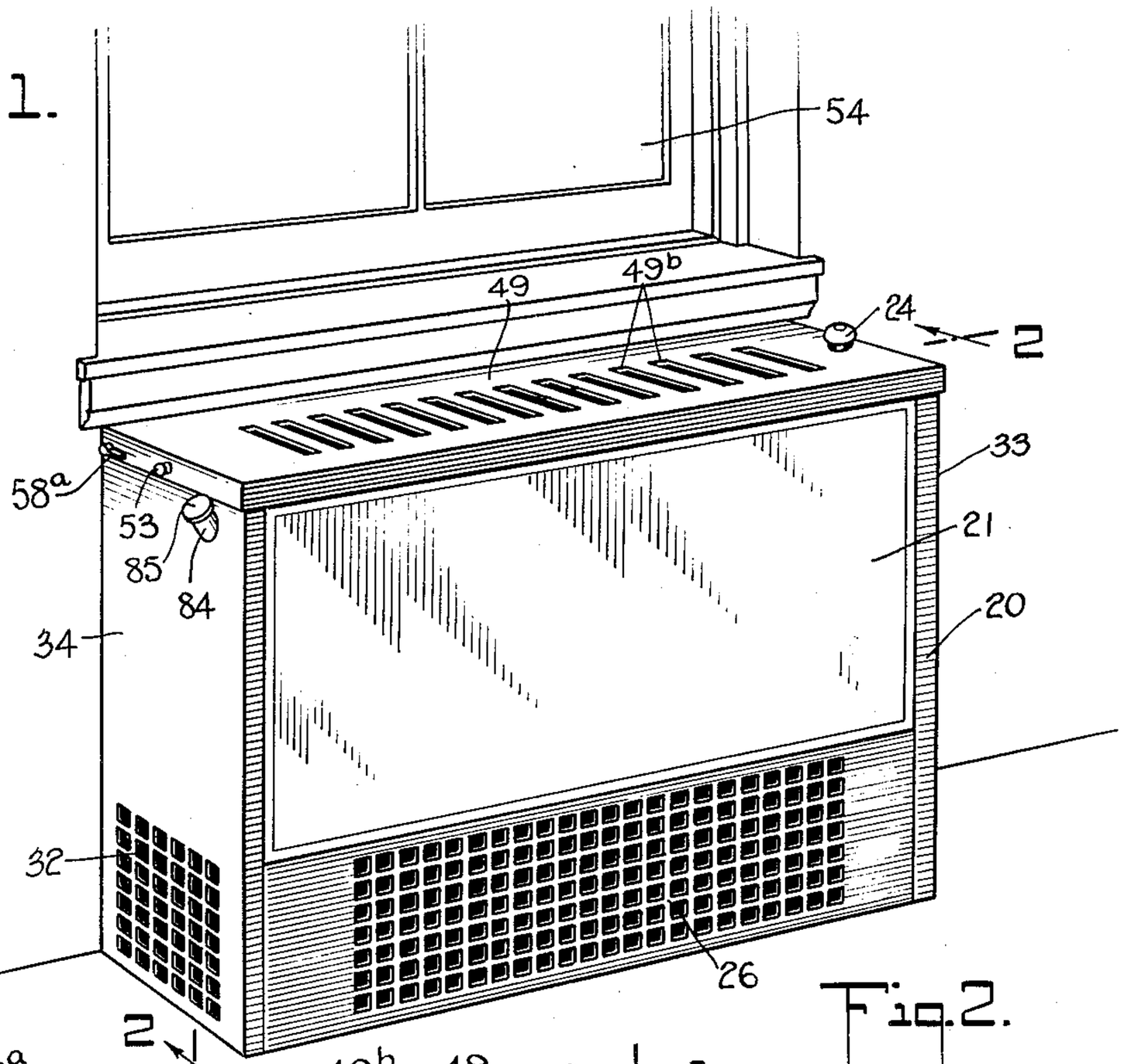

Fig. 2.

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AIR CONDITIONING HEATING CABINET

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Fig. 3.

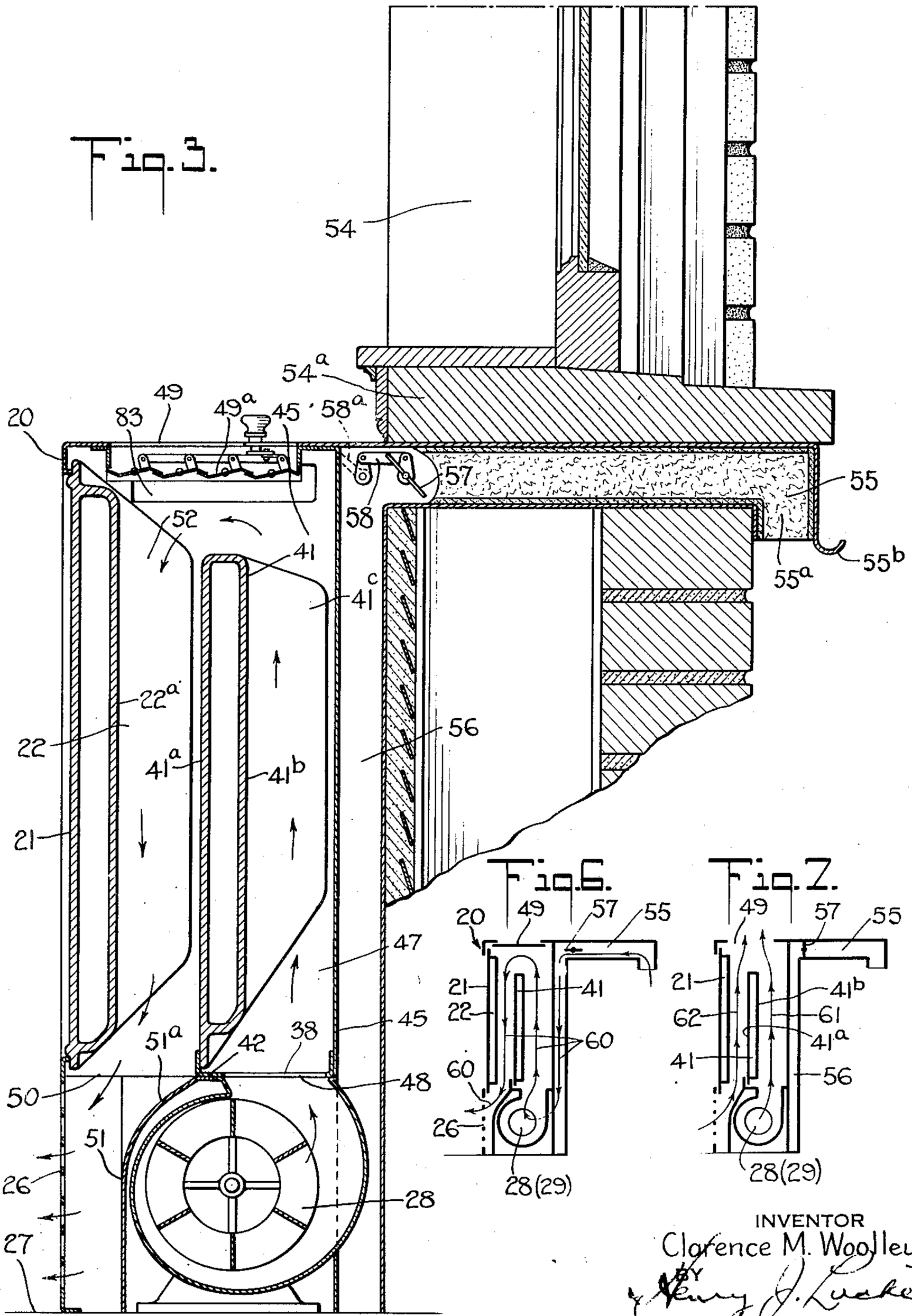

Fig. 6.

Fig. 7.

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Nov. 26, 1935. C. M. WOOLLEY 2,022,332

AIR CONDITIONING HEATING CABINET

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Fig. 4

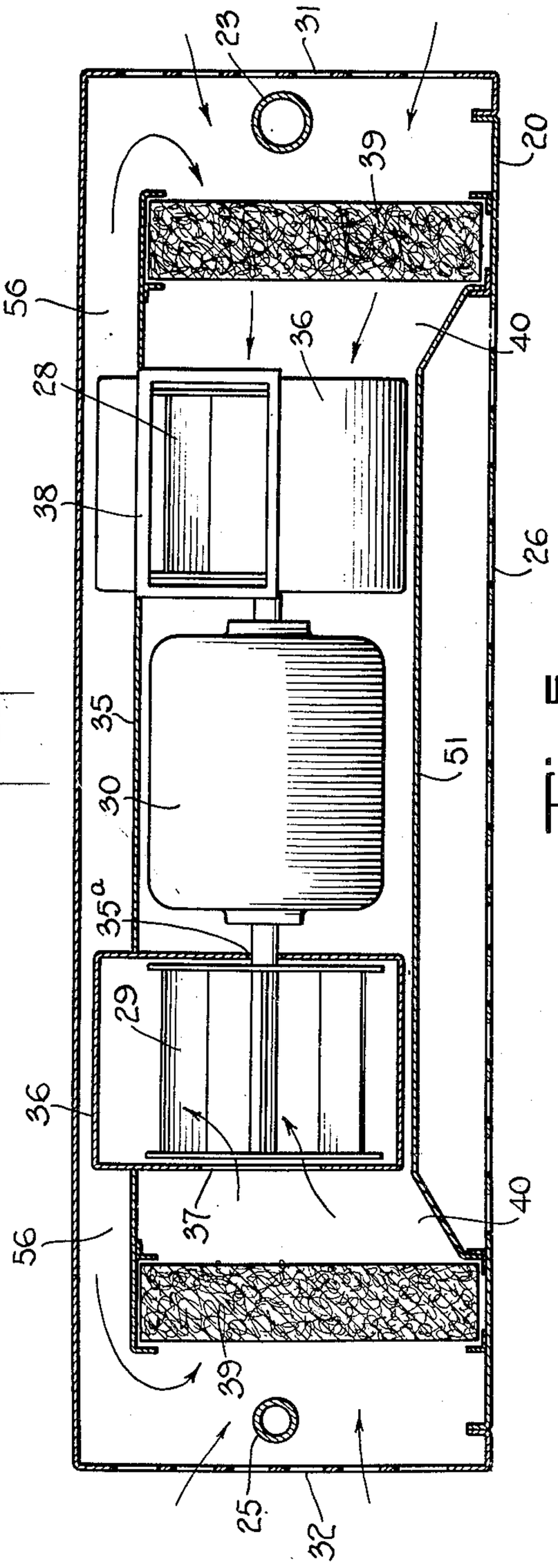
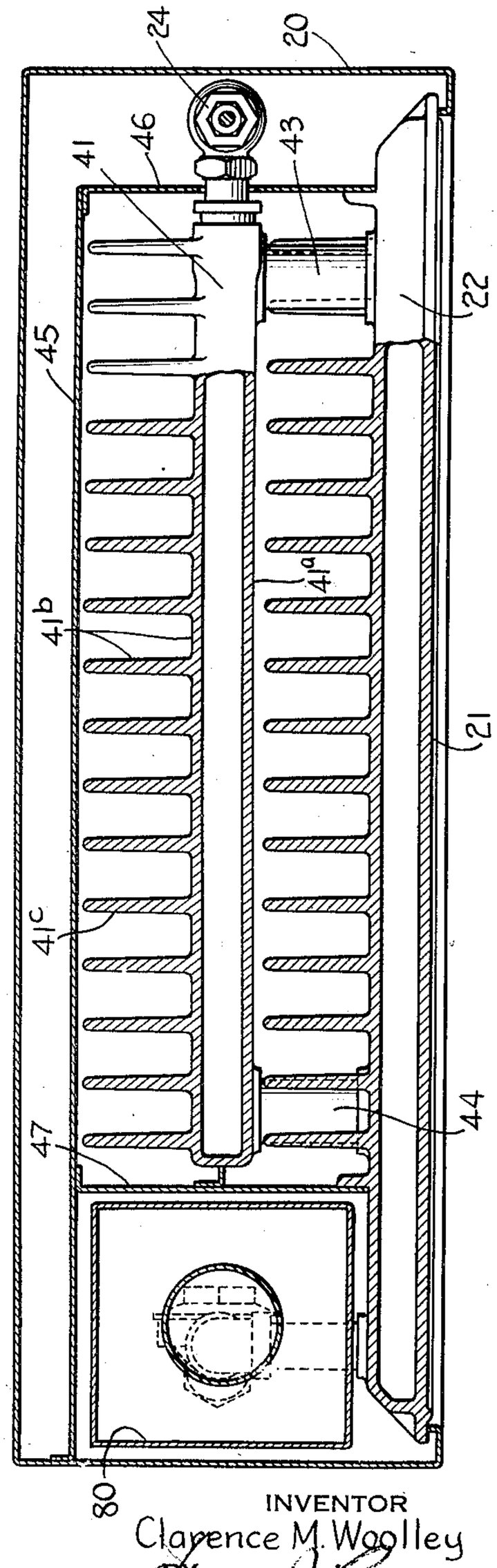


Fig. 5.



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Nov. 26, 1935. C. M. WOOLLEY 2,022,332

AIR CONDITIONING HEATING CABINET

Filed April 4, 1934 5 Sheets-Sheet 4

Fig. 8.

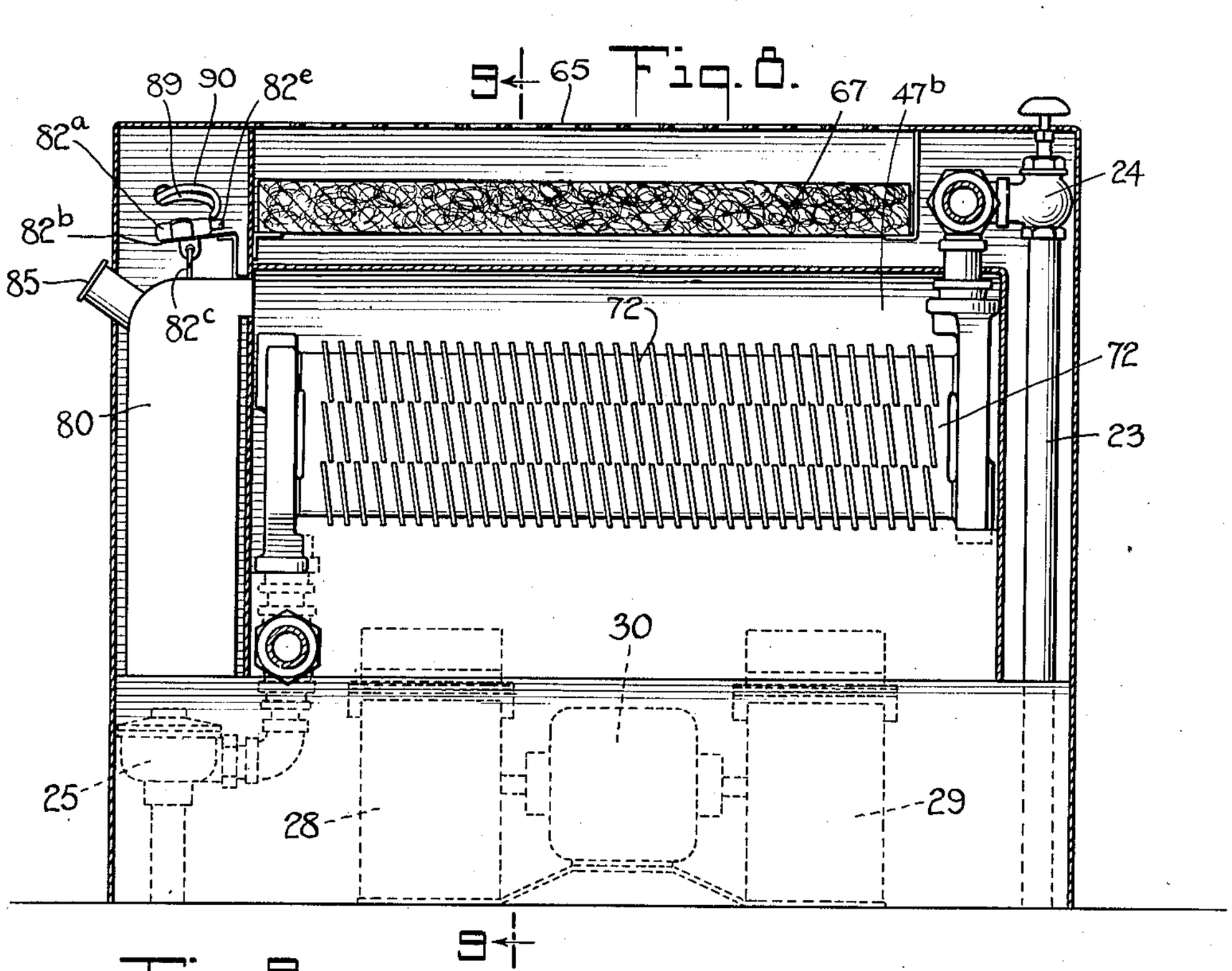

Fig. 9.

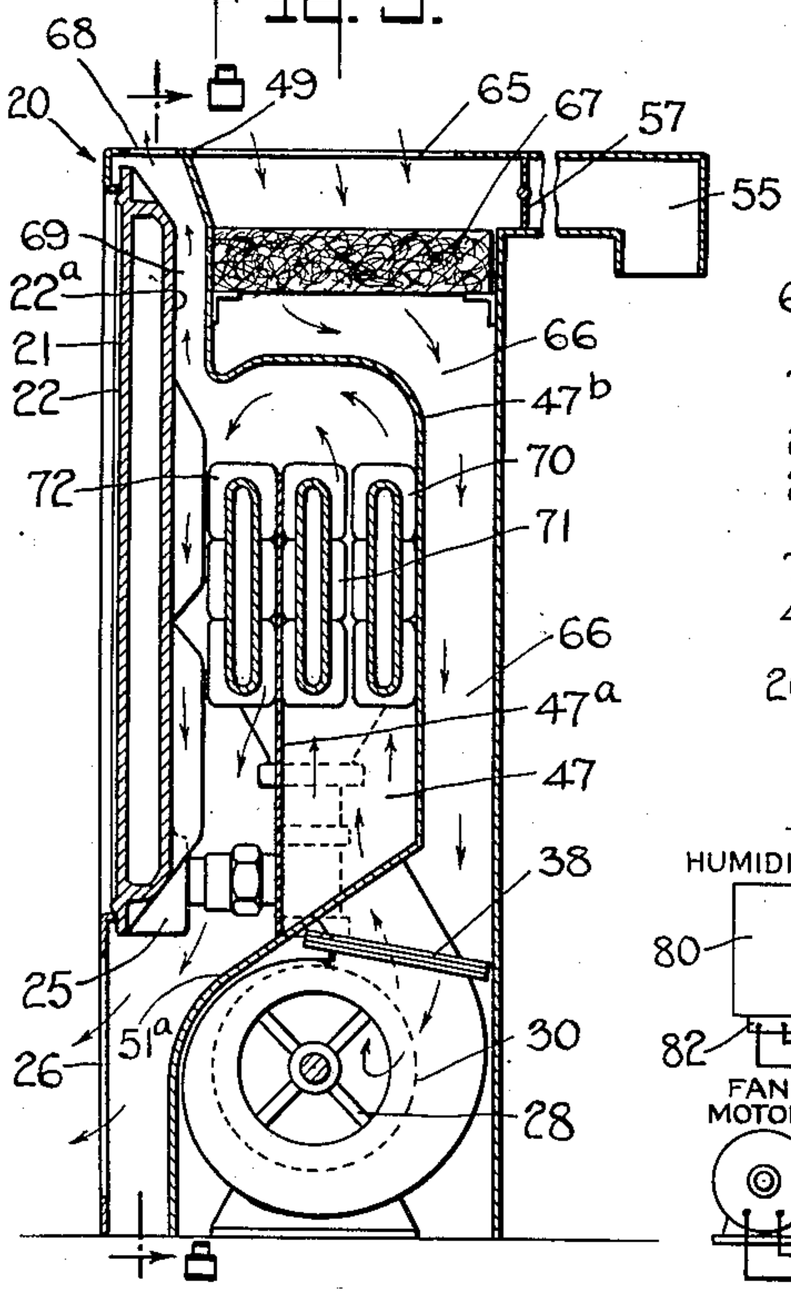

Fig. 10.

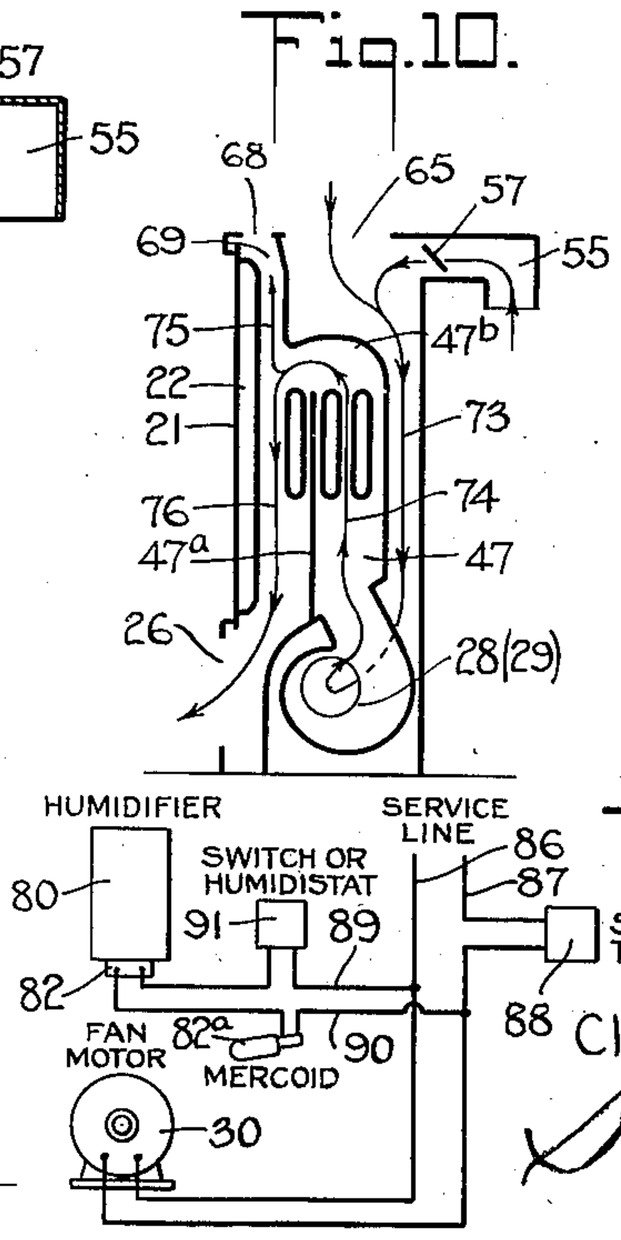

Fig. 11.

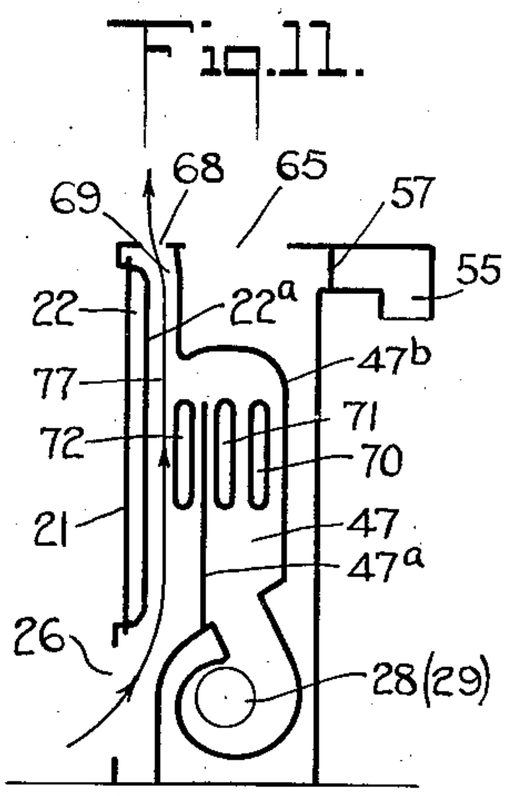

Fig. 12.

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Nov. 26, 1935. C. M. WOOLLEY 2,022,332

AIR CONDITIONING HEATING CABINET

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Fig. 13.

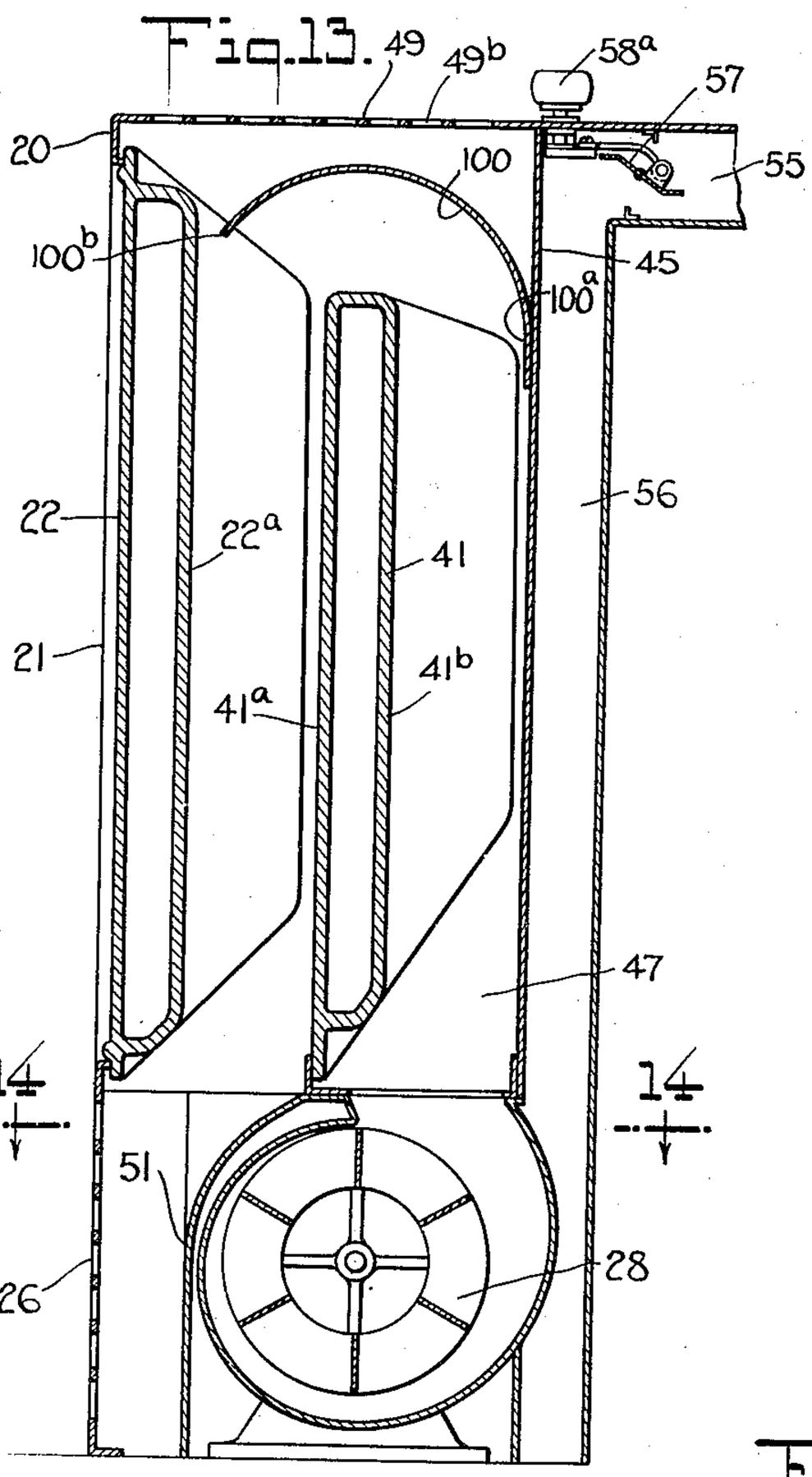


Fig. 15.

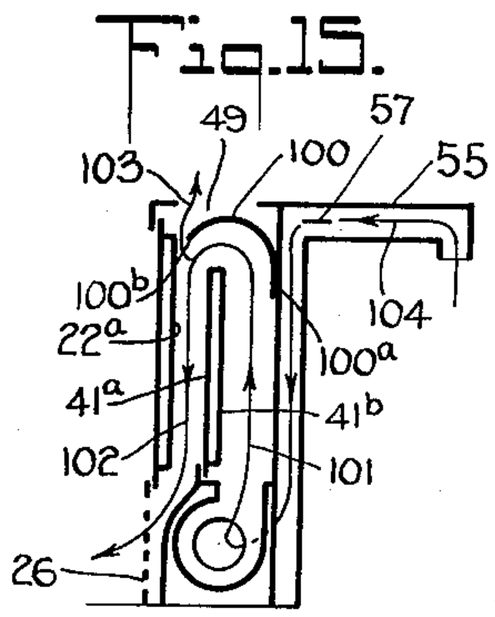


Fig. 16.

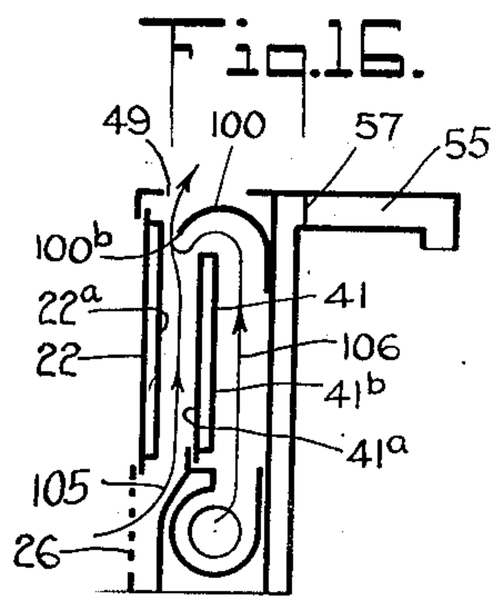
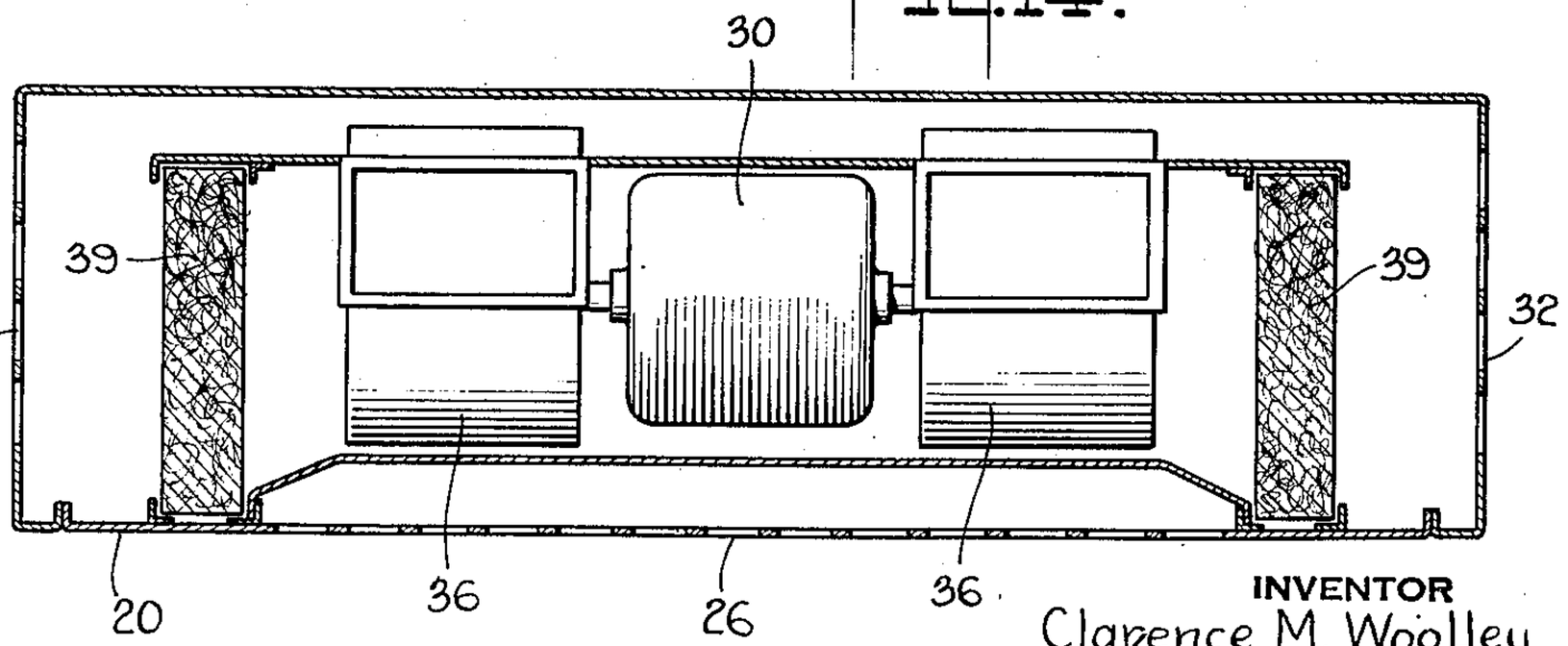


Fig. 14.



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Patented Nov. 26, 1935

2,022,332

UNITED STATES PATENT OFFICE

2,022,332

AIR CONDITIONING HEATING CABINET

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Application April 4, 1934, Serial No. 718,904

20 Claims. (Cl. 257—138)

My invention relates to an air conditioning heating cabinet.

A feature of my invention is the provision of a cabinet having suitable heating means including a heating element having a face disposed at or forming a virtual part of an exposed face of the cabinet, to provide the supply of heat units by radiant distribution during all stages of operation of the cabinet.

A feature of my invention is the provision of suitable means for projecting air in heat exchange contact with the heating means and to deliver the heated air exteriorly of the cabinet in a direction at or toward the floor.

A feature of my invention resides in the optional use of a motor activated fan or equivalent for projecting heated air exteriorly of the cabinet and to supply heated air by convection, that is in the form of gravity heat output, during the stage of cessation of the operation of the fan or equivalent.

In the various embodiments of my invention, provision is made for the recirculation of the air of the room or other space of a building or other structure simultaneously with the projection of heated air during the stage of operation of the fan or equivalent and during the stage of cessation of operation of the fan or equivalent.

A further feature of my invention resides in the supply of fresh air or conditioned air in regulated proportion to the recirculated air.

Simultaneous with the supply of heated air, I also provide for the supply of humidity automatically with the operation of the cabinet, the supply of humidity being preferably located in the path of the projected air stream to preclude condensation of moisture within the cabinet. Such supply of humidity is advantageously of the electrically heated type, the electrical heating unit of such humidifier being suitably electrically connected in the circuit of the fan motor, and therefore nonoperative during the stage of cessation of the supply of the heating medium to the cabinet. If desired, a humidifier heated by steam, may be employed, in lieu of an electrically operated humidifier. A steam operated humidifier is of advantage with heating elements employing steam as the heating medium.

In particular, the preferred forms of my invention embody a frame in which is enclosed a plurality of heating elements, one of which is provided with a frontal plate directly exposed to the air of the room or other space of the building or other structure served by the cabinet, the other heating elements being arranged relative to the frontal heating element and relative to the path of flow of the air projected by the fan or equivalent to provide a path of flow of the air under optimum conditions, thereby facilitating the transfer of heat energy supplied by the heating medium to the respective heating elements and in turn to the projected current of air, discharged exteriorly of the cabinet. The respective heating elements are also preferably provided with fins located to be traversed by the projected air flow, the direction of such fins preferably being arranged to coact in defining the paths of flow of the projected air through the cabinet.

It is desirable that the major portion of the projected heated air currents be discharged through a grille or other opening located substantially at the floor or otherwise disposed to project such major portion of the heated air toward the floor.

Embodiments of my invention provide for the discharge of heated air through the top of the cabinet or otherwise upwardly relative to the cabinet, serving inter alia to counteract drafts; such desirable function is effected in preferred types of my invention during the stage of fan non-operation as well as during the stage of fan operation.

Further features and objects of the invention will be more fully understood from the following detail description and the accompanying drawings, in which

Fig. 1 is a perspective view of one preferred embodiment of my invention.

Fig. 2 is a vertical sectional elevation on line 2—2 of Fig. 1.

Fig. 3 is a vertical sectional elevation on line 3—3 of Fig. 2, including a vertical sectional elevation partially through a window of a building structure.

Fig. 4 is a horizontal sectional view on line 4—4 of Fig. 2.

Fig. 5 is a horizontal section on the broken section line 5—5 of Fig. 2.

Fig. 6 and Fig. 7 are diagrammatic views in vertical section showing paths of flow of air currents, in the above type of embodiments of my invention.

Fig. 8 is a vertical central sectional elevation of another embodiment of my invention.

Fig. 9 is a sectional elevation on line 9—9 of Fig. 8.

Figs. 10 and 11 are diagrammatic views in vertical section showing paths of flow of air currents, in the type of embodiment illustrated in Figs. 8 and 9.

Fig. 12 is a diagram of one selective assembly of electrical control features.

Fig. 13 is a vertical sectional elevation of another embodiment of my invention.

Fig. 14 is a horizontal sectional elevation on line 14—14 of Fig. 13.

Figs. 15 and 16 are diagrammatic views in vertical section showing paths of flow of air currents, in the embodiment of my invention represented by Figs. 13 and 14, during the respective stages of operation of fan and non-operation of fan.

Referring to the embodiment of my invention as illustrated in Figs. 1 to 7, the cabinet **20** while shown of general rectangular form, may have any desired exterior configuration, inclusive of artistic effect as may be preferred.

An essential feature of the stated illustrated embodiment is the provision of the frontal plate **21** of the heating element **22**, such frontal plate **21** serving as a portion of the virtual front of the cabinet, to effect direct radiation of heat, that is radiant heat, into the room or other space of the building or other structure. The heating element **22** may be supplied with steam, hot water or other suitable heating medium, for which purpose I indicate the inflow pipe **23** equipped with a suitable control valve **24**. I have shown the return pipe **25** as indicative of a type of return system.

In the type of embodiment of my invention indicated by Figs. 1 to 7, I provide for the discharge of the projected air through a grille **26** disposed preferably at the bottom of the cabinet **20**, and therefore may be a part of the front face of the cabinet **20**, substantially at the floor line indicated at **27**.

Within the cabinet **20** I dispose suitable heating elements in co-action with the stated frontal heating element **22**, the said heating elements being arranged relative to suitable air projecting means to define the paths of flow of the projected air in effective heat exchange contact with the heating elements for delivery of the same through the grille **26** or equivalent.

Pursuant to the embodiment shown in Figs. 1 to 7, such arrangement is had, coupled with the provision of recirculating the air of the room of the other space, by locating the fan means, preferably two fans **28**, **29**, at opposite sides of and driven by a driving motor **30**, the same being disposed at a lowerly portion of the cabinet **20**, shown at the bottom of the cabinet in Figs. 2, 3 and 4, the stated two fans **28**, **29**, being respectively associated with two inflow grilles **31**, **32**, the last-named being disposed at or a part of a lowerly portion of the opposing sides **33**, **34** of the cabinet **20**.

The fans **28**, **29** may be of any suitable construction; advantageously, as shown, the fans **28**, **29** may be of the squirrel cage type. The motor **30** is advantageously of the electric type, preferably housed within a fully enclosing casing **35**, the opposite sides of which are provided with openings **35***a* through which project the shaft extensions **30***a*, **30***a* of the motor, which may be directly coupled with the shafts of the respective fans **28**, **29**, or if preferred in geared relation therewith.

Each fan **28**, **29**, is individually housed in a casing **36** having an inflow opening **37** and an outflow opening **38**.

Preferably, a filter **39** of any preferred type, is interposed between the inlet **37** of each fan casing **36** and the respective side inflow grilles **31**, **32**, each filter **39** being advantageously removably located in position within the respective conduits **40** serving the means of communication between each fan casing inlet **37** and the respective grilles **31**, **32**.

The type of cabinet illustrated in Figs. 1 to 5, embodies a simplified arrangement of the heating elements including a rear or inner heating element **41** mounted within the cabinet **20**; the opposite flat faces **41***a* and **41***b* of the rear heating element are disposed preferably substantially vertically, and within a subcasing forming a conduit for the flow of the heated air within the outer cabinet **20**. The heating element **41** is supported in any suitable manner within the cabinet **20** to be enclosed within the stated subcasing. The horizontally extending L-plate **42**, serves to seal the rearward channel of the subcasing relative to the forward channel of the sub-casing, by making a sealing joint with the lower edge of the heating element **41**, as appears more fully hereinafter. The inlet piping **23**, suitably connected with the intake port of the inner heating element **41**, and the nipples **43**, **44**, interconnecting the inner heating element **41** and the outer heating element **42**, contribute also to support and hold the respective heating elements in proper relative positions.

The sub-casing includes the rear wall **45**, and the side walls **46**, **47** and, as shown in the drawings, is defined at its front by the front heating element **22**.

Such sub-casing is provided at its bottom with inlets **48**, see Figs. 2, 3 and 4, in direct communication with the outlets **38** of the respective fan casings **36**, whereby the air projected by the respective fans **28**, **29** is forced upwardly in heat exchange moving contact with the rear face **41***b* of the rear or inner heating element **41**, the path of the air flow being deflected by the portion of the top plate **49** of the cabinet **20** disposed between the closing sides **46**, **47**, of the sub-casing, in a direction downwardly between the front face **41***a* of the rear heating element **41** and the rear face **22***a* of the front heating element **21**, thence through the bottom opening, see **50** Fig. 3, of the sub-casing into and through the space defined by the arcuate wall **51***a*, and finally through the grille **26**, downwardly and outwardly of the cabinet.

For the dual purposes of increasing the efficiency and rate of heat exchange and to define the path of the heated air in the stated subcasing, the rear or inner heating element **41** is provided with fins **41***c*, which, as shown in Figs. 3 and 5, extend in vertical direction, and similarly the front heating element **22** is provided with the vertically extending fins **52**.

The operation of the fans **28**, **29**, above described, effects also the inflow of air through the grilles **31**, **32**, at the opposite sides of the cabinet **20**, thus functioning to recirculate the air of the room or other space served by the cabinet and to elevate the temperature of the circulated air by passage of the same over the stated path of flow into and through the stated sub-casing, in heat exchange relation with the heating elements **41**, **22**, successively. The path of flow of the thus recirculated and heated air is indicated by the arrows applied in Figs. 3 and 4.

Advantageously, a thermostat or equivalent controls the stages of operation and non-operation of the motor driven fan or fans, or equivalent.

If desired, the top plate **49** may be provided

with slots 49*b* and a co-acting louver 49*a* employed, to afford closure of the top plate 49 during the period of operation of the fans, and the opening of the slots in the top plate 49 during the period of non-operation of the fans. A handle 53, see Figs. 1 and 2, is shown for manual operation of the louver 49*a*. The louver 49*a* may be automatically operated by the thermostat controlling the fan operation of the cabinet, namely, to close the openings 49*b* of the top plate 49 during the stage of fan operation and to open the openings 49*b* during the stage of non-operation of the fan or fans, as will be understood by those skilled in the art.

The horizontal dimension of the outer heating element 22, see Fig. 5, may be greater than that of the inner heating element 41, to thereby increase the effective area of the radiant face 21.

The cabinet may be located in the room or other space as may be desired. In Figs. 1 and 3, the cabinet is shown disposed adjacent a window, an arrangement which is of advantage in combination with the supply of fresh air from the exterior of the building, as by means of a duct extending through the window opening.

Such supplemental air may be supplied by a conduit 55, see Fig. 3, installed under the sill 54*a* of the window. The conduit 55 communicates in a suitable manner with the interior of the cabinet, as through the space 56 at the rear of the cabinet, leading downwardly, see Fig. 4, to the respective filters 39 and the inlet conduits 40, 40, of the fans, thus merging with the re-circulated air in transit through and out of the cabinet.

The conduit 55 may be provided with suitable means for silencing noises arising outside of the building, and otherwise conveyed through the conduit 55. An effective silencing means is had by lining the inner walls of the conduit with sound absorbing material, see 55*a*, Fig. 3.

The valve 57, see Fig. 3, regulates the proportion of fresh air delivered through the conduit 56, for given rates of fan operation, effective to corresponding extent of suction through the conduit 56. The lever linkage 58, including an operating handle 58*a*, indicates adjustability of the valve 57.

Figs. 6 and 7 illustrate diagrammatically varied stages of air flow and of fan operation of the generic type of my invention as embodied in cabinets above described, equipped with a supply of fresh or conditioned air, and like parts are designated by like reference characters.

Specifically, Fig. 6 illustrates air flow by the indicated multi-arrowed line 60 during the condition of operation of the fan or fans 28, (29) and also the supply of conditioned, in this instance fresh air, under which circumstances the valve 57 of the inflow conduit 55 is in open position and the top plate 49 of the cabinet 20 has its openings closed. It will be understood, as above explained, that air is drawn into the cabinet through the end openings 31, 32, to recirculate the air of the room or space served by the cabinet. The thus constituted air projected through the cabinet is heated by the stated heating elements and discharged from tne cabinet through its lower opening 26 downwardly upon the floor, while simultaneously heat is radiated into the room or space by the radiant face 21 of the front heating element 22.

Specifically, Fig. 7 illustrates air flow by the indicated multi-arrowed lines 61, 62 under the condition of non-operation of the fan and the opening of the slots of the top plate 49, thus effecting air flow through the cabinet by convection, that is to say, by gravity, the air current indicated by the arrowed line 61 representing currents of air drawn through the end grilles 31, 32, thence through the fans 28, (29) i. e., fan housings, thence through the rearward portion of the sub-casing in contact with the rear face 41*b* of the rear heating element 41, and thence upwardly through the slots 49*b* of the top plate 49. The arrowed line 62 indicates air flow inwardly through the grille or bottom opening 26, thence upwardly through the sub-casing between and in contact with the rear face 22*a* of the front heating element 21 and the front face 41*a* of the rearward heating element 41, merging with the air flow indicated by the arrowed line 61, just described, and discharged through the open top plate 49.

Incidentally, Fig. 7 also shows the valve 57 of the conduit 55 closed, thus shutting off the inflow of fresh air, or the supplemental supply of conditioned air furnished to the conduit 55. The opening of the valve 57 brings about the supplemental supply of fresh or conditioned air through the conduit 55 thence downwardly through the space 56, into and through the blowers 28, (29), merging with the air flow indicated by the arrowed line 61.

Another type of embodiment of my invention is illustrated in Figs. 8 and 9 which illustrate a cabinet having the exterior and general interior construction shown in the preceding figures; like parts are designated by like reference characters.

An essential feature specifically embodied in the construction of Figs. 8 and 9 is the provision of an open portion 65, of the top plate 49, serving as the inlet of the air re-circulated from the room or other space into the cabinet 20, which air flow is downwardly through the conduit 66, leading to the fan housings 30, and thence through the sub-casing in which the heating elements are housed, such air flow taking place during the stage of operation of the fan or fans, as hereinafter more fully described. A filter 67 is shown in the conduit 66.

Figs. 8 and 9, also, show the top plate 49 having an air discharge opening 68, communicating through the conduit 69 with the sub-casing enclosing the heating elements. The sub-casing, as shown in the embodiment of Figs. 8 and 9. embodies also the discharge outlet 26 similarly as in the hereinabove described embodiments.

The embodiments, as shown in Figs. 8 and 9 may also embody a conduit 55 for the inflow of fresh and other conditioned air; such conduit 55 is illustrated as provided with a valve 57 for the control of the portion of fresh or conditioned air supplied to the conduit 55 into the cabinet, to be merged with the re-circulated air, similarly as in the hereinabove described embodiments.

The embodiments, as shown in Figs. 8 and 9, illustrate also the application of a plurality of heating elements disposed within the sub-casing; the illustrated construction of heating units comprises three units arranged in serial alignment relative to one another, the two units 70 and 71 being disposed in the rearward channel portion 47 of the sub-casing and the unit 72 disposed in the forward channel portion of the sub-casing.

The cabinet of Figs. 8 and 9 embodies a front heating unit 22, the front face 21 of which serves as the virtual front of the cabinet 20, thus providing for radiation of heat by and from the radiant front face 21 of the heating unit 22 during

all stages of supply of the heating medium to the heating units of the cabinet.

The rearward heating units **70**, **71** and **72** are conveniently unitarily connected with the supply pipe **23**, and also with a common return pipe **25** if employed. The heating medium may be steam or hot water and other suitable fluid medium.

It will be observed that in the embodiment of Figs. 8 and 9, the filter **67** serves to filter any fresh air supplied by the conduit **55** as well as air recirculated through the cabinet passing through the opening **65** of the top plate of the cabinet during the stage of fan operation.

The front heating unit **22** of the embodiment of Figs. 8 and 9 is advantageously enlarged in vertical dimension as compared with the rearward heating units **70**, **71**, **72**, or positioned to extend vertically above the sub-casing, such enlarged dimension or vertically upper position of the front heating unit **22** affording the advantage of serving as a side of the conduit **69** at the rearward face **22***a* of the front heating element, to add supplemental heating facial area of the air flowing through the conduit, as will appear more fully hereinafter.

The sub-casing and the inclusion of the rearward heating units **70**, **71**, **72**, or equivalent, in the rearward and forward channels of the sub-casing, may be varied as desired; a satisfactory arrangement is had by extending a partition **47***a* from the arcuate wall **51***a* between two of the heating units, say between heating unit **71** and heating unit **72**, thus disposing the heating units **70**, **71**, in the rearward channel **47** of the sub-casing, and the heating unit **72** in the forward channel of the sub-casing.

Figs. 10 and 11 illustrate diagrammatically varied stages of operation of the embodiment shown in Figs. 8 and 9, like parts are designated by like reference characters.

Fig. 10 indicates by the multi-arrowed line **73** the air flow in the stage of fan operation, namely, through the opening **65** of the top plate of the air recirculated from the room or space served by the cabinet with such supplemental fresh or conditioned air supplied by the conduit **55** determined by the extent of opening of its valve **57**. The proportion of such supplied fresh or conditioned air for any given setting of the valve **57** and given rate of operation of the fan or fans includes the factors of relative resistance to air flow occasioned by the cross-sectional areas of the conduits and angularity of angular parts, relative temperatures, etc., as well understood by those skilled in the art.

The arrowed line **74**, see Fig. 10, indicates the air flow into the channel **47** of the sub-casing, projected by the fans in moving heat exchange contact with the rearward heating units.

The arrowed line **75**, see Fig. 10, indicates the flow of heated air through the upper opening **68** in the top plate of the cabinet diverted from the air flow **74**, and the arrowed line **76** indicates the flow of heated air **74** projected downwardly through the sub-casing during fan operation and discharged through the bottom opening **26**.

Radiant heat, of course, is supplementarily supplied by the front face **21** of the front heating unit.

Fig. 11 shows the air flow during the stage of nonoperation of the fan or fans, and incidentally for closed position of the valve **57** of the supply of fresh or conditioned air.

In Fig. 11, the arrowed line **77** shows the air flow through the cabinet of the type illustrated in Figs. 8 and 9, during the stage of non-operation of the fan or fans **28**, **29**. The air flow represented by the arrowed line **77** is through the bottom grille or opening **26**, thence upwardly through the forward channel of the sub-casing, in moving heat exchange contact with the rearward face **22***a* of the front heating element **22**, and also with the faces of the heating element **72**, thence passing through the upper discharge channel **69**, in further moving heat exchange contact with the upper or extended portion of the rear face **22***a* of the heating element **22**, and eventually discharged through the opening **68** of the top plate of the cabinet.

The currents of heated air engendered by the heating elements **70**, **71**, in the rearward channel **47** of the sub-casing, rise in the rearward channel of the sub-casing **47** to the top of its wall **47***b* and merge with the air flow **77** through the channel **69**, and are discharged through the upper opening **68**.

My invention also provides for humidifying the air currents discharged or passing through the cabinet.

One preferred form of humidification is illustrated in Figs. 1 to 4, and comprises a receptacle **80**, see Figs. 2 and 5, arranged to receive water, see **81**, which is heated by a suitable heating element, preferably an electrical heater unit, indicated at **82**. The receptacle **80** has a discharge opening **83** which communicates with the sub-casing within the cabinet between the inlet and outlet of such sub-casing, see Figs. 2 and 3, whereby the moisture supplied by the humidifier merges with the flow of heated air passing through the sub-casing during fan-operation and non-operation and therefore under conditions precluding "clouding" and also precluding any accumulation of moisture within the cabinet at all times.

The receptacle **80** may be supplied with water in any suitable manner. As illustrated in Figs. 1 and 2, the moisture is shown supplied manually, as through the inlet port **84**, extending through one side of the cabinet, and provided with a closure cap **85**.

Preferably, the humidifier is operated solely during the stage of fan operation, and also preferably subject further to the control of a humidistat. Should a humidistat not be employed, the operation of the humidifier may be controlled by a manually operated or other electrical switch.

Provision is made for opening the electrical circuit under the condition of depletion or substantial depletion of the water **81** in the receptacle **80**. One form of such control comprises a mercoid switch, indicated at **82***a*, which is connected in series with the electrical resistance of the electrical heater unit **82**; the mercoid switch is arranged to be moved to circuit-open position under the condition of depletion of the water, as by physically mounting the mercoid switch **82***a* on a spring support **82***b*, to the free end of which is attached a chain **82***c*, in turn attached to a float **82***d*, whereby under the condition of the level of the water **81** subsiding below a predetermined height, the unbuoyed weight of the float **82***d* effects the downward tilting of the spring support **82***b*, to move the mercury under gravity out of engagement with the terminals of the mercoid switch **82***a*, thus interrupting the circuit through the electrical heater unit **82**. The terminals of the mercoid switch are located at

the end indicated at 82*e* of the glass bulb of the mercoid switch 82*a*.

Fig. 12 is a diagram of a typical electrical circuit. The service lines, represented at 86, 87, are suitably connected with the terminals of the fan motor 30, such circuit including a switch or thermostat 88. The leads 89, 90 connect the terminals of the electrical heater unit 82 of the humidifier 80 with the service lines 86, 87, preferably between the switch or thermostat 88 and the motor 30, to thereby render the humidifier responsive in operation to a thermostat 88, and/or any electrical switch 88, as well as operative solely during fan-operation. The humidistat (or a manually operated switch) is indicated at 91.

Under the stated arrangement, the fan motor 30 is set in operation upon throwing in the switch 88, or upon closure of the circuit by a thermostat 88. Assuming the employment of a humidistat 91 and further that the moisture content of the room or space supplied by the cabinet is below the normal or predetermined humidity value, and further assuming water of sufficient height to be contained in the humidifier 80, the closure of the circuit through the fan motor 30 simultaneously effects the closure of the circuit through the electrical heater 82 of the humidifier, thus providing for the evaporation of the water in the humidifier 80, and supplied to the heated air current passing through the cabinet.

However, under the circumstance of the moisture of the room or space being at or above the normal or other predetermined humidity value, the switch 91 of the humidistat is in open-circuit position, thus rendering the humidifier idle. Also, in the event of depletion of water in the humidifier 80, as above more fully explained, the circuit through the mercoid switch 82*a* is disconnected, thus rendering the humidifier idle.

It will be observed that the bottom or lowerly disposed opening of the grille 26 serves the dual purposes of the discharge therethrough of its heated air during the stage of fan operation as well as the inflow therethrough of air during the stage of non-operation of the fan motor, and also to afford access to the motor and/or fan or fans, without disturbance of other parts of the cabinet.

The cabinet illustrated in Figs. 13 and 14 illustrates another embodiment of my invention, conforming generally to the above stated principles. The cabinet, see Figs. 13 and 14, includes the lower opening 26 in its front face, the openings 32, 32 at lowerly portions of its opposite ends, and slotted or other openings 49*b* in its top plate 49. A distinguishing feature of the cabinet, shown in Figs. 13 and 14, resides in a deflector plate 100, secured at its rear edge 100*a* to the rear plate 45, and suitably arched and suitably extended determined by the location of its free edge 100*b* to deflect during the stage of fan operation the major portion of the heated air downwardly through the front channel of the sub-casing, in heat exchange with the rear face 22*a* of the front heating element 22 and the front face 41*a* of the rear heating element 41, to be discharged through the lower grille or opening 26, while simultaneously providing for a lesser flow past the free edge 100*b* through the open top 49. Such conjoint air flow is diagrammatically illustrated in Fig. 15, the arrowed line 101 representing the air projected by the fan or fans upwardly through the rear channel of the sub-casing, in heat exchange contact with the rear face 41*b* of the rear heating element 41, thence deflected by the deflector 100 partly downwardly as indicated by the arrowed line 102 through the front grille or opening 26 and partly upwardly represented by the arrowed line 103 through the slotted or other perforated top 49. Such air flow includes the recirculation of the air of the room or other space serviced by the cabinet, which enters through the lower opposite end openings 32, 32, and may also include any fresh air supplied through the inflow passage 55, indicated by the arrowed line 104, the relative volume being controlled by the setting of its valve 57 by its regulating handle 58*a*.

Fig. 16 indicates the stage of non-operation of the fan, the arrowed line 105 indicating the air flow induced by gravity or convection currents, namely by entry of air through the lower grille or opening 26, upwardly in heat exchange contact with the rear face 22*a* of the front heating element 22 and the front face 41*a* of the rear heating element 41, thence past the front free edge 100*b* of the deflector 100 and discharged through the perforated or open top 49. A heated air current, as indicated by the arrowed line 106, also arises, induced at the rear face 41*b* of the rear heating element 41, the current flowing upwardly in the rear channel of the sub-casing, past the free edge 100*b* of the deflector and through the open top 49, entrailing air from the room re-circulated through the compartments 36, 36 of the fans 28, 29, now idle. Fig. 16 illustrates, incidentally, the valve 57 of the fresh air intake 55 in closed position.

Referring to Fig. 3, the outer edge 55*b* of the conduit 55, for the supply of fresh air from the outer atmosphere, is preferably upturned, to serve as an eave, for the purpose of eliminating rain being entrained through the mouth of the channel 55. It will be understood that other refinements of the specific parts shown or indicated in the drawings are incorporated in the commercial embodiments of my invention.

Whereas I have described my invention by reference to specific forms thereof, it will be understood that many changes and modifications may be made without departing from the spirit of the invention.

I claim:

1. The combination of a cabinet provided with a lowerly disposed opening, said cabinet having also an opening in one of its faces, heating means disposed in the cabinet, said heating means including a heating element having a face located in said facial opening of the cabinet to provide for radiant heating, and means for projecting air through the cabinet in heat exchange contact with said heating means and for discharging the thus heated air through said lowerly disposed opening of the cabinet.

2. The combination of a cabinet provided with a lowerly disposed opening, said cabinet having also an opening in one of its faces, heating means disposed in the cabinet, said heating means including a heating element having a face located in said facial opening of the cabinet to provide for radiant heating, conduit means within the cabinet embracing said heating means, and means for projecting air through the conduit means in heat exchange contact with said heating means and for discharging the thus heated air through said lowerly disposed opening of the cabinet.

3. The combination of a cabinet provided with a lowerly disposed opening, said cabinet having also an opening in one of its faces, said cabinet

being further provided with an opening in its top, heating means disposed in the cabinet, said heating means including a heating element having a face located in said facial opening of the cabinet to provide for radiant heating, and means for projecting air through the cabinet in heat exchange contact with said heating means and for discharging the thus heated air through said lowerly disposed opening of the cabinet, said opening in the top of the cabinet serving to discharge heated air during the stage of non-operation of the fan.

4. The combination of a cabinet provided with a lowerly disposed opening, said cabinet having also an opening in one of its faces, said cabinet being further provided with an opening in its top, heating means disposed in the cabinet, said heating means including a heating element having a face located in said facial opening of the cabinet to provide for radiant heating, conduit means within the cabinet embracing said heating means, said conduit means communicating with said opening in the top of the cabinet, and means for projecting air through the conduit means in heat exchange contact with said heating means and for discharging the thus heated air through said lowerly disposed opening of the cabinet.

5. The combination of a cabinet provided with a lowerly disposed opening, said cabinet having also an opening in one side of its faces, heating means disposed in the cabinet, said heating means comprising a plurality of heating elements disposed in spaced relation to one another, one of said heating elements having a face located in said facial opening of the cabinet to provide for radiant heating, conduit means within the cabinet embracing said heating elements in serial relation, and means for projecting air through said conduit means in heat exchange contact with said heating elements serially and for discharging the thus heated air through said lowerly disposed opening of the cabinet.

6. The combination of a cabinet provided with a lowerly disposed opening, said cabinet having also an opening in one of its faces, heating means disposed in the cabinet, said heating means including a heating element having a face located in said facial opening of the cabinet to provide for radiant heating, and means for projecting air through the cabinet in heat exchange contact with said heating means and for discharging the thus heated air through said lowerly disposed opening of the cabinet, said air projecting means including fan means disposed rearwardly and lowerly within the cabinet.

7. The combination of a cabinet provided with a lowerly disposed opening, said cabinet having also an opening in one of its faces, heating means disposed in the cabinet, said heating means including a heating element having a face located in said facial opening of the cabinet to provide for radiant heating, conduit means within the cabinet embracing said heating means, and means for projecting air through the conduit means in heat exchange contact with said heating means and for discharging the thus heated air through said lowerly disposed opening of the cabinet, said air projecting means including fan means disposed rearwardly and lowerly within the cabinet.

8. The combination of a cabinet provided with a lowerly disposed opening, said cabinet having also an opening in one of its faces, said cabinet being further provided with an opening in its top, heating means disposed in the cabinet, said heating means including a heating element having a face located in said facial opening of the cabinet to provide for radiant heating, and means for projecting air through the cabinet in heat exchange contact with said heating means and for discharging the thus heated air through said lowerly disposed opening of the cabinet, said opening in the top of the cabinet serving to discharge heated air during the stage of non-operation of the fan, said air projecting means including fan means disposed rearwardly and lowerly within the cabinet.

9. The combination of a cabinet provided with a lowerly disposed opening, said cabinet having also an opening in one of its faces, said cabinet being further provided with an opening in its top, heating means disposed in the cabinet, said heating means including a heating element having a face located in said facial opening of the cabinet to provide for radiant heating, conduit means within the cabinet embracing said heating means, said conduit means communicating with said opening in the top of the cabinet, and means for projecting air through the conduit means in heat exchange contact with said heating means and for discharging the thus heated air through said lowerly disposed opening of the cabinet, said air projecting means including fan means disposed rearwardly and lowerly within the cabinet.

10. The combination of a cabinet provided with a lowerly disposed opening, said cabinet having also an opening in one side of its faces, heating means disposed in the cabinet, said heating means comprising a plurality of heating elements disposed in spaced relation to one another, one of said heating elements having a face located in said facial opening of the cabinet to provide for radiant heating, conduit means within the cabinet embracing said heating elements in serial relation, and means for projecting air through said conduit means in heat exchange contact with said heating elements serially and for discharging the thus heated air through said lowerly disposed opening of the cabinet, said air projecting means including fan means disposed rearwardly and lowerly within the cabinet.

11. The combination of a cabinet provided with a lowerly disposed opening, said cabinet having also an opening in one of its faces, heating means disposed in the cabinet, said heating means including a heating element having a face located in said facial opening of the cabinet to provide for radiant heating, means for projecting air through the cabinet in heat exchange contact with said heating means and for discharging the thus heated air through said lowerly disposed opening of the cabinet, and means for supplying fresh or conditioned air to the cabinet.

12. The combination of a cabinet provided with a lowerly disposed opening, said cabinet having also an opening in one of its faces, heating means disposed in the cabinet, said heating means including a heating element having a face located in said facial opening of the cabinet to provide for radiant heating, conduit means within the cabinet embracing said heating means, means for projecting air through the conduit means in heat exchange contact with said heating means and for discharging the thus heated air through said lowerly disposed opening of the cabinet, and means for supplying fresh or conditioned air to the cabinet.

13. The combination of a cabinet provided with a lowerly disposed opening, said cabinet having also an opening in one of its faces, said cabinet being further provided with an opening in its

top, heating means disposed in the cabinet, said heating means including a heating element having a face located in said facial opening of the cabinet to provide for radiant heating, means for projecting air through the cabinet in heat exchange contact with said heating means and for discharging the thus heated air through said lowerly disposed opening of the cabinet, said opening in the top of the cabinet serving to discharge heated air during the stage of non-operation of the fan, said air projecting means including fan means disposed rearwardly and lowerly within the cabinet, and means for supplying fresh or conditioned air to said conduit means.

14. The combination of a cabinet provided with a lowerly disposed opening, said cabinet having also an opening in one side of its faces, heating means disposed in the cabinet, said heating means comprising a plurality of heating elements disposed in spaced relation to one another, one of said heating elements having a face located in said facial opening of the cabinet to provide for radiant heating, conduit means within the cabinet embracing said heating elements in serial relation, means for projecting air through said conduit means in heat exchange contact with said heating elements serially and for discharging the thus heated air through said lowerly disposed opening of the cabinet, said air projecting means including fan means disposed rearwardly and lowerly within the cabinet, and means for supplying fresh or conditioned air to said conduit means.

15. The combination of a cabinet provided with a lowerly disposed opening, said cabinet having also an opening in one of its faces, heating means disposed in the cabinet, said heating means including a heating element having a face located in said facial opening of the cabinet to provide for radiant heating, means for projecting air through the cabinet in heat exchange contact with said heating means and for discharging the thus heated air through said lowerly disposed opening of the cabinet, and means for supplying humidity within the cabinet.

16. The combination of a cabinet provided with a lowerly disposed opening, said cabinet having also an opening in one of its faces, heating means disposed in the cabinet, said heating means including a heating element having a face located in said facial opening of the cabinet to provide for radiant heating, conduit means within the cabinet embracing said heating means, means for projecting air through the conduit means in heat exchange contact with said heating means and for discharging the thus heated air through said lowerly disposed opening of the cabinet, and means for supplying humidity to said conduit means.

17. The combination of a cabinet, heating means disposed within the cabinet, means for projecting air in heat exchange relation with said heating means, thermostat means controlling said air projecting means; humidifying means arranged to communicate with the interior of the cabinet, and means for effecting simultaneous operation of said humidifying means and said air projecting means and simultaneous non-operation of said humidifying means and said air projecting means, said humidifying means including means responsive to the level of the water in said humidifying means to render said humidifying means non-operative under condition of water depletion.

18. The combination of a cabinet, heating means disposed within the cabinet, means for projecting air in heat exchange relation with said heating means, thermostat means controlling said air projecting means, humidifying means arranged to communicate with the interior of the cabinet, humidistat means controlling said humidifying means and means for effecting simultaneous operation of said humidifying means and said air projecting means and simultaneous non-operation of said humidifying means and said air projecting means, said humidifying means including means responsive to the level of the water in said humidifying means to render said humidifying means non-operative under the condition of water depletion.

19. The combination of a cabinet, heating means disposed within the cabinet, means for projecting air in heat exchange relation with said heating means, thermostat means controlling said air projecting means, humidifying means arranged to communicate with the interior of the cabinet, humidistat means controlling said humidifying means and means for effecting simultaneous operation of said humidifying means and said air projecting means and simultaneous non-operation of said humidifying means and said air projecting means, said humidifying means including means responsive to the level of the water in said humidifying means for rendering said humidifying means non-operative under the condition of water depletion.

20. The combination of a cabinet provided with a lowly disposed opening, said cabinet having also an opening in one of its faces, heating means disposed in said cabinet, said heating means including a heating element having a face located in said facial opening of the cabinet to provide for radiant heating, and means for projecting air through the cabinet in heat exchange contact with said heating means and for discharging the thus heated air through said lowerly disposed opening of the cabinet.

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