July 31, 1956 R. W. KRITZER 2,756,569

AIR CONDITIONING APPARATUS

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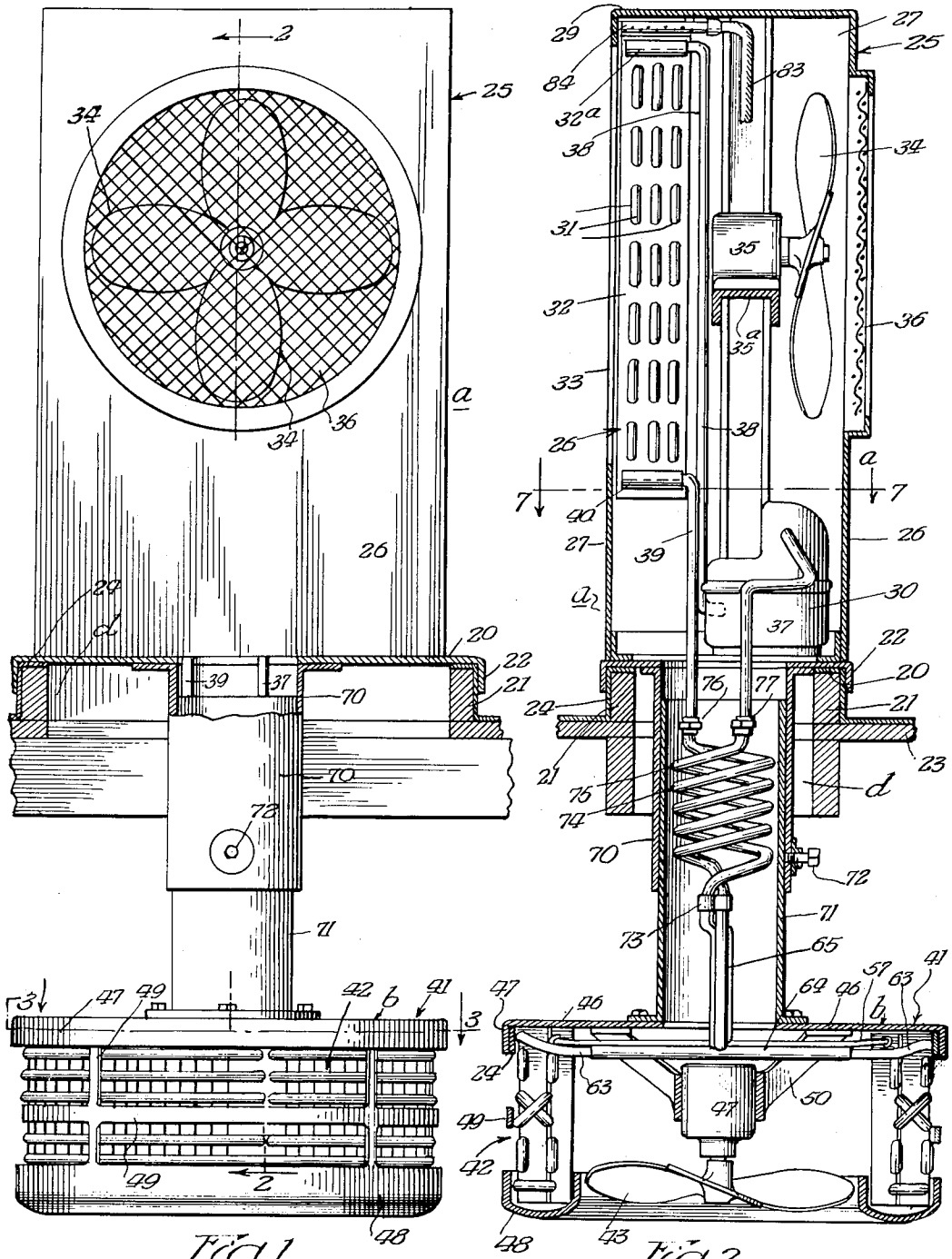


Fig. 1 Fig. 2

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Fig 3

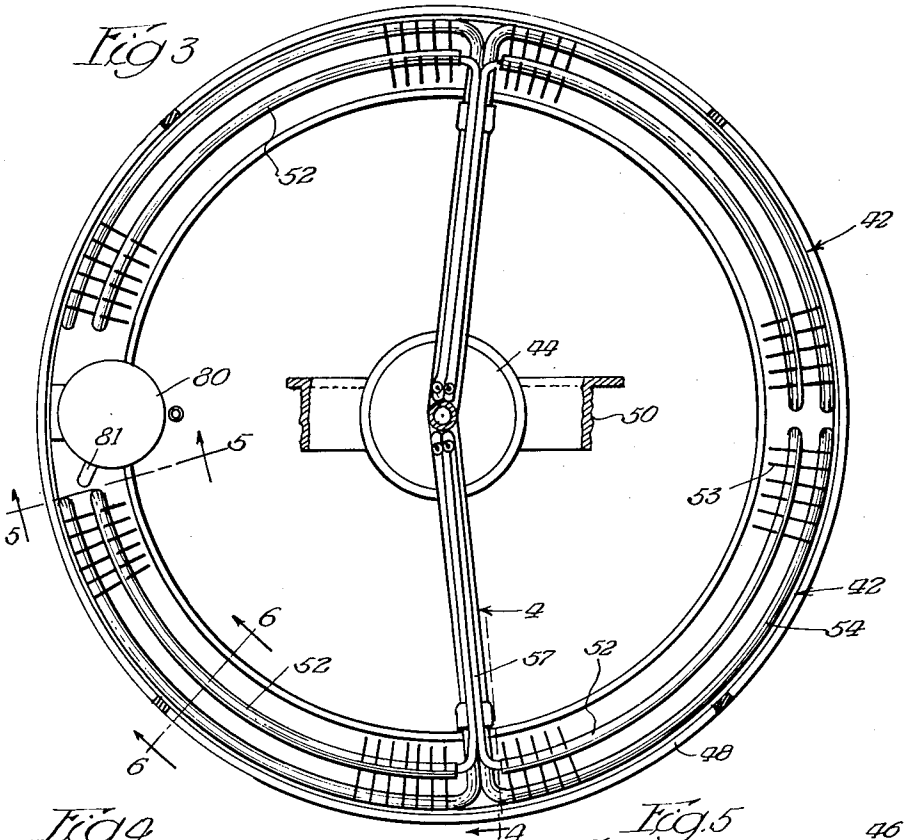


Fig.4

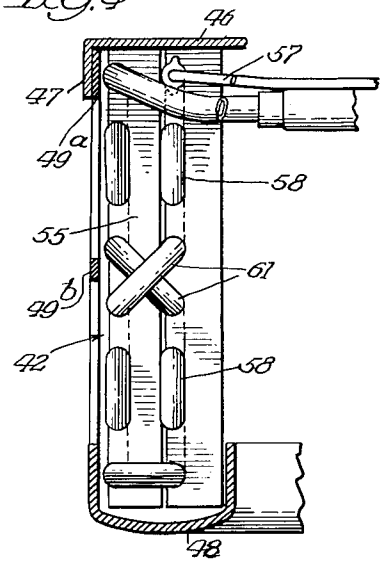


Fig.5

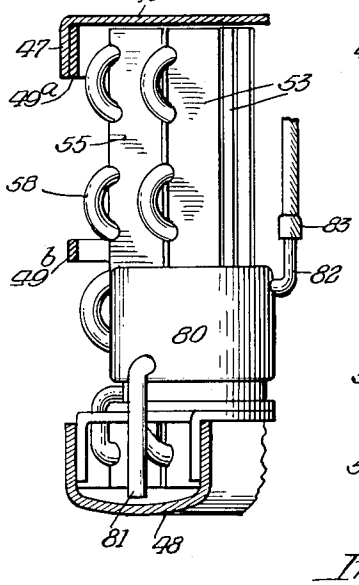
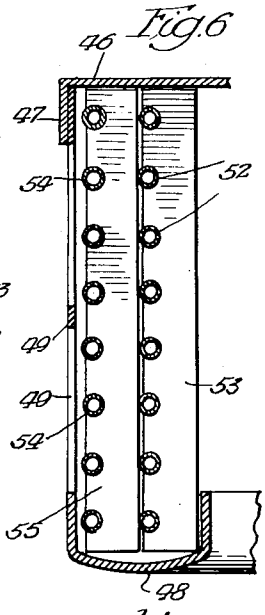


Fig.6



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Fig. 7

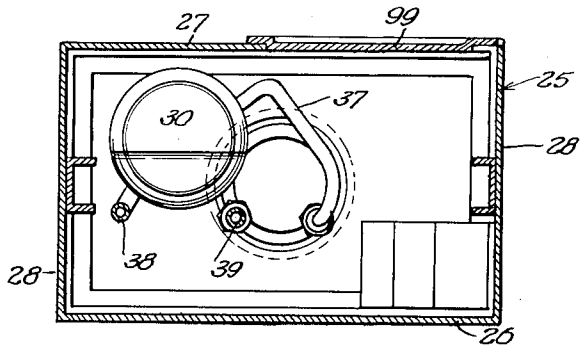


Fig. 9

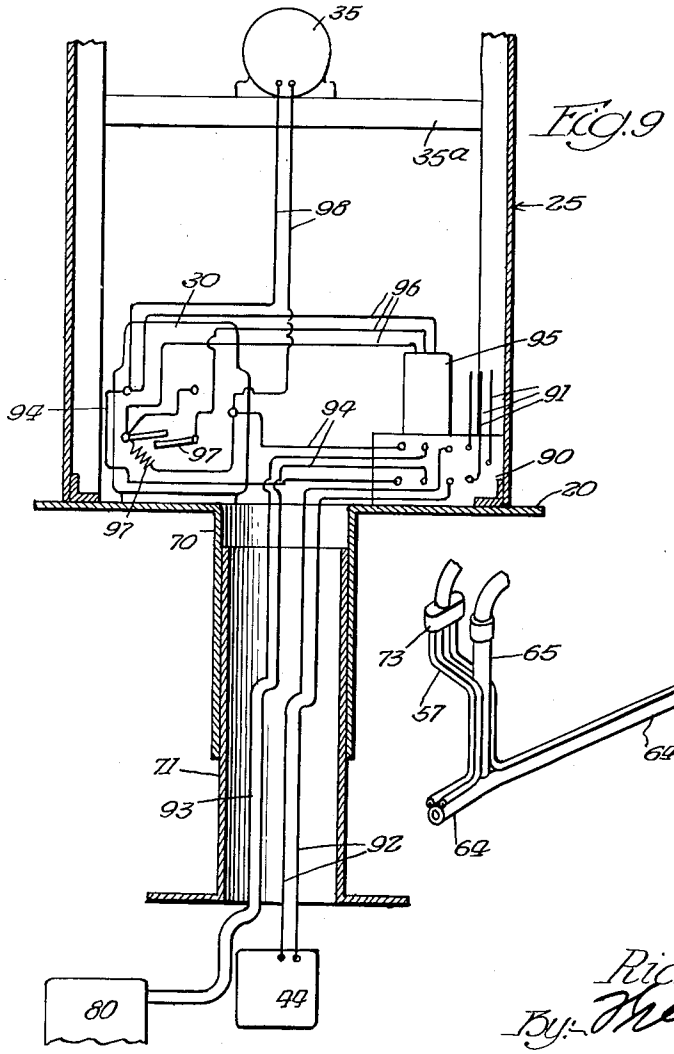
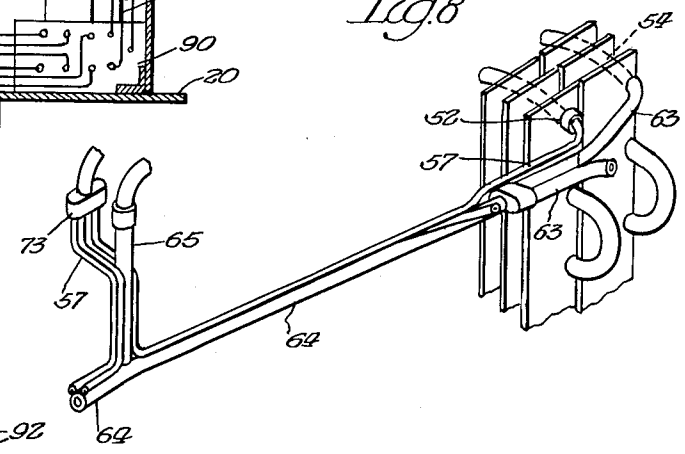


Fig. 8



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AIR CONDITIONING APPARATUS

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3 Claims. (Cl. 62—129)

The invention relates to air conditioning apparatus.

One object of the invention is to provide improved air conditioning apparatus which includes an assembly of refrigerating apparatus, an assembly of cooling apparatus, and a telescopic structure for supporting the refrigerating assembly above the roof or outside of a building and the cooling assembly inside of the building with refrigerating connections in a tubular structure between the assemblies.

Another object of the invention is to provide air conditioning apparatus of this type with a supporting structure which is adjustable to support the cooling apparatus at different heights in the building.

Another object of the invention is to provide air conditioning apparatus of this type which can be readily installed for use.

Other objects will appear from the detail description.

The invention consists in the several novel features hereinafter described and more particularly defined by claims at the conclusion hereof.

In the drawings:

Fig. 1 is a side elevation of the apparatus exemplifying the invention, parts being shown in sections;

Fig. 2 is a section taken on line 2—2 of Fig. 1;

Fig. 3 is a horizontal section taken on line 3—3 of Fig. 1;

Fig. 4 is a section taken on line 4—4 of Fig. 3;

Fig. 5 is a section taken on line 5—5 of Fig. 3;

Fig. 6 is a section taken on line 6—6 of Fig. 3;

Fig. 7 is a section taken on line 7—7 of Fig. 2;

Fig. 8 is a perspective of a portion of the suction line and the capillary tubes leading to one of the evaporator sections; and

Fig. 9 is a diagrammatic view of the electrical connections and apparatus.

The invention is exemplified in air conditioning apparatus which comprises, an assembly of refrigerating apparatus generally designated *a*, which is disposed over and supported on the roof of a building, an assembly of air conditioning or cooling apparatus generally designated *b*, disposed under the roof of the building, and a tubular structure depending from the refrigerating assembly, for supporting the cooling assembly adjacent the ceiling or roof or in a room in the building.

The supporting structure comprises a rectangular plate 20 which fits over a curb 21 around an opening *d* in the roof 23 of the building and has a depending marginal flange 22 around said curb. A gasket 24 forms a seal between curb 21 and plate 20.

The assembly of refrigerating apparatus is housed in an upstanding casing 25 which is mounted on the plate 20, is rectangular in horizontal section, and includes a front wall 26, a rear wall 27, side walls 28 and a top wall 29. The refrigerating apparatus in casing 25 comprises: a sealed unit 30 which includes a compressor or pump for the refrigerant and an electric motor for driving the pump, and is mounted on the bottom of casing 25; a condenser 26 which includes a coil of tubing 31 and the usual cross-fins 32 and extends across an opening 33 in the rear wall of

casing 25; and an air impeller 34 on the shaft of an electric motor 35 which is supported in casing 25 on a cross bar 35*a*. A screened inlet opening 36 is provided in the front wall 26 of casing 25. Impeller 34 is adapted to propel air from the outside of casing 25 around the coil 31 and between the fins 32 for discharging it through opening 33, for condensing the refrigerant flowing through coil 31 and expelling the heated air through opening to the outside of casing 25. The pressure side of the compressor is connected by a pipe 38 to an inlet header 32*a* for coil 31. A pipe 39 is connected to the outlet header 40 of coil 31 for delivering refrigerant to the evaporator of the air conditioning unit as hereinafter described. A suction line 37 is connected to the low pressure side of the compressor in unit 30.

The assembly of cooling apparatus comprises a cage or structure, generally designated 42, an air impeller 43 and an electric motor 44 for driving said impeller. The cage 41 comprises a horizontal top wall 46 having a depending flange 47, an annular lower member 48 which forms a downwardly facing inlet opening around impeller 43, an upper ring 49*a*, a central ring 49*b* and ribs 49 between member 48 and said rings for the outlet of air from the evaporator. Member 48 is of channel shape in cross section to function as collector for condensate from the evaporator. The impeller 43 and the shaft of motor 44 are mounted to rotate on a vertical axis so that air entering the cage through annular member 48 will be forced laterally and radially outward through the evaporator and impelled to the outside of the cage after it has been cooled by the evaporator. The motor 44 is supported from top wall 46 by a bracket 50 so its axis will be vertical.

The evaporator 42 is generally annular and comprises quadrantal units, each of which includes conforming inner and outer arcuate sections. Each of said units comprises an inner conforming and outer arcuate sections. The inner section of each quadrantal unit comprises a coil of tubing with arcuate members 52 and cross fins 53. The outer section of each of said units comprises a coil of tubing of arcuate members 54 and cross fins 55. One end of each coil 52 has connected thereto a capillary tube 57 which delivers refrigerant into the inlet end of said coil. The members of the inner and outer coils of each unit are serially connected by bends 58 to flow the refrigerant from a tube 57 through both coils 52 and 54 to a suction conduit section 63 for returning the spent refrigerant from the evaporator to the suction pipe 37 of the compressor. Crossed bends 61 may be used between the inner and outer coils to flow the refrigerant successively through a portion of the inner coil, a portion of the outer coil back to the remaining portion of the inner coil and the remainder of the outer coil. Each conduit section 63 is connected to a radial pipe section 64. Pipe sections 64 from both pair of units are merged into an upstanding section 65 which is connected to the suction line 37. Portions of the capillary tubes 57 are parallel and soldered to pipe sections 64 and 65 for heat interchange to render the refrigerant in said capillary tubes responsive to the temperature in said members for varying the rate of flow of the refrigerant to the evaporator responsively to the temperature of the refrigerant in the suction line. The capillary tubes 57 to all of the evaporator units are merged into a fitting 73 to which refrigerant from pipe 39 is conducted.

The air conditioning unit *b* is suspended below the roof and is supported for vertical adjustment in the subjacent room by a tubular structure or column which comprises telescopically connected sections. A tubular section 70 is secured to and depends from the plate 20 which covers the opening *d* in the roof through which said section extends downwardly. A tubular section 71 has its lower end secured to the top of cage 41 and its upper end is

slidably fitted in section 70 for vertical adjustment of the cooling unit relatively to the roof or ceiling of the building. One or more set screws 72 are adapted to support the tubular section 71 and unit *b* in their assigned elevation relatively to the ceiling or roof.

The pipe 39 from the condenser is communicatively connected to fitting 73 from which the capillary tubes 57 emerge. The pipe connection 39 above fitting 73 to which the capillary tubes are connected includes a helical portion 74. The pipe 37 is connected to a helical pipe section 75. Said helical sections render the refrigerant lines extensible and contractible to permit vertical adjustment of the cooling unit without uncoupling the refrigerant lines. The refrigerant lines extend through and are housed in the telescopic structure between the units *a* and *b*. A detachable coupling 76 between the helical section 74 and pipe 39 and a detachable coupling 77 between suction pipe 37 and helical section 75 are provided for coupling the refrigerant lines after the units *a* and *b* are installed and to permit separation of the units for repair or service.

The lower end of the evaporator is confined in the annular channel in member 48 so that said member functions as a collector for condensate which gravitates from the fins and coils of the evaporator. A combined unit 80 includes an electric motor and a pump has an inlet 81 for the condensate which collects in the channel in member 48 and an outlet 82 which is connected by a hose 83 to a spray pipe 84 which discharges the condensate onto the heat exchanger in casing 25. This utilizes the condensate to cool said condenser and disposes it. The unit 80 is mounted on member 48 in a circumferential gap between the adjacent ends of a pair of evaporator units.

The electrical connections and apparatus are diagrammatically illustrated in Fig. 9 and comprise: a terminal block 90 in the casing 25; line conductors 91 from a source of potential to said terminal block; conductors 92 which extend from block 90 through telescopic sections 70 and 71 to motor 44 which drives the impeller 43; conductors 93 which also extend from block 90 through telescopic sections 70 and 71 to the motor of the unit 80 for pumping the condensate from the annular member 48 to the spray pipe 83; conductors 94 which extend between block 90 and the terminals of the windings of the motor of unit 30; a suitable device 95 for controlling current for starting and running the motor of unit 30; a conductor 96 connects the terminal of windings of the motor of said unit 30 and device 95; a magnetic relay and switch 97 which is connected by conductors 96 to device 95; and a pair of conductors 98 for supplying current to motor 35 which drives the impeller 34 of the refrigerating unit.

The conductors 92 between motor 44 at block 90 and conductors 93 at block 90 for the motor of unit 80 are disconnectable at said block.

In the installation of the apparatus, an opening *d* is cut in the roof of the building, usually between joists, and a curb 21 is built around said opening. The telescopic section 70 on plate 20 on which the unit *a* is supported is dropped through opening *d*. Plate 20 is mounted on the curb 21 and the casing 25 of unit *a* and the refrigerating apparatus therein will be supported on the roof with the telescopic section 70 depending therefrom into the building. The upstanding telescopic section 71 on unit *b* is then inserted into the depending tubular section 70 and secured in its assigned height by screws 72. The conductors 92 and 93 are connected to their terminals on block 90. The sections of the suction line in casing 25 are connected together at coupling 77 and the section of the refrigerant line from condenser coil 31 is connected by coupling 77 to the continuation of said line in telescopic section 71. The hose 83 from spray pipe 84 is coupled to outlet 82 of the pump in unit 80. An opening which is covered by a removable plate 99 may be provided in the rear wall 27 of casing 25 for access to said couplings and the devices in the casing 25 and the tubular supporting structure. The refrigerating unit *a* will then be operatively supported over the roof and the cooling unit will be suspended from the roof or ceiling and operative for air inside of the building. This construction permits the units *a* and *b* to be pre-assembled and shipped separately.

When current is supplied to line conductors 91, the motor 44 for impeller 43 will be operated by current through conductors 92; the motor of unit 80 will be operated by current through conductors 93; the motor of compressor unit 30 in starting will be operated by current through its windings which are controlled by device 95 and magnetic switch 97 and after starting by current through windings which are directly connected to the conductors 94. Motor 35 will be operated by current through conductors 98 for operating the impeller 34 for air to the condenser.

The motor of unit 30 will operate its compressor to force refrigerant through pipe 38, condenser coil 31, pipe 39, coupling 76, helical section 74, the series of capillary tubes 57 to the coils 52 and 53 of the four evaporator units. The compressor will apply suction to the refrigerant for returning it via pipes 63, 64, 65, helical section 75, coupling 77 and pipe 37 to the compressor. The refrigerant from the compressor will be condensed in coil 31 and flow via pipe 39, coupling 76, helical section 74 and fitting 73 to the capillary tubes 57 to the inlet ends of the four evaporator units. Tubes 57 are responsive to the temperature of the refrigerant in the suction line to vary the rate of flow of refrigerant to the evaporator. The impeller 43 will draw air upwardly through the annular member 48. This air will be deflected laterally between the coils and fins of the evaporators 42 and cooled thereby before it is discharged laterally into the room. The condensate from the evaporator 42 gravitates and is collected in the annular channel in member 48 and is pumped by the unit 88 via hose 83 to the spray nozzle 84 which discharges it onto the coil and fins of the condenser to assist to aid in cooling the refrigerant passing through said coil.

The invention exemplifies air conditioning apparatus which includes a pre-assembled refrigerating unit with a casing through which outside air is forced above the roof of a building, a pre-assembled cooling unit for air and disposed inside of the building, a supporting structure for the cooling unit which includes telescopic members which are adjustably and demountably connected for convenience in installation and shipment. The telescopic supporting structure between the units houses the refrigerating and electrical connections between said units.

The invention is not to be understood as restricted to the details set forth since these may be modified within the scope of the appended claims without departing from the spirit and scope of the invention.

Having thus described the invention what I claim as new and desire to secure by Letters Patent is:

1. The combination with an assembly of refrigerating apparatus, comprising: a motor-driven compressor, a condenser including a coil for refrigerant and a motor-driven air impeller, and a box-like casing in which said refrigerating apparatus is housed, provided with a base-plate mounted on the roof of a building and on which said casing is supported in an upstanding position above said roof, and with inlet and outlet openings through which outside air will be forced by said impeller; and an assembly of air-cooling apparatus inside of said building including an evaporator, a motor-driven impeller for forcing air through the evaporator, and a cage provided with a top over the evaporator; of a supporting structure for the air-cooling apparatus extending through said roof, including slidably and telescopically connected tubular sections secured to the base-plate of the casing for the refrigerating apparatus and to the top of the cage respectively; and refrigerant conduits between the evaporator and the refrigerating apparatus, extending through said adjustable tubular sections.

2. The combination with an assembly of refrigerating apparatus, comprising: a motor-driven compressor, a condenser including a coil for refrigerant and a motor-driven air impeller, and a box-like casing in which said refrigerating apparatus is housed, provided with a base-plate mounted on the roof of a building and on which said casing is supported in an upstanding position above said roof and with inlet and outlet openings through which outside air will be forced by said impeller; and an assembly of air cooling apparatus inside of said building including an evaporator, a motor-driven impeller for forcing air through the evaporator, and a cage provided with a top over the evaporator; of a supporting structure for the air-cooling apparatus extending through said roof, including slidably and telescopically connected tubular sections secured to the base-plate of the casing for the refrigerating apparatus and to the top of the cage respectively; and refrigerant conduits between the evaporator and the refrigerating apparatus and extending through said base-plate and tubular sections.

3. The combination with an assembly of refrigerating apparatus, comprising: a motor-driven compressor, a condenser including a coil for refrigerant and a motor-driven air impeller, and a box-like casing in which said refrigerating apparatus is housed, provided with a base-plate mounted on the roof of a building and on which said

casing is supported in upstanding position above said roof and with inlet and outlet openings through which outside air will be forced by said impeller; and an assembly of air cooling apparatus inside of said building including an evaporator, a motor-driven impeller for forcing air through the evaporator, and a cage provided with a top over the evaporator; of a supporting structure for the air-cooling apparatus extending through said roof, including slidably and telescopically connected tubular sections secured to the base-plate of the casing for the refrigerator apparatus and to the top of the cage respectively; and refrigerant conduits between the evaporator and the refrigerating apparatus and extending through said base-plate, tubular sections and the central portion of the top of the cage.

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