Dec. 20, 1938. L. W. CHILD 2,140,829

AIR CONDITIONING

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Fig. 1

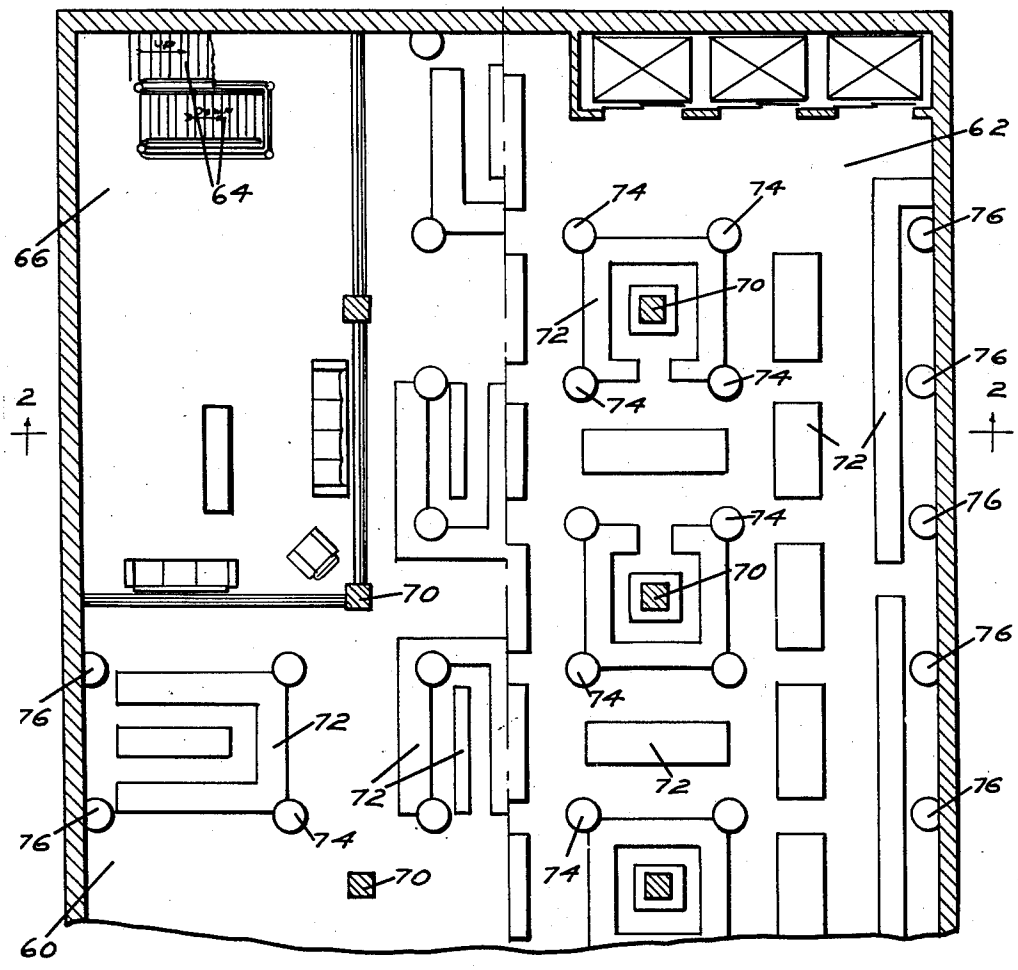
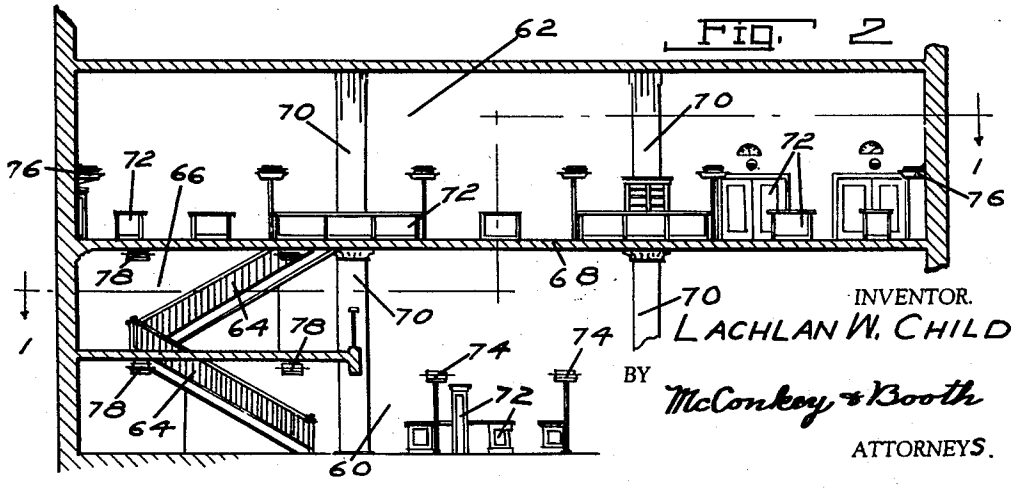


Fig. 2



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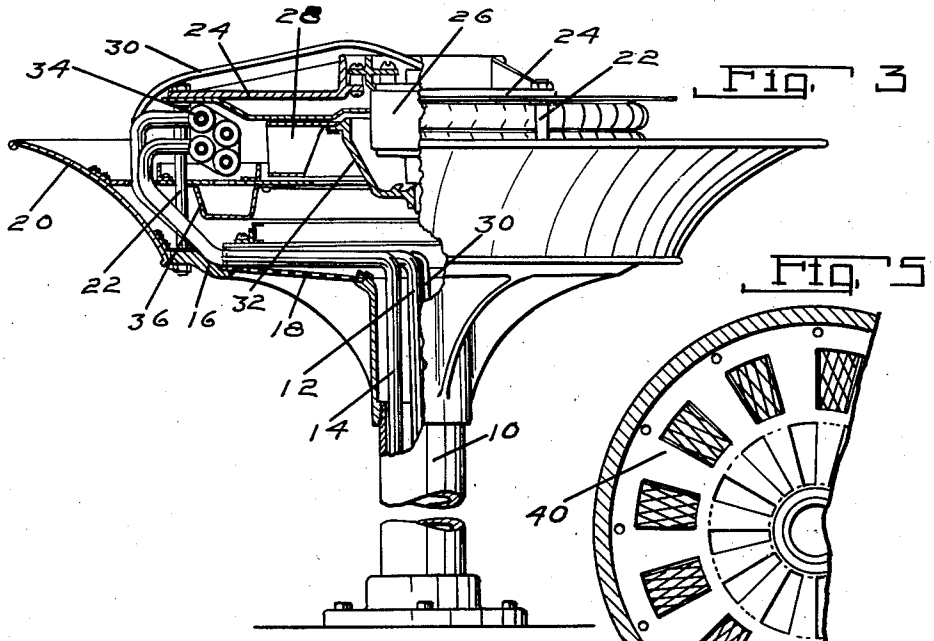


Fig. 3

Fig. 5

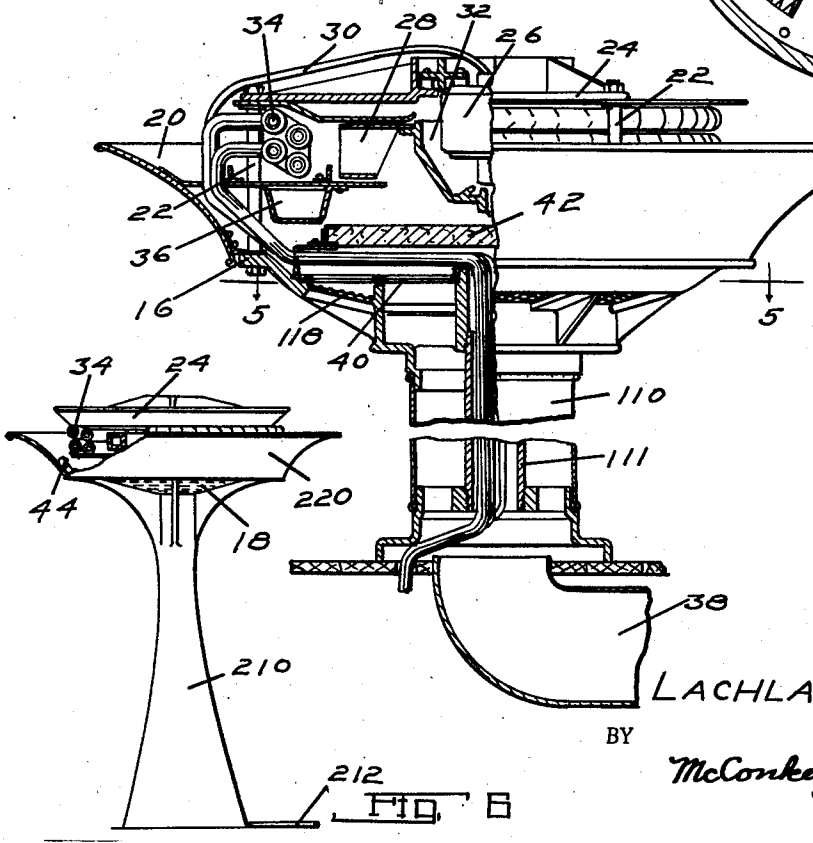


Fig. 4

Fig. 6

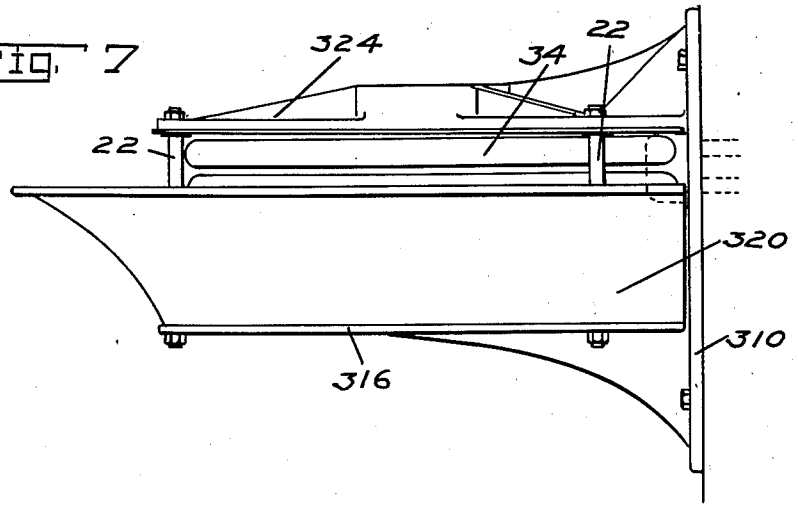
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Fig. 7



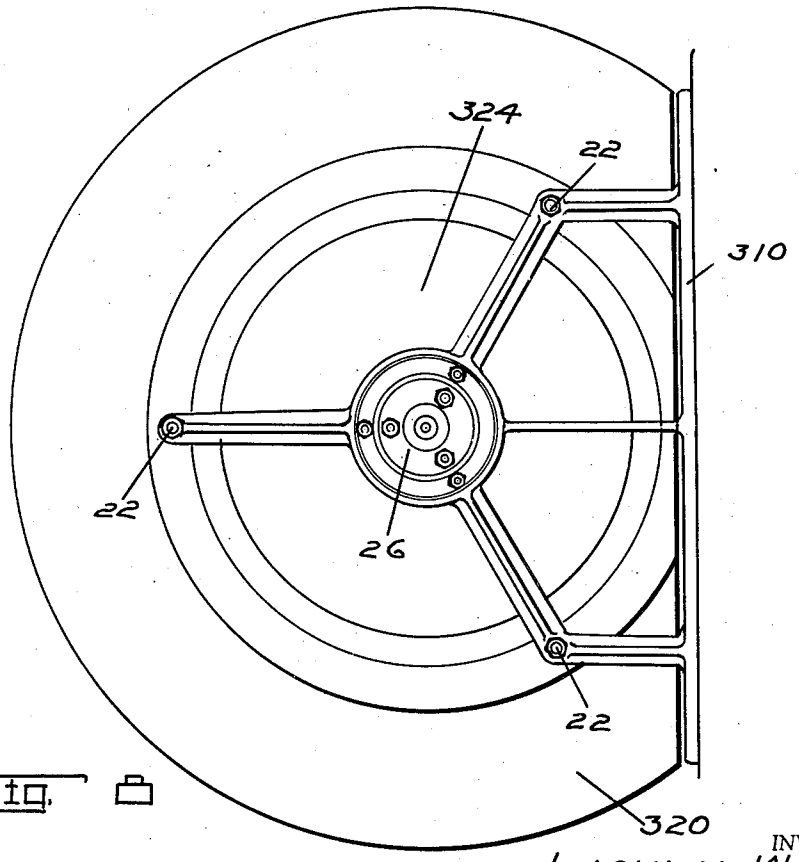


Fig. 8

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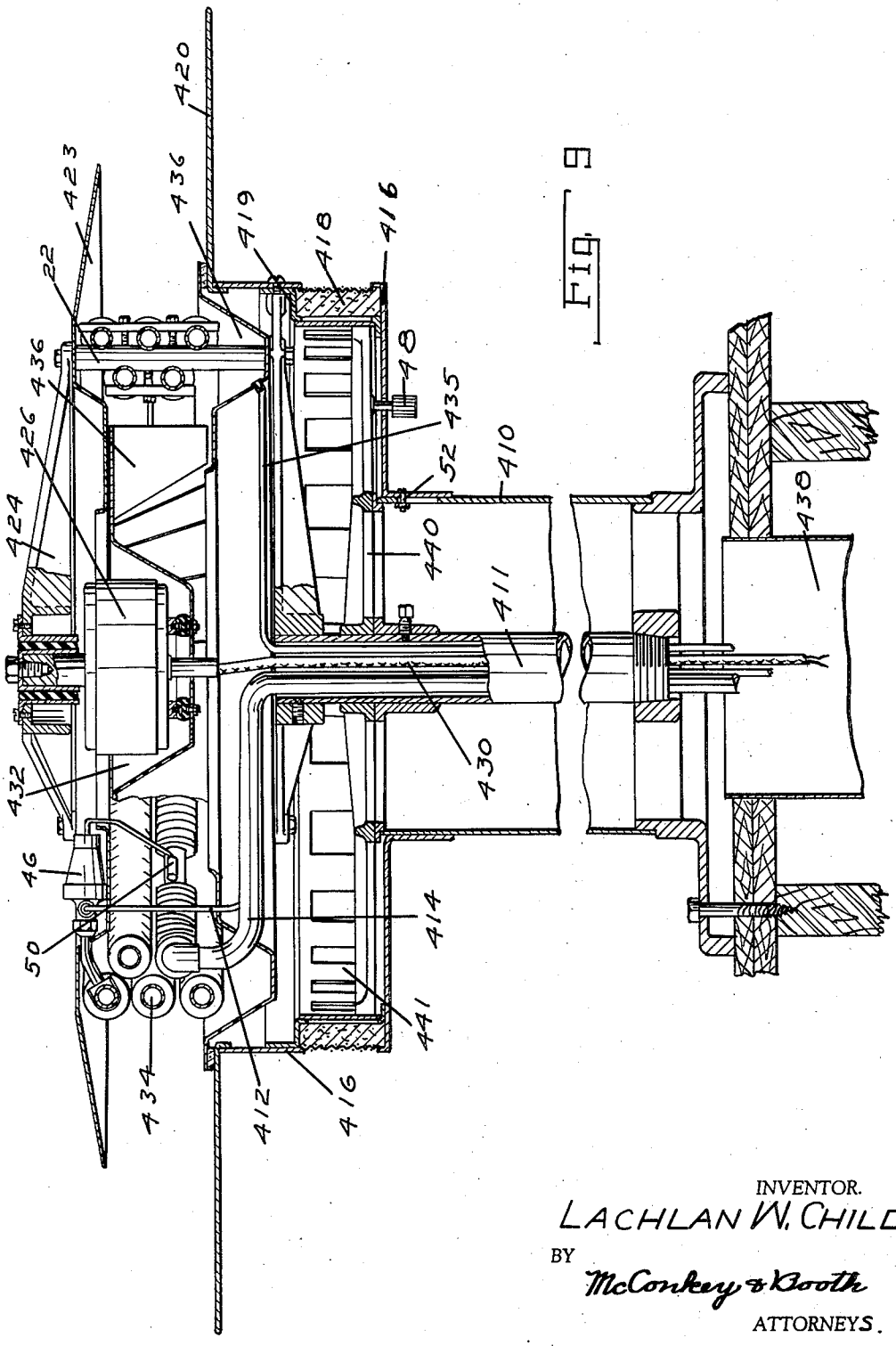


Fig. 5

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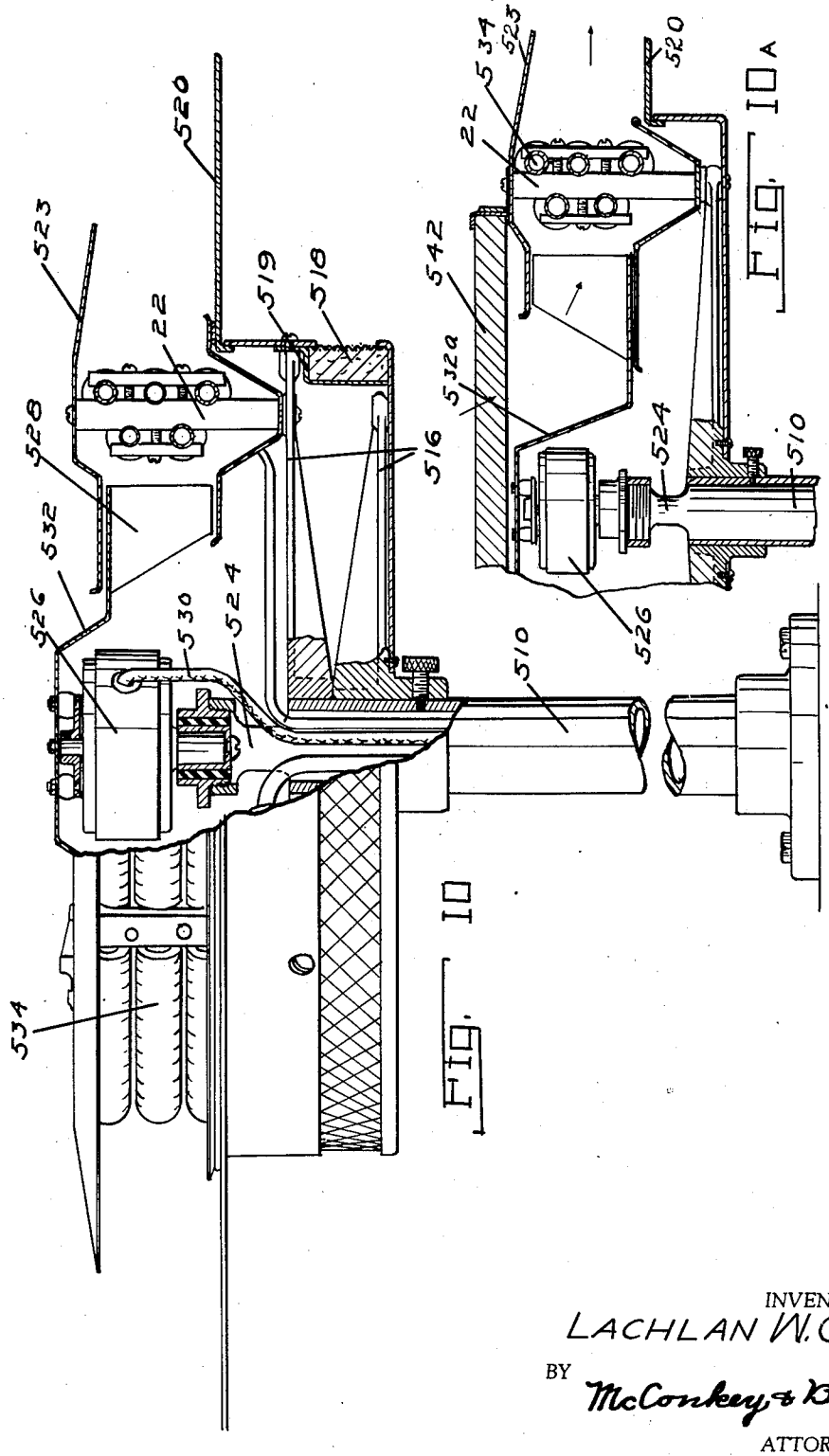


FIG. 10

FIG. 10A

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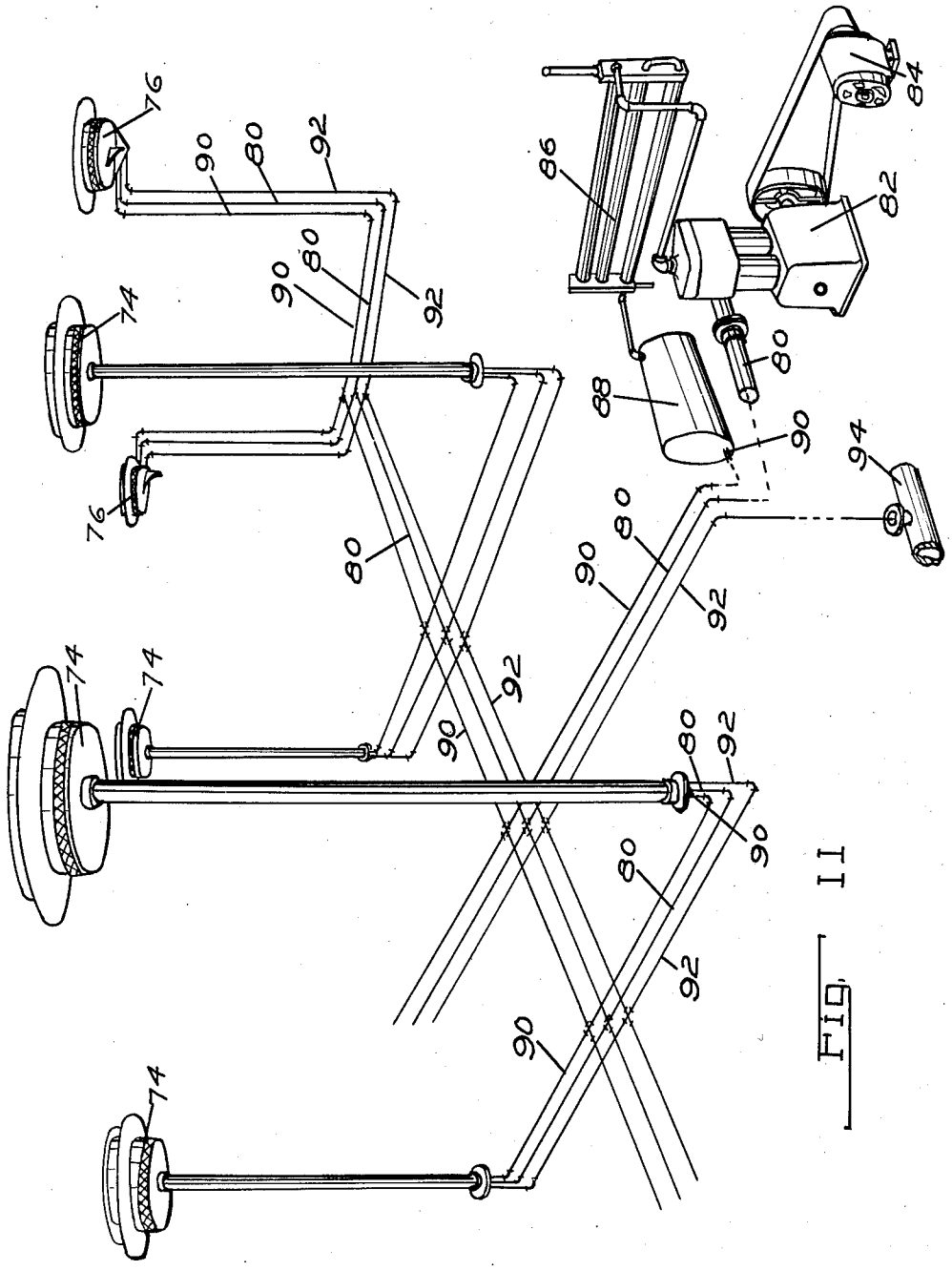


FIG. 11

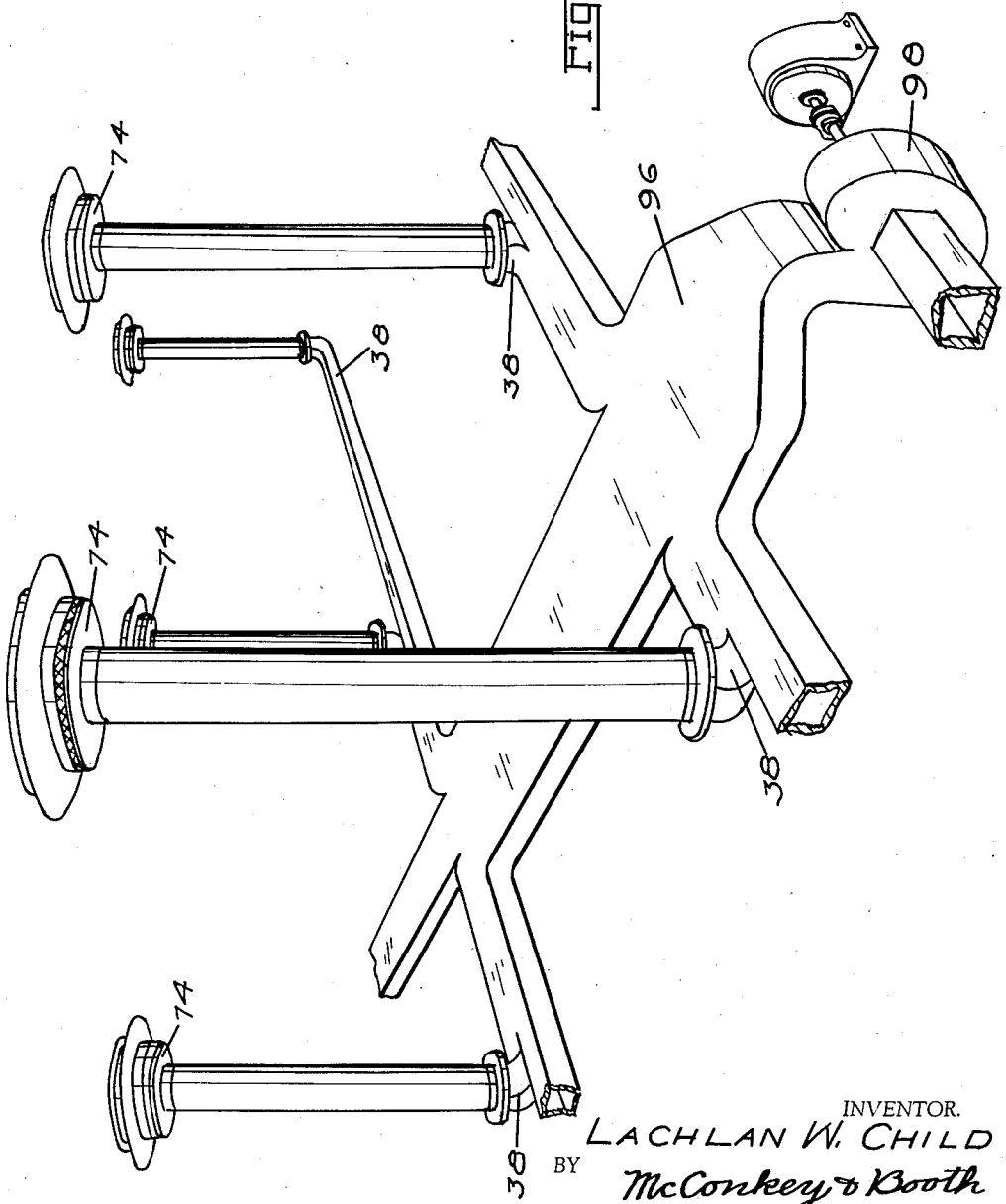
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FIG. 12



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2,140,829

UNITED STATES PATENT OFFICE

2,140,829

AIR CONDITIONING

Lachlan W. Child, South Bend, Ind., assignor, by mesne assignments, to Air Devices Corporation, Chicago, Ill., a corporation of Delaware

Application June 1, 1936, Serial No. 82,849

9 Claims. (Cl. 62—129)

This invention relates to air conditioning, and is herein described in connection with the cooling of relatively large rooms, such as a salesroom in a department store, by a series of floor-supported cooling units. The application is a continuation in part of my application Serial No. 32,256 which has matured into Patent No. 2,069,816, dated February 9, 1937.

One feature of the invention relates to facilitating the cooling of high-ceiling rooms, such as these salesrooms, by providing a stratum of cooled and dehumidified, or otherwise conditioned, air in the lower levels of the room, up to a height somewhat greater than the height of the occupants (i. e., up to about eight feet from the floor), without undertaking the relatively great cost and complication of treating all the air in the room.

Such stratification of the air is brought about by distributing approximately uniformly about the room a series of fixtures, usually mounted on pedestals supported on the floor, all at the desired height, and which discharge conditioned air horizontally, or at a slight angle upwardly from the horizontal, so that there is formed at the desired eight-foot level a layer of conditioned air which settles slowly toward the floor without noticeable air currents, displacing the warmer air upwardly. As pointed out below, fresh air may be mixed with the recirculated room air in forming the cooled layer.

Another feature of the invention relates to the construction and arrangement of the fixtures used in conditioning the air, and especially in mounting on the upper end of a floor-supported pedestal a novel mechanism for cooling the air and blowing it horizontally outward in all directions, and in carrying vertically therefrom through the pedestal connections for circulating refrigerant fluid and for carrying off moisture condensed from the air being cooled.

The fixture may also be provided with lighting means having electrical connections extending through the pedestal.

The above and other objects and features of the invention, including various novel arrangements and desirable particular constructions, will be apparent from the following description of the illustrative embodiments shown in the accompanying drawings, in which:

Figure 1 is a horizontal section, on the line 1—1 of Figure 2, showing in plan one floor of a department store;

Figure 2 is a vertical section therethrough on the line 2—2 of Figure 1;

Figure 3 is a view, partly in side elevation and partly broken away in vertical section, of one of the floor-supported fixtures;

Figure 4 is a similar view of a fixture having means for introducing fresh outside air;

Figure 5 is a section on the line 5—5 of Figure 4;

Figure 6 is a side elevation, partly broken away at one side, of a fixture provided with lighting means;

Figures 7 and 8 are respectively an elevation and a plan view of a fixture formed to be mounted on the wall of the room;

Figure 9 is a vertical section through another form of floor-supported fixture;

Figure 10 is a view, partly in side elevation and partly broken away in vertical section, of a different form of floor-supported fixture;

Figure 10*a* is a partial vertical section showing the fixture of Figure 10 modified to have its air intake at the top of the unit;

Figure 11 is a diagram showing the connections to a number of fixtures from a compressor unit arranged in the basement; and

Figure 12 is a diagram of conduit connections for introducing fresh outside air through a number of fixtures.

The air conditioning fixture illustrated in Figure 3 comprises a hollow vertical pedestal **10** supported by (and shown bolted to) the floor of a room, there being an opening through the floor in line with the pedestal through which the refrigerant connections pass. Refrigerant such as cold water or brine is circulated to and from the cooling means through conduits **12** and **14** which pass vertically through the pedestal **10**.

The upper end of the pedestal supports, about seven or eight feet from the floor, an upwardly-dished deflector built up of a bottom member **16** formed with air intake openings covered by grilles **18**, and a flared annular sheet metal part **20** secured to the edge of the bottom member **16**. A series of posts **22**, threaded at both ends to receive attaching nuts, is mounted on the bottom member **16** and supports above the deflector a plate **24** which is smaller than the part **20** and cooperates therewith to define an annular mouth for discharging horizontally (or at a slight angle upwardly) in all directions the air cooled in the fixture.

The plate **24** also carries, suspended at its center, a vertically-arranged motor **26**, whose armature shaft carries at its lower end a centrifugal fan or blower **28** arranged to circulate air from the openings **18** outwardly in all directions

through the annular mouth just described. The electrical connections 30 for the motor pass downwardly through the pedestal 10. The central part of the blower 28 is in the form of an upwardly-dished disk 32 surrounding the lower part of the motor 26, adding to the compactness of the assembly.

The air circulated by the fan or blower 28 passes over a cooling coil 34, through which the cold water or brine is continuously circulated, and which is preferably arranged annularly around the outside of the blower 28. An annular drip pan 36 arranged below the coil 34 collects moisture condensed by the coil from the air being cooled, and is provided with a suitable drain conduit passing downwardly through the pedestal 10.

Figures 4 and 5 show a construction differing from that just described, in that it has a pedestal 110 of somewhat larger diameter, which receives fresh outside air from a duct 38 arranged below the floor, to be mixed with room air to be recirculated and which is received through grilled openings 118. The fixture is provided with adjustable shutters 40 controlling the amounts of fresh air and room air. Above the shutters is removably mounted a filter 42. The pedestal 110 may if desired have at its center a guide tube 111 for the refrigerant conduits and drain tube and the electrical connections.

Figure 6 illustrates a movable fixture, having a flaring base 210 and which can be moved around to a limited extent, the refrigerant conduits and drain tube being provided with flexible extensions which, with the electrical connections, are carried out from the lower part of the base as a flexible connecting assembly 212.

This figure also illustrates how the part 220 of the air deflector may be made of translucent glass, and electric bulbs 44 mounted in the fixture with their electrical connections extending through the pedestal 210, so that the fixture also serves as a semi-indirect lighting fixture.

Figures 7 and 8 illustrate how the fixture may be modified to mount it on the wall, the upper plate 324 and the bottom part 316 being shown as integral extensions from a bracket 310 adapted to be mounted on the wall, and the flared part 320 being cut off at the wall side. In this case, the refrigerant conduits and the drain tube and electrical connections of course pass into and down through the wall.

In Figure 9 there is shown a fixture in which a compressed liquid refrigerant from a remote compressor unit (not shown) is led through a conduit 412 passing through a guide tube 411 arranged axially of a pedestal 410 arranged to receive fresh air from a duct 438 below the floor, the refrigerant passing to an expansion valve 46 from which the expanded and gaseous (and cold refrigerant passes through a cooling coil 434 and back through a return conduit 414 to the compressor unit.

In this fixture the air coming up through the pedestal 410 is controlled by a shutter 440 operated by means such as a handle 48, while the room air enters through an annular filter 418 held by an apertured stamping 419 secured to the bottom member 416, the room air being controlled by an annular shutter 441 also having a suitable operating handle (not shown). The electrical connections 430 in this case pass directly to the motor 426 which actuates the centrifugal fan 436.

In this arrangement, the cooled air passes directly horizontally outward between lower and upper flat plates 420 and 423, the latter being secured to and forming an extension of the upper member 424 carried by the posts 22. In this figure the drain tube 435 of the drip pan 436 is shown extending down through the guide tube 411.

The temperature of the gasified refrigerant returning through the conduit 414 is preferably maintained high enough to prevent sweating, by mounting a thermostatic bulb 50 a sufficient distance from the end of coil 434 to assure that the refrigerant gas will be warmed to above the temperature causing sweating before leaving the coil.

The head formed by the cooling mechanism is in this embodiment vertically adjustable, the bottom member 416 being secured to the top of the pedestal 410 by bolt-and-slot fastenings 52.

The embodiment of Figure 10 is much like that of Figure 9, and corresponding parts are indicated by the same reference characters increased by 100. In this case, however, the motor 526 is supported by a bracket 524 on the upper end of the pedestal 510, and the central part 532 of the blower 528 is above the motor, and cooperates with an annular stationary plate 523 carried by the posts 22.

Figure 10*a* illustrates the fixture of Figure 10 modified so that the room air is taken in from the top through a filter 542 supported over the center of the annular plate 523 previously mentioned, the part 532*a* of the blower being changed in shape accordingly This form of intake can of course also be used with the fixtures previously described.

One important feature of the invention relates to the use of a series of fixtures, such as those described above, in cooling a large room having a relatively high ceiling, as for example the main salesroom of a department store. In the past it has been necessary to cool all the air in such a room, if the room is to be cooled at all. I reduce the cost very greatly by causing a stratification of the air, and cooling only the air below a level a short distance above the heads of the occupants, leaving untreated all of the air between that level and the ceiling, or more than half of the air in the room.

As one such arrangement, Figures 1 and 2 illustrate two floors of a department store. The street floor salesroom is indicated at 60 and the second floor salesroom at 62, with connecting stairways 64 and a mezzanine or balcony 66. The floor 68 of the second floor of course forms the ceiling of the first floor, and is shown supported on spaced pillars 70.

Various articles 72 of furniture, such as showcases and banks of shelves and the like, are distributed in the usual manner over the sales floors. These articles aid materially in stratifying the air, since they break up the space and prevent the circulation of convection currents which would interfere with the desired slow settling of a cold air blanket toward the floor. In effect, the furniture breaks up the sales space into a series of wells or pockets of cold air.

Distributed uniformly over the floor in each salesroom is a considerable number of air cooling and circulating fixtures 74 of the type shown in Figures 3 to 6, 9, 10 and 10*a*. Similarly distributed along the wall there may be wall type fixtures 76 as shown in Figures 7 and 8. Under the mezzanine there may be mounted on the ceiling a series of ceiling type fixtures 78 as described in

Patent Nos. 2,082,441 dated June 1, 1937, 2,044,832 dated June 23, 1936, and 2,069,816 dated February 9, 1937. If desired, the mezzanine may also be cooled by ceiling fixtures **78**, or reliance may be placed on cold air flowing down the stairway **64**. The stairways may also of course be closed off by doors, if desired, to prevent the flow of cold air from the second to the first floor.

The heads of all of the fixtures **74**, **76**, and **78** on each floor are at substantially the same height, at a level above the heads of the occupants and above the furniture **72**, or a level about seven to nine feet from the floor. As each of the fixtures is discharging cold air horizontally in all directions, this results in a blanket of cold air at this level, which settles slowly toward the floor. The warmed air is displaced upwardly to the intakes of the fixtures **74**—**76**—**78**, and (especially if fresh outside air is mixed with the recirculated air) into the space between the cold air blanket and the ceiling of the room.

Figure 11 illustrates the connections in or below the floor and leading to the fixtures **74** and **76**. In this case the fixtures are of the type using a liquid refrigerant gasified through expansion valves into the cooling coils. The return lines **80** all lead to a compressor **82** in the basement, shown as belted to and driven by a motor **84**. The compressed refrigerant is then cooled and liquefied in a water cooled condenser coil **86**, and then collects in an accumulator **88**, from which it passes through conduits **90** to the expansion valves in the fixtures **74** and **76**. The various condensate drains all empty into conduits **92** emptying into the drain **94** of the plumbing system.

Figure 12 illustrates how the fresh air ducts **38** may be supplied from a main air supply pipe **96** fed by a motor-driven blower **98**.

While various illustrative constructions have been described in detail, it is not my intention to limit the scope of the invention by that description, or otherwise than by the terms of the appended claims.

I claim:

1. That method of air-conditioning a room having a high ceiling which comprises directing horizontally in all directions from substantially uniformly distributed points at the same level, just above the heads of the occupants of the room and well below the ceiling, cooled air which settles gradually toward the floor without noticeable air currents and which displaces warm air below said level and forces it upwardly, part of said cooled air being recirculated room air and part being cooled fresh air from outside of the room.

2. An air conditioning fixture comprising a pedestal constructed and arranged to rest on the floor of a room, a head at the upper end of the pedestal comprising a cooling coil and means for circulating air over the coil and generally horizontally outward in all directions from the axis of the pedestal and having means below the cooling coil for collecting moisture condensed from the air by said coil, and connections passing vertically through the pedestal for circulating refrigerant fluid to and from said coil and for removing condensate from said collecting means, and means formed and arranged to supply fresh outside air from below said pedestal to be passed upward through said pedestal and mixed with room air recirculated by said circulating means.

3. An air conditioning fixture comprising a pedestal constructed and arranged to rest on the floor of a room, a head at the upper end of the pedestal comprising a cooling coil and means for circulating air over the coil and generally horizontally outward in all directions from the axis of the pedestal, and connections passing vertically through the pedestal for circulating refrigerant fluid to and from said coil, and means being formed and arranged below said pedestal to supply fresh outside air through said pedestal to be mixed with room air recirculated by said circulating means.

4. An air conditioning fixture comprising a pedestal constructed and arranged to rest on the floor of a room, an upwardly-facing air deflector mounted on the upper end of the pedestal, a horizontal member carried by the pedestal and mounted above and within the outline of said deflector and with the edge of the deflector defining an annular mouth directed at an angle slightly above a horizontal plane, air cooling means between said member and the deflector, and means for directing air over the air cooling means and out through said mouth.

5. An air conditioning fixture comprising a pedestal constructed and arranged to rest on the floor of a room, an upwardly-facing air deflector mounted on the upper end of the pedestal and having an air intake opening arranged adjacent the pedestal, a horizontal member carried by the pedestal and mounted above and within the outline of said deflector and with the edge of the deflector defining an annular mouth, air cooling means between said air intake opening and said mouth and between said member and the deflector, and means for directing air from the air intake opening over the air cooling means and out through said mouth.

6. An air conditioning fixture comprising a pedestal constructed and arranged to rest on the floor of a room, an upwardly-facing air deflector mounted on the upper end of the pedestal, a horizontal member carried by the pedestal and mounted above and within the outline of said deflector and with the edge of the deflector defining an annular mouth directed at an angle slightly above a horizontal plane, air cooling means between said member and the deflector, and means for directing air over the air cooling means and out through said mouth, said fixture being provided with an intake for room air to be recirculated by said air-directing means.

7. An air conditioning fixture comprising a pedestal constructed and arranged to rest on the floor of a room, an upwardly-facing air deflector mounted on the upper end of the pedestal, a horizontal member carried by the pedestal and mounted above and within the outline of said deflector and with the edge of the deflector defining an annular mouth directed at an angle slightly above a horizontal plane, air cooling means between said member and the deflector, and means for directing air over the air cooling means and out through said mouth, said fixture being provided with an intake for room air to be recirculated by said air-directing means and said pedestal being provided with means for supplying fresh outside air and mixing it with the recirculated room air.

8. An air conditioning fixture comprising a pedestal constructed and arranged to rest on the floor of a room, a head at the upper end of the pedestal comprising a cooling coil and means for circulating air over the coil and generally horizontally outward in all directions from the axis of the pedestal, and connections passing ver-

tically through the pedestal for circulating refrigerant fluid to and from said coil, said head being provided with an intake for room air to be recirculated by said air-directing means and said pedestal being provided with means for supplying fresh outside air and mixing it with the recirculated room air.

9. An air cooling fixture comprising an upwardly-dished member having a support extended at one side in the form of a bracket adapted to be secured to the wall of a room, a plate mounted above and in the mouth of said member and with the edge of said member defining an annular mouth except on the side of said bracket, air-cooling means between said member and plate, and means for circulating air over the cooling means and outwardly through said mouth.

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