May 28, 1957 M. L. MUELLER 2,793,508

HOUSEHOLD AIR CONDITIONING SYSTEMS

Filed Dec. 7, 1953 3 Sheets-Sheet 1

FIG. 1

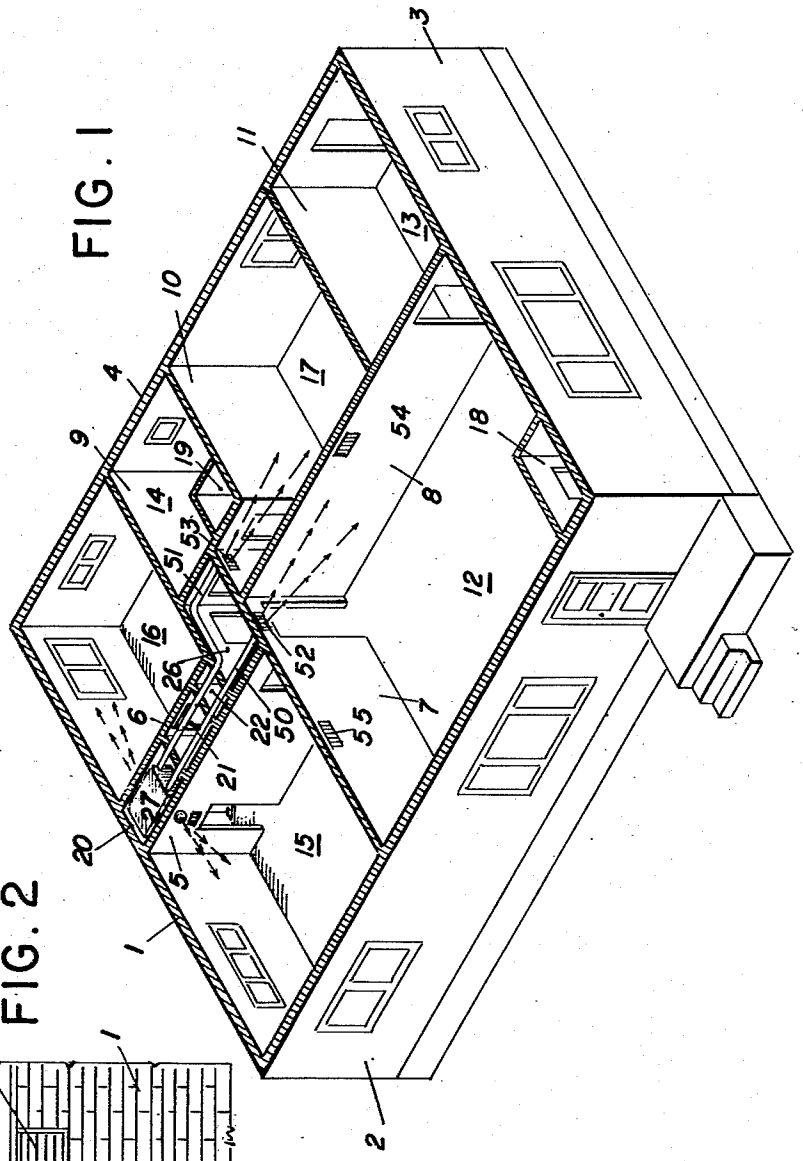
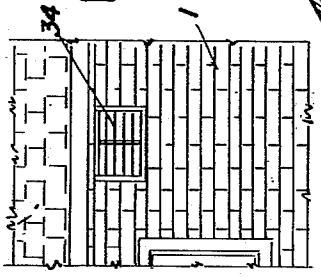


FIG. 2



INVENTOR
MORITZ L. MUELLER
Albert H. Kirchner
BY
ATTORNEY

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FIG. 4

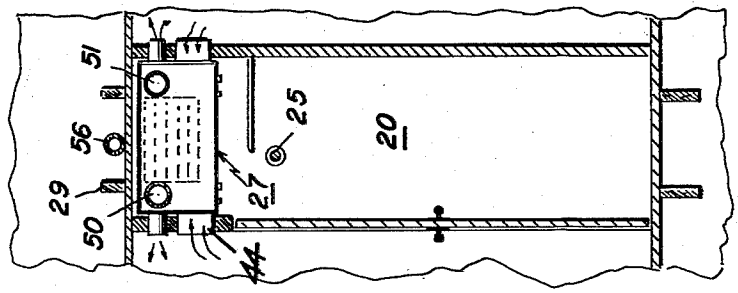
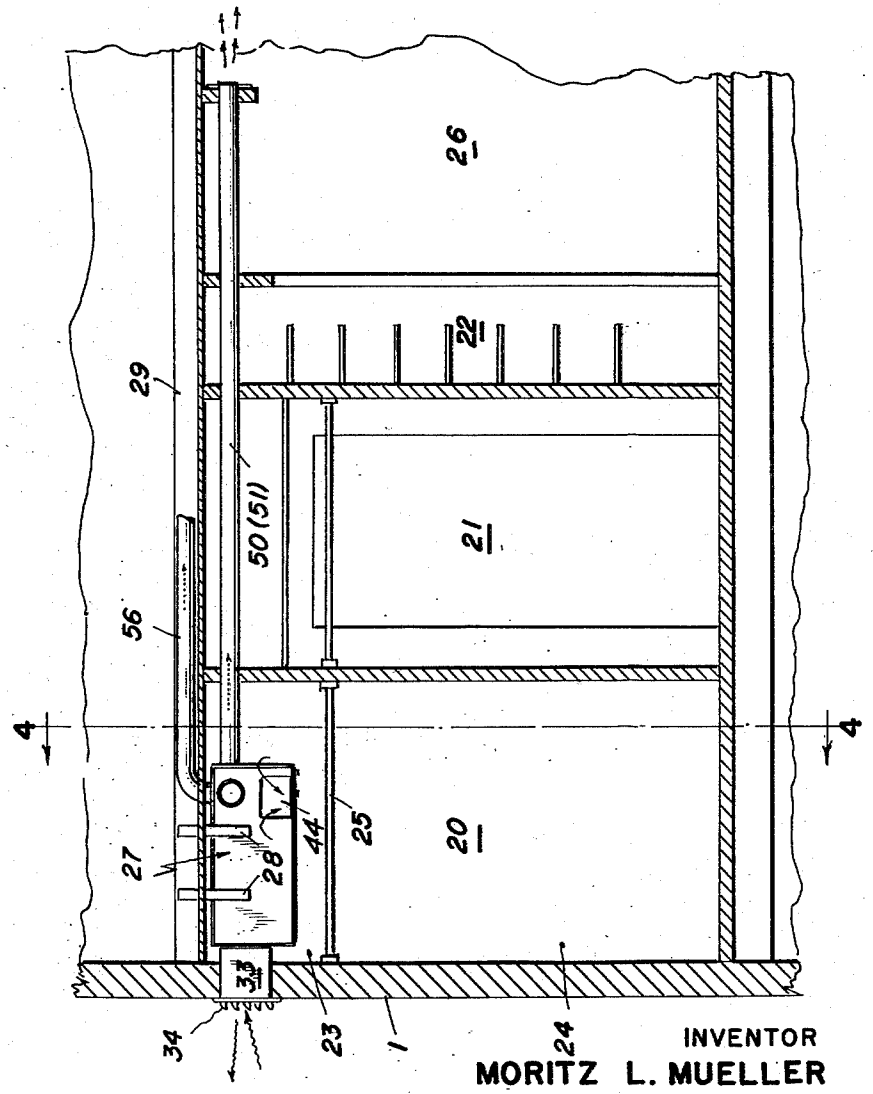


FIG. 3



INVENTOR
MORITZ L. MUELLER

BY Albert H. Kirchner
ATTORNEY

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FIG. 5

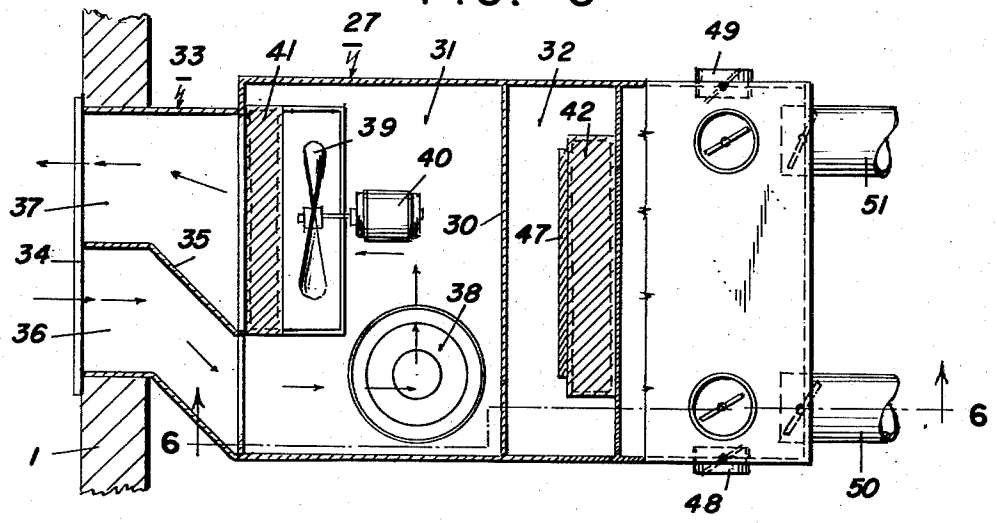


FIG. 6

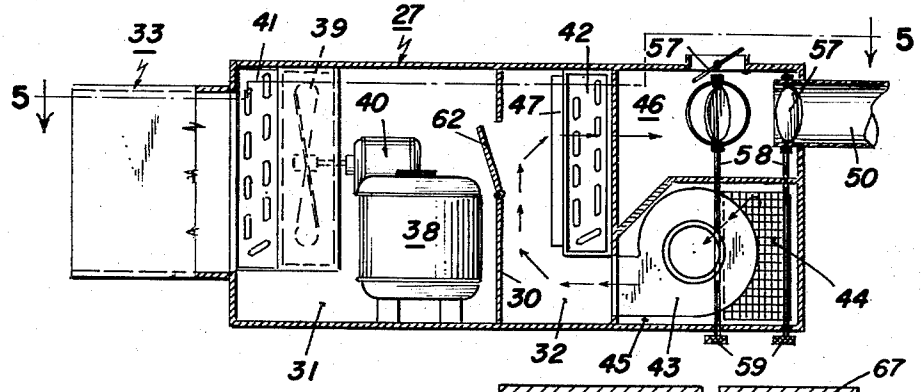
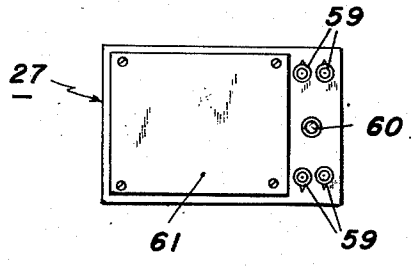


FIG. 7



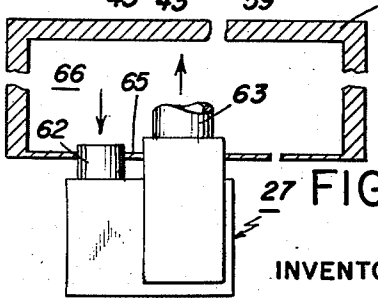


FIG. 8

INVENTOR

MORITZ L. MUELLER

BY Albert H. Kirchner

ATTORNEY

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HOUSEHOLD AIR CONDITIONING SYSTEMS

Moritz L. Mueller, Silver Spring, Md.

Application December 7, 1953, Serial No. 396,645

8 Claims. (Cl. 62—129)

The present invention relates to air conditioning systems and its principal object is to provide a practical installation for cooling the rooms of a dwelling house at unusually low equipment cost and operating expense.

The most practical air cooling systems now available for dwelling house use involve separate units for the individual rooms, generally located in windows where they are unsightly, occupy useful space, obstruct light, interfere with draperies, curtains and the like, and entail high equipment, installation, maintenance and operating expenses. Other types of installation have been proposed, involving a central unit connected by conduits to the rooms to be cooled, but these have all been objectionable as being too costly for the great majority of small home owners, as occupying otherwise usable space, and for other and related reasons, so that none has become widely adopted, with the result that the prior art now affords no type of installation within the financial reach of the average purchaser of a modern small dwelling house of one to three or four bedrooms.

The present invention aims to satisfy this present want by providing a system in which a single air conditioning unit is installed in a space that is available in substantially every small dwelling house and which is normally not used at all or is at best put only to low-value use as a dead storage space.

The invention includes the further advantage of so arranging the unit with relation to the rooms to be cooled and so equipping it with controls that the rooms may be cooled selectively at the option of the householder, with, for example, only the bedrooms being cooled at night and only such space as the living room and dining room being cooled during the day, with the result that a comparatively small capacity unit of correspondingly low cost is adequate to service a total room area that would require a much greater aggregate of air conditioning capacity if supplied in the form of separate units for the individual rooms.

A further advantage resides in the selection of a unique location for the unit that will minimize the number and length of conduits required to establish communication with the rooms to be cooled and with the exterior atmosphere for exhausting waste heat.

Other and further advantages and objects of the invention will be apparent to those skilled in the art from the following description of the preferred embodiment shown in the accompanying drawings, in which

Figure 1 is a perspective view of the floor plan of a typical modern relatively small dwelling house showing the system installed;

Fig. 2 is a side elevational view of a portion of the outer surface of one of the outer walls of the house showing the openings therethrough establishing an intake for condensing air and an exhaust for waste heat;

Fig. 3 is a vertical sectional view taken through the outer wall shown in Fig. 2 and through certain of the interior walls showing the unit installed and connected

with the outer atmosphere and with the rooms to be cooled;

Fig. 4 is a vertical sectional view taken at right angles to the view of Fig. 3, on the line 4—4 of Fig. 3;

Fig. 5 is a horizontal sectional view taken on line 5—5 of Fig. 6;

Fig. 6 is a vertical sectional view taken on the line 6—6 of Fig. 5;

Fig. 7 is a bottom plan view of the unit; and

Fig. 8 is an end elevational view of a modified form of unit.

But these views, and the following description of the structure and arrangement depicted by them, are to be regarded only as disclosing a preferred embodiment in which the invention has been actually reduced to practice and which has been found to be entirely satisfactory and hence is at present preferred, and the details of this embodiment are given merely for the purpose of disclosure and not for the purpose of limiting the principles of the invention. Those principles are capable of considerable modification in other and further embodiments, all within the spirit of the invention as defined by the broader of the appended claims.

Generally speaking, the invention, in its full and preferred embodiment, involves locating an air conditioning unit in the upper zone of a clothes or analogous closet of the house or equivalent dwelling unit, isolating the unit from the lower zone of the closet so that its air circuits do not include any of the lower zone space, connecting the unit with passageways through the walls that define the closet for communication with the exterior atmosphere and with the rooms to be cooled, and providing controls accessible from the lower zone of the closet for regulating selectively the delivery of cooled air to the several rooms.

It will be appreciated, it is believed, that substantially all modern dwelling houses, including even the smallest and lowest priced, have closets built in them or otherwise provided for the storage of clothes and other belongings of the occupants. Such closets commonly extend full floor to ceiling height, which is generally not less than eight feet in most houses now being constructed in the lowest price range. Considerably less than this eight feet height is ordinarily utilized for the sole purpose to which the closets are now intended to be put, i. e., for the hanging of clothes or the installation of shelves, and the space thereabove is seldom used for any purpose other than, in relatively rare instances, as dead storage space by fitting the high upper reaches of the closet with a shelf that is necessarily made quite narrow to permit parcels and articles to be put onto it and removed from it.

It is in this upper closet zone of no or very little practical usefulness that the present invention contemplates installing the air conditioning unit. There installed the unit detracts substantially nothing from the utilizable space within the house, and it is completely removed from sight and interference with any of the usual household furnishings. Moreover, relegation to such a location makes it unnecessary to dress the unit in any ornamental casing. Inexpensive unfinished sheet metal of light gauge is entirely adequate.

Moreover, most modern houses, particularly the smaller, low-cost homes for which the invention is more particularly proposed, include closets having one wall which is an outside wall. It is in such a closet that the unit is preferably installed because communication with the outside atmosphere for intake of condensing air and exhaust of waste heat is in such a case achieved at minimum expense by extending very short passageways through the outer wall.

Communication with the rooms to be cooled is effected by passageways through such single inner walls as direct-

ly separate the closet from any room or rooms to be cooled, which passageways may be very short and hence inexpensive to provide, and by conduits extending from the unit to any additional room which may not have an inner wall in common with the closet. The communication between each of the rooms and the unit is in each case effected by delivery and return openings, passageways or conduits which are entirely independent of the lower zone of the closet, so that none of the delivered or returned air traverses a path including any of the air in the lower zone. Hence cooling effort is not wasted on the storage space of the closet, where of course it is not wanted, and it becomes immaterial if the lower zone be filled with clothing or other things to be stored to a degree that would clog the space and impair the flow therethrough of air that might, in a different type of installation, be required as part of the circulating path.

Furthermore, while the space occupied by the unit in the presently proposed installation is, as has been seen, largely inaccessible, the bottom surface of the unit casing can be provided with controls for selecting delivery of cooled air to the individual rooms of the house, as well as for turning the unit off and on, and these controls can be arranged to be easily accessible from within the closet, i. e., from the lower zone thereof, without interference with the storage use of the lower zone.

In the drawing, Fig. 1 depicts the floor plan of a typical modern type of small dwelling house in which outer walls 1, 2, 3 and 4 cooperate with inner walls 5, 6, 7, 8, 9, 10 and 11 to define a living room 12, a kitchen 13, a bathroom 14, a pair of bedrooms 15 and 16, and an additional room 17 which may be used as a bedroom or as a dining room, den or otherwise. The rooms 12, 15, 16 and 17 are to be cooled; the bathroom 9 and kitchen 11, in accordance with standard practice, are not to be cooled.

The house includes substantially the usual full complement of closets, as shown at 18, 19, 20, 21 and 22, each being provided with a door opening into one or another of the rooms or into the hallway 26 between rooms 12, 15, 14 and 16. The closet 20 is selected for housing the air conditioning unit because that closet is defined in part by an outer wall 1 and by two inner walls 5 and 6 which constitute the sole separation between the closet and two of the rooms to be cooled. These three walls therefore require only minimum length passageways through them for intake and exhaust of condensing air (wall 1) and for recirculation of air to and from the rooms 15 and 16 (walls 5 and 6).

The closet 20, like the other closets, is of full ceiling height, so that, as best appears in Fig. 3, it includes a relatively inaccessible upper zone 23 above a lower zone 24 which is of ample height for all usual storage purposes, including for example the hanging of clothes on the customary cross rod 25. In the particular arrangement shown, the closet 20 which is selected for the location of the air conditioning unit is one of three closets conveniently located in the space between the rooms 15 and 16. This closet serves the room 15. It is adjacent to another closet 21 which serves the room 16, and this closet in turn abuts a smaller linen closet 22 which opens into the hall 26 by which access is had to the rooms 15, 16, 14, 12 and 17.

It is in the upper zone 23 of the closet 20 that the air conditioning unit 27 is installed as by suspending it by any suitable hangers 28 from the ceiling joists 29.

The unit comprises a casing of generally low oblong shape and is internally divided by a vertical cross partition 30 into a "hot" chamber 31 and a "cold" chamber 32. The hot chamber comprises the end portion of the casing which is nearer to the outer wall 1, and it communicates with the outside atmosphere by means of a divided duct 33 extending through an opening in that wall and terminating more or less flush with the outer surface of the wall in a grille or louvered opening 34.

The partition 35 which divides the duct separates it into two passageways: an intake 36 and an outlet 37. The intake leads directly to a compressor and motor assembly 38 in the chamber 31 over which air from the intake is pulled by a fan 39 driven by a motor 40 which blows the air through a condenser coil 41 in the chamber 31 before exhausting it through the outlet passageway 37.

The chamber 32 contains an evaporator coil 42 which is supplied with liquified refrigerant from the condenser coil 41 by appropriate connections (omitted from the drawings in the interest of simplicity) to form a refrigerating apparatus of the familiar compressor-condenser-evaporator cycle. The chamber 32 also contains a blower and motor assembly 43 and one or more inlet openings 44 mounted in an intake compartment 45 and a number of valved outlet openings provided in a supply compartment or plenum chamber 46. The intake compartment and plenum chamber are partitioned from each other and are so related to the evaporator coil 42 that air drawn through the openings 44 by the blower 43 will be passed through the evaporator coil (and preferably also through a filter 47 which may be affixed to the coil as shown in Figs. 5 and 6) to be cooled and discharged directly into the plenum chamber 46 for delivery through the valved openings therein to the rooms selected to be cooled, as will now be explained.

With the unit positioned in the preferred location illustrated, the rooms 15 and 16 may be supplied with cooled air by the plenum chamber outlets 48, 49, respectively, which may be simple short nipples or sheet iron stovepipe sleeves just long enough to fit through openings cut in the walls 5 and 6. Similarly the air intake openings 44 may be grilled or louvered holes cut in the walls 5 and 6. The rooms 15 and 16 are thus supplied with cooled, recirculated air without requiring any ducts for the purpose.

The other rooms that are to be cooled, such as the rooms 12 and 17 in the installation shown, are supplied with cooled air by ducts 50, 51 which extend from separate outlet openings in the plenum chamber 46 to delivery openings or registers 52, 53 in the respective rooms. Air is returned from these rooms to the unit by openings such as those shown at 54 in the wall 8 and 55 in the wall 7, each preferably located up near the ceiling. Such openings establish communication with the room 15 for return of air from the rooms 12 and 17 to the unit through opening 44 in the wall 5 of the room 15. If desired, other and more direct paths may be provided for returning air from the rooms 12 and 17, but the openings 54 and 55 have been found entirely adequate, and of course their cost is less than that of individual conduits.

The delivery conduits 50, 51 may be directed along the uppermost zone of the hall 26, as shown in Fig. 1, or at somewhat greater expense they may be run above the ceiling as shown at 56 in Figs. 3 and 4. In either case they are preferably made of relatively small bore so as to be inexpensive and inconspicuous, and they are caused to deliver an adequate supply of air by maintaining a sufficiently high pressure in the plenum chamber 46. The conduits may be made of any suitable sheet or other material, with or without insulating covering.

Each of the outlet or delivery openings in the plenum chamber 46, through which conditioned air is supplied directly to the rooms or to the conduits 50, 51 for transmission to other rooms, is provided with a valve or damper 57 which is operable between fully open and fully closed positions by means accessible from below the unit, such as the shafts 58 which are journaled in the unit casing bottom and terminate in knobs 59. The casing bottom also has mounted on it, for access from below, a switch 60 for turning the unit off and on, and a portion of the bottom, such as the plate 61, may be made removable to provide for servicing the mechanism, cleaning or replacement of the filter 47, etc.

It may be found desirable also to provide in the partition 30, which separates the hot end from the cold end of the unit, a door 62 as shown in Fig. 6 which is normally spring pressed to closed position but which is capable of opening, upon the occurence of some abnormally low pressure in the chamber 31 (such as might result from clogging of the intake opening 36) so as to admit air from the chamber 32 and thus relieve the low pressure and provide air for cooling the condenser coil 41.

Fig. 8 shows a modification of the first preferred embodiment in which the duct 33 is replaced by an intake conduit 62 and an exhaust conduit 63, both extending up into the space above the closet ceiling 65 to terminate in the attic 66 or to be extended through the roof 67 or otherwise to the exterior atmosphere. This is an arrangement that may be employed in the unusual circumstance of a house floor plan which does not include a closet adjacent to an outer wall or where for any reason it is not desired to form openings in such outer wall.

The manner in which the installation functions to achieve the objects of the invention and produce its advantages will, it is believed, be evident from the foregoing explanation. It is believed to be necessary only to add that in normal use the householder will set the controls 59, 60 selectively to supply conditioned air to only that portion of the house in which cooling is actually needed or can be used to advantage and to eliminate from the unit the load of delivery to rooms that are not at the time being used. Thus, in normal operation only the bedrooms, or those of the bedrooms that are being occupied, will be supplied during the night, and only the living room will be supplied during the daytime, with of course always the possibility of selectively altering the arrangement as conditions may require, as for example in the event that illness requires occupancy of a bedroom during the daytime. This selective delivery makes it possible to service the entire dwelling house with a single unit of considerably smaller capacity than the total that would be required if individual units were installed in each of the rooms.

The great advantage of this last mentioned feature of the invention will, it is believed, be appreciated when it is realized that in actual practice of the invention a three-quarter horsepower or one ton capacity compressor, installed as hereinabove explained, has been found adequate to service an entire house of 600 square feet of combined living, dining and bedroom floor space of average construction and exposure, and that approximately 85% of all one-story and one-and-one-half-story homes recently and currently constructed have less than 600 square feet of room area.

I claim:

1. In a human occupancy building, a plurality of walls including outer and inner walls defining a room and an enclosed space separate from said room and including a lower zone adapted to be used as a closet and an upper zone, an air conditioning unit in said upper zone including a condenser coil and an evaporator coil mounted in separate chambers sealed from each other and from said lower zone, means for circulating air from outside the building through an outer wall and said condenser coil comprising a duct extending from an opening in said wall direct to said condenser coil, and means for conducting air in a separate circuit directly from said room through said evaporator coil for conditioning thereby and thence back into said room, said separate circuit excluding said lower zone of said enclosed space.

2. In a human occupancy building, a plurality of walls defining a room and an enclosed space separate from said room and including a lower zone adapted to be used as a closet and an upper zone, an air conditioning unit in said upper zone including a condenser coil and an evaporator coil mounted in separate chambers sealed from each other and from said lower zone, means for circulating air from outside the building through said condenser coil comprising duct means establishing communication directly between the atmosphere outside the building and the condenser coil and thence to said outside atmosphere for discharge therein, and means for conducting air in a separate circuit directly from said room through said evaporator coil for conditioning thereby and thence back into said room, said separate circuit excluding said lower zone.

3. In a human occupancy building, a plurality of walls including outer and inner walls defining a room and an enclosed space separate from said room, adjacent to an outer wall and including a lower zone adapted to be used as a closet and an upper zone, an air conditioning unit in said upper zone including a condenser coil adjacent to said outer wall and an evaporator coil mounted in separate chambers sealed from each other and from said lower zone, a pair of passageways formed in said outer wall and communicating directly with said condenser coil, means for circulating air from outside the building through said passageways and said condenser coil and thence to the outside of the building for discharge, and means for conducting air in a separate circuit directly from said room through said evaporator coil for conditioning thereby and thence back into said room, said separate circuit excluding said lower zone.

4. In a human occupancy building, a chamber comprising an attic space at an upper level and a room and an enclosed space at a lower level, said room and enclosed space being separated from each other by a wall and said enclosed space including a lower zone adapted to be used as a closet and an upper zone below the level of said attic space, an air conditioning unit in said upper zone including a condenser coil and an evaporator coil mounted in separate chambers, means for circulating air from said attic space through said condenser coil, and means for conducting air in a separate circuit directly from said room through said evaporator coil for conditioning thereby and thence back into said room, said separate circuit excluding said lower zone.

5. In a human occupancy building, a plurality of walls defining a plurality of rooms and an enclosed space separate from said rooms and including a lower zone adapted to be used as a closet and an upper zone, an air conditioning unit in said upper zone including a casing having a bottom sealing said unit from said lower zone, a condenser and an evaporator in separate compartments in said casing, direct means for conducting air from outside the building directly through said condenser and thence discharging it outside the building, means including a plurality of conduits for conducting air from said rooms through said evaporator for conditioning therein and thence back into said rooms through circuits excluding said lower zone, and controls mounted on said casing bottom and accessible for manual actuation from said lower zone for regulating the delivery of air from said unit to said rooms.

6. In a human occupancy building, a plurality of walls including an outer wall and a pair of spaced parallel interior walls cooperating with said outer wall to define a pair of rooms and an intervening space separated from said rooms and including a lower zone adapted to be used as a closet and an upper zone, an air conditioning unit in said upper zone including a condenser coil adjacent to said outer wall and an evaporator coil relatively remote from said outer wall, a pair of passageways formed in said outer wall and leading directly to said condenser coil, means for circulating air from outside the building through said passageways and said condenser coil, passageways in said interior walls, and means for circulating air from said rooms through said interior wall passageways and said evaporator coil for conditioning thereby and delivery to said rooms through a circuit excluding said lower zone.

7. In a human occupancy building, a plurality of walls including outer walls and interior walls defining a plurality of rooms including a pair of rooms separated by an intervening space bounded by one of said outer walls and

including an additional room, said intervening space including a lower zone adapted to be used as a closet and an upper zone, an air conditioning unit in said upper zone including a condenser coil adjacent to said one outer wall and an evaporator coil relatively remote from said one outer wall, a pair of passageways formed in said one outer wall and leading directly to said condenser coil, means for circulating air from outside the building through said passageways and said condenser coil, passageways formed in the interior walls separating said intervening space from said pair of rooms and establishing communication between said pair of rooms and said evaporator coil, conduit means establishing communication between said additional room and said evaporator coil, and means for circulating air from said rooms through said interior wall passageways and said conduit means through said evaporator coil and back into said rooms through circuits excluding said lower zone.

8. The combination claimed in claim 7, including a

casing for said unit having a bottom separating said unit from said lower zone, and controls mounted on said casing bottom and accessible for manual actuation from said lower zone for regulating the delivery of air from said unit to said rooms.

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