# United States Patent

[11] 3,566,767


[72] Inventor **Paul Odelga**
**17 Nedergasse, 1190 Vienna, Austria**



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[33] **Austria**
[31] **A9194/67**


[54] **AIR VENTILATING OR AIR CONDITIONING SYSTEM**
**4 Claims, 11 Drawing Figs.**


[52] **U.S. Cl.** ..... **98/31,** 165/22, 98/33
[51] **Int. Cl.** ..... **F24f 7/00**
[50] **Field of Search** ..... 165/22; 98/33 (R), 122, 31



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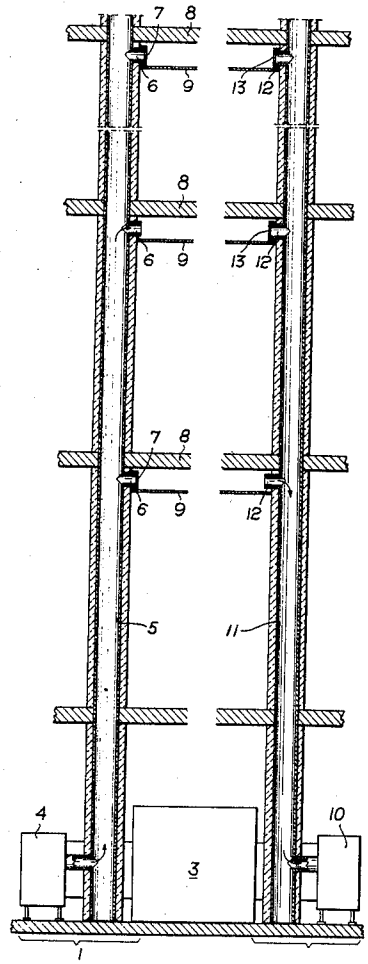
*Primary Examiner*—William J. Wye
*Attorney*—Singer, Stern & Carlberg



**ABSTRACT:** An air conditioning system for a building structure having several floors and which is provided with a ducting work having a horizontal main duct to which are connected at least two vertical distributing ducts is improved by making the vertical distributing ducts of equal cross section throughout their entire length. At least some of the floors are provided with openings which are in communication with said vertical ducts and serve for supplying and exhausting air respectively. Said openings are provided with selectively applicable closure caps.

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2 Sheets-Sheet 1

FIG. 1

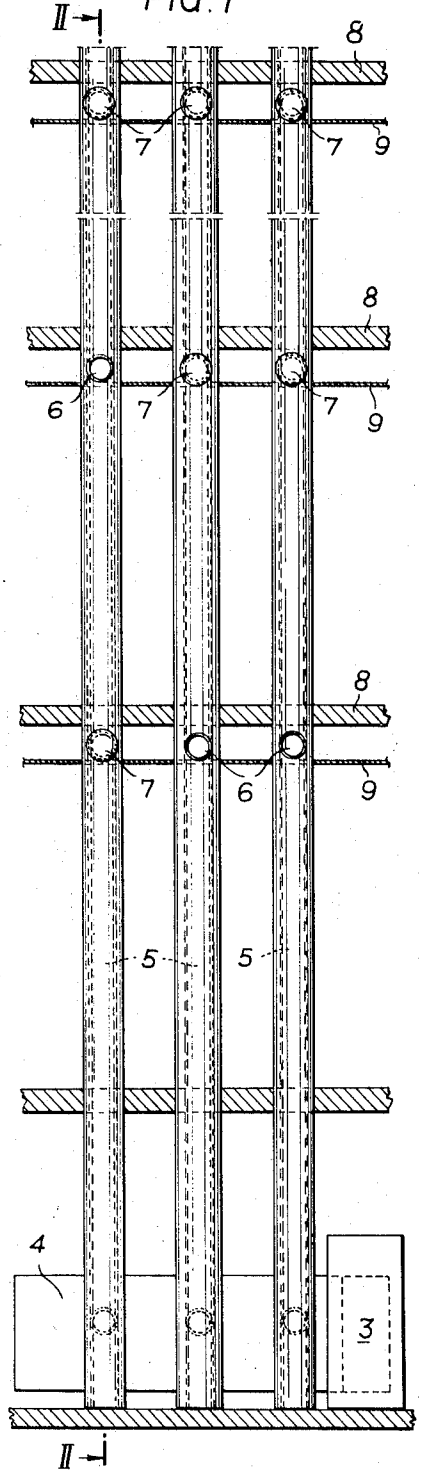
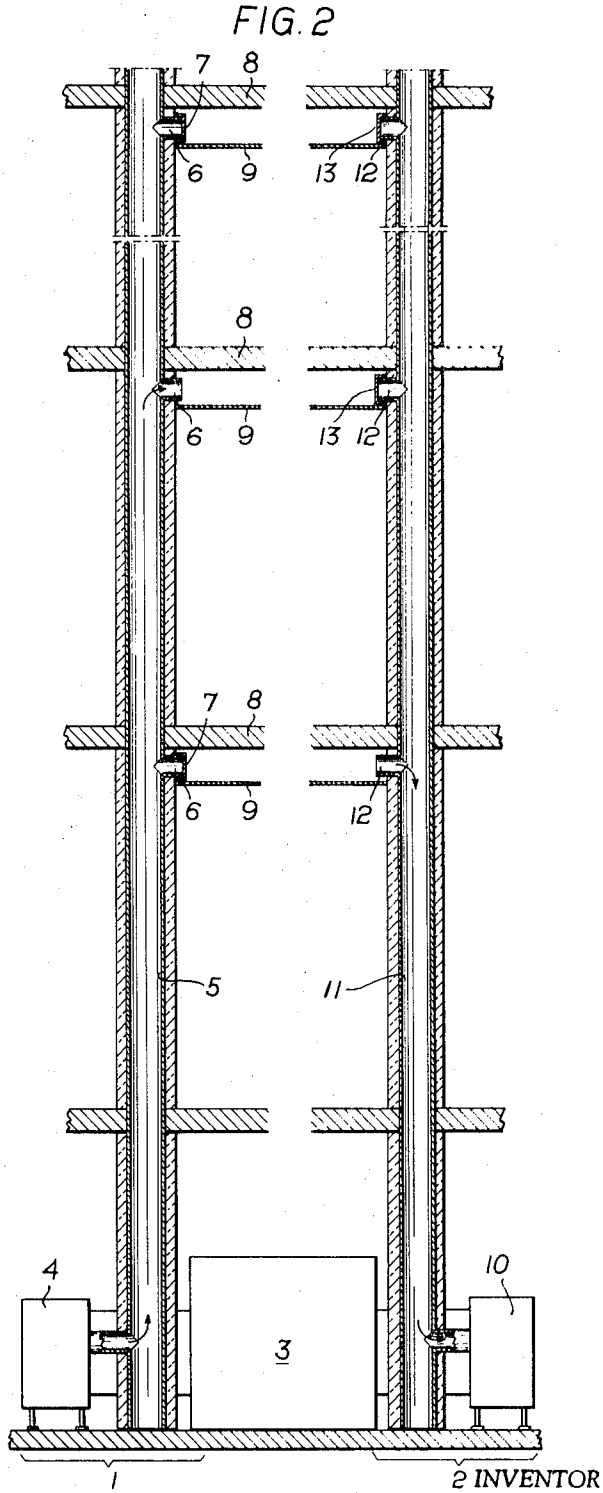



FIG. 2




INVENTOR
Paul Odelga
BY Singer, Stern & Carlberg
ATTORNEYS

FIG. 3

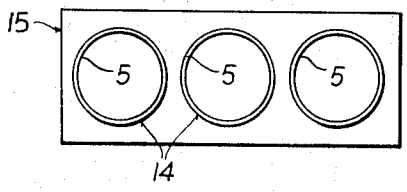



FIG. 4

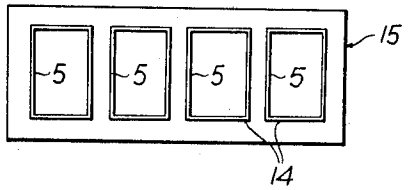



FIG. 5

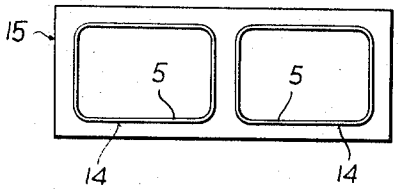



FIG. 6

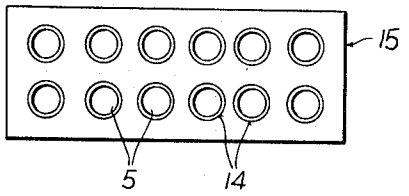



FIG. 7

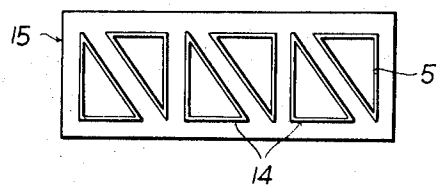



FIG. 8

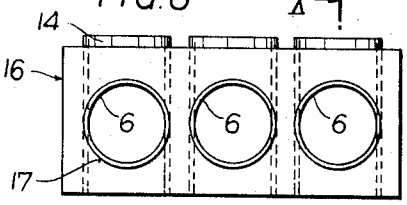



FIG. 9

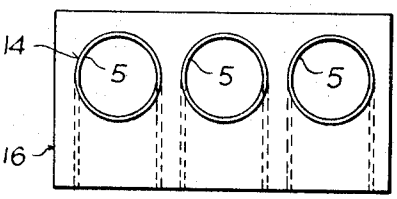



FIG. 10

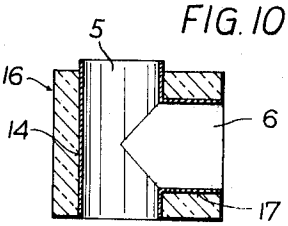
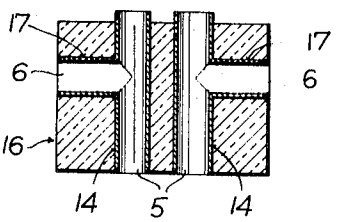



FIG. 11




INVENTOR

Paul Odelga

BY Singer, Stern & Carlberg

ATTORNEYS

# AIR VENTILATING OR AIR CONDITIONING SYSTEM

The invention refers to an air ventilating or air conditioning system.

Air ventilating or air conditioning systems are being used in ever increasing extent in view of simultaneaously with technical progress steadily infiltrating life additional heat sources being installed in increasing number within rooms, in view of the high prices of real estates and in view of the high building costs the air space available per individual becoming ever smaller. Air ventilating or air conditioning systems are therefore not only installed within crowded buildings, for instance warehouses, restaurants, cafe's, cinemas, theatres, auditoriums and so on, but also in ever increasing extent within office buildings, and it is also desireable to provide mixed apartment and office buildings and buildings exclusively intended for apartments with air ventilating or air conditioning systems. This trend is, however, counteracted by the high costs for installing air ventilating and air conditioning systems of known construction. This applies also when installing an air ventilating or air conditioning system within existing buildings, because, in most cases, this is only possible under extensive building alterations. Furthermore, such air ventilating or air conditioning systems require a relatively large area which is not always and everywhere at disposal.

Furthermore, when planning new buildings, there exists the problem that in spite of the cooling capacity of air conditioning systems in dependence on given climatic conditions being determinable, the cooling capacity of air conditioning systems in dependence on the heat production within the rooms cannot be exactly determined, because when planning new buildings it is not forseeable what the rooms are to be used for. Even if the future user of the building is fixed this problem still exists, because this future user is in most cases not in the position to give informations relative to the number of persons and to the number and type of machines to be accommodated within the rooms. Even if it is not intended to install within the rooms machines and apparatus of great heat production, for instance computers, the heat production within rooms of equal size and equal orientation may vary by 100 percent. Such variations, of course, must be considered when planning an air conditioning system.

If, with the time elapsing, individual rooms are made another use of as originally planned, or if rooms are enlarged by removing separating walls, or if rooms are reduced in size by erecting partition walls, unobjectionable performance of the originally planned air conditioning system can no more be expected. To reestablish an unobjectionable performance of the air conditioning system, existing air ducts must be altered and fixed at other places, or additional air ducts must be installed. In both cases extensive constructional work is necessary and high costs and a long stand still of the air conditioning systems is unavoidable.

Air conditioning systems of the type most frequently used comprise a central air processing equipment being arranged in the cellar or on the loft, and a vertical air duct or, in case of a dual ducting system working under high pressure, two vertical air supply ducts (one duct conveying cold air and the other duct conveying warm air), whereby to the air supply duct or to the air supply ducting work branch conduits are horizontally connected at the level of the corresponding floors. As a rule, a vertically arranged sucked air duct is provided via which a part of the sucked air (circulated air) is returned to the air processing equipment and the other part of the sucked air (exhaust air) is exhausted to the atmosphere. Such a sucked air or recirculated air duct can be omitted if the air conditioning system works under a pressure exceeding atmospheric pressure, or works with internal air circulation. Since from the vertical air supply duct the branch conduits are branched off at the respective floors, the cross section of the air supply duct must be, with the air processing equipment arranged at the loft, gradually reduced from top to bottom for establishing approximately uniform pressure conditions for all branch conduits. If now an additional branch conduit is provided or if the cross section of the branch conduit is altered or a branch is closed down, the pressure conditions and the air velocity is changed to such an extent that the air conditioning system can no more be properly operated.



It must further be considered that in view of the large cross section both, the air supply duct and the recirculated air duct act like a chimney. Furtheron, the propagation of fire from one floor to the other is greatly favorized by the openings in the air supply duct and in the recirculated air duct. Both facts are quite undesired in crowded buildings.

The invention now aims at avoiding the difficulties and disadvantages mentioned. The invention particularly aims at improving an air ventilating system or air conditioning system comprising at least one ducting work provided with a horizontal main duct to which are connected at least two vertical distributing ducts. The improvement of the system defined above consists, according to the invention, in the fact that each of the vertical distributing ducts is of equal cross section area over its whole length and is provided at at least some of the floors, preferably at each floor, with openings for exhausting air or sucking air, respectively, each of said openings being provided with closure means, and the cross section are of each of said openings being equal to that of the respectively corresponding vertical distributing duct, so that the total amount of air supplied via the ducting work may selectively be fed to one floor, several floors or all floors. With this construction an air circulating or air conditioning system is provided, which, at any time, may be adapted to new requirements arising. The danger of fire propagation is essentially reduced in view of the vertical climate duct of large cross section not being necessary with the inventive construction, which climate duct, however, is necessary with known constructions. Adaptability to the varying requirements of a system according to the invention results from the possibility to close a vertical distributing duct operated up to now and to open another vertical distributing duct in case a heat source has been put at another place. In case a room needs more cooling or more heating, a further duct at the floor of said room (not used till that moment) can be opened by removing the air tight closure means. As can be seen, the invention provides the possibility to adapt an air conditioning system to all normally occurring requirements without encountering constructional difficulties or being forced to install additional ducts. It is only necessary to consider the requirements of the system according to the invention when planning a ground plan of a building. It is of advantage that, according to the invention, the vertical distributing ducts can consist of tubular profiles of plastic material, said tubular profiles being provided with a jacket of fire resistant material, for instance concrete.

According to the invention there exists the possibility to embed the vertical distributing duct within prefabricated wall plinths consisting of fire resistant material, for instance concrete. Reinforcing iron rods may be incorporated within said jacket of fire resistant material, so that the jacket consisting of concrete, together with the vertical distributing ducts may serve as carrying part, for instance for the ceilings of the building.

The space requirements are substantially reduced because the vertical climate duct necessary with air conditioning systems recently used and having a large cross section, can be omitted, the cross section of said climate duct being larger by 60 to 100 percent than the necessarily large cross section of the air ducts. This is based on the necessity in known systems to provide for an accessibility of certain parts and the possibility for mounting certain parts within the vertical ducts. These requirements are not necessary with a system according to the invention. Therefore, with a system according to the invention. Therefore, with a system according to the invention the space requirements are smaller than the necessary cross section of the duct. In dependence on the selected cross section of the ducts, for a duct cross section of 0.17 to 0.29m$^2$ there results an additional space requirement of 0.18m$^2$ in ex-

cess of the constructionally necessary wall thicknesses, i.e. in most cases less than the free duct cross section. In buildings having six or seven floors, which buildings recently are most frequently erected, there results a saving of 1 to 2 percent in disposable space based on the total disposable base area with the outer dimensions of the building remaining unchanged.

A further essential advantage of the construction according to the invention is the resulting weight reduction. The weight of metal plate ducts of known air conditioning systems in buildings of medium size, as a rule, is 25 to 30 tons. The weight of the ducts of a system according to the invention, however, is, based on equal cross section, in spite of the greater wall thickness only 21 percent of the weight of metal plate ducts of equal size, what means that instead of metal plate ducts with a total weight of 25 tons, ducts of plastic material must be made the basis of calculations, the weight of said ducts amounting to 5.5 to 6 tons. Such weight reductions also enables reduction of the costs for erecting the building.

According to a further embodiment of the invention the cross section of each vertical distribution duct is the same over its whole length, whereby, preferably, also the cross sections of the individual vertical distributing ducts are all the same. With this the duct cross section is standardized, so that one can do with only a single duct shape. Such the costs of the air ventilating or air conditioning system can further be reduced.

With systems comprising a recirculated air ducting work there are, according to the invention two equal systems provided, one of which served for conveying the supplied air and the other of which is used for conveying the recirculated air. With this it is possible to consider varying requirements for both, the supplied air and the recirculated air, so that the supplied air and/or the recirculated air can be selectively supplied to and/or sucked from one floor, several floors or all floors, whereby it is also possible to suck different volumes of air per unit of time from individual floors and to very the proportions of the volumes of air sucked from the individual floors.

A system according to the invention, with respect to its air supply assembly, is, of course, applicable for single ducting works and for dual ducting works, in the latter of which ducting works cold air and hot air is conveyed through different ducts. With respect to the recirculated air it is of course possible to provide an air exhausting system or combinations thereof.

Further advantages result from the possibility to use vertical distributing ducts, which are not operated, for special purposes, for instance for mounting conduits of different kinds, as chimneys, for ventilating toilets, and so on.

The invention is further illustrated by the accompanying drawing, in which embodiments of a system according to the invention are schematically shown. FIG. 1 is a vertical section through a building with several floors and provided with an air conditioning system according to the invention. FIG. 2 is a section along line II–II of FIG. 1. FIGS. 3 through 7 are top plan views of different embodiments of moulded constructional parts, which can be used for erecting the vertical distributing ducts. FIGS. 8 through 10 show a side elevation, respectively a top plan view, respectively a section along line X –X of FIG. 8, of a connecting piece, which is provided with the exhaust openings and sucking openings, respectively, provided with closure members and to be coordinated to the individual vertical distributing ducts. FIG. 11 is a vertical section through such a connecting piece for a moulded constructional part of FIG. 6.

The air conditioning systems shown in FIGS. 1 and 2 is provided with an air supply system 1 (FIG. 2) and an exhaust air system 2. The air supply system 1 is fed by a central air processing equipment 3, to which the air at least partially is fed back via the recirculated air system 2. In the embodiment shown the air processing equipment is arranged within the cellar of the building, however, it is also possible to arrange the air processing equipment at the loft of the building.

The air supply ducting work 1 is provided with a horizontal main duct or collecting duct 4 connected to the air processing equipment 3. From this main duct 4 several vertical distributing ducts 5 are branched off. The vertical distributing ducts consist of a material as smooth as possible for providing an as low as possible resistance for the air forded through the ducts. Each of said vertical distributing ducts is provided at each floor with an exhaust opening 6, which can be airtightly sealed by a suitable closure cap 7. The cross section area of each exhaust opening 6 is equal to the cross section area of the corresponding vertical distributing duct 5, so that all of the air supplied from the main duct 4 can selectively be fed to one floor, several floors or all floors. The exhaust openings 6 are at each floor conveniently arranged between the ceiling 8 and the suspended ceiling 9, whereby it is possible to connect to the exhaust openings 6 pressure relief members of any known type, flow directing means or branch conduit systems.

The recirculated air ducting work 2 is essentially identical with the air supply ducting work 1. The horizontal collecting duct is designated with 10, the vertical ducts are designated with 11 and the sucking openings are designated with 12; the closure caps for the sucking openings 12 are designated with 13.

In view of the numerous vertical ducts 5 and 11, respectively, the vertical cross section of each vertical duct is sufficiently small to enable the use of tubes, consisting of synthetic plastic material tubes, these tubes are provided with a jacket consisting of concrete. Such a construction can be realized in two different manners. Firstly it is possible to erect the synthetic plastic material tube system, then to completely enclose the tube system within a mould and then to cast concrete into the mould for the height of a story, and so on. Secondly it is possible to prefabricate wall parts within which air ducts are spared out. The cross section of such wall parts is shown in FIGS. 3 through 7. Such wall parts are manufactured in different length, so that stories of different heights can be erected.

Each wall part has the form of a plate and is provided with a plurality of tubes or profiled ducts 14 consisting of synthetic plastic material, said tubes or ducts defining the vertical distributing ducts 5. The jacket of concrete is designated with 15. The cross section is selected in dependence on the intended final use of the building. The cross sections shown in FIGS. 3 through 5 are particularly suitable for buildings with vast rooms, for instance for warehouses, restaurants and so on, whereas the cross section shown in FIGS. 6 and 7 will preferably be used if a great number of small rooms is to be air conditioned.

It is convenient not to directly arrange the exhaust openings 6 and the sucking openings 12, respectively, on the wall parts, but to provide connecting pieces 16 (FIGS. 8 to 11) separately from said wall parts. Within said connecting pieces the exhaust openings 6 and the sucking openings 12, respectively, are also conveniently made out of tubes 17 consisting of synthetic plastic material, the cross section of each of said tube 17 corresponding to the cross section of the synthetic plastic material tube 14 forming the vertical distributing duct 5.

The concrete jacket 15 of both, the wall parts and the connecting pieces can be provided in a manner known per se with reinforcing inserts, so that the wall parts and the connecting pieces may serve as carrying elements, for instance for ceilings.

The invention further provides the possibility to connect in a single building air conditioning systems of types to common air supply ducts, recirculated air ducts, filters and so on, and thereby to avoid additional costs.

I claim:

1. An air conditioning system for a multi-floor structure comprising at least one ducting work with a horizontal main duct to which several vertical distributing ducts, combined into groups, are connected, said distributing ducts extending through all floors and each distributing duct being provided at each floor to be supplied with an opening connecting said duct with said floor, said openings being disposed to be closed, whereby always not more than one of these opening is kept open in each distributing duct.

2. An air conditioning system according to claim 1, in which the number of the distributing ducts is at least equal to the number of the floors to be supplied.

3. An air conditioning system according to claim 1, in which said openings connecting said ducts with said floors have the same cross section at each floor to be supplied.



4. An air conditioning system according to claim 1, in which said distributing ducts are embedded in prefabricated plinths made of fire resistant material, said plinths being provided with through-passages disposed in parallel relationship to one another.