Air Treatment

The subject invention relates to air treatment in passenger cabins of aircraft such, for example, as an aeroplane.

Aircraft which incorporate pressurisable cabins comprise cabin ventilation systems, which systems are operable to introduce air to the cabin at first locations thereof, to withdraw air from the cabin at second locations thereof, to vent overboard a proportion of the air withdrawn from the cabin and to compress air from outboard the aircraft, the so compressed air forming a proportion of the air introduced to the cabin. Such ventilation systems comprise air conditioning packs, usually located beneath the cabin floor, and air-flow ducting for the delivery of air from the packs to said first locations of the cabin and for the delivery of air from said second locations of the cabin to the packs.

The air conditioning packs comprise filters, which filters serve the purpose of effecting removal from air withdrawn from, and to be introduced back into, the cabin of components carried in the air such as those the result of the smoking of cigarettes in the cabin.

The quantity of air in an aircraft cabin can be very considerable. In a Boeing 747 aircraft, for example, the cabin contains about 900kg of air. Thus the power requirement for operating the ventilation system of a

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passenger aircraft can be considerable. Even in the case of smaller passenger aircraft it is an operational requisite to minimise the power requirement of the cabin ventilation system.

An object of the subject invention is the provision of an improved passenger cabin air quality. It is a further object of the subject invention to provide improved means of maintaining an acceptable air quality in a passenger cabin.

The subject invention provides a combination of a passenger seat and air treatment means, said passenger seat being located in a pressurisable aircraft passenger cabin, said air treatment means comprising air inlet means in air-flow communication with the environment at and to the fore of said seat, air induction means, air filtration means and air outlet means, and said induction means being operable to cause air flow from said environment via said inlet means, through said filtration means and to said outlet means.

The said environment is bounded to the fore of said seat by bounding means, which bounding means can take the form of the backrest of a second passenger seat, or can take the form of bulkhead or partition means. The air inlet means is at said bounding means. In the case where the passenger seat is adjacent the outer wall of the pressurisable aircraft passenger cabin, the bounding means can take the form of a portion of the aircraft fuselage wall, in which case the air inlet may be at the outer wall

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of the cabin. Thus air can be drawn directly from the said environment by the air treatment means, rather than passing from said environment to another location in the cabin before being withdrawn from the cabin.

The air filtration means may be, for example, electrostatic, polarised or passive air filtration means.

A convenient arrangement is for the air inlet means, the air induction means, the air filtration means and the air outlet means to be assembled together as a single air treatment unit. Such unitary assemblage is advantageously mounted at, and preferably in, the said backrest or bulkhead means with the air inlet means opening at the rear of the backrest or bulkhead means in the usual case in which the first mentioned seat is to the rear of the second seat or the bulkhead means. Suitably, the air inlet means comprises grill means, which grill means is flush or substantially flush with the rear face of the backrest or bulkhead means.

The subject invention further provides an aircraft passenger seat in combination with air treatment means, said air treatment means comprising air inlet means, air induction means, air filtration means and air outlet means.

The air outlet means of the air treatment means may be located relatively of cabin air withdrawal means of the cabin ventilation system such that air issuing from the outlet means is drawn from the cabin via the withdrawal means.

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Air filtration means of the air treatment means may be provided by air filtration means of the cabin ventilation system.

Air induction means of the air treatment means may be provided by air induction means of the cabin ventilation system.

In order that the subject invention may be clearly understood and readily carried into effect, reference will now be made, by way of example, to the diagrammatic drawings hereof, in which:-

Figure 1 shows two aircraft passenger seats installed in a passenger cabin of an aircraft, an aeroplane for example;

Figure 2 shows, in section and to an enlarged scale, an upper portion of the backrest of the rightward of the seats shown in Figure 1;

Figure 3 shows the upper portion of the backrest of Figure 2 as viewed in the direction of arrow A of Figure 2; and

Figure 4 shows a rearward view of a row of three aircraft passenger seats.

In Figure 1 the first and second aircraft passenger seats are designated by reference numerals 1 and 2. The seats 1 and 2 are secured to aircraft cabin floor 3, with seat 1 being positioned directly behind seat 2. Reference numeral 4 designates a cabin bulkhead or partition.

Mounted in the backrest 5 of seat 2 is an air treatment unit 6. The unit 6 comprises two air inlet

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grills 7 and 8 (see Figure 3), mesh grills for example, behind each of which is located an electrostatic filter, the filter associated with inlet grill 7 being designated by reference numeral 9 in Figure 2. The unit 6 also comprises air induction means, taking the form of an induction fan 10, a first duct 11, extending from the aforementioned filters to the air inlet side of the fan 10, an air outlet baffle 12 and a second duct 13 which extends from the air outlet side of the fan 10 to the baffle 12. The unit 6 further comprises an electric motor (not shown) arranged to drive the fan 10.

Wiring (not shown) runs within the backrest 5 for the provision of an electrical supply to the aforesaid motor and to the grids (not shown) of the aforesaid electrostatic filters.

When the fan 10 is in operation, air from the environment at the rear of the backrest 5, i.e. to the fore of seat 1, is drawn continuously through the grills 7,8 and the electrostatic filters associated therewith and is expelled *via* the duct 13, the presence of the baffle 12 causing the expelled air to flow in a downward direction. Thus, should a passenger in seat 1 be smoking a cigarette, tobacco smoke is drawn into the unit 6 with the continuous airflow therethrough, whereupon tobacco smoke components are trapped on the aforesaid electrostatic filters.

The backrest of each cabin seat behind which is positioned a smoking designated seat accommodates an air

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treatment unit as per unit 6, together with the associated electrical wiring.

Should a smoking designated seat be positioned immediately to the rear of a cabin bulkhead or partition, an air treatment unit as per unit 6 is mounted of the bulkhead. Such a unit, designated by reference numeral 14, is shown mounted in bulkhead 4 (Figure 1).

By use of the backrest or bulkhead mounted air treatment units, when a person smoking a cigarette is seated in a smoking designated seat, tobacco smoke is removed directly from the location of the generation thereof. Absent the use of such air treatment units, the whole tobacco smoke is moved within the cabin from said location by the air circulating under the action of the cabin ventilation system. The units provide the further advantage of reducing the load on the cabin ventilation system.

If a stowable table is mounted at the rear of seat 2, the location of the baffle 12 should preferably be no higher than the position occupied by the table when folded out for use. Similarly, if a stowable table is provided for a seat positioned behind (to the left viewing Figure 1) the bulkhead 4, the air outlet baffle of the air treatment unit 14 should preferably be no higher than the position occupied by the table when folded out or fitted for use.

The aircraft passenger seats shown in Figure 4 are designated by reference numerals 15, 16 and 17. Reference

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numerals 18 and 19 designate respectively the aircraft fuselage wall and the cabin floor. Reference numeral 20 designates a cabin air withdrawal grill of the cabin ventilation system. Air introduction means (not shown) of the cabin ventilation system are located at upper locations of the cabin. Two air inlet grills are mounted at the rear of each of the backrests of the seats 15-17, which grills are designated by reference numerals 21, 22; 23,24; and 25,26. An air-flow duct extends downwardly, within the respective backrest, from each of the grills 21-26, these air-flow ducts being designated by reference numerals 27, 28; 29,30; and 31,32. At the lower ends thereof the ducts 27-32 communicate with a common air-flow duct 33, which duct 33, extends to the air inlet side of an induction fan unit 34, which unit 34 provides air induction means. From the air outlet side of the fan unit 34 there extends an air-flow duct 35, the distal end of which duct 35 is downwardly directed towards the cabin air withdrawal grill 20.

With the fan unit 34 in operation air is drawn continuously through the air inlet grills 21-26, whereby should a passenger in a seat immediately behind one of the seats 15-17 be smoking a cigarette, tobacco smoke too is drawn through the air inlet grills of the backrest of said one of the seats. The smoke laden air is expelled by the fan unit 34 via the air-flow duct 35, and is thereupon drawn from the cabin via the grill 20.

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A filter may be installed in duct 35 or in duct 33 downstream of the juncture of ducts 27,28 with duct 33. Alternatively, a large filtration unit, located, for example, beneath cabin floor 19, may serve to filter smoke laden air drawn from all of the air inlet grills mounted at the rear of the backrests of a plurality of rows of seats. In this alternative case, instead of a fan unit as per unit 34 being associated with each row of seats, a large air induction unit, located, for example, below the cabin floor 19 may be utilised to draw air through all of said air inlet grills and through the said large filtration unit.

The said large filtration unit may be that of an air conditioning pack of the cabin ventilation system.

If an aforesaid large filtration unit is utilised, the ducting serving to convey air thereto may be separate from ducting of the cabin ventilation system.

As will be realised by the skilled-in-the-art addressee, should a row of seats as per seats 15-17 of Figure 4 be positioned to the rear of a cabin bulkhead, air treatment elements generally similar to those depicted in Figure 4 would be associated with the bulkhead, whereby should a passenger in one of the seats be smoking a cigarette, tobacco smoke would be drawn through air inlet grills at the bulkhead, which smoke would be withdrawn from the cabin via withdrawal grill means as per grill 20 of the cabin ventilation system.

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If a passenger seat comprises a headrest, an air treatment unit as per unit 6 or air inlet grills as per 21-26 could be installed at the headrest. Thus references herein to "backrest" encompass "headrest".

As described and shown hereinabove, two air inlet grills are located at the rear of a backrest. As will be realised by the skilled-in-the-art addressee, as an alternative a single air inlet grill could be employed, suitably a horizontally disposed grill of elongate conformation.

Co-pending U.K. Patent Application No. 9508252.5 standing in the name of the present Applicant discloses a passenger seat in combination with air treatment means. The air treatment means comprises air inlet means, air induction means, air filtration means and air outlet means. The air inlet means of the air treatment means is at the arm rest of the passenger seat, the air induction means being operable when the air inlet means is placed in air flow communication with the environment about the arm rest.

Advantageously the subject invention is used in combination with the invention disclosed in the referenced co-pending application to provide a yet further improved air filtration system.

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CLAIMS

1. A combination of a passenger seat and air treatment means, said passenger seat being located in a pressurisable aircraft passenger cabin, said air treatment means comprising air inlet means in air-flow communication with the environment at and to the fore of said seat, air induction means, air filtration means and air outlet means, said induction means being operable to cause air flow from said environment via said inlet means, through said filtration means and to said outlet means.
2. The combination according to Claim 1, wherein said air inlet means is other than at said first mentioned seat.
3. A combination according to Claim 1 or 2, wherein said environment is bounded to the fore by the backrest of a second passenger seat and said air inlet means is at said backrest.
4. A combination according to Claim 1 or 2, wherein said environment is bounded to the fore by bulkhead means and said air inlet means is at said bulkhead means.
5. A combination according to any one of the preceding Claims, wherein said air induction means comprises an induction fan.
6. A combination according to any one of the preceding claims, wherein said filtration means comprises one

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or more of an electrostatic, polarised or passive air filtration means.

7. A combination according to any one of the preceding claims, wherein said air filtration means is provided by air filtration means of the cabin ventilation system.

8. A combination according to any one of the preceding claims, wherein said air induction means is provided by air induction means of the cabin ventilation system.

9. The combination according to any one of Claim 1 to 6, wherein said air inlet means, said air induction means, said air filtration means and said air outlet means are assembled together to form a unit.

10. An aircraft passenger seat in combination with air treatment means, said air treatment means comprising air inlet means, air induction means, air filtration means and air outlet means said air inlet means being at the rear of the seat and providing communication between the environment at the rear of said seat and said air induction means.

11. A seat according to Claim 10, wherein said air inlet means said air induction means, said air filtration means, and said air outlet means are assembled together to form a unit.

12. An aircraft comprising a passenger cabin, an aircraft passenger seat located within said cabin and air treatment means, said air treatment means comprising

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air inlet means in air-flow communication with the environment at and to the fore of said seat, air induction means, air filtration means and air outlet means, said induction means being operable to cause air flow from said environment via said inlet means, through said filtration means and to said outlet means.

13. The combination according to Claim 12, wherein said air inlet means is other than at said first mentioned seat.

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