(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) EP 0 916 575 A2

(12) EUROPEAN PATENT APPLICATION

(43) Date of publication:
19.05.1999 Bulletin 1999/20

(51) Int Cl.[6]: **B63J 2/04**
// F24F11/00

(21) Application number: **98660117.7**

(22) Date of filing: **06.11.1998**

(84) Designated Contracting States:
AT BE CH CY DE DK ES FI FR GB GR IE IT LI LU MC NL PT SE
Designated Extension States:
AL LT LV MK RO SI

(30) Priority: **13.11.1997 FI 974220**

(71) Applicant: **Koja Marine**
33101 Tampere (FI)

(72) Inventors:
- **Vainio, Jari**
  33100 Tampere (FI)
- **Nousiainen, Esko**
  33100 Tampere (FI)

(74) Representative: **Pelin, Torolf**
Berggren Oy Ab,
P.O. Box 16
00101 Helsinki (FI)

(54) Air conditioning system for ships

(57) An air-conditioning system for ships which is chiefly intended for the air-conditioning of ship cabins consists of an air-conditioning unit (1) comprising one or more zone radiators (2) from where supply air is conducted through supply air ducts (3) to the cabins (4). Each cabin (4) has an individual air quantity regulator and a cooling coil (6) for controlling and cooling the supply air flow rate.

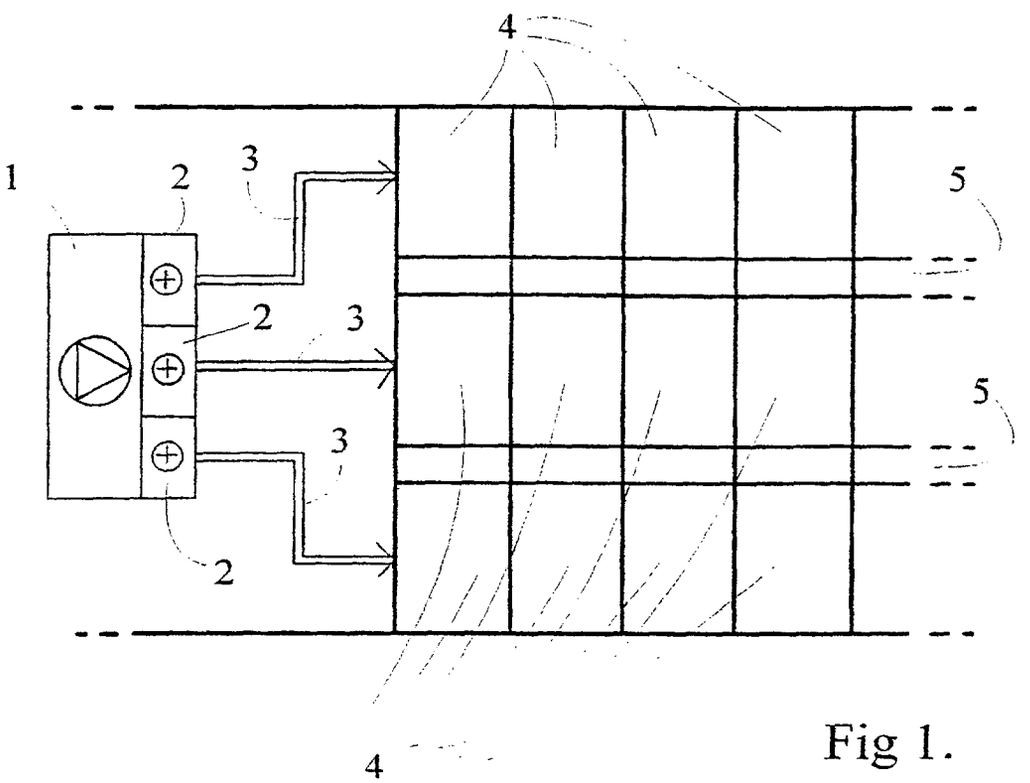

Fig 1.

EP 0 916 575 A2

Description

[0001] This invention relates to an air-conditioning system for ships, which is chiefly intended for the air-conditioning of ship cabins, and which consists of an air-conditioning unit comprising one or more zone radiators, from where supply air is conducted through supply air ducts to the cabins, each cabin having an individual air quantity regulator equipped with a cooling coil for controlling and cooling the supply air flow rate.

[0002] Previously known solutions comprise a "single-duct system" in which supply air is introduced from a central unit through a heat-insulated duct. Such ducts require much space and are expensive compared to uninsulated ducts. This system has been stated to be unnecessarily energy-consuming because of the constant air flow continuously introduced into the cabins. The single-duct system frequently uses a supplementary electric heater mounted in the cabin unit. Electric heating is about 4 to 5 times more expensive than the energy consumption in accordance with this invention. The single-duct system mentioned above also has the drawback of the major portion of exhaust air passing from the cabin to the cabin corridor. The system called "double-duct system" has the same drawbacks as those mentioned above.

[0003] A third air-conditioning system known *per se* is the Fancoil system, which consists of a return air unit, i. e. a fan coil system. This system known *per se* has the drawback of providing a minuscule quantity of fresh air. Supply air is introduced from the central unit through a heat-insulated duct. Such ducts are space-requiring and expensive compared to uninsulated ducts. The system has also been noted to generate fan noise and it may also involve problems relating to condensing water. In additon, such a device comprises an energy-consuming supplementary electric heater. The system involves a plurality of components requiring maintenance, such as a fan, a filter, a supplementary heater, a cooling coil and a three-way valve.

[0004] The purpose of the invention is to eliminate the drawbacks mentioned above. The air-conditioning system of the invention is characterised by the fact that the cabin is equipped with a second individual air quantity regulator, by means of which the exhaust air flow rate is controlled. Various embodiments of the invention are defined in the remaining dependent claims of the set of claims.

[0005] The air-conditioning system of the invention has the following advantages:

- uninsulated supply air ducts,
- individual temperature control in each cabin,
- maintaining good air quality compared to the Fancoil system,
- no need for supplementary electric heaters,
- no unnecessary components requiring maintenance, no fan, no filters in the cabins,
- low noise level, no fan in the cabins,
- no exhaust air led to the corridor (no smoke problems in the corridor in the event of cabin fire or vice versa),
- no problems with condensing water within the cabin as the cabin door or window is opened,
- air-conditioning of the cabins whenever necessary, resulting in energy savings.

[0006] The air flow rate is controlled according to the temperature and/or CO_2 concentration of the cabin. An empty cabin has a minimum of air-conditioning.

[0007] The invention is described below with the aid of an example and with reference to the accompanying drawing, in which

figure 1 is a schematic top view of the cabins, cabin corridors and the air-conditioning unit of a ship,
figure 2 is atop view of a cabin.

[0008] The air-conditioning system consists of an air-conditioning unit 1 having the necessary number of zone radiators 2, in this case three, from where supply air is conducted by means of supply air ducts 3 to cabins 4. Cabins 4 are separated by cabin corridors 5. Each cabin 4 has an individual air quantity regulator 6, by means of which the supply air flow rate is controlled. The control is performed with the use of an air quantity regulator plate 7 known *per se.* The regulator plate is followed by a damper 8 and a supply air grille 9. The cabin is also provided with a second individual air quantity regulator 10, by means of which the exhaust air flow rate is controlled. This second air quantity regulator also has an exhaust air grille 11, a damper 12 and an air quantity regulator plate 13. The supply air quantity regulator is equipped with a cooling coil 14. The supply air quantity regulator 6 is located in the ceiling of the toilet module of cabin 4. The exhaust air quantity regulator 10 is located in the top panel of the cabin closets. The supply air flow rate is controlled by a sensor means 16 mounted in the cabin. The sensor means consists of a cabin thermostat and a CO_2 sensor.

[0009] Supply air is introduced from central unit 1 through zone radiator 2 along duct 3 to the cabins. The air temperature is + 18 °C at minimum. The air is cooled to +14 °C in cooling coils 14. Regulator plate 7 is controlled by a message from sensor 16. Air is blown through damper 8 and supply air grille 9 into cabin 4. Exhaust air is removed through grille 11 and damper 12 to regulator plate 13, which is subjected to the operation of a supply air plate. The toilet module has an exhaust air valve 15, over which a constant air quantity is continuously removed. The supply air temperature may vary within the range from + 18 °C to +25 °C, depending on the set values of the cabin thermostats, the time of the day and the outdoor temperature. The set value of all of the cabin thermostats can be varied by e.g. ±3 °C. The set value is normally + 21 °C. All of sensors 16 are

connected to the central automation system and through this to air-conditioning unit 1. Each outer edge and inner cabin is served by an individual zone radiator 2.

[0010] Whenever necessary, the supply air unit can be complemented with a supplementary electric heater. Due to their high cost, the CO_2 sensor and control may also be left out from the system.

Claims

1. An air-conditioning system for ships, which is intended chiefly for the air-conditioning of ship cabins and which consists of an air-conditioning unit (1) comprising one or more zone radiators (2), from where supply air is conducted through supply air ducts (3) to the cabins (4), and in which each cabin (4) has an individual air quantity regulator (6) equipped with a cooling coil for controlling and cooling the supply air flow rate, **characterised** in that the cabin (4) has a second individual air quantity regulator (10) for controlling the exhaust air flow rate.

2. An air-conditioning system as claimed in claim 1, **characterised** in that the supply air quantity regulator (6) is positioned in the ceiling of the toilet module of the cabin (4).

3. An air-conditioning system as claimed in claim 1 or 2, **characterised** in that the exhaust air quantity regulator (10) is positioned in the top panel of the cabin (4) closets.

4. An air-conditioning system as claimed in any of the preceding claims, **characterised** in that the supply air flow rate is controlled by means of a cabin thermostat and a CO_2 sensor (14) mounted in the cabin.

5. An air-conditioning systema s claimed in claim 4, **characterised** in that the cabin thermostat and the CO_2 sensor are connected under bus control to the automation system included in the air-conditioning system of a ship.

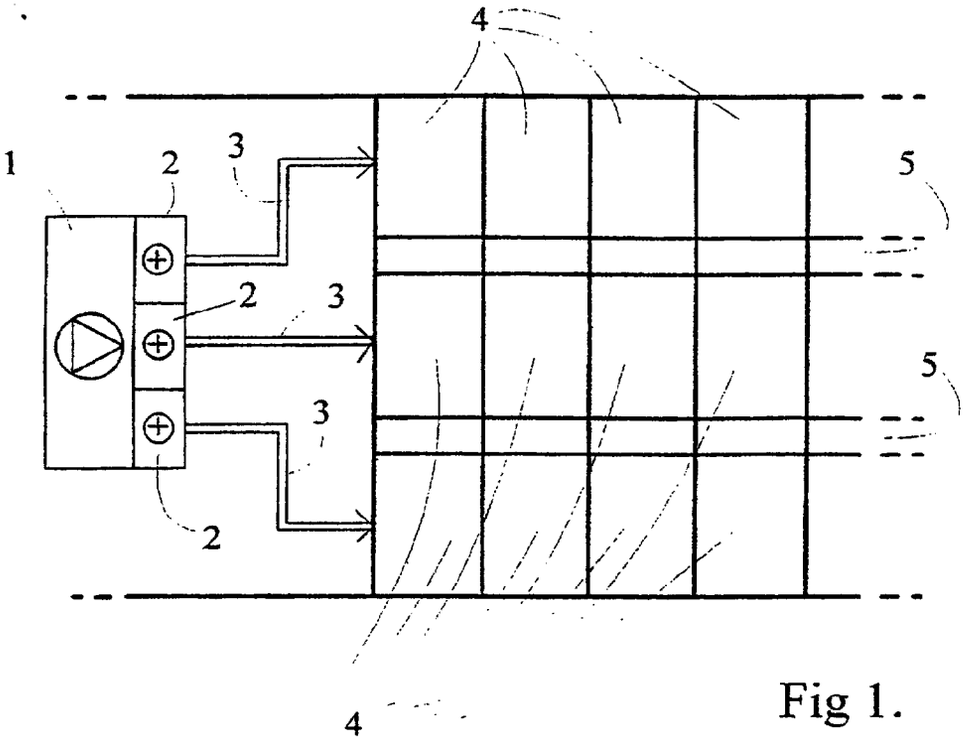

Fig 1.

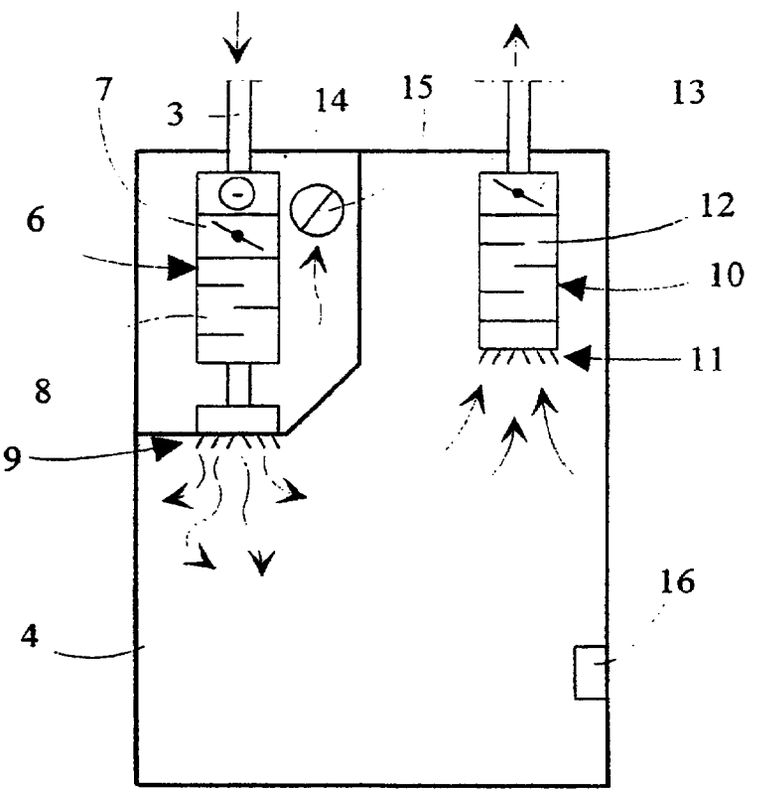

Fig 2.