A piping kit (30) for an air conditioning apparatus is disclosed. The piping kit enables mounting of elements meeting the specification of the air conditioning apparatus, upon installing pipes, for elements associated with pipes, and enables easy installation of pipes of the air conditioning apparatus and installation of elements to be mounted to the pipes. An air handling unit having the piping kit is also disclosed. The piping kit includes a case, at least one refrigerant supplying tube (32a,32b,32c) arranged in the case, to guide a refrigerant from an outdoor unit (20) to an indoor heat exchanger (17), at least (33a,33b,33c) arranged in the case, to guide the refrigerant from the indoor heat exchanger to the outdoor unit, and at least one refrigerant expansion device (34a,34b) arranged in the at least one refrigerant supplying tube within the case.
PIPING KIT FOR AIR CONDITIONING APPARATUS AND AIR HANDLING UNIT HAVING THE SAME

CROSS-REFERENCE TO RELATED APPLICATION

This application claims the benefit of Korean Patent Application No. 10-2007-78661, filed on August 6, 2007 in the Korean Intellectual Property Office, the disclosures of which are incorporated herein by reference.

BACKGROUND OF THE INVENTION

The present invention relates to a piping kit for an air conditioning apparatus, and, more particularly, to a piping kit for an air conditioning apparatus enabling easy in-situ installation of pipes and mounting of elements meeting the conditions of the appliance, and an air handling unit having the piping kit.

Generally, an air handling unit is used to air-condition a large-scale structure such as a building or a hotel. Such an air handling unit sucks air from a plurality or indoor spaces, and conditions the sucked air, using a heat exchanger or the like. The conditioned air is then re-supplied to the rooms. Such an air handling unit is disclosed in Korean Unexamined Patent Publication No. 2005-101301 (published on October 21, 2005).

The air handling unit disclosed in the above publication includes a plurality of heat exchangers to perform heat exchange with circulating indoor air, an outdoor unit connected with each heat exchanger by a pipe, a refrigerant expansion device (an electronic expansion valve, a capillary tube, or the like) arranged in a pipe
extending from the outdoor unit to each heat exchanger, to reduce the pressure of a refrigerant supplied through the pipe, and thus to expand the refrigerant, and a temperature sensor arranged on the pipe extending from each heat exchanger, for a control operation to control overheating of the heat exchanger, etc.

Such an air handling unit must have a desired cooling capacity determined taking into consideration the air-conditioning environment of a building to be air-conditioned, and thus must include an appropriate number of heat exchangers meeting the determined cooling capacity. That is, the number of heat exchangers in the air handling unit is determined taking into consideration a desired cooling capacity. Accordingly, an appropriate number of heat exchangers are mounted in an air conditioning apparatus when the air handling unit is installed in the building. Of course, pipes connecting the outdoor unit and heat exchangers, refrigerant expansion devices, and various sensors are also mounted upon the installation of the air handling unit.

However, the above-mentioned air handling unit may have a problem in that the heat exchangers, pipes, refrigerant expansion devices, etc. of the air handling unit, which are installed in situ, in particular, the refrigerant expansion devices, may not meet the air conditioning apparatus. In other words, the refrigerant expansion devices installed in situ may not meet the specification of the air conditioning apparatus, or may not meet a desired cooling capacity. In this case, the performance of the air conditioning apparatus may be degraded. The control operation for the air conditioning apparatus may also be unstable.
Furthermore, the above-mentioned air handling unit requires a complex installation task when it is installed in a building because a number of pipes, refrigerant expansion devices, temperature sensors, etc. should be installed.

SUMMARY OF THE INVENTION

The present invention has been made in view of the above-mentioned problems.

In accordance with one aspect, the present invention provides a piping kit for an air conditioning apparatus comprising: a case; at least one refrigerant supplying tube arranged in the case, to guide a refrigerant from an outdoor unit to an indoor heat exchanger; at least one refrigerant returning tube arranged in the case, to guide the refrigerant from the indoor heat exchanger to the outdoor unit; and at least one refrigerant expansion device arranged in the at least one refrigerant supplying tube within the case.

Thus there is provided a piping kit for an air conditioning apparatus enabling mounting of elements meeting the specification of the air conditioning apparatus, upon installing pipes, for elements associated with pipes, and an air handling unit having the piping kit.

Further, a piping kit is provided for an air conditioning apparatus capable of easily achieving installation of pipes of the air conditioning apparatus and installation of elements to be mounted to the pipes, and an air handling unit having the piping kit.
Opposite ends of the refrigerant supplying tube and opposite ends of the refrigerant returning tube may be exposed outwardly of the case, to be connected to associated ones of pipes arranged toward the outdoor unit and the indoor heat exchanger.

The refrigerant supplying tube may comprise one inlet tube connected to one of the pipes arranged toward the outdoor unit, and a plurality of outlet tubes branched from the inlet tube, and connected to associated ones of the pipes arranged toward the indoor heat exchanger.

The refrigerant returning tube may comprise one outlet tube connected to one of the pipes arranged toward the outdoor unit, and a plurality of inlet tubes branched from the outlet tube, and connected to associated ones of the pipes arranged toward the indoor heat exchanger.

The piping kit may further comprise at least one temperature sensor arranged on at least one of the refrigerant supplying tube and the refrigerant returning tube.

The piping kit may further comprise a control unit to control an operation of the air conditioning apparatus or to control an operations of the refrigerant expansion device, based on sensing information from the temperature sensor.

The control unit may comprise a control circuit, and a control box receiving the control circuit.

The control box may comprise a plurality of wire holes, through which wires extend, and a plurality of wire fixing members respectively mounted around the wire holes, to fix the wires, each of the wire fixing members closing
an associated one of the wire holes in a watertight state.

A filter may be arranged in the refrigerant supplying tube, to filter out foreign matter from the refrigerant.

In accordance with another aspect, the present invention provides an air handling unit comprising: a body; a blower arranged in the body, to blow indoor air; at least one indoor heat exchanger arranged in the body, to perform heat exchange with air; at least one outdoor unit arranged outside the body, and connected to the heat exchanger via a plurality of pipes; at least one piping kit separably mounted to the pipes, wherein the piping kit comprises a case, at least one refrigerant supplying tube arranged in the case, to guide a refrigerant from the outdoor unit to the indoor heat exchanger, at least one refrigerant returning tube arranged in the case, to guide the refrigerant from the indoor heat exchanger to the outdoor unit, and at least one refrigerant expansion device arranged in the at least one refrigerant supplying tube within the case.

Additional aspects and/or advantages of the invention will be set forth in part in the description which follows and, in part, will be obvious from the description, or may be learned by practice of the invention.

BRIEF DESCRIPTION OF THE DRAWINGS

These and/or other aspects and advantages of the invention will become apparent and more readily appreciated from the following description of the embodiments, taken in conjunction with the accompanying drawings in which:
FIG. 1 is a schematic view illustrating an air handling unit to which a piping kit for an air conditioning apparatus according to the present invention;

FIG. 2 is a perspective view illustrating a configuration of the piping kit according to the present invention; and

FIG. 3 is a plan view illustrating the configuration of the piping kit according to the present invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

Reference will now be made in detail to the embodiments of the present invention, examples of which are illustrated in the accompanying drawings. The embodiments are described below to explain the present invention by referring to the figures.

FIG. 1 illustrates an air handling unit, to which a piping kit according to the present invention is applied. The air handling unit includes a body 10, and a first inlet 11 and a first outlet 12 respectively formed through a top wall of the body 10 at opposite sides of the body 10. A suction duct 13 is connected to the first inlet 11, to guide air from a plurality of indoor spaces defined in a building to the body 10. A discharge duct 14 is connected to the first outlet 12, to guide conditioned air from the body 10 to the indoor spaces of the building. Thus, indoor air is introduced into the body 10 through the first inlet 11, and is discharged from the body 10 through the first outlet 12 after being conditioned.

In the body 10, a first blower 15, a ventilation unit 16, a heat exchanging unit 17, and a second blower 18 are
arranged in this order in a direction from the first inlet 11 to the first outlet 12. The first blower 15 sucks air through the first inlet 11, and blows the sucked air toward the ventilation unit 16. The ventilation unit 16 includes a second inlet 16a, through which ambient air around the top of the body 10 is introduced into the ventilation unit 16, and a second outlet 16b, through which indoor air is discharged. The ventilation unit 16 mixes the ambient air introduced through the second inlet 16a with indoor air blown from the first blower 15. That is, the ventilation unit 16 exchanges a part of the circulating indoor air with ambient air. The air ventilated in such a manner corresponds to about 30% of the circulating indoor air.

The introduced air emerging from the ventilation unit 16 is subjected to heat exchange while passing through the heat exchanging unit 17. The heat exchanging unit 17 includes a plurality of heat exchangers 17a, 17b, 17c, 17d, ... arranged in series or in parallel. The number of the heat exchangers 17a, 17b, 17c, 17d, ... can increase or decrease to meet a desired cooling capacity, taking into consideration the air-conditioning environment of the building. The second blower 18 blows, to the first outlet 12, air conditioned while passing through the heat exchanging unit 17. Thus, indoor air conditioned in the body 10 can be re-supplied to the indoor spaces through the first outlet 12.

An outdoor unit 20 is installed outside the body 10. The outdoor unit 20 may comprise a single outdoor unit or a plurality of outdoor units in accordance with the number (cooling capacity) of the heat exchangers 17a, 17b, 17c, 17d, ... installed in the body 10. In the illustrated
case, two outdoor units 20 are used. Although not shown, each outdoor unit 20 mainly includes an outdoor heat exchanger to perform heat exchange with outdoor air, an outdoor air blower to blow the outdoor air, and a compressor to compress a refrigerator. Each outdoor unit 20 is connected to the heat exchanging unit 17 arranged in the body 10 by a plurality of pipes 21, 22, 23, and 24.

A piping kit 30 is mounted to the pipes 21, 22, 23, and 24 connecting each outdoor unit 20 to the heat exchanging unit 17. As shown in FIGS. 2 and 3, the piping kit 30 includes a case 31, and various elements arranged in the case 31, namely, a refrigerant supplying tube 32, a refrigerant returning tube 33, a plurality of refrigerant expansion devices, for example, two refrigerant expansion devices 34a and 34b, and a plurality of temperature sensors 35a, 35b, 35c, and 35d.

As shown in FIGS. 2 and 3, the refrigerant supplying tube 32 and refrigerant returning tube 33 extend outwardly of the case 31 through opposite side walls of the case 31 such that opposite ends 32d, 32e, 32f, 33d, 33e, and 33f of the refrigerant supplying tube 32 and refrigerant returning tube 33 are outwardly exposed. In accordance with this arrangement, when each piping kit 30 is installed, the pipes 21 and 22 extending from the outdoor unit 20 associated with the piping kit 30 and the pipes 23 and 24 extending from the heat exchanging unit 17 of the body 10 can be connected to the associated opposite ends 32d, 32e, 32f, 33d, 33e, and 33f of the refrigerant supplying tube 32 and refrigerant returning tube 33, respectively.

The refrigerant supplying tube 32 includes one inlet
tube 32a connected to the pipe 22 arranged toward the outdoor unit 20, and two outlet tubes 32b and 32c branched from the inlet tube 32a, and respectively connected to the pipes 24 arranged toward the heat exchanging unit 17. The two outlet tubes 32b and 32c are branched from the inlet tube 32a by a branching socket 36. In accordance with this arrangement, a refrigerant, which is introduced from the outdoor unit 20 into the single inlet tube 32a, can be supplied to the heat exchanging unit 17 of the body 10 via the two outlet tubes 32b and 32c. The refrigerant expansion devices 34a and 34b are arranged in the outlet tubes 32b and 32c of the refrigerant supplying tube 32, respectively. In the case of FIGS. 2 and 3, electronic expansion valves are used for the refrigerant expansion devices. Of course, general capillary tubes may be used for the refrigerant expansion devices. The temperature sensors 35a and 35b are arranged on the outlet tubes 32b and 32c, respectively, to sense the temperature of the refrigerant supplied to the heat exchanging unit 17. Filters 37a, 37b, and 37c are also arranged in the inlet tube 32a and outlet tubes 32b and 32c of the refrigerant supplying tube 32, respectively, to filter out foreign matter from the refrigerant.

The refrigerant returning tube 33 includes one outlet tube 33a connected to the pipe 21 arranged toward the outdoor unit 20, and two inlet tubes 33b and 33c branched from the outlet tube 33a, and respectively connected to the pipes 23 arranged toward the heat exchanging unit 17. The two inlet tubes 33b and 33c are branched from the outlet tube 33a by a branching socket 38. In accordance with this arrangement, refrigerant flows, which are introduced from the heat exchanging unit 17 of the body 10 into the inlet tubes 33b and 33c, can be supplied to the
outdoor unit 20 after being joined through the outlet tube 33a. The temperature sensors 35c and 35d are arranged on the inlet tubes 33b and 33c, respectively, to sense the temperature of the refrigerant emerging from the heat exchanging unit 17 of the body 10.

Although this embodiment is associated with the case in which the refrigerant supplying tube 32 is configured such that one inlet tube 32a is branched into two outlet tubes 32b and 32c, and the refrigerant returning tube 33 is configured such that two inlet tubes 33b and 33c is joined into one outlet tube 33a, the present invention is not limited to this case. For example, each of the refrigerant supplying tube and refrigerant returning tube may be a single tube. Also, each of the refrigerant supplying tube and refrigerant returning tube may have a branching structure including three or more branched flow paths, if necessary. In this case, of course, the numbers of refrigerant expansion devices and temperature sensors installed in the case 31 may vary in accordance with the branching structure of each tube.

As shown in FIG. 1, each piping kit 30 is connected to the pipes 21, 22, 23, and 24 when the pipes 21, 22, 23, and 24 are installed to connect the associated outdoor unit 20 and the heat exchanging unit 17 of the body 10. That is, the outlet tubes 32b and 32c of the refrigerant supplying tube 32 are connected to the pipes 24 extending from the heat exchanging unit 17, respectively. The inlet tubes 33b and 33c of the refrigerant returning tube 33 are connected to the pipes 23 extending from the heat exchanging unit 17, respectively. Also, the inlet tube 32a of the refrigerant supplying tube 32 and the outlet tube 33a of the refrigerant returning tube 33 are
connected to the pipes 21 and 22 extending from the outdoor unit 20, respectively. This embodiment is associated with the case in which each piping kit 30 connects one outdoor unit 20 and two heat exchangers, for example, the heat exchangers 17a and 17b.

As shown in FIGS. 1 and 2, each piping kit 30 includes a control unit 40 to control an operation of the air handling unit, to which the piping kit 30 is applied, or to control operations of the refrigerant expansion devices 34a and 34b, based on sensing information from the temperature sensors 35a, 35b, 35c, and 35d. The control unit 40 constitutes a set, together with the piping kit 30. The control unit 40 includes a control circuit (not shown), and a control box 41 receiving the control circuit. The control box 41 may be fixedly mounted to the case 31 of the piping kit 30. The control circuit arranged in the control box 41 may include a terminal block (not shown) for connection of electrical wires, and a plurality of relays (not shown) for control of power. The control box 41 includes a plurality of wire holes 42, through which wires extend, and a plurality of wire fixing members 43 mounted around respective wire holes 42, to fix the wires. Each wire fixing member 43 can close the associated wire hole 42 in a watertight state.

The piping kit 30 enables easy installation of the pipes 21, 22, 23, and 24 connecting the associated outdoor unit 20 and the heat exchanging unit 17. The piping kit 30 can eliminate the time taken to install the refrigerant expansion devices 34a and 34b, temperature sensors 35a, 35b, 35c, and 35d, and filters 37a, 37b, and 37c upon installing the apparatus in situ, because these elements have already been mounted in the associated refrigerant
supplying tube 32 and refrigerant returning tube 33 in the piping kit 30. That is, as the piping kit 30 is connected with the pipes 21, 22, 23, and 24, the connection between the outdoor unit 20 and the heat exchanging unit 17 is completed without any further process. At this time, the installation of the elements arranged in the piping kit 30 is also completed without any further process. Also, the refrigerant expansion devices 34a and 34b and temperature sensors 35a, 35b, 35c, and 35d has previously been set to meet the capacities of the heat exchanging unit 17 and outdoor unit 20. Accordingly, there is no problem caused by mounting of elements not meeting the specification of the apparatus. Thus, it is possible to prevent a degradation in the performance of the apparatus, and to prevent an unstable control operation of the apparatus.

As shown in FIG. 1, the number of the piping kits 30 can increase or decrease to meet the increased or decreased number of the heat exchangers 17a, 17b, 17c, 17d, ... determined in accordance with the air-conditioning environment of the building. That is, when the number of the heat exchangers 17a, 17b, 17c, 17d, ... increases upon the process of mounting the heat exchangers, additional piping kits 30 may be mounted to meet the increased number of the heat exchangers. In this case, of course, additional control units 40, which constitute respective sets, together with the additional piping kits, are also mounted. When the piping kits 30 of the present invention are used, as described above, it is possible to easily cope with the design of the field because the installation conditions of pipes and heat exchangers can be easily changed to meet the conditions of the field.
As apparent from the above description, the piping kit of the present invention, which is applied to an air conditioning apparatus, has a structure in which respective parts of pipes connecting an outdoor unit to heat exchangers arranged in a body of the air conditioning apparatus, and elements to be mounted to the pipes have previously been installed in a case. Accordingly, the installation of the piping kit in the air conditioning apparatus can be achieved by simply connecting the piping kit to the pipes. Thus, the piping kit of the present invention provides an effect capable of easily achieving the installation of the pipes of the air conditioning apparatus and the installation of elements to be mounted to the pipes.

Also, the piping kit of the present invention can prevent mounting of elements not meeting the specification of the apparatus because the elements arranged in the case, namely, refrigerant expansion devices, temperature sensors, etc., have previously been set to meet the specification of the apparatus. Thus, it is possible to minimize a degradation in the performance of the apparatus and an unstable control operation of the apparatus caused by mounting of erroneous elements.

Although a few embodiments of the present general inventive concept have been shown and described, it will be appreciated by those skilled in the art that changes may be made in these embodiments without departing from the principles and spirit of the invention, the scope of which is defined in the appended claims and their equivalents.

Attention is directed to all papers and documents
which are filed concurrently with or previous to this specification in connection with this application and which are open to public inspection with this specification, and the contents of all such papers and documents are incorporated herein by reference.

All of the features disclosed in this specification (including any accompanying claims, abstract and drawings), and/or all of the steps of any method or process so disclosed, may be combined in any combination, except combinations where at least some of such features and/or steps are mutually exclusive.

Each feature disclosed in this specification (including any accompanying claims, abstract and drawings) may be replaced by alternative features serving the same, equivalent or similar purpose, unless expressly stated otherwise. Thus, unless expressly stated otherwise, each feature disclosed is one example only of a generic series of equivalent or similar features.

The invention is not restricted to the details of the foregoing embodiment(s). The invention extends to any novel one, or any novel combination, of the features disclosed in this specification (including any accompanying claims, abstract and drawings), or to any novel one, or any novel combination, of the steps of any method or process so disclosed.
CLAIMS

1. A piping kit (30) for an air conditioning apparatus comprising:

   a case (31);

   at least one refrigerant supplying tube (32) arranged in the case, to guide a refrigerant from an outdoor unit (20) to an indoor heat exchanger (17);

   at least one refrigerant returning tube (33) arranged in the case, to guide the refrigerant from the indoor heat exchanger to the outdoor unit; and

   at least one refrigerant expansion device (34a,34b) arranged in the at least one refrigerant supplying tube within the case.

2. The piping kit according to claim 1, wherein opposite ends (32d,32e,32f) of the refrigerant supplying tube and opposite ends (33d,33e,33f) of the refrigerant returning tube are exposed outwardly of the case, to be connected to associated ones of pipes (21,22,23,24) arranged toward the outdoor unit and the indoor heat exchanger.

3. The piping kit according to claim 2, wherein:

   the refrigerant supplying tube comprises one inlet tube (32a) connected to one of the pipes arranged toward the outdoor unit, and a plurality of outlet tubes (32b,32c) branched from the inlet tube, and connected to
associated ones of the pipes arranged toward the indoor heat exchanger.

4. The piping kit according to claim 2 or 3, wherein:

5 the refrigerant returning tube comprises one outlet tube (33a) connected to one of the pipes arranged toward the outdoor unit, and a plurality of inlet tubes (33b,33c) branched from the outlet tube, and connected to associated ones of the pipes arranged toward the indoor heat exchanger.

5. The piping kit according to any one of claims 1 to 4, further comprising:

at least one temperature sensor (35a,35b,35c,35d) arranged on at least one of the refrigerant supplying tube and the refrigerant returning tube.

6. The piping kit according to claim 5, further comprising:

a control unit (40) to control an operation of the air conditioning apparatus or to control an operations of the refrigerant expansion device, based on sensing information from the temperature sensor.

7. The piping kit according to claim 6, wherein the control unit comprises:

a control circuit; and

a control box (41) receiving the control circuit.
8. The piping kit according to claim 7, wherein the control box comprises:

   a plurality of wire holes (42), through which wires extend; and

   a plurality of wire fixing members (43) respectively mounted around the wire holes, to fix the wires, each of the wire fixing members closing an associated one of the wire holes in a watertight state.

9. The piping kit according to any preceding claim, wherein a filter (37a,37b,37c) is arranged in the refrigerant supplying tube, to filter out foreign matter from the refrigerant.

10. An air handling unit comprising:

    a body (10);

    a blower arranged in the body, to blow indoor air;

    at least one indoor heat exchanger (17) arranged in the body, to perform heat exchange with air;

    at least one outdoor unit (20) arranged outside the body, and connected to the heat exchanger via a plurality of pipes (21,22);

    at least one piping kit (30) separably mounted to the pipes,
wherein the piping kit comprises a case (31), at least
one refrigerant supplying tube (32) arranged in the case,
to guide a refrigerant from the outdoor unit to the indoor
heat exchanger, at least one refrigerant returning tube
(33) arranged in the case, to guide the refrigerant from
the indoor heat exchanger to the outdoor unit, and at
least one refrigerant expansion device (34a,34b) arranged
in the at least one refrigerant supplying tube within the
case.

11. The air handling unit according to claim 10,
wherein opposite ends (32d,32e,32f) of the refrigerant
supplying tube and opposite ends (33d,33e,33f) of the
refrigerant returning tube are exposed outwardly of the
case, to be connected to associated ones of pipes
(21,22,23,24) arranged toward the outdoor unit and the
indoor heat exchanger.

12. The air handling unit according to claim 11,
wherein:

the refrigerant supplying tube (32a) comprises one
inlet tube connected to one of the pipes arranged toward
the outdoor unit, and a plurality of outlet tubes
(32b,32c) branched from the inlet tube, and connected to
associated ones of the pipes arranged toward the indoor
heat exchanger.

13. The air handling unit according to claim 11 or 12,
wherein:

the refrigerant returning tube comprises one outlet
tube (33a) connected to one of the pipes arranged toward
the outdoor unit, and a plurality of inlet tubes (33b,33c) branched from the outlet tube, and connected to associated ones of the pipes arranged toward the indoor heat exchanger.

14. The air handling unit according to any one of claims 10 to 13, further comprising:

   at least one temperature sensor (35a,35b,35c,35d) arranged on at least one of the refrigerant supplying tube and the refrigerant returning tube.

15. The air handling unit according to claim 14, further comprising:

   a control unit (40) to control an operation of the air conditioning apparatus or to control an operations of the refrigerant expansion device, based on sensing information from the temperature sensor.

16. The air handling unit according to claim 15, wherein the control unit comprises:

   a control circuit; and

   a control box (41) receiving the control circuit.

17. The air handling unit according to claim 16, wherein the control box comprises:

   a plurality of wire holes (42), through which wires extend; and
a plurality of wire fixing members (43) respectively mounted around the wire holes, to fix the wires, each of the wire fixing members closing an associated one of the wire holes in a watertight state.

18. The air handling unit according to any of claims 9 to 17, wherein a filter (37a, 37b, 37c) is arranged in the refrigerant supplying tube, to filter out foreign matter from the refrigerant.
Application No: GB0809830.3
Claims searched: 1-18

Examiner: Mr Niels-Jorgen Helbech Larsen
Date of search: 29 August 2008

Patents Act 1977: Search Report under Section 17

Documents considered to be relevant:

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<td>X: 1-18</td>
<td>EP1876398 A (DAIKIN INDUSTRIES LTD.) See fig. 1-3, abstract, [0064], [0053]-[0056] and [0086].</td>
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Field of Search:

Search of GB, EP, WO & US patent documents classified in the following areas of the UKC:

Worldwide search of patent documents classified in the following areas of the IPC:

B60H; F16L; F24F; F25B

The following online and other databases have been used in the preparation of this search report:

EPODOC, WPI

International Classification:

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