Description

Title of Invention

AIR COMPRESSION DEVICE

Technical Field

[0001] The present invention relates to an air compression device.

Background Art

[0002] An air compression device has been conventionally known which is mounted on a vehicle or the like to generate compressed air for use in the vehicle. As such an air compression device, Patent Literature 1 describes an air compression device provided with a housing case, and a compressor and a compression drive portion housed in the housing case. In the air compression device of Patent Literature 1, the compression drive portion is coupled to a compressor. By driving the compressor by the compression drive portion, compressed air for use in a vehicle is generated.

[0003] The air compression device of Patent Literature 1 further includes a cooling fan for cooling the compressor and the compression drive portion. The cooling fan is directly connected to the compression drive portion to generate an air flow in a direction in which the compression drive portion and the compressor are arranged. Here, the housing case is provided with a filter portion facing a cooling fan in a direction of an air flow generated by the cooling fan. Specifically, in the air compression device of Patent Literature 1, the filter portion, the cooling fan, the compression drive portion, and the compressor are arranged in line in the direction of the air flow generated by the cooling fan. Then, air flowing into the housing case through the filter portion is led to the compression drive portion and the compressor so as to go straight by the cooling fan. As a result, the compression drive portion and the compressor are cooled.

[0004] In the air compression device of Patent Literature 1, air flowing into the housing case through the filter portion goes straight toward the cooling fan so as to be led to the compressor. As a result, the cooling fan is to suck air going straight in the housing case. In the air compression device of Patent Literature 1, therefore, sound attenuation caused by an air flow in the housing case cannot be sufficiently obtained, so that loud noise might be generated in the cooling fan.

Citation List

Patent Literature

[0005] Patent Literature 1: Japanese Patent Unexamined Publication No. 2011-226285

Summary of Invention

[0006] An object of the present invention is to provide an air compression device enabling noise reduction.

[0007] An air compression device according to one aspect of the present invention includes a housing having an inflow port for allowing air to flow into an inside of the housing, and a fan device unit which has an inlet port which sucks air flowing into the housing through the inflow port and sends out the air sucked through the inlet port toward a compressor. The inlet port of the fan device unit is arranged so as to cause air in the housing to go around toward the inlet port and suck the air.

Brief Description of Drawings

[0008] FIG. 1 is a schematic view of a railroad vehicle on which an air compression device according to a first embodiment is mounted, the view seen from the side.

FIG. 2 is a schematic view of the railroad vehicle shown in FIG. 1 when seen from above, in which view, rails, cross ties, and the air compression device are illustrated with chain double-dashed lines.

FIG. 3 is a perspective view showing a schematic configuration of the air compression device according to the first embodiment.

FIG. 4 is a perspective view showing a schematic configuration of the air compression device according to the first embodiment, which is a view of the housing seen through a side portion thereof in a state where a panel unit and a filter panel are detached from the housing.

FIG. 5 is a view of the inside of the housing in the air compression device according to the first embodiment seen from the side.

FIG. 6 is a perspective view showing, in the air compression device according to the first embodiment, a schematic configuration of a motor housed in a second housing space S2 of the housing.

FIG. 7 is a view of an inside of the housing in the air compression device according to the first embodiment seen from above, which is a view of a compressible air filter and a guide path seen through insides thereof.

FIG. 8 is a perspective view of the panel unit of the air compression device according to the first embodiment seen from the back.

FIG. 9 is a perspective view showing a schematic configuration of an adaptor of the panel unit according to the first embodiment.

FIG. 10 is a sectional view showing a schematic configuration of the air compression device according to the first embodiment, which is a view showing an air flow which cools a compressor unit.

FIG. 11 is a front perspective view showing a schematic configuration of an air compression device according to a second embodiment.

FIG. 12 is a side perspective view showing a schematic configuration of the air

compression device according to the second embodiment, which is a view of the housing seen through a side portion and an upper portion thereof.

FIG. 13 is a view of the inside of the housing in the air compression device according to the second embodiment seen from above.

Description of Embodiments

[0009] In the following, one embodiment of the present invention will be described with reference to the drawings. The respective figures to be referred to in the following are simplification of only main members among constituent members of air compression devices X1 and X2 according to a present embodiment for the purpose of illustration. Accordingly, the air compression devices X1 and X2 according to the present embodiment can include an arbitrary constituent member not shown in each figure referred to in the present specification.

[0010] (First Embodiment)

FIG. 1 and FIG. 2 show a railroad vehicle 100 on which the air compression device X1 according to the first embodiment is mounted. Compressed air generated by the air compression device X1 is used for activating various kinds of pneumatic apparatuses such as a brake device, a door open-and-close device, and the like which are mounted on the railroad vehicle 100. The air compression device X1 may not be mounted on the railroad vehicle 100 but be mounted on an apparatus of other vehicle mounted with a pneumatic apparatus, or the like.

[0011] The railroad vehicle 100 has a floor portion 100a, an upper wall portion 100b located above the floor portion 100b, and a pair of side wall portions 100c and 100d extending vertically so as to link the floor portion 100a and the upper wall portion 100b. Additionally, the railroad vehicle 100 has wheels attached to the floor portion 100a, and door portions attached to the side wall portions 100c and 100d. A user of the railroad vehicle 100 gets into the railroad vehicle 100 from a platform in a station through the door portion attached to the side wall portion 100c or the side wall portion 100d. Then, as shown in FIG. 2, the railroad vehicle 100 travels on a track formed with cross ties 102 and rails 101 extending in a direction orthogonal to the cross ties 102, along the rails 101. A direction in which the cross ties 102 extend is referred to as a first direction A1, and a direction which is orthogonal to the first direction A1 and in which the rails 101 extend is referred to as a second direction B1.

[0012] The air compression device X1 is attached to the floor portion 100a of the railroad vehicle 100 from below as shown in FIG. 1. Additionally, the air compression device X1 is arranged closer to the side wall portion 100c than to the side wall portion 100d in the first direction A1 as shown in FIG. 2.

[0013] Next, in addition to FIG. 1 and FIG. 2, with reference to FIG. 3 and FIG. 4, the air compression device X1 will be specifically described. FIG. 3 is a perspective view showing a schematic configuration of the air compression device X1. FIG. 4 is a view showing a state where a panel unit 11 and a filter panel 16 to be described later are detached from the air compression device X1 shown in FIG. 3. FIG. 5 is a view of the air compression device X1 seen from the second direction B1, which view is seen through a side portion of a housing 10 to be described later.

[0014] As shown in FIG. 3 to FIG. 5, the air compression device X1 mainly includes the housing 10, a motor unit 17 and a compressor unit 19 housed in the housing 10, and a controller unit 18 arranged outside the housing 10. In the air compression device X1, in conjunction with the motor unit 17 driven by the controller unit 18, the compressor unit 19 is driven. As a result, air flowing into the compressor from the outside of the housing 10 is compressed.

[0015] The housing 10 houses various kinds of members such as the motor unit 17, the compressor unit 19, and the like provided in the air compression device X1. In the first embodiment, the housing 10 is fixed to the floor portion 100a in a manner of hanging on a lower side of the floor portion 100a of the railroad vehicle 100 via a hanging member 200. Specifically, the housing 10 has a substantially hexahedral shape having an the upper portion 10A and a lower portion 10B facing to each other, a front portion 10D and a rear portion 10E facing to each other, and one side portion and the other side portion facing to each other. Then, a space surrounded by the upper portion 10A , the lower portion 10B, the front portion 10D, the rear portion 10E, the one side portion, and the other side portion serves as a housing space which houses various kinds of members provided in the air compression device X1.

[0016] In the first embodiment, the air compression device X1 is mounted on the railroad vehicle 100 in a posture of having the upper portion 10A facing to the floor portion 100a, the front portion 10D located on the side of the side wall portion 100c in the first direction A1, and the rear portion 10E located on the side of the side wall portion 100d (on the side of the center in a car width direction).

[0017] As shown in FIG. 4, the housing 10 has an intermediate portion 10C provided between the upper portion 10A and the lower portion 10B so as to divide an internal housing space of the housing 10 into two. In the first embodiment, as shown in FIG. 4 and FIG. 5, in the internal housing space of the housing 10, a space formed between the upper portion 10A and the intermediate portion 10C serves as a first housing space S1 which houses the compressor unit 19, and a space formed between the intermediate portion 10C and the lower portion 10B serves as a second housing space S2 which

houses the compressor unit 19. In other words, in the first embodiment, the motor unit 17 and the compressor unit 19 are arranged so as to be deviated from each other in a vertical direction C1. This enables a reduction in a horizontally occupied area in the air compression device X1.

[0018] Although in the first embodiment, the housing 10 has a substantially hexahedral shape, the shape is not limited thereto. The shape of the housing 10 is arbitrary and can be appropriately changed according to sizes, arrangement, and the like of the various kinds of members housed in the housing 10.

[0019] Additionally, the intermediate portion 10C may not be necessarily provided. For example, by fixing the compressor unit 19 to the upper portion 10A and also fixing the motor unit 17 to the lower portion 10B, the compressor unit 19 and the motor unit 17 may be arranged so as to be deviated from each other in the vertical direction C1.

[0020] As shown in FIG. 4, the motor unit 17 is housed in the first housing space S1 inside the housing 10. The motor unit 17 has a first motor 17A and a second motor 17A. The first motor 17A and the second motor 17A are arranged in line with each other as shown in FIG. 6. In the first embodiment, the direction in which the first motor 17A and the second motor 17A are arranged in line is parallel to the second direction B1. The first motor 17A and the second motor 17A have the same structure and are arranged to be in a posture symmetrical to each other in the second direction B1. In the following, the first motor 17A will be described.

[0021] The first motor 17A has an output shaft 171, a motor main body 172, a motor fan 173, and a drive pulley 174.

[0022] The output shaft 171 projects from the motor main body 172 to the side of the one side portion of the housing 10. The drive pulley 174 is attached to the projecting output shaft 171. This makes the motor main body 172 and the drive pulley 174 be arranged in line in an axis direction of the output shaft 171. In the first embodiment, the first motor 17A is arranged such that the motor main body 172 and the drive pulley 174 are arranged in line in the second direction B1.

[0023] On an outer circumference surface of the motor main body 172, a plurality of cooling fins 172a is formed. The respective cooling fins 172a extend along the axis direction of the output shaft 171 and are arranged spaced apart in a circumferential direction of the motor main body 172.

[0024] The motor fan 173 generates an air flow for cooling the motor main body 172. The motor fan 173 is attached to the same axis as those of the motor main body 172 and the drive pulley 174. Specifically, the motor fan 173 is attached to the output shaft 171. The motor fan 173 is located on the side opposite to the drive pulley 174 with respect to

the motor main body 172. Specifically, in the first embodiment, the motor fan 173 is located on the second motor 17B side with respect to the drive pulley 174 in the second direction B1.

[0025] The motor fan 173 is driven according to rotation of the output shaft 171 along with driving of the motor main body 172 to generate an air flow in the second housing space S2 within the housing 10. The air flow is to flow through the second housing space S2 in the second direction B1 as a result of passing between the respective cooling fins 172a.

[0026] The controller unit 18 is attached to the rear portion 10E of the housing 10 in the outside of the housing 10. The controller unit 18 has a box-shaped member, and has a controller which is housed in the box-shaped member and controls drive of the motor unit 17. Each motor main body 172 of the respective motors 17A and 17B is to be driven by the controller unit 18. In the controller unit 18, various kinds of electronic parts may be housed other than the controller for controlling drive of the motor unit 17.

[0027] The compressor unit 19 is housed in the second housing space S2 in the housing 10 as shown in FIG. 4. Specifically, the compressor unit 19 is mounted on the intermediate portion 10C of the housing 10. The compressor unit 19 has a first compressor 19A and a second compressor 19B. The first compressor 19A and the second compressor 19B are arranged in line. The first compressor 19A is arranged above the first motor 17A, and the second compressor 19B is arranged above the second motor 17A in the vertical direction C1. As a result, in the first embodiment, the first compressor 19A and the second compressor 19B are arranged in line in the second direction B1.

[0028] The first compressor 19A and the second compressor 19B have the same structure. The first compressor 19A and the second compressor 19B are arranged symmetrically to each other in spaced relation so as to have suction ports thereof facing to each other in the second direction B1. In the following, the first compressor 19A will be described.

[0029] The first compressor 19A has a compressor main body 19a, a drive pulley 19b, and an input shaft 19c.

[0030] The input shaft 19c projects from the compressor main body 19a to the side of the one side portion of the housing 10. The drive pulley 19b is attached to the projected input shaft 19c. This makes the compressor main body 19a and the drive pulley 19b be arranged in line in an axis direction of the input shaft 19c. In the first embodiment, the first compressor 19A is arranged such that the compressor main body 19a and the drive pulley 19b are arranged in line in the second direction B1. The drive

pulley 19b of the first compressor 19A is arranged so as to overlap the drive pulley 174 of the first motor 17A in the vertical direction C1.

[0031] As shown in FIG. 4, an endless belt B is wound around the drive pulley 19b of the first compressor 19A and the drive pulley 174 of the first motor 17A. Specifically, the intermediate portion 10C of the housing 10 has a through hole formed on the side portion side of the housing 10, which through hole communicates the first housing space S1 with the second housing space S2. The communication through hole overlaps the drive pulleys 19b and 174 in the vertical direction C1. Then, the belt B is arranged to extend from the first housing space S1 to the second housing space S2 through the through hole, and is attached to the drive pulleys 19b and 174 in the housing spaces S1 and S2, respectively. To the compressor main body 19a of the first compressor 19A, driving force is transmitted via the input shaft 19c by circulation of the belt B around the drive pulleys 19b and 174 along with drive of the motor main body 172 of the first motor 17A. As a result, the compressor main body 19a of the first compressor 19A is to generate compressed air.

[0032] As shown in FIG. 5 and FIG. 7, the air compression device X1 further includes a filter member 25 which allows air outside the housing 10 to flow inside, a guide path 20 which guides air from the filter member 25 into the compressor main body 19a, an outflow pipe portion 21 which allows compressed air generated in the compressor main body 19a to flow out from the compressor main body 19a, and an aftercooler 22 for cooling compressed air flowing through the outflow pipe portion 21.

[0033] The guide path 20 is housed in the first housing space S1 in the housing 10. Specifically, the guide path 20, as shown in FIG. 7, is arranged between the first compressor 19A and the second compressor 19B to extend from the front portion 10D side to the rear portion 10E side. In the first embodiment, the guide path 20 extends along the first direction A1. The guide path 20 has an inflow opening 20a allowing air to flow inside, and a first outflow opening 20b and a second outflow opening 20c allowing the air to flow into the first and second compressors 19A and 19B, respectively.

[0034] The inflow opening 20a is formed, in the guide path 20, on a surface facing to the front portion 10D of the housing 10. One end of the filter member 25 is fitted in the inflow opening 20a of the guide path 20 via a trim seal. This allows air flowing from the outside of the housing 10 into the filter member 25 to flow into the guide path 20 through the inflow opening 20a.

[0035] The first outflow opening 20b is formed, in the guide path 20, on a surface facing to the first compressor 19A. The first outflow opening 20b leads to the suction

port in the first compressor 19A through a linkage pipe (not shown by a reference numeral). This causes air flowing into the guide path 20 to flow out from the guide path 20 through the first outflow opening 20b and flow into the first compressor 19A.

[0036] The second outflow opening 20c is formed, in the guide path 20, on a surface facing to the second compressor 19B. The second outflow opening 20c leads to the suction port in the second compressor 19B through the linkage pipe (not shown by a reference numeral). This causes air flowing into the guide path 20 to flow out from the guide path 20 through the first outflow opening 20b and flow into the second compressor 19B.

[0037] The outflow pipe portion 21 has a first outflow pipe 21a leading to the compressor main body 19a of the first compressor 19A, a second outflow pipe 21b leading to the compressor main body 19a of the second compressor 19B, a manifold portion 21c which links the first outflow pipe 21a and the second outflow pipe 21b, and a confluence pipe 21d through which compressed air joining in the manifold portion 21c flows.

[0038] As shown in FIG. 4, the first outflow pipe 21a is connected to a surface of the first compressor 19A facing to the second compressor 19B, extends toward the front portion 10D side, and bends upward in the vicinity of the front portion 10D to extend toward the upper portion 10A. Air flowing into a suction port of the compressor main body 19a in the first compressor 19A through the guide path 20 is compressed in the compressor main body 19a to flow out through the first outflow pipe 21a.

[0039] As shown in FIG. 4, the second outflow pipe 21b is connected to a surface of the second compressor 19B facing to the first compressor 19A, extends toward the front portion 10D side, and bends upward in the vicinity of the front portion 10D to extend toward the upper portion 10A. Air flowing into the suction port of the compressor main body 19a in the second compressor 19B through the guide path 20 is compressed in the compressor main body 19a to flow out through the second outflow pipe 21b.

[0040] The manifold portion 21c is attached to the upper portion 10A of the housing 10 as shown in FIG. 4 and FIG. 5. Specifically, the manifold portion 21c is housed in the first housing space S1 in the housing 10 and is attached to the front portion 10D side, in the upper portion 10A, between the first compressor 19A and the second compressor 19B. The first and second outflow pipes 21a and 21b are connected to the manifold portion 21c, so that in the manifold portion 21c, compressed air flowing through the first outflow pipe 21a and compressed air flowing through the second outflow pipe 21b join.

[0041] As shown in FIG. 5, the confluence pipe 21d is connected to the manifold portion

21c to extend from the front portion 10D side of the housing 10 to the rear portion 10E side along the upper portion 10A of the housing 10. Compressed air having joined in the manifold portion 21c is to flow into the confluence pipe 21d to flow from the front portion 10D side of the housing 10 to the rear portion 10E side.

[0042] Here, as shown in FIG. 5, in a part of the rear portion 10E surrounding the first housing space S1 in the housing 10, an outflow port 10c is formed which communicates the first housing space S1 with the outside of the housing 10. Specifically, the outflow port 10c is formed in a part of the rear portion 10E on the upper portion 10A side. Then, outside the housing 10, an external duct portion 40 is attached to the rear portion 10E so as to cover the outflow port 10c. The confluence pipe 21d extends from the front portion 10D side to the rear portion 10E side and also extends into the external duct portion 40 provided outside the housing 10 through the outflow port 10c formed in the rear portion 10E.

[0043] The aftercooler 22 is attached to the rear portion 10E of the housing 10 in the outside of the housing 10. The aftercooler 22 has a meandering pipe 22a, a protection cover 22b which houses the meandering pipe 22a, and a cooler fan 22c which sends air outside the housing 10 to the inside of the protection cover 22b.

[0044] The protection cover 22b is arranged outside the housing 10 and back and above the external duct portion 40 attached to the rear portion 10E. The meandering pipe 22a extends in the protection cover 22b while meandering in the second direction B1. The confluence pipe 21d disposed in the external duct portion 40 attached to the rear portion 10E leads to the meandering pipe 22a. Compressed air flowing through the confluence pipe 21d flows into the meandering pipe 22a. The cooler fan 22c is arranged between the rear portion 10E and the protection cover 22b below the external duct portion 40. The cooler fan 22c sucks air outside the housing 10 and sends the same into the protection cover 22b.

[0045] As shown in FIG. 3 and FIG. 4, the air compression device X1 further includes the filter panel 16 attached so as to be able to open or close a cooling air inflow port 10b formed in the front portion 10D of the housing 10.

[0046] The cooling air inflow port 10b is formed for cooling various kinds of members inside the housing 10 by causing air to flow into the housing 10. The cooling air inflow port 10b is formed in the front portion 10D of the housing 10. Specifically, the front portion 10D of the housing 10 has a beam portion 10d to which the intermediate portion 10C is fixed as shown in FIG. 4. The beam portion 10d extends in parallel to the upper portion 10A and the lower portion 10B. The cooling air inflow port 10b is formed between the beam portion 10d and the lower portion 10B and has a substantially

rectangular shape. This allows the cooling air inflow port 10b to communicate the outside of the housing 10 with the second housing space S2 in the housing 10.

[0047] The filter panel 16 is attached to the front portion 10D of the housing 10 so as to cover the cooling air inflow port 10b. The filter panel 16 has a louver 161 including a plurality of elongated plate-shaped members assembled to be spaced apart from each other and to be in parallel to each other, and a the filter portion 162 attached to a back surface of the louver 161 as shown in FIG. 3 and FIG. 5. The louver 161 is attached to the front portion 10D of the housing 10 such that the filter portion 162 is fitted in the cooling air inflow port 10b.

[0048] To the louver 161, a hinge 161a and a lever lock 161b are attached. The hinge 161a fixes an upper end portion of the louver 161 in the vertical direction C1 to the front portion 10D of the housing 10. The lever lock 161b detachably fixes a lower end portion of the louver 161 in the vertical direction C1 to the front portion 10D of the housing 10. This allows, in the air compression device X1, the cooling air inflow port 10b to be opened by releasing the lever lock 161b and causing the filter panel 16 to turn with the hinge 161a as a turning center.

[0049] Air passing through the louver 161 has dusts removed in the filter portion 162. Then, the air with the dusts removed is to flow into the second housing space S2 in the housing 10 through the cooling air inflow port 10b.

[0050] Here, as shown in FIG. 4 and FIG. 5, on the front portion 10D side of the intermediate portion 10C, a through hole 10e is formed which passes through the intermediate portion 10C in the vertical direction C1. The through hole 10e is formed on the front portion 10D side with respect to the compressor unit 19 and the motor unit 17. In the first embodiment, the through hole 10e has a rectangular shape extending from ahead of the first motor 17A to ahead of the second motor 17B. The through hole 10e communicates the first housing space S1 with the second housing space S2. Therefore, air flowing into the second housing space S2 in the housing 10 through the cooling air inflow port 10b can be moved to the first housing space S1 through the through hole 10e before reaching the motor unit 17.

[0051] Since in the first embodiment, in the intermediate portion 10C, a part on the side portion side of the housing 10 has the through hole formed through which the belt B passes, air flowing into the second housing space S2 is also allowed to move to the first housing space S1 through the through hole.

[0052] The air compression device X1 further includes the panel unit 11 provided so as to be able to open or close an opening 10a formed in the front portion 10D of the housing 10 as shown in FIG. 3 and FIG. 4.

[0053] The opening 10a is formed for the maintenance of the compressor unit 19 and the like housed in the housing 10. The opening 10a is formed in the front portion 10D of the housing 10. Specifically, the opening 10a is formed between the beam portion 10d and the upper portion 10A and has a substantially rectangular shape. This enables the opening 10a to communicate the outside of the housing 10 with the first housing space S1 in the housing 10. In the first embodiment, the opening 10a is located above the cooling air inflow port 10b.

[0054] The panel unit 11 is attached to the front portion 10D of the housing 10 so as to cover the opening 10a. The panel unit 11 has a panel member 12, a sound-absorbing member 13 attached to a part of the panel member 12, a fan device unit 14 fixed to the panel member 12, and an adaptor unit 15 fixed to the fan device unit 14 as shown in FIG. 8.

[0055] The panel member 12 is provided so as to be able to open or close the opening 10a. The panel member 12 includes a main body portion 121, and a swelling portion 122 which swells from the main body portion 121 toward the outside of the housing 10.

[0056] The main body portion 121 has a flat-plate-shape along the front portion 10D of the housing 10. The main body portion 121 is attached to the front portion 10D of the housing 10 so as to cover the opening 10a with the entire panel member 12. As a result, the opening 10a is in a state of being closed by the panel member 12. In the first embodiment, the main body portion 121 is fixed to the front portion 10D by a bolt so as to be able to open the opening 10a. This enables, in the air compression device X1, the opening 10a to be opened by detaching the bolt which fixes the main body portion 121 of the panel member 12 and the front portion 10D of the housing 10 to detach the panel unit 11 from the housing 10.

[0057] Although in the first embodiment, the main body portion 121 of the panel member 12 is fixed to the front portion 10D by the bolt, this is not always the case. The main body portion 121 of the panel member 12 may be fixed to, for example, the front portion 10D of the housing 10 by the hinge portion and the lever lock similarly to the filter panel 16. In this case, the panel member 12 is allowed to open or close the opening 10a by releasing or fastening the lever lock.

[0058] The main body portion 121 has a compressible air inflow port 121a which passes through the main body portion 121. The compressible air inflow port 121a serves to allow air outside the housing 10 to flow into the guide path 20 in the housing 10. The compressible air inflow port 121a is formed at a position facing the inflow opening 20a of the guide path 20. In the first embodiment, the compressible air inflow port 121a is arranged in line with the inflow opening 20a of the guide path 20 in the first direction

A1. Then, the filter member 25 is detachably attached to the main body portion 121 so as to be fitted in the compressible air inflow port 121a. In this state, one end of the filter member 25 is fitted in the inflow opening 20a of the guide path 20.

[0059] The swelling portion 122 is formed as a part of a back surface of the panel member 12, the part being recessed to a front surface side of the panel member 12. In other words, the swelling portion 122 is integrally configured with the main body portion 121 in the panel member 12. In the first embodiment, the swelling portion 122 is recessed toward the outside of the housing 10 in the first direction A1. The swelling portion 122 has a facing portion 122b and a side portion 122a as shown in FIG. 3.

[0060] The facing portion 122b is a part facing the fan device unit 14 to be described later in a direction orthogonal to the front portion 10D (an orthogonal direction). The facing portion 122b is located ahead of the main body portion 121. Specifically, the facing portion 122b is located on the side opposite to the compressor unit 19 with respect to the main body portion 121 in the orthogonal direction.

[0061] The side portion 122a is a part extending in the orthogonal direction so as to link the facing portion 122b and the main body portion 121. The side portion 122a faces a side surface 14c in the fan device unit 14. The side portion 122a includes a first part 122c extending horizontally above the fan device unit 14, second and third parts 122d and 122e extending vertically on both sides of the fan device unit 14, and a fourth part 122f extending horizontally below the fan device unit 14. The side portion 122a forms a closed loop surrounding the fan device unit 14 in a circumferential direction as a result of continuation of the respective parts 122c to 122f. In the first embodiment, an intermediate portion of the fourth part 122f is recessed to the first part 122c side so as to avoid the compressible air inflow port 121a formed in the main body portion 121.

[0062] The swelling portion 122 has a first swelling portion 122A and a second swelling portion 122B. The first swelling portion 122A overlaps the first compressor 19A in the orthogonal direction orthogonal to the front portion 10D. The second swelling portion 122B overlaps the second compressor 19B in the orthogonal direction orthogonal to the front portion 10D. The first swelling portion 122A and the second swelling portion 122B are located in line with the compressible air inflow port 121a provided therebetween. In the first embodiment, a space surrounded by the facing portion 122b and the side portion 122a in the first swelling portion 122A is referred to as a first recessed space S3 and a space surrounded by the facing portion 122b and the side portion 122a in the second swelling portion 122B is referred to as a second recessed space S4. In the first embodiment, the first swelling portion 122A and the second swelling portion 122B are linked to each other above the compressible air inflow port

121a in the vertical direction C1. In other words, the first recessed space S3 and the second recessed space S4 are linked to each other.

[0063] Although in the first embodiment, the first swelling portion 122A and the second swelling portion 122B are linked to each other, the first swelling portion 122A and the second swelling portion 122B, not limited thereto, may be separate from each other. In this case, the first recessed space S3 and the second recessed space S4 will be spaces separate from each other.

[0064] The fan device unit 14 sends out air in the housing 10 toward the compressor unit 19. The fan device unit 14 is located so as to be deviated from the cooling air inflow port 10b in the vertical direction C1. Specifically, the fan device unit 14 is located above the cooling air inflow port 10b. The fan device unit 14 has a first fan device 14A with a part thereof arranged in the first recessed space S3 and a second fan device 14B with a part thereof arranged in the second recessed space S4. In the first embodiment, the first fan device 14A and the second fan device 14B are each configured with two axial fans which are arranged to overlap with each other in the orthogonal direction orthogonal to the front portion 10D. The number of axial fans configuring each of the first fan device 14A and the second fan device 14B may be one, or three or more.

[0065] The first fan device 14A and the second fan device 14B have the same structure. In the following, the first fan device 14A will be described.

[0066] The first fan device 14A has an inlet port 14a which sucks air flowing into the housing 10 through the cooling air inflow port 10b, an outlet port 14b located on the side opposite to the inlet port 14a to send out air, and an attachment portion 14d for attaching the first fan device 14A to the panel member 12. The first fan device 14A is configured to have an impeller arranged inside a tubularly-formed side surface 14c. Then, the inlet port 14a is formed with an opening at one end side on the tubularly-formed side surface 14c, and the outlet port 14b is formed with an opening at the other end side on the side surface 14c. In the first embodiment, the inlet port 14a and the outlet port 14b have substantially circular shapes.

[0067] As shown in FIG. 5, the first fan device 14A is arranged in a posture of having the inlet port 14a facing to the facing portion 122b of the first swelling portion 122A so as to be spaced therefrom, and having the outlet port 14b facing to the first compressor 19A side. Specifically, the first fan device 14A is arranged to extend from the first recessed space S3 to the first housing space S1 such that the inlet port 14a is located in the first recessed space S3. More specifically, an end portion of the side surface 14c on a side where the inlet port 14a is provided in the first fan device 14A is arranged on a

side closer to the facing portion 122b than to an end portion of the side portion 122a on the first compressor 19A side. Additionally, the first fan device 14A is arranged such that an axis of the axial fan configuring the first fan device 14A is deviated from the outflow port 10c formed in the rear portion 10E of the housing 10.

[0068] The attachment portion 14d of the first fan device 14A extends from the side surface 14c of the first fan device 14A in a radial direction of the first fan device 14A. Then, the attachment portion 14d of the first fan device 14A is attached to the panel member 12 via a bolt. As a result, the first fan device 14A is attached to the panel member 12 such that a part of the side surface 14c of the first fan device 14A faces the side portion 122a of the first swelling portion 122A so as to be spaced apart therefrom. The first fan device 14A may be fixed to the panel member 12 so as to be located as a whole in the first recessed space S3.

[0069] Similarly to the first fan device 14A, the second fan device 14B, detailed description of which will be omitted, is fixed to the panel member 12 such that a part of the side surface 14c of the second fan device 14B faces the side portion 122a of the second swelling portion 122B so as to be spaced apart therefrom.

[0070] The adaptor unit 15 leads air sent through the outlet port 14b in the fan device unit 14 to the compressor unit 19. The adaptor unit 15 has a first adaptor 15A fixed to the outlet port 14b side of the first fan device 14A, and a second adaptor 15B fixed to the outlet port 14b of the second fan device 14B. The first adaptor 15A is arranged between the outlet port 14b of the first fan device 14A and the first compressor 19A. The second adaptor 15B is arranged between the outlet port of the second fan device 14B and the second compressor 19B. The first adaptor 15A and the second adaptor 15B have the same structure. In the following, the first adaptor 15A will be described.

[0071] The first adaptor 15A is a rectangular plate-shaped member as shown in FIG. 9. The first adaptor 15A has a one main surface (first main surface) 15a facing the outlet port 14b of the first fan device 14A, and the other main surface (second main surface) 15b facing the first compressor 19A. The one main surface 15a is formed with one opening (first opening) 15c having a circular shape corresponding to a shape of the outlet port 14b. The other main surface 15b is formed with the other opening (the second opening) 15d having a rectangular shape corresponding to a rectangular outer shape of the first compressor 19A in the first direction A1. Then, the one opening 15c and the other opening 15d communicate with each other, thereby forming a through hole 15e which passes through the first adaptor 15A. Specifically, the through hole 15e of the first adaptor 15A forms, on the first fan device 14A side, a shape corresponding to the shape of the outlet port 14b and on the first compressor 19A side,

forms a shape corresponding the outer shape of the first compressor 19A.

[0072] The adaptor unit 15 may not necessarily be provided, and air may be sent out from the outlet port 14b of the fan device unit 14 directly to the compressor main body 19a of the compressor unit 19.

[0073] The sound-absorbing member 13 is arranged in the first and second recessed spaces S3 and S4 to reduce noise of the air compression device X1 caused by air passing through the first and second recessed spaces S3 and S4. As shown in FIG. 8 and FIG. 10, the sound-absorbing member 13 is attached to the swelling portion 122. Specifically, the sound-absorbing member 13 has a peripheral edge portion 13a provided along an inner surface of the side portion 122a and along an inner surface of the facing portion 122b of the swelling portion 122, and a dividing portion 13b arranged in a space above the compressible air inflow port 121a so as to divide the first recessed space S3 and the second recessed space S4. The peripheral edge portion 13a and the dividing portion 13b are arranged to be spaced from the fan device unit 14.

[0074] In the first embodiment, the peripheral edge portion 13a is provided to extend all over the first part 122c, the second part 122d, the third part 122e, and the fourth part 122f of the side portion 122a, and the facing portion 122b. The peripheral edge portion 13a may be provided only in a part of the side portion 122a and the facing portion 122b, for example, the peripheral edge portion 13a may be provided only in the facing portion 122b. Additionally, the peripheral edge portion 13a may be provided only in the first part 122c of the side portion 122a.

[0075] The air compression device X1, as shown in FIG. 5, further includes an outflow guide portion 23 which guides air sent out from the outlet port 14b of the fan device unit 14 to the compressor unit 19 so as to be bent toward the outflow port 10c formed in the rear portion 10E of the housing 10.

[0076] The outflow guide portion 23 is arranged behind the compressor unit 19 in the first housing space S1 in the housing 10. Specifically, the outflow guide portion 23 is located on the side opposite to the fan device unit 14 with respect to the compressor unit 19. In the first embodiment, the outflow guide portion 23 is attached to the rear portion 10E in the first housing space S1. The outflow guide portion 23 has a facing portion 23b which faces the compressor unit 19 in the axis direction of the axial fan configuring the fan device unit 14, and a side portion 23a extending from an edge of the facing portion 23b toward the compressor unit 19.

[0077] In the facing portion 23b, a communication hole 23c is formed which communicates with the outflow port 10c formed on an outer surface of the housing 10. The communication hole 23c is located out of the axis of the axial fan configuring the

fan device unit 14. The confluence pipe 21d of the outflow pipe portion 21 extends into the outflow guide portion 23 along the upper portion 10A and further to the external duct portion 40 outside the housing 10 through the communication hole 23c and the outflow port 10c.

[0078] On an inner surface of the outflow guide portion 23, a sound-absorbing member 24 is provided. In the present embodiment, the sound-absorbing member 24 is provided to extend on the entire side portion 23a and the entire facing portion 23b excluding the communication hole 23c.

[0079] In the above-described compression device X1 according to the first embodiment, as shown in FIG. 10, the compressor unit 19 is cooled by air flowing in the housing 10. In the following, description will be made of a flow of air which cools the first compressor 19A in the compressor unit 19 with reference to FIG. 10. The second compressor 19B is to be cooled in the same manner as for the first compressor 19A.

[0080] In the air compression device X1, air horizontally flows into the second housing space S2 in the housing 10 from the outside of the housing 10 through the cooling air inflow port 10b. A part of the air flowing into the second housing space S2 rises to the first housing space S1 through the through hole 10e of the intermediate portion 10C according to suction of the inlet port 14a in the first fan device 14A before reaching the motor unit 17. Then, the air rising to the first housing space S1 flows into a passage F1 formed between the side surface 14c of the first fan device 14A and the sound-absorbing member 13 provided in the fourth part 122f of the side portion 122a. The air flowing into the passage F1 flows toward the facing portion 122b side, goes around to the inlet port 14a while being bent in the sound-absorbing member 13 provided in the facing portion 122b, and is sucked into the inlet port 14a.

[0081] Thus, in the air compression device X1, the inlet port 14a in the fan device unit 14 is arranged such that air in the housing 10 goes around toward the inlet port 14a so as to be sucked. Specifically, the facing portion 122b of the swelling portion 122 is arranged to face the side surface 14c of the fan device unit 14 so as to cause the air in the housing 10 to go around from a position along the side surface 14c toward the inlet port 14a. In other words, the swelling portion 122 according to the first embodiment corresponds to an inflow guide portion which causes air in the housing 10 to go around toward the inlet port 14a. Then, an inner surface of the swelling portion 122 serves as an inflow guide surface which actually guides an air flow.

[0082] Air sent from the outlet port 14b of the first fan device 14A to the first compressor 19A through the through hole 15e of the first adaptor 15A flows along the axis direction of the axial fan configuring the first fan device 14A to cool the first

compressor 19A. Then, after cooling the first compressor 19A, the air flows to the back of the first compressor 19A along the axis direction of the axial fan configuring the first fan device 14A and is bent by the sound-absorbing member 24 provided in the facing portion 23b of the outflow guide portion 23. Then, the bent air is led to the communication hole 23c formed in a peripheral edge portion of the facing portion 23b while having movement in the vertical direction C1 being regulated by the side portion 23a of the outflow guide portion 23. The air flowing through the communication hole 23c and the outflow port 10c is discharged from the compressor to cool compressed air flowing through the confluence pipe 21d.

[0083] The air led to the communication hole 23c flows into the external duct portion 40 attached to the rear portion 10E of the housing 10 through the communication hole 23c and the outflow port 10c. The air flows into the protection cover 22b of the aftercooler 22 arranged behind the external duct portion 40. As a result, the air flowing out from the inside of the housing 10 blows on the meandering pipe 22a in the protection cover 22b, so that compressed air flowing through the meandering pipe 22a is cooled. The meandering pipe 22a is to be cooled also by the cooler fan 22c located below the external duct portion 40.

[0084] As described in the foregoing, in the air compression device X1 according to the first embodiment, air flowing into the housing 10 through the cooling air inflow port 10b goes around toward the inlet port 14a of the fan device unit 14 so as to be sucked into the inlet port 14a and thereafter sent out to the compressor unit 19. Specifically, the air compression device X1 according to the first embodiment is capable of bending a flow direction of air flowing into the housing 10 through the cooling air inflow port 10b by suction of air through the inlet port 14a of the fan device unit 14. Specifically, the air compression device X1 according to the first embodiment enables an increase in an air flowing distance from the cooling air inflow port 10b to the inlet port 14a, while at the time of bending the air flow direction, the air more frequently collides with each member in the housing 10. This enables reduction in noise occurring in the housing 10 of the air compression device X1.

[0085] Further, in the air compression device X1 according to the first embodiment, the swelling portion 122 as the inflow guide portion is arranged so as to face the side surface 14c of the fan device unit 14. This enables air in the housing 10 to be led to the inlet port 14a via the passage F1 between the side surface 14c of the fan device unit 14 and the swelling portion 122. As a result, it is possible to reliably make the air in the housing 10 go around to the inlet port 14a.

[0086] Further, in the air compression device X1 according to the first embodiment, air

flowing between the side surface 14c of the fan device unit 14 and the side portion 122a of the swelling portion 122 is to be led to the inlet port 14a while being bent by the facing portion 23b of the swelling portion 122. As a result, it is possible to reliably bend the flow direction of the air to be sucked into the inlet port 14a of the fan device unit 14.

[0087] Further, in the air compression device X1 according to the first embodiment, the swelling portion 122 as the inflow guide portion is formed in the panel member 12 which closes the opening 10a formed for conducting maintenance in the housing 10. It is therefore unnecessary to separately provide the inflow guide portion in the housing 10.

[0088] Further, in the air compression device X1 according to the first embodiment, when moving the panel member 12 so as to open the opening 10a formed in the housing 10, the swelling portion 122 formed in the panel member 12 and the fan device unit 14 attached to the panel member 12 are to move simultaneously. In particular, in the air compression device X1 according to the first embodiment, since the adaptor unit 15 is attached to the fan device unit 14, when moving the panel member 12, the adaptor unit 15 is also to move simultaneously. As a result, by moving the panel member 12 so as to open the opening 10a of the housing 10, the compressor unit 19 in the housing 10 is to be exposed through the opening 10a. Accordingly, maintenance of the compressor unit 19 can be conducted with ease.

[0089] Further, in the air compression device X1 according to the first embodiment, the sound-absorbing member 13 attached to the swelling portion 122 enables reduction in noise caused by air flowing along the swelling portion 122.

[0090] Further, in the air compression device X1 according to the first embodiment, the sound-absorbing member 13 is provided between the upper portion 10A of the housing 10 and the fan device unit 14. Being attached to the floor portion 100a of the railroad vehicle 100, this enables, for a person who gets into a railroad vehicle, efficient reduction in noise generated from the floor portion 100a.

[0091] Further, in the air compression device X1 according to the first embodiment, when the railroad vehicle 100 arrives at a platform on the side of the side wall portion 100c, the sound-absorbing member 13 attached to the facing portion 122b is to be located between the platform and the fan device unit 14. This enables efficient reduction in noise for a person on the platform.

[0092] Further, in the air compression device X1 according to the first embodiment, the one opening 15c of the through hole 15e in the adaptor unit 15 has the shape corresponding to the shape of the outlet port 14b, and the other opening 15d of the

through hole 15e has the shape corresponding to the shape of the compressor main body 19a. This enables highly efficient supply of air sent out from the outlet port 14b to the compressor unit 19 even if a loss is generated in air introduced into the fan device unit 14 when the inlet port 14a sucks air in the housing 10 so as to go around toward the inlet port 14a. This makes it possible to sufficiently cool the compressor unit 19 while reducing noise.

[0093] Further, in the air compression device X1 according to the first embodiment, the cooling air inflow port 10b and the fan device unit 14 are arranged so as to be deviated from each other in the vertical direction C1. This causes a flow direction of air flowing through the cooling air inflow port 10b into the housing 10 to be bent at least once to the vertical direction C1. Specifically, air flowing through the cooling air inflow port 10b into the second housing space S2 in the housing 10 bends in a direction of rise toward the first housing space S1 according to suction through the inlet port 14a of the fan device unit 14. This allows the air compression device X1 according to the first embodiment to have a reduced area of the housing 10 in the horizontal direction as compared with a case of noise reduction realized by repeatedly bending the air flow direction only in the horizontal direction. In other words, the air compression device X1 according to the first embodiment enables an installation area of the air compression device X1 mounted on the railroad vehicle 100 to be smaller, while sufficiently reducing noise.

[0094] Further, since in the air compression device X1, the motor unit 17 has the motor fan 173 attached on the same axis as that of the motor main body 172, no ventilation fan needs to be separately provided in the housing 10, so that an increase in the housing 10 in size can be suppressed.

[0095] Further, in the air compression device X1 according to the first embodiment, an air flow generated by the motor fan 173 passes between the respective cooling fins 172a, resulting in flowing in the horizontal direction. Specifically, in the air compression device X1 according to the first embodiment, an air flow in the vertical direction C1 is generated by suction through the inlet port 14a of the fan device unit 14, while an air flow in a horizontal direction orthogonal to the vertical direction C1 is generated by drive of the motor fan 173. This prevents air from remaining inside the housing 10.

[0096] Further, in the air compression device X1 according to the first embodiment, air sucked through the inlet port 14a of the fan device unit 14 is sent out from the outlet port 14b of the fan device unit 14 to cool the compressor unit 19, and then bent by the outflow guide portion 23 to flow to the outside of the housing 10 from the outflow port 10c. Specifically, in the air compression device X1 according to the first embodiment,

not only a flow direction of air before being sucked into the fan device unit 14 but also a flow direction of air after cooling the compressor unit 19 can be bent to further reduce noise.

[0097] Further, in the air compression device X1 according to the first embodiment, the confluence pipe 21d of the outflow pipe portion 21 passes through the outflow guide portion 23 to extend to the outside of the housing 10 through the communication hole 23c and the outflow port 10c. As a result, the compressed air flowing through the confluence pipe 21d is to be cooled by air discharged from the outflow port 10c to the outside of the housing 10 through the outflow guide portion 23 before being led to the aftercooler 22.

[0098] Although in the first embodiment, the panel member 12 has the main body portion 121, and the swelling portion 122 swelling from the main body portion 121, this is not always the case. The first and second recessed spaces S3 and S4 may be formed, for example, by forming the panel member 12 to have a flat-plate-shape as a whole and forming an outer surface of the panel member 12 to be flat, while forming a part of a back surface thereof to be recessed to the outer surface side. In this case, the rear surface of the panel member 12 forming the first and second recessed spaces S3 and S4 serves as the inflow guide surface which guides an air flow to be led to the inlet port 14a, and the panel member 12 as a whole serves as the inflow guide portion.

[0099] Additionally, although in the first embodiment, the swelling portion 122 as the inflow guide portion which guides the air flow to be led to the inlet port 14a is formed on the panel member 12, this is not always the case. For example, when a part functioning as an inflow guide portion is not formed on the panel member 12, an inflow guide portion independent of the panel member 12 may be arranged in the housing 10.

[0100] Additionally, although in the first embodiment, the fan device unit 14 is attached to the panel member 12, and the panel unit 11 is configured as a whole to be able to open or close the opening 10a, this is not always the case. The fan device unit 14 may not necessarily be attached to the panel member 12, and may be disposed, for example, in the housing 10. This is also the case with the adaptor unit 15.

[0101] Additionally, although in the first embodiment, the compressor unit 19 has the two compressors, the first compressor 19A and the second compressor 19B, this is not always the case. The number of compressors provided in the compressor unit 19 may be one, or three or more. In this case, according to the number of compressors provided in the compressor unit 19, the number of motors provided in the motor unit 17 and the number of fan devices provided in the fan device unit 14 are to be appropriately changed.

[0102] Additionally, although in the first embodiment, providing the housing 10 with the intermediate portion 10C and forming the first housing space S1 and the second housing space S2 with the intermediate portion 10C provided therebetween result in arranging the motor unit 17 and the compressor unit 19 to be deviated from each other in the vertical direction C1, this is not always the case. For example, the motor unit 17 and the compressor unit 19 may be arranged in line in a plane direction orthogonal to the vertical direction C1.

[0103] (Second Embodiment)

In a second embodiment shown below, description will be made with respect to an air compression device X2 in which a motor unit 17 and a compressor unit 19 are arranged so as to be in line in a plane direction.

[0104] FIG. 11 to FIG. 13 show the air compression device X2 according to the second embodiment. FIG. 11 is a perspective view showing the air compression device X2 seen from a front portion 10D side of a housing 10. FIG. 12 is a perspective view showing the air compression device X2 from a side portion side of the housing 10, which is a view seen through the side portion and an upper portion 10A of the housing 10. FIG. 13 is a view of the inside of the air compression device X2 seen from the upper portion 10A side of the housing 10, in which predetermined sections are shown only of a fan device unit 14 and an inflow guide portion 26 to be described later. In FIG. 11 to FIG. 13, the same constituent members in the air compression device X2 as those of the air compression device X1 are given the same reference numerals as those in the first embodiment.

[0105] As shown in FIG. 11 and FIG. 12, in the front portion 10D of the housing 10, a cooling air inflow port 10b for allowing air to flow into the housing 10 is formed. The cooling air inflow port 10b has a rectangular shape and communicates the outside of the housing 10 with a first housing space S1 which is a space above an intermediate portion 10C in the housing 10. Then, a filter panel 16 is attached to the front portion 10D of the housing 10 so as to be able to open or close the cooling air inflow port 10b.

[0106] In the air compression device X2, as shown in FIG. 12, a controller unit 18 and an aftercooler 22 are housed in a second housing space S2. Additionally, a motor unit 17 and a compressor unit 19 are housed in the first housing space S1.

[0107] The motor unit 17 has a first motor 17A and a second motor 17A arranged in line in the first housing space S1. Output shafts of the first and second motors 17A and 17B extend in a direction in which the front portion 10D and the rear portion 10E are arranged. The first and second motors 17A and 17B are arranged on a side closer to the rear portion 10E than to the front portion 10D.

[0108] The compressor unit 19 has a first compressor 19A and a second compressor 19B arranged in line in the second housing space S2. The first and second compressors 19A and 19B are arranged on a side closer to the front portion 10D than to the rear portion 10E. The first compressor 19A and the first motor 17A are arranged in the direction in which the front portion 10D and the rear portion 10E are arranged, and the second compressor 19B and the second motor 17B are arranged in the direction in the direction in which the front portion 10D and the rear portion 10E are arranged. Specifically, the first and second compressors 19A and 19B are arranged such that output shafts thereof overlap with the output shafts of the first and second motors 17A and 17B, respectively. The first and second compressors 19A and 19B are linked with the first and second motors 17A and 17B, respectively. The first and second compressors 19A and 19B face the filter panel 16 in the arrangement direction of the front portion 10D and the rear portion 10E.

[0109] The fan device unit 14 has a first fan device 14A facing the first compressor 19A and a second fan device 14B facing the second compressor 19B. The first fan device 14A and the second fan device 14B are arranged in an arrangement direction of the first compressor 19A and the second compressor 19B. The first fan device 14A and the second fan device 14B have the same configuration and are symmetrically arranged in the arrangement direction of the first compressor 19A and the second compressor 19B. In the following, the first fan device 14A will be described.

[0110] As shown in FIG. 13, the first fan device 14A is arranged between the first compressor 19A and one side portion of the housing 10. Specifically, the first fan device 14A is arranged in a posture of having an inlet port 14a facing to the one side surface of the housing 10 at a spaced position and having an outlet port 14b facing to the first compressor 19A. Specifically, in the air compression device X2, an air flow direction in the first fan device 14A is orthogonal to an inflow direction of air flowing from the cooling air inflow port 10b into the housing 10. In the first embodiment, the first fan device 14A is arranged in line with a part of the cooling air inflow port 10b in an arrangement direction of the first motor 17A and the first compressor 19A.

[0111] As shown in FIG. 13, the air compression device X2 further includes a space portion 27 into which air sent out from the first and second fan devices 14A and 14B to the first and second compressors 19A and 19B flows, a discharge portion 29 into which air in the space portion 27 is discharged, and a discharge fan 28 which sends air in the space portion 27 to the discharge portion 29.

[0112] The space portion 27 is located between the first compressor 19A and the second compressor 19B in the second direction B1. Specifically, between the first compressor

19A and the second compressor 19B, the space portion 27 is formed between one side wall arranged along the first compressor 19A and the other side wall arranged along the second compressor 19B. Air flowing from the fan device unit 14 to the compressor unit 19 is to flow into the space portion 27 through, for example, openings formed in the one side wall and the other side wall.

[0113] The discharge portion 29 is arranged on the rear portion 10E side with respect to the space portion 27 so as to be arranged in line with the space portion 27. The discharge fan 28 is arranged between the space portion 27 and the discharge portion 29. Air flowing into the space portion 27 is caused to flow in the space portion 27 from the front portion 10D side to the rear portion 10E side by suction by the discharge fan 28 so as to be led to the discharge portion 29. The discharge portion 29 discharges air, for example, toward an aftercooler 22 arranged below the discharge portion 29.

[0114] Here, the air compression device X2 further includes an inflow guide portion 26 provided in the housing 10 in place of the swelling portion 122 in the air compression device X1.

[0115] The inflow guide portion 26 is housed in the first housing space S1 in the housing 10. The inflow guide portion 26 has a first inflow guide portion 26A and a second inflow guide portion 26B. The first inflow guide portion 26A causes air flowing from the cooling air inflow port 10b into the housing 10 to go around from a position along a side surface 14c of the first fan device 14A toward the inlet port 14a. The second inflow guide portion 26B causes air flowing from the cooling air inflow port 10b into the housing 10 to go around from a position along the side surface 14c of the second fan device 14B toward the inlet port 14a. The first inflow guide portion 26A is arranged between the first compressor 19A and one side surface of the housing 10, and the second inflow guide portion 26B is arranged between the second compressor 19B and the other side surface of the housing 10.

[0116] The first inflow guide portion 26A and the second inflow guide portion 26B have the same structure and are arranged in a symmetrical posture in the arrangement direction of the first compressor 19A and the second compressor 19B. In the following, the first inflow guide portion 26A will be described in detail.

[0117] The first inflow guide portion 26A has a compressor holding portion 261, an upper guide portion 262, and a side guide portion 263.

[0118] The compressor holding portion 261 of the first inflow guide portion 26A has a flat-plate-shape, in which a fan opening 261a is formed in a central part. The compressor holding portion 261 of the first inflow guide portion 26A is arranged to face the first compressor 19A in the arrangement direction of the first compressor 19A and

the second compressor 19B. Then, the fan opening 261a formed in the compressor holding portion 261 of the first inflow guide portion 26A communicates with the outlet port 14b of the first fan device 14A. As a result, air sent out from the outlet port 14b of the first fan device 14A is led to the first compressor 19A through the fan opening 261a.

[0119] The upper guide portion 262 of the first inflow guide portion 26A extends from an upper end of the compressor holding portion 261 toward the one side portion of the housing 10. At a position above the first fan device 14A, the upper guide portion 262 of the first inflow guide portion 26A faces the side surface 14c of the first fan device 14A. The upper guide portion 262 is arranged so as to be spaced apart from the upper portion 10A of the housing 10, and is arranged so as to be spaced apart from the one side portion of the housing 10. To an inner surface of the upper guide portion 262 (a surface on the first fan device 14A side), a sound-absorbing member 30 is attached.

[0120] The side guide portion 263 of the first inflow guide portion 26A extends from a front end of the compressor holding portion 261 (an end portion on the front portion 10D side of the housing 10) toward the one side portion of the housing 10. The side guide portion 263 of the first inflow guide portion 26A faces the side surface 14c of the first fan device 14A at the side of the first fan device 14A. The side guide portion 263 leads to the upper guide portion 262. The side guide portion 263 is arranged so as to be spaced apart from the front portion 10D of the housing 10 and is arranged so as to be spaced apart from the one side portion of the housing 10. To an inner surface of the side guide portion 263 (a surface on the first fan device 14A side), the sound-absorbing member 30 is attached.

[0121] As shown in FIG. 13, the side guide portion 263 of the first inflow guide portion 26A is located between the cooling air inflow port 10b and the first fan device 14A. Then, the inlet port 14a of the first fan device 14A falls within a range of a width of the side guide portion 263 of the first inflow guide portion 26A in an arrangement direction of the first fan device 14A and the cooling air inflow port 10b. In the second embodiment, in the arrangement direction of the first compressor 19A and the second compressor 19B, one end of the side guide portion 263 of the first inflow guide portion 26A, the end being on the one side portion side of the housing 10, is located on a side closer to the side portion than to an outer edge of the cooling air inflow port 10b. Then, the inlet port 14a of the first fan device 14A is located on the first compressor 19A side with respect to the one end of the side guide portion 263.

[0122] In the air compression device X2, air flows into the first housing space S1 inside the housing 10 from the outside of the housing 10 through the cooling air inflow port

10b. The air flowing into the first housing space S1 is bent at the side guide portion 263 according to suction of the inlet ports 14a of the first and second fan devices 14A and 14B. Specifically, the air flowing into the first housing space S1 flows toward the one side portion and the other side portion of the housing 10 through a gap between the side guide portion 263 and the front portion 10D. Then, the air reaching the one side portion and the other side portion of the housing 10 is bent at the side portion to go around the side guide portion 263 and is sucked into the inlet port 14a. In the second embodiment, since a gap is formed also between the upper guide portion 262 and the upper portion 10A of the housing 10, air in the housing 10 is also allowed to go around the upper guide portion 262 through the gap so as to be sucked into the inlet port 14a.

[0123] Thus, in the air compression device X2 according to the second embodiment, the inflow guide portion 26 allows air in the housing 10 to go around toward the inlet port 14a. This enables an increase in a distance of an air flow from the cooling air inflow port 10b to reach the inlet port 14a of the fan device unit 14, thereby reducing noise similarly to the air compression device X1 according to the first embodiment.

[0124] Besides, in the air compression device X2 according to the second embodiment, it is possible to bend a flow direction of air flowing into the space portion 27 by the discharge fan 28 after cooling the first and second compressors 19A and 19B. This realizes noise reduction.

[0125] The above-described first embodiment and second embodiment are for illustrative purpose only and are not to be construed as limiting in any manner. The scope of the present invention is represented not by the description of the above-described first embodiment and second embodiment but by the scope of claims for patent and further includes meanings equivalent to the scope of claims for patent and all changes within the range.

[0126] Here, the above embodiments will be outlined.

[0127] (1)In the above air compression device, air flowing into the housing through the inflow port goes around toward the inlet port of the fan device unit so as to be sucked into the inlet port and thereafter sent out to the compressor unit. Specifically, the above air compression device is capable of bending a flow direction of air flowing into the housing by suction of air through the inlet port of the fan device unit. Specifically, the above air compression device enables an increase in an air flowing distance from the inflow port to the inlet port, while at the time of bending the air flow direction, the air more frequently collides with the members in the housing. This enables reduction in noise occurring in the housing of the air compression device.

[0128] (2) The above air compression device preferably further includes the inflow

guide portion arranged to face the side surface of the fan device unit so as to cause air to be sucked into the inlet port to go around from a position along the side surface toward the inlet port.

[0129] Since in the air compression device, the inflow guide portion is arranged so as to face the side surface of the fan device unit, air in the housing can be led to the inlet port via a space between the side surface of the fan device unit and the inflow guide portion. As a result, it is possible to reliably make the air in the housing go around to the inlet port.

[0130] (3)The inflow guide portion preferably has the side portion which faces the side surface of the fan device unit, and the facing portion which faces the inlet port of the fan device unit.

[0131] In the above air compression device, air flowing between the side surface of the fan device unit and the side portion is to be led to the inlet port while being bent by the facing portion. As a result, it is possible to reliably bend the flow direction of the air to be sucked into the inlet port of the fan device unit.

[0132] (4) The above air compression device may further include the panel member provided so as to be able to open or close the opening formed in the housing, the opening being for maintenance of the inside of the housing. In this case, the inflow guide portion is preferably configured integrally with the panel member.

[0133] Since in the above air compression device, the inflow guide portion is configured integrally with the panel member, it is unnecessary to separately provide the inflow guide portion in the housing.

[0134] (5) The fan device unit is preferably attached to the panel member.

[0135] In the above air compression device, when moving the panel member so as to open the opening formed in the housing, the inflow guide portion configured integrally with the panel member and the fan device unit attached to the panel member are to move together. Accordingly, by moving the panel member so as to open the opening of the housing, maintenance of the compressor unit in the housing can be conducted through, for example, the opening with ease.

[0136] (6) The inflow port and the fan device unit are preferably arranged such that the inflow port is in a position deviated with respect to the fan device unit in the vertical direction.

[0137] In the above air compression device, arranging the inflow port and the fan device unit so as to be deviated in the vertical direction causes a flow direction of air flowing from the inflow port into the housing to be bent at least once to the vertical direction. This allows the above air compression device to have a reduced area of the housing in

the horizontal direction as compared with a case of noise reduction realized by repeatedly bending the air flow direction only in the horizontal direction. In other words, the above air compression device enables an installation area of the air compression device mounted, for example, on a vehicle to be smaller, while sufficiently reducing noise.

[0138] (7) The above air compression device may further include the inflow guide portion which causes air flowing into the housing through the inflow port to go around toward the inlet port. In this case, the inflow guide portion is preferably arranged between the inflow port and the fan device unit. Additionally, the inlet port of the fan device unit preferably falls within a range of a width of the inflow guide portion in a direction in which the fan device unit and the inflow port are arranged.

[0139] Since in the above air compression device, the inlet port falls within a range of a width of the inflow guide portion provided between the inflow port and the fan device unit, air flowing from the inflow port into the housing is to go around the inflow guide portion according to suction through the inlet port. Specifically, in the above air compression device, the inflow guide portion enables air flowing into the housing to go around toward the inlet port, thereby realizing noise reduction.

[0140] (8) The above air compression device preferably further includes the sound-absorbing member attached to the inflow guide portion.

[0141] In the above air compression device, the sound-absorbing member attached to the inflow guide portion further enables reduction in noise caused by air flowing along the inflow guide portion.

[0142] (9) The sound-absorbing member is preferably provided at least between the upper portion of the housing and the fan device unit.

[0143] In the above air compression device, the sound-absorbing member is provided between the upper surface of the housing and the fan device unit. When the air compression device is attached under a floor of a vehicle, this enables efficient noise reduction for a person to get on the vehicle.

[0144] (10) The above air compression device may further include the adaptor unit having the through hole which leads air sent through the outlet port of the fan device unit to the compressor unit. In this case, the through hole of the adaptor unit preferably has the shape corresponding to the shape of the outlet port on the fan device unit side and has the shape corresponding to the outer shape of the compressor unit on the compressor unit side.

[0145] In the above air compression device, even if a loss is generated in air introduced into the fan device unit when the inlet port sucks air in the housing so as to go around

toward the inlet port, it is possible to highly efficiently supply air sent out from the outlet port to the compressor unit. This makes it possible to sufficiently cool the compressor unit while reducing noise.

[0146] (11) The above air compression device preferably further includes the motor unit having the motor main body for driving the compressor unit, and having the motor fan which is attached on the same axis as an axis of the motor main body and which generates an air flow according to drive of the motor main body.

[0147] Since in the air compression device, the motor unit has the motor fan attached on the same axis as that of the motor main body, no ventilation fan needs to be separately provided in the housing, so that an increase in the housing in size can be suppressed.

[0148] (12) The housing may have the outflow port which allows air in the housing to flow out. In this case, the air compression device preferably further includes the outflow guide portion provided so as to bend, toward the outflow port, a direction of a flow of air flowing on the side opposite to the fan device unit with respect to the compressor unit.

[0149] In the above air compression device, air sucked from the inlet port of the fan device unit is sent out from the fan device unit to cool the compressor unit, and then bent by the outflow guide portion at a side opposite to the fan device unit with respect to the compressor unit to flow to the outside of the housing from the outflow port. Specifically, in the air compression device, not only a flow direction of air before being sucked from the inlet port into the fan device unit but also a flow direction of air after cooling the compressor unit can be bent to further reduce noise.

[0150] As described in the foregoing, the embodiments provide an air compression device enabling noise reduction.

Claims

1. An air compression device comprising:

a housing having an inflow port for allowing air to flow into an inside of the housing; and

a fan device unit which has an inlet port which sucks air flowing into the housing through the inflow port and sends out the air sucked through the inlet port toward a compressor unit,

wherein the inlet port of the fan device unit is arranged so as to cause air in the housing to go around toward the inlet port and suck the air.

2. The air compression device according to claim 1, further comprising an inflow guide portion arranged to face a side surface of the fan device unit so as to cause air to be sucked into the inlet port to go around from a position along the side surface toward the inlet port.

3. The air compression device according to claim 2, wherein the inflow guide portion has a side portion which faces the side surface of the fan device unit and a facing portion which faces the inlet port of the fan device unit.

4. The air compression device according to any one of claims 1 to 3, further comprising a panel member provided so as to be able to open or close an opening formed in the housing, the opening being for maintenance of the inside of the housing,

wherein the inflow guide portion is configured integrally with the panel member.

5. The air compression device according to claim 4, wherein the fan device unit is attached to the panel member.

6. The air compression device according to any one of claims 1 to 5, wherein the inflow port and the fan device unit are arranged such that the inflow port is in a position deviated with respect to the fan device unit in a vertical direction.

7. The air compression device according to claim 1, further comprising:

an inflow guide portion which causes air flowing into the housing through the inflow port to go around toward the inlet port,

wherein the inflow guide portion is arranged between the inflow port and the

fan device unit, and

the inlet port of the fan device unit falls within a range of a width of the inflow guide portion in a direction in which the fan device unit and the inflow port are arranged.

8. The air compression device according to any one of claims 2 to 7, further comprising a sound-absorbing member attached to the inflow guide portion.

9. The air compression device according to claim 8, wherein the sound-absorbing member is provided at least between an upper portion of the housing and the fan device unit.

10. The air compression device according to any one of claims 1 to 9, further comprising an adaptor unit having a through hole which leads air sent through an outlet port of the fan device unit to the compressor unit,

wherein the through hole of the adaptor unit has a shape corresponding to a shape of the outlet port on the fan device unit side and has a shape corresponding to an outer shape of the compressor unit on the compressor unit side.

11. The air compression device according to any one of claims 1 to 10, further comprising a motor unit having a motor main body and a motor fan, the motor main body being for driving the compressor unit, the motor fan being attached on the same axis as that of the motor main body and generating an air flow according to drive of the motor main body.

12. The air compression device according to any one of claims 1 to 11, wherein the housing has an outflow port which allows air in the housing to flow out, the air compression device further comprising:

an outflow guide portion provided so as to bend, toward the outflow port, a direction of a flow of air flowing on the side opposite to the fan device unit with respect to the compressor unit.