

AIR CURTAIN STRUCTURE CAPABLE OF REDUCING INTERFERENCE WITH MECHANICAL OPERATIONS

FIELD OF THE INVENTION

[0001] The present invention relates to an air curtain structure, and more particularly to an air curtain structure capable of reducing interference with mechanical operations.

BACKGROUND OF THE INVENTION

[0002] Machinery and equipment for factory production often need to be customized or modified with additional parts to meet the needs of production operations. For example, a machine is customized or modified with additional parts, and the upper end of the machine protrudes outwardly to have an eaves structure. If the product production conditions require the isolation of fine dust and moisture, it is necessary to install an air curtain structure at the eaves structure.

[0003] However, the air curtain structure at the eaves structure reduces the space for mechanical operations. As to the mechanical operations, such as picking up or placing articles into the machine, mechanical components are prone to positional conflict with the air curtain structure, resulting in collision or difficulty in operation. This may cause production losses and reduce production efficiency. Even though the air curtain structure is modified to adapt to the eaves structure, if the components of the air curtain structure are not properly designed for installation, the modified air curtain structure may still conflict with the operating position of the operating machinery easily.

SUMMARY OF THE INVENTION

[0004] The primary object of the present invention is to provide an air curtain structure capable of reducing interference with mechanical operations. The air curtain structure includes an air curtain device. The air curtain device has a casing. One side of the casing is recessed to form a mounting groove for a connection port of the air guide device to be embedded and mounted in the mounting groove to reduce the proportion of the safe distance of the air curtain structure after installation, thereby reducing mechanical interference and minimizing production losses.

[0005] In order to achieve the foregoing object, the present invention provides an air curtain structure capable of reducing interference with mechanical operations. The air curtain structure is installed in an installation space having an eaves structure protruding outwardly. The eaves structure has an extension length in an outward protruding direction. The installation space extends in the outward protruding direction of the eaves structure by a safe distance to prevent interference with mechanical operations. The air curtain structure comprises an air guide device and an air curtain device.

[0006] The air guide device has a body and at least one air guide element mounted in the body. The body has at least one air inlet for introducing an air. An underside of the body communicates with at least one connection port. One end of the connection port is connected to the air guide element. One side of the connection port is formed with at least one air flow exit. The air passing through the body is directed to the connection port through the air guide element and guided out of the air flow exit.

[0007] The air curtain device has a casing extending in a length direction and a plurality of air guide spaces formed in the casing. A bottom of the casing has at least one air outlet communicating with the air guide spaces. One long side of the casing, extending in the length direction, is formed with at least one air flow entry communicating with the air flow exit. The air passes through the air flow entry to the air guide spaces and is regulated in the air guide spaces and uniformly discharged in straight lines via the air outlet.

[0008] The casing further has two short sides adjacent to the long side. A maximum length of the short sides in a horizontal direction is defined as a casing width. The connection port has two opposing connection sides. A length of the connection sides in the horizontal direction is defined as a connection length. W represents the casing width, R represents the connection length, D represents the safe distance, L represents the extension length, and the relational expression is $W + R \leq D + L$.

BRIEF DESCRIPTION OF THE DRAWINGS

[0009] FIG. 1 is a perspective view according to a first embodiment of the present invention;

[0010] FIG. 2 is a partial exploded view according to the first embodiment of the present invention;

[0011] FIG. 3 is a side sectional view according to the first embodiment of the present invention;

[0012] FIG. 4 is a side schematic view according to the first embodiment of the present invention in a use state;

[0013] FIG. 5 is a perspective view according to a second embodiment of the present invention;

[0014] FIG. 6 is a partial exploded view according to the second embodiment of the present invention;

[0015] FIG. 7 is a side sectional view according to the second embodiment of the present invention;

[0016] FIG. 8 is a partial exploded view of another implementation according to the second embodiment of the present invention;

[0017] FIG. 9 is a perspective view of another implementation according to the second embodiment of the present invention; and

[0018] FIG. 10 is a side sectional view according to a third embodiment of the present invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0019] Referring to FIG. 1 through FIG. 4, an air curtain structure 100 capable of reducing interference with mechanical operations according to a first embodiment of the present invention is installed in an installation space 200 having an eaves structure 201 protruding outwardly.

[0020] Referring to FIG. 1 and FIG. 2, the air curtain structure 100 includes an air guide device 1 and an air curtain device 2. The air guide device 1 has a body 11 and at least one air guide element 12 mounted in the body 11. The number of air guide elements 12 can be adjusted according to production requirements. In this embodiment, the air guide device 1 has four air guide elements 12. The air guide element 12 is a fan. The body 11 has at least one air inlet 111 for introducing an air. The underside of the body 11 communicates with at least one connection port 13. The connection port 13 serves as an air delivery passageway. One end of the connection port 13 is connected to the air guide element 12. One side of the connection port 13 is formed

with at least one air flow exit 131. The air passing through the body 11 is directed to the connection port 13 through the air guide element 12 and guided out of the air flow exit 131.

[0021] As shown in FIG. 2, in order to ensure that the air guide element 12 is mounted to the connection port 13 stably, a mounting platform 14 is provided at the end of the connection port 13. The mounting platform 14 has a through hole 141 facing an end opening 132 of the connection port 13. A mounting seat 15 is provided on the mounting platform 14 for mounting the air guide element 12. Through the mounting platform 14 and the mounting seat 15, the installation space at the end of the connection port 13 is expanded, so that the air guide element 12 is securely mounted on the connection port 13 to ensure smooth air flow during operation.

[0022] Referring to FIG. 2 and FIG. 3, the air curtain device 2 has a casing 21 extending in a length direction and a plurality of air guide spaces 22 formed in the casing 21. The bottom of the casing 21 has at least one air outlet 23 communicating with the air guide spaces 22. In this embodiment, the air outlet 23 extends in the length direction of the casing 21 and communicates with the air guide spaces 22. One long side 211 of the casing 21, extending in the length direction, is recessed to form a mounting groove 212 for the connection port 13 to be embedded and mounted in the mounting groove 212. An inner wall 213 of the mounting groove 212 has at least one air flow entry 214 communicating with the air flow exit 131. The connection port 13 is embedded and mounted in the mounting groove 212 to reduce the length of the air guide device 1 extending out of the outside of the casing 21, thereby allowing mechanical operations and reducing interference.

[0023] In this embodiment, one side of the connection port 13, facing the long side 211, is formed with the air flow exit 131. The inner wall 213 of the mounting groove 212 has the air flow entry 214 communicating with the air flow exit 131. The air guide element 12 guides the air passing through the body 11 to the connection port 13, and then the air flows to the air flow entry 214 via the air flow exit 131 to enter the casing 21.

[0024] Referring to FIG. 3, at least one vertical air guide plate 215 and at least one transverse air guide plate 216 are disposed in the casing 21. The vertical air guide plate 215 and the transverse air guide plate 216 each have a plurality of air holes (not shown). The vertical air guide plate 215 and the transverse air guide plate 216 divide the internal space inside the casing 21 into the plurality of air guide spaces 22. In this embodiment, one vertical air guide plate 215 and two transverse air guide plates 216 are disposed in the casing 21. The vertical air guide plate 215 faces the air flow entry 214 and divides the internal space of the casing 21 into

an entrance space 221 for transversely directing the air to an adjacent one of the air guide spaces 22. The transverse air guide plates 216 are spaced apart from each other and face the air outlet 23. The transverse air guide plates 216 divide the internal space of the casing 21 into two regulating spaces 222 for regulating the air flowing from the entrance space 221 to become uniform laminar flow to flow out in the vertical direction.

[0025] As shown in FIG. 4, when in use, the top of the casing 21 of the air curtain device 2 of this embodiment is fixed to the underside of the eaves structure 201, and the casing 21 is placed in the installation space 200. The air guide device 1 is arranged toward the operating space of an external machine. In order to achieve the effect of reducing the air guide device to interfere with mechanical operations, the dimensional relationship between the air guide device 1, the curtain device 2, the eaves structure 201 and the installation space 200 are described in detail as follows:

[0026] The underside of the eaves structure 201 has an extension length L. A safe distance D is defined between the installation space 200 and an external machine to prevent operational interference. The casing 21 further has two short sides 218 adjacent to the long side 211. The maximum length of the short sides 218 in the horizontal direction is defined as a casing width W. The connection port 13 has two opposing connection sides 133 that are in contact with the inner wall 213 of the mounting groove 212. The length of the connection sides 133 in the horizontal direction is defined as a connection length R. The distance at which the connection sides 133 are embedded in the coupling groove 212 is defined as an embedded depth Z. The relational expression of the casing width W, the connection length R, the embedded depth Z, the safe distance D and the extension length L is $W + R - Z < D + L$.

[0027] When the above relationship is met, the present invention has little interference with mechanical operations within the safe distance D. When the embedded depth Z is equal to the connection length R, the connection port 13 is completely embedded in the coupling groove 212. At this time, the present invention accounts for the smallest proportion of the safe distance D, achieving the effect of reducing the air guide device to interfere with mechanical operations effectively.

[0028] FIG. 5, FIG. 6 and FIG. 7 illustrate a second embodiment of the present invention. The second embodiment is substantially similar to the first embodiment with the exceptions described hereinafter. The body 11 communicates with at least one air guide pillar 16. The air guide pillar 16 is hollow. One end of the air guide pillar 16, far away from the body

11, serves as the connection port 13 having the air flow exit 131. As shown in FIG. 7, the air guide device 1 of the second embodiment has the air guide pillar 16 with a certain length to increase the vertical distance between the air guide device 1 and the air curtain device 2, in order to cooperate with mechanical operations. In other feasible implementations, as shown in FIG. 8, the connection sides 133 of the connection port 13 each have the air flow exit 131, and the inner wall 213 of the mounting groove 212 has the air flow entry 214 communicating with the air flow exit 131, such that the air flow introduced into the casing 21 has different flow rates and directions. The collision of the air flows with different flow rates and directions can quickly adjust the flow rate of the air flows, which is conducive to the subsequent discharge of the laminar flow.

[0029] FIG. 9 illustrates another feasible implementation of the second embodiment. The long side 211 is formed with the air flow entry 214 communicating with the air flow exit 131 of the connection port 13. The relational expression of the casing width W , the connection length R , the safe distance D and the extension length L is $W + R \leq D + L$. The air curtain structure of the present invention achieves the effect of giving way to mechanical operations and reducing mechanical interference effectively.

[0030] FIG. 10 illustrates a third embodiment of the present invention. The third embodiment is substantially similar to the second embodiment with the exceptions described hereinafter. In the third embodiment, two transverse air guide plates 216 are disposed in the casing 21. The transverse air guide plates 216 are spaced apart from each other and face the air outlet 23. The transverse air guide plates 216 divide the internal space of the casing 21 into two regulating spaces 222 for regulating the air flowing into the casing 21 from the connection port 13 to become uniform laminar flow to flow out in the vertical direction.

[0031] In order to enable the present invention to adjust the embedded depth of the connection port according to the allowable distance of different machines, an elastic member having an air guide channel is provided between the connection port and the casing. Two ends of the elastic member communicate with the air flow exit and the air flow entry, respectively. The connection port is connected to the casing by at least one locking component, such as a screw. The embedded depth of the connection port relative to the coupling groove is adjustable through the locking component, so that the space required for the operation of the machine can be adjusted.

[0032] According to the above description, the features of the present invention are to shorten the protruding length of the air guide device through the coupling groove recessed on the side of the casing, to reduce the occupation of the safe distance of the machine, to make way for sufficient operation space, thereby reducing mechanical interference and minimizing production losses.

[0033] Although particular embodiments of the present invention have been described in detail for purposes of illustration, various modifications and enhancements may be made without departing from the spirit and scope of the present invention. Accordingly, the present invention is not to be limited except as by the appended claims.

WHAT IS CLAIMED IS:

1. An air curtain structure capable of reducing interference with mechanical operations, installed in an installation space having an eaves structure protruding outwardly, the eaves structure having an extension length in an outward protruding direction, the installation space extending in the outward protruding direction of the eaves structure by a safe distance to prevent interference with mechanical operations, the air curtain structure comprising:

an air guide device, having a body and at least one air guide element mounted in the body, the body having at least one air inlet for introducing an air, an underside of the body communicating with at least one connection port, one end of the connection port being connected to the air guide element, one side of the connection port being formed with at least one air flow exit, the air passing through the body being directed to the connection port through the air guide element and guided out of the air flow exit;

an air curtain device, having a casing extending in a length direction and a plurality of air guide spaces formed in the casing, a bottom of the casing having at least one air outlet communicating with the air guide spaces, one long side of the casing, extending in the length direction, being formed with at least one air flow entry communicating with the air flow exit, the air passing through the air flow entry to the air guide spaces and being regulated in the air guide spaces and uniformly discharged in straight lines via the air outlet;

wherein the casing further has two short sides adjacent to the long side, a maximum length of the short sides in a horizontal direction is defined as a casing width, the connection port has two opposing connection sides, a length of the connection sides in the horizontal direction is defined as a connection length, W represents the casing width, R represents the connection length, D represents the safe distance, L represents the extension length, and the relational expression is $W + R \leq D + L$.

2. The air curtain structure as claimed in claim 1, wherein the long side is recessed to form a mounting groove for the connection port to be embedded and mounted in the mounting groove, an inner wall of the mounting groove is formed with the air flow entry communicating with the air flow exit, a distance at which the connection sides are embedded in the coupling groove is defined as an embedded depth, Z represents the embedded depth, and the relational expression of the casing width, the connection length, the embedded depth, the safe distance and the extension length is $W + R - Z < D + L$.

3. The air curtain structure as claimed in claim 1, wherein at least one vertical air guide plate and at least one transverse air guide plate are disposed in the casing for dividing an internal space inside the casing into the plurality of air guide spaces.

4. The air curtain structure as claimed in claim 1, wherein the air guide spaces include at least one entrance space, at least one vertical air guide plate facing the air flow entry is disposed in the casing to divide an internal space of the casing to form the entrance space for transversely guiding the air to an adjacent one of the air guide spaces.

5. The air curtain structure as claimed in claim 1, wherein the air guide spaces include at least one regulating space, at least one transverse air guide plate facing the air outlet is disposed in the casing to divide an internal space of the casing to form the regulating space for regulating the air coming from an adjacent one of the air guide spaces to become a uniform laminar flow to flow out in a vertical direction.

6. The air curtain structure as claimed in claim 1, wherein the body communicates with at least one air guide pillar, and one end of the air guide pillar, far away from the body, serves as the connection port.

7. The air curtain structure as claimed in claim 2, wherein the connection sides of the connection port each have the air flow exit, and the inner wall of the mounting groove has the air flow entry communicating with the air flow exit.

8. The air curtain structure as claimed in claim 1, wherein a mounting platform is provided at the end of the connection port, the mounting platform has a through hole facing an end opening of the connection port, and a mounting seat is provided on the mounting platform for mounting the air guide element.

9. The air curtain structure as claimed in claim 1, wherein the air guide element is a fan.

10. The air curtain structure as claimed in claim 2, wherein an elastic member having an air guide channel is provided between the connection port and the casing, two ends of the elastic member communicate with the air flow exit and the air flow entry respectively, the connection port is connected to the casing by at least one locking component, and the embedded depth of the connection port relative to the coupling groove is adjusted by the locking component.