

DEVICE FOR CONTROLLING MOTION OF MAGNETIC ATTRACTION VEHICLE ON STRUCTURAL FACE OF STEEL HULL, AND METHOD FOR USING SAME

TECHNICAL FIELD

[0001] The present invention relates to a device for controlling motion of a magnetic attraction vehicle on a structural face of a steel hull and a use method thereof, and belongs to the technical field of ship and ocean engineering

BACKGROUND

[0002] Ship and marine engineering equipment generally has large scale characteristics, such as large surfaces of steel hulls, decks and bulkhead structures. These structures need to be cleaned, coated and inspected for welds repeatedly in the manufacturing process. The construction equipment requires a device capable of operating on the large hull surfaces, the decks and the bulkhead structures. In addition to being capable of overcoming gravity by means of the magnetic attraction force and thus moving automatically, the carrying device also has a self-adaptive emergency self-protection function, thereby avoiding accidental falls during construction. In addition, the carrying device can save labor, increase working efficiency and enhance working safety. Therefore, the present invention relates to a device for controlling motion of a magnetic attraction vehicle on a structural face of a steel hull and a use method thereof. The device has simple structure, convenient use and high reliability, can be effectively applied in the manufacture of ships and marine engineering products, and has wide engineering application prospects especially for the production of large hull sections and the inspection and coating technology of large surfaces of the structures after the products are closed.

SUMMARY

[0003] In order to overcome the problems in the prior art, the present invention provides a device for controlling motion of a magnetic attraction vehicle on a structural face of a steel hull and a use method thereof. In addition to being capable of overcoming gravity by means of the magnetic attraction force and thus moving automatically, the device also has a self-adaptive attraction-stopping function, thereby protecting the device during an emergency and avoiding accidental falls during construction. The device has simple structure, convenient use and high reliability, and can carry a construction apparatus to carry out detection and coating operations on a large surface of the steel hull, a deck and a cabin wall structure.

[0004] The present invention adopts the following technical solution: A device for controlling motion of a magnetic attraction vehicle on a structural face of a steel hull comprises a grillage magnet mechanism and further comprising a platform mechanism and a sliding block mechanism, wherein the grillage magnet mechanism comprises an outer plate, first groove wheels and a permanent magnet block; in the outer plate, one end of a first side plate and a second side plate is fixedly connected with a panel in a right-angle type, and the other end of the first side plate and the second side plate is fixedly connected with the permanent magnet block; two first groove wheels are fixed on the inner side of the panel via respective first brackets; the platform mechanism comprises platform plates, magnetic platform wheels, second guide rails and a tension spring; guide rail structures of two platform plates are respectively arranged on the inner side walls of the first side plate and the second side plate above the permanent magnet block; the first guide rail of the guide rail structures is matched with a guide groove on the platform plates; a limiting plate is arranged at the end of the first guide rail below the platform plates; the tension spring is arranged between a spring baffle plate on the top of the first guide rail and the platform plate; the lower plane of the platform plate is connected with four platform wheels that roll on the structural face of the hull via four second brackets; the sliding block mechanism comprises a trough-shaped sliding block, a pull bar, a bottom sliding groove and second groove wheels; one end of the trough-shaped sliding block is located on a convex sliding plate in a side sliding groove and is abutted against the second side plate via a pressure spring, and the other end of the trough-shaped sliding block is fixedly connected with the pull bar that penetrates through

a pull bar groove on the first side plate; the upper part of the trough-shaped sliding block is provided with two sections of upper guide rail, slanted guide rail and lower guide rail which are connected together, and are matched with the two first groove wheels; the second groove wheels connected via a third bracket below the trough-shaped sliding block are matched with the second guide rail located above the platform plate; a cylindrical touch control rod that penetrates through a circular hole on the platform plate is fixedly connected to the permanent magnet block; and the cylindrical touch control rod extends into a circular touch control hole of the bottom sliding groove located in the trough-shaped sliding block. A use method for the device for controlling motion of the magnetic attraction vehicle on the structural face of the steel hull:

[0005] (a) under the motion condition, the structural face of the hull is a horizontal plane, a perpendicular plane or has any angle in space; four magnetic platform wheels and the permanent magnet block plays a combined action; the permanent magnet block absorbs the entire device and the structural face of the hull together; a spacing between the permanent magnet block and the structural face of the hull is constant; four platform wheels roll to drive the entire device to move; at this moment, the first groove wheels are on the upper guide rail; the upper end of the cylindrical touch control rod is in the circular touch control hole; the convex sliding plate keeps the trough-shaped sliding block stable relatively under the thrust effect of the pressure spring;

[0006] (b) under the attraction-stopping condition, when the platform wheels encounter an obstacle or the device body is disturbed by external forces, a relative displacement occurs between the grillage magnet mechanism and the sliding block mechanism; as a result, the upper end of the cylindrical touch control rod is separated from the circular touch control hole; the trough-shaped sliding block moves under the thrust effect of the pressure spring; the first groove wheels roll onto the lower guide rail through the slanted guide rail from the upper guide rail; at this moment, the upper end of the cylindrical touch control rod slides in the bottom sliding groove; the pressure of the pressure spring is released; and the trough-shaped sliding block also keeps a relatively stable equilibrium state; but at this moment, the permanent magnet block quickly descends; the distance between the permanent magnet block and the structural face of the hull decreases; the

magnetic adsorption force increases rapidly; and the entire device is adsorbed into a stationary state;

[0007] (c) under the resetting condition, an external force is exerted on the pull bar to drive the trough-shaped sliding block to move. The pressure spring gets back to the compression state, and the two first groove wheels roll from the lower guide rail to the upper guide rail via the slanted guide rail. The whole device gets back to the motion condition.

[0008] The patent of the present invention has the beneficial effects that: The device for controlling motion of the magnetic attraction vehicle on the structural face of the steel hull comprises a grillage magnet mechanism, a platform mechanism and a sliding block mechanism. First groove wheels of the grillage magnet mechanism move on an upper guide rail of a trough-shaped sliding block. The trough-shaped sliding block moves on an upper guide rail of a platform plate via second groove wheels. Platform wheels on the platform plate move on a structural face of the hull. A cylindrical touch control rod fixed on a permanent magnet block extends into a circular touch control hole of a bottom sliding groove in the trough-shaped sliding block. In addition to being capable of overcoming gravity by means of the magnetic attraction force between the magnetic platform wheels and the permanent magnet block and thus moving automatically, the device also has a self-adaptive attraction-stopping function, thereby protecting the device during an emergency and avoiding accidental falls during construction. The device has simple structure, convenient use and high reliability, and can carry a construction apparatus to carry out detection and coating operations on a large surface of the steel hull, a deck and a cabin wall structure..

BRIEF DESCRIPTION OF THE DRAWINGS

[0009] FIG. 1 is a stereogram of a device for controlling motion of a magnetic attraction vehicle on a structural face of a steel hull.

[0010] FIG. 2 is a front view of FIG. 1.

[0011] FIG. 3 is a diagram of an outer plate.

[0012] FIG. 4 is a stereogram without an outer plate structure in FIG. 1.

[0013] FIG. 5 is another stereogram without an outer plate structure in FIG. 1.

[0014] FIG. 6 is an A-A sectional view in FIG. 2.

[0015] FIG. 7 is a B-B sectional view in FIG. 2.

[0016] FIG. 8 is a C-C sectional view in FIG. 2.

[0017] FIG. 9 is a D-D sectional view in FIG. 2.

[0018] FIG. 10 is an E-E sectional view in FIG. 2.

[0019] FIG. 11 is an F-F sectional view in FIG. 2.

[0020] FIG. 12 shows an end of a side sliding groove of a trough-shaped sliding block of G enlarged diagram in FIG. 5.

[0021] FIG. 13 shows a guide rail structure of H enlarged diagram in FIG. 5.

[0022] FIG. 14 is an enlarged diagram of I in FIG. 7.

[0023] FIG. 15 is a schematic diagram of an operating condition of a device in which a cylindrical touch control rod is in a circular touch control hole.

[0024] FIG. 16 is a schematic diagram of an attraction-stopping condition of a device in which a cylindrical touch control rod is in a bottom sliding groove.

[0025] In the drawings: 11 outer plate; 12a panel; 12b first side plate; 12c second side plate; 12d pull bar groove; 13 first groove wheel; 14 first bracket; 15 pressure spring; 16 convex sliding plate; 17 first guide rail; 17a spring baffle plate; 17b limiting plate; 18 tension spring; 19 guide rail structure; 21 permanent magnet block; 22 cylindrical touch control rod; 31 platform plate; 32 circular hole; 33 guide groove; 34 platform wheel; 34a second bracket; 35 second guide rail; 41 trough-shaped sliding block; 42 pull bar; 43 upper guide rail; 44 slanted guide rail; 45 lower guide rail; 46 bottom sliding groove; 47 circular touch control hole; 48 side sliding groove; 49 second groove wheel; 49a third bracket; and 51 structural face of hull.

DETAILED DESCRIPTION

[0026] FIGS. 1-14 show structural diagrams of a device for controlling motion of a magnetic attraction vehicle on a structural face of a steel hull. In the figures, the device for controlling motion of the magnetic attraction vehicle on the structural face of the steel hull comprises a grillage magnet mechanism, a platform mechanism and a sliding block mechanism.

[0027] The grillage magnet mechanism comprises an outer plate 11, first groove wheels 13 and a permanent magnet block 21; in the outer plate 11, one end of a first side plate 12b and a second side plate 12c is fixedly connected with a panel 12a in a right-angle type, and the other end of the first side plate 12b and the second side plate 12c is fixedly connected with the permanent magnet block 21; and two first groove wheels 13 are fixed on the inner side of the panel 12a via respective first brackets 14.

[0028] The platform mechanism comprises platform plates 31, magnetic platform wheels 34, second guide rails 35 and a tension spring 18; guide rail structures 19 of two platform plates 31 are respectively arranged on the inner side walls of the first side plate 12b and the second side plate 12c above the permanent magnet block 21; the first guide rail 17 of the guide rail structures 19 is matched with a guide groove 33 on the platform plates 31; a limiting plate 17b is arranged at the end of the first guide rail 17 below the platform plates 31; the tension spring 18 is arranged between a spring baffle plate 17a on the top of the first guide rail 17 and the platform plate 31; and the lower plane of the platform plate 31 is connected with four platform wheels 34 that roll on the structural face 51 of the hull via four second brackets 34a.

[0029] The sliding block mechanism comprises a trough-shaped sliding block 41, a pull bar 42, a bottom sliding groove 46 and second groove wheels 49; one end of the trough-shaped sliding block 41 is located on a convex sliding plate 16 in a side sliding groove 48 and is abutted against the second side plate 12c via a pressure spring 15, and the other end of the trough-shaped sliding block 41 is fixedly connected with the pull bar 42 that penetrates through a pull bar groove 12d on the first side plate 12b; the upper part of the trough-shaped sliding block 41 is provided with two sections of upper guide rail 43, slanted guide rail 44 and lower guide rail 45 which are connected together, and are

matched with the two first groove wheels 13; the second groove wheels 49 connected via a third bracket 49a below the trough-shaped sliding block 41 are matched with the second guide rail 35 located above the platform plate 31.

[0030] A cylindrical touch control rod 22 that penetrates through a circular hole 32 on the platform plate 31 is fixedly connected to the permanent magnet block 21; and the cylindrical touch control rod 22 extends into a circular touch control hole 47 of the bottom sliding groove 46 located in the trough-shaped sliding block 41.

[0031] A use method for the device for controlling motion of the magnetic attraction vehicle on the structural face of the steel hull:

[0032] (a) under the motion condition, the structural face 51 of the hull is a horizontal plane, a perpendicular plane or has any angle in space; four magnetic platform wheels 34 and the permanent magnet block 21 plays a combined action; the permanent magnet block 21 absorbs the entire device and the structural face 51 of the hull together; a spacing between the permanent magnet block 21 and the structural face 51 of the hull is constant; four platform wheels 34 roll to drive the entire device to move; at this moment, the first groove wheels 13 are on the upper guide rail 43; the upper end of the cylindrical touch control rod 22 is in the circular touch control hole 47; the convex sliding plate 16 keeps the trough-shaped sliding block 41 stable relatively under the thrust effect of the pressure spring 15 (as shown in FIG. 15);

[0033] (b) under the attraction-stopping condition, when the platform wheels 34 encounter an obstacle or the device body is disturbed by external forces, a relative displacement occurs between the grillage magnet mechanism and the sliding block mechanism; as a result, the upper end of the cylindrical touch control rod 22 is separated from the circular touch control hole 47; the trough-shaped sliding block 41 moves under the thrust effect of the pressure spring 15; the first groove wheels 13 roll onto the lower guide rail 45 through the slanted guide rail 44 from the upper guide rail 43; at this moment, the upper end of the cylindrical touch control rod 22 slides in the bottom sliding groove 46; the pressure of the pressure spring 15 is released; and the trough-shaped sliding block 41 also keeps a relatively stable equilibrium state; but at this moment, the permanent magnet block 21 quickly descends; the distance between the permanent

magnet block 21 and the structural face 51 of the hull decreases; the magnetic adsorption force increases rapidly; and the entire device is adsorbed into a stationary state (as shown in FIG. 16);

[0034] (c) under the resetting condition, an external force is exerted on the pull bar 42 to drive the trough-shaped sliding block 41 to move. The pressure spring 15 gets back to the compression state, and the two first groove wheels 13 roll from the lower guide rail 45 to the upper guide rail 43 via the slanted guide rail 44. The whole device gets back to the motion condition.

What is claimed is:

1. A device for controlling motion of a magnetic attraction vehicle on a structural face of a steel hull, comprising a grillage magnet mechanism and further comprising a platform mechanism and a sliding block mechanism, wherein the grillage magnet mechanism comprises an outer plate (11), first groove wheels (13) and a permanent magnet block (21); in the outer plate (11), one end of a first side plate (12b) and a second side plate (12c) is fixedly connected with a panel (12a) in a right-angle type, and the other end of the first side plate (12b) and the second side plate (12c) is fixedly connected with the permanent magnet block (21); two first groove wheels (13) are fixed on the inner side of the panel (12a) via respective first brackets (14); the platform mechanism comprises platform plates (31), magnetic platform wheels (34), second guide rails (35) and a tension spring (18); guide rail structures (19) of two platform plates (31) are respectively arranged on the inner side walls of the first side plate (12b) and the second side plate (12c) above the permanent magnet block (21); the first guide rail (17) of the guide rail structures (19) is matched with a guide groove (33) on the platform plates (31); a limiting plate (17b) is arranged at the end of the first guide rail (17) below the platform plates (31); the tension spring (18) is arranged between a spring baffle plate (17a) on the top of the first guide rail (17) and the platform plate (31); the lower plane of the platform plate (31) is connected with four platform wheels (34) that roll on the structural face (51) of the hull via four second brackets (34a); the sliding block mechanism comprises a trough-shaped sliding block (41), a pull bar (42), a bottom sliding groove (46) and second groove wheels (49); one end of the trough-shaped sliding block (41) is located on a convex sliding plate (16) in a side sliding groove (48) and is abutted against the second side plate (12c) via a pressure spring (15), and the other end of the trough-shaped sliding block (41) is fixedly connected with the pull bar (42) that

penetrates through a pull bar groove (12d) on the first side plate (12b); the upper part of the trough-shaped sliding block (41) is provided with two sections of upper guide rail (43), slanted guide rail (44) and lower guide rail (45) which are connected together, and are matched with the two first groove wheels (13); the second groove wheels (49) connected via a third bracket (49a) below the trough-shaped sliding block (41) are matched with the second guide rail (35) located above the platform plate (31); a cylindrical touch control rod (22) that penetrates through a circular hole (32) on the platform plate (31) is fixedly connected to the permanent magnet block (21); and the cylindrical touch control rod (22) extends into a circular touch control hole (47) of the bottom sliding groove (46) located in the trough-shaped sliding block (41).

2. A use method for the device for controlling motion of the magnetic attraction vehicle on the structural face of the steel hull according to claim 1, wherein

(a) under the motion condition, the structural face (51) of the hull is a horizontal plane, a perpendicular plane or has any angle in space; four magnetic platform wheels (34) and the permanent magnet block (21) plays a combined action; the permanent magnet block (21) absorbs the entire device and the structural face (51) of the hull together; a spacing between the permanent magnet block (21) and the structural face (51) of the hull is constant; four platform wheels (34) roll to drive the entire device to move; at this moment, the first groove wheels (13) are on the upper guide rail (43); the upper end of the cylindrical touch control rod (22) is in the circular touch control hole (47); the convex sliding plate (16) keeps the trough-shaped sliding block (41) stable relatively under the thrust effect of the pressure spring (15);

(b) under the attraction-stopping condition, when the platform wheels (34) encounter an obstacle or the device body is disturbed by external forces, a relative displacement occurs between the grillage magnet mechanism and the sliding block mechanism; as a result, the upper end of the cylindrical touch control rod

(22) is separated from the circular touch control hole (47); the trough-shaped sliding block (41) moves under the thrust effect of the pressure spring (15); the first groove wheels (13) roll onto the lower guide rail (45) through the slanted guide rail (44) from the upper guide rail (43); at this moment, the upper end of the cylindrical touch control rod (22) slides in the bottom sliding groove (46); the pressure of the pressure spring (15) is released; and the trough-shaped sliding block (41) also keeps a relatively stable equilibrium state; but at this moment, the permanent magnet block (21) quickly descends; the distance between the permanent magnet block (21) and the structural face (51) of the hull decreases; the magnetic adsorption force increases rapidly; and the entire device is adsorbed into a stationary state;

(c) under the resetting condition, an external force is exerted on the pull bar (42) to drive the trough-shaped sliding block (41) to move. The pressure spring (15) gets back to the compression state, and the two first groove wheels (13) roll from the lower guide rail (45) to the upper guide rail (43) via the slanted guide rail (44). The whole device gets back to the motion condition.