CLAIMS

1. A welding control method of a portable welding robot that moves along a guide rail for welding a workpiece having a groove, the method comprising:

a sensing step of setting two or more groove shape detection positions in a welding section from a welding start point to a welding end point, and sensing groove shapes at the groove shape detection positions via a detection unit provided in the portable welding robot moving on the guide rail;

a groove shape information calculation step of calculating groove shape information based on detection data obtained in the sensing step; and

a welding condition acquisition step of acquiring a welding condition based on the groove shape information,

wherein in a case where intersections of the groove shape detection positions and a predetermined weld line on the workpiece are set as weld line position detection points, and a trajectory of welding at a time when welding is performed between adjacent weld line position detection points is set as a welding trajectory line, the groove shape detection positions are set such that a maximum value of a relative distance between the weld line and the welding trajectory line is equal to or less than two times of a welding wire diameter.

2. The welding control method of the portable welding robot according to claim 1,

wherein the welding condition is controlled so as to change in at least one of a linear manner, a stepwise manner, and a curved manner between the groove shape detection positions in accordance with a value of the welding condition acquired for each of the groove shape detection positions in a case where a change in the welding condition occurs between the groove shape detection positions.

3. The welding control method of the portable welding robot according to claim 2,

wherein at least one welding condition is a travel speed, and in a case where

a moving direction of the portable welding robot is set as an X direction,

a groove width direction perpendicular to the X direction is set as a Y direction, and

a groove depth direction perpendicular to the X direction is set as a Z direction,

moving speeds in three directions of the X direction, the Y direction, and the Z direction are calculated according to values of the travel speed that are acquired for the three

directions at the groove shape detection positions, and

the travel speed between the groove shape detection positions is controlled according to moving speeds in the three directions.

4. The welding control method of the portable welding robot according to claim 2,

wherein at least one welding condition is a travel speed,

in a case where

a moving direction of the portable welding robot is set as an X direction,

a groove width direction perpendicular to the X direction is set as a Y direction, and

a groove depth direction perpendicular to the X direction is set as a Z direction,

moving speeds in three directions of the X direction, the Y direction, and the Z direction are calculated according to values of the travel speed that are acquired for the three directions at the groove shape detection position,

wherein a welding distance or a moving time between the groove shape detection positions is divided into two or more sections, and a travel speed of each division point is calculated according to moving speeds in the three directions at each division point, and

wherein a travel speed between the groove shape detection positions is controlled such that a travel speed of each division point is constant and a travel speed between the groove shape detection positions changes in a stepwise manner.

5. The welding control method of the portable welding robot according to claim 1,

wherein at least one of the groove shape detection positions is provided in a boundary region between a linear portion and a curved portion of the guide rail or in a boundary region where a curvature of the guide rail changes in the curved portion.

6. The welding control method of the portable welding robot according to claim 5,

wherein a section for controlling the welding condition is provided immediately before or immediately after the groove shape detection position provided in the boundary region.

7. The welding control method of the portable welding robot according to claim 1,

wherein at least one of a weaving condition, a travel speed, and a welding current is selected as the welding condition, and

wherein at least one of the weaving condition, the travel speed, and the welding current is controlled based on the groove shape information between the groove shape detection positions, so that a weld metal in the groove has a constant height along a welding direction.

8. The welding control method of the portable welding robot according to claim 1,

wherein the sensing step includes sensing at least one of a workpiece surface on a side on which the groove is provided in the workpiece and a workpiece end portion in a welding direction of the workpiece, in addition to sensing of the groove shape at the groove shape detection position.

9. The welding control method of the portable welding robot according to claim 1,

wherein the sensing is touch sensing,

wherein at least five detection points arranged along a cross section of the groove are provided on a root gap and groove side surfaces on both sides of the groove at the groove shape detection position, and

wherein the groove shape information is calculated based on the detection data obtained from the detection point.

10. The welding control method of the portable welding robot according to claim 1,

wherein the weld line is a groove end of any one of both groove side surfaces of the groove shape.

11. A welding control device configured to weld a workpiece having a groove using a portable welding robot that moves along a guide rail, the welding control device comprising:

a groove shape information calculation unit that calculates groove shape information based on detection data obtained in a sensing step of

setting two or more groove shape detection positions in a welding section from a welding start point to a welding end point, and

sensing groove shapes at the groove shape detection positions via a detection unit provided in the portable welding robot moving on the guide rail; and

a welding condition acquisition unit that acquires a welding condition based on the groove shape information,

wherein in a case where intersections of the groove shape detection positions and a predetermined weld line on the workpiece are set as weld line position detection points, and a trajectory of welding at a time when welding is performed between adjacent weld line position detection points is set as a welding trajectory line, the groove shape detection positions are set such that a maximum value of a relative distance between the weld line and the welding trajectory line is equal to or less than two times of a welding wire diameter.

12. A portable welding robot that welds a workpiece having a groove while moving on a guide rail and is controlled by the welding control device according to claim 11, the portable welding robot comprising:

a detection unit that, in a state of being set on the guide rail, sets two or more groove shape detection positions in a welding section from a welding start point to a welding end point, and senses groove shapes at the groove shape detection positions.

13. A welding system of a portable welding robot, the welding system comprising:

a portable welding robot that welds a workpiece having a groove while moving on a guide rail; and

a welding control device that is capable of controlling an operation of the portable welding robot,

wherein the portable welding robot comprises a detection unit that sets two or more groove shape detection positions in a welding section from a welding start point to a welding end point, and that senses groove shapes at the groove shape detection positions, and

wherein the welding control device comprises

a groove shape information calculation unit that calculates groove shape information based on detection data obtained by the sensing, and

a welding condition acquisition unit that acquires a welding condition based on the groove shape information; and

wherein in a case where intersections of the groove shape detection positions and a predetermined weld line on the workpiece are set as weld line position detection points, and a trajectory of welding at a time when welding is performed between adjacent weld line position detection points is set as a welding trajectory line, the groove shape detection positions are set such that a maximum value of a relative distance between the weld line and the welding trajectory line is equal to or less than two times of a welding wire diameter.