CLAIMS

1. A plasma welding method using a welding device comprising one welding electric power source for a TIG welding device; a welding torch comprising an electrode extending in a predetermined direction, an insert tip surrounding the electrode, and a shield cap surrounding the outside of the insert tip; and a first selector switch which is configured to electrically connect or disconnect a plus terminal of the welding electric power source and the insert chip,

wherein the plasma welding method comprises:

a pilot arc generation step in which a pilot arc is generated between the electrode and the insert chip by electrically connecting the plus terminal and the insert chip by the first selector switch, supplying a first pilot gas which is easily converted into a plasma state between the electrode and the insert chip while supplying a shield gas between the insert chip and the shield cap; and

a first welding step in which, after the pilot arc generation step, a main arc is generated to weld the workpiece between the electrode and the workpiece by electrically disconnecting the plus terminal and the insert chip by the first selector switch while supplying the first pilot gas and the shield gas.

2. The plasma welding method according to Claim 1, wherein the plasma welding method comprises a second welding step, instead of the first welding step; and

in the second welding step, after the pilot arc generation step, the main arc is generated to weld the workpiece between the electrode and the workpiece by electrically disconnecting between the plus terminal and the insert chip by the first selector switch, then electrically connecting the plus terminal and the workpiece, stopping the supply of the first pilot gas, while supplying the shield gas, and supplying a second pilot gas which

is more suitable for plasma welding than the first pilot gas between the electrode and the insert chip.

3. The plasma welding method according to Claim 2,

wherein the plasma welding device further comprises a second selector switch which is configured to electrically connect or disconnect between the plus terminal and the workpiece, and

in the second welding step, while the plus terminal and the insert chip are electrically connected with each other by the first selector switch, the plus terminal and the workpiece are electrically connected with each other by the second selector switch, and then the plus terminal and the insert chip are instantaneously electrically disconnected by the first selector switch.

4. The plasma welding method according to Claim 1,

wherein the welding device further comprises a wire which is configured to always electrically connect between the plus terminal and the workpiece, and

the plasma welding method comprises a third welding step instead of the first welding step, and

the third welding step comprises:

a first stage in which, after the pilot arc generation step, the main arc is generated between the electrode and the workpiece by electrically disconnecting the plus terminal and the insert chip by the first selector switch, stopping the supply of the first pilot gas while supplying the shield gas, and supplying a second pilot gas which is more suitable for plasma welding than the first pilot gas between the electrode and the insert chip at a first flow rate; and

a second stage in which while supplying the shield gas, the second pilot gas is supplied at a second flow rate lower than the first flow rate at the end of the third welding step.

5. The plasma welding method according to Claim 4,

wherein the plasma welding device comprises another wire in which a second selector switch configured to electrically connect or disconnect between the plus terminal and the workpiece is provided, instead of the wire, and

in the third welding step, while the plus terminal and the insert chip are electrically connected with each other by the first selector switch, the plus terminal and the workpiece are electrically connected with each other by the second selector switch, and then the plus terminal and the insert chip are instantaneously electrically disconnected by the first selector switch.

6. The plasma welding method according to any one of Claims 1 to 5, wherein any one selected from the group consisting of argon gas, a mixed gas of argon and hydrogen, a mixed gas of argon and helium, and a mixed gas of argon and nitrogen is used as the first pilot gas.

7. The plasma welding method according to any one of Claims 2 to 6, wherein a gas which has a higher potential gradient ratio than that of the first pilot gas, and is selected from a mixed gas of argon and hydrogen, a mixed gas of argon and helium, a mixed gas of argon and nitrogen, a mixed gas of argon, helium and hydrogen, and a mixed gas of argon, helium, and nitrogen is used as the second pilot gas.

8. The plasma welding method according to any one of Claims 1 to 7, wherein a no-load voltage of a TIG welding electric power source is used to generate the main arc.

9. The plasma welding method according to any one of Claims 1 to 7, wherein a high-frequency voltage generating device of a TIG welding electric power source is used to generate the main arc.

10. The plasma welding method according to any one of Claims 1 to 7, wherein the welding device further comprises a shield gas supply line which is connected to a shield gas supply source and supplies the shield gas to the welding torch, a pilot gas supply line which is connected to a pilot gas supply source and supplies the pilot gas to the welding torch, and a solenoid valve and a check valve are provided in the shielding gas supply line and/or the pilot gas supply line in this order in a direction from the upstream side to the downstream side.

11. The plasma welding method according to Claim 1,

wherein the pilot arc generation step comprises a pre-flow processing period and a period which is after the pre-flow processing period, and maintains the current value of the non-transfer type pilot arc at the initial current value; and

in the first welding step, a current value is gradually increased in a range from 0 second to 10 seconds of an upslope time so that the current value of the main arc becomes a predetermined current value within the range of 10 to 300A, and then, the predetermined current value is maintained for a certain period, and thereby, a main arc is generated between the electrode and the workpiece to weld the workpiece.