

# **INDUSTRIAL ROBOT FOR FILLING**

## **TECHNICAL FIELD**

5    [0001] The present invention relates to the technical field of industrial machinery, in particular to an industrial robot for filling.

## **BACKGROUND**

[0002] An industrial robot is a multi-joint manipulator or multi-degree-of-freedom  
10   robot for the industrial field. The industrial robot is a machine device that automatically operates and a machine that realizes various functions by its own power and control capabilities. The industrial robot consists of three basic parts: a main body, a driving system and a control system. The industrial robot can accept human command or run in accordance with pre-arranged programs. Modern  
15   industrial robots can also act according to the principles and programs formulated by artificial intelligence technology. Typical applications of industrial robots comprise welding, painting, assembling, capturing and placing, product inspecting and testing, etc.; all operations are completed with high efficiency, durability, high speed and precision. All the industrial robots in the prior art use a solenoid valve for filling in  
20   the filling process. The filling speed is slow and the efficiency is low. Moreover, in the filling process, it is easy for the industrial gas and bacteria in the bottle body and the air to contaminate the filling liquid, leading to unqualified products. In view of this, an industrial robot for filling is proposed.

## SUMMARY

Technical problem

[0003] An object of the present invention is to provide an industrial robot for  
5 filling to solve the problems raised in the background described above.

Solution to the problems

Technical solution

[0004] To achieve the above object, the present invention provides the following  
technical solutions:

10 [0005] An industrial robot for filling, comprising a fixed base, wherein a rotating  
base is provided on the surface of the fixed base, a first joint is provided on the  
surface of the rotating base, one end of the first joint is provided with a main arm and  
is rotatably connected to one end of the main arm, the other end of the main arm is  
provided with a forearm and is rotatably connected to the forearm, one end of the  
15 forearm is provided with a connector, a second joint is provided on both sides of the  
connector, the connector is rotatably connected to the second joint, the bottom end of  
the second joint is provided with a chassis, a filling mechanism is provided under the  
chassis, the fixed base is further provided with a liquid storage tank, one end of the  
fixed base is provided with a disinfection mechanism, and one side of the liquid  
20 storage tank is equipped with a swing mechanism.

[0006] Preferably, a first servo motor is provided on the surface of the rotating  
base, the output shaft of the first servo motor passes through a motor shaft hole on  
the rotating base and is coaxially provided with a pinion gear between the rotating  
base and the fixed base, a large gear is provided on one side of the pinion gear, the

pinion gear meshes with the large gear, the top end of the large gear is fixedly connected to the rotating base, and the bottom end of the large gear is rotatably connected to the fixed base.

5 [0007] Preferably, a side of the first joint is provided with a second servo motor for driving the main arm to rotate, the side wall at one end of the main arm is provided with a third servo motor for driving the forearm to rotate, and the side wall at one end of the connector is provided with a fourth servo motor for driving the second joint to rotate.

10 [0008] Preferably, the filling mechanism comprises a filling tube fixed to the side wall of the chassis and a filling head below the filling tube, the filling head is coaxially and fixedly connected to the chassis, the top end of the filling head is provided with a filling cylinder, a piston rod of the filling cylinder passes through the top of the filling tube and is slidingly connected to the inner wall of the filling tube through a piston.

15 [0009] Preferably, the bottom end of the filling tube is connected to a tee through a pipe, the top end of the tee is connected to a first one-way check valve, the bottom end of the tee is connected to a second one-way check valve, the top end of the first one-way check valve communicates with the filling head through a pipe, and the bottom end of the second one-way check valve communicates with the liquid storage  
20 tank through a hose.

[0010] Preferably, the disinfection mechanism comprises a heating tank fixed to the surface of the fixed base, a pressure release valve at the bottom end of the heating tank and an air outlet at one end of the fixed base, the pressure release valve communicates with the air outlet through the air outlet hose, the top end at the inner

side of the heating tank is provided with a power socket, and the bottom end of the power socket is provided with a quartz heating tube.

[0011] Preferably, the pressure release valve comprises a valve body and a spring base, one end of the valve body is provided with an air inlet, the side end of the valve  
5 body is provided with an air outlet, a valve base is provided inside the air inlet, the valve base is sealed by a valve flap, a guide sleeve is provided at one end of the valve base, a disc holder is provided at the top end of the guide sleeve, and a valve stem is provided at the top end of the disc holder.

[0012] Preferably, a spring is provided inside the spring base, a valve stem is  
10 provided at the center of the spring, the valve stem extends onto the disc holder and is sleeved with the disc holder, and the valve flap is slidingly connected to the guide sleeve.

[0013] Preferably, the swing mechanism comprises a rocker on the side wall of the air outlet, one end of the rocker is fixed to the air outlet and is provided with a  
15 connecting rod, one end of the rocker is rotatably connected to one end of the connecting rod, one end of the connecting rod is provided with a crank and is rotatably connected to one end of the crank, one end of the crank is provided with a driving motor and is coaxially and fixedly connected to the output shaft of the driving motor, the driving motor is fixed to the liquid storage tank through a  
20 connecting base, and the other end of the rocker is rotatably connected to the air outlet through a rotating shaft.

Beneficial effects of the present invention

Beneficial effect

[0014] Compared with the prior art, the beneficial effects of the present invention

are as follows.

- [0015] 1. In the present invention, the first servo motor drives the gear to rotate, thereby driving the large gear meshed with it to rotate, so that the rotating base can rotate in all directions at the angle of 360° along the fixed base. The second servo  
5 motor and the third servo motor drive the rotation of the main arm and the forearm, respectively. The fourth servo motor drives the second joint to simulate the rotation of the human wrist, so that the entire robot can move in four degrees of freedom, and simulate the joint structure of the human arm, which has an excellent effect and accuracy in the industrial handling process.
- 10 [0016] 2. In the present invention, the piston rod of the filling cylinder drives the piston in the filling tube to descend, so that a negative pressure area is formed in the filling tube. The first one-way check valve is connected to the pipe to extract the filling liquid from the storage device of the filling liquid into the tee. When the piston rod of the filling cylinder drives the piston in the filling tube to ascend, the air  
15 pressure in the filling tube decreases, the first one-way check valve is closed by the opposite liquid flow, and the second one-way check valve is opened by pressure, so that the mask liquid falls from the second one-way check valve into the lower bottle body for filling. The air pressure is driven by the cylinder. The two one-way check valves are cleverly used to achieve effective filling of the filling liquid, which fully  
20 guarantees the dosage of each filling with the guarantee of the extension distance of the piston rod of the cylinder, so that the filling is accurate and orderly, and the problems of liquid leakage and backflow during filling are effectively solved.
- [0017] 3. In the present invention, high-pressure high-temperature water vapor in a heating tank is sprayed from the air outlet along an air outlet hose to fully disinfect

the bottle body. When the air pressure from the air inlet is less than the elastic force of the spring, the valve flap will quickly return to the closed position under the action of the spring. The pressure release valve is used to continuously spray the high-pressure water vapor in the heating tank to disinfect and sterilize the filled bottle body and the surrounding air, so that the whole process of filling remains safe and non-toxic.

[0018] 4. In the present invention, during the air-jet disinfection process of the air outlet, the driving motor drives the crank to make a circular motion. Under the principle of the crank rocker, one end of the crank drives the rocker and the air outlet through the connecting rod to swing around the rotating shaft as the center of the circle, so that the air-jet end of the air outlet is swung up and down to increase the area and angle of disinfection and improve the efficiency of disinfection and sterilization.

## 15 **BRIEF DESCRIPTION OF THE DRAWINGS**

[0019] FIG. 1 is a schematic diagram of the overall structure of a perspective according to the present invention;

[0020] FIG. 2 is a schematic diagram of the overall structure of another perspective according to the present invention;

20 [0021] FIG. 3 is a schematic diagram of the connection structure between a fixed base and a rotating base according to the present invention;

[0022] FIG. 4 is a schematic structural diagram of a filling mechanism according to the present invention;

[0023] FIG. 5 is a schematic structural diagram of a disinfection mechanism

according to the present invention;

[0024] FIG. 6 is a schematic cross-sectional structure diagram of a pressure release valve according to the present invention;

5 [0025] FIG. 7 is a schematic structural diagram of a disinfection mechanism according to the present invention.

[0026] In the figures: 1, fixed base; 10, rotating base; 100, motor shaft hole; 11, first servo motor; 12, pinion gear; 13, large gear; 14, installing hole; 2, first joint; 20, second servo motor; 3, main arm; 30, third servo motor; 4, forearm; 40, fourth servo motor; 41, connector; 5, second joint; 50, chassis; 6, filling mechanism; 60, filling  
10 tube; 61, tee; 62, first one-way check valve; 63, second one-way check valve; 64, hose; 65, filling cylinder; 66, filling head; 67, connecting rod; 7, disinfection mechanism; 70, air outlet; 71, heating tank; 710, power socket; 711, quartz heating tube; 72, pressure release valve; 720, spring base; 721, air inlet; 722, valve body; 723, valve flap; 724, disc holder; 725, guide sleeve; 726, valve stem; 727, air outlet; 728,  
15 spring; 729, valve base; 73, air outlet hose; 8, storage tank; 9, swing mechanism; 90, rocker; 91, connecting rod; 92, crank; 93, driving motor; 94, connecting base; 95, rotating shaft.

## DESCRIPTION OF THE EMBODIMENTS

20 [0027] The technical solutions in the embodiments of the present invention will be described clearly and completely in conjunction with the drawings in the embodiments of the present invention. Obviously, the described embodiments are only a part of the embodiments of the present invention, rather than all the embodiments. Based on the embodiments of the present invention, all other

embodiments obtained by those skilled in the art without paying creative labor fall within the protection scope of the present invention.

[0028] Referring to FIGS. 1-7, the present invention provides a technical solution:

[0029] An industrial robot for filling, comprises a fixed base 1, wherein a rotating  
5 base 10 is provided on the surface of the fixed base 1, a first servo motor 11 is  
provided on the surface of the rotating base 10, the output shaft of the first servo  
motor 11 passes through a motor shaft hole 100 on the rotating base 10, the first  
servo motor is coaxially provided with a pinion gear 12 between the rotating base 10  
and the fixed base 1, a large gear 13 is provided on one side of the pinion gear 12, the  
10 pinion gear meshes with the large gear 13, the top end of the large gear 13 is fixedly  
connected to the rotating base 10, and the bottom end of the large gear 13 is rotatably  
connected to the fixed base 1. The first servo motor 11 drives the gear 12 to rotate,  
thereby driving the large gear 13 meshed with it to rotate, so that the rotating base 10  
can rotate in all directions at the angle of 360° along the fixed base 1. A first joint 2 is  
15 provided on the surface of the rotating base 10, one end of the first joint 2 is provided  
with a main arm 3 and is rotatably connected to one end of the main arm 3, the other  
end of the main arm 3 is provided with a forearm 4 and is rotatably connected to the  
forearm 4, one end of the forearm 4 is provided with a connector 41, a second joint 5  
is provided on both sides of the connector 41, the connector 41 is rotatably connected  
20 to the second joint 5, the bottom end of the second joint 5 is provided with a chassis  
50, a side of the first joint 2 is provided with a second servo motor 20 for driving the  
main arm 3 to rotate, the side wall at one end of the main arm 3 is provided with a  
third servo motor 30 for driving the forearm 4 to rotate, and the side wall at one end  
of the connector 41 is provided with a fourth servo motor 40 for driving the second

joint 5 to rotate. The second servo motor 20 and the third servo motor 30 drive the rotation of the main arm 3 and the forearm 4, respectively. The fourth servo motor 40 drives the second joint 5 to simulate the rotation of the human wrist, so that the entire robot can move in four degrees of freedom, and simulate the joint structure of the human arm, which has an excellent effect and accuracy in the industrial handling process.

[0030] A filling mechanism 6 is provided under the chassis 50, the filling mechanism 6 comprises a filling tube 60 fixed to the side wall of the chassis 50 and a filling head 66 below the filling tube 60, the filling head 66 is coaxially and fixedly connected to the chassis 50, the top end of the filling head 66 is provided with a filling cylinder 65, a piston rod of the filling cylinder 65 passes through the top of the filling tube 60 and is slidingly connected to the inner wall of the filling tube 60 through a piston. The bottom end of the filling tube 60 is connected to a tee 61 through a pipe, the top end of the tee 61 is connected to a first one-way check valve 62, the bottom end of the tee 61 is connected to a second one-way check valve 63, the top end of the first one-way check valve 62 communicates with the filling head 66 through a pipe, and the bottom end of the second one-way check valve 63 communicates with the liquid storage tank 8 through a hose 64. The piston rod of the filling cylinder 65 drives the piston in the filling tube 60 to descend, so that a negative pressure area is formed in the filling tube 60. The first one-way check valve 62 is connected to the pipe to extract the filling liquid from the storage device of the filling liquid into the tee 61. When the piston rod of the filling cylinder 65 drives the piston in the filling tube 60 to ascend, the air pressure in the filling tube 60 decreases, the first one-way check valve 62 is closed by the opposite liquid flow, and the second

one-way check valve 63 is opened by pressure, so that the mask liquid falls from the second one-way check valve 25 into the lower bottle body for filling. The air pressure is driven by the cylinder. The two one-way check valves are cleverly used to achieve effective filling of the filling liquid, which fully guarantees the dosage of each filling with the guarantee of the extension distance of the piston rod of the cylinder, so that the filling is accurate and orderly, and the problems of liquid leakage and backflow during filling are effectively solved.

[0031] The fixed base 1 is further provided with a liquid storage tank 8, one end of the fixed base 1 is provided with a disinfection mechanism 7, the disinfection mechanism 7 comprises a heating tank 71 fixed to the surface of the fixed base 1, a pressure release valve 72 at the bottom end of the heating tank 71 and an air outlet 70 at one end of the fixed base 1, the pressure release valve 72 communicates with the air outlet 70 through the air outlet hose 73, the top end at the inner side of the heating tank 71 is provided with a power socket 710, and the bottom end of the power socket 710 is provided with a quartz heating tube 711. The pressure release valve 72 comprises a valve body 722 and a spring base 720, one end of the valve body 722 is provided with an air inlet 721, the side end of the valve body 722 is provided with an air outlet 727, a valve base 729 is provided inside the air inlet 721, the valve base 729 is sealed by a valve flap 723, a guide sleeve 725 is provided at one end of the valve base 729, a disc holder 724 is provided at the top end of the guide sleeve 725, and a valve stem 726 is provided at the top end of the disc holder 724. A spring 728 is provided inside the spring base 720, a valve stem 726 is provided at the center of the spring 728, the valve stem 726 extends onto the disc holder 724 and is sleeved with the disc holder 724, and the valve flap 723 is slidingly connected to the guide

sleeve 725. In the process of filling, the power socket 710 in the heating tank 71 is heated by the quartz heating tube 711 after being energized. The quartz heating tube 711 is a far-infrared heating tube, uses a milky quartz glass tube processed by a special process, and is equipped with a resistance composite material as a heater.

5 Milky white quartz glass can absorb almost all visible light and near infrared light from the heating wire radiation, and can convert it into far infrared radiation, so that the water added in the heating tank 71 in advance is evaporated, and the water continuously generates water vapor after be heated, When the whole pressure of the pressure release valve 72 is greater than the outside air pressure, the valve is in the

10 closed state. At this time, the force acting on the valve flap 723 comprises a pre-tightening force of the spring 728, in which the direction is upward, the force of the medium, in which the direction is downward, and the supporting force (sealing force) of the valve base 729 against the valve flap 723. The specific pressure generated by the sealing force on the sealing surface ensures that the pressure release

15 valve 72 has the necessary sealing performance. When the water vapor raises the air pressure in the heating tank 71 to a certain level, the pre-tightening force of the spring 728 and the sealing force do not change. The air pressure from the air inlet 721 increases, so that the valve flap 723 moves downward, and the kick starts. Once the pressure release valve 72 is opened, using the static pressure of the fluid on the

20 disc holder 724, the valve flap 723 of the pressure release valve 72 continues to move downward quickly. At this time, the flow rate is always restricted by the opening between the valve flap 723 and the valve base 729, until the height of the valve flap 723 away from the valve base 729 reaches a quarter of the diameter of the flow path. Thereafter, the flow rate is controlled by the diameter of the flow path at

the throat, and then the pressure release valve is discharged in a full amount, so that the medium pressure rapidly descends. At this time, the pressure release valve 72 is in the discharge state. High-pressure high-temperature water vapor in a heating tank 71 is sprayed from the air outlet 70 along an air outlet hose 73 to fully disinfect the bottle body. When the air pressure from the air inlet 721 is less than the elastic force of the spring 728, the valve flap 723 will quickly return to the closed position under the action of the spring 728. The pressure release valve 72 is used to continuously spray the high-pressure water vapor in the heating tank 71 to disinfect and sterilize the filled bottle body and the surrounding air, so that the whole process of filling remains safe and non-toxic.

**[0032]** One side of the liquid storage tank 8 is equipped with a swing mechanism 9. The swing mechanism 9 comprises a rocker 90 on the side wall of the air outlet 70, one end of the rocker 90 is fixed to the air outlet 70 and is provided with a connecting rod 91, one end of the rocker 90 is rotatably connected to one end of the connecting rod 91, one end of the connecting rod 91 is provided with a crank 92 and is rotatably connected to one end of the crank 92, one end of the crank 92 is provided with a driving motor 93 and is coaxially and fixedly connected to the output shaft of the driving motor 93, the driving motor 93 is fixed to the liquid storage tank 8 through a connecting base 94, and the other end of the rocker 90 is rotatably connected to the air outlet 70 through a rotating shaft 95. During the air-jet disinfection process of the air outlet 70, the driving motor 93 drives the crank 92 to make a circular motion. Under the principle of the crank rocker, one end of the crank 92 drives the rocker 90 and the air outlet 70 through the connecting rod 91 to swing around the rotating shaft 95 as the center of the circle, so that the air-jet end of the air

outlet 70 is swung up and down to increase the area and angle of disinfection and improve the efficiency of disinfection and sterilization.

## Claims

### WHAT IS CLAIMED IS:

1. An industrial robot for filling, comprising a fixed base (1), wherein a rotating base (10) is provided on the surface of the fixed base (1), a first joint (2) is provided on the surface of the rotating base (10), one end of the first joint (2) is provided with a main arm (3) and is rotatably connected to one end of the main arm (3), the other end of the main arm (3) is provided with a forearm (4) and is rotatably connected to the forearm (4), one end of the forearm (4) is provided with a connector (41), a second joint (5) is provided on both sides of the connector (41), the connector (41) is rotatably connected to the second joint (5), the bottom end of the second joint (5) is provided with a chassis (50), a filling mechanism (6) is provided under the chassis (50), the fixed base (1) is further provided with a liquid storage tank (8), one end of the fixed base (1) is provided with a disinfection mechanism (7), and one side of the liquid storage tank (8) is equipped with a swing mechanism (9);
- wherein the disinfection mechanism (7) comprises a heating tank (71) fixed to the surface of the fixed base (1), a pressure release valve (72) at the bottom end of the heating tank (71) and an air outlet (70) at one end of the fixed base (1), the pressure release valve (72) communicates with the air outlet (70) through the air outlet hose (73), the top end at the inner side of the heating tank (71) is provided with a power socket (710), and the bottom end of the power socket (710) is provided with a quartz heating tube (711).
2. The industrial robot for filling according to claim 1, wherein a first servo motor (11) is provided on the surface of the rotating base (10), the output shaft of the first

servo motor (11) passes through a motor shaft hole (100) on the rotating base (10) and is coaxially provided with a pinion gear (12) between the rotating base (10) and the fixed base (1), a large gear (13) is provided on one side of the pinion gear (12), the pinion gear (12) meshes with the large gear (13), the top end of the large gear (13) is fixedly connected to the rotating base (10), and the bottom end of the large gear (13) is rotatably connected to the fixed base (1).

3. The industrial robot for filling according to claim 1, wherein a side of the first joint (2) is provided with a second servo motor (20) for driving the main arm (3) to rotate, the side wall at one end of the main arm (3) is provided with a third servo motor (30) for driving the forearm (4) to rotate, and the side wall at one end of the connector (41) is provided with a fourth servo motor (40) for driving the second joint (5) to rotate.

4. The industrial robot for filling according to claim 1, wherein the filling mechanism (6) comprises a filling tube (60) fixed to the side wall of the chassis (50) and a filling head (66) below the filling tube (60), the filling head (66) is coaxially and fixedly connected to the chassis (50), the top end of the filling head (66) is provided with a filling cylinder (65), a piston rod of the filling cylinder (65) passes through the top of the filling tube (60) and is slidingly connected to the inner wall of the filling tube (60) through a piston.

5. The industrial robot for filling according to claim 4, wherein the bottom end of the filling tube (60) is connected to a tee (61) through a pipe, the top end of the tee (61) is connected to a first one-way check valve (62), the bottom end of the tee (61) is

connected to a second one-way check valve (63), the top end of the first one-way check valve (62) communicates with the filling head (66) through a pipe, and the bottom end of the second one-way check valve (63) communicates with the liquid storage tank (8) through a hose (64).

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6. The industrial robot for filling according to claim 1, wherein the pressure release valve (72) comprises a valve body (722) and a spring base (720), one end of the valve body (722) is provided with an air inlet (721), the side end of the valve body (722) is provided with an air outlet (727), a valve base (729) is provided inside the  
10 air inlet (721), the valve base (729) is sealed by a valve flap (723), a guide sleeve (725) is provided at one end of the valve base (729), a disc holder (724) is provided at the top end of the guide sleeve (725), and a valve stem (726) is provided at the top end of the disc holder (724).

15 7. The industrial robot for filling according to claim 6, wherein: a spring (728) is provided inside the spring base (720), a valve stem (726) is provided at the center of the spring (728), the valve stem (726) extends onto the disc holder (724) and is sleeved with the disc holder (724), and the valve flap (723) is slidingly connected to the guide sleeve (725).

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8. The industrial robot for filling according to claim 1, wherein the swing mechanism (9) comprises a rocker (90) on the side wall of the air outlet (70), one end of the rocker (90) is fixed to the air outlet (70) and is provided with a connecting rod (91), one end of the rocker (90) is rotatably connected to one end of the connecting rod

(91) , one end of the connecting rod (91) is provided with a crank (92) and is rotatably connected to one end of the crank (92), one end of the crank (92) is provided with a driving motor (93) and is coaxially and fixedly connected to the output shaft of the driving motor (93), the driving motor (93) is fixed to the liquid  
5 storage tank (8) through a connecting base (94), and the other end of the rocker (90) is rotatably connected to the air outlet (70) through a rotating shaft (95).