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BONAFIDE CERTIFICATE

Certified that this project report "**DESIGN & FABRICATION OF PNEUMATIC VICE**" is the bonafide work of

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CERTIFICATE OF EVALUATION

College : KUMARAGURU COLLEGE OF TECHNOLOGY.

Branch : MECHANICAL ENGINEERING.

Semester : SIXTH SEMESTER.

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The report of project work submitted by the above students in partial fulfillment for the award of Bachelor of Engineering degree in Mechanical Engineering of Anna university evaluated and confirmed to be the report of the work done by the above students.

SIGNATURE
INTERNAL EXAMINER

SIGNATURE
EXTERNAL EXMINER

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PNEUMATIC VICE

SYNOPSIS

In Engineering field clamping of work pieces are done by three methods.

1. Mechanical method.
2. Hydraulic method.
3. Pneumatic method.

This project work "PNEUMATIC VICE" can be used widely in engineering industries for holding work pieces rigidly and very accurately by using regulated air from Compressor.

This Vice could be used in modern machines where pneumatic attachements are available. Various operations such as milling, drilling, surface grinding etc... can be done on jobs held in "PNEUMATIC VICE".

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INTRODUCTION

Work holding is one of the main operations for carrying out a machining process in every industry. There are many work holding devices in use. In that machine vices are used commonly. The machine vice is works on the principle of serewrod and fixed nut.

This project entitled "PNEUMATIC VICE" works on the principle of cylinder and piston arrangement. This is used for clamping and unclamping of workpieces in this report submitted of components, Construction and working of "PNEUMATIC VICE".

LITERATURE SURVEY

PNEUMATICS

The word 'pneuma' comes from Greek and means breather wind. The word pneumatics is the study of air movement and its phenomena is derived from the word pneuma. Today pneumatics is mainly understood to means the application of air as a working medium in industry especially the driving and controlling of machines and equipment.

Pneumatics has for some considerable time between used for carrying out the simplest mechanical tasks in more recent times has played a more important role in the development of pneumatic technology for automation.

Pneumatic systems operate on a supply of compressed air which must be made available in sufficient quantity and at a pressure to suit the capacity of the system. When the pneumatic system is being adopted for the first time, however it wills indeed the necessary to deal with the question of compressed air supply.

The key part of any facility for supply of compressed air is by means using reciprocating compressor. A compressor is a machine that takes in air, gas at a certain pressure and delivered the air at a high pressure.

Compressor capacity is the actual quantity of air compressed and delivered and the volume expressed is that of the air at intake conditions namely at atmosphere pressure and normal ambient temperature.

The compressibility of the air was first investigated by Robert Boyle in 1962 and that found that the product of pressure and volume of a particular quantity of gas.

The usual written as

$$PV = C \qquad \text{(or)} \quad P_1V_1 = P2V2$$

In this equation the pressure is the absolute pressured which for free is about 14.7 Psi and is of courage capable of maintaining a column of mercury, nearly 30 inches high in an ordinary barometer. Any gas can be used in pneumatic system but air is the mostly used system now a days.

SELECTION OF PNEUMATICS

Mechanization is broadly defined as the replacement of manual effort by mechanical power. Pneumatic is an attractive medium for low cost mechanization particularly for sequential (or) repetitive operations. Many factories and plants already have a compressed air system, which is capable of providing the power (or) energy requirements and the control system (although equally pneumatic control systems may be economic and can be advantageously applied to other forms of power).

The main advantage of an all pneumatic system are usually economic and simplicity the latter reducing maintenance to a low level. It can also have out standing advantages in terms of safety.

PRODUCTION OF COMPRESSED AIR

Pneumatic systems operate on a supply of compressed air, which must be made available. In sufficient quantity and at a pressure to suit the capacity of the system. When pneumatic system is being adopted for the first time, however it wills indeed the necessary to deal with the question of compressed air supply.

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pressure and delivered the air at a high pressure. Compressor capacity is the actual quantity of air compressed and delivered and the volume expressed is that of the air at intake conditions namely at atmosphere pressure and normal ambient temperature.

Clean condition of the suction air is one of the factors, which decides the life of a compressor. Warm and moist suction air will result in increased precipitation of condense from the compressed air. Compressor may be classified in two general types.

Air Compressor

COMPRESSORS

The main function of the air compressor is to compress the air up to the required pressure. The maximum capacity of the compressor is 10| 105 to 12 | 105 N/m2. This is a two stages or two-cylinder reciprocating air compressor. The two cylinders are for low and high compression. The air pressure is measured at various places by the use of pressure gauges. V-belt and pulley are used to drive the compressor.

Compressors can be broadly classifieds into two groups. They are:

- Positive Displacement Compressor
- Dynamic Compressors

Positive Displacement Compressor

Successive volumes of air isolated and then compressed to a higher pressure. There are essential two forms of positive displacement compressor, reciprocating and rotary.

Dynamic compressors

These are rotary continuous machines in which a high speed rotating element accelerates the air and converts the resulting velocity head into pressure.

Positive displacement compressors work on the principle of increasing the pressure of a definite volume in an enclosed chamber. Dynamic (turbo) compressor employs rotating vanes or impellers to impart velocity and pressure to the flow of the air being handled. The pressure comes from the dynamic effects such as centrifugal force.

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SELECTION CRITERIA FOR COMPRESSORS

A number of factors are involved in the selection criteria of a suitable air compressor. These are dealt here briefly

1. Pressure

First of all, the pressure needed must be determined. Most air operated system and tools are designed to operate at a pressure from 6 | 105 to 7 | 105 N/m2. A compressor of normal make and type would normally be suitable if this can assure a pressure 6 | 105 N/m2 in the distribution line laid down for a pneumatic tools and system.

2. Capacity

Another important factor in compressor selection is the capacity or volume of air required. This factor is sometimes extremely difficult to evaluate. Obviously, the unit selected should be large enough to supply all the air devices, which will be operating at any given time. If all the air operation is continuous, the capacity required is simply the sum of air compression of each individual tool.

The main function of the air compressor is to compress the air up to the required pressure. The maximum capacity of the compressor is 10 | 105 to 12 | 105 N/m2.

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2.1.2 Pressure Gauge

Pressure gauge is used for measuring the outlet pressure of air from the compressor. The gauge used is Bourdon type pressure gauge. The maximum capacity of this gauge is 10 | 105 to 12 | 105 N/m2. The gauge is fitted at the outlet of the air compressor.

1. Positive displacement compressor.
2. Turbo compressor

Positive displacement compressors are most frequently employed for compressed air plant and have proved highly successful and supply air for pneumatic control application.

The types of positive compressor

1. Reciprocating type compressor
2. Rotary type compressor

Turbo compressors are employed where large capacity of air required at low discharge pressures. They cannot attain pressure necessary for pneumatic control application unless built in multistage designs and are seldom encountered in pneumatic service.

RECIPROCATING COMPRESSORS

Built for either stationary (or) portable service the reciprocating compressor is by far the most common type.

Reciprocating compressors lap be had is sizes from the smallest capacities to deliver more than 500 m^3/min. In single stage compressor, the air pressure may be of 6 bar machines discharge of pressure is up to 15 bars. Discharge pressure in the range of 250 bars can be obtained with high pressure reciprocating compressors that of three & four stages.

Single stage and 1200 stage models are particularly suitable for pneumatic applications , with preference going to the two stage design as soon as the discharge pressure exceeds 6 bar , because it in capable of matching the performance of single stage machine at lower costs per driving powers in the range .

PNEUMATIC CONTROL COMPONENT

3.1.1 Pneumatic cylinder

An air cylinder is an operative device in which the state input energy of compressed air i.e. pneumatic power is converted in to mechanical output power, by reducing the pressure of the air to that of the atmosphere.

3.11 a) Single acting cylinder

Single acting cylinder is only capable of performing an operating medium in only one direction. Single acting cylinders equipped with one inlet for the operating air pressure, can be production in several fundamentally different designs. Single cylinders develop power in one direction only.

Therefore no heavy control equipment should be attached to them, which requires to be moved on the piston return stoke single action cylinder requires only about half the air volume consumed by a double acting for one operating cycle.

3.1.1 B) Double acting cylinders :

A double acting cylinder is employed in control systems with the full pneumatic cushioning and it is essential when the cylinder itself is required to retard heavy messes. This can only be done at the end positions of the piston stock. In all intermediate position a separate externally mounted cushioning derive most be provided with the damping feature.

The normal escape of air is out off by a cushioning piston before the end of the stock is required. As a result the sit in the cushioning chamber is again compressed since it cannot escape but slowly according to the setting made on reverses.

The air freely enters the cylinder and the piston stokes in the other direction at full force and velocity.

2.1.4.1 Air Seal

Air seal is used to prevent the leakage of air pressure from the cylinder. Normally it is made up of neoprene rubber. If there are any air leakages in the system, it will reduce the efficiency.

2.1.4.2 Wiper Seal:

Wiper seal is provided at the entrance of the cylinder to avoid dust materials from the environment. It is made up of neoprene rubber.

2.1.4.3 Circlip

Circlip is used to protect the out coming of air seal and wiper seal from the cylinder. It is made up of steel.

2.1.4.4 "O" Ring

The "O" rings are fitted into the grooves of piston to maintain perfect seal between the piston and the cylinder wall. They are mostly made up of neoprene rubber.

Need of Valves

DIRECTIONAL CONTROL VALVES

To control the to and fro motion of cylinder, the fluid energy has to be regulated, controlled and reversed with a predetermined sequence in a pneumatic system.

Similarly one may have to control the quantity of pressure and flow rate to generate the desired level of force and speed of actuators.

To achieve these functions, valves are used. Valves are fluid power elements used for controlling and regulating the working medium.

The main functions of the valves are,

- Start and stop the fluid energy
- Control the direction of flow of compressed air
- Control the flow rate of the fluid
- Control the pressure rating of the fluid

Although various types of valves are available, they are mainly classified as below,

- Direction control valves
- Direction control check valves
- Flow control valves
- Pressure control valves

The main purpose of a valve in a pneumatic circuit is to control outputs. Valves can be divided into a number of groups according to what they control.

Directional control valves

Directional control valve on the receipt of some external signal, which might be mechanical, electrical or a fluid pressure pilot signal, charges the direction of or stops, or starts the flow of fluid in some part of the pneumatic/hydraulic circuit.

3.2.2 Flow control valve :

In any fluid power circuit, flow control valve is used to control the speed of the actuator. The floe control can be achieved. By varying the area of flow through which the air in passing.

When area is increased, more quantity of air will be sent to actuator as a result its speed will increase. If the quantity of air entering into the actuator is reduced, the speed of the actuator is reduced.

3.2.3 Pressure Control Valve :

The main function of the pressure control valve is to limit (or) control the pressure required in a pneumatic circuit.

Depending upon the method of controlling they are classified as

1. Pressure relief Valve
2. Pressure reducing Valve

a) Pressure relief Valves :

Pneumatic system is designed for a pressure for its working. Whenever the pressure in the system exceeds the designed pressure, the pipeline, pistons, cylinder and valves may burst. Therefore, it is necessary to make sure that the system pressure does not rise above the limited pressure. Valve used for this purpose is known as relief valve.

Hoses used in this pneumatic system are made up of polyurethane. These hose can with stand at a maximum pressure level of 10 N/m^2.

Connectors :

In our system there are two type of connectors used. One is the hose connector and the other is the reducer. Hose connectors normally comprise an adoptee hose nipple and cap nut. These types of connectors are made up of brass (or) Aluminum (or) hardened pneumatic steel.

Double acting cylinder:

A double acting cylinder is employed in control systems with the full pneumatic cushioning and it is essential when the cylinder itself is required to retard heavy messes. This can only be done at the end positions of the piston stock. In all intermediate position a separate externally mounted cushioning derive most be provided with the damping feature.

The normal escape of air is out off by a cushioning piston before the end of the stock is required. As a result the sit in the cushioning chamber is again compressed since it cannot escape but slowly according to the setting made on reverses. The air freely enters the cylinder and the piston stokes in the other direction at full force and velocity.

FLOW CONTROL VALVE:

In any fluid power circuit, flow control valve is used to control the speed of the actuator. The floe control can be achieved by varying the area of flow through which the air in passing. When area is increased, more quantity of air will be sent to actuator as a result its speed will increase. If the quantity of air entering into the actuator is reduced, the speed of the actuator is reduced.

FLEXIBLE HOSES:

. Hose is fabricated in layer of elastomer or synthetic rubber and braided fabric, which permits operation at higher pressure. The standard tubing outside diameter is 1/16 inch. If the hose is subject to rubbing, it should be encased in a protective sleeve.

(ii) DIRECTIONAL CONTROL VALVE

To control the to and fro motion of cylinder, the fluid energy has to be regulated, controlled and reversed with a predetermined sequence in a pneumatic system.

Similarly one may have to control the quantity of pressure and flow rate to generate the desired level of force and speed of actuators. To achieve these functions, valves are used. Valves are fluid power elements used for controlling and regulating the working medium.

The main functions of the valves are,

- Start and stop the fluid energy
- Control the direction of flow of compressed air
- Control the flow rate of the fluid
- Control the pressure rating of the fluid

4.5. HOUSE AND FITINGS:

It is provided for the passage of compressed air from the compressor outlet to the operating valve.

Two separate pipes also connect the operating valve with the working cylinder pressure drop through and air line depends on the flow rate, pipe diameter, pipe length and pipe geometry. It can be determined directly for straight pipes of any given length.

A small chaining bore size can have marked effect on pressure drop, where as even doubling the pipe length, will only result in doubling the pressure drop.

Pressure drop through bends and fittings can only be determined by empirical tests, since it is specific to the internal geometry involved. Rigid pipes however are less manipulated through remain form of bends with arrangements increase and variable air have to flow and the flow itself may be of fluctuating or pulsating nature. In this case it is thus normally based on practical recommendation.

4.6. SEALS:

Seal is an important component of a pneumatic system and is used to prevent the air leakage through the joint.

This project passes the static seal which are used to prevent the leakage through the stationary surface.

Material of the seal is Teflon tape. Teflon has the following properties

- Withstand the system pressure and temperature without any damage.
- Resist the wear and abrasion.
- Recover from deformation.

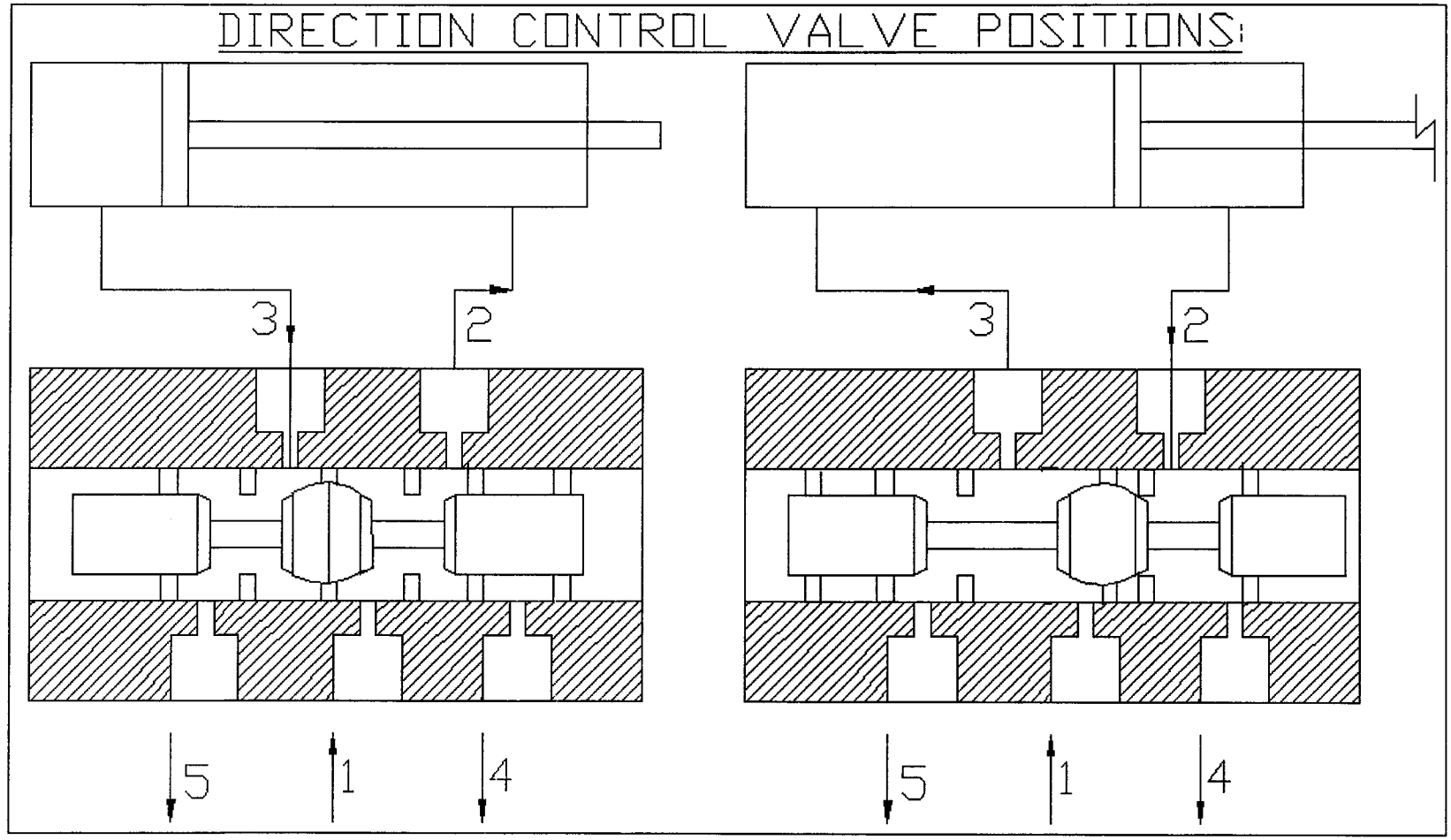
- Resists the adverse effects such as deterioration and shrinking caused by the system air.

Seals are devices for closing gaps to prevent leakage or make pressure joints and also to prevent the entry of air and dirt from outside into the system. The material of seal must be compatible with the fluid medium. It is a circular ring made of synthetic rubber. It is used for providing tight sealing between the piston and the cylinder wall. It prevents air leakage from the top and bottom of the cylinder.

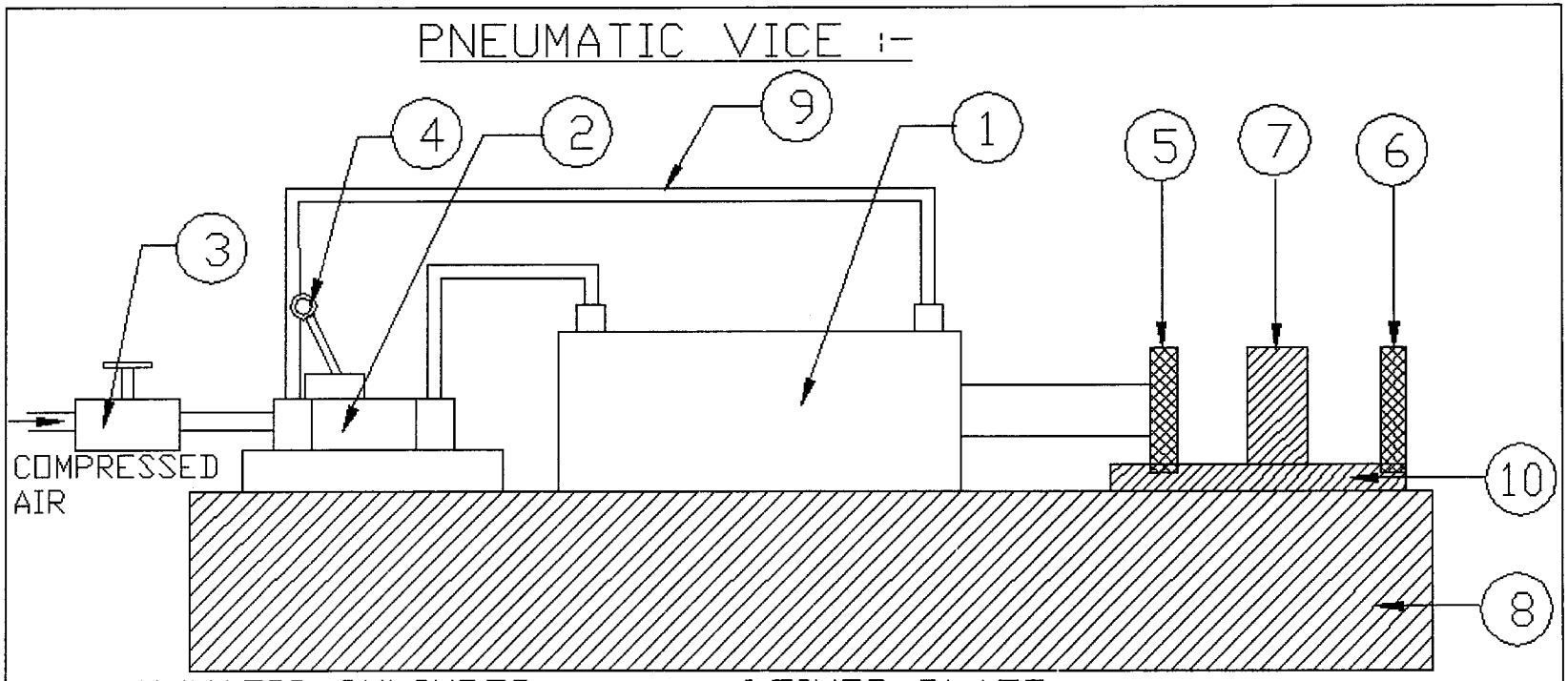
Seals for air cylinder and valves are not normally called upon to seal pressure higher than about 2 bars. Since the fluid to be seated is a gas, (in our case air) rubbing speeds tends to be high and the seal the seal may have to be operated under dry conditions with minimal lubrication.

LIST OF MATERIAL

SL. NO.	CONTENT	MATERIAL	QUANTITY
1	PNEUMATIC CYLINDER	M.S	1
2	FIXED PLATE	M.S	1
3	MOVING PLATE	M.S	1
4	FLOW CONTROL VALVE	AL.	1
5	DIRECTION CONTROL VALVE	AL.	1
6	PU CONNECTOR		1
7	HOSE COLLAR	AL.	1
8	REDUCER	AL.	1
9	STAND	M.S	1


DIRECTION CONTROL VALVE POSITIONS:
3
2
3
2
5
1
4
5
1
4

PNEUMATIC VICE :-



1.PNEUMATIC CYLINDER
2.DIRECTION CONTROL VALVE
3.FLOW CONTROL VALVE
4.D.C. VALVE HANDLE
5.MOVABLE PLATE
6.FIXED PLATE
7.WORK PIECE
8.WORK TABLE
9.PU CONNECTOR
10.VICE