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Printed circuit board etching machine using vaccum generator

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***Abstract*-The objective of this paper is to design the etching machine for manufacturing printed circuit board. It is used to reduce the man power. It also reduces the time to complete the etching process, saving cost without using an expensive machine. Even though we already have an etching machine, usually it is placed in an industry that construct electronic circuits and that will makes us difficult to use all the time. It can be done manually by shaking the PCB board in a container that dissolve with etching liquid which is costly.**

Keywords- *proximity sensor, vacuum generator, dc motor.*

I. INTRODUCTION

The operation of this etching machine uses radio frequency (RF) to switch on. Next, the heat coil will boil the water until it reaches its boiling point so that the etching process will produce good result of the PCB. Then, the next process will triggered on with a timer which is the etching process started. Other than that, this machine will operate by using motor that can spin the PCB for etching process. It will be operated on 12V supply and the speed of motor can be controlled and can spin by forward and reverse. Then, the motor will stop automatically because its sets with a timer so that, within the time setting the operation will end. In that duration, it limits, if the unwanted copper of the PCB still there, the process will be repeated.

The purpose of designing this paper is based on the observation: (1)To make the user easy to do the etching process without manually.(2)To Consider the time used to complete the etching process for the PCB board. (3)This product is more affordable compare to the etching machine that we use nowadays which is bigger and expensive. (4)User friendly.

II. BLOCK DIAGRAM

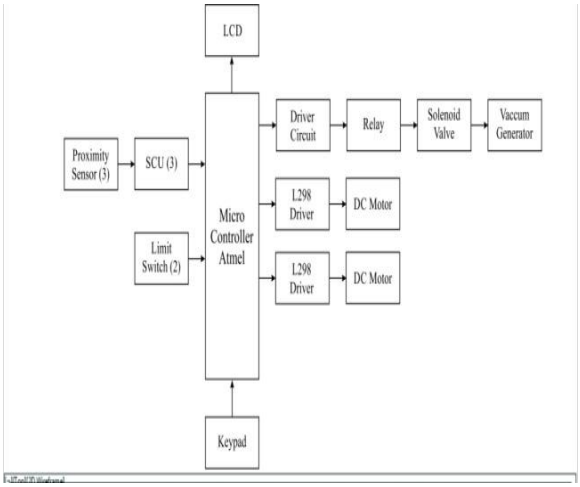


Fig1: Block Diagram of PCB Etching Machine

A.*System design*

This paper deals with the manufacturing of PCB board designing. There are twelve different kinds of steps to design PCB board. In that ,we are doing etching process which is used to manufacture the printed circuit board.

B.*Proximity sensor*

Inductive proximity sensors generate an electromagnetic field and detect the eddy current losses induced when the metal target enters the field. The field is generated by a coil, wrapped round a ferrite core, which is used by a transistorised circuit to produce oscillations. The target, while entering the electromagnetic field produced by the coil, will decrease the oscillations due to eddy currents developed in the target. If the target approaches the sensor within the so-called "sensing range", the oscillations cannot be produced anymore: the detector circuit generates then an output signal controlling a relay or a switch.

Predicting then the field distribution around the sensor can enhance the sensor design.

Fig.2 Proximity Sensor.

C. DC motor principle

An electric motor is a machine which converts a electrical energy to mechanical energy.All D.C machines have five principal components viz (i) Field system (II) armature core (iii) armature winding (iv) Commutator (v) brushes. Power supply is an integral parts a vital role in every electronic System and hence their design constitutes a major part in every application. In order to overcome mal-operation which results due to fluctuations in the load and discontinuity in the supply proper choice of power supply is indeed a great need in this hour.

The present chapter introduces the operation of power supply circuits built using filters, rectifiers, and then voltage regulators. Starting with an ac voltage, a steady dc voltage is obtained by rectifying the ac voltage, then filtering to a dc level, and finally, regulating to obtain a desired fixed dc voltage. The regulation is usually obtained from an IC voltage regulator unit, which takes a dc voltage and provides a somewhat lower dc voltage, which remains the same even if the input dc voltage varies, or the output load connected to the dc voltage changes.

A block diagram containing the parts of a typical power supply and the voltage at various points in the unit. The ac voltage, typically 120 V rms, is connected to a transformer, which steps that ac voltage down to the level for the desired dc output. A diode rectifier then provides a full-wave rectified voltage that is initially filtered by a simple capacitor filter to produce a dc voltage. This resulting dc voltage usually has some ripple or ac voltage variation. A regulator circuit can use this dc input to provide a dc voltage that not only has much less ripple voltage but also remains the same dc value even if the input dc voltage varies somewhat, or the load connected to the output dc voltage changes. This voltage regulation is usually obtained using one of a number of popular voltage regulator IC units.

D.Vacuum generator

A vacuum generator is a single stage venturi that creates high vacuum with fast response using compressed air. The ability to control this performance renders this technology as an excellent solution for factory automation. In principle, compressed air is throttled as the air exits the nozzle and is discharged into the diffuser. This increased velocity of air lowers the pressure in the diffusion chamber. The volume of air within the closed vacuum system flows into the low pressure area of the diffusion chamber and is exhausted thru the diffuser. This effect increases the vacuum level and evacuates most of the air within the closed vacuum system at supersonic speeds.

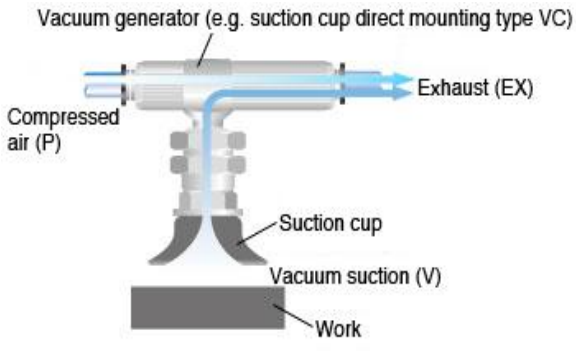


Fig 3. Vacuum Generator

D. square DC motor calculation

Speed N = 30 RPM
Voltage V = 12 Volt
Current I = 0.3 A (loading condition)
Current I = 0.06 A (No Load Condition)
Power P =V x I=12x0.3 = 3.6 WATT
1 WATT = 0.00134102HP
3.6 WATT = 3.6 X 0.00134102
P= 0.0048 HP

E. Torque of the motor

Torque = 0.412 Nm
1Kg-cm = 0.0980665 Nm
1 Nm = (1/.0980665)
=10.197 kg-cm
(10.197 x .412)
= 4.**2**

III. MANUAL ETCHING PROCESS

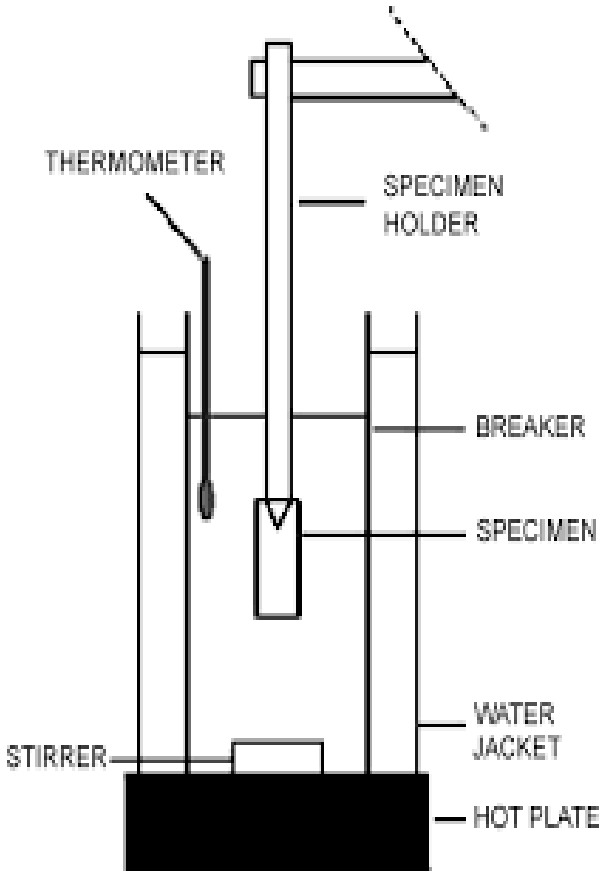


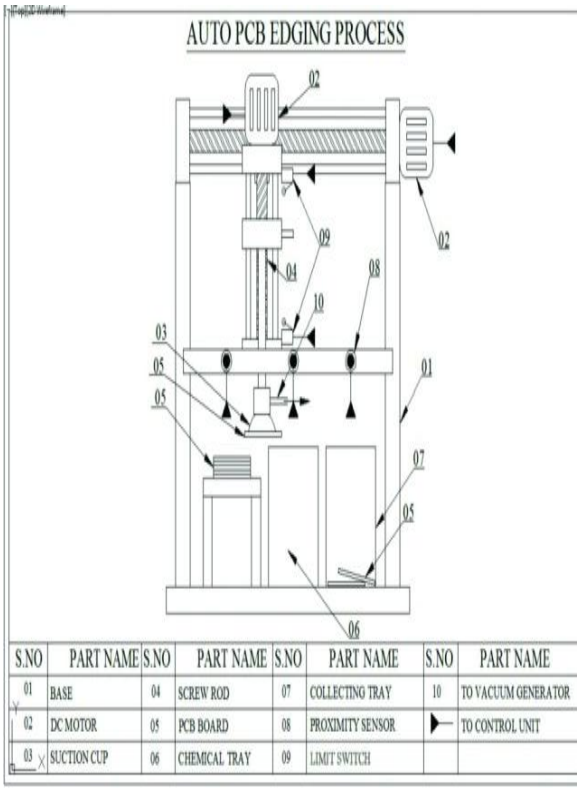
Fig4. Manual Etching Process

The most common etchants are: (1) Ferric chloride (2)Sulphuric acid (3)Chromic acid(4) Cupric chloride (5)Alkaline ammonia .

Ferric chloride etching solutions are widely used in etching process in PCB industry. It has a high etching rate and high copper dissolving capacity. It is used with gold plate boards. As the ferric chloride etchant attacks tin, this is not suitable for tin or tin-lead plated boards. The rate of dissolution of copper depends on the ferric chloride concentration, temperature and agitation rate. Other than that, ferric chloride is the oldest and perhaps the most common etchant. It normally comes in crystal form. The crystals are dissolved in de-ionized water to achieve the concentration in the solution. This is typically 500 gm of ferric chloride in one litre of water.

Sulphuric acid is extensively used for copper surface preparation which is also called micro etching. It is compatible with organic and metallic resists and provides a steady etching rate with optimum undercut. It is a strong oxidizing agent. It oxidizes and dissolved the metallic copper. The sulphuric acid makes the copper soluble and keeps the dissolved copper as copper sulphate in the solution while copper sulphate helps to stabilize etch and recovery rates.

Chromic acid mixed with sulphuric acid is used because of its strong oxidizing power and suitability for all kinds of metal resists. The etching rate is inconsistent but it has the advantage of little under cutting. However it's used is now limited since it is difficult to regenerate and it is highly toxic, polluting and hazardous to health. It is generally not recommended for use. Cupric Chloride Cupric chloride offers an economical solution in the etching on a larger scale. From the pollution point of view, it offers the advantage of easy regenerate ability with the possibility of a relatively easy disposal, high throughput and better material recovery the dissolved copper capacity which is up to 150 g/l is high.



S.NO	PART NAME	S.NO	PART NAME	S.NO	PART NAME	S.NO	PART NAME
01	BASE	04	SCREW ROD	07	COLLECTING TRAY	10	TO VACUUM GENERATOR
02	DC MOTOR	05	PCB BOARD	08	PROXIMITY SENSOR		TO CONTROL UNIT
03	SUCTION CUP	06	CHEMICAL TRAY	09	LIMIT SWITCH		

Fig5. Automatic Etching Process

Alkaline Ammonia Alkaline ammonia etching system is used in both etching system and is compatible with metallic and organic resists. The advantages of this etching are its minimum undercut, high copper dissolving capacity and fast etch rates. Alkaline etchants provide continuous etching rates of 30-60 um cu/min at a dissolved copper content of 150 g/l in the etchant. Equipment and techniques The etchant may be applied to boards in one of the following ways: (1)Immersion etching (2) Bubble etching (3)Splash etching (4)Spray etching

IV.CONCLUSION

The scope of the paper is to protect the users from the harmful acids and to reduce the man power. To design the Automatic machines to industries for manufacturing the large size Printed circuit board .We cannot use the same automatic machine for small size PCB board. In industries, they are using manual etching to design a printed circuit board. To avoid those difficulty, we are replacing with automatic etching machine for industry purpose.

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