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# Study of Portable Welding Machine Using Toroidal Transformer

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## Abstract

*The utility model belongs to the field of arc welding machines, and provides a toroidal core arc welding machine adopting a toroidal core, in order to solve the problems of an existing arc welding machine. A primary coil is wound on the toroidal core and provided with a first tap, a second tap, a third tap, a fourth tap, a fifth tap and a sixth tap, a secondary coil is wound outside the primary coil, the second tap is provided with a seventh tap, an eighth tap, a ninth tap, a tenth tap and an eleventh tap, and the primary coil and the secondary coil are separated on the upper portion and the lower portion of the outer side of the toroidal core through strip-shaped insulators. Compared with the existing arc welding machine, the toroidal core arc welding machine has the advantages that during the same power output, sectional area of a core of an arc welding transformer can be effectively decreased, and a large quantity of ferromagnetic materials are saved.*

***Index Terms:*** *Primary Winding, Secondary Winding, Core, Flux etc.*

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## 1. INTRODUCTION

Welding is a fabrication process that joins materials usually metals or thermoplastics, by causing coalescence. The most popular of the welding machines uses the arc welding methods (Catarina, 2014).

Arc welding is a process that is used to join metal to metal by using electricity to create enough heat to melt metal, and the melted metals when cool result in a binding of the metals. It is a type of welding uses a welding power supply to create an electric arc between an electrode and the base material to melt the metals at the welding point. Arc welding processes may be manual, semi-automatic, or fully automated.

Due to the vast need and use of iron rods, metal bars and pipes, right from the domestic level up to industrial extent, the electric arc welding machine was built in order to ensure that the ulterior motive of themanufacturers of these products (iron rods, metal bars and pipes) by their manufacturers is being achieved as part of technological advancement. With the Construction of Electric Arc welding machines, the difficulty of using iron rods, bars and pipes in construction works will be removed.

## 2. BASIC PRINCIPLE OF ELECTRIC WELDING MACHINE

Power supply is given to electrode and the work. A suitable gap is kept between the work and the electrode. A high current is passed through the circuit. An arc is produced around the area to be welded. The electric energy is converted into heat energy, producing a temperature of 3000 to 4000 C. This heat melts the edges to be welded and the molten pool is formed. On solidification the welding joint is obtained (Evbogbai and Enoch 2002).

### 2.1. ELECTRIC ARC WELDING

Arc welding is a type of welding process using an electric arc to create heat to melt and join metals. A power supply creates an electric arc between a consumable or non-consumable electrode and the base material using either direct (DC) or alternating (AC) currents.

Arc welding is a fusion welding process used to join metals. An electric arc from an AC or DC power supply creates an intense heat of around 6500°F which melts the metal at the join between two work pieces.

The arc can be either manually or mechanically guided along the line of the join, while the electrode either simply carries the current or conducts the current and melts into the weld pool at the same time to supply filler metal to the join.

Because the metals react chemically to oxygen and nitrogen in the air when heated to high temperatures by the arc, a protective shielding gas or slag is used to minimise the contact of the molten metal with the air. Once cooled, the molten metals solidify to form a metallurgical bond.

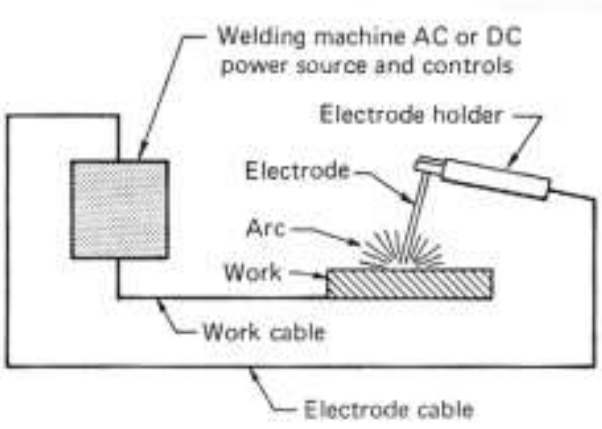


**Fig.1:-Setup of Arc Welding**

#### 2.1.1. SHELL TYPE TRANSFORMER

The shell type transformer is a simple rectangular form and the core surrounds the considerable portion of the windings which is shown in fig. Both the primary & secondary windings are placed in the one limb. And the coils are wound in from of multi-layer disc type. The different layers of the multi-layer disc are insulated from each other by paper.

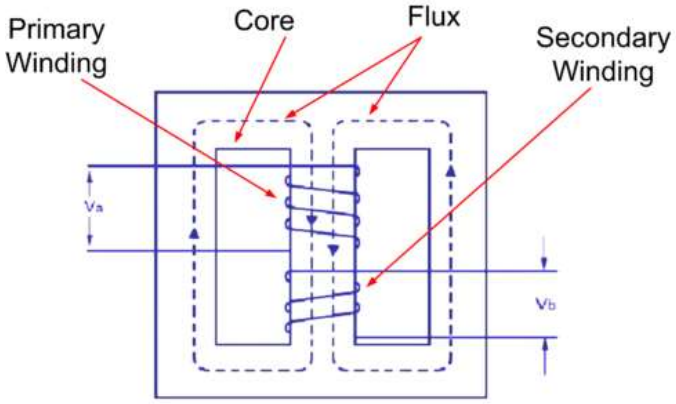


**Fig.2:- Shell Type Transformer**

#### 2.1.2. TOROIDAL TRANSFORMER

The **toroidal transformer** core has round or donut shape. The wires are wound around this shape. The core is built by some of the ferromagnetic materials such as laminated iron, iron powder or ferrite. Small transformers with higher operation frequency from tens of kHz to hundreds of MHz usually uses a ferrite core. The toroidal core cross-section can be square, rectangular or circular. The circular cross-section is more expensive.

Just a small amount of magnetic flux can escape because of the symmetrical toroidal core shape. This transformer type has core losses between 10-20 % of the total transformer losses. The other transformer types have core losses 50% of the total transformer losses. Because of this small core loss, the toroidal transformers are smaller and have less weight 20-50% compared with other conventional transformers.

The low losses are very important for the instrument transformers and because that this transformer type is usually used for this purpose. Those transformers are a good choice for the audio devices because of their low noise level and EMI. Because of high efficiency, they have an important benefit in amplifier application. They could deliver much

more power on the output. The halogen lamp uses the toroidal transformers. Those transformers have been manufacturing with nominal power from 20 VA do 500VA. The thermal switch is usually inbuilt in the case of overheating.

They have an application in industrial electronics as amplifier, charger, rectifier, UPS device. The transformer can be found in the different power range from 20 VA to 7000 VA. They can be provided with a different number of outputs. Because of expensive and complex production, they are practically made for the power range up to 10 kVA (very rarely up to 20 kVA).

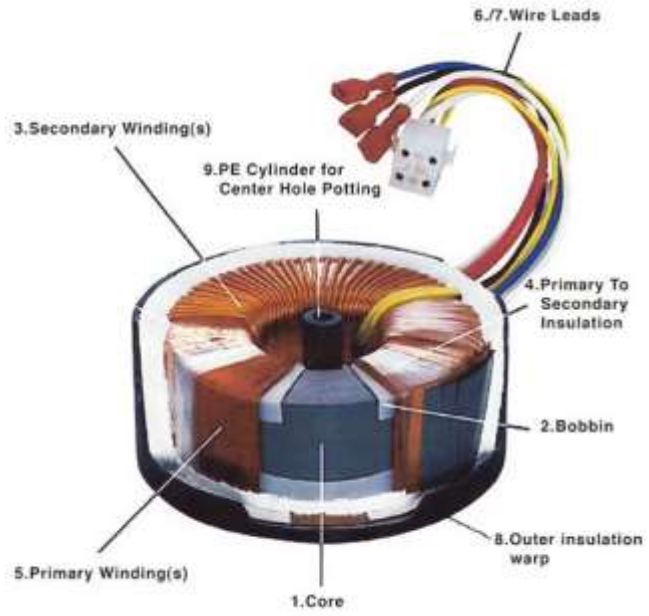


**Fig.3:- Nomenclature of Toroidal Transformer**

**Fig.4:- Welding Machine**

## 3. SPECIFICATION

| Technical Specification | Unit | Toroidal Transformer |
|---|---|---|
| Phase | No. | 1,3 |
| Voltage | V | 240-440 |
| Frequency | Hz | 50-60 |
| Current Range | A | 25-630 |
| Packed Dim.(L*W*H) | mm | 355*650*624 |
| Weight | Kgs | 25-28 |

## 4. COMPARISON BETWEEN TOROIDAL TRANSFORMER AND SHELL TRANSFORMER

| Toroidal Type Transformer | Shell Type Transformer |
|---|---|
| 1.High Electrical Efficiency | 1.Low Electrical Efficiency |
| 2.Low Noise Level | 2. High Noise Operation |
| 3.Low Electromagnetic Interference (EMI) | 3.HighElectromagnetic Interference (EMI) |
| 4.Low Signal Distortion | 4. High Signal Distoration |
| 5. Minimal Magnetic Core Losses | 5.Maximal Magnetic Core Losses |
| 6. Small Dimension | 6. High Dimension |
| 7.High Power Factor | 7. Low Power Factor |
| 8.High Costing | 8. Low Costing |
| 9.In welding m/c used all types of tungsten rod i.e. 2mm,2.5mm,3.15mm,4mm | 9.In welding m/c used only one type of tungsten rod i.e.4mm |

## 5. CONCLUSION

1.The **toroidal** transformers efficiency makes them useful for a wide array of machines such as audio/visual equipment, security systems, telecommunication systems, industrial control equipment and power distribution equipment.

2. This portable welding machine is of low weight and handy one.

3. It is economically viable to replace the manual method of steel bar winding in RCC column.

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