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Energy Saving Device for Welding Transformer

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Abstract - *Demand for electrical power is influenced by competition from other forms of energy. The process of estimating future demands is a continuing one and as the economy expands uniform seen demands arises particularly from technological advances. It is very important that the present power sources should be utilized maximum and at highest efficiency. This is so because only by doing so we can ensure most efficient and economic use of power and a very fast growth of industrial sector.*

The welding machines are extensively used in different sectors such as railways, large scales fabrications, heavy industries etc. and there are about 95 % of industries which directly or indirectly use welding machines. Welding machine require high amount of power ranging in kilowatts to megawatts. This also accounts for heavy power wastage in the form of no load loss, which by effective designing can be reduced to a considerable level and this will not affect the welding performance of the equipment, by reducing the no load loss in welding transformer we can very effectively reduce the overall cost of machine in terms of by back period.

There are about 50 lack welding machines connected to the supplies out of which at least about 7.5 lack machines are always in operation round the clock. If this machine is provided with power saving scheme then we can save energy equivalent to the energy consumption of big metropolitan city.

Key Words: **Welding Machine, No load Loss, Sensor, Automatic Controller, Energy Conservation with ESD**

INTRODUCTION

Demand for electrical power is influenced by competition from other forms of energy. The process of estimating future demands is a continuing one and as the economy expands uniform seen demands arises particularly from technological advances. For securing maximum benefits of electricity supplies are planned in relation to the Generating system taken entirely. It is very important that the present power sources should be utilized maximum and at highest efficiency. This is so because only by doing so we can ensure most efficient and economic use of power and a very fast growth of industrial sector.

In other world we can say that the diversity of load should be maximum. This can be very effectively achieved by positive use of energy i.e.to say the unwanted or unused power wastage should be tried and eliminated to its maximum. Thus energy saving also means generation of extra energy.

1.1 Economic Benefits due to Energy Saving

It is very well known fact that in India there is lack of electric power generation. The demand exceeds the supplies by a huge margin. Thus, it is quite evident that the cost of power generation is higher. if a consumer is supplied with 100 KVA power input then it is often seen that all the power supplies is not converted into useful work done but about 30% to 40% of power is wasted which makes a great difference in economic consideration.

If we succeed in saving this extra power wasted then it will definitely be a great help to the nation as well as the individual. The same power save can be effectively use in operating some other equipment at practically no extra cost of generation. Thus it is very clear that the energy save means energy generated and faster growth to the industry and nation.

The no load current of the transformer consists of two component,

1) The magnetizing component, which is in phase with the magnetic flux.

2) The core loss component, which is opposite in phase with the induced E.M.F. the magnitude of core loss component depends on iron losses, as the copper losses are negligible at no load.

The magnitude of the magnetizing current depends on the quality and thickness of transformer, steel flux density, frequency and quality of the joint. the upper limit of the no load current of power transformer is about 10% at normal voltage of general purpose transformer but in case of welding transformer the no load losses varies between 30% to 40% of the total power rating.

Hence it can be very clearly understood that the no-load power of welding machine contribute to a great amount of power. This power is in reality not useful for the welding purpose and arc occurring only because the transformer is kept on and the same time welding is not carried out. Thus and attempt should be made to reduce no load power loss which is the main aim of project.

2. PROPOSED TECHNIQUE

2.1 Block Diagram

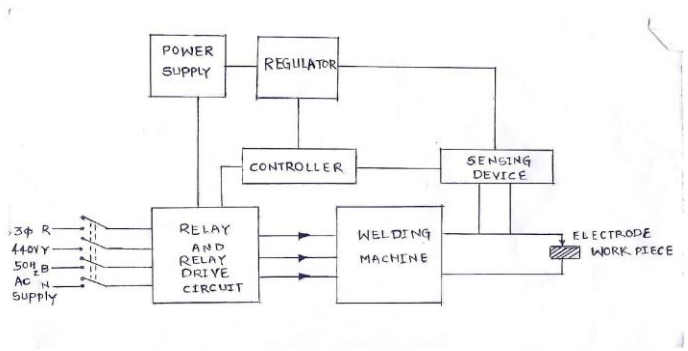

Fig.1. Block Diagram of ESD for Welding Machine

We basically required a circuit which operates in a such a way that it puts off the welding transformer unit when welding operation is not going on and it should put on the machine as soon as welding has to be carried out. For such requirement we need a sensing circuit or sensing logic which senses the welding operation. This can be sensed by output secondary voltage level of the welding machine. We know that OCV of a welding machine ranges between 55 to 90 volt and the secondary voltage at the time of welding ranges from 30 to 45 volt. This two distinct level of voltage can be sense very easily and accordingly a circuit can be made or fabricated such that no load condition is sensed.

Next we require a logic circuit which sense when the welding is supposed to start. This is the point where difficulty arises as the sensing of such instant can only be possible by sensing the short circuit between job and electrode which is in parallel with the transformer second. A possible way of achieving such result effectively can be by making secondary winding impedance considerably high as compare to short circuit. Impedance existing between job (grounded) and electrode. This can be achieving by using high frequency signal for sensing short circuit between the job and electrode.

Our next task gives a time for a machine to switch off, time delay for the machine to switch off or hold on for some time. In other words we have to developed a circuit which senses the stopping of welding operation and then hold the welding machine in circuit, for some time and then after words put off the supply if winding is not started again.

To immediately stop the machine or to put it out of connection as soon as welding operation stop is not desirable because this will cause frequent ON and OFF of the contactor this is used to switch ON and OFF the transformer. Hence the need of delay network is essential. Our main aim should be make a scheme or circuit which eliminates maximum unused power without causing any change in the mode of operation.

2.2 Operation of ESD

1. Initial on Condition

To obtain initial ON condition that is as soon as welder put ON the mains ON. Supply becomes to the relays pole terminal. Normally relay is NC. When welders hand put on the electrode holder then touch sensor sense the touch of the hand and energized the relay coil then relay will on and its contact becomes NC to NO and machine will be ON.

2. Phase 1

When welder put the hand on the sensor the sensor is fitted on the electrode holder. The sensor will sense the touch and it gives signal to the controller. The sensing circuit consists of hex inverting Schmitt trigger (hex 40106B), three NPN Transistor (SL100), resistor etc. this sensing circuit works on 5v supply. The normally the three transistor are in OFF condition. After touching the hand on electrode holder the sensing circuit senses the touch and this signal passes through the base terminal of the transistor. After the passing the signal through base terminal the transistor will be turn ON. Three transistor are connected to the IC 40106.output of Schmitt trigger is connected to the controller analog pin A0 (pin no.23).A0 pin gets signal from Schmitt trigger and it convert into digital form i.e.it indicates in binary form (o's and 1's) . If the voltage level exceeds 1.5volt then it gives high signal and voltage level below the 1.5 volt it gives low signal. After exceeding 1.5 volt voltage level then A0 pin will be high and it makes the pin no. 11, 12, 13 high then drive circuit will come in operation.

The drive circuit consists of transistor (SL100), diode (BC 547), and resistor (1 K) for each phase. The drive circuit works on 12volt supply. The high signal coming from the pin no.11,12,13 .this signal provide to the base terminal of the transistor and NPN transistor will turn ON.it will energized the relay coil. The diode will be connected in reversed biased to avoid reverse current. After energizing the relay coil the relay contact will be changed i.e.NO will be NC and NC will be NO for each phase and machine terminal connected to the NO for each phase due to this relay will come in contact and the machine will be start.in this process we can adjust the starting as well as stopping time from 1 sec to 1 minute according to application.

3. Phase 2

After complete the welding the welder removes the hand from the electrode holder. due to removing hand sensor will be open circuited and the transistor SL100 is in OFF condition .this condition sense the Schmitt trigger and passes to the controller.in this condition voltage level below 1.5 volt. The voltage level below the preset value the controller will generate low signal i.e. (0).

This condition will pass the controller through pin no.11,12,13.this low signal is applied to the transistor base terminal trough resistor for each phase because of low signal

to the transistor becomes turn OFF and relay coil will be de-energized. This condition will be sense by the relay and changed the contact immediately i.e.NC becomes NO and NO becomes NC.

Due to relay contact changed condition the machine will be automatically turn OFF.

3. CONCLUSION

At no load by using conventional method the machine is continuously ON therefore no load power losses is 10% to 15% of its rating. By using energy saving device the no load losses are zero.

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