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Modification of Fabrication Spot Welding Machine

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Abstract: *In decades of years the spot-welding process, with which yearly millions of automobile vehicles are produced, was controlled by current and time. The preset welding time and the current level defined the nugget volume and so the result of the weld. With introducing adhesives and a daily growing number of different kinds of high strengthen steel new initial conditions for the assembly to be weld are created which makes it more complicate in resolving good welding results. Not only current and time were any longer responsible for the output but more than ever also the welding voltage. The actual voltage to be measured directly between the tips of the electrodes defines together with the actual welding current the process resistance which individually is changing from spot to spot. Because of the loss of measuring cables just to the touching points between the electrode tips and the material to be welded, there was no option known for measuring the exact welding voltage and as a result of this the momentary process resistance. The energy input – and depending on this nugget diameter, volume and technological values – however is the result of current, process resistance and time during the whole process.*

Keywords: Spot Welding, Nugget Volume, Nugget diameter

I. INTRODUCTION

In decades of years the spot-welding process, with which yearly millions of automobile vehicles are produced, was controlled by current and time. The preset welding time and the current level defined the nugget volume and so the result of the weld. With introducing adhesives and a daily growing number of different kinds of high strengthen steel new initial conditions for the assembly to be weld are created which makes it more complicate in resolving good welding results. Not only current and time were any longer responsible for the output but more than everal so the welding voltage. The actual voltage to be measured directly between the tips of the electrodes defines together with the actual welding current the process resistance which individually is changing fromspot to spot. Because of the loss of measuring cables just to the touching points between the electrode tips and the material to be welded,there was nooption known for measuring the exact welding voltage and as a result of this the momentary process resistance.The energy input – and depending on this nugget diameter, volume and technological values – however is the result of current, process resistance and time during the whole process. The physical background to this is well known for a long time: Energy is created by the integral of current in square multiplied with the impedance over time ($e = \int i(t)2 * r(t) *dt$, with e=energy, i=current, r=resistance, t=time) where current and resistance are changing with time, they are time variant parameters. As long as the varying resistance is neither measured nor used in the weld controller a reliable statement with respect to the energy input must fail.

II. PROBLEM DEFINITION

"Conventional spot-welding machine manufacturing purpose, it is needing a step-down transformer but in markets, it is very difficult to find the step-down transformer as per requirements also cost of that machine is high"

• For our project, we need a step-down transformer which takes a normal input i.e., 230V and 7 amps and deliver the output as 12V and 7 amps.

• This type of step-down transformer is impossible to find in the general markets.

• Generally, in the transformer, the output voltage is decided on the basis of the number of turns in the secondary winding.

• We are trying to make an portable, lightweight & low cost spot welding machine for workshop sheet metal working.

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• The spot welding available in market is too big in size and have huge electric power consumptions. Due to their size, it is impossible to use these portable or handy.
• The study of various spot-welding process and various automatic and semiautomatic spot-welding machine reveal that there is scope for modification in design of conventional spot-welding system.

III. LITERATURE SURVEY

Shruti Naik, Dr. M. Aruna Devi, Dr. C.P.S. Prakash, done the work on,A Review on Optimization of Resistance Spot Welding of Aluminum Components Used in Automotive Industry, according to his work, Resistance Spot welding (RSW) is one of the common welding processes used for sheet joining especially in the automobile and aerospace industry. It is used in a wide range of industries but notably for the assembly of sheet steel vehicle bodies. This is a type of resistance welding where the spot welds are made at regular intervals on overlapping sheets of metal. Spot welding is primarily used for joining parts that are normally up to 3 mm in thickness. The joint quality can be defined in terms of properties such as weld-bead geometry, mechanical properties and distortion. The objective of the research is to determine the optimum combination of parameters responsible for better quality of joints. The complicated behavior of the process must be analyzed to set the optimum parameters to get the optimum weld quality. The paper also presents the FEA simulation of the RSW process. In the review, it was observed that the common input parameters affecting the strength of multiple spot-welded joints are spot welding pressure, current and weld time. The spot welds withstand much better shearing forces than normal forces. Also the spot weld can rupture in two modes. Nugget pullout failure which occurs in stronger joints and interfacial failure occurs in weaker joints. The survey clearly manifests that Aluminum material is much preferred for spot welding in automotive industries because of its higher thermal and electrical conductivity and a good tensile strength.

Due to these properties, spot welding of aluminum requires much higher tip forces and higher welding current but takes one-third the weld time of steel. Taniguchi Koichi, Okta Yasuaki & Ikeda Rinsei, done the work on, Development of Next Generation Resistance Spot Welding Technologies Improving the Weld Properties of Advanced High Strength Steel Sheets, according to his work, The new technologies of resistance spot welding, which has been widely used for auto body production, are significant to realize the high collision safety of car body. Pulse SpotTM welding, utilizing the short-time high-current post-heating can improve the weld joint strength of high strength steel sheets. Intelligent SpotTM welding, varying the force and welding current during welding, enables to mitigate the limitation of the three sheets lap welding which is more frequently performed with increased application of high strength steels. Both high performance in terms of steel sheet material quality and the development of manufacturing processes such as press technologies and welding technologies are crucial for application of high-functionality, high-strength steel sheets to auto bodies. These reports introduced examples of the development of two new spot-welding technologies that realize improved joint strength and weld ability. Authors would like to promote practical application of these welding technologies, and contribute to improved environmental performance by auto body weight reduction, as well as improved crashworthiness, by expanding the applications of high strength steel sheets.

IV. METHODOLOGY

• Basic Information & Literature survey Synthesis using
• Optimized Method in MATLAB.
• Design of Machine Components.
• Selection of Components for Machine.
• CAD modelling & Fabrication of Machine parts.
• Assembly, Testing & Documentation of Machine

V. MATHEMATICAL MODEL OF MECHANISM

Assume spring Design force on spring Fmax=F=50N Maximum deflection of each spring 25mm
Spring index C = D÷d=10÷1=10 D=dia of spring
d=dia of wire
Maximum permissible shear stress for steel material as 400 N/mm2 Modulus of rigidity Assume 85 GN/m2

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Fmax = 50 N, δ=25mm C=10, Z=400N/mm2
G=85×103 n/mm2 Wire diameter-
Wahl factor, Kw =(4C-1/4C- 4)+(0.615/C)
=(4×10)-1/(4×10)-4+(0.615/10) Kw=1.145
Shear Stress induced Z = Kw(8FmaxC/πd2)
400=1.145(8×50×10/π×dˆ2)
d=1.9mm=2mm.
Assume wire dia. Mean coil diameter C=D/d D=Cd=10×2 D=20mm.
No of coils,
Spring stiffness, K = Fmax/δmax
=50/25
=2N/mm2 K=Gd/8Cˆ3n
2 =$85\times10^3\times2/(8\times10^3n)$
n=10.625=11 turn Assume Square & Ground end Total no of Coil n'=n+2=11+2=13
Spring Length & Pitch Solid Length Ls =(n+2)×d
=(11+2)×2
Ls=26 mm
Free length=Ls+δmax+(n'-1)×2
=42+25+(13-1)×2
Lf=75mm
Assume Clearance of 2mm between adjacent coil, Lf=Pn+2d
75=P×11+(2×2)

VI. OPTIMIZATION APPROACH

• Fabrication of Portable Spot-Welding Machine: The principle of the portable spot-welding machine is same as the conventional spot-welding machine i.e. "When the low voltage and the high ampere current is passed over the two thin metal plates at the particularly concentrated spot, then those two metals joined and form the welding

• Transforme: A transformer is an electrical device that transfers electrical energy between two or more circuits through electromagnetic induction. Electromagnetic induction produces an electromotive force within a conductor which is exposed to time-varying magnetic fields. Basically, the transformer consists of two windings they are primary and secondary windings. Generally, we give our power supply to the primary winding later the output depends on the secondary winding. So, the secondary winding plays the important role in the transformer. Generally, there are two forms of transformers.

VII. SIMULATION

• Fabrication of Portable Spot-Welding Machine:
• Transformer.
• Conversion of Step-Up Transformer into StepDown Transformer.
• Modification of Transformer.

VIII. RESULT AND DISCUSSION

• Type of material: By using machine, we can weld the sheet metal, aluminium sheets, galvanized iron sheets, Mild sheets. We do experiments on these materials only and we studied that it can weld another material also.

• Thickness: The maximum thickness that our can weld is the1mm of the single plate. if the thickness exceeded more than that the time of weld is more and more and the main problem is the machine gets overheated.

• Time of Weld:
- If we take 1mm thickness plates it takestime1 sec.
- If we take 2mm thickness plates it takes time2-3 sec.
- If we take 3mm thickness plates it takes time4-6 sec.

IX. CONCLUSION

- Reduce the man power & efforts in spot welding operations
- To develop automation unit for the drill so that m/c can easily be adopted in today's automated plats.
- To performed the most rigid operation with high-speed spot-welding sheet metal work
- To make a portable, lightweight & low-cost spot-welding machine for workshop.

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