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Design and Fabrication of Portable Spot Welding Machine

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Abstract: *Spot welding is a sort of electric resistance welding that is used to unite contacting metal surface points on various sheet metal goods. This is accomplished by a process in which heat is produced through resistance to electric current. It works by contacting copper alloy electrodes to the sheet surfaces, where the pressure and electric current are applied and heat is generated by the passage of current through resistive materials such as low-carbon steels. Using shaped alloy copper electrodes that conduct an electrical current through the weld pieces, the procedure entails applying pressure and heat to the weld region. The component melts, joining the pieces together. Portable is a term that describes "capable of being carried from place to place". This mini project is designed in such a way that the spot welding machine should be light in weight and convenient to carry. In the present work, we have tried to overcome the above problems by restructuring the design. The newly designed apparatus was a simpler, lighter, portable, compact, and flexible machine which will be able to weld at any angle and can be easily operated by even a non-skilled Labor with much ease and required accuracy.*

Key Word: *Spot welding machine, design, CATIA, portable, fabrication.*

I.INTRODUCTION

One of the earliest electric welding techniques still in use today is resistance welding. The weld is made by a combination of heat, pressure, and time. Resistance welding gets its name from the fact that localized heating in the component is caused by the material's resistance to the flow of electricity during the welding process. The pressure exerted by the tongs and electrode tips, through which the current flows, holds the parts to be welded in intimate contact before, during, and after the welding current time cycle.The required amount of time current flows in the joints is determined by material thickness and types, the amount of the current flowing, and the cross-sectional area of the welding tip contact surface. When current is made to flow through the electrode tips and the various metal parts that need to be linked, resistance spot welding can be completed. The resistance of the base metal to electric current flow causes localized heating in the joint and the weld is made. When current is made to flow through the electrode tips and the various metal parts that need to be linked, resistance spot welding can be completed. The heat produced by resistance to electric current is used to combine metal surface points in a process known as resistance spot welding (RSW). It is a subset of electric resistance welding, as shown in Fig. 1. When welding specific kinds of sheet metal, welded wire mesh, or wire mesh, spot welding is frequently utilized. Because the heat spreads more readily into the surrounding metal while working with thicker material, spot welding is more challenging. Several sheet metal products, such as metal buckets, can be easily identified by spot welding. Aluminum alloys can be spot welded, but their much higher thermal conductivity and electrical conductivity require higher welding currents. This requires larger, more powerful, and more expensive welding transformers. Spot welding is also utilized in the orthodontist's office to resize metal "molar bands" used in orthodontics. Small-scale spot welding equipment is employed in this setting. Good design practices must always allow for adequate accessibility. To achieve high-quality welding, connecting surfaces should be free of impurities like scale, grease, and dirt. Metal thickness is generally not a factor in determining good welding.

Construction:

1. The Resistance Spot welding setup consists of a transformer, workpieces, two copper electrodes, and two tongs, as shown in fig.2.
2. Depending upon the requirement, the transformer will be used either to step up or step down the voltage.
3. The power supply will be passed through the two Tongs to the electrodes.

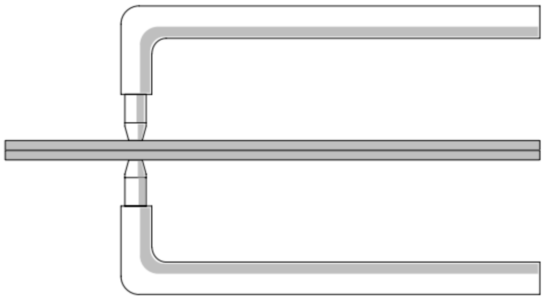

Fig. 1: *Spot Welding Electrodes*

4. Copper (Cu), tungsten, copper-tungsten alloy, and other materials are the most frequently employed electrode materials in resistance welding.
5. Due to the application of pressure on the tongs, heat is generated between the workpieces due to the passage of current and the formation of spots or nuggets takes place.
6. Thereby a joint is formed between two workpieces.

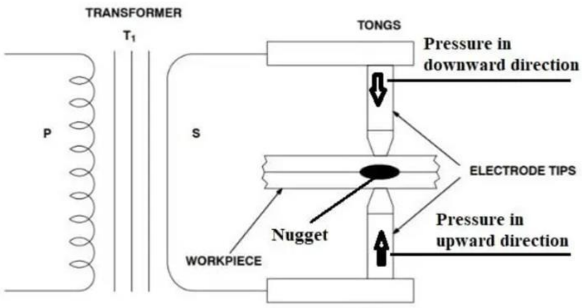

Fig. 2: *Construction Of A Resistance Spot Welding Machine*

Working Principle:

The Working Principle of the portable spot-welding machine is the 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"

Spot welding has three stages, the first of which entails bringing the electrodes up to the metal's surface and applying light pressure. The electrodes are then momentarily exposed to current before the current is withdrawn, leaving the electrodes in situ to allow the material to cool. Weld times range depends on the thickness of the metal, the electrode force, and the diameter of the electrodes themselves. The equipment used in the spot welding process consists of tool holders and electrodes, as shown in Fig. 3. The tool holders function as a mechanism to hold the electrodes firmly in place and also support optional water hoses that cool the electrodes during welding. Tool holding methods include a paddle-type, light-duty, universal, and regular offset. Depending on the application, the electrodes are often constructed of a low-resistance alloy, typically copper, and come in a variety of forms and sizes. The workpieces, which are the two materials being welded together, must be electrically conductive.

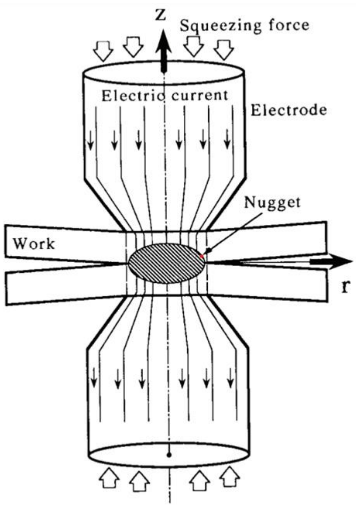

Fig. 3: *Working Principle*

Literature Review:

Anike A. Nimje et. al., [1] Has done a mini project representing the portability of resistance spot welding machine and study of various factors like the thermo-effect of nugget growing in single phase AC resistance spot welding and heating of electrodes during spot resistance welding. The designed welding machine is very less in weight with same strength of the regular spotwelding machine with more degree of freedom to work with..This mini project was done with transformer electrodes and wooden casing. There is need to optimize the structure of the machine. we can use higher rating transformer, with the help of higher rating transformer we can weld thick metals.

Mahesh Kumar Pimpale et. al., [2] For their mini 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. Spot welding is primarily used for joining parts that are normally up to 3 mm in thickness. The survey clearly manifests that Aluminum material is much preferred for spot welding in in automotive industries because of its higher thermal and electrical conductivity and a good tensile strength.

A. Gowtham Rajan et. al., [3] In This mini project they made our own transformer according to requirements of specifications for welding as a general transformer used in electronic appliances was costly and as well a Bulky. Then they fabricated a portable spot-welding machine at a very low cost. By this machine, we can fulfil all our domestic spot-welding purpose and also, that can fulfil some workshop purpose also.

Giridhar N et. al., [4] In this mini project, the effect of welding time on the tensile-shear strength and tensile-peel strength of the welding joints in electrical resistance spot welding of mild steel plates having 1.0 mm thicknesses were investigated. The plates are welded by electrical resistance spot welding by fixing electrode form, materials type and electrode force while changing welding current and time. Fabrication is done according to the design and dimension. Spot welding of mild steel sheet of thickness 0.6mm has been achieved. The auto feed mechanism is done by using Arduino which helps in nugget formation exactly at 1cm distance between them. The drawback of the machine is, the weld is of low strength.

Shaymaa Abdul Khader Al-Jumaili. et. al., [5] The effect of welding parameters on the mechanical properties and failure mode is reviewed in this study. The relationship between the joint strength and welding parameters is presented. Effect of annealing heat treatment on the weldment properties was investigated as well. Few of investigations studied the defect formation in spot weld. The most critical defects such as cracks and cavities are presented as well as the residual. Besides, the effect of welding environments on the joint properties is reviewed in this study. Resistance spot welding (RSW) was extensively researched because the dissimilar joining of aluminum and steel by RSW represents a crucial goal in the manufacture of vehicles and a major obstacle for the multi-materials lightweight design approach.

Nitipat. E et. al., [6] A research is related to the development of a portable spot welding machine as a tool used for joining thin metal parts. In conventional equipment, a transformer is the main power supply working for short duration at low voltage and high power, resulting in a large and heavy spot welding machine. Studies show that the Ultracapacitor (UC), which functions as a transformer but works at low-voltage, high-current and high-power conditions, can provide higher power-to-weight ratio than typical iron core transformers. The power part starts at a 220 V 50 Hz AC power supply working under the limit current applied and sending the high power to the UC. The size of the power supply will affect the amount of time required for accumulating the energy of the UC. Physical phenomena in resistance spot welding can be described in two parts: heat energy for joining the sheets and power discharged by the capacitor.

Mallaradhya H. M et. al., [7] Welding is a basic manufacturing process for the manufacture of components or parts with noble mechanical properties. Resistance Spot Welding (RSW) is frequently employed as a reliable joining technique for a range of tasks in the industrial and automotive industries. Precipitation hardening (PH) steels are known to be significant as a structural material among the emerging light alloy steels and are used for fabricating components by conventional metal working processes. The standard fusion and resistance welding techniques are often thought to be capable of joining the PH group of stainless steel. Resistance spot welding with various materials is tested, and discussion of optimization strategies is included. In order to enhance the strength qualities using conventional welding, the best features of PH steels are specified, and microstructural changes are analysed.

P. Sreenivasulu et. al., [8] Spot welding machine requires a lot of space requires a lot of space, is heavy, restricted by height and does not weld at any angle. In this mini project, we have tried to overcome the above problems by recreating the design. They made it a simpler, lighter, portable, compact and flexible machine which will be able to weld at any angle and can be easily operated by even a non-skilled Labor with much ease and required accuracy. We studied various research papers and concluded that a portable spot welding machine is required. For creating this machine we used modeling software such as solid works and created a prototype based on its design. In this mini project we made our own transformer according to Requirements of specifications for welding as a general transformer used in electronic appliances was costly and as well as Bulky.

Miller et. al., [9] In the present paper, various types of resistance spot welding guidelines are given including safety measures and harmful causes. This paper also describes various factors of the resistance spot welding and various factors to get a good welding of the metal sheet.

Kunal Mehra et. al., [10] Resistance Spot Welding (RSW) consists of mechanical-thermal-metallurgical-electrical phenomenon in which investigation of heat generation, current and resistance plays a key role. In this work, a review about material, nugget, and electrode has been carried out, which is the main point of concern in resistance spot welding. In industry, any small modification in the above concerned points may result in reduction of cost and time as well as increase in electrode life and strength of nugget.

Jithin Krishnan et. al., [11] Welding tip are made of Copper/ Copper Alloy having length of 14mm and diameter of 1.2mm dimensions. The workpiece is held between welding tip and welding plate which are connected to relay and ground respectively. Welding tip are used to direct the electrical current through workpiece resulting in the formation of nugget.Design and analysis of a high-efficiency portable resistance spot welding with capacitor discharge has been suggested in this paper. The prototype implementation and evaluation confirmed that the proposed method provide increased accuracy of resistance spot welding for electrode parts.

Rishabh Sharma et. al., [12] This paper represents the portability of resistance spot welding machine and study of various factors like the thermo-effect of nugget growing in single-phase AC resistance spot welding and heating of electrodes during spot resistance welding. The construction of the portable spot welding machine is separated into two stages. The first stage is the creation of the machine's basic circuit, which consists of a tiny transformer with an output voltage range of 0 to 2 volts and a power switch. Second is the formation of body and arm mechanism of the machine. Also the study is on various the factors which come into light when process of spot welding takes place. One such factor is nugget formation. The nugget formed in the work piece plays a crucial role in joining structure. Nugget forming process is not visible and also hard to test.

Zoha Nasir et. al., [13] Present discussion deals with a critical review of spot welding carried out by different investigators.The review also includes the various methods of optimization of process parameters.The sheets to be welded are clamp together between the electrodes and current is allowed to flow.The plates get heated at the interface due to the resistance in the path of current flow.The study gives an overview of latest research works on resistance spot welding.It presents a brief information about the resistance spot welding ,its parameters and about the techniques used to optimize the parameters and to obtain high quality welds.

S. M. Manladan et. al., [14] The automotive industry is now one of the most important sectors of all developed economies. It provides job opportunities to many people at various levels of the econoour. Resistance spot welding is the dominant welding process in the automotive industry. The process is fast, effective and also complicated due to complex interactions between electrical, mechanical, thermal and metallurgical processes. Due to increasing demand for improved fuel efficiency, reduced CO_2 emission and superior crashworthiness, significant effort is continuously being applied to develop lightweight materials with excellent strength-ductility combination. The mechanical performance of resistance spot welds in terms of weld nugget size, load bearing capacity, and failure mechanism under quasi-static loading circumstances is reviewed in this research for automobile sheet materials. Moreover, it discusses how welding current, duration, and electrode force affect the mechanical performance of spot welds. By considering all the above-mentioned journals, as per our knowledge we observed that the spot welding consists of various parameters such ad pressure, time of weld, electrodes, etc.. We also observed various kinds of information to fabricate and form a better quality weld by using the resistance spot welding machine. l. The proposed work will be very much helpful to the designers to get an overview of designing and fabricating of a portable spot welding machine.

Sachin K Jadav et. al., [15] Welding input parameters play a very significant role in determining the quality of a weld joint. Weld-bead shape, mechanical characteristics, and distortion are a few examples of the features that may be used to describe the junction quality. The primary goal of this review is to investigate the impact of various resistance spot welding input parameters on the weld quality. To establish a mathematical relationship between the welding process input parameters and the weld joint output variables in order to identify the welding input parameters that result in the desired weld quality, design of experiments (DoE), evolutionary algorithms, and computational networks are now frequently used. The experimental studies have been conducted under varying welding current and welding time, squeeze and hold time. In this investigation the quality characteristic (tensile strength) has been considered using Grey Relational Analysis Method.

P. Podrzˇaj et. al., [16] Presentation of the physical background of the resistance welding process is followed by the description of the main problems concerning the appurtenant control theory. Solutions to these problems are presented primarily according to the measured signals used and to the type of control strategies.There are two extremes in terms of the amount of generated heat during resistance spot welding: if the amount of generated heat is too high, expulsion occurs; if the amount of generated heat is too low, the welding nugget does not form. Monitoring system (MS): an MS only detects whether the weld has an appropriate weld strength (weld diameter). If the weld strength is not sufficient, another spot weld can be made in the vicinity in order to ensure the strength of the joint assembly

S. Aslanlar et. al., [17] This study looked at how welding duration affected the tensile-peel strength and tensile-shear strength of welding joints when chromate micro-alloyed steel sheets with 1.2 mm thicknesses were subjected to electrical resistance spot welding. A timer and current controlled electrical resistance spot welding machine having 120 kV A capacity and a pneumatic application mechanism with a single lever was used to prepare the specimens. Welding current periods of 5–10 kA and 12 kA were selected, and it was adjusted by increasing 5 cycle from 5 cycle to 15 cycle during the welding process. The electrode pressure was fixed at 6 kN. The welding joints were exposed to tensile-peel and tensile-shear tests, and the effect of welding time on tensile-peel strength and tensile-shear strength was researched by using related period diagrams. The optimum welding times were obtained.

Y. Cho et. al., [18] Using a digital highspeed camera to visually monitor and study the process of nugget creation, the mechanism of nugget formation in resistance spot welding is investigated, as well as its impact on the welding process parameters. The system was comprised of a processor, power supply, camera, viewfinder, and lighting sources. A resolution of 256 x 240 pixels was used in order to capture the nugget formation. The camera system consisted of an adapter plate, camera head, tripod, and lens. A specially designed electrode was used in order to monitor the process of nugget growth.

Y. Zhou et. al., [19] The resistance weldability of 0.2-mm-thick sheet aluminum, brass, and copper in small-scale resistance spot welding (SSRSW) was studied. The effects of electrode materials and process parameters on joint strength and nugget size were investigated. The minimum current that generated the appropriate nugget diameter and the highest currents that did not cause electrode-sheet sticking or weld metal ejection were used to define the welding current ranges for SSRSW of the sheet metals. A qualitative analysis indicated that resistance weldability of the metals is not only determined by their resistivity (or thermal conductivity) but is also affected by other physical properties.

S. J. Na et. al., [20] Effect of contact resistance including constriction and contamination resistance has been a major hurdle for the thermoelectrical analysis of the resistance spot welding process. In this paper, a simple model was suggested and used for calculating the electrical and thermal response of the resistance spot welding process to investigate the influence of contacting forces on the formation of weld nuggets. The electrode surface of the contact interface was assumed to be axisymmetric and its micro asperities to have a trapezoidal cross section. These micro asperities were considered as the one-dimensional contact resistance elements in the finite element formulation. The contamination film was assumed to be a nonconducting oxide layer, which is very brittle, so that it is broken to some number of pieces when a contacting pressure is being applied. The crushed films were assumed to be distributed at regular intervals and to conserve their size and number during the welding process. The simulation results revealed that the proposed model can be successfully used to predict the effect of the contact resistance on the electrical and thermal response of the resistance spot welding process.

Methodology:

1. Designing in various softwares of the spot welding machine (Example: CATIA).
2. Take the materials required for assembly and fabrication.
3. Assembling of the materials and parts to form final product.
4. Finally testing of the machine.

Spot Weld Formation:

When a significant amount of current is conducted through the panels for the proper length of time and under the proper pressure, spot welds are created. Two electrodes are typically used in spot welding applications to push the metal pieces together. These electrodes are positioned across from one another. This squeezing pressure is controlled. By running a welding current through the pieces that need to be welded, they are heated. A welding current of several thousand amps is used for a predetermined amount of time. As the temperature is elevated, the metal is heated to a plastic state. As the metal heats up, the force of the welding tip will deform it and cause a small dent to appear. As the heat builds in the metal, a small liquid pool of metal is formed at the interface. This pool is typically the same size as the face of the welding tip. When the welding temperature is reached, the timer should expire. Due to the copper welding tips' ability to draw heat from the weld zone, the weld zone cools down very quickly. Furthermore, heat is lost as the surrounding metal is contacted. The SPOT Welding Pliers should be held closed for at least one second to cool the weld.
WARNING: Caution must be given when using an airtight device that releases right away after the weld is created.

Welding Time Cycle:

Spot weld results can be improved and imperfections avoided by adjusting the time that the metals are subjected to electrode pressure and weld current, as shown in Fig. 4.

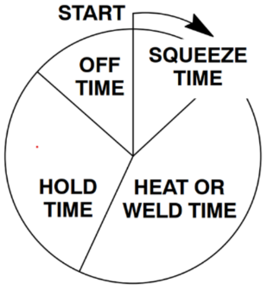

Fig. 4: *Time Cycle Of Welding*

1. **Squeeze time** is the duration during which the electrode's welding tip presses down on the overlapping metals.
2. **Upslope** is the time in which the electric current reaches its peak value.
3. **The amount of time that the electric current passes between the electrodes is known as the weld time.** During this time, heat is generated and fusion takes place between the metals.
4. **Downslope** is the span where the electric current is cut out from its peak value.
5. **Hold time** refers to the resting period where the molten metal solidifies. During this time, electrode pressure is still being applied, and the electrodes are conducting heat away from the weld.
6. **Off time** is used to signify the current's delay from the end of the sequence to the start of the next one.

History Of Spot Welding:

Elihu Tompson, an American, created and patented spot welding in 1885. The discovery was made while giving a lecture and demonstration on the exciting new field of electricity in 1884. In response to a question from the audience, Tompson created an e1xperiment and produced the first spot weld.

II.MODELING

Modeling:

The modeling and step-by-step procedure for the modeling of the spot welding machine is done using CATIA V5 software. The main goal of this investigation is to design a spot welding machine that will further be fabricated and tested. Our goal is to make the design very similar to the final fabricating product and test its working. In this, the different parts are designed as parts and are assembled in such a way that the design is approximately similar to the original fabrication model. CATIA V5 is Computer-aided design (CAD) software that is used to build the geometry model.

The parts utilized to model the spot welding machine by CATIA software are presented below:

1. **BASE**: The base is first prepared by using the centered rectangle option in sketcher and then the rectangle is shaped into the base part by using the option called pad.

   Then another plane is selected and we draw a circle which will be a place to hold the electrode. The hole is done by giving the pocket option to the circle, as shown in Fig. 5.

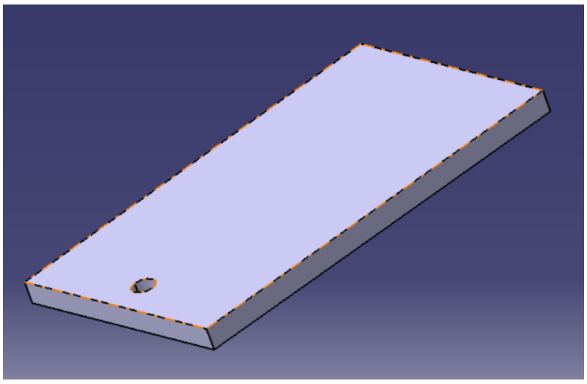

Fig. 5: *base of the spot welding machine*

2. **SUPPORT:** Draw another rectangle using the rectangle option in the profile toolbar and then give padding. Once the padding is given then a hole is placed to hold the arm support by using a nut, which holds the arm in place. as shown in Fig. 6.

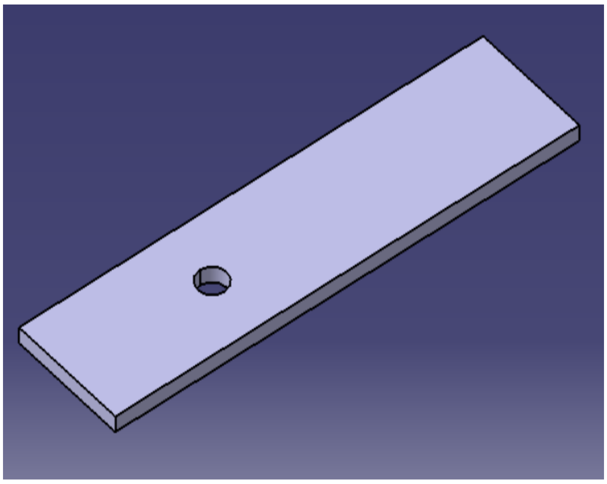

Fig. 6: *Support Which Holds The Arm*

3. **ARM:** We Drew another rectangle with a large length and less width to hold the electrode and also get the movement to apply pressure and take the electrodes to a certain place where both the electrodes are in contact with each other, as shown in Fig.7.

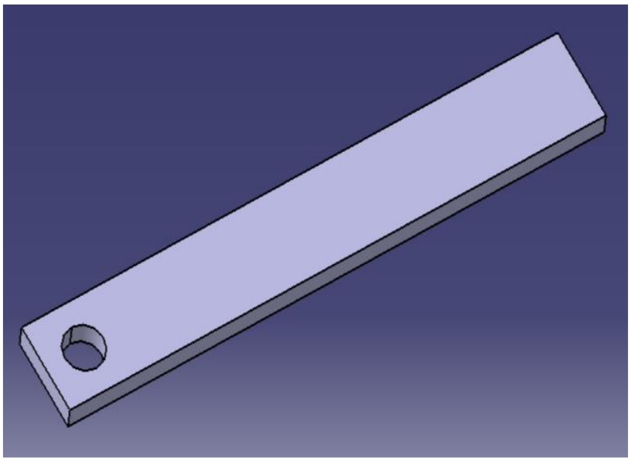

Fig. 7: *The Arm*

4. **NUT:** A hexagon is first drawn in the sketches and then it is padded. Then a plane is selected and a circle is drawn which will again be padded, forming a nut, as shown in Fig. 8.

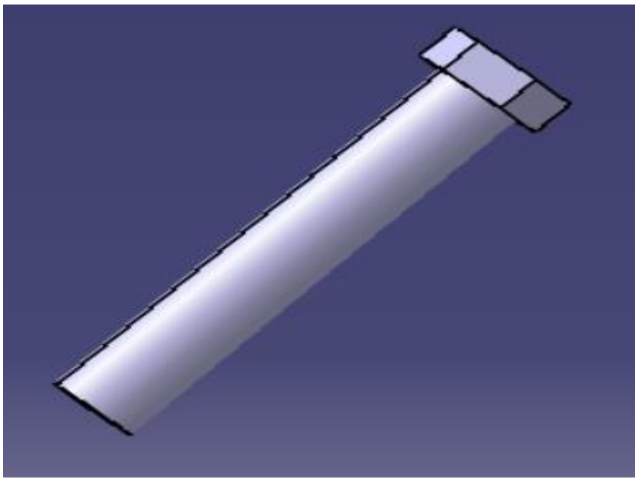

Fig. 8: *The Nut*

5. **BOLT:** A hexagon is first drawn in the sketches and then it is padded. Then a plane is selected and a circle is drawn which will be given a hole by using the pocket option, forming a bolt, as shown in Fig. 9

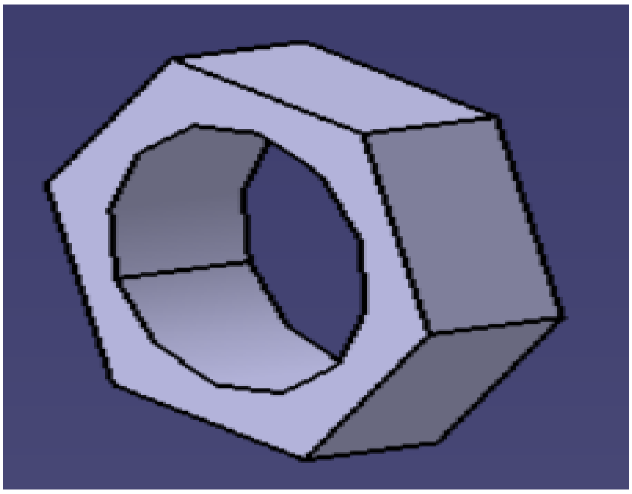

Fig. 9: *The Bolt*

6. **ARM SUPPORT:** First a rectangle is drawn in the workspace, then the padding is given to the rectangle. A how is given to a side of the object which will be a place to attach the nut, as shown in Fig.10.

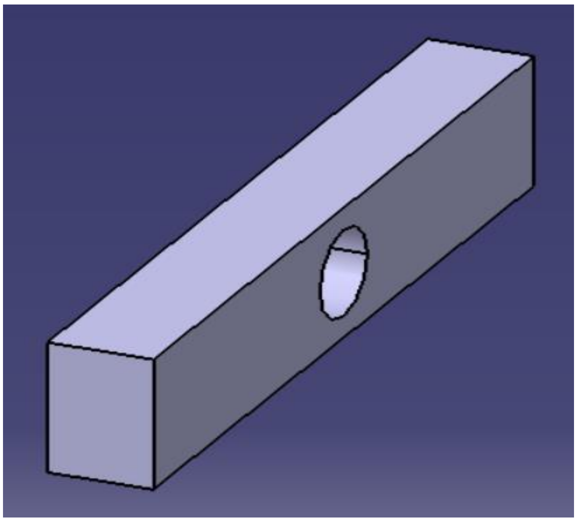

Fig. 10: *Arm Support*

7. **BUSH:** Bush is a material that is used to add a millimeter thickness to balance any object and to hold it at a particular position. Here the bush is used for the same purpose. The bush is 1mm thick and it's created by drawing 2 circles in a single workspace and giving padding of 1mm at Max, as shown in Fig. 11

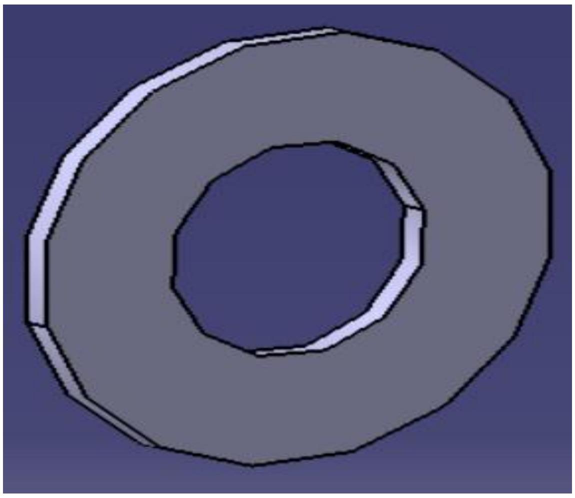

Fig. 11: *Bush*

8. **FIXING ARM SUPPORT:** The fixing arm support is added to increase the thickness and to hold the arm without being able to move out something. The fixing arm is drawn by taking a plane and by drawing 2 circles and giving them the padding, forming a fixing arm, as shown in Fig. 12

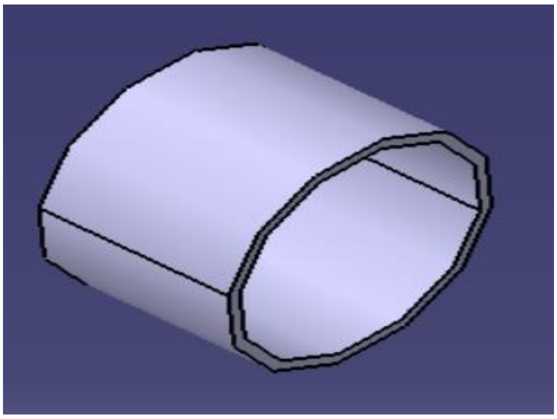

Fig. 12: *Fixing Arm Support*

9. **SPRING:** Open-coil helical springs are designed or coiled to oppose compression along the direction of the wind. The most typical metal spring configuration is helical compression. These coil springs can work independently, though often assembled over a guide rod or fitted inside a hole. The spring is made by taking a pointer in a plane and then drawing a shape of the spring in the product or using the option called HELIX in the search bar. Then a circle is drawn at the point which will then be subjected to RIB, as shown in Fig. 13

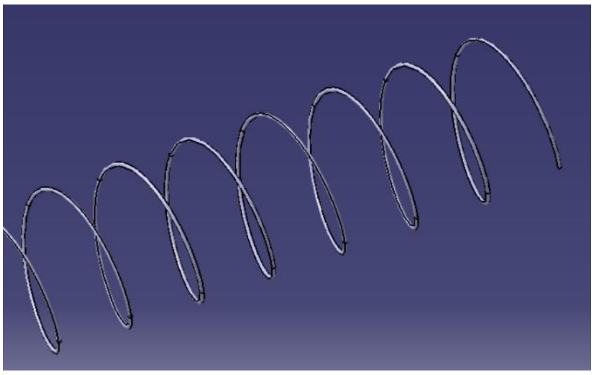

Fig. 13: *Spring*

10. **ELECTRODES:** Electrode plays a key role in resistance spot welding as they have to perform three major functions:- conduct electric current, hold the workpiece together, and dissipate heat from the weld zone as quickly as possible. During welding, electrodes experience high compressive stresses at increased temperatures. The electrode is drawn by drawing a shape of a half-section view in a plane and then making an electrode by using the SHAFT option, as shown in Fig. 14.

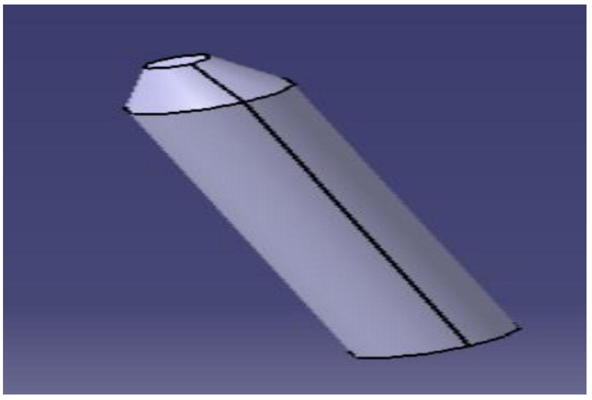

Fig. 14: *Electrodes*

11. **TRANSFORMER:** The transformer, as shown in Fig. 15, performs the task described by "stepping down' "from the high voltage/low current primary side, where we use a large number of turns of smaller wire (N1 in the schematic) and a lesser number of large wires turns (N2 in the schematic) on the secondary side. Depending on the turn ratio, or the number of turns of wire on the secondary side, this produces low voltage/higher amperage. Transformer plays a major role in spot welding.

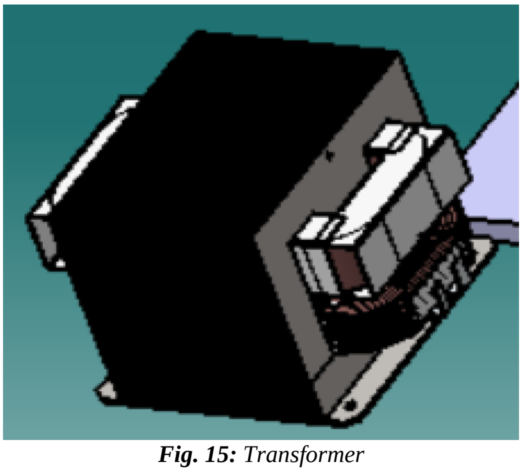

Fig. 15: *Transformer*

Assembling And Parts Description:

1. The base part is first fixed in a product (or) Assembly design, in CATIA. then the transformer is added at one end of the base part

2. The where arm support is fixed to the arm at the center (or) in the middle, and the arm support has a hole (or) pocket in the middle.
3. The supports are fixed in the middle of the plate where the arm is placed in between the supports.
4. The arm is placed in such a way that the pocket con hole in the base plate co-imides with the pocket (or) circular hole in the arm.
5. The supports also consist of holes in which the nut and bolts and placed. The nut and bolt go through the parts such as bushes, fixing supports, and supports, where all of them are fixed arm and supports, arm supports. It avoids any unnecessary movements and provides only motion to make the electrodes get closer and comes in contact.
6. The assembling of the spot welding machine is done and the result is shown below in various views, as shown in Fig. 16, Fig. 17, and Fig. 18.

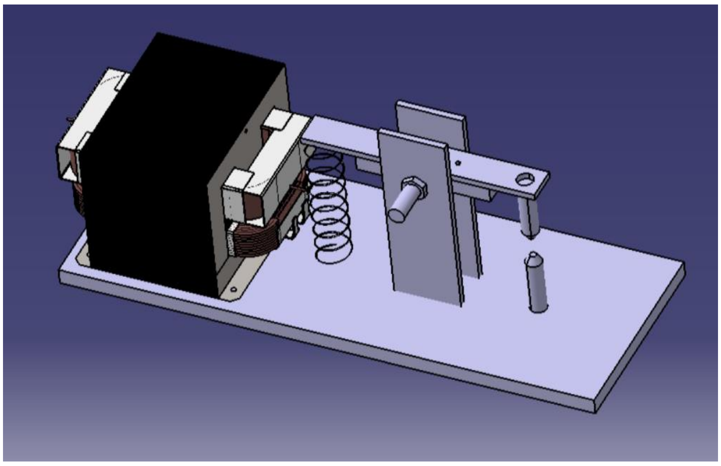

Fig. 16: *Isometric View*

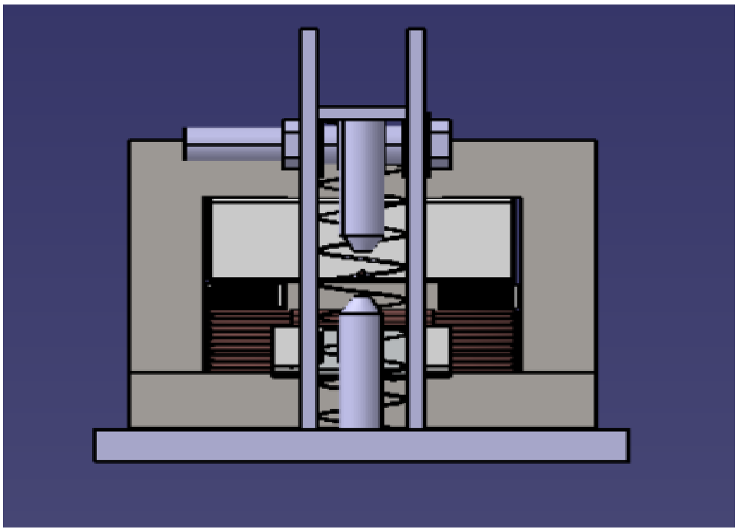

Fig. 17: *Front View*

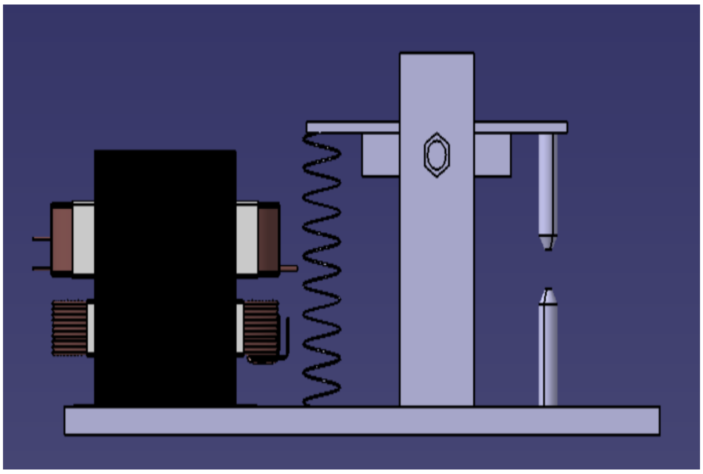

Fig. 18: *Side View*

7. The exploded view of the assembly is shown below, in Fig. 19.

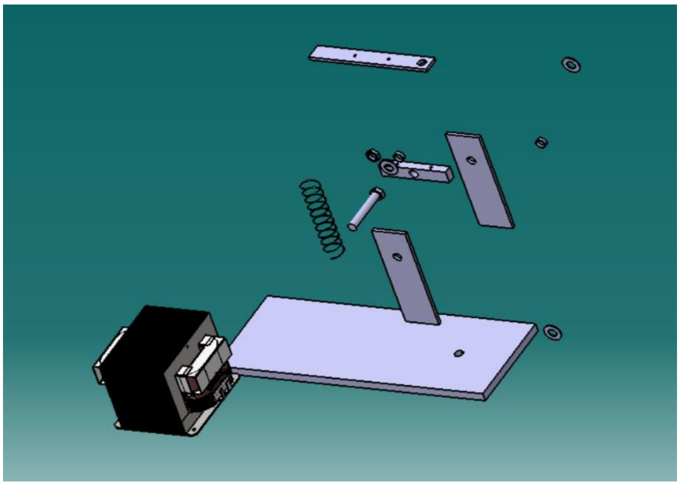

Fig. 19: *Exploded View Of The Spot Welding Machine*

III.FABRICATION

The fabrication and a step-by-step procedure for the fabrication of the spot welding machine. The fabrication was done according to the design.

As the design suggests. Different kinds of materials are bought for fabrication. The components are as follows:-

1. “Transformer”, which converts 230V AC supply or input to input to 5V 1Amp as output.
2. "Electrodes", The copper electrodes are used for faster. rate of conductivity. The electrode is ground in a shape such that the tip diameter is decreased at one end and the wires are joined at the other end. These tips are named positive electrodes and negative electrodes. The tips are the place where the sheet metal is in contact between them, to form a weld.
3. "Wooden piece", The wooden piece is cut and formed into different parts such as the Base plate, Arm, Arms Support, Support, and electrode holding Part.
4. "Spring", The spring is used which is placed (or) connected to the arm and the base plate. It is such that when pressure is applied to the position. arm, it is brought back to its original position.

The fabrication is done according to the design which was done in CATIA and the mini project tested at different thicknesses of sheet metal., and the result of fabrication is shown below in Fig. 20.

Fig. 20: *Fabrication Of The Spot Welding Machine*

IV.RESULT AND DISCUSSION

RESULT:

The spot welding machine is fabricated and the observations are dome below noted below in Table 1, and Fig. 21.

Table no. 1: *Thickness Of Sheet Metal And Time Of Weld*

S.No	Thickness in (mm)	Time of weld (sec)
1.	0.048	20
2.	0.072	40
3.	0.10	70

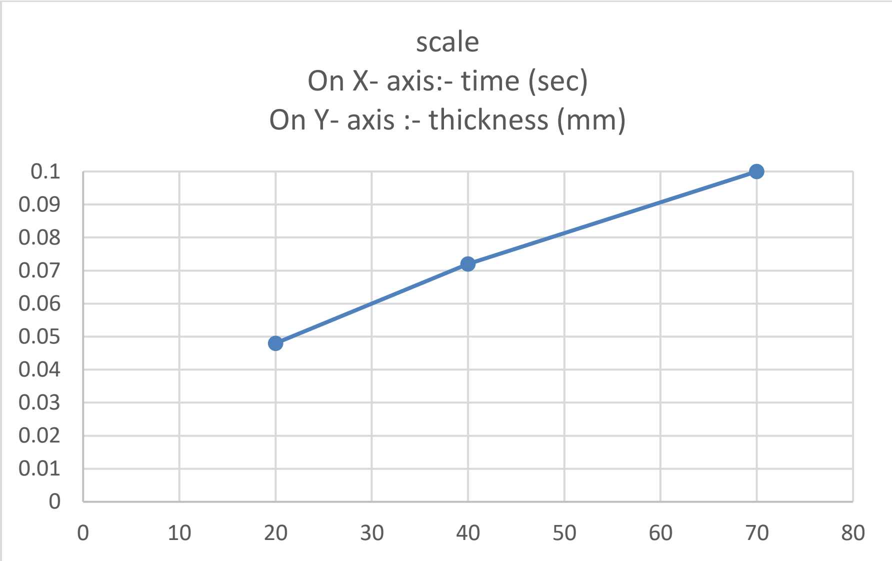

Fig. 21: *Graph For The Time Of Weld*

DISCUSSION:

According to research, welding a sheet metal of 1 mm thickness is required to get an output current of 40 to 60 Amps for galvanized iron sheet metal. As for our mini project, we took a transformer, which has an output of 1 Amp at maximum.

Max. thickness 1 Amp sheet metal can weld:-

1mm = 40 Amp

1 Amp = ?

1 Amp = 1/40 = 0.025 mm

Our mini project successfully welded sheet metal of 0.1 mm thickness which is greater than the theoretical value.

IV.CONCLUSION

Designing and fabrication of a portable spot welding machine is done successfully and obtained welding of up to 0.1 mm thickness weld of aluminum sheet metal. This mini project was done with transformer electrodes and wooden casing. There is a need to optimize the structure of the machine. we can use a higher-rating transformer, and with the help of a higher-rating transformer, we can weld thick metals. During the welding process, the transformer tends to generate a large amount of heat. To not damage the machine the transformer is left open in the air so as the air passes the heat will be lost, the air acts as a coolant and tends to cool the transformer slowly. The portability of the welding machine provides a crucial advantage to the user as it can be used at different places and in working conditions like overhead work. The market cost of portable spot welding machines ranges between Rs 4,500 to Rs 9,000 and weighs between 14 kg to 16 kg, but as a development the machine we fabricated costs only Rs 1,600 and weighs 1 to 2 kg. From this, we can conclude that the initial cost and weight of the machine are significantly reduced.

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