PLASTIC WELDING TOURCH DESIGNED FOR COMMERCIAL PURPOSES

N.Sivakumar[1], BalaSubramani.G[2], Dineshwaran.G[3], Durgaprabu.M[4], Gurusamy.A[5], Dr.N.Balakrishnan[6]

[1]*Assistant Professor, Department of Mechanical Engineering,Gnanamani College of Technology, Namakkal, Tamilnadu, India*
[2,3,4,5]*UG Students Department of Mechanical Engineering,Gnanamani College of Technology, Namakkal, Tamilnadu, India*
[6] *Professor, Department of Mechanical Engineering,Gnanamani College of Technology, Namakkal, Tamilnadu, India*

ABSTRACT

Thermoplastics can easily be welded as can regain their shape after heating. Most commonly welded plastics are PVC, polyethylene, acrylics etc. They are welded by melting the surface to be joined & allowing them to solidify as they solidify Geneva Mechanisms are widely used in motion picture film projectors to intermittently advance film through a film gate having a projection aperture. The film is moved or advanced by a Geneva Mechanism (also known as a “Maltese Cross”) until an image frame is in alignment with the projection aperture. The film is then held stationary for a discrete time period during which light is passed through the aperture, film frame, projection lens, and onto a screen.

Keywords: *Welding, Plastic, Geneva Mechanisms*

I.INTRODUCTION

Plastic welding is the process of creating a molecular bond between two compatible thermoplastics. Welding offers superior strength, and often drastically reduced cycle times, to mechanical joining (snap fits, screws) and chemical bonding (adhesives). There are three main steps to any weld: pressing, heating, and cooling. The application of pressure, which is often used throughout both the heating and cooling stages, is used to keep the parts in the proper orientation and to improve melt flow across the interface. The purpose of the heating stage is to allow intermolecular diffusion from one part to the other across the faying surface (melt mixing). Cooling is necessary to solidify the newly formed bond; the execution of this stage can have a significant effect on weld strength. During the cooling stage, the bonded polymer hardens into one solid part, completing the weld. For semi-crystalline materials, the cooling stage, generally called the "hold" phase, provides the opportunity for the polymer to re-crystallize. The rate of cooling will affect the final microstructure. For amorphous polymers, the cooling stage solidifies the microstructure into the orientation created by the melt flow. The pressure applied during this stage, the time allotted for it prior to putting the part under stress, and the rate of cooling all have significant effects on the final weld strength.

Plastic welding is the process of creating a molecular bond between two or more compatible thermoplastics. Welding and other fabrication techniques are used when a complex shape cannot be made by molding alone .Common applications of plastic welding include packaging and consumer products with intricate curves and cavities. Plastic Molded Concepts provides advanced welding services for high performance applications.

2. LITERATURE REVIEW

Plastic welding and spot welding - both are almost similar to each other. There is a difference noted. In plastic welding, heat is supplied through convection of the pincher tips, instead of conduction. The two plastic pieces are brought together. At the time of welding, a jet of hot air is liberated. This melts the parts to be joined along with the plastic filler rod. As the rod starts melting, it is forced into the joint and causes the fusion of the parts. Plastic identification is the first point to be noted in order to choose a suitable plastic welding rod. A plastic welding rod or thermoplastic welding rod is of a constant cross-section shape. Using this, two plastic pieces can be joined. It may have a circular or triangular cross-section.

Porosity of the plastic welding rod is an important factor. Air bubbles in the rod will be created due to its high porosity. This is responsible for decreasing the quality of the welding. So, the rods used must maintain zero porosity. Otherwise, they should be void less. Products like chemical tanks, water tanks, heat exchangers and plumbing fittings are manufactured by using the technique of plastic welding. By adopting this technique, money can be saved. Using plastic welding, two plastics can be welded together. This type of weld is performed on children's toys, lawn furniture, auto parts and other plastic equipments which are used daily - both for domestic and commercial purposes.

In order to join the thermoplastics, when they are heated an under a particular pressure, this type of welding is employed. In normal practice, using filler material, the pieces are joined together.There are certain occasions wherein filler material can be avoided. Generally, plastic is not durable and has a shorter life span. Natural elements like cold weather, ultraviolet radiation from the sun or continuous exposure to chemicals causing contamination, will create damage to plastic products. Plastic can be subjected to damage if it is hit on a hard surface. But, as the price of new parts is high, it is preferred to repair the existing products.As there are different types of plastics, we must know which one we are working with in order to find the exact welding material to be used. We must know the difference between thermoplastics and thermo sets because it is not possible to weld thermo sets.

If you use the wrong welding rod for the plastic to be repaired, bonding will not take place. As materials like polyolefin's have a lower surface energy, a special group of polyolefin adhesives has to be used. When you are repairing plastic, there are usually two types of defects - a crack or a broken part. In the case of a crack, there is a particular stress affecting the inside of the material. You have to repair the crack and you should not continue through the piece.

3. COMPONENTS DESIGNED

1 .plastic welding machine
2 .Geneva mechanism
3. Supporting Frame
4. Shaft
5. Cams

4. PLASTIC WELDING MACHINE

A bead of softened plastic is laid into the joint, and the parts and weld rod fuse. With some types of plastic such as polypropylene, the melted welding rod must be "mixed" with the semi-melted base material being fabricated or repaired.

Fig 1 plastic welding machine

Bondic is a new kind of adhesive that's like super-powered super glue except it's not glue. It's actually a liquid plastic that can weld items together allowingforrepairsthatordinarygluescannot perform. Bondic easily bonds and fixes plastic, wood, metal, and fabric with a fine-tip precision applicator. With a simple squeeze, But the best thing about Bondic is that it sets in seconds, but only when you shine the included UV light on it. Take your time positioning your repair just right.

Bondic is the better way to permanently stick things together. Use the precision applicator to dispense the incredible adhesive exactly where you want it. Then wave the included UV light over it to instantly turn Bondic rock-solid and forever fixed. It's easy to use, low mess, precise, and super-strong.Super glue was a pretty great invention in the '40s. But as technology has progressed, so have adhesives.Bondic leverages all of the advantages of super glue without any of the drawbacks. Bondic is a lower viscosity fluid that remains in a liquid state until you shine a UV light on it. So if you need to take your time making a fix or you just want to wipe any extra away, that's not a problem. Then when you beam the included LED light onto your spot of Bondic, it only takes a few seconds for it to harden to a solid state.

Bondic is useful in a variety of scenarios. When creating crafts or accessorizing, you can stick two different materials together and set it instantly.If something's been broken, you can mend it with a near-invisible Bondic patch. And you can use it to fill in holes or cracks to prevent further damage.

2. GENEVA MECHANISM

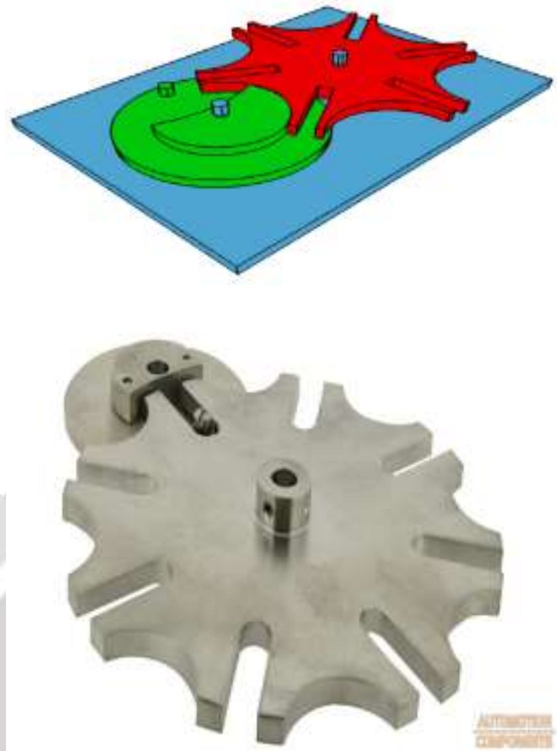


Fig 2. Geneva mechanism

The basic structure of a four slot Geneva wheel is shown in Fig.1. The system consists of constantly rotating disk coupled with a slotted disk, which gives rise to the desired discrete motion. Arotation of 2p radians of the former causes 2p/N radians of rotation of the latter, where N is the number of slots available on the slotted disk. Thus, one complete rotation of the slotted wheel requires N complete rotations of the other disk, thereby also increasing he otal time period. The conversion mechanism of this disk system is as follows.Considering the inner diameter of the ball bearing and by carrying out shaft design the diameter of shaft is decided. Thus accordingly shaft and the related shaft support structure on the frame is manufactured.

4. SUPPORTING FRAME

Supporting Frame can be used with Frame Motor to move smaller structures and even build airships or similar flying or moving machines. They can be used to create contraptions such as bridges. Note that when joined to a block that is being blocked in any way by another block, the frame motor won't be able to move them. To stop this, place a Cover of any kind and the support frame will then 'ignore' that side.

Also, you can transport items via support frames any block touching the support frame would be moved, except other Frame Motors with their moving side touching the support frame itself or any red power machine (such as deplorers or block breakers) facing the support frame.

3.SHAFT: Considering the inner diameter of the ball bearing and by carrying out shaft design the diameter of shaft is decided. Thus accordingly shaft and the related shaft support structure on the frame is manufactured.

4.1 UV LIGHT

Light-emitting diodes (LEDs) can be manufactured to emit radiation in the ultraviolet range, although practical LED arrays are very limited below 365 nm. LED efficiency at 365 nm is about 5–8%, whereas efficiency at 395 nm is closer to 20%, and power outputs at these longer UV wavelengths are also better.

Such LED arrays are beginning to be used for UV curing applications, and are already successful in digital print applications and inert UV curing environments. Power densities approaching 3 W/cm^2 (30 kW/m^2) are now possible, and this, coupled with recent developments by photo initiator and resin formulators, makes the expansion of LED-cured UV materials likely.

Fig 3 UV light

5. WORKING PRINCIPLE

The major difference among these various methods of welding is in the method of applying heat to the materials Specialized welding equipment has been developed in which the pressure and the rate and area of heating are precisely controlled in order to provide strong, tight bonds. The strength of the welds, however, can differ widely among the various plastics. Hot-gas welding is generally performed only on thermoplastic materials having thickness of 1/16 inch or more. Thermoplastic sheeting and films that are used primarily for packaging are often heat-sealed. Heat-sealing will not be discussed here because it is not used in structural fabrication.Ingeneral, welding is one of the last operations on a structure. This means that all previous operations such as cutting, heating, bending, and beveling will have been completed. All parts have to fit dimension wise.

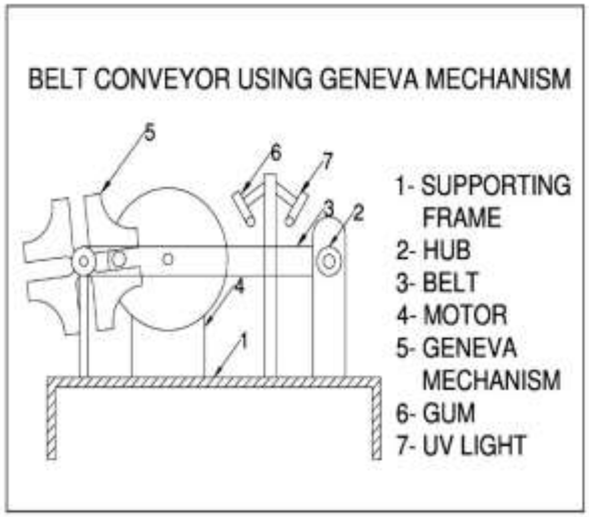
Once welded, it will be rather difficult, if not impossible, to repair mis-fitted parts. Scrap pieces of all types, shapes, and thicknesses are useful for the training of beginners in various welding methods. This includes polypropylene (PP), polyethylene (PE), polyvinyl chloride (PVC), plasticized tank linings, and other thermoplastics. The basic took for all three types of hand welding are: the welding gun (often called welding torch or simply welder), metal tips, pliers, and cutting knife. Air pressure, a combustible gas and/or electricity are used to provide the hot air stream; i.e., water-pumped nitrogen or another inert gas is used instead of air for polyethylene and, in some cases, for polypropylene. Clamp one side of the cooled test piece into the jaws of a vise, with the weld-bead facing outward, about 3/16 inch and parallel to the top of the jaws. Cover with a loose cloth to prevent injury due to flying pieces. A blow with a hammer on the weld side will usually break off the top piece. If the weld is a good one, each broken piece will retain some portion of the welding rod, with the break occurring through the body of the rod. In an exceptionally good weld, the break will occur through the base material. This indicates a weld strength of 100%

6. CONCLUSION

These exercises should he repeated until you can consistently achieve welds of adequate strength and good appearance. For most structural fabrication, a weld strength of not less than 75% of the strength of the base material is acceptable, although for certain critical fabrications, effort should he made to achieve as close to 100% as possible.

The techniques described above are for flat-surface work. Welding round material is essentially identical in all phases. The one primary difference is this: In welding flat pieces, the arm moves the welder in the forward direction only; in welding round shapes, the welder has to go forward and follow in the direction of the round shape at the same time. This, of course, requires considerable additional practice. Suggested practice technique is using 2-inch diameter pipe, cut 1 inch long, with a bevel on one exterior end.

7. DESIGN



8.ACKNOWLEDGEMENT

The authors would like to acknowledge the help of Dr. N. Balakrishnan, Dr. M. Ashok Raj Kumar for helping with briquette making and collecting part of the data.

9. REFERENCES

[1]. "Plastics-Vocabulary". ISO 472 International Organization for Standardization. Switzerland. 1999.

[2]. Jump up to:[a b] Balkan, Onur; Demirer, Halil; Ezdeşir, Ayhan; Yıldırım, Hüseyin (2008). "Effects of welding procedures on mechanical and morphological properties of hot gas butt welded PE, PP, and PVC sheets". Polymer Engineering and Science. 48 (4):732. doi:10.1002/pen.21014. ISSN 1548-2634.

[3]. .Jump up^ Vijay K. Stokes (1989). "Joining methods for plastics and plastic composites: An overview". Polymer Engineering & Science. 29: 1310. doi:10.1002/pen.760291903. ISSN 1548-2634.

[4]. . Jump up^ Crawford, Lance (January–February 2013). "Port Sealing: An Effective Heat Sealing Solution". Plastic

[5]. . Jump up^ "Induction Welding of Reinforced Thermoplastics". KVE composites group.

[6]. . J. Alex Neumann and Frank J. Bockoff, "Welding of Plastics", 1959, Reinhold publishing.

[7]. . Safety in the use of Radiofrequency Dielectric Heaters and Sealers, ISBN 92-2-110333-1

[8]. Michael J. Troughton, "Handbook of Plastics Joining, A Practical Guide", 2nd ed., 2008, ISBN 978-0-8155-1581-4Tres, Paul A., "Designing Plastic Parts for Assembly", 6th ed., 2006, ISBN 978-1-5699-0401-5

[9].E.Paul Degarmo, J.T Black, Ronald A Kohser, Materials and processes in manufacturing, Prentice Hall, India.

[10]. Robert A Grimm, Welding processes for plastics, Advance materials and processes, vol 147, 1995.

[12]. Joining plastics in production, The welding institute.

[13]. . Balakrishnan,N, Mayilsamy, K & Nedunchezhian, N 2015, 'An investigation of the performance, combustion and emission characteristics of CI engine fueled with used vegetable oil methyl ester and producer gas', International Journal of Green Energy, vol.12, pp. 506-514. P-ISSN: 1543-5075, E-ISSN: 1543-5083 (Electronic).

[14]. Karthikeyan, R, Solaimuthu, C &Balakrishnan, N 2014, 'A study of performance and emissions of diesel engine fuelled with neat diesel and heat hydnocarpus pentandra biodiesel' IOSR Journal of Mechanical and Civil Engineering, vol. 10, issue.2, pp. 53-57, E-ISSN: 2278-1684, P-ISSN: 2320-334X.

[15].Balakrishnan, N & Mayilsamy, K 2014, 'Effect of compression ratio on CI engine performance with biodiesel and producer gas in mixed fuel mode', Journal of Renewable and Sustainable Energy, vol.6, pp. 0231031-02310313. ISSN: 1941-7012.

[16]. Balakrishnan, N & Mayilsamy, K 2013, 'A study of cotton coated with intumescents flame retardant: Kinetics and effect of blends of used vegetable oil methyl ester', Journal of Renewable and Sustainable Energy, vol.5, pp. 0531211-0531218. ISSN: 1941-7012.

[17]..Balakrishnan, N, Mayilsamy, K & Nedunchezhian, N 2015, 'Experimental investigation of evaporation rate and emission studies of diesel engine fueled with blends of used vegetable oil biodiesel and producer gas' Thermal Science, vol. 19, No. 6, pp. 1967-1975, ISSN: 0354-9836.

[18]..Balakrishnan, N, Mayilsamy, K & Nedunchezhian, N 2013, 'Effects of compression ratio on performance and emission of internal combustion engine with used vegetable oil methyl ester', Advanced Materials Research, vol.768, pp. 250-254. P-ISSN: 1022-6680, E-ISSN: 1662-8985.

[19].Balakrishnan, N, Mayilsamy, K & Nadunchezhian, N 2012, 'Effect of fuel injection pressure in CI engine using biodiesel and producer gas in mixed fuel mode' European Journal of Scientific Research, vol. 92, issue. 1, pp. 38-48. ISSN: 1450-216X.