MODIFICATION FOR SAFETY MEASURE ON MANUAL CRIMPING M/C

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1. ABSTRACT

Currently, technology and safety mechanisms have improved significantly, becoming more compact, energy-efficient, and advanced. In order to keep up with these advancements, it's essential to implement modifications that enhance safety measures in manual crimping machines. These modifications are necessary to prevent accidents, reduce material wastage, and save costs that may be incurred due to damages resulting from the absence of safety features.

One of the key safety features that can be added is a micro switch that functions by changing the position of contacts when it comes in contact with an object. This switch is designed with a tipping-point mechanism that helps to create specific trip and reset points every time the contacts change their condition. By installing such a safety feature, the likelihood of accidents can be minimized, and the machine's overall efficiency can be enhanced.

1. INTRODUCTION

Crimping machines can be classified into two types: domestic and foreign. Domestic crimping machines are priced several hundred rupees cheaper than foreign ones, but their performance is not up to international standards. On the other hand, foreign hydraulic crimping machines, although priced in thousands of rupees, offer excellent performance.

Now, let's delve into the introduction of crimping machine equipment in more detail.

1.1 The role of Crimping Machine.

Crimping machines play a crucial role in wire splicing and crimping for infrastructure construction and line maintenance in the power industry. There are various types of crimping machines available, including

hydraulic crimping machines, large-tonnage crimping machines (punch), insulated terminal crimping machines, crimping pliers, split crimping machines, and hand-operated hydraulic crimping machines.

When using a crimping machine, the parts to be crimped are placed in the pressing mold of the crimping pliers. The pliers are then moved to the desired position for crimping, while the hydraulic pump station provides high-pressure oil to push the pliers for crimping.

Crimping technology has been developed to replace the need for soldering terminations and offers a high-quality connection between a terminal and a wire at a relatively low cost. The application methods for crimp terminations range from hand-held devices to fully automated systems, and the setup of each tool is critical for achieving a quality crimp. Today, many OEM companies are using Statistical Process Control (SPC) to continuously improve their crimp terminations.

It's important to understand the complexity of the crimping process and all the factors that can affect it to ensure consistent quality. The three key elements in the crimping process are the terminal, the wire, and the tooling. Without a thorough understanding of these elements and their inter-relational interactions, the end result may not meet expectations.

Terminal

Designing a terminal that only accepts one wire size, stranding, and insulation diameter (UL type) is not cost-effective for most connector manufacturers. Instead, terminals are designed to accommodate a wide range of wire sizes, strandings, and insulation diameters to ensure that they meet acceptable levels throughout the entire range. This approach is more practical and economically feasible for most applications.

Wire

Within a single wire size, the wire stranding and insulation type can vary significantly. For instance, an 18 AWG x 19 strand wire has over 18% more material than an 18 AWG x 16 strand wire. The insulation diameter for an 18 AWG wire can range from as little as .070" (1.78 mm) to over .180" (4.57 mm). Additionally, wire strands can be made of copper, tinned, over-coated, or top coated. The type of wire insulation materials, thickness, and durometers used can also vary depending on the specific application.

Tooling

To ensure quality crimps, it is important to consider the application's tooling requirements. This includes determining whether hand stripping or automatic wire

stripping machines are necessary based on volume. The type of tooling required for the application can be manual hand tools, press and die, or fully automatic wire processing machines. Each of these tools has a different level of variability that affects the quality of the completed terminations. The setup of the tooling is crucial for determining the quality of the finished crimp, and attributes like crimp height, conductor brush, bell mouth, cut-off tab, strip length, and insulation position need to be considered. Adjusting one attribute may affect others, so it may be necessary to make multiple adjustments before establishing an optimal setup. The order in which adjustments are made can help reduce the number of repetitions required for an optimum set.

2. LITERATURE REVIEW

1. Design and Fabrication of a Low-Cost Benchtop Crimper for Electrical Connectors' by Bradley C. Recker et al.

This paper presents the design and fabrication of a low-cost benchtop crimper for electrical connectors. The goal was to create a machine that could perform crimping operations on small quantities of connectors without requiring significant capital investment. The design process included a literature review of existing crimping machines and an analysis of the forces and motions involved in the crimping process.

2. Development of a Manual Crimping Machine for Small Scale Industries' by Mohammed Abdul Hannan et al.

This paper describes the development of a manual crimping machine for use in small-scale industries. The machine was designed to be simple and affordable, with a focus on ease of use and maintenance. The design process included a literature review of existing crimping machines, as well as an analysis of the forces and motions involved in the crimping process.

3. Design and Development of Manual Crimping Machine for Electrical Terminals' by S. S. Patil et al.

This paper presents the design and development of a manual crimping machine for electrical terminals. The machine was designed to be portable, affordable, and easy to use, with a focus on crimping accuracy and repeatability. The design process included a literature review of existing crimping machines and an analysis of the forces and motions involved in the crimping process.

4. Design and Development of Micro Switches" by H. Mehta and S. K. Patel et al.:

This paper provides an overview of the design and development of micro switches. It discusses the basic working principle of micro switches and describes the different types of micro switches available in the market. The paper also highlights the key design parameters that affect the performance of micro switches, such as the

contact force, contact resistance, and actuation force.

5. "Performance Analysis of Micro Switches for Automotive Applications" by S. K. Patel and H. Mehta: This paper focuses on the performance analysis of micro switches used in automotive applications. The paper discusses the various parameters that affect the performance of micro switches, such as the contact force, contact resistance, and actuation force. The authors also present experimental results to demonstrate the performance of micro switches in different operating conditions.

6. "Design and Development of a Miniature Micro Switch for Medical Applications" by S. K. Patel and H. Mehta et al.:
This paper discusses the design and development of a miniature micro switch for medical applications. The authors describe the key design parameters that were considered in the development of the micro switch, such as the contact force, actuation force, and contact resistance. The paper also presents experimental results to demonstrate the performance of the micro switch in medical applications.

3. DESIGN OF CRIMPING MACHINE

The accuracy of a crimping machine used for wire harnessing operations relies heavily on the skill of the worker to hold the wire in the correct position. To eliminate the dependency on worker efficiency and skill, a guiding system is necessary. A sensor model consisting of an Arduino and a color recognition sensor can detect the change in color on the insulation of the wire using different markers, allowing the sensor to sense the accurate position for launching the pressing die. The Arduino then sends a signal to the worker through an LED to indicate that the wire is in the correct position. Once confirmed, the pedal is activated by the Arduino to perform the pressing operation. This system reduces the worker's workload and provides guidance in any condition or situation.

Fig. 3.1 Crimping Machine

4. MICRO SWITCH

Micro-switches are widely used in different fields such as industrial, agriculture, construction, transportation, and commercial for sensing and control purposes. They are small and simple devices that consist of two contacts, NO and NC, connected by a snap-action switching mechanism. Despite their small size, micro-switches are capable of performing safely,

reliably, and accurately in harsh environments, and there are trillions of them used in various industrial equipment, machinery, and control systems around the world.

4.1 What is a Micro Switch?

A micro switch, also called a miniature snap action switch, is a small and highly sensitive switch that requires minimal physical force to activate. It is commonly used as a sensor in various fields including industrial, medical instruments, and automotive. The switch is a type of momentary contact switch that is designed to react quickly to a change in its operating environment.

Fig.4.1- Micro Switch

4.2 Micro Switch Construction

Micro switches are constructed using various components such as a plunger or actuator, cover, moving piece, support, NC terminal, NO terminal, contact, and moving arm. These components work together to create a small and sensitive switch that is capable of activating with minimal physical force.

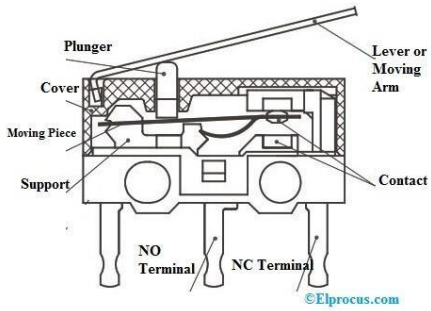

Fig. 4.2 - Micro Switch Circuit Construction

4.3 Working Principle

A micro switch is a type of switch that is triggered by a small physical force, such as the contact with an object. The switch's working principle involves a tipping-point mechanism that generates specific trips and reset points as the contacts change their position. When the switch lever is pressed, the normally closed pin of the circuit opens and the normally opened pin closes. Conversely, when the lever is released, the normally closed pin carries current and the normally opened pin insulates electrically. This makes micro switches widely used as sensors in various industries, such as industrial, medical instruments, and automotive.

4.4 Micro Switch Circuit

A micro switch typically has three terminals labeled as C, NO, and NC, and it can be utilized to control two LEDs using a battery as shown in the circuit diagram below. The diagram illustrates how the micro switch can be connected to achieve the desired result.

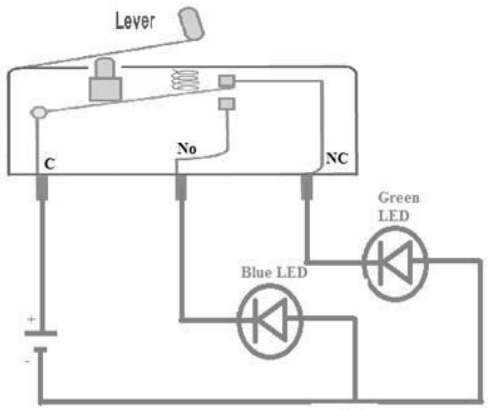

Fig. 4.3- Micro Switch Circuit Diagram

5. APPLICATION OF MICRO SWITCH ON MANUAL CRIMPING MACHINE

1. Micro switches can be used on manual crimping machines to ensure proper and safe operation of the machine. A micro switch is a type of switch that is activated by very small movements, such as the pressure exerted by a machine operator on a lever or button.

2. In a manual crimping machine, a micro switch can be used to detect when the operator has fully closed the crimping jaws around the wire or terminal being crimped. This can prevent the operator from accidentally releasing the crimping jaws before the crimp is complete, which can result in a defective or incomplete crimp.

3. Additionally, micro switches can be used to detect when the crimping machine is in the correct position for crimping, and to prevent the machine from operating if it is not in the correct position. This can prevent damage to the machine or the crimping tool, and can also ensure that the crimping process is consistent and accurate.

5.1 SOME MORE INDUSTRIAL APPLICATIONS OF MICRO SWITCH

1. Preventing accidental operation: Micro switches can be used to detect whether the machine's safety guards are closed properly before the machine can be operated. This prevents accidental operation and ensures that the operator is safe while using the machine.

2. Monitoring machine status: Micro switches can be used to detect when the machine is in operation and when it is idle. This information can be used to monitor the machine's productivity and efficiency, as well as to detect any issues or malfunctions that may occur during operation.

4. Control functions: Micro switches can be used to control various functions of the crimping machine, such as the speed of the crimping jaws or the pressure exerted during the crimping process. This can ensure that the crimping process is consistent and precise, and can also reduce operator fatigue and improve overall productivity.

5. Maintenance: Micro switches can be used to detect when certain parts of the machine need maintenance or replacement, such as the crimping tool or the machine's motor. This can help prevent breakdowns and downtime, and can also reduce the overall cost of ownership of the crimping machine.

Overall, the use of micro switches on manual crimping machines can improve safety, reliability, and accuracy of the crimping process.

6. RESULTS AND CONCLUSION

This paper discusses a safety modification of a manual crimping machine, which was previously lacking safety measures that could lead to discomfort and risks for workers. The authors propose a modification that includes the use of a micro-controller and sensing features to overcome these problems. The modification is cost-effective and easy to control, and it does not require highly skilled operators as it is automated. Additionally, it can be used for long duration's, improving the working efficiency of existing machines. The installation of the micro-controller chip and sensing feature addresses several problems, including potential production waste, which can lead to losses for the company and scrap formation. It also addresses the risk of injury to workers due to slight negligence and the high cost of the applicator, which can be around 40.50K for the company. Overall, this modification makes the manual crimping machine more efficient and safe for operators. The authors report that the modification has received positive feedback from its operators.

7. REFERENCES

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