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ACCIDENT AVOIDING SYSTEM FOR PNEUMATIC PUNCHING MACHINE

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Abstract: The aim of our project is to take a system-wide approach to preventing the machine accident. The system includes not just the machine and the operator; but rather, it includes everything from the initial design of the machine to the training of everyone that is responsible for any aspect of it, to the documentation of all changes, to regular safety audits and a finally a corporate culture of safety – First design is the part of a machine's life where the greatest impact can be made in relation to avoiding accidents. The designer should ensure that the machine is safe to set up and operate, safe to install, safe to maintain, safe to repair, and safe to decommission. Although safe operation is usually at the forefront of a designer's mind, safe maintenance and repair should also be a high priority. Around 50% of fatal accidents involving industrial equipment are associated with maintenance activities, and design is a contributory factor in some 32% of these fatalities. In our project the IR sensors are used to avoiding the accident. The system automatically stops, when the IR sensor detecting the any parts of the operator inside the machine.

Keywords: Accident avoidance, Pneumatic punching machine, Safety system, NodeMCU, Pneumatic cylinder, Solenoid valve

I. INTRODUCTION

The designer should make the machine as reliable as reasonably possible to minimize the maintenance requirement and allow for long intervals between routine maintenance tasks. It is also important to design the machine and its control system so that maintenance can be carried out safely.

For example, hold-to-run controls can be installed that allow a machine to be run at a reduced speed, or removable tool holders can be used so that sharp blades can be replaced on a workbench instead of in an difficult position inside a machine. In addition, operators and maintenance technicians must be discouraged from bypassing safety equipment.

Safety components are often designed to interrupt processes in the event of a fault and will have an impact on machine availability. In order to minimize this effect - and the temptation to interfere with the safety circuits - high-reliability safety components should be specified so as to keep the number of nuisance faults at a minimum.

Designing safety into a new machine is important, but it has to be remembered that the vast majority of machines do not remain unaltered, with unchanged operating procedures, for their entire lifetime.

1.1 NEED FOR SAFETY SYSTEM IN MACHINERY

Modifications are almost inevitable and working practices can evolve or be deliberately revised by managers in an attempt to improve throughput. Any changes made to the machine or the way it is operated also changes the original risk assessment. Research has shown that a significant number of industrial accidents result from uncontrolled changes. It is usually via a complex sequence of events that a change leads to an accident.

Clearly it is necessary to ensure that machinery and operating procedures are fully documented. Even if a machine and its associated safety systems are all properly designed and documented, it is vital that the machine is monitored during installation, commissioning and first-off production. Often it is necessary to make small changes during any or all of these stages.

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It is imperative that any proposed change is first subjected to a rigorous risk assessment, and any changes that are implemented must be fully documented. After production has commenced, a further review should take place to make certain that no further changes have been made. Note also that "no further changes" also refers to the raw materials or components that are being processed by the machine. Audits should be undertaken on a regular basis to check that the machine and operating procedures are still in the documented state.

Furthermore, functional audits should also be carried out on the machinery safety systems. Often the components in a safety control system are only used in the event of an emergency, which can make them very difficult to test. Nonetheless these systems should be tested at regularly scheduled intervals.

Safety field buses such as AS-i Safety At Work (AsiSafe) and Profisafe can support intelligent field devices able to perform self-monitoring functions and transmit diagnostic data to a central controller that can alert the machine operator prior to the failure becoming an unacceptable risk.

Education and training is another aspect of the company-wide approach to machinery safety. Increasingly complex modern machinery makes education and training ever more important. There are new standards and regulations with which companies must comply. On-the-job experience may have sufficed in the past but this is unlikely to be acceptable in the future.

1.2 PURPOSE AND SCOPE OF THE PROJECT:

The aim of our project is to take a system-wide approach to preventing the machine accident. The system includes not just the machine and the operator; but rather, it includes everything from the initial design of the machine to the training of everyone that is responsible for any aspect of it, to the documentation of all changes, to regular safety audits and a finally a corporate culture of safety-first.

Design is the part of a machine's life where the greatest impact can be made in relation to avoiding accidents. The designer should ensure that the machine is safe to set up and operate, safe to install, safe to maintain, safe to repair, and safe to decommission.

II. LITERATURE REVIEW

Modifications are almost inevitable and working practices can evolve or be deliberately revised by managers in an attempt to improve throughput. Any changes made to the machine or the way it is operated also changes the original risk assessment. Research has shown that a significant number of industrial accidents result from uncontrolled changes. It is usually via a complex sequence of events that a change leads to an accident.

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III. METHODOLOGY

Understand Requirements: Begin by understanding the requirements and constraints of the system. Identify the potential hazards associated with the pneumatic punching machine, such as accidental activation or operation in unsafe conditions.

Design Safety Mechanisms: Design safety mechanisms that will prevent accidents. This may include implementing emergency stop buttons, safety interlocks, or sensors to detect operator presence.

Select Components: Choose appropriate components for your system. Ensure compatibility and reliability. For example:

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- NodeMCU or similar microcontroller for control and monitoring.
- Pneumatic cylinder suitable for the punching force required.
- 5/2 solenoid valve for controlling the air flow to the cylinder.

Interface Components: Interface the selected components with the NodeMCU. This may involve wiring, soldering, or using breadboard connections. Ensure proper connections and follow safety guidelines for electrical components.

Develop Control Logic: Develop control logic for the NodeMCU to monitor and control the operation of the pneumatic punching machine. This logic should include:

- Monitoring inputs from sensors or switches for safety.
- Controlling the solenoid valve to actuate the pneumatic cylinder.
- Implementing safety protocols such as emergency stop functionality.

Implement Safety Features:
Use sensors such as proximity sensors or limit switches to detect the presence of objects or hands in the punching area.

Program the NodeMCU to disable the punching operation if an obstruction or unsafe condition is detected.

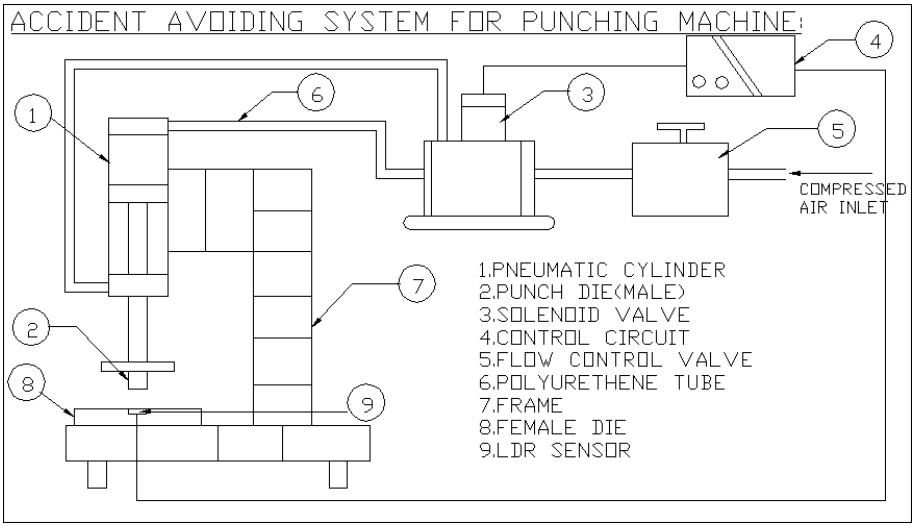
Implement fail-safe mechanisms to ensure the machine returns to a safe state in case of power failure or communication errors.

Testing and Calibration: Test the system extensively to ensure proper functionality and safety. Calibrate sensors and control parameters as needed to optimize performance and reliability.

Documentation and Training: Document the system design, including schematics, control logic, and safety procedures. Provide training for operators on safe use and maintenance of the pneumatic punching machine.

Compliance and Certification: Ensure that the system complies with relevant safety standards and regulations. If necessary, seek certification from appropriate authorities to ensure legal compliance and user safety.

IV. DRAWING FOR ACCIDENT AVOIDING SYSTEM FOR PNEUMATIC PUNCHING MACHINE



V. WORKING PRINCIPLE

A punch or a punching machine is a tool used to work metal (typically steel) by changing its shape and internal structure. A forge press reforms the work piece into a three dimensional object not only changing its visible shape but also the internal structure of the material. A stronger part results from this process than the object was machined. Bending is a typical operation performed and occurs by a machine pressing, or applying direct pressure, to the material and forcing it to change shape. A press brake is a typical machine for this operation.

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The metal is placed between the plates, and the plates are pressed up against each other, deforming the metal in the desired fashion. This may be coining or embossing or forming. A punch press is used for forming holes. Progressive stamping is a manufacturing method that can encompass punching, coining, bending and several ways of modifying the metal, combined with an automatic feeding system. An object sensor is kept on the table which senses the work piece and sends corresponding signal to the microcontroller. According to the signal from the object sensor the microcontroller switches on / off the pneumatic system. Hence this system is an automatic one.

VI. MERITS AND DEMERITS

MERITS:

- Safe to operate
- Automatic operation
- Low skilled labor can also operate
- Efficient operation

DEMERITS:

Separate compressor required to operate

VII. APPLICATION

- It can be modified to any extent to bring out the required effort
- Its outcome can be utilized properly in the extensive mechanical field

VIII. CONCLUSIONS

In conclusion, the development of an accident-avoiding system for a pneumatic punching machine, incorporating components such as the NodeMCU, pneumatic cylinder, and 5/2 solenoid valve, is a critical endeavor to ensure operator safety and machine reliability.Through careful consideration of requirements, thoughtful design of safety mechanisms, and meticulous implementation of control logic, this system can effectively mitigate the risk of accidents in the workplace. By integrating safety features like emergency stop functionality, obstacle detection sensors, and fail-safe mechanisms, the system aims to prevent unintended operation and protect operators from harm. Testing, calibration, and documentation play crucial roles in verifying the functionality and reliability of the system, as well as in providing operators with the necessary knowledge and training to use the machine safely. Ultimately, compliance with relevant safety standards and regulations is paramount, and seeking certification from appropriate authorities underscores the commitment to ensuring legal compliance and user safety. By following this comprehensive methodology, the accident-avoiding system can not only enhance workplace safety but also contribute to increased productivity and peace of mind for operators and stakeholders alike.

REFERENCES

[1]. We must clarify that as of my last knowledge update in January 2022, I don't have specific references for an "Accident Avoidance System for pneumatic punching machines" since it might be a specialized and recent development. However, I can guide you on how to find relevant information.

[2]. Research Papers: Search academic databases like IEEE Xplore, PubMed, or Google Scholar for research papers related to safety systems in pneumatic machines. Relevant keywords could include "Accident Avoidance System," "Pneumatic Punching Machine Safety," or similar terms.

[3]. Industry Publications: Look for articles in industry publications, magazines, or websites related to manufacturing, automation, or safety in industrial settings. These might provide insights into recent developments and technologies.

[4]. Manufacturer Documentation: If there are specific manufacturers of pneumatic punching machines or safety systems, check their official documentation, websites, or whitepapers. They often provide detailed information about their products and applications.

[5]. Conference Proceedings: Proceedings from conferences related to industrial automation, machine safety, or engineering might include papers or presentations on accident avoidance systems for pneumatic machines.

[6]. Consult Experts: Reach out to experts in the field, either through professional networks, conferences, or online forums. They might be aware of recent advancements or studies in the area.

[7]. When searching for information, make sure to use specific keywords related to your topic of interest. Additionally, since my information might be outdated, checking recent publications and sources is crucial for the latest developments in this field.