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Control System Upgradation with Encoder in Vibbreurs Application Machine

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ABSTRACT: The Vibbreurs [VIB] application machine serves as a riveting apparatus utilized in the production of watches. This process is based on advanced PLC controller model SIEMENS-S7 1200. Wheels are made by press machine in press shop module. Wheels and Pinions are assembled in Gears sub assembly. PLC controllers primarily govern the operations of the arms, vibrator bowl feeder, riveting rod, and anvil housed within this machine. By using basic encoder, for setting the accurate arm position and to change the arm position based on user requirement. HMI is used to display the arm positions in degree.

KEYWORDS: PLC, Encoder, Inductive proximity sensor, Laser sensor, Reed switch, Power circuit, Control circuit, DCmotor, HMI device

I. INTRODUCTION

Every individual should possess a timepiece to partake in the opulence and prosperity of life. The construction of a watch involves numerous stages and processes, each contributing to the creation of the final product. Key operations in the watchmaking process include Press Shop, Ebauche, Auto Turning, Gear hobbing, Burnishing, and Gear Assembly. The watch has two sides in the main plate, the Bridge side, and Dial side. This machine is used to assemble the parts of the date and day indicator. Star, Wheel, and Lever are the three components needed to correct the date and day corrector. The day indicator is placed below the date plate. There are two series of day indicator i.e. 7022 and 7122. The difference lies in the diameter of the disc. The setting lever is placed directly on the main plate and it is used while the watch is being set. Additionally, it contains the setting lever jumper mechanism for day and date adjustment.

II. RELATED WORK

Earlier telemechanic PLC controllers are huge programs, spare parts are rare, inbuilt programming that we could not change as per the requirements and the absolute model which is difficult to learn. While microcontroller systems often adopt an open architecture approach, the majority of PLC manufacturers tend to adhere to closed architectures for their products. PLC devices typically operate within proprietary systems, making it challenging to integrate components or software from different manufacturers seamlessly. This limitation constrains design flexibility and cost-saving opportunities for users.

III. METHODOLOGY

The methodology described in the document revolves around the manufacturing processes employed in the watch industry. It includes various heat treatment methods such as hardening, tempering, and age hardening to enhance the toughness and durability of watch parts and machine tools. Additionally, the document details the operation of the Vibbreurs Application Machine, which is utilized for assembling components like pinions and wheels in the watch

manufacturing process. The electrical panel configuration, consisting of components like SMPS, relays, fuses, and PLC for power and control circuits, is also highlighted. Furthermore, there is a focus on PLC programming, testing programs, input/output lists, and the control system upgrade with an encoder for improved accuracy and user control. The methodology encompasses a comprehensive approach to manufacturing, automation, and quality control within the watch production environment.

IV. EXPERIMENTAL RESULTS

After writing a program, the next step involves testing and debugging it. One method involves simulating field inputs using an input simulator, such as the model designed for the S7-1200 PLC. The program is transferred from the programming device to the CPU initially. Then, the selector switch is shifted to the RUN position as shown in Figure 1. Operators manipulate the simulator switches, and the resulting indications are observed on the output status indicator lamps.



Fig: 1 Experimental Setup of Vibreurs application machine

Figure 2 corresponds to the circuit diagram detailing the input connections for the Arm motors, where "R" designates Phase and "N" denotes Neutral. The SMPS converts a 230V power supply into a 24V output capable of delivering 5A. RCCB is a wiring device that breaks a circuit when the electric current is out of flow. These are designed to prevent current leakage and it protects the circuit from over current or short circuit conditions. Then the current equally flows through Motors. For Arm 1 motor and Arm 2 motor MPCB switch is placed in which it protects motor from short circuit, overload, and disconnect functions. For Arm 3 motor VFD is placed in which it is adjustable and it is used to control motor speed.

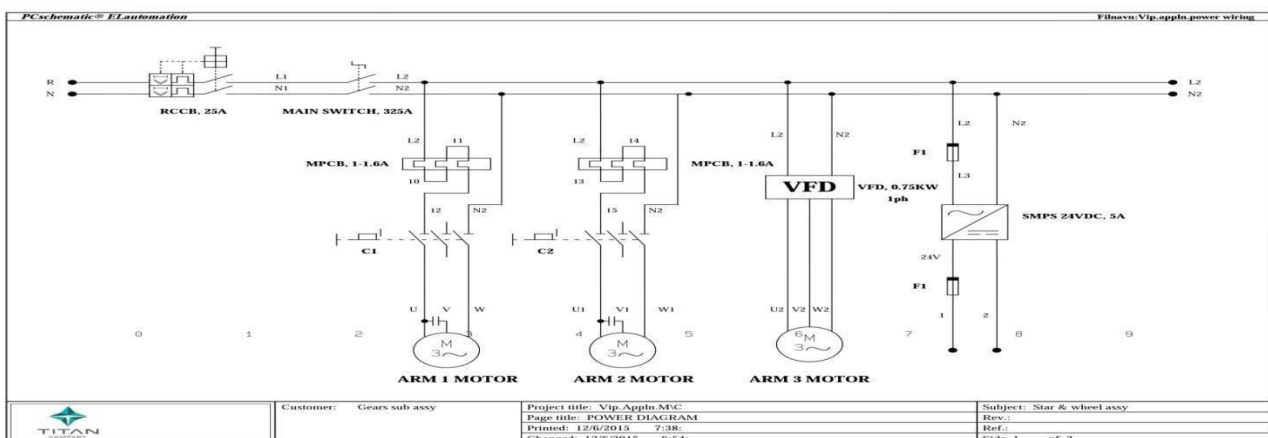


Fig: 2 Circuit Diagram

ALGORITHM:

AUTOMATIC MODE:

STEP1: Start the program STEP2: Select the mode

STEP3: Activate the foot switch or pedal.

STEP4: Secure the coil core in place with a clamp. STEP5: Unlock the mechanism.

STEP6: Tap the coil core as required. STEP7: Secure the indexing pulley in place. STEP8: Return to the initial home position STEP9: Blade moves to forward direction

STEP10: And again, its move to the backward direction STEP11: Unclamp a coil core

STEP12: Eject the coil core

STEP13: Record the number of tapped coil cores STEP14: End the program

MANUAL MODE:

STEP1: Start the program

STEP2: select the mode

STEP3: ON/OFF the clamp push button STEP4: ON/OFF the lock push button STEP5: ON/OFF the index push button

STEP6: ON/OFF the blade push button STEP7: ON/OFF the unlock push button STEP8: ON/OFF the unclamp push button STEP9: Then eject a coil core

STEP10: Count a tapped coil core

V. CONCLUSION

In this project, we undertook the conversion of PLCs and encoders. This conversion enhances the maintenance of arm position accuracy, facilitated by the HMI's display of precise positions in degrees. By substituting the cam shaft with an encoder, we achieve accurate arm positioning and adaptability to user requirements. Consequently, the limitations of the previous system have been mitigated.

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