

Electrically Controlled Bearing Puller

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Abstract:

This study focuses in the development of the Electrically Controlled Bearing Puller. It highlights the electrical control of the bearing puller to motorize the pulling process of manual bearing puller. Time and efficiency were the matter of priority mostly for the operator maintenance. The study was made for the Bearing Puller easier through the newly designed Electrically Controlled Bearing Puller. The purpose of this prototype is to ensure and provide convenience to the maintenance operator. It allows easy pulling of the bearing with lesser time consumed. The steps of utilizing this device start with the control of the toggle switch to setup positioning and pulling process. The push button sets positioning and alignment via extension and retraction of the chuck. The pulling system button have maintaining contact to remove the bearing and when the bearing has reach the target position the limit switch the pulling process will be stop while it opens the grip to finish the process. After going through evaluation phase, the study was found to be reliable providing an easy way in dismounting bearing.

Keywords — **Bearing Puller, Electrically controlled, Motorized.**

I. INTRODUCTION

Electric motors top the industrial landscape as the most widely deployed asset driving processes and productivity. Despite the dependence on these motors and their vital roles in industry, electric motors can fail for many reasons leading to losses in productivity and associated profitability. Nevertheless, the health of electric motors might not be perceived as a top priority in day-to-day operations, even where predictive maintenance programs have been implemented to make timely maintenance fixes on critical machinery before catastrophic failures can occur. The universal reliance on electric motors underscores the inherent value in detecting, identifying and evaluating operating abnormalities. Without proper attention, the likelihood of failure increases, and it will likely come without warning and at an inopportune time [1]. Do bearing-related problems causes motor failures?

When a motor fails, the operator must check its bearings - even if the motor windings are blackened and still smoking. It is possible the motor malfunction was due to a voltage problem, or an excessively hot, moist, or otherwise bad environment. But most of the time, a bearing-related problem is the root cause. For example, a bearing that is beginning to gall can place an extra load on the motor. That extra load would then, in turn, cause the motor to draw excessive current. Bearing-related problems are among the most common causes of motor failures. Solving those problems will reduce motor failures [2]. Thus bearing replacement should be done during preventive maintenance schedules.

There are many ways to remove or install a bearing on a shaft. The best way is with a pressor or a bearing puller tool. It's controlled and there is little chance of nicking the shaft with the hammer or drift,

or damaging the bearing. In somecases, a specialized press or puller is neededbecause no other method will work [3].

Due to the importance of bearing replacement and method of removal, the researcher come up with an Electrically Controlled Bearing Puller. It is designed to pull bearings out from the rotor of an electric motor without damaging the motor shaft.This study could bebeneficial to the operators byreducing the amount of labor forceand safety hazards, thus would lead to saving man power resources and time consumption on the removal process.

Statement of the Problem

The main purpose of the study is to design an Electrically Controlled Bearing Puller that would be useful and convenient to the operator. This supports the answer the following questions.

1. How to design the Electrically Controlled Bearing Puller and its pulling parts?
2. How to develop the Electrically Controlled Bearing Puller?
3. How to evaluate the acceptability of the project?

Objectives of the Study

The main objective is to design and construct a device that automatically pulls the bearing using a gear motor control and sensor.

The specific objectives of the study are as follow:

1. To design and develop the Electrically Controlled Bearing Puller and fabricate the pulling parts.
2. To construct the Electrically Controlled Bearing Puller.
3. To evaluate the project in terms of predetermined parameters.

Conceptual Framework of the Study

The input process includes the information, data gathering, problem identification, and the expertise. The researchers identified the problems on how to pull the bearing of the motors to maintain its condition. Information's was gathered through other references and books. The process covers the planning, designing, fabrication, list of materials, and testing. A plan in making an Electrically

Controlled Bearing Puller was done to give efficiency in maintaining the Bearings of motors. The researcher's plans were made to evaluate the project by the help of the teachers and students. The output indicates the evaluation of the prototype and completed the prototype.

Figure 1 below shows the Input Process and Output of the Conceptual Framework.

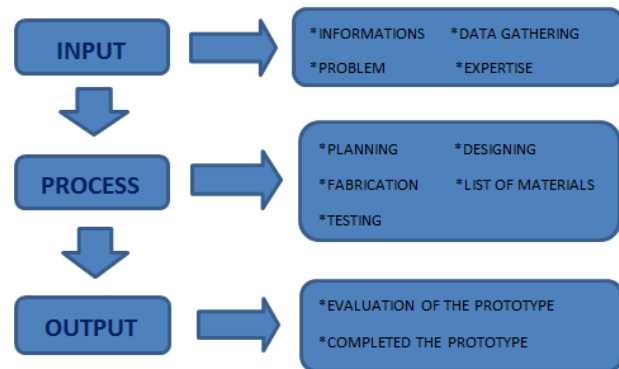


Figure 1. Conceptual Framework of the Study

Significance of the Study

The purpose of this study is to help maintenance personnel do their jobs easier and be convenient in dismantling the bearings. This also helps industries in maintaining the motor they use. Industries have their own way on dismantling bearings, but it takes time and effort to execute it without the damage of the rotor.

The Electrically Controlled Bearing Puller helps companies in maintaining electric motors. It could lessen the time in dismantling bearings as well as minimize the laborcost.

Scope and Limitation of the Study

The main focus of the study is to design and develop the Industrial Motor's Electrically Controlled Bearing Puller. The size of the puller can only pulls from 1 ½ inches to 3 inches diameter. The puller only pulls bearing on external spread out on internal spread of the bearing. The bearing puller type has three legs externally spread bearing are only bearing that can be pulled. It can also be operated in one person only. Electrically Controlled Bearing Puller can only pull bearing that are

mounted on the industrial motor rotor. The maximum size of the motor's rotor is 6 inches length, and 4 inches diameter. The smallest size of bearing can be pulled is 1½ inch diameter.

II. RELATED WORKS

Three-Arm Jaw Puller

The most dangerous tool in kit might well be a two-arm jaw puller. These devices, used correctly, can safely remove a press-fitted bearing from a shaft. But in many cases, the jaws of the puller don't reach the inner ring, which would be the safest place to apply the pulling force. So, place the puller jaws on the outer ring and tighten the center spindle of the puller to apply the removal force. If the outer ring is slightly misaligned, applying force to two balls or rollers, and it's much more likely fracture the bearing outer ring, sending dangerous chips flying. There is also a chance the puller may slip off entirely.

The safer tool, especially for the occasional user, is a three-arm jaw puller. It's simply a more stable arrangement, and generally centers itself during removal[4].

In all cases, if applying force to the OUTER ring, rotate the puller as you remove the bearing. You may hear the rollers "clunk" into place as the pulling force is evenly distributed through all the rolling elements to the bearings rings.

Gear Puller

The best way to remove worn out gears or bearings from a shaft is to pull them off using a gear puller. These have arms that hook behind the gear or bearing and a centre screw.

Simply hook the arms of gear puller behind the gear or bearing and adjust the arms so that they are evenly spaced either side of the centre screw and spin the screw down onto the end of the shaft. Once finger tight apply an even pressure with a spanner or socket to the large head of the centre screw [5].

III. METHODOLOGY

Design

The Electrically Controlled Bearing Puller shown in Figure 2 is designed and made for dismantling bearings of a motor's. The electrical system is made for the benefits of the maintenance personnel's dismantling bearings.

The prototype has a circuit breaker for the protection and safety in case of short circuit or overload. Using the toggle switch, the operator can control the single-phase motor to operate forward and reverse manually to set the puller to pull the bearing of the rotor. Toggle switch also used to operate Auto pull. The circuit has a stop button for manual stop. The closing and opening of the puller was driven by a small motor. The Limit switch is used to grip open and Jog button for the grip close.

The researchers use two motors the main motor and the 2nd motor. On this operation the toggle switch selects the pulling control and the other is the manual forward reverse jog control. First is to set the toggle switch to move forward and set-up the rotor center alignment of motor shaft. After the setup, a push button of a bearing puller can now be pressed to energize the 2nd motor to clamp the claw to the bearing. This movement will stop after reaching the limit depending on the size of the bearing to be pulled.

The operator can now switch the toggle switch to start pulling the bearing out of the shaft. After reaching maximum pulling position state the limit switch stops the main motor and the 2nd motor to open the legs and the process ends.

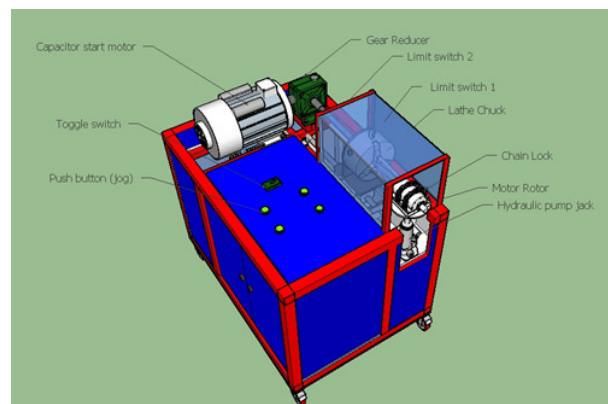


Figure 2. Electrically Controlled Bearing Puller

Motor Control and Power Diagram

Figure 3 shows the Main Motor control Forward Reverse of Electrically Controlled Bearing Puller. The Toggle Switch is the selector, either to pull the bearing ready or to position the puller to grip. Push button 1 and 2 are jog buttons for extension and retraction. The push button 4 is the pull button and the relay contact normally closes one to stop the forward.

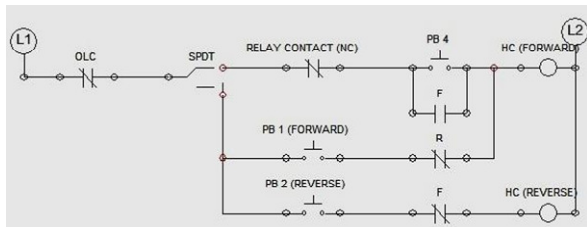


Figure 3. Motor Control Forward Reverse Operation

Figure 4 shows the Main Motor Power Circuit of Electrically Controlled Bearing Puller. The main motor is a single phase capacitor start motor that uses a forward reverse contactor.

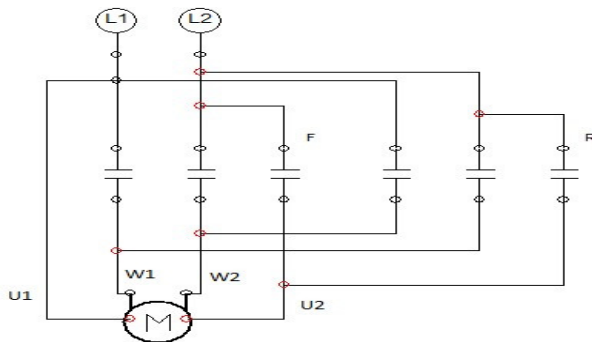


Figure 4 shows the control circuit of the Gripper of the Electrically Controlled Bearing Puller.

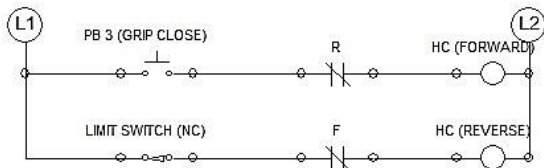


Figure 4 Control Circuit of the Gripper

Data Gathering

Survey questionnaire was used to gather the total of twenty five (25) students randomly selected from the department of Electrical Technology and Management (ETM) Electro Mechanical Technology (EMT) and Automotive Mechanical Technology (AMT) to evaluate the prototype.

Evaluation

The evaluation uses the Five Point Scale to determine the acceptability of the prototype. The evaluation uses the Five Point Scale to determine the acceptability of the prototype as shown in Table I below.

Table I. Five Point Scale

Scale	Adjectival Rating	Scale Range
5	Highly Acceptable	4.5 - Above
4	Moderately Acceptable	3.5-4.4
3	Acceptable	2.5-3.4
2	Slightly Acceptable	1.5-2.4
1	Not Acceptable	1.4 - Below

IV. RESULTS AND FINDINGS

The results and findings of the study are based on the required methodology involved in conducting the study that highlighted the design, the development and evaluation of the Electrically Controlled Bearing Puller; completed device is shown in Figure 5 below.



Figure 5. Completed Electrically Controlled Bearing Puller

The Electrically Controlled Bearing Puller is evaluated using descriptive statistics using survey, observation or analysis of the subject and measures the data gathered from a range of selected respondents.

In Figure 6 the bar graph shows the mean responses of the Electrically Controlled Bearing Puller base on the different categories the mean result on the category Aesthetic is 4.6 thus, it implies that the respondent rated moderately acceptable in terms of the overall appearance of the machine is presentable. Also the machine effectiveness has the numerical rating of 5.0 corresponding to highly acceptable adjectival rating which implies that the overall operation of the machine is convenient and easy for the respondents. Moreover the efficiency in processing of the machine is 5.0 numerical rating was rated by the respondents corresponding to a highly acceptable adjectival rating indicates the efficiency in processing the machine. Furthermore, on the functionality is 5.0 thus, it implies that the respondents rated highly acceptable in terms of giving the exact functionality of the machine.

Parameter	Mean
Aesthetic	4.6
Effectiveness	5.0
Efficiency	5.0
Functionality	5.0
Average Mean	4.9

IV. Conclusion and Recommendation

The final chapter is dedicated to the summary of findings which is the totality of the work. The conclusion was determined through the most remarkable findings. The recommendation is based on the conclusion made and actions to be done by people so that the problem can be solved.

The important opinions were bound on the design, development, implementation and evaluation of the Industrial Motors Electrically Controlled Bering Puller. The machines circuit is electronically functions through the input and output devices connected together to perform the bearing puller. Limit switch, toggle switch, pilot lamp and push buttons were the input devices of the machine. The motor is determined to be the output component because it controls the process of the machine. The technical evaluation of the machine was conducted in such a way that the physical profile, operability and significance were evaluated using descriptive statistics. This was conducted using a prudently planned questionnaire distributed to individuals who have knowledge about the bearing puller who are mostly residents of Cagayan de Oro City.

The machine was potentially accepted due to its noticeable aesthetics and influence on the bearing puller as well as the consumers. The economic impact of the machine provides reliable marketability. On the other hand, the Electrically Controlled Bearing gives convenience to the Industry.

Recommendations

The recommendation was attached on the least significant advantage of the Electrically Controlled Bearing Puller which was qualified to its complex mechanism.

1. Safety Glass
2. Limit Switch
3. Safety Lock for the rotor

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