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Idling of Turbocharger in Earthmovers

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Abstract: ***Turbochargers is used all over the automotive industry it can embellish the output of an internal combustion (IC) engine without in need to increase cylinder capacity. Such a mechanical device empower automobile manufacturers to adopt greater power in high torque applications. In this project of installing of 'off-delay' timer unit in earthmover turbocharger machine as a medium of increasing life of turbocharger. Basically our project focuses on the part as soon as the operator shuts off the machine after heavy digging jobs, does not allow the machine for idle running for certain minute (1 to 2 min) as engine gets shut down but still turbocharger rotates at high rpm approx.. 250,000 rpm and due to high inertia of turbocharger coms to rest the engine life span get hampered. Thus by introducing additional unit increasing the efficiency and life span of turbocharger.***

Keywords : Turbocharger, OFF Delay, Excavator. Inertia.

I. INTRODUCTION

A turbocharger is turbine driven forced induction that increase an IC engine efficiency and output by forcing extra air into the combustion chamber. This improve in an aspirated engine power output due to fact the compressor can force extra air into combustion chamber than ambient pressure. A turbocharged engine produces more power overall than the same engine without the charging. This can significantly improve the power-to-weight ratio for engine. In order to achieve this boost the turbocharger compressor draws in ambient air at atmospheric pressure and compresses before it enters into the intake manifold at elevated pressure. This results in a greater mass of air entering the cylinders on each power stroke. The power required to spin the centrifugal compressor derived from the kinetic energy of the engine's exhaust gases. Energy provided by the turbine work is converted from the enthalpy and the kinetic energy of the gas. Turbine housing directs the flow to turbine and rotates up to 250,000 rpm.

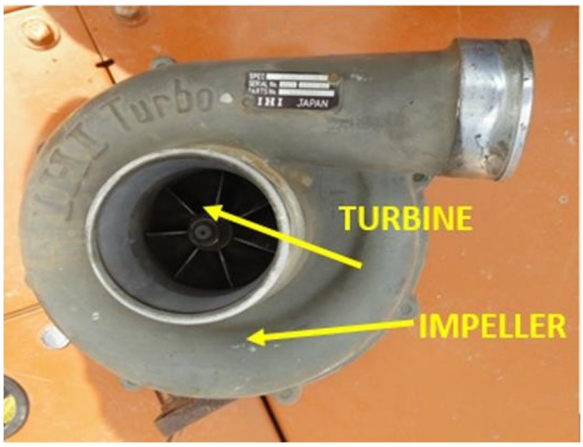


Fig-1: Turbocharger

Turbocharger lag (turbo lag) is the time required to change the power output in response to the throttle change, as a slowed throttle response when accelerating as compared to a naturally aspiratory engine. This is due to the time needed for the exhaust system and turbocharger to generate the required boost which can also be referred to as spooling. Inertia, fiction and compressor load are the primary contributors to turbocharger lag. Sometimes turbo lag is been mistaken for engine speeds that are below boost threshold rpm. The turbine in the turbocharger spins an air pump (impeller). The turbine in the turbocharger spins at speed up to 200,000 RPM that's about 50 times faster than most car engine. Our project will aim on avoiding premature failure of turbocharger due

To lack of lubrication cause by sudden stop of engine, makes an unusual sound which indicates in a large jerk (shock) which damages to internal parts.

It is very essential to stop the engine by following 'idling rule', which says After running, keep engine speed to Low Idle rpm and run it for minimum 1-2minutes, then turn Key Switch to 'OFF' position to stop engine because, the inertia keeps the turbo spinning even after switching off the engine, also hot shut down occurs the main reason for turbocharger failure. But, in actual working condition no one follows the procedure i.e. (idling rule), resulting in, oil will not be supplied to turbocharger for lubrication as engine got shut off, but turbocharger will not continue to rotate at very high speed due to high inertia, can cause consequentially failure of engine.

II. EXCAVATOR

Excavators are the heavy construction equipment consisting of a boom, arm, dipper (or stick), bucket and cab or superstructure on arotating platform known as the undercarriage. The superstructure sits at top of an undercarriage with tracks or wheels. All the movement and functions of a hydraulic excavator are accomplished through the use of hydraulic fluid, with hydraulic cylinders and hydraulic motors and hydraulic pump for pressurizing fluid and pilot pump for actuating controlling elements.

Excavators are also called diggers, JCBs (a proprietary name, in an example of a generic trademark), mechanical shovels, or 360-degree excavators (sometimes abbreviated simply to 360). Tracked excavators are sometimes called track hoes by analogy to the backhoe. In the UK, wheeled excavators are sometimes known as rubber ducks.

Fig-2: Excavator (Earthmoving machine)

A. Applications

1) Digging of holes, foundations.
2) Forestry work
3) Demolition
4) General Grading
5) River Dredging
6) Drilling shafts for putting
7) Forestry mulching

B. Configuration

There are two main types of "Control" configuration generally use in excavators to control the boom and bucket, both four maindigging controls between two x-y joysticks.

C. Noble Manufacturers

1) Bucyrus international
2) Caterpillar Inc.
3) Hitachi Construction Machinery
4) Hydrema
5) Mitsubishi Heavy Industries
6) Hyundai Heavy Industries

7) John Deere
8) J.C Bamford (JCB)
9) Komatsu Limited
10) L&T

III. PROGRAMMING DETAILS

Fig-3: OFF Delay Timer Unit

Switch No-1 is OFF
Switch No-2 is ON – For selecting "Selecting Scale" of 10
Switch No- 3 is ON – For selecting "Time Range" of Minute
Switch No-4 is OFF- For selecting "Mode" of ON delay

Fig-4: Program Instructions.

IV. WORKING

A. Condition No.1

1) When key switch is at "OFF" position.

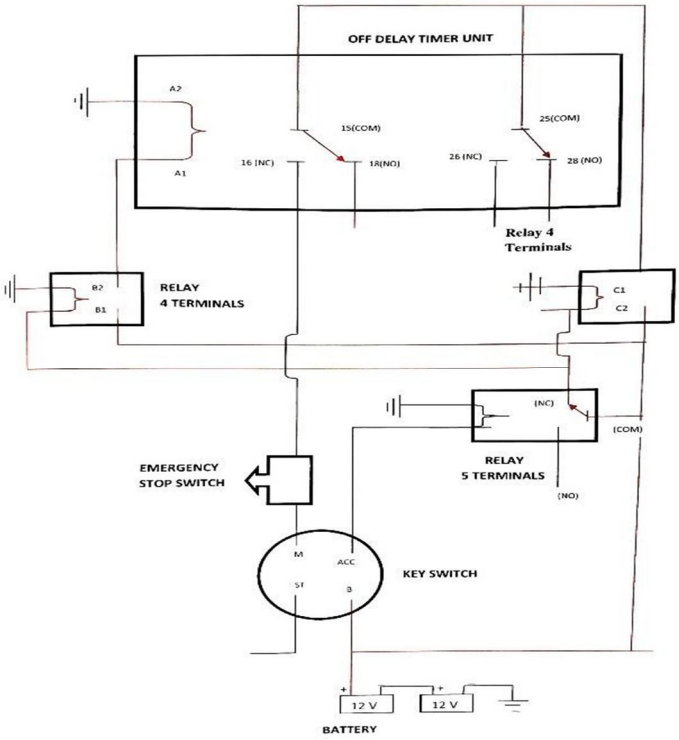
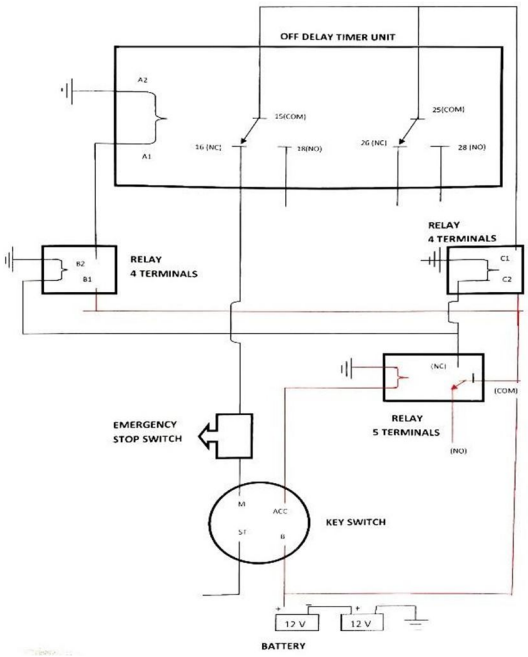


Fig-5: Circuit Diagram-1

B. Condition No2

1) When key switch is turned to "ON Position" and engine started by cranking, Current from battery positive terminal, when key switch is ON and engine is started by cranking. Machine is operated by the machine operator for doing earthmoving work.

Fig-6. Circuit Diagram-2



C. Condition No.3

1) When key switch is turned to "OFF Position" to Shut Down the engine. Current from battery positive terminal flows, when key switch turned to "OFF" to shut down the engine, but by installing "OFF DELAY TIMER UNIT" which will continue to hold and connect terminal-15 and terminal-16 of Delay Timer Unit for a set time.

2) Current from terminal-15 flows to terminal-16 and from terminal-16 to terminal-M of key switch for a set time and engine will continue to run for a specific time as set in "Off Delay Timer". After a specific time, terminal-15 will connect to terminal-18.

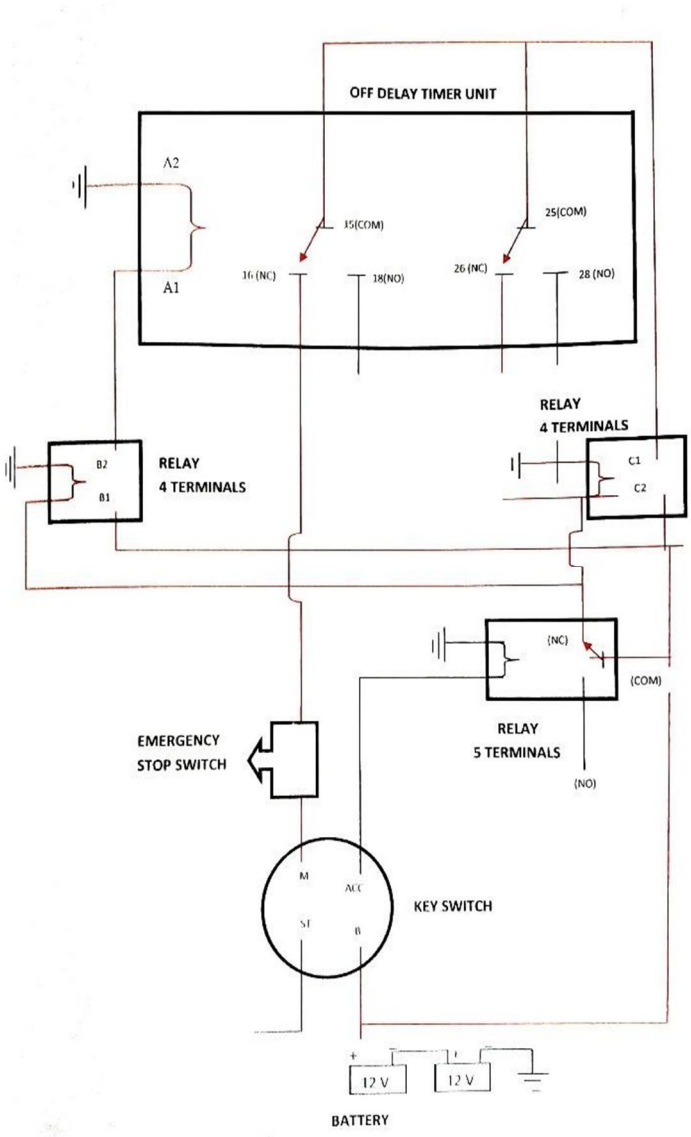


Fig-7. Circuit Diagram-3

V. ADVANTAGES OF PROJECT

A. Efficiency of turbocharger get increased.

B. Life span of turbocharger get increased as reduction is sudden jerks.

C. Maintenance of the excavator regarding turbocharger gets decreased.

D. Bearing of turbocharger get maximum efficiency due to less heat soaking of blades, inertia effects are eliminated.

VI. CONCLUSIONS

To avoid sudden stoppage of engine by careless behavior of operator, modifying the circuit by installing Delay Timer Unit for following IDLING RULE, engine will stop after 3 minutes of switch off position. This will increase the life of turbocharger

avoiding the premature failure, and eliminating sudden shocks on stoppage of engine, due to high inertia, and heat soaking of blades will not occur. By giving adjustment for time selector, time can be adjusted for idling depending upon horsepower of engine.

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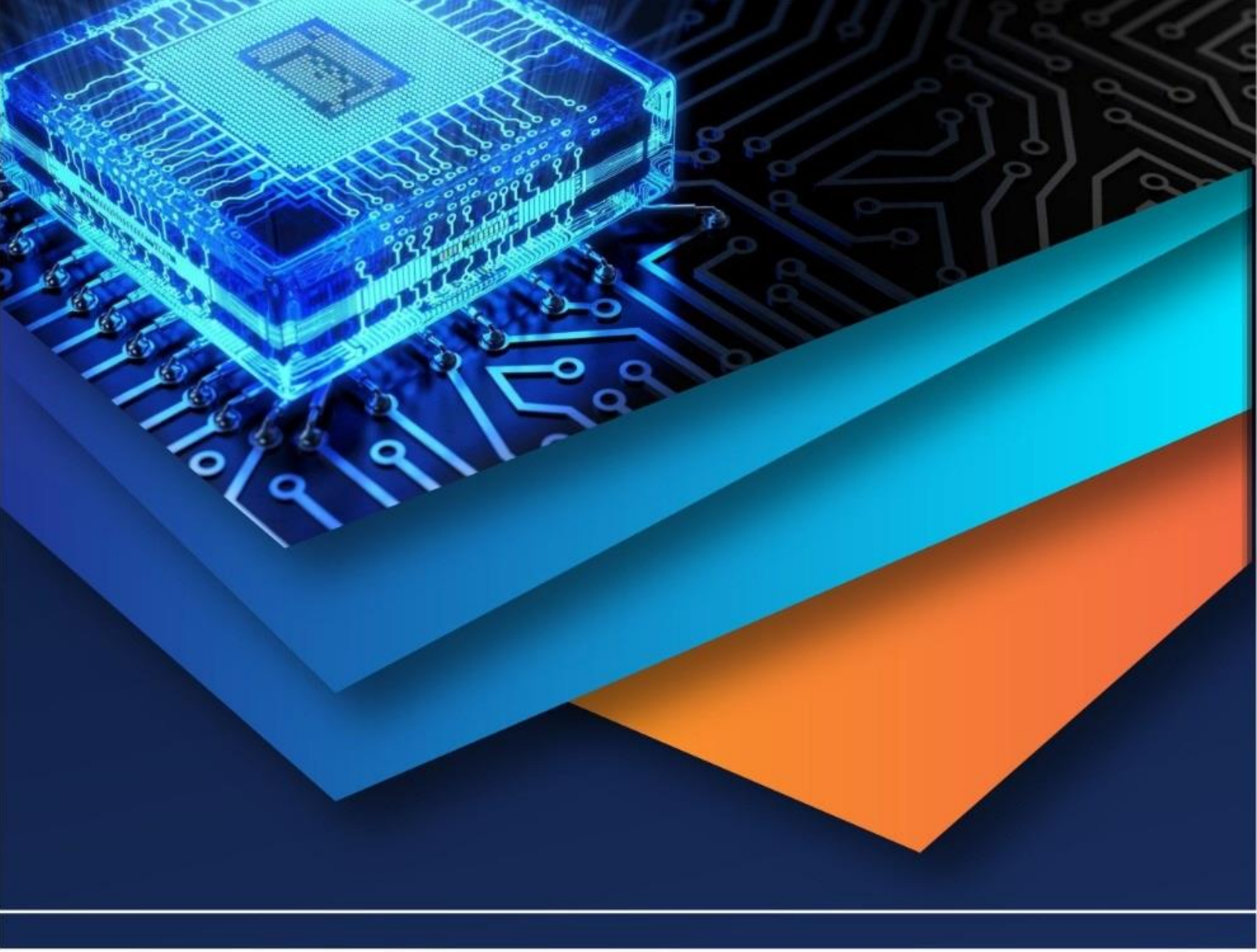

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