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CAWANGAN TERENGGANU KAMPUS
BUKIT BESI

MEC299

DEVELOPMENT AND KINEMATIC ANALYSIS OF SCOTCH YOKE MECHANISM

ABDUL AZIM BIN MOHD SABRI

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SUPERVISOR:

EN. HAIZUAN ABDUL RAHMAN

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ABSTRACT

The Scotch Yoke Mechanism is an example of slider-crank mechanism. The Scotch Yoke is a mechanism for converting the linear motion of a slider into rotational motion or vice versa. It is made of aluminium and consists of a rotary element, called crank, with a graduated disc. The Scotch yoke mechanism is most commonly used in control valve actuators in high-pressure oil and gas pipelines, as well as in various internal combustion engines, such as the Bourke engine, Sy Tech engine and many hot air engines and steam engines. The Scotch Yoke Mechanism is to be consider more efficient because of the rotational motion spent more time at high point of its rotation than Piston part. Also, The Scotch yoke mechanism had a very simple mechanism by having a simple contracture and need less quantity of material to build.

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CHAPTER 1

INTRODUCTION

1.1 Background of study

What is a Scotch yoke mechanism?

The Scotch Yoke, also known as slotted link mechanism, is a reciprocating motion mechanism. In a typical Scotch yoke mechanism, a yoke frame presents a pair of parallel inner tracks between which a roller or slide block operates in reciprocating motion. In its simplest form the yoke frame moves linearly in simple harmonic motion in a direction transverse of the tracks, and the reciprocating element in the yoke frame is pivotally connected to a rotating crank. Commonly, the yoke frame is rigidly connected to a piston rod and the reciprocating crank is on a crankshaft. When the reciprocating element is a roller, during each stroke the roller engages one of the yoke frame tracks when rolling in one direction and engages the other track when rolling in the opposite direction. Even though the tolerance between the roller diameter and the distance between the tracks is small, the roller impacts the track to which it is shifting. Typical Scotch yoke mechanisms using a roller as the reciprocating element in the yoke frame, and serving as a linkage between a crankshaft and a piston, are shown in U.S. Pat. Nos. 2,132,802 (Pierce) and 2,482,967 (Cook)(1).

1.2 Problem statements

It has been discovered that in such mechanisms the roller shifts tracks before the end of its stroke and hence is forced to instantaneously change direction of rotation while finishing the stroke in engagement with the other track. Then, at the finish of the stroke, the roller is again forced to reverse its rotational direction. As a consequence, a scuffing action occurs between the roller and tracks during each stroke.

When a slide rod is used as the reciprocating element in the yoke frame, causing the tolerance between the rod width and the track spacing. This action can cause the art as "wedging" and results in scuffing and wear problems. Typical Scotch yoke mechanisms using a slide block as the reciprocating element in the yoke frame and functioning between a crankshaft and a piston are shown in U.S Pat. Nos. 963,880 (Eason); 1,316,192 (Sawyer); 2,127,729 (Grant) and 2,148,820 (Tucker)(1).

Another problem is the tendency of the reciprocating scotch yoke to rotate about the reciprocation axis and thereby cause additional scuff and wear as the side edges of the scotch yoke collides with the webs of the crankshaft during operation.