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Twin Cylinder Optional Engine Mechanism (Advanced Technology)

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Abstract-In general, lower capacity engine gives us more mileage and a higher capacity engine gives a comparatively less mileage. Consequently, lower volume engines supply lesser power as compared to their higher volume counterparts.

By designing twin cylinder optional engine mechanism , we would be able to choose between running one cylinder when at lesser loads thereby getting more mileage and at higher load conditions we can actuate the other dormant cylinder for additional power.
We intend to achieve this in three phases:

1. A pedal operated model to check the feasibility at lower rpm's.

2. A running test at idling rpm of 1000 rpm using an electric motor.

3. Complete overhaul of two 50 cc engines and re-assembly with installing the mechanism (Major Project).

Index Terms— Bearing seat, crankshaft, camshaft, twin cylinder,

1 INTRODUCTION

Stage 1 and 2: The arrangement consists of the active engine mounted on a fixed pillar which is supported in position by crank shaft. The crank shaft is kept in alignment by supporting the crank shaft bearing on the fabricated bearing seat or spider. The fixed pillar is of I cross-section. This was chosen due to equal load distribution on all four sides of the bearing seat.

A slider is used to bring into contact the two crank shafts. The optional cylinder is to be moved in to position by sliding it close to the active cylinder. The slider should have only one degree of freedom so as to prevent any form of vibrations which can lead to miss alignment upon operation. We use dog clutch to engage two engines into working together because of the following reasons:

- Efficiency advantages
- Reduced installation space
- Low drag torques
- Low actuation forces
- Low production costs

To provide the necessary axial force so as to keep the clutch engage we have used coil springs which are placed diametrically opposite on the clutch.

So as to further eliminate any vibrations, we have used rubber seals to damp out the excessive vibrations on running of the two engines when engaged.

The slider bearing should have no tolerance and should slide smoothly over the slider shaft. And, upon engagement should not vibrate or deviate from its position. So as to ensure this the bearing should be hydrostatically lubricated and should be sealed. The dog clutch should have provision for fool-proofing. This is achieved by making three teeth square and one triangular. This is done so as to ensure engaging of the engines in the desired position i.e. both the pistons upon engagement should have the exact same positions in their respective cylinders.

Stage 3: In this stage, we mount the two cylinders in a single crank case so as to eliminate any leakage of lubrication in the crank case. After above mentioned calculations the appropriate crank diameter determined was 70 mm. This crank is a hollow cylinder in shape which has key ways on the inner side and houses in it a spring which provides an axial force of 20 N. This spring provides axial force for the male dog clutch. The male dog clutch has keys on it which limits its rotational movement and allows only linear motion. The dog clutch is made of EN8 steel.

This material was selected because of:

1. It is a mild strength steel.
2. Has high tensile strength.
3. Cost considerations.
4. Availability.

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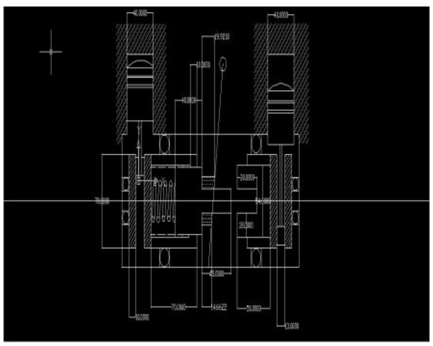
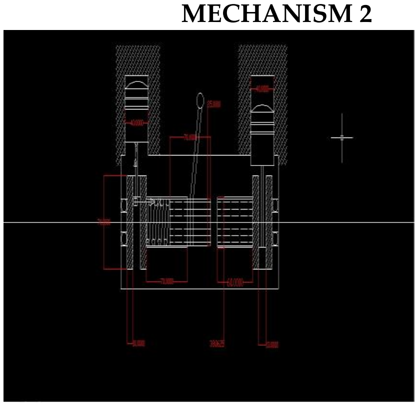
Both the cylinders are fixed in their respective positions. The hand lever controls the engaging of the dog clutch. Bearing 6214 manufactured by NBC is used since the inner race of the bearing is equal to 70 mm in mechanism 1 and bearing 6207 is used in mechanism 2 since the bearing has inner race of 35mm. In mechanism 1, the weight of the crank was very heavy and that affected the volumetric efficiency. This was, however, rectified in mechanism 2 in which the crank size was reduced to compensate for the increased weight.

MECHANISM 1



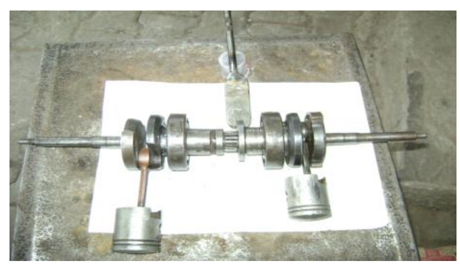
MECHANISM 2



Fabricated Slider using M.S. bearing, also shown in the picture is the male dog clutch mounted on the crank shaft:

Final assembly using M.S. slider:

Tentative assembly of mechanism 2:



CAD generated model for mechanism 2:

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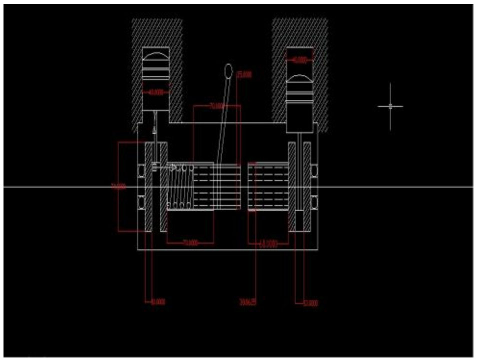

CALCULATIONS

Design Procedure:

1. Determine the magnitudes of the various loads acting on the crank shaft.

2 Determine the distances between the supports. The distances will depend upon the lengths of the bearing. The lengths and the diameters of the bearing are determined on the basis of maximum permissible bearing pressures, *l/d* ratios and the acting loads.

3 For the sake of simplicity and safety, the shaft is considered to be supported at the centers of the bearings.

4 The thickness of the crank webs is assumed, about 0.5 d to 0.6 d, where d is the shaft diameter, or from 0.22 D to 0.32 D, where D is the cylinder bore.

5 Now calculate the distances between supports.

6 Assume allowable bending and shearing stresses.

7 Compute all the necessary dimensions of the crank shaft.

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