DESIGN AND CONSTRUCTION OF A SHAKER DEVICE

by

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Project Report

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INTRODUCTION

The design and construction of a shaker device for mixing (steering up) of substances inside vial (small open experimental bottle), is the objective of this project.

Those devices are widely used in laboratories where mixing of more than one or two vial is required. There are two categories of commercial shaker devices : The first category is a moving platform device, performing cyclic motion. The second type which the device of concern, is a vibrating shaft.

In order to construct a vibrating shaft device a mechanism that would be simple and easy to manufacture, providing at the same time means for varying speed, should be designed. The mechanism designed, is an axle carrying an unbalance mass, rotating in a bearing at the centre of shaft. The beam carrying the vial is supported by two other bearing, allowing the shaft to slide(vibrate) on them (figure 1).

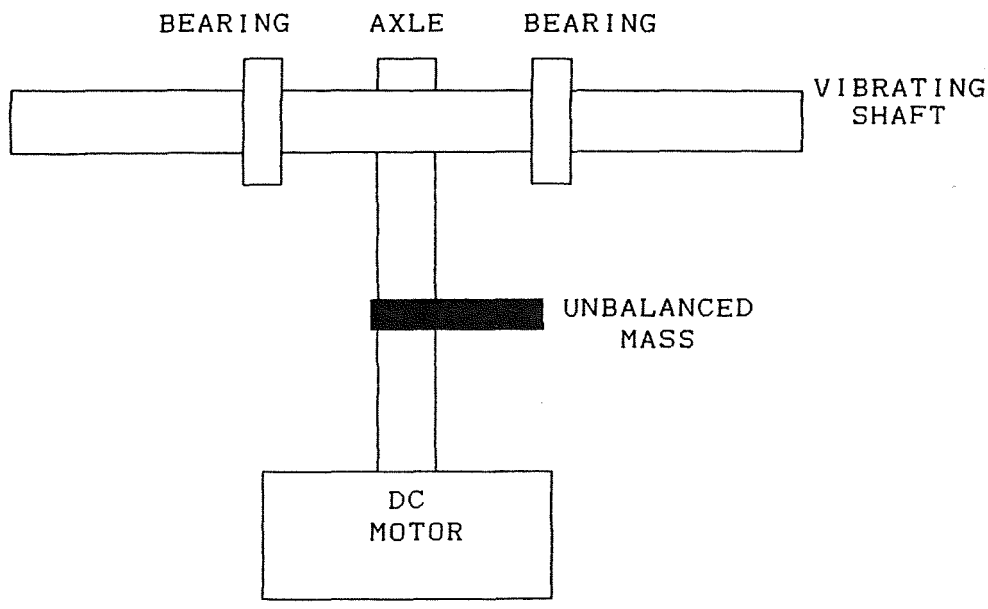

fig. 1: (Mechanism)

The operation of the mechanism is simple. Since the motor axle is rotating with a certain speed the unbalanced

mass creates a centrifugal force (Fc). This centrifugal force is instantly pointing from the centre of gravity radially outside the axle centre. At any time the centrifugal force at a constant speed w, is equal to a certain constant value. Since the only support is the vibrating shaft's bearings the only forces acting on the axle are those of the reactions (R) (figure 2).

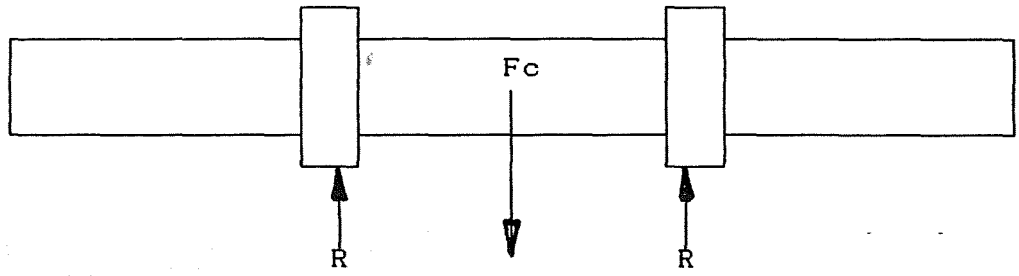

fig. 2 (Forces acting on vibrating shaft)

When the centrifugal force is now perpendicular to the vibrating shaft the reaction of bearings are equal to half the centrifugal force each. When the centrifugal force is then at an angle Fc*cos(a) is equal to the bearing reaction force and the Fc*sin(a) force is equal to the static frictional force (Ff) (figure 3).

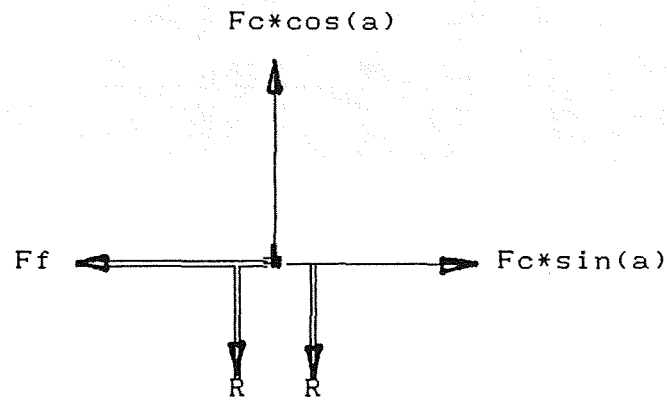

fig. 3 (Forces at centre of axle)

When Fc*sin(a) force reaches the value of frictional force

of bearing then it causes sliding of shaft. Until centrifugal force coincides with the shaft the sliding force increases and reaches max at a=90 degrees and a=270 degrees. Afterwards the force decreases until it goes to zero.

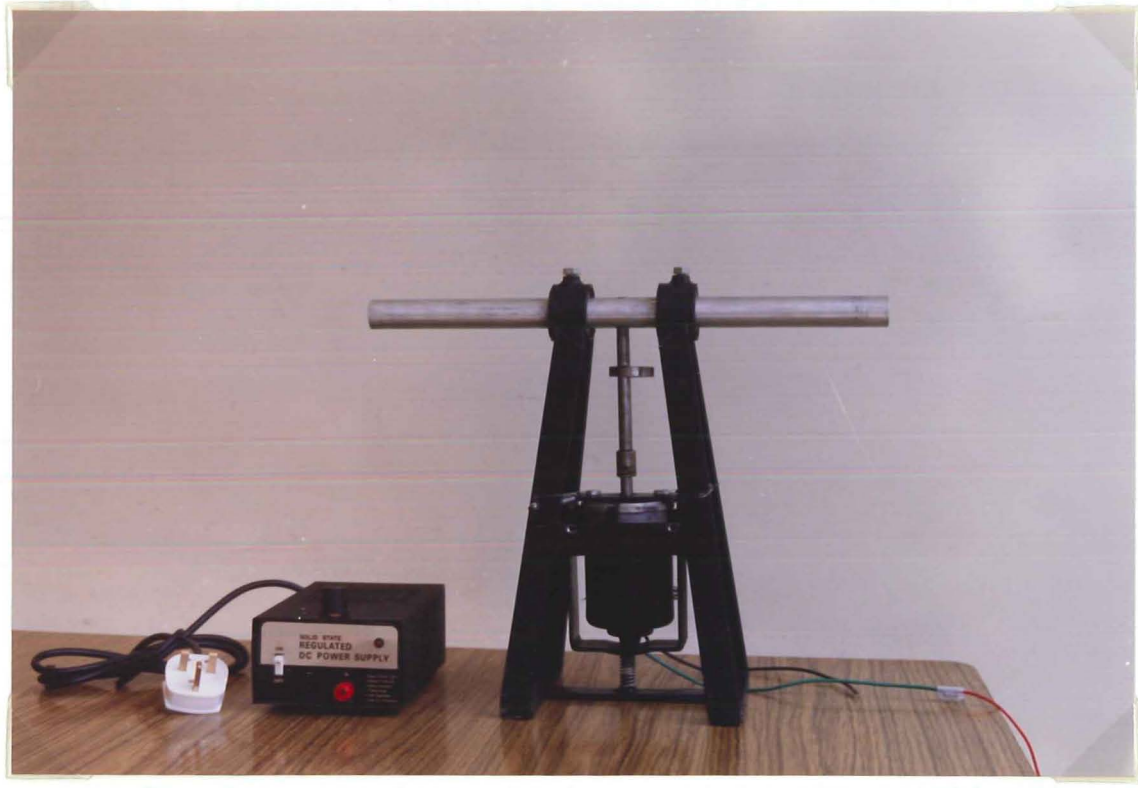

Photo.1 (Mechanism and DC power supply of the shaker)

C O N T E N T S