INSTRUCTIONAL MANUAL FOR CAM ANALYSIS MACHINE

OBJECTIVE:-

- To study the various cam and follower pairs.
- To study the effect of follower weight on bounce.
- To study the effect of spring compression on bounce.

AIM:-

- To find out the angular displacement of various cam follower pairs.
- To plot the n-θ (follower displacement vs. angle of cam rotation) curves for different cam follower pairs.
- The test can be repeated by changing compression spring, follower weights, & cam speed.

INTRODUCTION:-

A cam may be defined as a rotating or a reciprocating element of a mechanism which imparts a rotating, reciprocating or oscillating motion to another element termed as follower.

THEORY:-

CAM MECHANISM AND ITS USES:
In most of the cases the cam is connected to a frame, forming a turning pair and the follower is connected to the frame to form a sliding pair. The cam and the follower form a three- link mechanism of the higher pair type. The three links of the mechanism are:-

a) The cam, which is the driving link and has a curved or a straight contact surface.
b) The follower, which is the driven link and it, gets motion by contact with the surface of the cam.
c) The frame, which is used to support the cam and guide the follower. The cam mechanism is used in clocks, printing machines, automatic screw cutting machines, internal combustion engines for operating valves, shoe-making machinery etc.

DESCRIPTION:-

The machine is a motorized unit a camshaft is driven by a D.C. Motor. The shaft runs in a double ball bearing. At the end of the cam shaft a cam can be easily mounted. As the follower is properly guided in gun- metal bushes and the type of the follower can be

changed to suit the cam under test. A graduated circular protractor is fitted coaxial with the shaft and a dial gauge can be fitted to note the follower displacement for the angle of cam rotation. A spring is used to provide controlling force to the system. Weights on the follower rod can be adjusted as per the requirements. An arrangement is provided to vary the speed of camshaft. The machine is particularly very useful for testing the cam performance for jump phenomenon during operation. The machine clearly shows the effect of change of inertia forces on jump action of cam follower during the operation. It is used for testing various cam and follower pairs, i.e.

1) An eccentric arc cam with Knife edge follower
2) Tangent cam with roller follower
3) Circular cam with Mushroom follower

UTILITIES REQUIRED:

- Electricity Supply: Single phase, 220 volts DC, 5-15 amp socket with earth connection.
- Stroboscope.
- Bench Area Required: 0.6 m x 0.33 m

TECHNICAL SPECIFICATION: -

Cam Shaft	:	Material Stainless Steel
Cams	:	Tangent, Eccentric, Circular Arc type.
Followers	:	Roller, Knife edge, Mushroom
Compression Spring	:	Provided
Weights	:	1 kg., 500gm, 200 gm & 100gm
Motor	:	Variable Speed, ½ HP., 0-1500 RPM with Speed Controller
Dial Gauge	:	Baker & Mercer/Standard Make

EXPERIMENTAL PROCEDURE:

1. Fix the required cam & follower assembly on the apparatus.
2. Fix the dial gauge at top of follower shaft to get the follower displacement.
3. To find out the angular displacement, rotate the cam manually.
4. Note the angular displacement of cam and vertical displacement of the follower wi th the help of protractor & dial gauge respectively.
5. Draw the n – θ (follower displacement Vs rotation of cam) curve.
6. Now remove the dial gauge from the follower shaft.
7. Switch on the main power supply.
8. Slowly increase the rpm of the motor with the help of dimmerstat provided at the control panel & check the jump of the follower with the help of stroboscope.
9. If jump of the follower is not appears then again adjust the speed of the motor. At certain speed jump of the follower will occur. When jump occurs the

follower makes a good thumping sound on cam surface. This speed is the jump speed.

10. Decrease the speed of the motor to the minimum value.
11. Now put some weight on the follower shaft plate and keep the spring tension constant.
12. Increase the speed of the motor and find out the jump speed.
13. Now vary the weight on the follower shaft plate and get the two or three jump speeds of the follower at constant spring tension.
14. Plot the curve for follower weight Vs jump speed.
15. Now get the jump speed by varying the spring tension and keeping the follower weight constant.
16. Repeat the procedure for other two cam & follower assemblies.

OBSERVATION & CALCULATION:-

OBSERVATION TABLE:-

Eccentric Cam with Knife Edge Follower

Sr. No.	θ	n, mm
1.	20	
2.	40	
3.	60	
4.	80	
5.	100	
6.	120	
7.	140	
8.	160	
9.	180	
10.	200	
11.	220	
12.	240	
13.	260	
14.	280	
15.	300	
16.	320	
17.	340	
18.	360	

To plot the n vs. θ curve for Eccentric Cam with Knife Edge Follower

Tangent Cam with Roller Follower

Sr. No.	θ	n, mm
1.	20	
2.	40	
3.	60	
4.	80	
5.	100	
6.	120	
7.	140	
8.	160	
9.	180	
10.	200	
11.	220	
12.	240	
13.	260	
14.	280	
15.	300	
16.	320	
17.	340	
18.	360	

To plot the n vs. θ curve for Tangent Cam with Roller Follower

Circular Cam with Mushroom Follower

Sr. No.	θ	n, mm
1.	20	
2.	40	
3.	60	
4.	80	
5.	100	
6.	120	
7.	140	
8.	160	
9.	180	
10.	200	
11.	220	
12.	240	
13.	260	
14.	280	
15.	300	
16.	320	
17.	340	
18.	360	

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To plot the n vs. θ curve for Circular Cam with Mushroom Follower

NOMENCLATURE:-

N = Revolutions per minute.
n = Displacement, mm
S = Spring Force.
W = Follower assembly weight, kg
ω = Angular velocity of cam, rad/sec
θ = Cam Angle

PRECAUTIONS & MAINTENANCE INSTRUCTIONS:-

1. Always lubricate the cam before starting the apparatus.
2. Tighten all the nuts properly before starting the apparatus.
3. Do not increase the speed of the motor at once.

TROUBLESHOOTING:-

4. If main light in not ON check the main supply.
5. If the motor is not working check the rotary switch & dimmer-stat.

REFERENCES:-

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7. Thomas Bevan, **"The Theory of Machines"**, 3rd ed., CBS Publishers & Distributors, ND, 1984, Page 281-282.