K **J Somaiya College of Engineering** **(A Constituent College of Somaiya Vidyavihar University)**

Batch: Roll No.: 17(P4_1)
Experiment / assignment / tutorial No. Grade: Expt. No.3
Signature of the Staff In-charge with date

Title – Bell Crank lever

CO1: Evaluate resultant and moment of a force system

CO4: Analyze applications of equilibrium using free body diagram

Objective

To verify the principle of moments using bell crank lever.

Theory

Principle of moments states that, 'the algebraic sum of moments of a system of coplanar forces about any point in the plane is equal to the moment of the resultant of a force of the system about the same point'.

This principle would be verifed for a bell crank lever arrangement.

A lever whose two arms form a right angle and having its fulcrum at the apex of the angle is known as bell crank lever. These levers were initially used to operate the bell from a long distance especially where change in the direction of bell wires was involved and hence the name.

AIM:

To verify the principle of moments of a coplanar non-concurrent system of forces and to fnd the error if any.

APPARATUS:

Bell crank lever apparatus, weights, hangers and scale.

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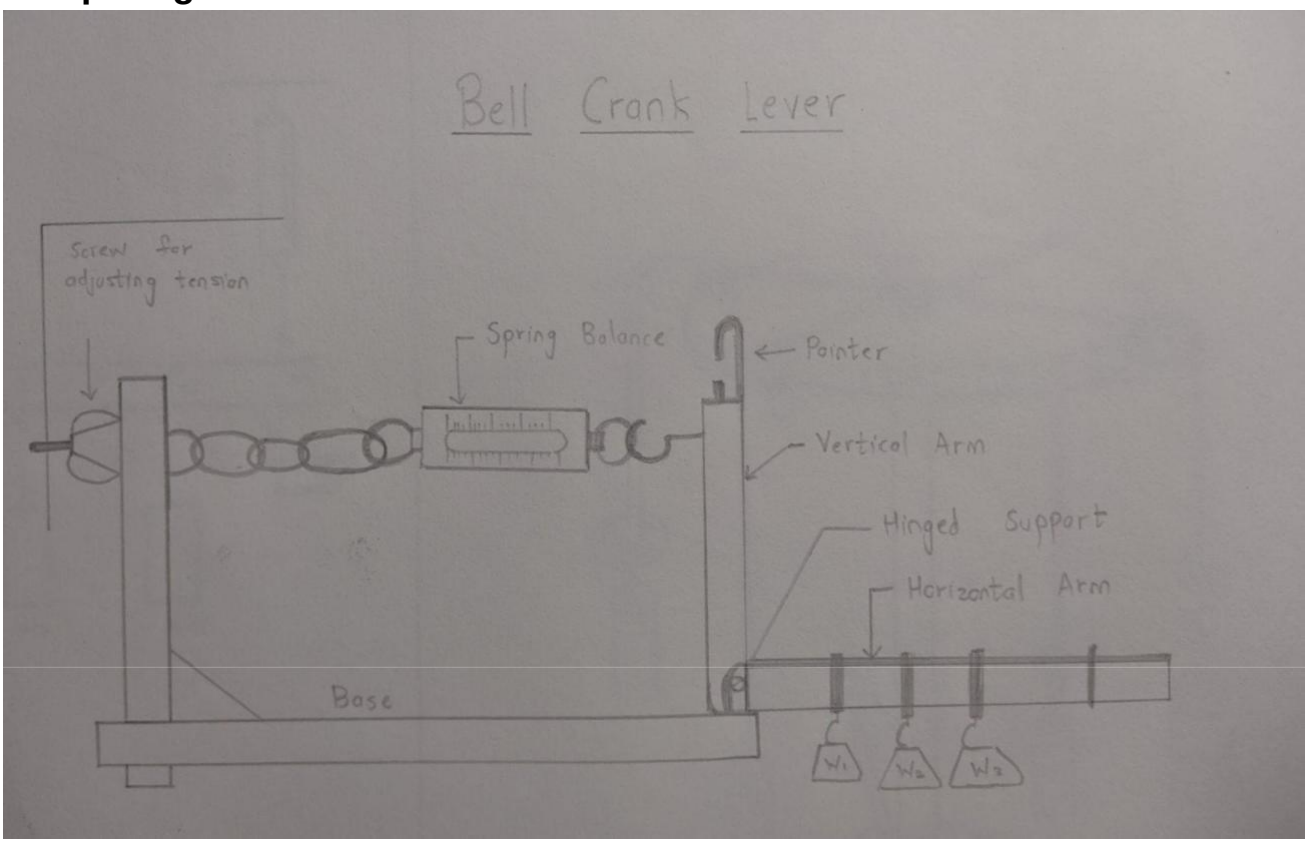
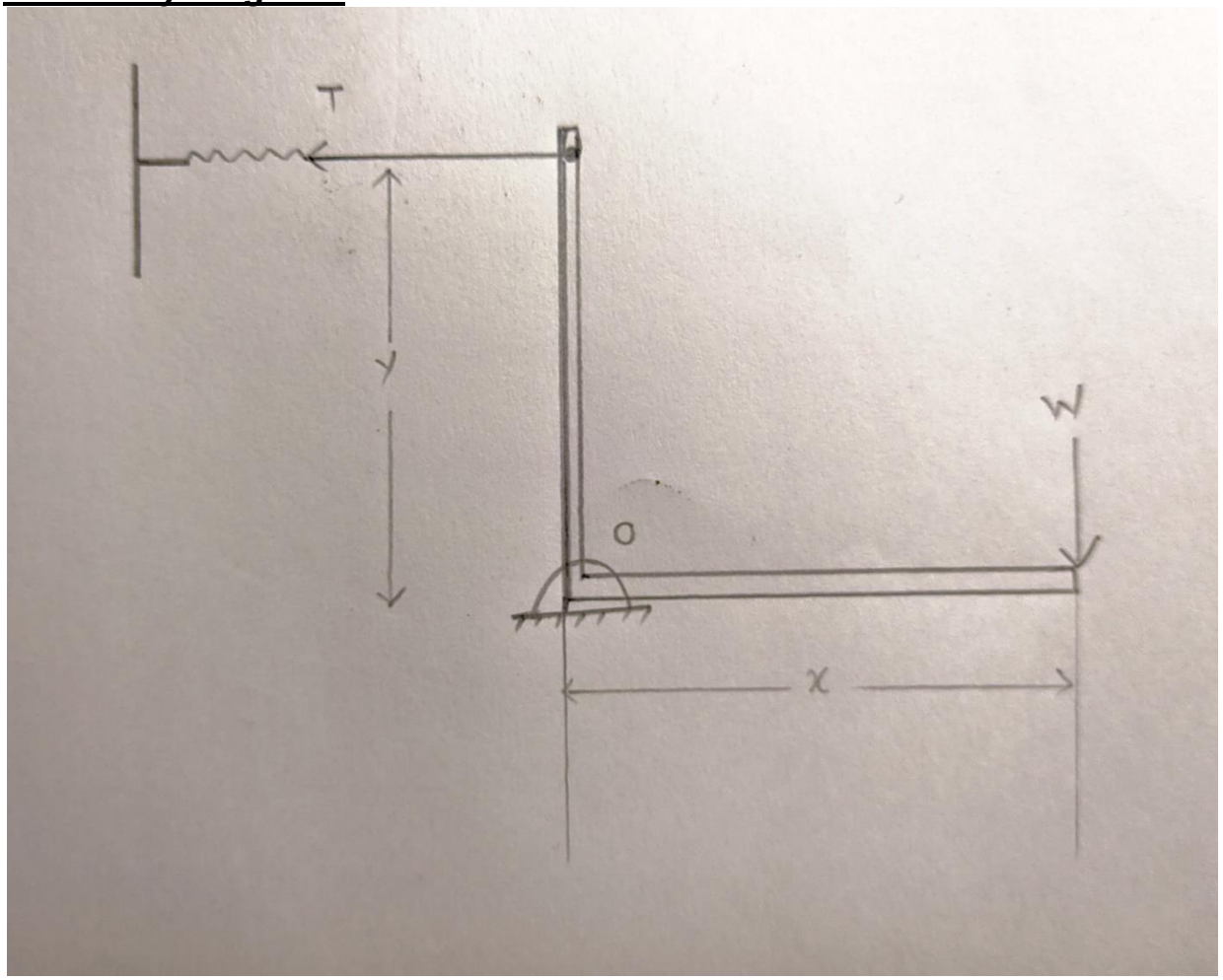
Setup Diagram:



Free body diagram:



PROCEDURE:

1. Arrange hanger at arbitrary location on the horizontal arm. Note the location X from the hinge. Adjust the tension in the spring connected to the vertical arm such that the two pointers come in the same vertical line. In this position the horizontal arm is truly horizontal. Note the initial spring balance reading T_1. Also note the location of the spring from the hinge.
2. Hang the weight W from the hanger. This will cause the arms to tilt and the pointers to move away from each other. Now adjust the tension in the spring such that the pointers once again come in the same vertical line. The horizontal arm is once again in its horizontal position. Note down thefnal spring balance reading T_2. The tensile force on the vertical arm is the diference T_2-T_1.
3. Since the external force is supported by the single hinge at the apex of the arm, implies that the resultant of these forces passes through the hinge. Therefore to verify the principle of

the moments we need to take moments of all the forces about hinge and if the total sum is zero, verify the law of moments since the moment of the resultant is also zero at the hinge.

4. Repeat the above steps by changing the weights and their location in the horizontal arm.

OBSERVATION TABLE:

Sr No	Weight (W) Kg	Distance from fulcrum (X cm)	M_1 = w * x Kg cm	Reading of Spring balance		Efort $T=(T_2-T_1)$ kg	Distance Y cm	M_2 = T*Y	M_1- M_2	% Error
				Initial T_1	Final T_2					
1	1	10	10	0.3	0.7	0.4	21	8.4	1.6	16%
2	2	15	30	0.3	1.5	1.2	21	25.2	4.8	16%
3	3	20	60	0.3	2.9	2.6	21	54.6	5.4	9%

CALCULATION:

M_1 = w * x (Kg cm)
1*10=10
2*15=30
3*20=60

Efort $T=T_2-T_1$ (kg)
0.7-0.3=0.4
1.5-0.3=1.2
2.9-0.3=2.6

M_2 = T*Y (Kg cm)
0.4*21=8.4
1.2*21=25.2
2.6*21=54.6

% Error=(M_1- M_2)/M_1*100
1.6/10*100=16%
4.8/30*100=16%
5.4/60*100=9%

RESULT:

Error at 1Kg=16%
Error at 2Kg=16%
Error at 3Kg=9%

CONCLUSION:

We have found out the errors present and the principle of moments of a coplanar non-concurrent system of forces are hence verifed.

Signature of faculty in-charge