Department of Mechanical Engineering

2023-2024

(Somaiya Vidyavihar University)

K J Somaiya College of Engineering

(A Constituent College of Somaiya Vidyavihar University)

Batch:P4-1   Roll No.: 17
Experiment / assignment / tutorial No. 4
Grade: AA / AB / BB / BC / CC / CD /DD

Signature of the Staff In-charge with date

Title: Jib crane

CO4 Analyze applications of equilibrium using free body diagram

Objective

To calculate the forces in the members of a simple jib crane

Theory

A crane is a type of machine, generally equipped with a hoist, wire ropes or chains, and sheaves, that can be used both to lift and lower materials and to move them horizontally. It is mainly used for lifting heavy things and transporting them to other places. It uses one or more simple machines to create mechanical advantage and thus move loads beyond the normal capability of a human. Cranes are commonly employed in the transport industry for the loading and unloading of freight, in the construction industry for the movement of materials and in the manufacturing industry for the assembling of heavy equipment.
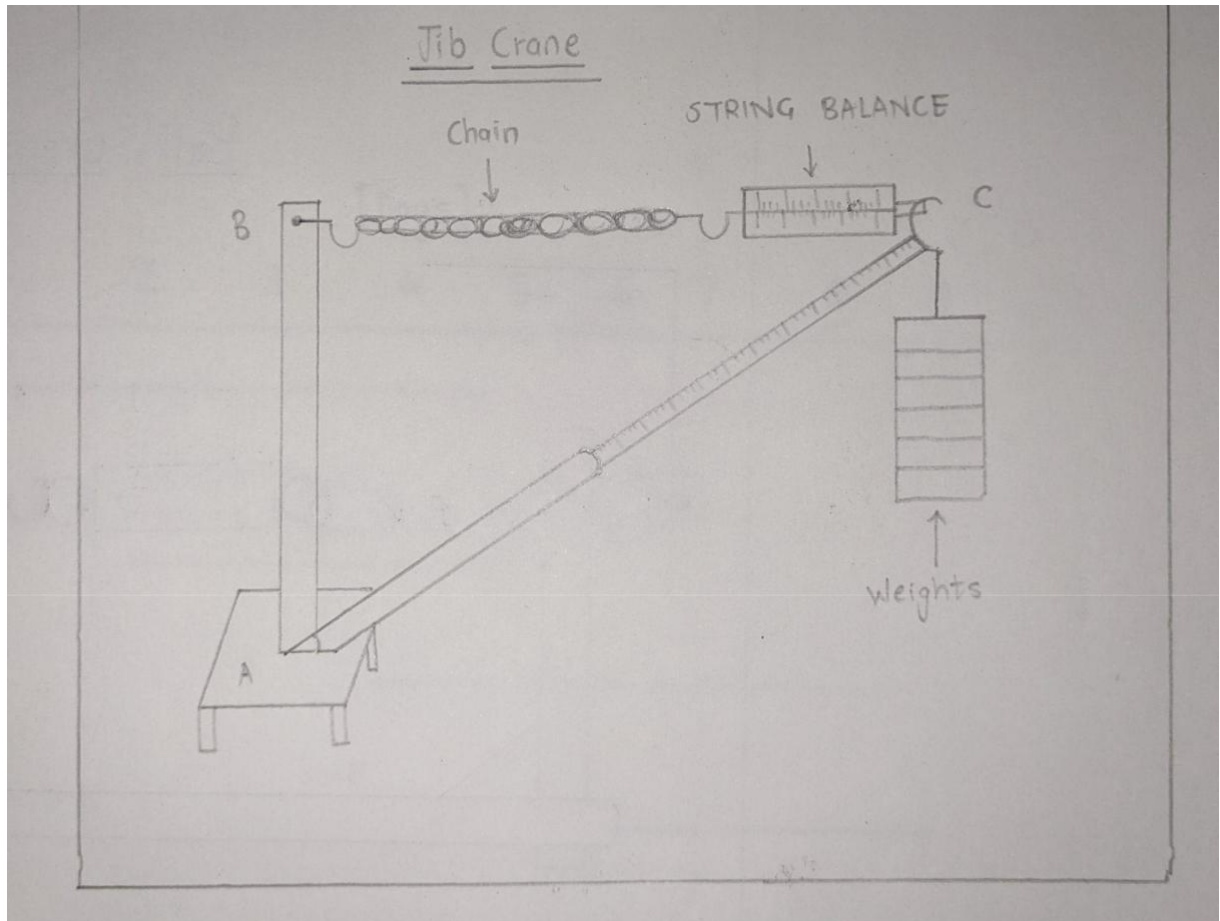
AIM:

To fnd the forces in the members of a truss.

APPARATUS:

Jib crane apparatus, spring balance, weights, scale, etc.

Setup Diagram:

Jib Crane

PROCEDURE:

1. Attach spring balance with BC member.
2. Put weight in pan at C.
3. With the help of scale measure the length of each member.
4. Take the readings on spring balance at members BC and AC and the weight inpan at C.
5. Find the forces in members by analytical calculations and verify the results.

OBSERVATION TABLE:

Sr. No.	Weight in Pan	Length of members		
		AB(cm)	BC(cm)	AC(cm)
1	10N	94	52	104
2	20N	94	53.5	103
3	30N	94	54.5	102.5

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Sr. No.	Weight in Pan	Spring balance reading at		Forces in members	
		BC	AC	BC	AC
1	10N	4N	13N	5.7N	11N
2	20N	11N	18N	11.4N	21.1N
3	30N	20N	34N	18.7N	33.1N

CALCULATION:

Lami's Theorem
$W/\sin(\alpha) = F_{AC}/\sin(\beta) = F_{BC}/\sin(\gamma)$

For 1kg:
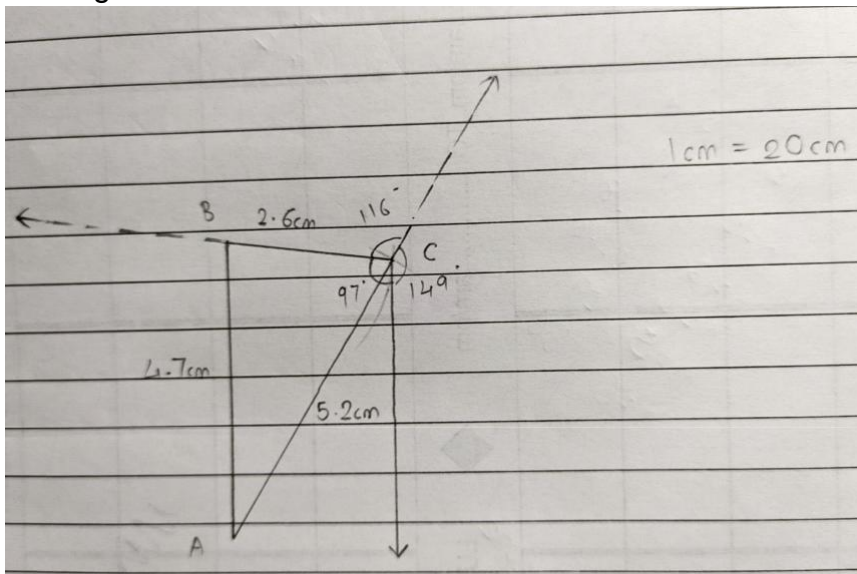
here ,$\alpha=116°$,$\beta=97°$,$\gamma=149°$
Similarly we can calculate the angles for other weights 2 & 3kg.
$AB/\sin(116°) = AC/\sin(97°) = BC/\sin(149°)$
From this we get,
$AC = 1.1kg = 11N$
$BC = 0.573kg = 5.7N$

For 2kgs:
AB/sin(112°)=AC/sin(102°)=BC/sin(148°)
AC=2.11kg=21.1N
BC=1.14kg=11.4N

For 3kgs:
AB/sin(116°)=AC/sin(100°)=BC/sin(146°)
AC=3.31kg=33.1N
BC=1.87kg=18.7N

RESULT:

Force in Member BC =5.7N,11.4N,18.7

Forcein Member AC =11N,21.1N,33.1N

Signature of faculty in-charge

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