

Experiment No. 26.1. Aim:-

To verify a Roberval type counter machine of 10 kg capacity

2. Apparatus used:-

- 1) Standard weights
- 2) Fractional weight box (1 mg to 100 g)
- 3) Side calipers etc.

3. Theory:-

Counter machine is an equal armed weighing instrument of capacity not exceeding 50 kg the pans of which are above the beam. Counter machines are constructed based on the principle Roberval static Eigma. Simple diagram of a Roberval type diagram of m/c is shown in figure.

Conditions of accuracy of the m/c

are

- 1) The main arms of the ~~are~~ beam must be equal i.e. $AF = BF$
- 2) Each leg must be optimum in length i.e. as longer as possible.
- 3) The length of the stay must be equal to the length of the beam i.e. $AB = CD$
- 4) Each leg must be equal to the distance between the fulcrum i.e. $AC = FF' = BD$

Table - 1
Zero load test (horizontal test)

Sr. No.	Load on Pan		Position of the Pointers	Remarks
	Left	Right		
1	0	0	Both pointers were co-incided	equipoised
2	0	0	— do —	equipoised

Table - 2
Sticky Test / Repeatability Test.

Sr. No.	Load on Pan		Position of the Pointers	Remarks
	Left	Right		
1	0	0	No deflections	equipoised
2	0 + GP	0	Pointer regained its original position	Non sticky
3	0	0 + GP	— do —	— do —
4	10 kg	10 kg	—	equipoised
5	10 kg + GP	10 kg	Pointer regained its original position	Non-sticky
6	10 kg	10 kg + GP	— do —	— do —

Table - 3:
Knife edge & bearing test (at half load)

Sr. No.	Load on Pan		Position of load		Error observed	Error prescribed	Remark
	left	Right	left	Right			
1	5 kg	5 kg	N	N	-	10.5/2	equipoised
2	5 kg	5 kg	N	F	10 g	5.95g	(B/L)
3	5 kg	5 kg	N	B	4.2 g	---	W/L
4	5 kg	5 kg	N	I	8 g	---	(B/L)
5	5 kg	5 kg	N	O	7 g	---	(B/L)
6	5 kg	5 kg	N	N	-	---	equipoised
7	5 kg	5 kg	F	N	8 g	---	(B/L)
8	5 kg	5 kg	B	N	10 g	---	(B/L)
9	5 kg	5 kg	I	N	9.5 g	---	(B/L)
10	5 kg	5 kg	O	N	8.5 g	---	(B/L)
11	5 kg	5 kg	N	N	-	---	

Table - 4:

Fall Test .

Sr. No.	Position of Pan in load		Fall measured in mm	Fall Prescribed in mm	Remark
1	Extreme up	Extreme down	9.3	10	(B/L)
2	Extreme down	Extreme up	16.5	10	W/L

- 5) Size of the pans should be reasonable in comparison to the capacity i.e. as smaller as possible.
- 6) Vertical distance between knife edges (terminal) and their associated pans should be as small as practicable.
- 7) Knife edges & bearing should be made of hard-steel & continuous in nature.

Now if L be the load on the goods pan and w is the weight on the pan placed at the centre of the pans.

Applying principle of moment about 'F' we get

$$L \times BF = w \times AF$$

$$L = w [\because AF = BF]$$

4 Physical Examination:-

- | | | |
|------------------|---|------------------------|
| 1) Denomination | - | 10 kg |
| 2) Type | - | Roberval ordinary |
| 3) Pan | - | Scoop type (Goods pan) |
| 4) Make | - | ATLAS |
| 5) Pointer | - | Single movable pointer |
| 6) Visual defect | - | Nil. |

5 Procedure:-

- 1) The counter machine under verifications was taken in cleaned condition and coins placed on a well levelled table.

Table - 5
shift test (at half load)

sr. no.	Load on Pan		Position of load		Error observed	Error Prescribed	Remarks
	left	Right	left	Right			
1	5 kg	5 kg	C	C	-		equipoised
2	5 kg	5 kg	C	A	17.8 g	$10.5/9 =$	(B/L)
3	5 kg	5 kg	C	B	12.8 g	5.25g	(B/L)
4	5 kg	5 kg	C	D	14.8 g	---	(B/L)
5	5 kg	5 kg	C	E	10.8 g	---	(B/L)
6	5 kg	5 kg	C	C	-	---	equipoised
7	5 kg	5 kg	A	C	8.8 g	---	(B/L)
8	5 kg	5 kg	B	C	16.8 g	---	(B/L)
9	5 kg	5 kg	D	C	12.8 g	---	(B/L)
10	5 kg	5 kg	E	C	12.8 g	---	(B/L)
11	5 kg	5 kg	C	C	-	---	equipoised

- 2) General examination was made
- 3) No load Test :- At zero load, the m/c was equipoised. showed in table -1
- 4) Repeatability / sticky test :- After equipoised the machine at zero load a gentle push on the right pan and released immediately to be the stickness. Then similar operation was followed for left pan. Similarly the machine was tested for stickness at full load. showed in table -2
- 5) knife edges and bearing test :-
After equipoising the machine at half load i.e. 5 kg the right pan disturbed in forward direction namely forward - F, backward - B, inward - I and outward - O direction. Similar operation was followed for left pan also. The error observed were tabulated in table -3
- 6) Shift Test :- (at half load) :-
The counter machine was equipoised at half load i.e. 5 kg. Here the right pan is scoop type. so at the four points A, B, C, D of the goods pan (i.e. scoop) 5 kg weight can not be kept for this 2.5 kg weight is kept at the centre of the scoop pan and the pan 2.5 kg wt.

Table - 6.

Sensitivity test

Sr. No.	Load on Pan		Deflection of Pointer	Prescribed value of sensitivity	Remark	
	Left	Right				
1	10 kg	10 kg		}	equipoised.	
2	10 kg + 7g	10 kg	Appreciable		sensitive	
3	10 kg	10 kg + 7g	- do -		- do -	
4	10 kg + 7g	10 kg	- do -		7g	- do -
5	10 kg	10 kg + 7g	- do -		}	- do -
6	10 kg + 7g	10 kg	- do -			- do -

This manner at all the points 2.5 kg were placed once the 2.5 kg weight kept at centre and in all the cases, the error observed in the table - 4 similar process was followed in the weight pan keeping 5 kg weight at the centre of the scoop type goods pan and the results was tabulated in the table - 4.

2) sensitiveness Test :- (at full load) :-

The counter machine was equipped at 10 kg now weight equal to the prescribed value of sensitiveness was put on the right pan & deflection of pointer was observed. Similar operation was followed for left pan also observation was tabulated in the table - 5.

3) Error Test :- The machine was equipped at 10 kg load i.e. full load weight of the both pans were inter-changed & functional weight were added to the lighter pan and and equipped again half the weight added to the lighter pan was error due to inequalities of arms. The process of repeated for two times more table - 6

3) Fall Test 1 - Putting some weight on the right pan. The pan was made downward. The distance between the fixed and moving

Table - 7

Error Test (at full load)

Sr. No.	Load on Pans		Error observed	Error Prescribed	Remarks.	
	Left	Right				
1	0	0		}	equipoised	
2	10 kg (w_1)	10 kg (w_2)			equipoised	
3	w_2	w_1	$3\frac{1}{2} = 16g$		10.5g	(B/L)
4	w_1	w_2	-	}		
5	w_2	w_1	$3\frac{1}{2} = 15.5g$			(B/L)
6	w_1	w_2				equipoised

pointer was the measure of fall. This distance was measured by side calipers similar operation was followed for left part also and every operation was repeated.

6 Result :-

It was found that the counter machine under verification was non sticky & sensitive but error observed in case of beaming & knife edges test shift test, error test, and fall test, ~~is~~ beyond limit in accordance with the ISO 9000 (General) rules. 1987. limit in accordance with rules.

Hence, the counter machine ~~is~~ was rejected for stamping.

7 Precautions :-

- 1) weights ~~are~~ placed on the parts with due care to avoid any damage to the μ m.
- 2) During taking reading from side calipers parallel error was avoided
- 3) Fractional weights were handled with care.
- 4) Sufficient light was arranged in the lab.