

Experimental Investigation of Pole Stopper Performance in Anchoring of Vessels

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ABSTRACT: This methodology deals with the increase in performance of the pole stopper, and to improve labour safety while anchoring. In this system, the pole stopper end is coupled with a hydraulic jack instead of the pole stopper lock to reduce the effort in engaging pole stopper for breaking operation of the anchor. Hence the pole stopper operates in a semi-automatic and in an efficient manner. By converting the pole stopper into semi-automatic, the system can be operated in three ways namely, by directional valve, hand pump and also by manual method. By applying hydraulic jack mechanism in a manual pole stopper, the manual effort can be reduced in a tremendous manner, there is no anchor failure while anchoring the anchor due to the gradual submerging. Due to this system, if any failure occur in breaking motors, the breaking applied by the pole stopper makes it easy to do. It also increases overall efficiency of the breaking system. Anchoring failures can also be prevented and human lives can be saved. This project will be worthy in life saving of labour and also in anchor safety

KEYWORDS: Hydraulic Chain Stopper.

I. INTRODUCTION

The anchor stopper (chain stopper) is a device for holding the anchor chain to the windlass and the hawse hole. The anchor pole stopper is used for setting the anchor and discharge to the windlass. A fitting used to secure the anchor chain when riding at anchor, thereby relieving the strain on the windlass, and also for securing the anchor in the housed position in the hawse pipe. Chain stopper usually consists of two parallel vertical plates mounted on a base with a pivoting bar or pawl which drops down to bear on a chain link. The pole stopper is a device for holding the anchor chain to the windlass and the hawse hole. The anchor pole stopper is used for setting the anchor and discharge to the windlass. A hinged bar is fitted in the chain stopper which may be dropped between two links of the chain in order to prevent the chain from running out when the windlass brake is released. Pole stopper is a device which is used to braking of anchoring chain. Pole stopper is a one method/stage of braking in anchoring chain. There are three types/stages of braking system in anchor. They are Motor engage braking system, Drum braking system and Pole stopper. After conversion of Pole stopper in semi automatic (Hydraulic) can be operated in three ways, there are 1. Directional valve 2. Hand pump 3. manually. Directional valve will be attached with main control valve which use to open drum brake (can use same valve to open jack/cylinder). Pole stopper is a device which is used to braking of anchoring chain. Pole stopper is a one method/stage of braking in anchoring chain. There are three types/stages of braking system in anchor. They are Motor engage braking system, Drum braking system and the Pole stopper. After conversion of Pole stopper in semiautomatic (Hydraulic) can be operated in three ways, there are 1. Directional valve 2. Hand pump 3. manually. Directional valve will be attached with main control valve which use to open drum brake (can use same valve to open jack/cylinder).

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II. LITERATURE REVIEW

Chopra and Meindl, Mentzer (2012)

In this research paper they have come up with the idea of Integrated Automated Jacks for 4-wheelers in which the jack is provided on both the sides of the vehicle and can be easily operated with the help of a button placed at the dashboard of the vehicle. This jack is specially designed to overcome the difficulties faced by the senior citizens and ladies who find it difficult to manually operate the jack.

Mentzer et (2013)

In this research paper they have focused on an inbuilt hydraulic jack system which is attached to automobile vehicle on front and rear part of the chassis. There is a front suspension hydraulic jack that is mounted centrally to the front suspension of an automobile between its front wheels. There is also a rear suspension hydraulic jack that is mounted centrally to the rear suspension of the automobile between its rear wheels. The system operates from a compressed fluid reservoir tank that has connections for the front and rear car jack outlets.

Mayank Agrawal et al. (2018)

This paper represents a study over in- built hydraulic jack system and shows its benefits over traditional mechanical jack system. The design of inbuilt hydraulic jack is also studied and modified to require extent which can be seen by analyzing design of prototype. An Inbuilt hydraulic jack system can be easily operated by buttons provided on the dash board of the vehicle. The jack will be installed on chassis of the vehicle. The motive behind using this system instead of a conventional mechanical system is the more power produced by the system and simple in design as compared to a conventional design. As the hydraulic oil is incompressible so the lifting capacity is more in comparison with the pneumatic system which operates on air which is compressible.

Parth M. Patel et al. (2013)

This paper describes Implementation of Automatic hydraulic jack Mechanism in a four wheeler itself. The jack will be powered by the battery. So at a time of puncture to replace the wheel one has to just press the button and the jack which is fitted in the car itself will lift the car.

III. OBJECTIVE OF PROPOSED WORK

- To Prevent Anchor failure.
- Worker safety.
- To reduce labor in the time of anchor braking.
- To hold the anchor safely.

IV. SELECTON OF POLE STOPPER

Features of Marine Roller Lever Pole Stopper

Nominal Diam	Chai n Diam	L	L 1	L 2	L 3	L 4	B	b 1	D	d 1	d 2	h 1	h 2	t	t 1	Weight(kg)
44	42~44	10	37	40	27	80	38	26	48	28	62	39	28	12	32	274
48	46~48	10	42	45	30	85	44	28	52	26	73	43	30	10	34	351
52	50~52	11	44	47	32	90	50	30	55	27	77	44	31	11	35	451
56	54~56	11	45	48	33	95	53	31	58	28	80	45	32	11	36	536

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60	58~60	1 2	4 7	5 7	3 6	9 5	6 1	3 3	6 2	3 8	4 7	3 9	1 7	4 6	651
64	62~64	1 2	5 0	6 0	3 7	1 0	6 6	3 4	6 4	4 0	9 4	5 2	4 0	1 7	753
68	66~68	1 3	5 5	6 4	3 9	1 0	7 3	3 7	6 8	4 2	4 0	1 4	5 2	4 8	939
73	70~73	1 3	5 7	6 7	4 7	1 1	8 0	4 0	7 3	4 5	1 0	5 8	4 6	2 0	1178
78	76~78	1 4	6 1	7 0	4 4	1 1	8 6	4 2	7 8	4 8	1 1	6 3	4 9	2 2	1422
84	81~84	1 4	6 5	7 4	4 7	1 2	9 4	4 5	8 4	5 0	1 2	6 7	5 3	2 4	1758
90	87~90	1 5	7 1	7 8	5 0	1 3	1 0	4 8	9 0	5 5	1 3	7 2	5 7	2 6	2171
95	92~95	1 6	7 4	8 2	5 3	1 4	1 0	5 0	9 5	5 8	1 3	7 6	6 1	2 8	2567
102	97~102	1 6	7 9	8 7	5 7	1 4	1 1	5 4	1 0	6 4	1 0	8 5	6 0	3 0	2755
107	105~107	1 7	8 4	9 0	6 0	1 5	1 2	5 6	1 0	6 3	1 5	8 6	6 9	3 2	3640
114	111~114	1 8	8 8	9 4	6 3	1 6	1 2	5 9	1 1	6 8	1 6	9 1	7 4	3 4	4302
122	117~122	1 8	9 3	1 0	6 7	1 6	1 3	6 3	1 2	7 0	1 7	9 8	7 9	3 6	5326
132	124~132	1 9	1 0	1 0	7 3	1 7	1 4	6 7	1 3	7 5	1 8	1 0	8 6	3 8	6244

Anchor Chain Diameter:95mm;

Weight :2567kg;

Material : Cast Steel;

Smooth, polished surface without any defects such as cracks, sand hole that influence the strength;

Surface Coating: anti-rust primer and bitumen paint;

Flexible roller, accurate positioning;



(Wheel bearing)

HYDRAULIC_JOCKEY A system for transfer die set from pipe machine to the equipment store section for the various size of pipe production. A moveable hydraulic jockey is used for changing a Die set. Dies set. various process of hydraulic wheels play major role and brief explanation about it.

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V. CALCULATION OF HYDRAULIC JACK

FACTOR OF SAFETY:

It is the ratio between ultimate load of the material to the maximum working stress.

Let we take factor of safety=4

Factor of safety= ultimate load/working load

Working load = anchor weight + total chain weight + pole stopper weight

$$=12 + 3.9 + 2.567 \text{ (tons)}$$

$$=18.467 \text{ tons}$$

To find ultimate load:

Take ultimate load =X

Factor of safety = ultimate load/working load

$$4 = X/18.467$$

$$X = 4 \times 18.467$$

$$= 73.868$$

Ultimate load (X) = 73.868 tons

Hydraulic jack specification,

Capacity	= 100tons
Minimum height	= 480mm
Maximum height	= 760mm
Stroke	= 300mm
Diameter of cylinder	= 219mm
Dimension of plunger	= 125mm
Dimension of oil pump	= 180mm
Pressure of oil	= 63 MPA
Lifting height of piston	= 300mm

VOLUME DISPLACEMENT OF HYDRAULIC CYLINDER :

$$Q = AS / 231$$

Q = volume displacement

A = cylinder area

S = cylinder stroke

A = diameter of piston x π

$$=17.5 \text{ cm}^2 \times 3.14$$

$$=549.5 \text{ cm}^2$$

S = 18cm

$$Q = (549.5 \times 18) / 231$$

$$Q = 42.82 \text{ cm}^3$$

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Fig (6.3): fabricated model of moveable hydraulic jockey



Fig(6.4 & 6.5) : Jockey and Link chain

VI. CONCLUSION

The equipment is purposely designed for cargo ships having weight of 70,000 tons. It is suitable for holding the anchoring chain. The equipment will result more beneficially when it is subjected to failure of motor brake and also drum brake and then it is easily stop the anchoring chain from falling down. The performance of the equipment will increase on the smooth surface or less uneven surface and also it is more effective when it is used for failure of other brakes.



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