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The Analysis on the Bouys Used on the River for Making a Non-Conventional Energetic System

River buoys separate themselves from the maritime ones by their special construction which provide them with a low draft and their stability is calculated for waves of small height and short period. The tail of these buoys is usually made out of one cylinder with a big diameter. The river buoys are technically capable to ensure the surveillance of the pass on special sectors, on sectors in which the level of the water is fluctuating or nearby islands or ports.

1. Introduction

River buoys are used as buoyant warning signals at the mouths of water flows, entrance in ports, channels and passes. Like other buoyant means for fitting out navigable water ways, they cannot be considered reference points to determine the location of the ship because they can be carried out by the current, wind, other ships etc.

The river buoys must perform the following conditions:

1. they must have a low draft
2. they must keep their place permanently
3. they must stay vertically and be anchored so that the wind or the current cannot move them
4. they must have a simple construction
5. they must have stability at small waves with short period
6. the tail of the buoy must be a cylinder with a big diameter in order to be used for shallow water with strong current and be kept safe of the danger of being hit by buoyant bodies.

2. The conical river light buoy

This buoy is used on streams with a small depth and is formed out of a metallic floating cone. The body of the buoy is made out of C3 or C4 steel. At the basis of the cone are welded two lifting hooks.

In the center of the buoy is a prone seat for the acetylene bottle. The orifice of the seat is closed with a watertight cap. Through the center of the cap passes a screw with a ring. From the exterior part of the screw are fasten two shut-down levers which keep the cap permanently opened. For the tightness of the cap a rubber fitting can be added.

On the water line of the buoy is fixed a protective waist which defends the body of the buoy from bumps and reduces the rolling through the resistance it opposes in water when the buoy oscillates.

On the interior face of the buoy's body, in the center it is fixed a ring from which the anchor chain is fastened.

To give it a greater stability to the current, under the weigh center of the buoy it is fixed a counterbalance in the shape of a massive ring.

These kinds of buoys have a good stability on a 2 Knots current speed.

The conical river buoy is made out of the following components:

1. the conical body with spherical bottom, out of welded steel;
2. the superstructure has the form of a central tube for installing the mechanism which produces light;
3. the cylindrical weigh on the bottom of the buoy;
4. the seat for the acetylene tank or the electrical battery;
5. the anchoring installation.

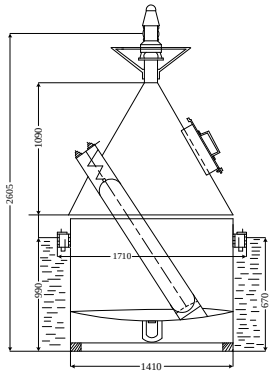

Figure 1.

2.1. Main dimensions and data

Total height of the buoy: 2.3m
The maximum diameter of the buoy's body: 1.7m
The draft of the buoy: 0.6m
The height of the light above the water: 2m
The thickness of the material out of which the buoy is made: 4-5m

The type of the acetylene tank: B-27 (1 piece)

The type of the electrical elements: M.O.E.M.-300

The type of the light producing machine: P.F.-1, A.M.-100, A.M.- 140, E.M.-100, E.M.-140

The caliber of the chain: 13-17mm

The total weigh of the buoy, without the anchoring installation: 0.75t

The weigh of the anchor: 0.45t

The depths at which the buoy can be anchored: from 2 to 15m

2.2. The river light buoy

These buoys are installed on the water flow with strong current and great depths. The body of the buoy is made out of C3 or C4 steel.

The buoy is made out of two cones.

The inferior cone has a very small height in order to oppose as less resistance to the current as possible. The upper cone has above the cap of the seat for the tank. The seat of the acetylene tank goes across from one end to the other the buoy's body and it extends in the lower part.

The inferior part of the seat together with the gas recipient represents the counterweight of the buoy. On the cap of the seat there is a platform on which the light producing mechanism it's installed. In order for the buoy to keep its position under the action of the current, the tail has a rudder.

The chain is fixed on the tail of the buoy near the rudder. The weight center of the buoy is low and it provides a good stability, on a current up to 4 Knots.

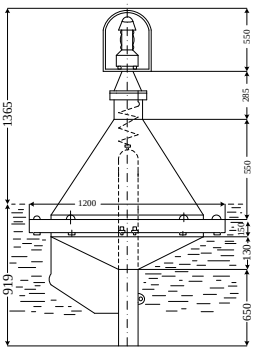

Figure 2.

The small river buoy has the following parts:

1. the body has cone like shape with a conic bottom, made out of welded steel

2. the central tube has above the platform for the light producing mechanism

and below the seat for the acetylene tank

3. the anchoring installation

Total height of the buoy: 2.3m

The maximum diameter of the buoy's body: 1.2m

The draft of the buoy: 0.9m

The height of the light above the water: 1.1m

The thickness of the material out of which the buoy is made: 4-5m

The type of the acetylene tank: B-27 (1 piece)

The type of the light producing machine: A.M.-100

The caliber of the chain: 8-12 mm

The totals weigh of the buoy, without the anchoring installation: 200 kg

The weigh of the anchor: 250 kg

The depth at which the buoy can be anchored: from 2 to 10m

2.3. The installation for buoy anchorage

The anchoring installation is made out of the following parts:

1. the shackle
2. the anchor chain
3. the anchor

The shackle is fastened to the ring of the chain. The shackle must not twirl.

To lift the shackle, a separate chain is used. In order for the chain not to rub against the buoy's body and damage its paint, at some buoys it is not directly fixed to the ring but to a special support.

In order for the chain of the buoy not to twirl and snarl, it is fixed with 3 whirl keys.

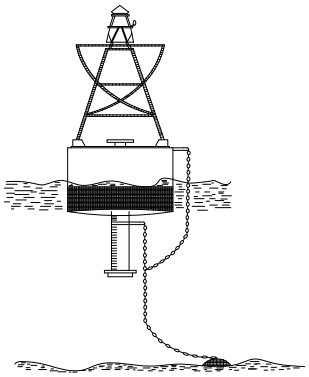

Figure 3.

One of these is fixed near the shackle, the second half of the chain near the

weigh, and the third at the bottom end of the anchor chain.

The overall length of the chain can be calculated after the formula:

L=T+2,5D.....waves:

T= the draft of the buoy in meters,

L= LOA of the chain of the anchor in meters,

D= the depth of the water in meters.

The length of the chain to be lifted is usually 1-2 times the draft of the buoy. The anchors used for buoys must be smooth and without sharp edges. There are usually used anchors made out of metal plates or concrete prisms. The metal plates used as anchors are made out of cast iron and have a regulated form; it is not permitted to be finished at the lathe or the planing machine.

The grey cast iron is more often used because it has mechanical properties, it stands up at corrosion longer than the steel and it is more resistant at the sea water's action for a long time.

The inner face of the anchor is slightly concave. This concavity permits it to catch well on a soft bottom. The upper face of the anchor is convex and has its margins rounded in order for the chain not to snarl around the anchor. This type of anchor fixates itself well on the bottom.

NOTE: The ring of the anchor screws itself in the center of the segment or two rings are tied at the end of the segment, in a 45° angle.

2.4. The Anchor Chain, Shackle, Twirl Keys

For different types of buoys there are used these kinds of chains for anchoring:

1. For roadstead buoys and small maritime buoys a chain with a chain mail caliber of 19mm. The chain has chain mails with a bridge.
2. For medium maritime buoys, lighted and with sound installation a chain with a chain mail caliber of 28mm. The chain has chain mails with a bridge.
3. For medium light buoys a chain with a chain mail caliber of 22mm is used. The chain has chain mails with a bridge.
4. For big light buoys and with sound installation a chain with a chain mail caliber of 28-31mm. The chain has chain mails with a bridge.
5. For winter buoys type G.I.-2300 a chain with a chain mail caliber of 31mm is used. The chain has chain mails with a bridge.
6. For winter buoys typeG.I.-720 a chain with a chain mail caliber of 22mm is used. The chain has chain mails with a bridge.

The shackle and the twirl keys are chosen in accordance with the chain.

2.5. The buoy's form

The form is the technical document for the study of the buoy's qualities.

The form is filled in for all the installed buoys in the respective department of the sea and which are part of means to secure the sea.

When the buoys are installed for a short period of time, the form is no longer filled in.

For every buoy the form is filled in 3 or 4 copies: one for the subunit which has the buoy on its inventory, one for the hydrographic department and one for the Maritime Hydrographic Direction.

In the form there must be stipulated:

1. the name of the buoy; 2. the name of the sea and the department in which it is installed; 3. the latitude and the longitude of the point in which it is installed; 4. the geographic name of the place in which it is installed (golf, bay); 5. the name of the danger or the pass which it marks; 6. the depth at which the buoy is anchored (with a precision of 0,1m); 7. the nature of the bottom on which it is anchored; 8. the type of the buoy; 9. the description of the buoy's aspect; 10. the height of the light's center above the sea level; 11. the draft of the buoy; 12. the weigh of the buoy without the chain, lantern, gas tanks or electric batteries; 13. the sound signaling installation; 14. the color and the characteristics of the light; 15. the type and the number of the lantern; 16. the light source indicating the intensity of the light; 17. the visibility of the light in Nm; 18. the geographical visibility of the buoy in Nm; 19. the name of the eclipse device, its type and number; 20. the supplementary device (solar vulvae); 21. the power source; 22. the total energy reserve; 23. the duration of the buoy's functioning with complete reserves; 24. the duration of the buoy's running within a year; 25. who is in charge of the well functioning of the buoy and its maintenance on the spot mentioned in the bulletin; 26. the type of the anchor; 27. the number of the anchors; 28. the weight of the anchor; 29. the anchor chain, its length, weight, and the chain mail caliber; 30. the number of the twirl keys; 31. the dimension of the twirl keys; 32. the supplementary chain; 33. other data regarding the technical installations of the buoy.

3. The behavior of the buoys fasten through a vegetable rope

In the projection of a buoy we held into account the life time, the tensions owed to the currents, which are different from a season to another, and whose speed varies on bad weather, rising with 1 m/s. To study the anchorage elastometric tensions in the buoy, a device has been mounted which serves for the measurement of the wind forces and the currents. The data has been processed at intervals of days, the maximum and the minimum tensions are collected. The medium tension an hour of the buoy has a value of 1100kg strength. In figure 4 the four tips are due to the currents which had their maximum and minimum values four times during 24 hours on bad weather (figure 4.a) and on good weather (figure 4.b) in October - November 2005.

The height of the wave because of the wind and current as well as the

tension in the buoy in the same period of the year are presented underneath.

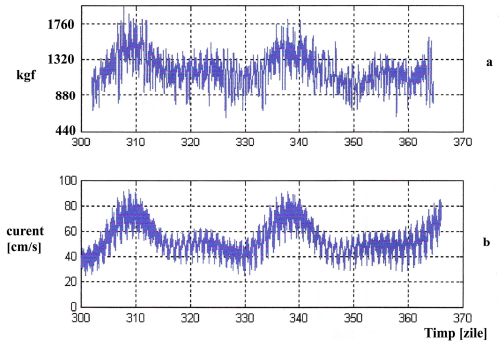

Figure 4

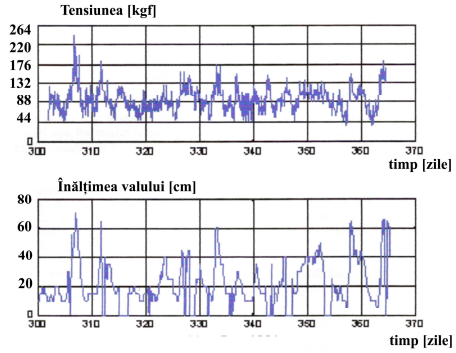

Figure 5

The height of the wave because of the wind and current as well as the tension in the buoy in the same period of the year are presented underneath.

The statistic results obtained from the characteristics in figure 5 are presented in the next table.

Table 1

Current (m/s)	Elastic Tension (kgf)	Elastic Watch Circle (m)	Chain Tension (kgf)	Chain Watch Circle (m)
0.1	1210	0.2	1102.2	44.0
0.4	1225.4	3.1	1192.4	49.7
0.8	1397	10.9	1478.4	56.8
1.2	1766.6	19.5	1903	61.8
1.6	2263.8	28.0	2453	65.5
2.0	2855.6	36.7	3135	68.4

4. Conclusion

The differences obtained in the case of two buoys, one with an anchoring system which has a vegetable rope and the other one with chain are presented in figure 4 where the speed of the current wad between 0,1m/s and 2m/s. The characteristics of the tensions function of time at speeds of the current between 0,1m/s and 2m/s have risen.

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