

Design and Application of a New Type of Reversible Bulwark System

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Abstract

For ships sailing internationally, there are opportunities to pass through canals all over the world, and each canal has corresponding rules and regulations. For ships that need to pass through the Panama Canal and the St. Lawrence Canal, the width of the bridge deck needs to be taken into account. Therefore it is necessary to design a reversible bulwark. In view of the unsafety of the simple reversible bulwark at present, a new type of reversible bulwark system is proposed and applied in real ships.

Keywords

International Voyage Ships; Panama Canal; St. Lawrence Canal; Reversible Bulwark.

1. Preface

Ships in the unlimited navigation area will pass through canals all over the world, and different canals have different calibers. Therefore, in the process of ship design, ships that need to pass through different canals need to take into account the rules and regulations of different canals.

2. Requirements for Bridge Wings in the Specification

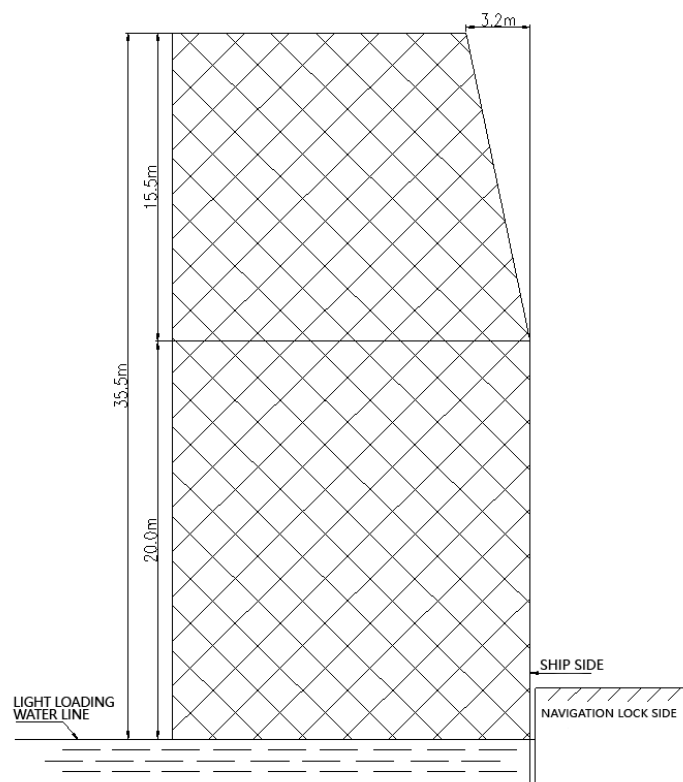


Fig. 1 Schematic diagram of the requirements for the size of the ship in the St. Lawrence Canal lock

In the rules of the St. Lawrence Canal, in order to prevent the ship in the lock from colliding with the lock wall, the dimensions of the superstructure of the ship are as follows: the width of the superstructure shall be controlled within the limit line required by the rules. The limit line starts to shrink towards the middle of the ship at the height of 20m above light loading water line, and it needs to retract 3.2m to the height of 15.5m . See Fig. 1 (APPENDIX I SHIP DIMENSIONS).

The Panama Canal Regulations stipulate that the wings of the bridge deck of the ship should extend to the maximum width of the ship. If it is not possible, it should be extended as far as practicable, and at the same time, a platform that can be rotated out or movable should be set up. (4.Navigation Bridge Features Required of Transiting Vessels/c. Bridge Wings).

3. Real Ship Analysis

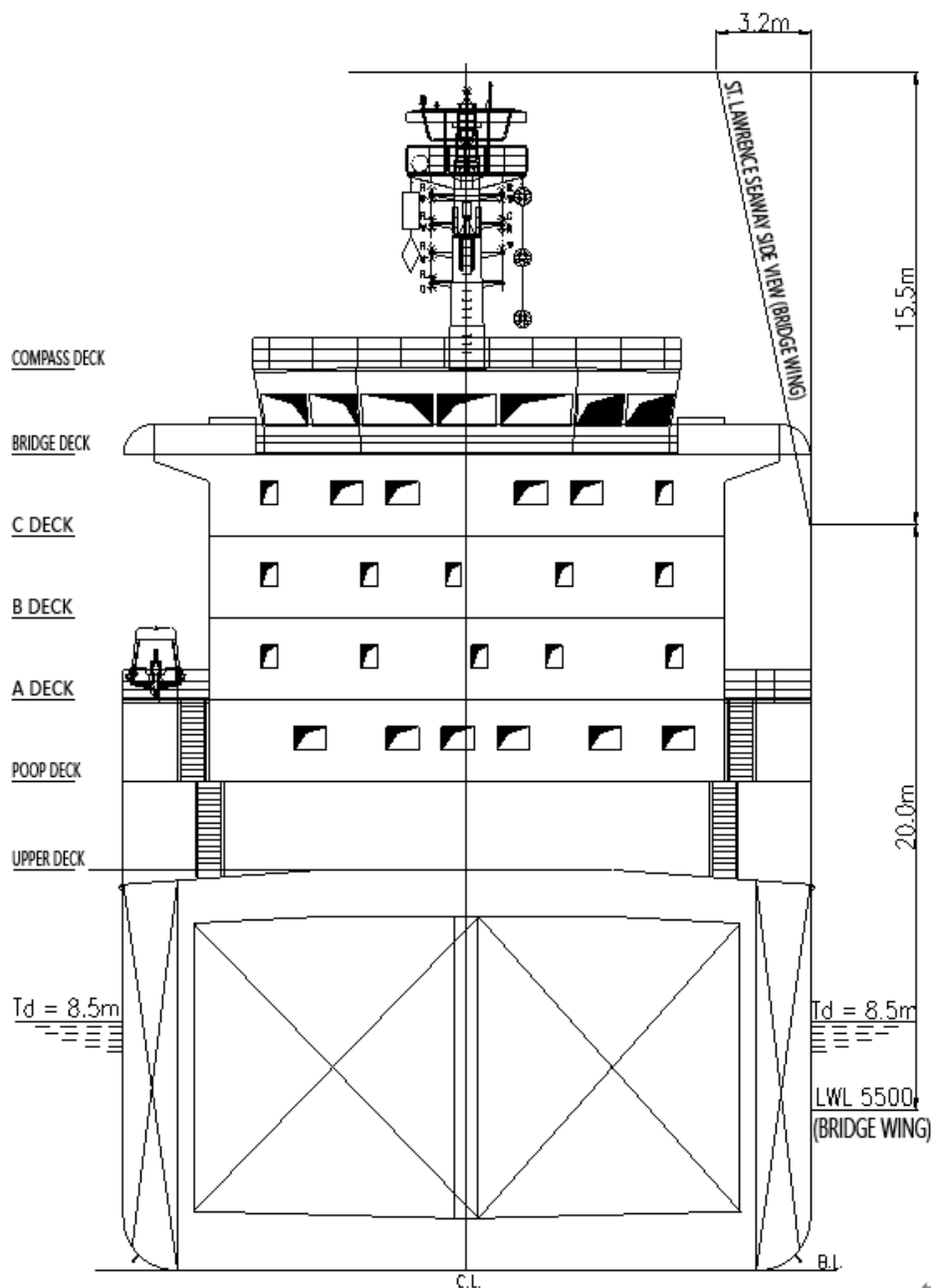


Fig. 2 Construction section of an asphalt ship

The sailing route of an asphalt ship needs to pass through the Panama Canal and the St. Lawrence Canal. However, due to the limitation of the St. Lawrence River lock, the width of the bridge wing cannot reach the maximum ship width, and the two wings of the bridge deck of the ship passing through the Panama Canal should be extended to the maximum width of the ship. If this is not possible, it should be extended as far as practicable, and at the same time, a platform that meets the requirements can be rotated out or movable for the use of pilots.

An asphalt ship has a width of 23.5m . According to the regulations of the St. Lawrence Canal, the width of the superstructure must be within the boundary line before it can safely pass through the canal. The superstructure of an asphalt tanker designed according to the rules of the St. Lawrence Canal is shown in Fig. 2. It can be seen in Fig. 2 that the bridge wings of the pilot deck are beyond the limit line at the maximum beam width.

As mentioned in the Panama Canal Rules regarding bridge wings, the two wings of the bridge deck of the ship should extend to the maximum width of the ship. Therefore, the bridge deck needs to be designed with a reversible bulwark. When the ship passes through the St. Lawrence Canal, the platform is retracted as part of the bulwark to control the width of the bridge deck within the limit line; when the ship passes through the Panama Canal, the reversible bulwarks were lowered to serve as platforms for Panamanian pilots.

4. Problems with Existing Designs

In the existing design (as shown in Fig. 3), the extension platform basically adopts a simple platform (that is, the reversible bulwark), and the eye plates are installed at the edge of the deck and at the edge of the reversible bulwark. The eye plates on the reversible bulwark and deck are in one-to-one correspondence and are on the same straight line. One end of the small marine chain is first fixed on the eye plate of the reversible bulwark by the shackle, and the bulwark is slowly lowered manually. After the bulwark is leveled, the other end of the small chain is fixed on the eye plate on deck through the shackle. After passing through the canal, the bulwark can be retracted by manually pulling up. The reversible bulwark weighs about 100kg . It is very dangerous to manually lift the platform.

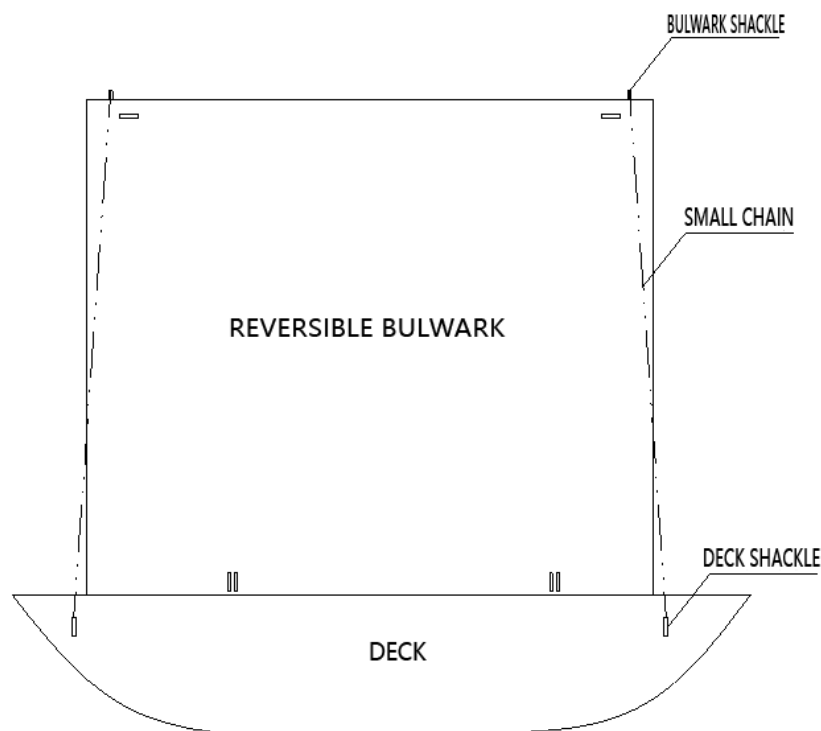


Fig. 3 Top view of the simple platform onbridge deck

5. A New Type of Reversible Bulwark System

In the design of the reversible bulwark of an asphalt ship, a relatively safe storage method is adopted. Fig. 4 shows a top view of the installation of the reversible bulwark system.

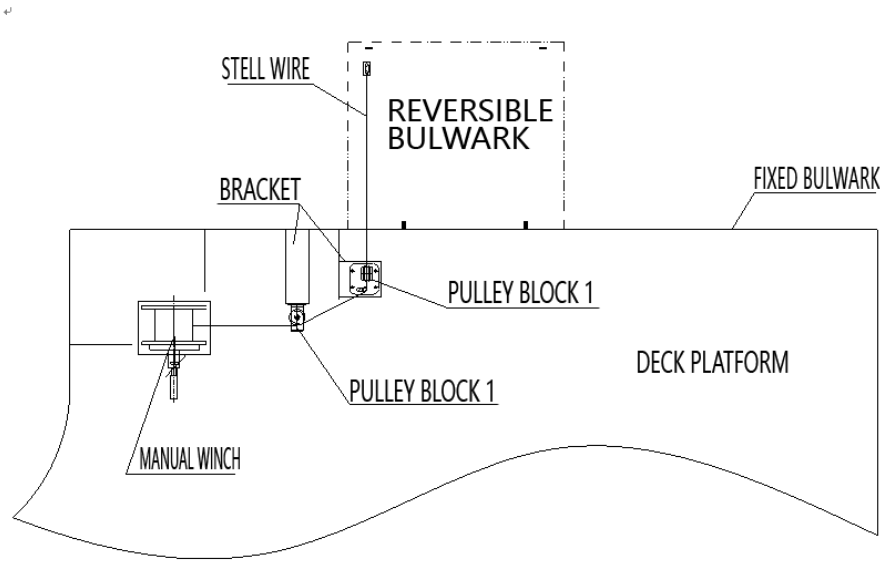


Fig. 4. Top view of the system installation of the reversible bulwark

Fig. 5 is a schematic diagram of system installation.

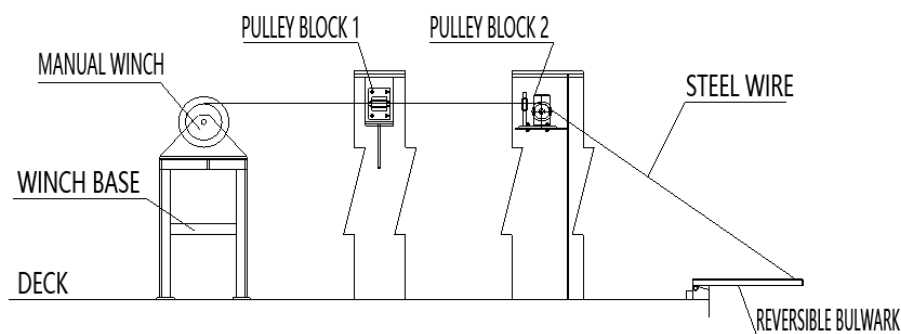


Fig. 5 Schematic diagram of the installation of the reversible bulwark system

The composition of pulley block 1 and pulley block 2 are respectively given. Pulley block 1 is composed of a pulley and a roller. The roller mainly plays a guiding role. Installation, in which the roller part consists of a U-shaped strut made of round steel with a diameter of 18 mm, a round tube and a limit block set on the outside of the U-shaped roller strut, and the limit block is made of round steel with a diameter of 6 mm and is both ends of the fixed round tube welded to the U-shaped strut. The pulley of the second pulley block is placed horizontally, the installation height should be at the same height as the wire rope of the winch, and it is welded to the bulwark bracket through the backing plate. Fig. 6 is the view of the pulley block 1, and Fig. 7 is the view direction of the second pulley block. Fig. 8 is the roller part of the pulley group one.

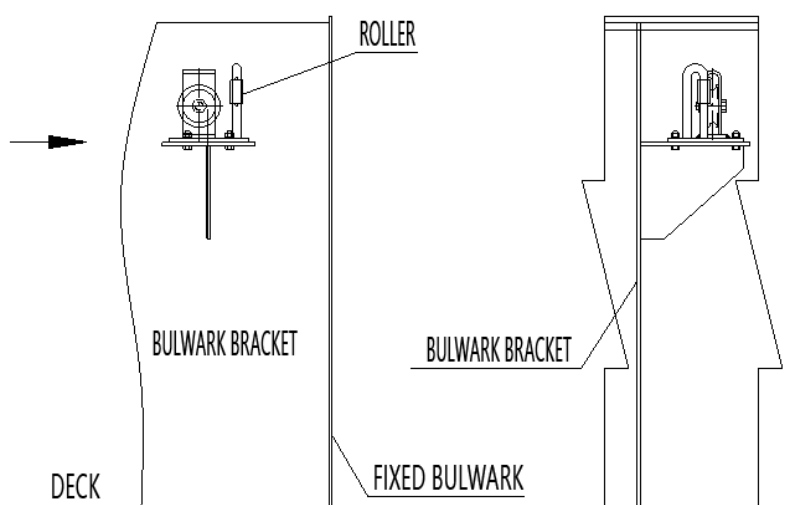


Fig. 6 Pulley group one

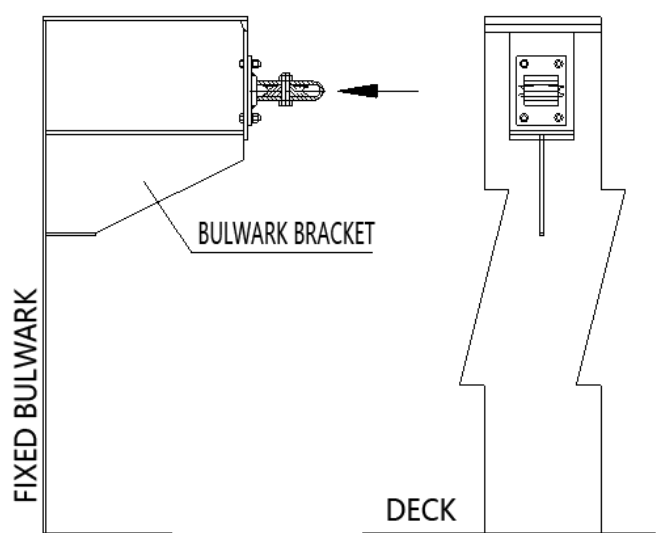


Fig. 7 Pulley group two

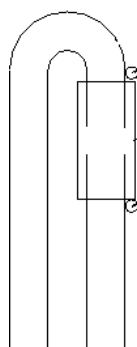


Fig. 8 Roller parts

The system of this set of reversible bulwarks has been the national utility model patent and also applied on a real ship. Fig. 9 is the installation photo of the actual ship. Due to the type of the bridge

deck in the actual ship, the distance between the winch and the reversible bulwark is relatively close, so the second pulley block is cancelled according to the actual situation, which also reflects the flexibility of the system. Adjust the position of each component of the system according to the layout of the bridge deck and the form of the edges. Or cancel the arrangement of the second pulley block when the winch is very close to the bulwark and the deck space is tight.



Fig. 9 Reversible bulwark on real ship application

6. Summary

The advantages of this set of reversible bulwark system are obvious. First of all, it ensures the safety of the crew. Secondly, the system is flexible and not limited to one deck shape. The installation of system changes accordingly with the changes of the contour. Thirdly, if the winch is replaced by a small electric winch, it will greatly save manpower.

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