Chapter 2
Configurations and Characteristics of Ship Structural Assemblies

1 Introduction

This chapter presents the main configurations and characteristics of ship structural assemblies. Both transversely and longitudinally stiffened bottom, deck and side shell structure assemblies are considered. The main structural features of transverse bulkheads are described. A brief description of the scantlings of ship strength members is introduced. The basic role of classification societies is clarified. Some ship structural connections and details such as frame brackets, beam brackets, tripping brackets and connection between bottom longitudinals and bottom transverses are accentuated.

2 Ship Structural Assemblies

The main ship structural assemblies are:

- Bottom structure
- Side structure
- Deck structure
- Transverse bulkheads

3 Bottom Structure

3.1 Single Bottom Structure

In small vessels having single bottom, open floors are fitted at every frame and are stiffened at their upper edges. When a bar keel is fitted, the floors are continuous from bilge to bilge and when using a flat plate keel a continuous longitudinal center keelson is fitted. In this case the center keelson is continuous and runs as far forward and aft as possible, the floors are made intercostal. Side keelsons are made intercostal and extend as far forward and aft as possible. In way of the machinery space additional side keelsons should be fitted to support the heavier machinery weights.
3.2 Double-Bottom Structure

The double bottom structure is composed of outer and inner watertight bottom plating to provide complete watertight integrity should the outer shell plating be pierced in way of the double bottom. The minimum depth of the double bottom depends on the size of the vessel and is determined by the rule requirements of classification societies. The actual depth is sometimes increased in places to provide adequate capacity of the double-bottom tanks. One or two side girders are fitted port and starboard depending on the width of the ship. The side girders could be either continuous or intercostal, see Fig. (2.1).

Watertight floors are fitted beneath the main bulkheads and are also used to subdivide the double-bottom space into tanks for ballast water, fuel oil or fresh water. Solid plate floors of non-watertight construction are lightened by manholes, see Fig. (2.2). Manholes are provided for access through the tanks and lightening holes are cut to reduce the steel weight of these floors. Also, small air and drain holes may be drilled at the top and bottom edges of the solid plate floors in the tank spaces. The spacing of the solid plate floors varies according to the loads supported and the induced local stresses. Bracket floors are fitted between solid plate floors. Bracket floors consist of plate brackets attached to the center girder and the side shell with bulb plate or angle stiffeners running between. The stiffeners are supported by angle bar struts at intervals and any side girders, see Fig. (2.3). The inner bottom provides a considerable margin of safety, since in the event of bottom shell damage only the double bottom space may be flooded. The double bottom space is utilized to carry oil fuel and fresh water as well as providing the required ballast capacity.

**Fig. 2.1** Longitudinally stiffened double bottom structure

Water ballast bottom tanks are commonly provided right forward and aft for trimming purposes and the depth of the double bottom may be increased in these regions. In way of the machinery spaces the double bottom depth is also increased to provide adequate capacities for lubricating oil and fuel oil. The increase in the inner bottom height is always made by a gradual taper in the longitudinal direction to avoid sudden discontinuities in the structure.