10th JUNE, 1909.

NOTES ON SOME MODERN METHODS OF STEAMSHIP CONSTRUCTION.

(By WALTER REEKS).

Since steamers were first built of iron as distinguished from wood and up to the present when steel is used almost to the entire exclusion of the less refined metal, many changes in the methods of construction have been introduced. It would be idle to attempt to enumerate them all, nor would it be worth while, but a few minutes spent on a glance at some of the more radical changes, so radical in fact as to establish distinct types of construction, may be of interest.

Leaving out for the moment the exceptional case of the "Great Eastern," which was in her time an entire departure from the then accepted method of construction, she being in point of fact a double skin ship, one skin outside the deep frames more or less in the ordinary way, excepting for the very narrow strakes of plating as compared with now-a-days; the other inside the frames secured to them per medium of the reverse bars. Leaving this vessel out then, it may be said that but for increased scantling due to the growth in size, no very radical changes in the method of construction obtained till comparatively recently.

The early method consisted of angle frames spaced uniformly throughout the vessel's length to which reverse bars were riveted, and served to stiffen the frame and formed a convenient means of securing stringers and hold battens; plate floors were attached to both frame and reverse bars, and extended from bilge to bilge, which, to gether with keelson or keelsons, gave the requisite strength for docking (plate xxix.). The beams with of course the

required camber, were placed on top with forged ends to give proper riveting surface, and acted also as knees. Vessels of size were usually fitted with 'tween decks, which added vastly to their athwartship strength, but not to the vertical strength, and this was obtained by hold pillars usually palmed and riveted to sides or top plate of the keelson below, and with a jog and palm above, the jog took the vertical web or bulb of the beam and the palm was riveted to keep it in place. In addition to the centre line pillars, there were in most cases additional pillars about the hatches, and in large vessels wing or quarter pillars again in addition to them; the number of pillars therefore often amounted to fifty in a single hold, and in some cases even more. It will be seen at a glance that such a forest of immovable obstructions would seriously interfere with the stowage of cargo. From the stevedore's point of view it meant lost time, and from the ship owner's standpoint lost space. Herein, then, lies the grain of mustard seed from which have sprung many of the most drastic changes in ship construction of late years, and produced in some cases practically new types. Of course, it goes without saying that the new types, while peculiarly adapted to certain trades and doing their work well, are not being built to the exclusion of the ordinary frame and pillars type: that is a form of construction that has stood the test of time and, excepting where special conditions have to be met, is still an excellent method.

The desire for clear holds, i.e., the absence of obstructions to stowage, is no new thing; much anxious thought and many careful calculations have been devoted to the subject, but, probably, to Mr. Alfred Holt, is due the credit of the first really practical effort in this direction; his method, like most things accomplished, was simple in principle. He substituted for the ordinary hatch carlines, which consist of a vertical plate secured to half beams by lugs and margin plates, a substantial girder of

box form, running all the length of the hold, strongly bracketed off the bulheads at each end and supported by four heavy built pillars, one at each corner of the hatch, thus doing away with a large number of small pillars and substituting four large ones, and so leaving large open spaces in the holds; this proved successful up to a point, and was by comparison, much more convenient, but still left something to be desired, viz., an entirely free hold.

Amongst the methods adopted to achieve the desired end, viz., clear holds, the deep or web frame system is now so well known as not to call for more than passing remark. They consist of built deep frames at intervals of from four to eight ordinary frame spaces which, in conjunction with special depth of stringers, efficiently stiffen the sides of the vessel and permit of the hold pillars being left out. This method goes far in the direction of clear holds, but still the web frames and stringers take up a lot of room and break stowage at the sides.

The introduction of the now familiar cantilever system (plate xxx.) by Sir Raylton Dixon and Co., Ltd., of Middlesborough on Tees, would appear to have completely solved the problem of clear holds. The construction consists of the usual double bottom, with deep frames spaced uniformly, and in point of scantling, a compromise between ordinary and web frames extending up the sides in the usual way to about where the lower deck would be, but there built inboard at an angle of 45 degrees, and terminating at the hatches, thus efficiently supporting the main deck, without the assistance of vertical pillars and leaving a practically clear hold. Seldom can one use the word "absolute," but this is a case where one may almost do so, for even the side stringers are worked intercostally, and do not project inboard beyond the ordinary hold battens, the gusset plates connecting them to bulkheads of necessity take up a small space in extreme corners, but for practical purposes it may be called an absolutely clear hold, and therefore the object accomplished.

While almost certainly the primary object of the cantilever system was to obtain clear holds, incidentally it led to what may be regarded as an entirely new feature in construction. The space above the frames where they turn inboard to form struts or substitutes for hold pillars is triangular in cross section and, therefore, not good for the stowage of ordinary cargo, and as most modern cargo boats are still very light, even with all their ordinary ballast tanks full, but no cargo, and as when in that condition often stiffer than is desirable, that space has been used for additional water ballast, thus giving the vessel a better hold in the water, and by carrying the weight high has given a degree of stability more in accord with modern practice, for while not wishing to get on to side issues, too great stability has been shewn to be derogatory to the longevity of many good vessels. This 'tween decks ballast space can, of course, be used for liquid cargo such as oil, and has, also, been turned to good account in at least one case for the conveyance of molasses. It will be noted that the plating of these 'tween deck tanks forms a continuous triangular shaped box girder of great strength in itself, and gives rigidity to the whole ship, both longitudinally and laterally. In addition to the points enumerated, the cantilever steamer is in common with other types, self-trimming, but that is now so usual as not to call for special remark.

Turning from the clear hold type, we find a radical change in the method of construction, patented and introduced by Mr. J. W. Isherwood, one of the senior surveyors of Lloyd's Register, and now known as the Isherwood system (plate xxxi.). The leading features are as follows: In place of ordinary frames, spaced 23 inches to 27 inches apart, according, of course, to the size of the vessel, large and strong transverse frames, including beams and floors forming a complete girder, are placed at intervals of from 15 feet to 20 feet. Obviously, plating over such large spaces

would not be strong, so in order to stiffen it, longitudinals are run all fore and aft and riveted to the shell plating, one or two on each strake of plate between their laps, the number depending on the width of such plating. Precisely the same thing is done with regard to decks, the fore and afters spanning over from pier to pier, otherwise the strong frames, to which fore and afters the deck plating is riveted, and additional intercostal keelsons in the double bottom. Broadly speaking, such vessels are built on the longitudinal principle as opposed to the transverse, and though attempts have been made before with more or less success, the latest development in the shape of Mr. Isherwood's system appears the best, for in addition to an appreciable reduction in material used, size for size of ship, which means corresponding increase in cargo capacity, time is also saved in the building by virtue of so much of the material being used in straight lengths, and so cost of production is reduced. It is seldom that the combination of greater carrying capacity at less cost can be obtained, but it appears to have been done in this case. A glance will show that the vessel produced under the system above referred to is in one respect at any rate, the antithesis of those referred to earlier, viz., clear holds, for while hold pillars are reduced to a minimum, some obstruction to cargo stowage arises from the strong frames. Some genius may yet combine the two and succeed in embodying the advantages of both systems.

The author, in this short paper, has only been able to touch on two or three systems of construction which appear to him not only novel but successful. There are of course others, for example, the whaleback pure and simple, as used on the great American lakes, the modification of that in the familiar turret deck steamer, and the very many modifications of self-trimmers, which he hoped would be touched upon during the discussion.