be a series of horizontal ranges of materials, supported by alternations of firmly secured triangles, so placed, that the bases of the superior ranges of these triangles derive firm support from the triangles of the inferior ranges. Considering the unalterability of form of the triangle, and the advantage of the pressure being brought upon the end grain, in which there is comparatively little shrinkage, this is certainly a mode of constructing a top-side which must be possessed of great rigidity. In fact, if there was an eιτor in the system of trussing the top-sides adopted by Sir Robert Seppings, it was, that he did not extend it to the extremities, even round the bow and stem, and also apply a similar system to the short stuff outside between the ports.

The advantages to be derived from triangular combina­tions of the timber composing the hull of a ship are yet but imperfectly appreciated. We have no doubt that great improvement in ship-building is to be effected by these means, unless, indeed, timber should be superseded by iron, and the stupendous and costly line-of-battle ship be destined to give place to small but powerfully armed steam­boats. An iron sailing vessel is being built in Scotland, of between five and six hundred tons burthen. It seems also not improbable that the introduction of so destructive a mis­sile as the hollow shot into naval warfare, will render it ex­pedient to diminish the aggregate loss from their effect, by lessening the size and increasing the number of the vessels used in naval battles. This is, however, as yet merely spe­culative.

Another important part of the diagonal system, as it is described in the foregoing account given by Sir Robert Seppings, was the making the bottom a solid mass, by filling in the openings between the frame-timbers. This we have already mentioned as most effective in resisting alteration in form. It possessed a more important advantage, in the immense additional safety it assured to the vessel in the event of grounding, or of starting a but of the plank. The introduction of the system of solid bottoms into the mercantile navy, which Mr Ballingall has so long and so strenuously urged, would be an incalculable advantage, not to the merchant or ship-owner, for the system of in­surance is their refuge, but to a class of men of equal value to England with either merchant or ship-owner—sea­men, whose lives arc often most cruelly sacrificed to the present immunity from pecuniary loss which marine in­surance guarantees to their employers.

We are no friends to the system of marine insurance. We doubt much whether the evils which have resulted from it, in the loss of human life, and its attendant miseries to survivors, the system of gambling which it encourages among all classes of commercial men engaged in it, and the fraud and crime which it often occasions, do not more than counterbalance its advantages, which, after all, may be summed up in this, that in the event of shipwreck, the merchant and ship-owner are indemnified for a loss which, in a majority of cases, would not have occurred had it not been for the recklessness and carelessness engendered by the very knowledge that this indemnification was to be purchased. We here advance no unsupported opinion : the Report of the committee of the House of Commons on ship­wrecks says, “ The system of marine insurance, though affording the means of protecting individuals from excessive loss, has nevertheless a tendency, by transferring the pe­cuniary responsibility for such losses from the owners of ships to the underwriter who insures them, to induce less care in the construction of ships, less efficiency in their equipment, and less security for their adequate management at sea ; in as much as the risk of such loss to the ship-owners can be covered by a fixed premium of insurance, which, being charged on the freight, and then recharged on the goods conveyed, fixes the real responsibility and real loss ultimately on the public; as all the parties actually engaged in the transaction can insure themselves from any partici­pation in such loss, by the aid of marine insurance.” This, too, is from the Report of a committee composed principally of merchants, of ship-owners, and of ship-builders. But to return to our more immediate subject, though we can hardly call this a digression, connected as it is with the progress of the science we are writing on.

The system of wooden riders, longitudinal pieces, and trusses (Plate CCCCLVL fig. 48), is now discontinued in Her Majesty's ships, and is superseded by a modification of the iron riders or braces, which were formerly only proposed by Sir Robert Seppings for frigates and the smaller classes of vessels. In the recent adaptation of these braces to line- of-battle ships, there are several material differences from the original plan. The ceiling, with its thick strakes over the heads and heels of the timbers, is restored, excepting that the planking between these thick strakes is laid dia­gonally, as shown in Plate CCCCLVII. fig. 49. There are also two ranges of iron riders ; the lower range is brought upon the inside of the timbers of the frame, and the ceil­ing worked upon and scored over them. The upper ends of this range of riders extend forward in the fore-body and aft in the after-body, and the heads run high enough to turn out upon the orlop clamps, and bolt through them. The riders of the upper range give long shift to those of the lower range, and their direction crosses that of the lower range at right angles. Both ranges are very secure­ly bolted through the bottom.

It will have been evident from the foregoing remarks, that we do not consider the hold as an advantageous situa­tion for any great expenditure, either of workmanship or materials, simply for the purpose of preventing the altera­tion in the form of a ship.

After having obtained the greatest degree of incompres­sibility compatible with the materials used, the next ob­ject, in this part of the body, should be to insure adequate local strength to resist the strain of taking the ground ; and we assume it for granted, that it is for this purpose the thick strakes at the heads and heels of the timbers have been restored, and also that the lower tier of iron riders is worked. The placing the ceiling diagonally be­tween the several assemblages of thick strakes, was proba­bly with an idea that it would act as a trussing; but, accord­ing to the views of the action of the disturbing forces which we have taken in this part of our article, it can have little, if any, effect in preventing alteration in form, beyond that of ceiling worked in the ordinary and less costly manner, and is inferior in other respects.

In the upper range of riders the iron bars are placed with their upper ends extending inwards from the extremities of the ship, offering a series of very effective ties, or braces, to connect the unsupported extremities of the vessel to the midship, or supported part, and to the firm basis of the zone about the surface of the water. This series of braces is unquestionably advantageous, and is also correct in prin­ciple, as affording support to the extremities of the vessel, by connecting them with the most unalterable part of the fabric, and to that portion which is abundantly supported by the external fluid. We think it probable that the addi­tional strength resulting to the lower part of the vessel from the lower range is scarcely adequate to the additional expense incurred by working them, with all the accessory fastening and fitting. This method which we have describ­ed of strengthening the floor, has not near the rigidity to resist damage from grounding, of the system that it has superseded, which certainly did, according to the intention of the inventor, partake of the nature of an inverted arch, or rather dome. It has, however, one, and that too a very considerable advantage, over the wooden diagonal system, as it offers a fair surface for stowage.