Since the luminous appearance of the Milky Way is caused by stars that are invisible to the naked eye, this part of the heavens presents a vast field for observation on the existence of a clustering power. To the naked eye it is visibly divided into large patches; and a telescope shows it to be still further subdivided into unequal groups, which, though now not completely detached, it is presumed will hereafter become insulated; so that the Milky Way will finally be broken up, and cease to be a stratum of clustered stars.

The same mode of reasoning that leads the imagination to conceive the progressive changes of its future existence, involves also the supposition of its origin at some period certainly very remote, but which it may possibly be in the power of *future* astronomers to estimate, by means of accurate observations on the rate of those changes that may be discovered to have taken place in the course of ages yet to come.

With respect, however, to the extent in space of that portion of infinity through which any objects are discernible, and the arrangement and relative distances of all celestial bodies yet observed, the author is of opinion, that some *present* judgement may be formed; and he is now engaged in a series of observations, with a view to investigate the visible extent of the universe.

On a new principle of constructing His Majesty's Ships of War. By Robert Seppings, *Esq. one of the Surveyors of His Majesty's Navy. Communicated by the Right Hon. Sir* Joseph Banks, *Bart. K.B. P.R.S.* Read March 10, 1814. [*Phil. Trans.* 1814, *p.* 285.]

After remarking upon the length of time that has elapsed since any considerable improvement has taken place in the art of shipbuilding, and the causes that appear to have prevented amendments being introduced, the author gives a general outline of the structure of ships, as hitherto built, which he represents as consisting generally of pieces of timber or plank, all placed nearly at right angles to each other. For, first, the ribs rise at right angles to the keel. The ribs are crossed, on their inner as well as outer side, with planks at right angles to them, and parallel to the keel. And within the inner linings are also a secondary series of ribs, called riders, at some distance from each other, parallel to the former set, and at right angles to the keel. Across this fabric are placed beams, connecting the opposite sides of the vessel; and these also are at right angles to all the parts before mentioned. From beam to beam, at right angles, are the carlings, which support joists parallel to the beams, on which are laid the planks of the deck, in a right line from head to stern, and accordingly preserving uniform adherence to the parallel and rectangular structure, which in every other instance of carpentry is known to every common mechanic to be the weakest form in which any number of lines can be framed together, as it affords no check to that bending of the materials to which they are liable in the direction of their greatest length. To this cause is to be ascribed the well-known

propensity of all large vessels to bend from head to stern when first launched, by reason of the great weight of the two extremities, and the little support at these parts in comparison with the centre, which, from its greater breadth, sustains an over-large proportion of the whole pressure.

This defect of the common structure is shown by reference to a common field gate, which, without the diagonal piece, or brace, would soon fail at every joint, but, when braced, partakes of the advantage of the triangular structure, the principle of which, when correctly applied, occasions the whole stress to be diverted from the transverse direction of the timbers employed, and thrown into that of their length, in which their strength is greatest.

Accordingly, in the new system of ship-building here described, the object of the author has been to introduce diagonal timbers and planks in as many parts of the fabric as could well be accomplished.

In the first place, a diagonal timber is introduced between the upright timbers in each interval between the ports; secondly, instead of the lining, which it has hitherto been the custom to place within the frame, a diagonal timber-work is introduced, intersecting the timbers of the frame at angles of 45°, and about six or seven feet asunder, with their upper ends abutting against what are called the shelf-pieces of the gun-deck beams, and having their lower ends supported by the timber strakes. Between these are also placed other timbers, equally inclined, but in an opposite direction, so as to present a rhombic net-work, which is dowelled to the original frame, and is itself further strengthened by short pieces placed diagonally from corner to corner of each rhombic compartment.

Beside the addition which is thus made to the strength of the sides of the vessel, these sides are also more firmly united together by an improved construction of the knees, by which the transverse beams are united to them. A degree of unity and firmness is also given to the decks by an oblique position of the planks, which, upon the same principle as before, brace the beams and joists, and resist that yielding of the joints which would otherwise take place in their rectangular construction.

The object of the author has been to give as much inflexibility as possible to every part of the hull; for in this part he conceives that unbending stiffness is better calculated than any yielding elasticity to resist those forces to which this portion of the vessel is liable; for though a hope has been entertained, that the known weakness of the common construction might lessen the violence of sudden shocks, by allowing each part to yield in some measure to the force impressed, this conception, he thinks, is not founded on any distinct knowledge of principles, and could not be entertained by those who consider that yielding does not imply elasticity, and who observe, that those parts which yield instead of recoiling with equal force, only become progressively weaker, in consequence of the violence they sustain.

In addition to the foregoing means of bracing by oblique position of timbers and decks, Mr. Seppings has introduced another practice,

which is altogether new, and contributes to the strength on a totally different principle. When a frame-work has the form of a parallelogram, its power to preserve that form depends solely on the strength of the joints; but when the space surrounded by this outline is filled with the same kind of materials, then every part will sustain a proportionate share of any force applied. Accordingly, in the new system, the openings between the ribs are filled in with slips of timber nearly to the height of the orlop, or lowest tier of beams; and when these pieces have been fitted, and closely wedged together, they are caulked and pitched over, so as to make the whole frame, from head to stern, to within a few feet of the greatest draught of water, one compact water-tight mass of timber. Hence, even if any of the outer planking of the bottom were to be knocked off, the ship might not only for a time be kept afloat, but permanently be secured from sinking; whereas, upon the old system, the starting of a plank has been often fatal to the ship and crew.

In addition to these principal improvements of Mr. Seppings, others of less importance are also described, and some observations are added respecting the economy of the new construction, not only with regard to the quantity of timber necessary, but also the quality, and the facility of replacing any parts that may afterwards be found decayed.

Remarks on the employment of Oblique Riders, and on other alterations in the construction of Ships. Being the substance of a Report presented to the Board of Admiralty; with additional demonstrations and illustrations. By Thomas Young, *M.D. For. Sec. R.S.* Read March 24, 1814. [*Phil. Trans.* 1814, *p.* 303.]

Dr. Young observes, that the question respecting the best disposition of the timbers of a ship is by no means so easily discussed as may be supposed by those who have considered the subject but superficially; and deprecates, on the one hand, the forming a hasty determination from a few plausible experiments, as only tending to expose those who are influenced by it to very dangerous errors; and, on the other, the total rejection of the conclusions formed from such experiments without a minute examination of the objections brought against them. He enters into a detailed enumeration of all the force that can act on the fabric of a ship, and into an exact calculation of the probable magnitude of each in such circumstances as are likely to occur; and afterwards considers how far the resistances to be opposed to those forces are sufficient to withstand their action. The strains which occasion the effect of arching are, he observes, of two kinds; the one derived from the distribution of the weight of the ship, with its contents being not duly proportioned to the pressure of the water; the other, which has not hitherto been noticed, from the simple and unavoidable application of the longitudinal pressure of the water to the lower parts of the ship only, amounting to more than one third as much as the former, in the case of a seventy-four gun ship of the usual dimensions, being equivalent to the effect of a weight