

6. "On the Temperature of Steam, and its corresponding Pressure." By John Curr, Esq. Communicated by J. Scott Russell, Esq., F.R.S.

In this paper, which is a continuation of a former paper bearing the same title, the author states that the law given in that paper, in reference to steam when superincumbent on the water in the boiler, may be rendered applicable to the determination of its pressure when insulated therefrom, as in the case of the expansive engine, of which the cylinder being in part filled with steam of the same temperature as that in the boiler, the communication is suddenly cut off, and the stroke is completed by the pressure on the piston of the steam whilst expanding within the cylinder. He considers that the power of expansive engines has been greatly overrated, instancing those of the Great Britain, which were of the estimated power of 1200 horses, but which he states he can prove did not exceed in actual power that of 300 horses. This he attributes to the inapplicability of Mariotte's law without a particular limitation. Having premised that "it is assumed that, by nature's law in the generation of steam, of the temperature 100° and of a pressure of 15 lbs. on a square inch, the density of the Matter of Heat, is to that of atmospheric air of the same temperature and pressure exactly as 1 to 2," he then gives general laws, by means of which, he considers, the pressure of steam when cut off from its generating source may be correctly estimated.

"In conclusion," the author states, "it may be said that, this and the former paper, both professing to give laws relative to the pressure and temperature of steam, *independently of experiment*, the theories proposed must in general be accepted as absolute truths, in case of being verified by experiment, or taken as vain attempts to subvert laws already firmly or sufficiently established."

7. "An Experimental Inquiry into the strength of Wrought Iron Plates and riveted Joints as applied to Ship-building." By William Fairbairn, Esq., F.R.S.

The object of the author was to determine by direct experiment the strength and value of rolled iron plates and bars of different forms in reference to their application to ship-building, and the construction of other vessels exposed to severe strain.

The experiments described in this paper were conducted with great care, and the irons used were purposely selected from those districts where the largest quantities were manufactured. The relative strengths of each kind, as also the deductions, are given in the order in which the experiments were made.

The author found the tensile strength of plates, when torn asunder in the direction of the fibre, and when torn asunder across the fibre, as nearly as possible the same. This fact is derived from twenty distinct experiments, and he attributes this equality to the improved method of manufacture which of late years has been introduced. This new system is described as rendering the plate more uniform by crossing the layers in the process of 'piling,' thus forming an alternate series of laminae, whose fibres cross each other in the body of the plate.

Having ascertained the comparative value of the different manufactures of plate-iron, the author, by another class of experiments, investigated the different methods in use of joining the plates together by rivets. This appears to be an important section of the inquiry, as the relative strength of each description of joint within reach of the experiments is clearly ascertained, and their relative values of strength determined in reference to each other, and to the plates themselves. These were found after a careful investigation to be nearly as the numbers 100, 70 and 56; that is to say, the plate being taken at 100, the double-riveted joint was 70, and the single-riveted joint 56.

The resisting powers of plates, and the different kind of joints by which they are united, having been proved, the paper goes on to investigate the value of the different kinds of timber when applied to a similar purpose, and by a careful comparison of the results, it is ascertained that the tensile powers of each, compared with iron, amber representing unity, are in the following ratio, viz.

Ash as	1 : 2.94
Teak as	1 : 3.33
Fir (good) as	1 : 4.16
Beech as . . .	1 : 4.34
Oak as	1 : 5.00

From the above it is inferred by the author, that iron being five times stronger than oak, a vessel built of that material is neither so strong, nor yet so secure, as the iron ship.

The next subject of inquiry is the transverse strength of angle-iron, **T**-iron and other sectional forms which enter into the construction of the beams, frames and ribs of ships. These combinations were likewise put to the test of experiment. In this part of the inquiry it was soon ascertained that bars of angle-iron used for that purpose are not of the best form, but exhibited great weakness when compared with wrought-iron beams of the **I** form, having flanges on both sides. From these results the author recommends that a combination of angle-iron should be used for these objects, as explained in the paper, and shown in the diagrams which accompany it.

In order to render the inquiry of practical value, experiments were made on the resisting powers of plates, by forcing a blunt instrument with hemispherical end of three inches diameter through the plates. These experiments were again repeated under similar circumstances upon timber, and a comparison is drawn from these data as to the resisting power of each. These experiments are interesting so far as they establish the superior strength of iron when exposed to severe strain, as frequently occurs in vessels taking the ground upon boulder-stones, or any uneven surface.

These results being obtained, the author closes the paper with a series of experiments made at Woolwich Dockyard on the strengths and elongation of iron-bars. In this department some curious results are obtained, such as the fact that an iron bar, when elongated to a considerable diminution of its sectional area, was not reduced but rather increased in strength; and after repeated experiments, it was found that wrought-iron bars, when elongated or wire-drawn, were

considerably improved in their powers of resistance to a transverse strain.

8. "On extraordinary Oscillations of the Sea; with an account of some Observations in Mount's Bay." By Richard Edmonds, Jun. Communicated by Sir Charles Lemon, Bart., F.R.S.

In this communication the author notices many remarkable oscillations of the sea which had been observed nearly a century ago in Mount's Bay and Plymouth Sound, and also elsewhere. He then particularly describes some which have occurred more recently at the former places. Of these the following are the principal:—

On the morning of the 31st of May, 1811, the sea was observed to rise and fall rapidly from 4 to 8 feet.

On the 5th of July, 1843, the author witnessed oscillations of the sea in Mount's Bay.

In the evening of the 30th of October, 1843, oscillations of the sea were observed in Mount's Bay and at Plymouth.

On the morning of the 5th of July, 1846, immediately after a terrific thunder-storm, oscillations of the sea were observed at Marazion. The author remarks that the great storm which passed over England on this day raged in the Atlantic during the night of the 4th of July.

On the morning of the 1st of August, 1846, the sea at Penzance pier was observed suddenly to rise between 1 and 2 feet, and as suddenly to rush back. It is remarked that London and its vicinity were visited on this day by a most destructive hail- and thunder-storm.

On the 23rd of May, 1847, there were extraordinary oscillations of the sea, and a slight motion of the ground was felt on the cliff between Newlyn and Mousehole.

After referring to the theories which have been advanced in explanation of these phenomena, the author observes, in conclusion, that, from what he has stated on the subject, and from the fact of earthquakes, as well as extraordinary oscillations of the sea, having so frequently occurred during thunder-storms, he sees no difficulty in the supposition, that all the oscillations to which he has referred may have resulted from submarine shocks of the earth, occasioned by electrical discharges between the earth and the atmosphere, or between oppositely electrified portions of the earth.

June 20, 1850.

THE EARL OF ROSSE, President, in the Chair.

The following papers were read:—

1. "Observations on the Nebulæ." By the Earl of Rosse, Pres. R.S., &c. &c.

The object of this paper is to lay before the Royal Society an account of the progress which has been made, up to the present time,