steam of boiling water upon them, as would be the case when the ordinary wafers were so treated.

Clay's Paste, of Wheaten Flour and Gelatine.—The paste by which the sheets of whited brown paper were so firmly held together, in the celebrated Clay's, of Birmingham, japanned paper tea trays, &c. was a composition of wheaten flour and carpenter's glue boiled together. Each sheet of paper was united singly to the others by this paste, the air being carefully driven out from between them by wiping with a coarse cloth from the centre towards the sides; and they were carefully dried in stoves, after the putting on of each layer. Thus combined, they might be sawn, planed, nailed, and glued together, in the manner of wood; but the articles were much lighter and stronger, when japanned, than if formed of wood.

[*Technological Repository.*

Additional Remarks on the Stowage of Ships. By Commander JOHN PEARSE, R. N.

My former remarks (see vol. iv. page 145,) were written with the intention of endeavouring to show that we have no regular system for stowing our ships, and that an alteration in the distribution of the weights is necessary. Subsequent to their publication, I have seen an authentic calculation of the weight and pressure, according to the ordinary distribution in a modern 74 gun ship. This has induced me to publish these additional remarks, by which I shall be enabled to prove that the alterations I proposed would materially contribute to remedy the inequality of the weight and pressure represented in the calculation alluded to; and which is referred to in the following observations of Dr. Young's, in his remarks on the employment of oblique riders. *Philos. Trans.* 1814.

"It is unnecessary to explain here the well known inequality of the distribution of the weight and pressure, which causes almost all ships to have a tendency to arch or hog, that is, to become convex upwards, in the direction of their length. It is possible that there may be cases in which a strain of a very different nature is produced; but in ships of war this tendency appears to be universal.

"It is, however, very different in degree in the different parts of a ship; and, of course, still more different according to the different modes of distribution of the ballast and stores, which may occur in different ships; but, in ordinary cases, it will probably be found nearly such as is represented in the calculations subjoined in the note,* deduced from data, which have been obligingly furnished by an acute and experienced member of the Navy Board."

* "In a modern 74 gun ship, fitted for sea, the length being 176 feet, the breadth 47½, the forces are thus distributed.

Aftermost 49 feet	Weight 699	Pressure 627	Difference 72 tons.
Next 20	297	405	— 108
50	1216	1098	118
20	290	409	— 119
37	498	461	37
176	3000	3000	000

By the above calculation, it will appear that there is an excess of weight at both extremities, and that in the adjoining sections the pressure greatly preponderates. Consequently, these forces are opposed to each other, and in a direction very prejudicial to the ship; as it is not only the evil of weight preponderating at the extremities, the power of which will be increased by the action of the ship, but from the formation of the body at those parts they can afford but a feeble resistance to so great a force.

Perhaps the following figures will best explain where the weights and pressure now preponderate, what particular weights may be supposed to cause an excess, and such as may be most conveniently and advantageously transferred.

Fig. 1.

Excess of weight 72 tons.	20 feet.	Excess of weight 118 tons.	20 feet.	Excess of weight 37 tons.
49 feet.	108 tons Excess of pressure.	50 feet.	119 tons Excess of pressure.	37 feet.

Figure the 1st represents the length of a 74 gun ship, divided into five sections, and the excess of weight or pressure in each.

Figure the 2nd also represents the length, divided into sections and the positions of the masts, by which it will be seen that they are situated in those parts where the weights preponderate; and that they greatly contribute to it is a very natural conclusion.

In the foremost section there is, unavoidably, not only the weight of the foremast and its rigging, but the bowsprit and anchors also; the latter stowed at the extremity of the section, and the bowsprit projecting considerably beyond it; which, on the lever principle, assisted by the action of the ship and the excess of weight, and being situated in a part which, from its formation, affords but little resistance, and which is frequently left unsupported, must considerably augment the pitching motion, and contribute to the tendency to arch or hog.

In the aftermost section, the mizen-mast may be considered as contributing to the excess of weight; but it is not of such magnitude as the fore or main-mast; and its position is much more favourable for the ship than the fore-mast. The strain also on the after part is not so great as forward, as it is seldom left so entirely unsupported

by the passing of a sea, and the sending motion is not so sudden or violent as the pitching.

In the extreme sections, and from the formation of those parts below the surface of the water, the upper works may also be considered as contributing to the excess of weight.

In the middle section, the main-mast, from its magnitude, may be considered as materially contributing to the excess of weight; and that, according to the ordinary distribution of the weights in the main hold, a large proportion of it may be supposed to fall in the vicinity of the mast. If this conclusion be admitted, it must appear prejudicial, and the more so, in consequence of the pressure preponderating so much at both extremities of the section. Among other weights concentrated about the mast is the shot locker, and which must considerably add to the unavoidable and too great weight of the mast alone acting on so small a space.

I shall now endeavour to explain how far the alterations proposed in my former remarks would be likely to remedy the inequality of the distribution of the weight and pressure specified in the calculation.

In the foremost section, No. 5, where there is at present an excess of weight, are placed the bower anchors, and the gunners', boatswains', and carpenters' sea stores, which I proposed transferring; the anchors further aft, by removing the cat heads to the fore parts of the channels, which, although by the removal still situated in the same section, would considerably lessen the power of their weight on the ship in a sea; and the sea stores to the after cock-pit, which will be found situated in section No. 2, where the pressure now preponderates.

In the after section, No. 1, where there is also an excess of weight, the bread is stowed at the extremity; a part of which, together with beds, slops, marine clothing, &c., (at present stowed in the after cock-pit) I proposed should occupy the present place of the sea stores in section No. 5; which would reduce the excess of weight at present in the after extremity, and place less weight, more lively, and more speedily consumed than the sea stores, in the place now occupied by them.

Such arrangements would also be likely to contribute to a more equal distribution of the weights and pressure in sections 3 and 4; as it would most probably admit of weight being removed from the one where there is at present an excess, to that where pressure preponderates,—and, in fact, to a much more equal distribution throughout the whole body.

The following alterations would also contribute to a better distribution than the present.

Let the bower and sheet cables be stowed further aft; the stream cable and hawsers abaft them, in the space now occupied by cabins, slop-room, &c.; and the stores, at present stowed in the foremost section, No. 5, removed aft to the fore part of the cable tiers; a part of the bread, slops, beds, marine clothing, &c., as in the former proposal, to occupy the present place of the sea stores in section No. 5. By such arrangements the weight of the stream cable and hawsers,

and part of the bower cables, would be removed to section No. 2; the sea stores to No. 4; and the weights reduced at both extremities.

The excess of weight would not only be considerably reduced in the fore extremity, by the proposed alterations, but at sea, if desirable to lighten this part as speedily as possible, a regular decrease, in a 74 gun ship, of two tons per week, may be calculated on, till the expiration of half the cruise, when the fore bread room would be cleared.

By a minute inspection and measurement of the different parts, and a correct calculation of the different weights and their bulk, the distribution may be made with great exactness.

Removing the anchors where they will stow perfectly clear of the ports, and similar to the sheet and spare anchors, will also leave the round of the bow perfectly clear, and remove every impediment to its being better fortified.

[*Quarterly Journal.*

Experiments and Observations on some of the Phænomena attending the sudden expansion of compressed elastic Fluids. By PETER EWART, Esq.*

HAVING occasion, about seven years ago, to make some experiments on a high pressure steam engine of the estimated power of nine horses, in the boiler of which the elasticity of the steam was equal to sixty pounds (including the atmosphere) on the square inch, and, consequently, the interior temperature about 290° of Fahrenheit, I applied the bulb of a thermometer close to the opening of the safety-valve, while the steam issued from it in great quantity, and it stood steadily at 160°. The engine being in motion, and the steam, after having passed through the cylinder, escaping to the atmosphere by a perpendicular pipe four inches in diameter, and five feet in height, I applied a thermometer to the steam as it issued from the top of that pipe, and found the temperature to be 212°.

Finding the temperature of the issuing steam only 160° at the safety valve, close to the boiler, and 212° after it had passed to the distance of five feet from the boiler, I constructed an apparatus (fig. 1.) for the purpose of ascertaining whether, under certain circumstances, the temperature of the steam increases after it has issued from the boiler. I had an opportunity (in March 1823) of applying this apparatus to the high pressure steam boiler of Mr. Philip Taylor, at Bromley, near London. A is an iron pipe of three quarters of an inch bore, connected with the boiler, and terminated by a stop-cock B, the area of the opening of which was the same as that of the pipe. The end of a copper tube C, two inches diameter, and sixteen inches long, was screwed to the cock B, so as to be steam tight. To this tube was adapted a thermometer D, so that the bulb stood directly opposite the centre of the opening of the cock B, and at the distance of an inch and a half from it. The opening in the side of the copper

* This article consists of extracts from two papers read before the Literary and Philosophical Society of Manchester;—communicated by the author.