We next essayed two classes of vessels with different powers, in the effort to realize the idea of a fast gun-boat, heavily armed with cannon of great range and accuracy. To these belong the *Ticonderoga* (1,049 tons), and the *Wachusett* (695 tons). To the *Ticonderoga* construction assigns 78 tons for armament, of which only 22 tons were for guns and howitzers The Bureau of Ordnance therefore determined upon 3 of 11 inch, with 4 24-pounder howitzers; but before the vessel was finished, the 150-pounder (8 inch) rifle made its appearance, and the battery was modified to

1st Battery.	Weight of Broadside.
2 11 inch, 32,000 lbs.	272 lbs. (shells)
1 150 pdr, 16,000 lbs.	150 lbs. (shot).
4 24 pdr., how.	.....
48,000 lbs.	422 lbs.

(Howitzer weights are omitted as too light to affect the question).

This was an excellent arrangement, combining range, power and facility of handling. Her first commanding officer, however, wished to have some broadside guns, therefore the detail was changed, and the first battery actually mounted was:

2nd Battery.	Broadside.
1 11 inch, 16,000 lbs.	136 lbs. (shells).
1 150 pdr, 16,000 lbs.	150 lbs. (shot).
4 9 inch, 36,000 lbs.	144 lbs. (shells).
1 50 pdr., 6,000 lbs.	50 lbs. "
2 24 pdr.,	.....
73,000 lbs.	480 lbs.

Here, the absolute weight of battery was somewhat increased, while its power of broadside remained practically the same, but imperilled by the introduction of two new calibres and a diminished facility of handling in a sea way. The ship was afterwards ordered to be fitted out for a foreign station, and the original weights restored. But the foremast having been shifted, and a forecastle built upon her, there remained only room enough for two pivot guns. Therefore, there were mounted as a

4th Battery.	Broadside.
2 11 inch, 32,000 lbs.	272 lbs. (shells)
2 9 inch, 18,000 lbs.	72 lbs.
1 60 pdr., 5,400 lbs.	60 lbs.
4 24 pdr. how.	.....
55,400 lbs.	404 lbs.

The *Wachusett* was particularly the exponent of the "cooper around the cask" idea—a swift, handy, light draft, powerfully armed craft, which should be able to keep the sea in all weather under canvas. The armament assigned was:

1st Battery.	2 11 inch
	4 32 pdr., of 27 cwt.
	1 30 " rifle.
	1 20 " "

Commodore Wilkes, who had his flag on board when she first fitted out, proposed an alteration of the battery to

2nd Battery 1 100 pdr, 9,200
10 8 inch, of 55 cwt. or 12 31, of 43 cwt. 61,600, or 57,792
1 30 pdr., rifle, 3,500

He argued that the removal of the heavy 11 inch gun, and a distribution of their weight in broadsides, would tend very much to prevent the vessel from rolling so much. Said he: "As for using the large pivot guns, it is entirely out of the question in a sea way. There is not an officer under my command but is satisfied with the inadequacy of the armament of these vessels, and the useless ness of having such large and heavy calibres;" and he recommended a broadside battery for all small steamers now in commission. This subject of broadside and pivot guns will be discussed further on; but my own experience is that the 11 inch can be cast loose and handled in a seaway when it would be difficult and dangerous with the broadside guns. The vessels of the *Wachusett* class were not intended to perform the functions of a broadside vessel like the old frigates and corvettes, as it is evident they would be very feeble in this respect, the weight thrown from their broadside not exceeding 300 lbs. But they were intended to have a high speed, so as to overtake or leave broadside armed vessels, and harrass them by deliberate practice with a few heavy shells, at ranges where the guns of broadside could not reach. Their light draft was also to permit them to roam in shoal water not accessible to heavy vessels. If the vessel was deficient in the primary condition, speed, the proposed change in the battery would not afford a remedy. As regards excessive roll, that belongs to all propellers, and the weights should moderate the movement; but it does not appear that this can be carried to a profitable extent for want of capacity, nor is there sufficient room for 9 inch guns. However, her armament has been increased to a 3rd battery of

	Broadside.
2 12 inch. 32,000 lbs.	272 lbs
4 9 inch. 36,800 lbs.	140 lbs
3 20 pdr. rifles. 3,900 lbs.	40 lbs
72,700 lbs.	452 lb.

The light cruisers of 410 tons *Kansas* class were designed to carry the 10 inch Parrott rifle (300 pounder), of 26,000 lbs; but such guns were never provided, and these vessels were therefore heterogeneously armed. At the end of the war the

Kansas carried	1 11 in, 29 in., 1 30 pdr. rifle
Nipsic "	1 11 in, 1 30 pdr, rifle.
Nyack " Shawmut "	1 100 pdr., 2 9 in., 1 30 pdr., rifle.
Yantic "	4 9 in, 1 30 pdr. rifle
Saco "	1 60 pdr., 6 32 pdrs., 1 30 pdr. rifle.
Pequot "	1 150 pdr., 6 32 pdrs., 1 30 pdr., 2 24 pdrs., how.

While the battery originally assigned to these ships was 1 300 pounder rifle and 2 24 pounder howitzers.

Sufficient has been stated to show the principles on which the armament is based. First. The aggregate assigned to Ordnance by the Naval Constructor in distributing his weights. Secondly. The weight of battery which experience shows, can be safely and conveniently carried, which is from one-third greater to double that allowed on the given displacement. Thirdly. The smallest number and heaviest pieces which can be conveniently handled, having due regard to speed and tonnage.

It is to be observed, that since the introduction of full power into steamers, the space below has to be carefully apportioned; and that the addition of even a single gun crowds the magazine, shell and store rooms. Having then determined the total weight of battery for a given tonnage, next in importance is its distribution, with a due regard to the accuracy, power and range of the guns. The power of a ship of war may always be in proportion to her capacity, and the largest ship can always be made the most powerful in offence as well as defence; the smaller ships, on the contrary, can never be made more effective than the larger, unless the means of the latter are misapplied.

One of the first elements to be considered is the ability to handle the projectile in the confined quarters of a ship, subject to violent motions of rolling and pitching. For obvious reasons, only one man can conveniently handle the shot of a broadside gun, and but two that of a pivot gun; and experiment proves that the 9 and 11 inch are the largest shells which can be so handled with ease. There are, however many persons of the opinion that some smaller calibre, 32 pounder or 8 inch substituted in broadside for 9 inch may, by celerity of fire, and being more numerous for the same weight of battery, more than compensate for diminished accuracy and power. This is entirely fallacious, and has been completely refuted by Admiral Dahlgren in "Shell and Shell Guns."

But we will here repeat the argumet.

. . . . . .

"The reasoning in favor of the 8 in. against the 9 in. is, that with the same weight one can have more cannon, and firing faster, the weight of metal thrown is much increased. This argument is not new—it was offered in 1812 by the English for preferring the 18 pounder to the 24 pounder, and has no better foundation now than it had then."

The 8 in. weighs 6,500 lbs., the 9 in, 9,200 lbs the rates being 65 92, or nearly two-thirds, that is: three 8 in. cannon weigh as heavy as 2 of 9 in. The 8 in. throw 3 shells of 51 lbs, 153 lbs.; the 9 in. two of 72lb, 144 lbs. In actual trial at the battery here, the 9 in. gun has been fired five rounds at an average of 53 seconds per round. It is likely that an 8 in. gun can be fired more rapidly? On board the *Plymouth*, commanded by myself, and then cruising as the Ordnance ship, a trial was made for rapid firing, with the following results:—

U. S. ship *Plymouth*, off Cape Catoche, September 10, 1851.

Guns manned by the regular crews, 17 to 9-in. and 15 to 8 in.
Guns run in, and all ready.

	Nine-inch.	Eight inch.
Sponge	28 min. 40 sec.	28 min. 40 sec.
Fire	29 " 25 45 "	29 " 25 45 "
"	30 " 12 47 "	30 " 12 47 "
"	30 " 57 45 "	31 " 00 48 "
"	31 " 47 50 "	31 " 55 55 "
"	32 " 38 51 "	32 " 59 64 "

Av'ge time of fire 47 3 5

Shifted the 15 from 8 in. and 15 from 9-in, leaving the roller h'h's'm and one other.

Sponge	45 min. 00 sec.	45 min. 00 sec.
"	45 " 30 30 "	45 " 30 30 "
"	46 " 07 37 "	46 " 06 36 "
"	46 " 44 37 "	46 " 40 34 "
"	47 " 23 39 "	47 " 22 42 "
"	48 " 03 40 "	48 " 03 41 "

Av'ge time of fire 36 3 5

Both crews had been under careful drill for more than three months. Of course no other pointing was possible than to preserve the guns nearly in their original position when fired. The *celerity* of fire, then from the 8 in. and 9 in guns will not vary materially under like circumstances. At the same time I may remark that every officer knows that the time required to load, fire and run out, is never the standard for accurate practice; *that* is controlled on ship-board by the difficulty of pointing amidst the smoke, and disturbed by the rolling and