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ELEMENTS OF FORCE IN WAR-SHIPS.

By Vice-Admiral P. H. COLOMB.

Wednesday, March 18th, 1896.

The Right Hon. the EARL OF NORTHBROOK, G.C.S.I., in the Chair.

THE question of the comparative force, or fighting powers, of modern men-of-war, though it is constantly brought before us by those who harp upon the one string of our incapacity to meet an enemy at sea, has been rarely faced. The most complete attempt to face it that I know of was made by Captain Noel, in a paper read before the Institution of Naval Architects in 1885. Sir Nathaniel Barnaby also put forward some considerations about that time, leading him to conclude that the one element of displacement was a good measure for the force of ships-of-war of the same date. Abroad, some steps were taken in the same direction.

In the days of sailing war-ships, when types and classes were fixed, and where the gun was the one weapon to be considered, the measure of force was invariably the weight of shot fired in one broadside. No questions of relative speed, of relative capacity to keep the sea—which might have been called “endurance”—nor of rapidity of fire, nor of shell-power, nor of ram-power, nor of torpedo-power, came under review, especially because, in the last three cases, such elements of force did not exist.

There were, however, latterly, some questions of calibre in debate, which, bringing forward the Carronade and using larger weight of projectile and smaller proportionate powder-charge, left the relative force of a mixed broadside of Carronades and long guns indeterminate. But, generally speaking, as both the numbers and calibres of the guns, otherwise the numbers and weight of the shot fired in a single broadside, both varied directly with the tonnage, the total weight of broadside always remained a fair measure of gun-power. Even numbers of guns alone became a comparative measure, because an increased number of guns generally carried with it an increased calibre or weight of broadside, and *vice versâ*.

But the questions of speed and penetration necessarily existed in times gone by, if we did not hear so much about them when considered as elements of force as we now do. The reason as to penetration was, that the scantling of the larger ship was compulsorily stouter than that of the smaller ship, in order to give the necessary structural strength; and

increased resistance to shot was measured by increased tonnage, quite apart from any design to resist the entry of shot.

Again, no one had thought of considering speed alone as an element of force. In certain classes of ships, speed was considered of more importance than fighting power; and gun-force in the frigate was frankly diminished in order that her speed might exceed that of the line-of-battle-ship. Though there were occasions in which frigates had—two or three together—successfully pitted themselves against the line-of-battle-ship, the general understanding was that their higher speed gave them no additional force; that their lighter broadside and lighter scantling could not be pitted, even when the numbers of frigates were doubled, trebled, or quadrupled, against the heavier broadside and heavier scantling of the line-of-battle-ship.

The personal element of force, again, though a necessary one, and generally taken into account, did not raise any question, because it was strictly controlled by, and was part of, the gun-power. The allowance of men per gun in the different classes of ships might be larger in one nation and smaller in another; and it might have been possible to say that materially equal broadsides were made unequal by the smaller number of men per gun in one case than in another; this did not destroy material broadside force as a reliable comparative measure.

In our day, there is no such admitted, or established, comparative measure of force as used to exist; and by adding immensely to the number of elements to be considered; by including some as elements of force, which used not to be so regarded; and by throwing open to debate, in a far more difficult and extended form, all the questions which left the relative force of the Carronade and the long gun indeterminate, we have made the task of estimating total comparative force almost, if not quite, an impossible one.

Attempts—however gallant, like Captain Noel's—to assign proportionate value to an enormous number of the elements which go to make a modern war-ship, only tend to assure us of our inability to do so.

Captain Noel proposed to assign proportionate values to armour, battery of guns, coal, displacement, machine guns, complement, lightness of draught of water, speed, torpedoes, manœuvring-power, sail-power, efficiency of conning-tower, quality of propellers, ram-bow, sea-worthiness, special economy of engines, ships' torpedo-boats, specialities, and defects; and by a system of co-efficients to get expressions which would comparatively value the fighting efficiency of any two ships.

The difficulty was, and is, that it is quite impossible to get any two competent men to agree upon co-efficients; and there are practically no experiments enabling us to settle proportionate, and therefore exchangeable, values amongst the elements composing the force of a war-ship.

At different dates, different elements come to be regarded as of high, if not of supreme, value, while others are thrown into the shade. At one date sea-worthiness, in the concentrated form of stability, is held to justify great reduction of all other elements; at another, inches of armour takes entire precedence of every other consideration, including even area of plating;

at another, all force resides in the compression of the greater energy into the smallest number of pieces of ordnance; at another, we are told that speed is like charity—all other elements of force are nothing worth; at another, all force is centred in and radiates from the torpedo, or the ram; at another, rapidity of fire is the one matter upon which our efforts should be concentrated; at another, everything ought to give way to concentrating fire on particular narrow arcs in regard to the direction of the ship's keel.

The great experiment of the battle off the Yalu has scarcely tended to settle our minds on such questions as these. Nearly every person of authority puts a different element of force in the forefront of the causes producing the defeat of the Chinese. One exalts the personal elements above all possible material ones; another thinks superior tactics overbore most other causes; a third points to the armour of the two battle-ships; a fourth to a probably greater rapidity of fire on the part of the Japanese as a consequence of their being superior in Q.F. guns; a fifth claims the superior power of the large single shell; and a sixth declares that superior speed on the part of the Japanese was the deciding element. Quite possibly less notice is taken of the unexpected effect of shell in producing fire, and the possibility that numerous small shells may have an excessive value on this account.

Thus any set of co-efficients which could be agreed upon at one date would certainly fail to produce agreement at another; and such a thought hints to us that the marks of such varying opinions are sure to have been left upon the designs of war-ships produced at different dates under their influences. The study of such marks could not fail to be interesting, even if it turned out to be useless in guiding our future steps.

Great attempts at generalisation from indeterminate particulars have never commended themselves to my mind. I have never been able to argue downwards from the general to the particular; my mind is so constituted that if it argues at all—which I gather it is somewhat apt to do—it insists upon working up from the particular to the general; and I am bound to say that I find the method satisfactory.

It will be remembered that I have for many years held that naval force must be financially measured at some point or other in the discussion; that a certain force which costs £100,000 is not to be held inferior to another force which costs £200,000 until after it is shown that an expenditure of £200,000 on the first kind of force will not prove superior to that produced by the same expenditure on the second kind of force.

Again, following the same principles of thought, I have long been accustomed to hold that the concentration of a naval force in a single bottom is not necessarily superior to its dispersion into several bottoms. The amount of concentration which can be economically practised is a matter for examination as to the force which can be floated in a single hull, or in several hulls giving in sum an equal displacement; or it might be, as to the force which could be floated in a smaller or in a larger number of hulls involving the same displacement. But then, if it were

found that a greater force could be produced in the larger, less numerous hulls, than in the smaller, more numerous hulls, or *vice versa*, it would still remain, before either system could be put into practice, to determine relative cost. The costliest of the two systems would have to justify itself by showing proportionate increase of force for increase of cost.

Still following the same methods with regard to ordnance, I was usually led to consider how far concentration of gun-power in a single cannon, rather than its dispersion in several cannon might be economically practised; or where the balance could be struck between smaller numbers of guns and greater individual calibres, or larger numbers of guns and smaller individual calibres. The determination involved space, weight, and rapidity of fire; and of course, a whole string of questions as to not only the absolute gun-power developed, but the power, relative to the kind of target to be opposed to the ordnance.

But as one went on with such considerations one was always landed in estimates of comparative displacement and comparative cost.

When new forces, such as Whitehead torpedoes, or rams, were developed, which had—like the Carronade in comparison with the long gun—shorter ranges, but greater power at the shorter ranges, than ordnance, it could be seen that, so long as they were in competition with guns in the same ships, their existence little affected the problem of the comparative fighting force of ships; for it followed that they tended to equalise forces apart from the displacement involved in supporting them. Neither of them involved weight in any sort of proportion to their destructive powers; and for the reason that the torpedo fired from the 1,000-ton ship against the 10,000-ton ship was as likely—perhaps more likely—to be fatally destructive than that fired by the 10,000-ton ship against the 1,000-ton ship.

Except the last, which excluded the torpedo from competing as an element of force side by side with guns, but did not touch its employment in special torpedo-vessels which excluded the idea of gun-power, these were not generalisations, but methods for generalisation. To generalise—to pronounce where the balance lay between distributed and concentrated displacement; or between distributed and concentrated gun-fire, and so on—it was necessary to begin with the particular; to consider carefully the individual power of the individual gun; to form some idea of the displacement involved in putting it afloat; to consider how, in reference to the individual gun, weight might be subtracted from offensive and added to defensive power in the form of armour; and so on. And it was absolutely necessary to get away from what might theoretically be done in war-ships, to what actually was done.

I found that such methods of thought, argument, and practice led me, in years gone by, to very fair inferences as to what the line of material progress was likely to be. Of course, all forecasts are liable to be upset by the development of new forces, and most especially by discoveries and inventions which reduce weight without reducing power; or allow power to increase out of proportion to weight; but even, in spite

of this, if the method of induction employed is a sound one, it grows curiously reliable. But no doubt great varieties of force, and great divergencies of target, make the general results more difficult to state.

When, after long preparation, and the closest examination of each particular that I was able to make, I drew inferences years ago, which remain on record, the whole problem was much more simple than it is now, and the necessary data, because they involved fewer branches, were more easily obtainable. Those no doubt are reasons why one was able to be so fairly correct in the forecasts then made.

They were to the effect that moderate displacements with a moderate calibre of heavy guns would be arrived at; that it was impossible that the armaments of war-ships could remain, as it was then proposed they should, composed of a very few guns of very large calibre; that classification was a necessity; that a secondary armament was a necessity; and that fleet actions between gun-ships would be fought apart from the use of the torpedo—that it would not influence the tactics adopted in them.

At the time these inferences were drawn, the current of opinion was forcing up the calibre of the guns, and diminishing their number; the tendency of displacements was somewhat downwards; the idea of very few very heavy guns was exceedingly prominent; and there was no idea of an auxiliary armament.

But, as already observed, the problem was comparatively simple. No one for instance had suggested that speed was an element of force which was interchangeable with others; and speed and coal endurance very generally increased with the displacement.

The gun was a muzzle-loading gun, and its mountings were not generally a disproportionate element in the weight involved in increase or decrease of calibre. The barbette did not exist, and the box-battery contended on fairly equal terms with the turret for the victory. Tactical considerations, however misplaced, had laid great stress on the necessity of powerful fire at particular angles to the line of keel, and the two things working together had tentatively reduced a minimum of four heavy guns, to a minimum of two, still heavier in proportion to displacement.

Speed was so far from having obtained a place as an element of force economically exchangeable for other elements, that an increased displacement was, through all classes and in almost every class, generally co-existent with an increased speed. The larger the ship—speaking broadly—the higher the speed and most probably the coal endurance. In any case, both speed and coal supply were simple measures. “Forced draught,” as distinguished from “natural draught,” had not been devised; and the coal supply named was generally the maximum that could be carried in the bunkers, and not a varying proportion of it involving a fixed displacement from which all calculations were made.

Respecting the general question of the armaments, many of the battle-ships, and almost all the smaller ships, were still armed as broad-side ships on the principles existing before the advent of steam.

The wide existence of sail-power in competition with steam-power, looked like a complication. But when it was carefully measured side by side with the measure of steam-power, I had no difficulty at all in dismissing it absolutely as an element of force bound to disappear immediately and suddenly, as it very shortly did.

The torpedo-boat had only just put in an appearance in one type. It was not possible to take into account a development with no experience behind it.

The task of first thoroughly examining particulars and then combining them in a generalisation was, in 1877, not so very difficult. In 1894 not only had the task of generalisation in the way of estimating the relative fighting force of any ship or group of ships become an exceedingly difficult one, but in almost every particular the definition and measurement of what was necessary before generalisation could be made, had become a complex quantity, the value of which might be, and was, differently stated according to how it was looked at. The armaments of ships had themselves become complex from the variety of calibres mounted in the same ship, and from the general adoption of a heavy armament, a medium, and a light armament, where the arcs of fire of the two latter were not conterminous with those of the former. Different methods of constructing guns of the same weight, different materials in the same sized projectiles, even different kinds of explosive in the gun and in the shell, all combined to make any comparative measure of gun-power excessively difficult. The special rapidity of discharge from the Q.F. gun presented another element for particular examination.

The several kinds of speed, as that due to forced draught, to natural draught, and to continuous steaming, and the naturally varying proportions between the air pressures at first taken to indicate the one or the other, and the different proportions of horse-power and consequent speed which were held in different ships and at different times, due to natural and forced draught, all combined to raise preliminary doubts as to whether the facts stated were always truly comparable.

Then there was the singularly disturbing fact that speed had been made interchangeable with other elements of force, and that there was a distinct tendency to make horse-power, and therefore speed, vary in some inverse, instead of some direct, ratio to the displacement; to make the smaller ships the faster and the larger ships the slower.

With regard to coal supply, and therefore to coal endurance, the double system of estimate for supply—that due to the load draught on which all calculations were made, and the maximum supply possible to be carried in the bunkers—created direct difficulties. The fact that sometimes one and sometimes the other were quoted in documents even of the highest authority, without clear distinction, was no doubt an inevitable result of the plan at first, but it shook the value of all figures given.

With regard to coal endurance, that had come to be quite a tangle of dispute; and it must be allowed to be still beyond accurate statement.

The introduction of Harveyized armour—an introduction which the method of argument employed had enabled me to forecast with some precision in 1877—permitting a given resistance to be extended over a larger area of the hull than with the common armour, while it enabled defence to be extended without increase of displacement, required close and accurate figures before any comparative estimate of force gained could be come to.

Altogether, in the year 1894, it seemed more difficult than ever to arrive at an expression which would indicate in units, combining all the elements of force, the total force of any one ship, so that it might be compared readily with that of any other.

But these difficulties did not hinder a general survey of our Navy, with the view of observing easily how far such interchanges were made in different classes of ships and at different dates. We might, if the figures were obtainable, come to some general conclusions as to the nature of the compromise which was effected in what must in every case be a compromise of some sort. We might see how opinion of the relative values of different elements of force varied at different dates in the same class of ship, or in different classes of ships at the same dates, and so on. We might in any case trace the progress of any one element of force through different classes of ships at different dates, and perhaps to some small extent recognise how it had been made possible as a consequence of the progress of invention.

Then, if we could not, in comparing ship with ship, assume units of total force, it might be possible to assume units for the same force, so as to see whether it was greater or less at one date or in one ship, than it was at another date or in another ship. By, as it were, splitting up the total force of each ship into its component parts, and by analysing the composition of each of these component parts, we should be at least laying the foundation for an estimate of the total force. We were doing something in preparation for a further step—we were in some degree learning to walk before we tried to run.

I had often had such thoughts as these in my mind since—so many years ago—I had given a special study to the question; but it was not till 1894 that I made any attempt to realise them. In that year I had occasion, for another purpose altogether, to endeavour to compress into the small compass of some simple tables a view of the classes of the ships of the Navy, ranged in each class according to their dates, with their displacements and a general statement of the force that each ship represented.

I put the ship's date, her name, her displacement, her speed, her coal supply, and endurance, the number and total calibre of her guns, the number of her torpedo-tubes, whether she was armoured, or protected or not, and whether she was copper-sheathed or not, all in parallel columns. I ran through the battle-ships as a class, then the first-class cruisers, the second-class, and third-class cruisers; and then those vessels which were called first-class gun-boats in the Navy List,

but which really embraced the two classes' specified in the Navy Estimates as first-class gun-boats and first-class torpedo gun-boats.

I was attempting no more than the roughest outline of a survey, but when I had completed the tables it began to strike me that both the variations and the continuity of the figures were of interest, and that there was a peculiar significance in the groupings. One got quicker and more easily at the changes in the quantities of the different elements of force set out, and how the views of different dates had prevailed to strengthen one element while weakening the other, or perhaps making an endeavour to strengthen all elements by a simple increase of displacement.

I found that there was even in so tentative and meagre a table a convenience for considering relative force which I had not before known. But as soon as I began to make any surmises as to what might really be lost or won in any interchanges of the different elements, or as soon as I began to consider the question of dispersing force into many bottoms or collecting it into few bottoms, the necessity of representing force in terms of displacement presented itself. It was common to speak of the horse-power per ton which appeared in any ship; common to speak of the difference in proportion per ton as a measure between ships of different classes, and at different dates. Coal supply being in tons—the same name as the displacement—was entirely comparable to displacement. But it had not been usual to speak of speed, coal endurance, number or calibre of guns, in terms of displacement. And yet, if we had not these elements in the terms of the weight of the machinery producing them, it was, as it had been felt in regard to horse-power, the next best thing to quote the proportionate results of whatever the weight might be. Accordingly, I drew up a second set of proportional tables, using 1,000 tons as the standard, and I got what seemed to me possibly a very useful way of regarding and measuring the elements of force in a war-ship.

Of course, the usefulness of such tables would depend on the way they were used. Supposing a 1,000-ton ship went 10 knots, and a 2,000-ton ship at the same speed, then in the proportionate tables the 1,000-ton ship would be shown with 10 knots per 1,000 tons, and the 2,000-ton ship with only 5 knots per 1,000 tons. It would be absurd to infer that the 2,000-ton ship ought to show the same speed per 1,000 tons as the 1,000-ton ship. That would be to say not only that speed ought to increase directly with the displacement—which it used to do—but that it should increase in the same ratio as the displacement, which would be impossible. On the other hand, if we found the 1,000-ton ship showing 10 knots speed per 1,000 tons, and the 2,000-ton ship showing only $4\frac{1}{2}$ knots per 1,000 tons, we should see that, for some reason or other, the speed of the 2,000-ton ship was less in that proportion than that of the 1,000-ton ship; and, being so, we should expect to find that some other element of force had taken the place of the speed which was dropped.

Again, supposing we found two 2,000-ton ships, one of which had

5 knots speed per 1,000 tons, and the other 6 knots, we should be in a position to inquire whether that proportion of increased speed in the latter ship had been due to invention which had increased power without increasing weight, or what other element of force had given way to the increased speed?

Coal supply might easily be supposed to increase in the ratio of the displacement, and if it did not, then either invention was getting more force out of the coal, or else coal supply was giving way to some other element. Or if coal supply increased in a greater ratio than displacement, the element of coal endurance took a higher place in the mind of the designer than it had done in the former case.

The coal endurance offered explanations on this head. For if it were found in two ships of different dates, but near about the same displacement, that the later ship, with a smaller proportionate coal supply, was suffering no loss in endurance on that account, then the hand of invention in drawing more force from the coal was seen. The two columns of coal supply and endurance amongst ships of the same date furnished some interesting figures as to the relations between coal endurance and displacement; a corollary on the known proposition that for a given proportion of horse-power better results are got out of the larger hull than out of the smaller.

With regard to the number of the guns carried per 1,000 tons of displacement, the variety in the methods of arming, and the different views at different dates, scarcely permitted—as similar numbers would have done in the days of sailing war-ships—number alone to be used as a comparative measure. But there was certainly some sort of measure of force in taking the total calibre, or the total number and calibre per 1,000 tons of displacement together. It would be more probable that any ship which carried a large number of guns of a greater total calibre than another was more powerfully armed. If two ships of different displacements were found, one of which carried a smaller proportion of guns of a smaller proportionate calibre than the other, there was at least a strong presumption that the gun-power had been sacrificed to some other element of force in the former ship. Before a final decision even here could be come to, it would be necessary to ascertain whether speed of fire remained the same in both cases; or whether there was increased speed of fire in the case of the ship which carried the smaller proportion of guns of less total calibre than the other. If there were this increased speed, it might be that number and calibre had both been sacrificed to gain it, and that the apparently proportionately weaker gun-power was actually proportionately stronger.

This question of relative speed of fire is inextricably mixed up with that of fewer guns of larger calibre, *versus* more guns of smaller calibre, as we shall see later on; but no such questions could be touched by the preliminary measures of numbers and calibres adopted.¹

¹ There was also a question of improved manufacture giving greater weight of metal, energy, or shell power.

In the same way a complete survey could not be made unless the question of arc of command was considered. It is a very special point, only to be properly dealt with when a variety of tactical considerations have been applied.

In torpedo force, a ship was very naturally measured by the number of her tubes; though, of course, any closer examination would necessitate discrimination between under-water and above-water tubes, and their respective values.

Out of the proportionate tables a curious result showed itself, namely, that, as displacement rose, all these elements, speed, coal supply, coal endurance, number, and calibre of guns fell. Speed, of course, was bound to show such a fall, but it fell out of proportion to the inverse ratio of the displacement. In other words, the law which, in the earlier days of steam had obtained, making the larger ship the faster ship, had disappeared in these later days. As ships grew smaller, the desire for high speed increased, and we had got back to the practice of the old war days, where other elements of force were given up in order to get speed.

But there was no obvious reason why all other elements of force should rise proportionately. The result was to show that, so far as the tables went, more actual force could be got out of dispersing it amongst many bottoms than by collecting it in few bottoms.

There was, however, a clear defect in the tables, inasmuch as there was no column showing the actual or proportionate weight of defensive armour allotted to the armoured or protected ships. I had not been in a position to go beyond the tables in the "Naval Annual" for my figures, and they did not give the weight of armour. It remained possible that the element of defensive armour might in the larger ships have drawn upon the weight available for the other elements in the larger ships, and that passive defence had in the larger ships assumed a proportion of the total elements which it did not in the smaller.

But at any rate here, in 1894, I had a method of judging of actual force, of relative force, and of the laws which were governing material naval progress, which seemed to me of great promise; but before I could decide on what it might all come to, I thought it well to bring the whole matter under the criticism of the Institution of Naval Architects, as the body most capable of appreciating or depreciating the uses and value of such a method. I was not at all clear in 1894 what the apparent diminution of proportionate force in the war-ship as the displacement rose might mean; but I thought it probable that, if it were a fact, it would be known and easily explainable. On the other hand, I thought that, if it were not the fact, this also would be known, and the fallacy involved in the table would be clearly disclosed. However, it appeared, from the course the discussion took, that the proportional method of estimating force was not customary. It was left uncertain how much or how little fact lay behind the tables, and they did not receive that close scrutiny which I had looked for.

My tables are now compiled so as to include all the elements of force obtainable, and the figures for the principal elements are drawn from

official documents, especially from the Estimates, directly supplemented from Lord Brassey's tables and from any other sources. Even now, however, the figures leave much to be desired, especially in the matters of the weight of armour carried in the different armoured and protected ships, and in the coal supply and endurance.

I have extended and divided the elements of force so as to include displacement; weight of hull; weight of armour; I.H.P. under natural and forced draught; coal supply, distinguishing where possible between legend and maximum weight; coal endurance due to the two different supplies of coal; the number of guns, down to and including 3-pounders; their total calibre; the total weight of the projectiles fired in one discharge; the total muzzle energy developed in this one discharge; and the total amount of powder capable of being burst in all the common shells fired in one round. These quantities are also estimated for one minute's fire. I have given the number of torpedo-tubes carried, and against each class of ship it is stated whether the ships are armoured, protected, or not, and whether they are copper-sheathed or not.

All these figures speak for themselves, and include what constitutes the power of the war-ship, set out in such a way as to enable us to see how any particular element is greater or less in any particular ship it is desired to compare with another. Of course, we can say that any ship which exceeds in all these elements is the more powerful ship; but our ingenuity and calculation may be exercised in considering how far diminution of one element in any ship is compensated by an increase of another, so as to make one ship equal, or more than equal, to another in fighting force.

Our attention is first drawn to the weight which disappears in mere hull and armour; and, where the figures have been obtainable, to the weight absorbed in the defensive element of armour.

We cannot help being struck by the varying proportions of H.P. allowed in different classes at different dates, between what is due to natural and to forced draught. Mr. Harry Williams, in his book, has spoken strongly, and it seems to me practically, in deprecation of exaggerating the value of forced draught. He takes the "Aurora" to show how, with half-an-inch of air pressure, she developed 5,500-H.P., and how, under forced draught, the H.P. had been raised more than 50 per cent., to 8,500-H.P. He considers that such exaggerations are dangerous to the boilers. "In view of the serious risk of injuring the boilers," he says, "it may be asked, What is the advantage gained? And it will be found that the real practical gain is very small."

Taking an instance, he says:—"In the case of the first-class belted cruiser "Aurora" in the actual trial under the two circumstances, the difference of the I.H.P. developed was as 5,706 to 9,013, viz., 57 per cent., the difference of the speed of the ship being as 17·15 knots to 18·53 knots, a little over 8 per cent. In other words, the strain on the boilers is increased 57 per cent., to gain an 8 per cent. advance in speed of the ship. And the question must be asked: Is it rational to incur so great a risk for so small a gain?"

It is the business of the naval tactician to show how, if such excessive strains are to be maintained, this element of force—an 8 per cent. increase of speed—is convertible into actual increase of fighting power. We should certainly be prepared to go further than the mere utterance of an opinion on this head.

But it seems that, apart from the tactical question, it has been found that forced draught cannot be safely pressed to the full extent originally intended. While we have the "*Sans Pareil*," laid down in 1885, showing a natural draught H.P. of 7,500, and a forced draught-power of 14,000—an increase of 87 per cent. to gain nearly 2 knots, or 11 per cent. in speed—we have the "*Majestic*," of 1893, showing 10,000 natural-draught H.P. and 12,000 forced-draught power, an increase of only 20 per cent. in power for an increase of from 17 to 18 knots in speed, or nearly 6 per cent. only.

Moreover, in the "*Royal Arthur*" class, where the design was in 1889 to have a natural-draught power of 10,000 horses and a forced draught-power of 12,000 horses, it was determined in 1893 to keep the natural and forced draught at the same level, and they now both stand officially at 10,000 horses. So in the "*Empress of India*" class, where the design was to have a natural draught-power of 10,000 horses, and a forced draught-power of 13,000 horses, the estimates for 1893 announced the intention of restricting the forced-draught power to 12,000 horses.

To a great extent, therefore, any increased speed which is due to a greater air-pressure than half-an-inch, falls much more out of the account than was originally contemplated.

The estimation of the relative power of any gun armament involves, as has already been briefly intimated, great possible variations. Taking merely the power of a single discharge into consideration, different types of the same gun near about the same weight will be found in different ships developing different muzzle energies. Not only so, but different classes of powder used will considerably vary the energies. Then the manufacture and material of the shell will vary the amount of the shell-charge burnt, and presumably we shall find different kinds of common shell in use side by side, which would give different results in shell-power to the same ship, according to which kind of shell is taken into account.

But I think we should at first keep clear of all these minute differences, which must continue to exist unless progress in the direction of increasing power beyond the proportionate increase of weight is to cease. In treating the method I adopt as a whole, I have therefore not taken each particular variation into account, nor assumed that the ships all carry the very latest pattern of gun developing the very highest energy; nor that they fire the latest pattern of forged steel shell. I have rather assumed that they each carry guns of a medium power for the calibre indicated, and fire common shells of medium bursting charge.¹

¹ I have made an exception in the case of the "*Majestic*," as the increased weight, energy, and shell-charge, and rapidity of fire of the 46-ton gun is a distinct element in the design.

The weight of the solid projectile is not often materially affected by these considerations, and it must be assumed that the total weight of projectiles fired in one round must be, like the number of guns and the total calibre, some sort of measure of force, however inexact it might be held. Whether this weight represents greater or less force according as it is aggregated amongst a few projectiles or distributed amongst many, obviously depends in a great degree on the nature of the target exposed to its effect. It is certain on the one hand that we could not, in any ship, increase her force by concentrating the whole weight of projectiles fired, into a single discharge of one gun; nor on the other could we infinitely sub-divide it in innumerable cannon with effect.

It is the middle position we must be always seeking after; and in all comparisons of gun-power we must have the ulterior object of discovering how near we are to that mean between numbers and individual "weight of metal"—using our old term—which we cannot depart from without loss.

I think we ought to assume a mean target. We are between a hypothetical battle-ship entirely plated with armour of a certain resisting power—a large slow-moving target, easily hit but hard to penetrate—and the thin shell of a torpedo-boat-destroyer with no resisting power, but quick-moving and difficult to hit. We are face to face with the latter as a reality; the former has never been advanced beyond the hypothetical form, except in the case of the American monitors.¹ The side of most gun-ships is, in fact, a medium target. Some part of every type of it is penetrable to the 3-pounder; very little of it is impenetrable to the projectile of the 67-ton gun.

The experiment of the Yalu is considered by many to uphold the value of belt and turret armour, not of the highest class, against guns very high up in the class. I believe we cannot say whether those Chinese ships that were actually sunk, were sunk by numerous very light projectiles, by a smaller number of medium projectiles, or by one or two of the heaviest fired.

I am, at least, assured of this, that water entering the ship through shot-holes near, but above the water-line, will rise inside the ship above the level of the water outside; and that, if perforations originally out of reach of the water are brought by the increased immersion within reach of the lapping waves they were originally clear of, the ship will sink if her pumps do not suffice to prevent the water from flowing in faster than it flows out.

In most ships, if not in all, considerable numbers of men must be, in action, unprotected by even the thinnest armour. In the days gone by, amongst European races, what gained the victory and brought the colours down was the proportion of men put *hors de combat*. It had no such effect in the case of the Chinese at the battle of Yalu. It is hard to say whether the destruction of the ships anticipated the stage at which a European crew would have surrendered; but there cannot be a doubt that

¹ Some early English developments of Captain Coles' ideal also.

if the ship is to be secured against destruction before that time, the men will be exposed to destruction by light projectiles.

On the whole, therefore, it would seem as if we must leave the question of more numerous lighter projectiles *versus* less numerous heavier projectiles as a part of the general question.

Another part is no doubt the energy of the projectile fired. This has chiefly to do with the penetration of armour; and perhaps, as against an unarmoured target, the advantage of energy lies in the extent to which it governs a flat trajectory, and, therefore, facilitates good shooting.

Shell-charge is, to my mind, a most important element of force; sometimes I am inclined to think it the most important element of fighting force; and the extraordinary and unexpected amount of conflagration at the battle of Yalu has added to my appreciation of that particular form of force. If there is penetration, it is difficult to say that a number of small shells bursting within the hull—destroying men and causing fires—have less power in organising victory than the bursting of a large single shell.

The effect of the bursting of the large shell on board the "Matsushima" at the battle of Yalu is rendered uncertain by the fact that it exploded a heap of other shells or powder-charges which were on the deck. At least one other 12-inch shell passed through the same ship without material damage. In the recital of the Japanese damages from shell there is not much to show that the effect of single large shells was especially marked, as against that of several smaller ones.

There is, lastly, simple rapidity of fire considered as an element of force in its moral effect. There are, I think, good reasons for supposing that a slow fire which can be watched and calculated on is not so disturbing as showers of projectiles, even though the single missile may be out of comparison in destructive effect, should it strike, with any of the bolts coming in a shower. The value of rapid fire, irrespective of its direct effect, is in making the return shooting bad.

But, of course, if one gun fires faster than another, we must consider the direct effect in the same sort of way as we should consider the effect of a more numerous or less numerous battery of guns. The lighter the gun the more rapid we must expect its fire to be; and a gun discharging a shell one-half the weight; with half the energy; bursting half the amount of powder; but firing twice as fast as another gun, will in any given time fire the same weight of metal, with an equal amount of energy in sum, bursting an equal amount of powder. It is this fact which makes mere total calibre a better measure of force than it could otherwise be. The Q.F. guns of course bring this point plainly forward. Suppose a 6-inch gun firing twenty rounds in the time it takes the 67-ton gun to fire one round, then the 6-inch gun will fire 2,000 lbs. of metal while the 67-ton gun is firing 1,250. In the twenty 6-inch shot there will be an accumulated energy of 49,140-foot-tons against the 35,230-foot-tons stored up in the projectile of the 67-ton gun. There will be 200 lbs. of powder burst in the twenty 6-inch shell, against the 86 lbs. burst in the single 13.5-inch shell. That is to say, that, at these rates of fire, a single Q.F. 6-inch gun

is in each element more powerful than the 13·5-inch, and the only point open to argument is whether 2,000 lbs. of metal fired in twenty lots will contribute as much, or more, towards victory, than 1,250 lbs. fired in a single lot; or whether 200 lbs. of powder burst in twenty shells will contribute as much or more to victory than 86 lbs. burst in a single shell.

No doubt all the 6-inch shot or shell in the world fired against an armoured-target which they cannot penetrate will not be so effective as a single 13·5-inch projectile which can penetrate. But then we may say broadly that no such target exists. Although a modern armoured or protected ship may possibly be made unsinkable by 6-inch projectiles; and, although a proportion of the guns of such a ship may be so protected as to make it impossible to put them out of action by 6-inch projectiles, yet I do not think we are in a position to say that any ship exists which may not be conquered by lighter guns.

Therefore we must work by general rules. I have prepared three tables (I, II, and III), which give at one view the elements of force, calibre, weight of projectile, energy, shell charge, and speed of fire of the principal types of our guns. In all except the last element, I have used Captain Orde Browne's figures in "*Brassey's Naval Annual*." The rate of fire must be to a great extent an estimate, and in any case a standard common to all classes of guns ought to be set up. I do not think it so much matters what the standard is, so long as it is applied as being common to every class of gun. Quite possibly it may be found that the highest speed attainable without aiming, is the safest standard to adopt, being least open to variation from circumstances, I have generally considered that the results given by prize firing is the most satisfactory standard to use, as the firing is carried out under similar conditions, and owing to the great numbers of experiments, fair averages can be struck.

These figures are not, however, available to me, and in preparing the paper I had to accept such data as I could obtain so as to approximate as nearly as might be to a prize firing standard, interpolating where I had no data. I found afterwards that Captain Orde Browne had adopted a standard after a good deal of inquiry, which would probably raise less discussion than that which I had adopted. As my object is more to illustrate a method than to make an exact use of it, I have thought it better to accept nearly the standard I found in use. In revising the paper read, I have done so in tables I, II, and III, and have corrected the subsequent tables to agree with them.

While we cannot perhaps, therefore, insist upon the correctness of any rate of fire set up, we can insist on the possibility of setting up a true rate of means of experiment, so that speed of fire shall be at least nearly as reliable an element as energy.

Using the scale mentioned, the first of these three tables gives the values of the elements of force for each gun. The second of them takes the 67-ton gun as the unit and shows the number of each class of gun which, when discharged, would equal in their accumulated elements of force those of a single discharge of the unit. The third table takes into account the rate of fire, and shows, considering this comparative rate of fire,

how many guns of each class would equal the 67-ton gun in each of the elements of its force.

It is striking, I think, to note the great differences between tables II and III, and to observe how, in table II, calibre fails, and in table III, how it succeeds as a measure of force. Taking the extreme case in table II, 7·29 3-pounder guns are equal to the 67-ton gun in calibre, but it takes more than 400 3-pounder guns to develop the energy of the 67-ton gun, nearly 400 guns to throw its weight of metal, and more than 143 guns to burst its shell-charge. But, then, the 3-pounders will fire 28 rounds while the 67-ton gun fires one, and taking this into account in table III, we see that in any given time, less than 27 3-pounder guns will throw the weight of metal and burst the shell-charge of the 67-ton gun, while 16 guns of that calibre will accumulate its energy. The point is, of course, that when we deal with the calibre of one gun, we deal with the square of the sum; but in many calibres we deal with the sum of the squares. The multiplication for rapidity of fire redresses the balance.

Summing up, then, this review of the elements of force in a war-ship, I leave out the question of the ram, because even special arrangements for developing the weapon do not involve much weight, and because, in a sense, every steam-ship is more or less of a ram; and because the examination of this element of force would involve the discussion of manœuvring powers, which is a complicated question even by itself. I take no more note of the torpedo than to assume that its place as an element of force may be roughly measured by the number of torpedo-tubes carried.

I am left, then, with the elements of armour, speed, coal endurance, and gun-power, the latter being sub-divided into weight of metal, muzzle-energy, shell-power measured by powder-charge, and simple rapidity of fire.

We can examine all these elements of force in relation to the date of the ship's design, because of the interest which attaches to the varying views of the day. So the dates taken are those of the year when the ship, or type of ship, was first laid down.

We require the displacement not only in view of its tendency to increase or decrease as time goes on, but in view of that important question of the concentration of force in few bottoms, or its dispersion in many bottoms.

We then get the two ways of looking at all the elements, namely, their actual amounts, and therefore, their relative amounts, as compared one with another in increases and decreases; and their amounts proportionate to the displacement of the ships in which they appear, which is in all cases taken at per 1,000 tons of displacement.

As regards weight of hull, armour, number of torpedo-tubes, speed, coal supply and endurance, number of guns, and total calibre, there is no further sub-division. We have but to consider the absolute amount of the element and its proportion per 1,000 tons of displacement.¹

¹ In calculating proportionate values in the summaries, I have taken the actual speed and coal endurance in combination with the other elements proportionately per 1,000 tons. No doubt speed and coal endurance should be treated proportionately for separate examination, in order to observe the ratios obtained for different powers and different displacements; but these ratios raise complex questions which cannot be treated in this paper.

Regarding the weight of armour carried, official figures are too few and too far between; and there are often such variations in the figures quoted that I have found it best to take the official "weight of hull" from the estimates, which includes armour generally, as the element to be dealt with. In armoured, or protected ships, I have supposed that, generally a larger or smaller proportionate weight of hull means a larger or smaller proportion of armour, and therefore a higher or a lower place as regards the element of armoured protection.

Gun-power, whether taken absolutely or proportionately to displacement, must be considered under two heads, namely, under that of the weight of metal thrown, energy developed, and shell-charges burst in a single discharge from every gun—the element of time being omitted; and the like quantities taken at the rate per minute; that is, with the element of time taken into account. Under this head we regard simple rapidity of fire.

The general tables will, I hope, give the student of these matters much of the information he wants in a concise form. As to the outcome of the whole matter, we get at it most easily and completely by ranging the ships according to their order in the possession of each element; that is, as to date, displacement, weight of hull, number of torpedo-tubes, speed—taken at natural draught in order to avoid the complications due to different values of forced draught—coal supply, coal endurance, number of guns, total calibre, gun-power per round and per minute, and the whole taken absolutely, and proportionately per 1,000 tons of displacement.

The first set of tables I prepared took the ships as ranged in their official classes. But I found that there was not real distinction enough between the classes to enable us to get a clear view in this way. The classes have had a tendency to merge into one another, so that there are no distinct breaks in the displacement, or force, which would enable us to separate classes easily, if they had not been officially separated. A general review shows that our fleet is still, on the whole, arranged in the gradually descending form which existed before the rise of the line-of-battle, and which I have pointed out in my "Naval Warfare," was found inconsistent with the experience of the sea-fight.

So that I treat our fleet as divided into fifty-one classes denoted by the names of typical ships, which sometimes comprise many ships and sometimes only one. Our later methods of building in large groups has undoubtedly a tendency to differentiate classes and reduce their number; but there is still so much doubt hanging over the question of what is the best compromise amongst the various elements of force, that necessary experiments upwards in displacement, like the "Powerful" and the "Talbot," or downwards in displacement, like the "Renown" and the "Barfleur," tend to make us lose the thread which governed our ancestors' ship-building policy centuries ago.

The range we get in the various elements of force as developed between the dates of 1869 and 1894 is worthy of passing notice. Thus:—

| | | |
|--|---------|--------------|
| Displacement | 525 to | 14,900 tons |
| Weight of hull | 270 „ | 10,180 tons |
| Armour, according to the very imperfect list I have | 2,223 „ | 4,550 tons |
| Number of torpedo-tubes | 2 „ | 7 |
| I.H.P.—natural draught | 720 „ | 25,000 |
| Speed—natural draught | 11·5 „ | 22 knots |
| Coal supply—legend weight | 80 „ | 1,500 tons |
| Coal supply—maximum weight | 100 „ | 3,000 tons |
| Coal endurance according to legend weight of coal (?) | 1,340 „ | 15,000 miles |
| Coal endurance according to maximum weight of coal | — „ | 25,000 miles |
| Number of guns | 6 „ | 44 |
| Inches of calibre | 15·1 „ | 190·2 |
| Weight of metal fired in one round | 44 „ | 7,030 lbs. |
| Energy developed in one round | 1,195 „ | 172,972 f.t. |
| Shell-charges burst in one round | 6 „ | 544 lbs. |
| Then, coming to the gun-power as measured by time, we have :— | | |
| Weight of metal fired in one minute | 300 to | 10,904 lbs. |
| Energy developed in one minute | 7,500 „ | 323,592 f.t. |
| Shell-charges burst in one minute | 32 „ | 1,312 lbs. |
| Number of rounds fired in one minute | 8 „ | 444 |
| Coming to the proportionate elements, that is, to the amount of each element per 1,000 tons of displacement found in each ship, we have :— | | |
| Weight of hull per 1,000 tons | 385 to | 713 tons |
| Weight of armour per 1,000 tons | 250 „ | 371 tons |
| Number of torpedo-tubes per 1,000 tons | 0·18 „ | 7·61 |
| I.H.P. natural draught per 1,000 tons | 547 „ | 3,401 |
| Coal supply per 1,000 tons, legend weight | 63 „ | 217 tons |
| Number of guns per 1,000 tons | 1·51 „ | 13·33 |
| Inches of calibre 1,000 tons | 7·1 „ | 38·3 |
| Weight of metal fired in one round per 1,000 tons | 83 „ | 591 lbs. |
| Energy developed in one round per 1,000 tons | 2·276 „ | 15,047 f.t. |
| Shell-charges burst in one round per 1,000 tons | 10·4 „ | 50·9 lbs. |

I have been struck in the preparation of these tables by the limited connection between displacement and force, and especially relative force, when divided into its elements.

Of course, as Sir Nathaniel Barnaby has pointed out, different dates represent different views of different elements of force. At one date, one element gives way, or is exalted, at another date, another element, and that has a great deal to say to it; but though in the main, displacement may be held to govern it, the position which some ships fall into when ranged according to particular or total elements of force, is sometimes surprising.

Though roughly, the larger displacements take the higher rank, and the smaller displacements the lower rank in absolute elements of force, as we should naturally expect, data, governing conceptions of the relative values of components of force, constantly vary the rank of ships in any particular element of force.

The "Talbot" of 5,600 tons, stands for H.P. between the "Barfleur" of 10,500 tons and the "Nile" of 11,940 tons; and the "Australia," of earlier date, but the same displacement, between the "Devastation" of 9,330 tons, recently supplied with 5,500-H.P., and the "Magicienne" of 2,950 tons and the same H.P.

As before observed, speed commonly goes in the inverse ratio of displacement, as it used to go in the days of sailing-ships. I think a very simple consideration enforces, and justifies, such a rule.

A ship meeting an enemy's ship generally has only one choice between fighting and running away. As her fighting power goes down, so do her chances of meeting ships with greater fighting power go up. It stands to reason that according to this increasing chance, so should there be an increasing chance of running away.

Absolute coal supply might, in the first instance, be expected to follow displacement, and it generally does. But in the days of the "Dreadnought" it was not only that engines consumed more coal for given power, but also that coal-endurance took a more distinct, and perhaps a higher, place in general estimation than it did at a later date. So she—with the "Inflexible"—displacing 10,820 tons—has a legend weight of 1,200 tons, and stands between the "Blake" with 1,500 tons and the "Majestic" with 900.

For something like the same reasons we find the "Arethusa" of 4,300 tons, but dating from 1880, carrying her legend weight of 550 tons of coal, the same as the "Talbot," dating from 1893, but displacing 5,600 tons.

But both in speed and coal endurance designers are met by the law that the smaller displacement requires the greater proportionate power, and the greater proportionate coal-supply to produce like results. Naturally, apart from improvement in engines, which follows date, we should expect not only that coal supply should follow displacement, but that it should proportionately increase as displacement falls.

To a very great extent this is so, but not to anything like the extent which would equalise endurance. Except that the modern cruisers pass the battle-ships in the matter of coal endurance, we might say that the tendency is to let the smaller vessel suffer in the matter of endurance, in view of increasing other elements of force. The "Royal Arthur" is credited with double the coal endurance of the "Renown," 10,000 against 5,000 miles; while the "Talbot" drops to 7,000 miles, the same as the "Australia" of earlier date. Vessels of least displacement on the list drop to 2,500 miles.

Number of guns goes—as we should expect now—pretty evenly with displacement; but in the older ships, built at dates when it was mistakenly supposed that concentration rather than dispersion of gun-power

was to be aimed at, space has not permitted much increase in the number. We have the "Mersey" of 4,050 tons ranking, with 23 guns, above the "Inflexible" of 11,880 tons, and the "Devastation" of 9,330 tons, with only 18 guns each.

Calibre, as might be supposed, very fairly follows displacement, and also runs pretty well with number of guns.

But weight of metal thrown in one round of course puts the ships carrying the heaviest guns forward; makes the "Inflexible" head the list with 7,030 lbs.; brings up the "Sans Pareil" with 5,411 lbs., and the "Benbow" with 4,681 lbs., and drops even the "Majestic" to the eighth place with 4,839 lbs.

The modern development of the gun is in the matter of energy; and this element sends the "Majestic" up again to the top of the list with 172,972 foot-tons, follows her by the "Empress of India" and the "Hood," drops the "Inflexible" to the eighth place with 117,548 foot-tons.

Shell-charge per round follows displacement a good deal; it leaves the "Majestic" at the head of the list with 544 lbs. of powder, but interposes the "Collingwood" with 390 lbs., between the "Rodney" with 419 lbs., and the "Nile" with 381 lbs. The "Edgar" of 7,350 tons, dating from 1889, only stands, with 178 lbs. of shell-charge, one place above the "Australia" of 5,600 tons, dating from 1885, with 174 lbs. of shell-charge. Here it is evident advantage has been taken of quick-firing to substitute other elements of force in the "Edgar," instead of using it to increase the shell-power. For, using the multipliers I have adopted, the shell power of the "Australia" stands at 283 lbs. per minute, while that of the "Edgar" is 708 lbs.

But the gun-power of one round is clearly a faulty measure of fighting force. The real force is the accuracy and the speed of fire multiplying the weight, energy, and shell-charge of the single round. On the point of accuracy it is well worthy of remark that it stands almost to reason that the accuracy of fire of our ships is likely to be higher than that of most others taken in the mass, simply because the large number of ships we keep in commission insures us in having the greater number of practised shots.

But a remark on the other side has to be borne in mind with regard to Q.F. guns. It is admitted that they entail a greater supply of ammunition, and the admission is acted on. At first sight, we hardly perceive that this discounts to some extent the power of the gun itself. But the argument must lie thus: Taking two ships of equal cost and displacement in action with each other, we must assume that defeat follows the greater number of effective hits received in a given time. The shot thrown away in misses during that given time do not count. Now, supposing that one of the two ships fires away twice the number of shot in the given time, but only makes the same number of hits that the other does, the battle is hypothetically drawn; but this extra weight that the first ship has thrown away in misses will have presumably been represented in the second ship by some element of force which is not possessed by the first ship.

On the other hand, if the speed of fire and proportionate number of hits on both sides are equal, the ship with the larger supply of ammunition left on board has sacrificed some element of force to carry it. If, therefore, it is necessary to carry for the Q.F. gun a larger number of rounds than are required for the slow-firing gun, the fact discounts by so much the value of the Q.F. gun. Putting it in another way, supposing the slow-firing ship carries 1,000 rounds of ammunition, and the quick-firing ship carries 2,000 rounds; and suppose the first fires 100 rounds and the second 200 rounds a minute. Then in a five-minute action the slow-firing ship will have fired 500 and the quick-firing ship 1,000 rounds. If the quick-firing ship beats the slow-firing ship in the five minutes, she has been carrying 500 rounds of ammunition more than the slow-firing ship, and is therefore losing some element of force that the other possesses instead of it. If she has not hit the slow-firing ship oftener in the five minutes than she has herself been hit, she has thrown away the rest of her ammunition, to carry which she has sacrificed some other element of force which the slow-firing ship possesses. If, therefore, the Q.F. gun requires a larger supply of ammunition than the slow-firing gun, we must take it as a provision for wasted shots, and therefore place it to the debit side of Q.F. guns.

Otherwise, the places of ships according to gun-power vary very much when taken as represented by the fire of one round, or by the fire of one minute.

The "Inflexible," which stood first for weight of metal, eighth for energy, and tenth for shell charge in one round, drops to twenty-fourth place for weight of metal, twenty-eighth place for energy, and twenty-ninth place for shell-charge when the fire of one minute is considered. In these three elements, she stands next below the "Dreadnought," the "Conqueror," and the "Arethusa." The "Majestic" heads the list in each element when time is taken into account, and the "Powerful" and "Empress of India" are her nearest neighbours.

The "Inflexible" throws 1,988 lbs. of metal in her minute, against 10,904 thrown by the "Majestic" and 8,734 thrown by the "Powerful." The "Inflexible" develops 39,198 foot-tons of energy per minute, while the "Majestic" develops 323,592, and the "Powerful" 232,682. The "Inflexible" bursts 146 lbs. of powder in her shell per minute, while the "Majestic" bursts 1,312, and the "Powerful" 1,107. The "Inflexible" fires 92 rounds per minute, while the "Majestic" fires 364, and the "Empress of India"—above her in rank—fires 444.

The "Edgar," which was placed nineteenth for weight of metal, eighteenth for energy, and seventeenth—below the "Ajax"—for shell charge when measured by one round, rises to the seventh place for each of the elements when measured by the fire of one minute. But in number of rounds per minute, she only takes eleventh place, next above the "Collingwood," with 289 rounds to the latter's 288.

The "Australia," which stands twentieth for weight of metal, twenty-first for energy, and eighteenth for shell-power measured by one round, stands twenty-first for the first and second, and twentieth for the last,

when time is considered. We know by the slight change in her position that she does not depend greatly on Q.F. guns, and she has in fact only a small armament of Q.F. 6 and 3 pounders.

On the other hand, the "Talbot" standing twenty-eighth for weight of metal, twenty-fifth for energy, and twenty-seventh for shell-charge when measured by the single round, goes up to the tenth and ninth places when measured by the fire of one minute. But yet the rapidity of her fire only places her twenty-fourth on the list. Her gain appears to be in the high average calibre of her guns, carrying twenty guns of the average of 4.2 inches, against the "Australia's" twenty-eight of 3.93 inches average calibre.

In a sense, the comparison points towards the attainment of that mean in which, as it appears to me, the highest efficiency is to be found.

On this particular point I might refer to the "Comus," with the unique armament of ten slow-firing 6-inch guns. She stands thirty-seventh near the bottom of the list—for number of rounds fired per minute; for weight of metal fired in one round, she stands before the "Talbot" in the twenty-seventh place; two places after her but still in the twenty-seventh place for energy; and one place above her for shell-charge, in the twenty-sixth place. When measured by time, we find the "Talbot" in the tenth place and the "Comus" in the thirty-fourth place for weight of metal; the "Talbot" in the tenth and the "Comus" in the thirty-seventh place for energy; the "Talbot" in the ninth place and the "Comus" in the thirty-third place for shell-charge. If the "Comus" had Q.F. guns she would go into the eleventh place, above the "Barfleur" for weight of metal per minute, to the same place for energy, and just below the "Barfleur" to the eleventh place, for shell-charge.

In all these cases, whether the measure be one round or one minute, we find the sloops, the torpedo gun-boats, and the first-class gun-boats, where we should expect to find them—at the bottom of the list; and I do not know that the movements in their places, when taken at per round and per minute, require any special notice.

But now, having placed all the fifty-one classes of ships according to their rank in each separate element, we can summarise their places as I have described, and bring them out in order, as we have them in table XXXVII.

We have them there ranged in the order of displacement; and then with their rank, or place in order, for weight of hull, locomotive elements, namely, I.H.P., speed, coal supply, and coal endurance. Then in rank for the elements of gun-power, namely, number of guns, total calibre; and then weight of metal, energy, shell charge, and speed of fire, taken at per minute. Then the rank for number of torpedo-tubes carried, and in the last column the four ranks are summarised so as to give the rank for all the elements.

The interesting features of the table are the distributions of locomotive and gun-power combining with the elements of weight of hull and number of torpedo-tubes to give a rank which includes all elements. We note the "Powerful" taking the first place in the sum total of

elements, because she stands first in rank for locomotive elements, and third only for gun-power, while her places for weight of hull, assumed to be attained by protective armour, and for number of torpedo-tubes are both high. The "Majestic's" force when summarised places her below the "Renown." She has sacrificed locomotion to armour and gun-power, being below the "Renown" in natural-draught speed, above her in coal supply, but considerably below her in coal endurance according to the legend weight taken.

But the positions in rank for elements of force for these heavier ships, of nearly the same date, do not differ greatly from what we might expect. When the older ships "Inflexible" and "Dreadnought," coming next below them in size, yet drop several places for force, we see the influence of date. Then, as the ships decrease in size, we get very fair gradations of force, till we come to the "Royal Arthur" and "Edgar," ships standing eighteenth and nineteenth in order of displacement, which suddenly spring up to the sixth and eighth places in order of general force. Their elements of locomotion and gun-power rank so high that their low rank for weight of hull (assumed to be low rank for protective armour) cannot throw them back.

The "Talbot," a still newer ship, drops rather more than might be expected, being handicapped by lightness of hull and lower gun-power. But being of the same displacement as the "Australia," we can note why the latter comes out below her in force. The "Australia" gains a point by having a heavier hull, but she loses heavily in locomotive power, having less indicated horse-power and less speed, though carrying a larger coal supply, which, however, only gives her an equal coal endurance.¹

As we run our eye down the rank for all elements, after the "Talbot," we are not struck by any great discrepancies between the fall in displacement and the fall in rank for force. The "Astræa," "Æolus," and "Apollo" rise considerably above the positions in which mere displacement puts them, a rise which appears to be due to their increased locomotive power. But for the rest there is a fairer balance apparent between the one power and the other.

Great interest arises when we regard the proportional summaries given in Table XXXVIII. Here there is a remarkable reversal of the order in which summaries of total, or actual, force has placed the ships. There is a great tendency to show that the higher proportionate power comes out of the smaller hull.

The smallest class of ship but one, the "Sharpshooter" class, takes the highest rank for proportionate elements of force, and the smallest class of ship, the "Rattlesnake," takes the second place.

¹ It will be understood of these summary tables that they are only rough approximations to the relative forces actually measured. A place in rank where there are 23 places, as in number of guns, or 7 places, as in number of torpedo-tubes, is of greater value than a place in rank where there are 43 places, as in energy, or 48 places, as in weight of hull. More accurate adjustment would be necessary if the data were more accurate and complete.

The "Sharpshooter" takes her high place from her proportionately immense locomotive and gun-power, while the great number of her torpedo-tubes is a set-off against the lightness of her hull. Proportionately, she stands first for horse-power, and first for coal supply, whilst she is third in rank for actual speed, which is a set-off against her holding only twenty-fifth place for coal endurance. As to her gun-power, she stands fourth on the list of proportionate number of guns carried, and eleventh on the list for proportionate calibre. She is fourth on the list for proportionate weight of metal fired per minute; ninth for proportionate energy, seventh for proportionate shell-charge, and fourth for proportionate speed of fire.

The "Algerine" and "Alert," which take the second and first places for gun-power, only take the twenty-second and twenty-fifth places for proportionate locomotive power, and their having no torpedo-tubes exaggerates their loss when it comes to be summarised in this manner. But in these two classes of ships we have an example—no doubt for carefully considered reasons—where locomotion has been sacrificed to gun-power in a remarkable way.

The "Æolus" and the "Apollo" take third place in rank for proportionate elements, gaining it by a greater approach to equality of rank in all. So it is with the "Alarm," which takes fourth place in proportionate power.

The "Barham" comes out in fifth place for proportionate force, gaining it by gun-power and the proportionate weight of her hull.

The "Medea," "Pallas," and "Halcyon" all stand together for proportionate force, though there are six or seven places between the latter and the former for displacement. The "Medea" gains her place chiefly by her locomotive power, and the "Pallas" by her gun-power, while the "Halcyon," is assisted by her increased weight of hull, the approach to balance between her locomotive and gun-power, and by the large number of her torpedo-tubes.

We find the "Royal Arthur" and "Edgar" taking high proportionate rank; while of the newer battle-ships, the "Majestic," "Empress of India," and "Renown" all stand in the seventeenth place for proportionate elements of force.

It will be understood of this classification that it is at best tentative and imperfect. I think it suggests a method by which the real force of men-of-war may be approached by way of estimate. It also, by the use of the proportionate method, promises a means of judging of design as a whole, more likely to be complete than the desultory comparison of single elements of force now in common use.

We seem to get generally a confirmation of the policy of sacrificing in the heavier ships locomotive elements for gun-power and armour protection. But, in the smaller ships the policy which sometimes elevates locomotion, and sometimes gun-power in excess, is less easy to understand, though if we had all the facts before us we should doubtless be more in a position to judge.

The general result of my somewhat laborious and troublesome examination of the fighting power of our fleet is to confirm me in my old belief that we are, in all cases, both in the ships and guns, seeking for the happy mean, which, when it is found, cannot be bettered.

NOTE.—In the following tables I have taken a great deal of trouble in checking and counter-checking to get the figures correct. But there are such a mass of them, and they hang together in such a way, that I am conscious of even a good deal of possible inaccuracy. But with regard to the figures relating to elements of force, other than gun-power, which are nearly all taken from the Estimates or other official documents, I have sometimes had to make a choice when the figures appeared to differ among themselves. I hope that in any case the figures will be found sufficiently correct to avoid glaring errors.

TABLE I.—SHOWING ELEMENTS OF GUN-POWER.

| Name of Gun. | Calibre. | Weight of Projectile. | Muzzle Energy. | Shell Charge. | Rounds Fired per Minute. |
|-------------------------|----------|-----------------------------|-------------------|------------------|--------------------------------|
| | Inches. | lbs. | Tons. | lbs. | Rounds. |
| 67-ton | 13·5 | 1,250 | 35,230 | 86 | 0·5 |
| 45-ton* | 12·0 | 714 | 18,130 | 79 | 0·5 |
| 29-ton | 10·0 | 500 | 14,430 | 38 | 0·5 |
| 22-ton | 9·2 | 380 | 10,910 | 32 | 0·5 |
| 15-ton | 8·0 | 210 | 6,730 | 18·5 | 0·5 |
| 6-inch Q.F.† | 6·0 | 100 | 2,457 | 10 | 5·0 |
| 6-inch | 6·0 | 100 | 1,938 | 10 | 1·0 |
| 5-inch | 5·0 | 50 | 1,124 | 4 | 1·0 |
| 4·7-inch Q.F.‡ | 4·72 | 45 | 995 | 4 | 6·0 |
| 4-inch Q.F.§ | 4·0 | 25 | 1,046 | 3 | 6·0 |
| 4-inch | 4·0 | 25 | 625 | 3 | 2·0 |
| 12-pounder Q.F. | 3·0 | 12·5 | 423 | 2·6 | 9·0 |
| 6-pounder Q.F. | 2·24 | 6·0 | 137 | 0·8 | 14·0 |
| 3-pounder Q.F. | 1·85 | 3·3 | 80 | 0·6 | 14·0 |

* The Wire Gun of 46 tons has 850-lb. projectile and 33,940 energy. Those allowed a speed of fire of 0·75 round per minute.

† The Wire Gun has 3,356 energy.

‡ A Wire Gun.

§ The Wire Gun has 1,494 energy.



TABLE II.—SHOWING PROPORTIONATE VALUE OF GUNS.

| Name of Gun. | Calibre. | Weight of Projectile. | Muzzle Energy. | Shell Charge. | Speed of Fire. |
|-------------------------|----------|-----------------------|----------------|---------------|----------------|
| 67-ton | 1·00 | 1·00 | 1·00 | 1·00 | 1·00 |
| 45-ton | 1·12 | 1·75 | 1·94 | 1·09 | 1·00 |
| 29-ton | 1·35 | 2·50 | 2·44 | 2·26 | 1·00 |
| 22-ton | 1·46 | 3·29 | 3·22 | 2·68 | 1·00 |
| 15-ton | 1·68 | 5·95 | 5·23 | 4·61 | 1·00 |
| 6-inch Q.F. | 2·25 | 12·50 | 14·33 | 8·60 | 10·00 |
| 6-inch | 2·25 | 12·50 | 18·17 | 8·60 | 2·00 |
| 5-inch | 2·70 | 25·00 | 31·44 | 21·50 | 2·00 |
| 4·7-inch Q.F. | 2·87 | 27·77 | 35·40 | 21·50 | 12·00 |
| 4·0-inch Q.F. | 3·37 | 50·00 | 56·36 | 28·66 | 12·00 |
| 4-inch | 3·37 | 50·00 | 56·36 | 28·66 | 4·50 |
| 12-pounder Q.F. | 4·50 | 100·00 | 83·26 | 33·04 | 18·00 |
| 6-pounder Q.F. | 6·02 | 208·33 | 257·15 | 107·50 | 28·00 |
| 3-pounder Q.F. | 7·29 | 378·78 | 440·72 | 143·33 | 28·00 |

NOTE.—The Table shows the number of each class of Gun which is equal to the 67-ton Gun in each element, i.e., the discharge of 2½ 29-ton Guns gives a cumulative energy equal to one discharge of the 67-ton Gun.

TABLE III.—SHOWING PROPORTIONATE VALUE OF GUNS, TAKING RAPIDITY OF FIRE INTO ACCOUNT.

| Name of Gun. | Calibre. | Weight of Projectiles Fired. | Cumulative Energy. | Total Shell Charge. | Rounds Fired per Minute. |
|-------------------------|----------|------------------------------|--------------------|---------------------|--------------------------|
| 67-ton | 1·00 | 1·00 | 1·00 | 1·00 | 0·50 |
| 45-ton | 1·12 | 1·75 | 1·94 | 1·09 | 0·50 |
| 29-ton | 1·35 | 2·50 | 2·44 | 2·26 | 0·50 |
| 22-ton | 1·46 | 3·29 | 3·22 | 2·68 | 0·50 |
| 15-ton | 1·68 | 5·95 | 5·23 | 4·61 | 0·50 |
| 6-inch Q.F. | 2·25 | 1·50 | 1·43 | 0·86 | 5·00 |
| 6-inch | 2·25 | 6·25 | 9·10 | 4·30 | 1·00 |
| 5-inch | 2·70 | 12·50 | 15·67 | 10·75 | 1·00 |
| 4·7-inch Q.F. | 2·87 | 4·63 | 5·90 | 1·79 | 6·00 |
| 4-inch Q.F. | 3·37 | 8·33 | 5·61 | 2·38 | 6·00 |
| 4-inch | 3·37 | 16·40 | 18·79 | 9·55 | 1·50 |
| 12-pounder Q.F. | 4·50 | 11·11 | 4·62 | 1·83 | 9·00 |
| 6-pounder Q.F. | 6·02 | 14·88 | 9·18 | 3·83 | 14·00 |
| 3-pounder Q.F. | 7·29 | 26·62 | 15·72 | 5·11 | 14·00 |

NOTE.—The Table shows the number of Guns required to equal the 67-ton Gun in each element in any given time, taking the different speeds of fire into account, i.e., a single 6-in. Q.F. Gun firing 5·0 rounds per minute will burst more powder in shells than the 67-ton Gun in a given time.

The names given in the following Tables are representatives of classes. As the figures are not exact for every ship in most classes, slight differences will sometimes appear; the class figures taking the place of the individual figures. It is also to be observed that many ships appear in different estimates with varying elements, though not to any great degree.

IV.—TOTAL ELEMENTS—SHIPS RANGED ACCORDING TO DATE OF LAYING DOWN.

| | | | | | | | | | | | |
|---|------------------|----|----|----|------|----|-------------|----|----|----|------|
| 1 | Powerful | .. | .. | .. | 1894 | 8 | Nile | .. | .. | .. | 1886 |
| 1 | Algerine | .. | .. | .. | 1894 | 8 | Raccoon | .. | .. | .. | 1886 |
| 1 | Majestic | .. | .. | .. | 1894 | 9 | Sans Pareil | .. | .. | .. | 1885 |
| 1 | Talbot | .. | .. | .. | 1894 | 9 | Australia | .. | .. | .. | 1885 |
| 2 | Renown | .. | .. | .. | 1893 | 9 | Archer | .. | .. | .. | 1885 |
| 2 | Alert | .. | .. | .. | 1893 | 9 | Rattlesnake | .. | .. | .. | 1885 |
| 3 | Halcyon | .. | .. | .. | 1891 | 10 | Fearless | .. | .. | .. | 1884 |
| 4 | Barfleur | .. | .. | .. | 1890 | 11 | Mersey | .. | .. | .. | 1883 |
| 4 | Astræa | .. | .. | .. | 1890 | 12 | Camperdown | .. | .. | .. | 1882 |
| 4 | Alarm | .. | .. | .. | 1890 | 12 | Benbow | .. | .. | .. | 1882 |
| 5 | Empress of India | .. | .. | .. | 1889 | 12 | Rodney | .. | .. | .. | 1882 |
| 5 | Hood | .. | .. | .. | 1889 | 13 | Warspite | .. | .. | .. | 1881 |
| 5 | Royal Arthur | .. | .. | .. | 1889 | 14 | Collingwood | .. | .. | .. | 1880 |
| 5 | Edgar | .. | .. | .. | 1889 | 14 | Arethusa | .. | .. | .. | 1880 |
| 5 | Æolus | .. | .. | .. | 1889 | 15 | Edinburgh | .. | .. | .. | 1879 |
| 5 | Apollo | .. | .. | .. | 1889 | 16 | Conqueror | .. | .. | .. | 1877 |
| 5 | Pallas | .. | .. | .. | 1889 | 17 | Ajax | .. | .. | .. | 1876 |
| 6 | Blake | .. | .. | .. | 1888 | 17 | Iris | .. | .. | .. | 1876 |
| 6 | Barham | .. | .. | .. | 1888 | 17 | Carysfort | .. | .. | .. | 1876 |
| 6 | Barracouta | .. | .. | .. | 1888 | 17 | Champion | .. | .. | .. | 1876 |
| 6 | Basilisk | .. | .. | .. | 1888 | 17 | Comus | .. | .. | .. | 1876 |
| 7 | Magicienne | .. | .. | .. | 1887 | 18 | Inflexible | .. | .. | .. | 1874 |
| 7 | Medea | .. | .. | .. | 1887 | 19 | Dreadnought | .. | .. | .. | 1870 |
| 7 | Magpie | .. | .. | .. | 1887 | 19 | Rupert | .. | .. | .. | 1870 |
| 7 | Pheasant | .. | .. | .. | 1887 | 20 | Devastation | .. | .. | .. | 1869 |
| 7 | Sharpshooter | .. | .. | .. | 1887 | | | | | | |

V.—TOTAL ELEMENTS—SHIPS RANGED ACCORDING TO DISPLACEMENT.

| | | | | | | | | | | | |
|----|------------------|----|----|----|--------|----|--------------|----|----|----|-------|
| 1 | Majestic | .. | .. | .. | 14,900 | 24 | Arethusa | .. | .. | .. | 4,300 |
| 2 | Powerful | .. | .. | .. | 14,200 | 25 | Mersey | .. | .. | .. | 4,050 |
| 3 | Empress of India | .. | .. | .. | 14,150 | 26 | Iris | .. | .. | .. | 3,730 |
| 3 | Hood | .. | .. | .. | 14,150 | 27 | Æolus | .. | .. | .. | 3,600 |
| 4 | Renown | .. | .. | .. | 12,350 | 28 | Apollo | .. | .. | .. | 3,400 |
| 5 | Nile | .. | .. | .. | 11,940 | 29 | Magicienne | .. | .. | .. | 2,950 |
| 6 | Inflexible | .. | .. | .. | 11,880 | 30 | Medea | .. | .. | .. | 2,800 |
| 7 | Dreadnought | .. | .. | .. | 10,820 | 31 | Pallas | .. | .. | .. | 2,575 |
| 8 | Camperdown | .. | .. | .. | 10,600 | 32 | Carysfort | .. | .. | .. | 2,380 |
| 8 | Benbow | .. | .. | .. | 10,600 | 32 | Champion | .. | .. | .. | 2,380 |
| 9 | Barfleur | .. | .. | .. | 10,500 | 32 | Comus | .. | .. | .. | 2,380 |
| 10 | Sans Pareil | .. | .. | .. | 10,470 | 33 | Barham | .. | .. | .. | 1,830 |
| 11 | Rodney | .. | .. | .. | 10,300 | 34 | Archer | .. | .. | .. | 1,770 |
| 12 | Collingwood | .. | .. | .. | 9,500 | 34 | Raccoon | .. | .. | .. | 1,770 |
| 13 | Edinburgh | .. | .. | .. | 9,420 | 35 | Fearless | .. | .. | .. | 1,580 |
| 14 | Devastation | .. | .. | .. | 9,330 | 35 | Barracouta | .. | .. | .. | 1,580 |
| 15 | Blake | .. | .. | .. | 9,000 | 36 | Basilisk | .. | .. | .. | 1,170 |
| 16 | Ajax | .. | .. | .. | 8,660 | 37 | Halcyon | .. | .. | .. | 1,070 |
| 17 | Warspite | .. | .. | .. | 8,400 | 38 | Algerine | .. | .. | .. | 1,050 |
| 18 | Royal Arthur | .. | .. | .. | 7,700 | 39 | Alert | .. | .. | .. | 960 |
| 19 | Edgar | .. | .. | .. | 7,350 | 40 | Alarm | .. | .. | .. | 810 |
| 20 | Conqueror | .. | .. | .. | 6,200 | 41 | Magpie | .. | .. | .. | 805 |
| 21 | Australia | .. | .. | .. | 5,600 | 42 | Pheasant | .. | .. | .. | 755 |
| 21 | Talbot | .. | .. | .. | 5,600 | 43 | Sharpshooter | .. | .. | .. | 735 |
| 22 | Rupert | .. | .. | .. | 5,440 | 44 | Rattlesnake | .. | .. | .. | 525 |
| 23 | Astræa | .. | .. | .. | 4,360 | | | | | | |

VI.—TOTAL ELEMENTS—MEAN CALIBRE OF GUNS, AND
WHETHER ARMoured, PROTECTED, OR SHEATHED.

| Names. | Average Calibre of Guns. | Armoured or Protected. | Sheathed or not. |
|------------------------|-----------------------------|------------------------------|---------------------|
| Majestic | 4.32 | A. | not |
| Powerful | 3.82 | P. | not |
| Empress of India | 4.09 | A. | not |
| Hood | 4.40 | A. | not |
| Renown | 4.30 | A. | sh. |
| Nile | 4.08 | A. | not |
| Indeflexible | 6.03 | A. | not |
| Dreadnought | 4.28 | A. | not |
| Camperdown | 4.42 | A. | not |
| Benbow | 4.29 | A. | not |
| Barfleur | 3.74 | A. | sh. |
| Sans Pareil | 4.19 | A. | not |
| Rodney | 4.22 | A. | not |
| Collingwood | 4.18 | A. | not |
| Edinburgh | 5.54 | A. | not |
| Devastation | 3.78 | A. | not |
| Blake | 3.85 | P. | not |
| Ajax | 4.51 | A. | not |
| Warspite | 4.52 | A. | sh. |
| Royal Arthur | 3.90 | P. | sh. |
| Edgar | 3.94 | P. | not |
| Conqueror | 5.11 | A. | not |
| Australia | 3.93 | A. | not |
| Talbot | 4.20 | P. | sh. |
| Rupert | 3.60 | A. | not |
| Astræa | 3.65 | P. | sh. |
| Arethusa | 4.15 | P.P. | not |
| Mersey | 4.23 | P. | not |
| Iris | 4.25 | not | not |
| Æolus | 3.53 | P. | sh. |
| Apollo | 3.53 | P. | not |
| Magicienne | 3.61 | P. | sh. |
| Medea | 3.61 | P. | not |
| Pallas | 3.28 | P. | not |
| Carysfort | 6.50 | P.P. | sh. |
| Champion | 4.46 | P.P. | sh. |
| Comus | 6.00 | P.P. | sh. |
| Barham | 3.57 | P. | not |
| Archer | 3.62 | not | not |
| Raccoon | 3.62 | not | not |
| Fearless | 2.90 | not | not |
| Barracouta | 3.57 | P. | not |
| Basilisk | 5.00 | not | sh. |
| Halcyon | 3.05 | not | not |
| Algerine | 3.14 | not | sh. |
| Alert | 3.14 | not | sh. |
| Alarm | 2.80 | not | not |
| Magpie | 4.00 | not | sh. |
| Pheasant | 4.00 | not | sh. |
| Sharpshooter | 2.80 | not | not |
| Rattlesnake | 2.15 | not | not |

VII.—TOTAL ELEMENTS—SHIPS RANGED ACCORDING TO WEIGHT OF HULL.

| | | | | | | | | | |
|----|------------------|----|----|--------|----|--------------|----|----|-------|
| 1 | Majestic | .. | .. | 10,180 | 26 | Mersey | .. | .. | 2,070 |
| 2 | Hood | .. | .. | 9,630 | 27 | Eolus | .. | .. | 1,910 |
| 3 | Empress of India | .. | .. | 9,610 | 28 | Apollo | .. | .. | 1,740 |
| 4 | Nile | .. | .. | 8,520 | 29 | Arethusa | .. | .. | 1,680 |
| 5 | Powerful | .. | .. | 8,480 | 30 | Magicienne | .. | .. | 1,490 |
| 6 | Renown | .. | .. | 8,020 | 31 | Iris | .. | .. | 1,436 |
| 7 | Inflexible | .. | .. | 7,300 | 32 | Medea | .. | .. | 1,360 |
| 8 | Dreadnought | .. | .. | 7,016 | 33 | Pallas | .. | .. | 1,250 |
| 9 | Sans Pareil | .. | .. | 6,970 | 34 | Carysfort | .. | .. | ? |
| 10 | Camperdown | .. | .. | 6,900 | 34 | Champion | .. | .. | ? |
| 10 | Benbow | .. | .. | 6,900 | 34 | Comus | .. | .. | ? |
| 11 | Barfleur | .. | .. | 6,800 | 35 | Barham | .. | .. | 1,050 |
| 12 | Rodney | .. | .. | 6,600 | 36 | Barracouta | .. | .. | 850 |
| 13 | Edinburgh | .. | .. | 6,260 | 37 | Archer | .. | .. | 800 |
| 14 | Collingwood | .. | .. | 6,190 | 38 | Racoon | .. | .. | 798 |
| 15 | Devastation | .. | .. | 6,076 | 39 | Fearless | .. | .. | 750 |
| 16 | Ajax | .. | .. | 5,900 | 40 | Basilisk | .. | .. | 605 |
| 17 | Warspite | .. | .. | 5,200 | 41 | Halcyon | .. | .. | 555 |
| 18 | Blake | .. | .. | 4,800 | 42 | Algerine | .. | .. | 510 |
| 19 | Royal Arthur | .. | .. | 4,435 | 43 | Alert | .. | .. | 478 |
| 20 | Conqueror | .. | .. | 4,200 | 44 | Magpie | .. | .. | 420 |
| 21 | Edgar | .. | .. | 4,085 | 45 | Pheasant | .. | .. | 400 |
| 22 | Rupert | .. | .. | 3,510 | 46 | Alarm | .. | .. | 385 |
| 23 | Australia | .. | .. | 3,235 | 47 | Sharpshooter | .. | .. | 320 |
| 24 | Talbot | .. | .. | 3,140 | 48 | Rattlesnake | .. | .. | 270 |
| 25 | Astræa | .. | .. | 2,460 | | | | | |

VIII.—TOTAL ELEMENTS—SHIPS RANGED ACCORDING TO WEIGHT OF ARMOUR.

| | | | | | | | | | |
|---|------------------|----|----|-------|---|-------------|----|----|-------|
| 1 | Empress of India | .. | .. | 4,550 | 5 | Devastation | .. | .. | 2,961 |
| 2 | Nile | .. | .. | 4,410 | 6 | Collingwood | .. | .. | 2,780 |
| 3 | Dreadnought | .. | .. | 3,510 | 7 | Edinburgh | .. | .. | 2,364 |
| 4 | Camperdown | .. | .. | 3,130 | 8 | Ajax | .. | .. | 2,223 |

IX.—TOTAL ELEMENTS—SHIPS RANGED ACCORDING TO NUMBER OF TORPEDO-TUBES.

| | | | | | | | | | |
|---|------------------|----|----|---|---|--------------|----|----|---|
| 1 | Empress of India | .. | .. | 7 | 4 | Iris | .. | .. | 4 |
| 1 | Hood | .. | .. | 7 | 4 | Eolus | .. | .. | 4 |
| 1 | Renown | .. | .. | 7 | 4 | Apollo | .. | .. | 4 |
| 1 | Barfleur | .. | .. | 7 | 4 | Magicienne | .. | .. | 4 |
| 1 | Fearless | .. | .. | 7 | 4 | Medea | .. | .. | 4 |
| 2 | Sans Pareil | .. | .. | 6 | 4 | Pallas | .. | .. | 4 |
| 2 | Warspite | .. | .. | 6 | 4 | Rattlesnake | .. | .. | 4 |
| 2 | Edgar | .. | .. | 6 | 5 | Talbot | .. | .. | 3 |
| 2 | Conqueror | .. | .. | 6 | 5 | Archer | .. | .. | 3 |
| 3 | Majestic | .. | .. | 5 | 5 | Racoon | .. | .. | 3 |
| 3 | Camperdown | .. | .. | 5 | 5 | Sharpshooter | .. | .. | 3 |
| 3 | Benbow | .. | .. | 5 | 6 | Dreadnought | .. | .. | 2 |
| 3 | Rodney | .. | .. | 5 | 6 | Edinburgh | .. | .. | 2 |
| 3 | Halcyon | .. | .. | 5 | 6 | Devastation | .. | .. | 2 |
| 3 | Alarm | .. | .. | 5 | 6 | Ajax | .. | .. | 2 |
| 4 | Powerful | .. | .. | 4 | 6 | Carysfort | .. | .. | 2 |
| 4 | Nile | .. | .. | 4 | 6 | Champion | .. | .. | 2 |
| 4 | Inflexible | .. | .. | 4 | 6 | Comus | .. | .. | 2 |
| 4 | Collingwood | .. | .. | 4 | 6 | Barham | .. | .. | 2 |
| 4 | Blake | .. | .. | 4 | 6 | Barracouta | .. | .. | 2 |
| 4 | Royal Arthur | .. | .. | 4 | 7 | Basilisk | .. | .. | 0 |
| 4 | Australia | .. | .. | 4 | 7 | Algerine | .. | .. | 0 |
| 4 | Rupert | .. | .. | 4 | 7 | Alert | .. | .. | 0 |
| 4 | Astræa | .. | .. | 4 | 7 | Magpie | .. | .. | 0 |
| 4 | Arethusa | .. | .. | 4 | 7 | Pheasant | .. | .. | 0 |
| 4 | Mersey | .. | .. | 4 | | | | | |

**X.—TOTAL ELEMENTS—SHIPS RANGED ACCORDING TO
I.H.P. NATURAL DRAUGHT; CORRESPONDING FORCED
DRAUGHT I.H.P. STATED.**

| | | | | | | | | | | | |
|---|------------------|----|----|--------|--------|----|--------------|----|----|-------|-------|
| 1 | Powerful | .. | .. | 25,000 | — | 10 | Devastation | .. | .. | 5,500 | 7,000 |
| 2 | Blake | .. | .. | 13,000 | 20,000 | 10 | Australia | .. | .. | 5,500 | 8,500 |
| 3 | Majestic | .. | .. | 10,000 | 12,000 | 10 | Magicienne | .. | .. | 5,500 | 9,000 |
| 3 | Renown | .. | .. | 10,000 | 12,000 | 11 | Arethusa | .. | .. | 6,000 | — |
| 3 | Royal Arthur | .. | .. | 10,000 | 10,000 | 12 | Conqueror | .. | .. | 4,500 | 6,000 |
| 3 | Edgar | .. | .. | 10,000 | 12,000 | 12 | Rupert | .. | .. | 4,500 | 6,000 |
| 4 | Hood | .. | .. | 9,000 | 11,000 | 12 | Pallas | .. | .. | 4,500 | 7,500 |
| 4 | Empress of India | .. | .. | 9,000 | 11,000 | 13 | Mersey | .. | .. | 4,000 | 6,000 |
| 4 | Barfleur | .. | .. | 9,000 | 13,000 | 14 | Barham | .. | .. | 3,500 | 6,000 |
| 5 | Talbot | .. | .. | 8,000 | 9,600 | 15 | Raccoon | .. | .. | 3,000 | 4,500 |
| 6 | Nile | .. | .. | 7,500 | 12,000 | 16 | Halcyon | .. | .. | 2,500 | 3,500 |
| 6 | Camperdown | .. | .. | 7,500 | 11,500 | 16 | Alarm | .. | .. | 2,500 | 3,500 |
| 6 | Benbow | .. | .. | 7,500 | 11,500 | 16 | Sharpshooter | .. | .. | 2,500 | 4,500 |
| 6 | Sans Pareil | .. | .. | 7,500 | 14,000 | 17 | Archer | .. | .. | 2,200 | 3,500 |
| 7 | Rodney | .. | .. | 7,000 | 11,500 | 18 | Carysfort | .. | .. | 2,000 | — |
| 7 | Collingwood | .. | .. | 7,000 | 9,500 | 18 | Champion | .. | .. | 2,000 | — |
| 7 | Warspite | .. | .. | 7,000 | 10,000 | 18 | Comus | .. | .. | 2,000 | — |
| 7 | Astræa | .. | .. | 7,000 | 9,000 | 18 | Fearless | .. | .. | 2,000 | 3,200 |
| 7 | Æolus | .. | .. | 7,000 | 9,000 | 19 | Barracouta | .. | .. | 1,900 | 3,000 |
| 7 | Apollo | .. | .. | 7,000 | 9,000 | 20 | Basilisk | .. | .. | 1,400 | 2,000 |
| 8 | Inflexible | .. | .. | 6,500 | — | 21 | Rattlesnake | .. | .. | 1,350 | 3,000 |
| 8 | Dreadnought | .. | .. | 6,500 | — | 22 | Algerine | .. | .. | 1,100 | 1,400 |
| 9 | Edinburgh | .. | .. | 6,000 | 7,500 | 22 | Alert | .. | .. | 1,100 | 1,400 |
| 9 | Ajax | .. | .. | 6,000 | — | 23 | Magpie | .. | .. | 720 | 1,200 |
| 9 | Iris | .. | .. | 6,000 | 7,000 | 23 | Pheasant | .. | .. | 720 | 1,200 |
| 9 | Medea | .. | .. | 6,000 | 9,000 | | | | | | |

**XI.—TOTAL ELEMENTS—SHIPS RANGED ACCORDING TO
SPEED, NATURAL DRAUGHT; SPEED DUE TO FORCED
DRAUGHT ADDED.**

| | | | | | | | | | | | |
|----|------------------|----|----|------|------|----|-------------|----|----|------|------|
| 1 | Powerful | .. | .. | 22·0 | — | 15 | Camperdown | .. | .. | 15·7 | 16·9 |
| 2 | Blake | .. | .. | 20·0 | 22·0 | 15 | Collingwood | .. | .. | 15·7 | 16·5 |
| 3 | Edgar | .. | .. | 18·7 | 20·0 | 16 | Sans Pareil | .. | .. | 15·5 | 17·2 |
| 3 | Sharpshooter | .. | .. | 18·7 | 21·0 | 16 | Warspite | .. | .. | 15·5 | 16·7 |
| 4 | Royal Arthur | .. | .. | 18·5 | 19·7 | 17 | Benbow | .. | .. | 15·4 | 16·7 |
| 4 | Talbot | .. | .. | 18·5 | 19·5 | 17 | Rodney | .. | .. | 15·4 | 16·7 |
| 4 | Apollo | .. | .. | 18·5 | 20·0 | 18 | Mersey | .. | .. | 15·2 | 17·0 |
| 5 | Astræa | .. | .. | 18·2 | 19·5 | 19 | Nile | .. | .. | 15·1 | 16·7 |
| 5 | Æolus | .. | .. | 18·2 | 19·7 | 20 | Barracouta | .. | .. | 15·0 | 16·5 |
| 6 | Iris | .. | .. | 18·0 | — | 20 | Rattlesnake | .. | .. | 15·0 | 19·0 |
| 7 | Alarm | .. | .. | 17·7 | 19·2 | 21 | Fearless | .. | .. | 14·7 | 17·0 |
| 8 | Medea | .. | .. | 17·5 | 20·0 | 22 | Edinburgh | .. | .. | 14·2 | 15·0 |
| 8 | Barham | .. | .. | 17·5 | 19·5 | 22 | Conqueror | .. | .. | 14·2 | 15·5 |
| 9 | Magicienne | .. | .. | 17·1 | 19·0 | 23 | Dreadnought | .. | .. | 13·7 | — |
| 10 | Renown | .. | .. | 17·0 | 18·0 | 24 | Rupert | .. | .. | 13·5 | 14·2 |
| 10 | Barfleur | .. | .. | 17·0 | 18·5 | 25 | Devastation | .. | .. | 13·2 | 14·2 |
| 10 | Australia | .. | .. | 17·0 | 18·5 | 25 | Basilisk | .. | .. | 13·2 | 14·0 |
| 10 | Halcyon | .. | .. | 17·0 | 19·0 | 26 | Ajax | .. | .. | 13·0 | — |
| 11 | Inflexible | .. | .. | 16·7 | — | 27 | Carysfort | .. | .. | 12·7 | — |
| 12 | Arethusa | .. | .. | 16·6 | — | 27 | Champion | .. | .. | 12·7 | — |
| 13 | Majestic | .. | .. | 16·5 | 17·5 | 27 | Comus | .. | .. | 12·7 | — |
| 13 | Pallas | .. | .. | 16·5 | 19·0 | 28 | Algerine | .. | .. | 12·2 | 13·0 |
| 13 | Archer | .. | .. | 16·5 | 17·0 | 28 | Alert | .. | .. | 12·2 | 13·2 |
| 14 | Empress of India | .. | .. | 16·0 | 17·5 | 29 | Magpie | .. | .. | 12·0 | 13·7 |
| 14 | Hood | .. | .. | 16·0 | 17·5 | 30 | Pheasant | .. | .. | 11·5 | 13·5 |
| 14 | Raccoon | .. | .. | 16·0 | 17·5 | | | | | | |

XII.—TOTAL ELEMENTS—SHIPS RANGED ACCORDING TO LEGEND COAL SUPPLY; MAXIMUM COAL SUPPLY ADDED.

| | | | | | | | | | | | |
|----|------------------|----|----|-------|-------|----|--------------|----|----|-------|-----|
| 1 | Powerful | .. | .. | 1,500 | 3,000 | 10 | Talbot | .. | .. | 550 | ? |
| 1 | Blake | .. | .. | 1,500 | 1,500 | 11 | Rupert | .. | .. | ? 480 | 480 |
| 2 | Inflexible | .. | .. | 1,200 | 1,300 | 12 | Carysfort | .. | .. | 470 | 470 |
| 2 | Dreadnought | .. | .. | 1,200 | 1,330 | 12 | Champion | .. | .. | 470 | 470 |
| 3 | Majestic | .. | .. | 900 | 1,850 | 12 | Comus | .. | .. | 470 | 470 |
| 3 | Empress of India | .. | .. | 900 | 1,390 | 13 | Astræa | .. | .. | 400 | ? |
| 3 | Hood | .. | .. | 900 | ? | 13 | Æolus | .. | .. | 400 | 560 |
| 3 | Nile | .. | .. | 900 | 1,200 | 13 | Apollo | .. | .. | 400 | 560 |
| 3 | Rodney | .. | .. | 900 | 1,200 | 13 | Magicienne | .. | .. | 400 | 600 |
| 3 | Camperdown | .. | .. | 900 | 1,200 | 13 | Medea | .. | .. | 400 | ? |
| 3 | Benbow | .. | .. | 900 | 1,200 | 14 | Raccoon | .. | .. | 325 | 475 |
| 3 | Collingwood | .. | .. | 900 | 1,200 | 15 | Pallas | .. | .. | 300 | ? |
| 3 | Warspite | .. | .. | 900 | 1,130 | 16 | Archer | .. | .. | 250 | 475 |
| 4 | Edinburgh | .. | .. | 850 | 970 | 16 | Fearless | .. | .. | 250 | 300 |
| 4 | Devastation | .. | .. | 850 | 1,400 | 17 | Barracouta | .. | .. | 160 | ? |
| 4 | Edgar | .. | .. | 850 | ? | 17 | Basilisk | .. | .. | 160 | ? |
| 4 | Royal Arthur | .. | .. | 850 | 1,288 | 17 | Algerine | .. | .. | 160 | ? |
| 5 | Renown | .. | .. | 800 | ? | 17 | Sharpshooter | .. | .. | 160 | 170 |
| 6 | Iris | .. | .. | 760 | 760 | 18 | Barham | .. | .. | 140 | ? |
| 7 | Barfleur | .. | .. | 750 | 1,240 | 19 | Alert | .. | .. | 130 | ? |
| 7 | Sans Pareil | .. | .. | 750 | 1,200 | 20 | Magpie | .. | .. | 105 | ? |
| 7 | Australia | .. | .. | 750 | 900 | 20 | Pheasant | .. | .. | 105 | ? |
| 7 | Mersey | .. | .. | 750 | 900 | 21 | Halcyon | .. | .. | 100 | 100 |
| 8 | Ajax | .. | .. | 700 | 960 | 21 | Alarm | .. | .. | 100 | 100 |
| 9 | Conqueror | .. | .. | 620 | 620 | 22 | Rattlesnake | .. | .. | 80 | 100 |
| 10 | Arethusa | .. | .. | 550 | 1,000 | | | | | | |

XIII.—TOTAL ELEMENTS—SHIPS RANGED ACCORDING TO COAL ENDURANCE, LEGEND WEIGHT; MAXIMUM ENDURANCE ADDED.

| | | | | | | | | | | | |
|----|------------------|----|----|---------|---------|----|--------------|----|----|--------|--------|
| 1 | Blake | .. | .. | 15,000 | 15,000 | 16 | Inflexible | .. | .. | 4,200 | 5,200 |
| 2 | Powerful | .. | .. | ?12,500 | 25,000 | 17 | Warspite | .. | .. | 4,000 | 6,800 |
| 3 | Royal Arthur | .. | .. | 10,000 | ?15,000 | 18 | Carysfort | .. | .. | 3,840 | 3,840 |
| 3 | Edgar | .. | .. | 10,000 | — | 18 | Champion | .. | .. | 3,840 | 3,840 |
| 4 | Æolus | .. | .. | 8,000 | 11,200 | 19 | Comus | .. | .. | 3,800 | 3,800 |
| 4 | Apollo | .. | .. | 8,000 | 11,200 | 20 | Archer | .. | .. | 3,750 | 7,000 |
| 4 | Magicienne | .. | .. | 8,000 | ?12,000 | 20 | Fearless | .. | .. | 3,750 | ?4,500 |
| 4 | Medea | .. | .. | 8,000 | — | 21 | Raccoon | .. | .. | 3,400 | 7,000 |
| 5 | Mersey | .. | .. | 7,300 | 8,750 | 21 | Barracouta | .. | .. | 3,400 | — |
| 6 | Collingwood | .. | .. | 7,000 | 9,000 | 22 | Majestic | .. | .. | 3,300 | 6,800 |
| 6 | Australia | .. | .. | ?7,000 | 8,400 | 22 | Algerine | .. | .. | ?3,300 | — |
| 6 | Talbot | .. | .. | 7,000 | — | 23 | Barfleur | .. | .. | ?3,100 | 5,180 |
| 7 | Astræa | .. | .. | 6,500 | ?16,000 | 24 | Ajax | .. | .. | ?3,000 | 4,100 |
| 8 | Arethusa | .. | .. | 6,050 | 11,000 | 24 | Conqueror | .. | .. | 3,000 | 3,800 |
| 9 | Camperdown | .. | .. | 6,000 | 7,100 | 24 | Basilisk | .. | .. | 3,000 | — |
| 9 | Benbow | .. | .. | 6,000 | 7,100 | 24 | Alert | .. | .. | 3,000 | — |
| 9 | Rodney | .. | .. | 6,000 | 7,200 | 25 | Sharpshooter | .. | .. | 2,700 | — |
| 10 | Dreadnought | .. | .. | 5,700 | — | 26 | Devastation | .. | .. | 2,600 | — |
| 11 | Edinburgh | .. | .. | 5,500 | 6,300 | 26 | Barham | .. | .. | 2,600 | — |
| 12 | Empress of India | .. | .. | 5,000 | 7,500 | 27 | Halcyon | .. | .. | 2,500 | — |
| 12 | Hood | .. | .. | 5,000 | — | 27 | Alarm | .. | .. | 2,500 | — |
| 12 | Renown | .. | .. | 5,000 | — | 27 | Magpie | .. | .. | 2,500 | — |
| 13 | Nile | .. | .. | 4,900 | 6,600 | 27 | Pheasant | .. | .. | 2,500 | — |
| 13 | Sans Pareil | .. | .. | 4,900 | 7,800 | 28 | Rattlesnake | .. | .. | 2,400 | — |
| 14 | Pallas | .. | .. | 4,800 | — | 29 | Rupert | .. | .. | ?1,340 | — |
| 15 | Iris | .. | .. | 4,400 | 4,400 | | | | | | |

**XIV.—TOTAL ELEMENTS—SHIPS RANGED ACCORDING TO
NUMBER OF GUNS.**

| | | | | | |
|----|------------------------|----|----|--------------------|----|
| 1 | Majestic | 41 | 16 | Iris | 17 |
| 2 | Powerful | 42 | 16 | Æolus | 17 |
| 2 | Empress of India | 42 | 16 | Apollo | 17 |
| 3 | Sans Pareil | 39 | 17 | Magicienne | 16 |
| 4 | Hood | 36 | 17 | Medea | 16 |
| 5 | Renown | 31 | 17 | Pallas | 16 |
| 5 | Barfleur | 31 | 17 | Champion | 16 |
| 6 | Camperdown | 32 | 18 | Rupert | 14 |
| 6 | Rodney | 32 | 18 | Carysfort | 14 |
| 7 | Nile | 30 | 18 | Archer | 14 |
| 7 | Benbow | 30 | 18 | Raccoon | 14 |
| 7 | Collingwood | 30 | 19 | Conqueror | 12 |
| 7 | Royal Arthur | 30 | 19 | Fearless | 12 |
| 8 | Edgar | 29 | 20 | Comus | 10 |
| 9 | Blake | 28 | 20 | Barham | 10 |
| 9 | Australia | 28 | 20 | Barracouta | 10 |
| 10 | Warspite | 27 | 20 | Algernoe | 10 |
| 11 | Edinburgh | 23 | 20 | Alert | 10 |
| 11 | Mersey | 23 | 21 | Basilisk | 8 |
| 12 | Dreadnought | 22 | 22 | Rattlesnake | 7 |
| 13 | Ajax | 20 | 23 | Halcyon | 6 |
| 13 | Talbot | 20 | 23 | Alarm | 6 |
| 14 | Astræa | 19 | 23 | Magpie | 6 |
| 15 | Inflexible | 18 | 23 | Pheasant | 6 |
| 15 | Devastation | 18 | 23 | Sharpshooter | 6 |
| 15 | Arethusa | 18 | | | |

**XV.—TOTAL ELEMENTS—SHIPS RANGED ACCORDING TO
TOTAL CALIBRE OF GUNS.**

| | | | | | |
|----|------------------------|-------|----|--------------------|------|
| 1 | Majestic | 190.2 | 26 | Champion | 71.4 |
| 2 | Empress of India | 172.0 | 27 | Astræa | 69.4 |
| 3 | Sans Pareil | 163.5 | 28 | Devastation | 68.2 |
| 4 | Powerful | 160.6 | 29 | Conqueror | 61.4 |
| 5 | Hood | 158.6 | 30 | Æolus | 60.0 |
| 6 | Renown | 146.2 | 30 | Comus | 60.0 |
| 7 | Camperdown | 135.3 | 30 | Apollo | 60.0 |
| 7 | Rodney | 135.3 | 31 | Magicienne | 57.9 |
| 8 | Benbow | 128.6 | 31 | Medea | 57.9 |
| 9 | Barfleur | 127.3 | 32 | Pallas | 52.5 |
| 10 | Collingwood | 125.6 | 33 | Archer | 50.8 |
| 11 | Nile | 122.4 | 33 | Raccoon | 50.8 |
| 12 | Warspite | 122.3 | 34 | Rupert | 50.4 |
| 13 | Royal Arthur | 117.2 | 35 | Basilisk | 40.0 |
| 14 | Edgar | 114.4 | 36 | Barham | 35.7 |
| 15 | Australia | 110.2 | 36 | Barracouta | 35.7 |
| 16 | Inflexible | 108.6 | 37 | Fearless | 34.8 |
| 17 | Blake | 108.0 | 38 | Algernoe | 31.4 |
| 18 | Edinburgh | 105.0 | 38 | Alert | 31.4 |
| 19 | Mersey | 97.5 | 39 | Magpie | 24.0 |
| 20 | Carysfort | 91.1 | 39 | Pheasant | 24.0 |
| 21 | Ajax | 90.2 | 40 | Halcyon | 18.3 |
| 22 | Dreadnought | 85.6 | 41 | Alarm | 16.8 |
| 23 | Talbot | 84.1 | 41 | Sharpshooter | 16.8 |
| 24 | Arethusa | 74.8 | 42 | Rattlesnake | 15.1 |
| 25 | Iris | 72.4 | | | |

XVI.—TOTAL ELEMENTS—SHIPS RANGED ACCORDING TO WEIGHT OF METAL FIRED IN ONE ROUND.

| | | | | | |
|----|------------------------|-------|----|--------------------|-------|
| 1 | Inflexible | 7,030 | 26 | Rupert | 1,003 |
| 2 | Empress of India | 6,135 | 27 | Comus | 1,000 |
| 3 | Hood | 6,099 | 28 | Talbot | 873 |
| 4 | Camperdown | 5,705 | 29 | Champion | 813 |
| 4 | Rodney | 5,705 | 30 | Iris | 663 |
| 5 | Sans Pareil | 5,411 | 31 | Magicienne | 657 |
| 6 | Nile | 5,357 | 31 | Medea | 657 |
| 7 | Benbow | 4,681 | 32 | Archer | 626 |
| 8 | Majestic | 4,839 | 32 | Racoon | 626 |
| 9 | Collingwood | 3,554 | 33 | Astræa | 611 |
| 10 | Ajax | 3,534 | 34 | Æolus | 521 |
| 11 | Edinburgh | 3,413 | 34 | Apollo | 521 |
| 12 | Dreadnought | 3,347 | 35 | Basilisk | 400 |
| 13 | Renown | 3,139 | 36 | Pallas | 386 |
| 14 | Warspite | 2,573 | 37 | Barham | 283 |
| 15 | Barfleur | 2,537 | 37 | Barracouta | 283 |
| 16 | Powerful | 2,199 | 38 | Fearless | 226 |
| 17 | Devastation | 2,062 | 39 | Algerine | 163 |
| 18 | Conqueror | 1,864 | 39 | Alert | 163 |
| 19 | Edgar | 1,848 | 40 | Magpie | 150 |
| 20 | Australia | 1,829 | 40 | Pheasant | 150 |
| 21 | Blake | 1,812 | 41 | Haleyon | 114 |
| 22 | Royal Arthur | 1,668 | 42 | Alarm | 103 |
| 23 | Mersey | 1,464 | 42 | Sharpshooter | 103 |
| 24 | Carysfort | 1,132 | 43 | Rattlesnake | 44 |
| 25 | Arethusa | 1,026 | | | |

XVII.—TOTAL ELEMENTS—SHIPS RANGED ACCORDING TO TOTAL ENERGY OF PROJECTILES FIRED IN ONE ROUND.

| | | | | | |
|----|------------------------|---------|----|--------------------|--------|
| 1 | Majestic | 172,972 | 26 | Arethusa | 20,029 |
| 2 | Empress of India | 168,642 | 27 | Comus | 19,380 |
| 3 | Hood | 167,820 | 28 | Champion | 17,784 |
| 4 | Camperdown | 154,992 | 29 | Iris | 16,012 |
| 4 | Rodney | 154,992 | 30 | Carysfort | 15,176 |
| 5 | Sans Pareil | 149,070 | 31 | Astræa | 14,050 |
| 6 | Nile | 149,036 | 32 | Magicienne | 12,941 |
| 7 | Benbow | 135,246 | 32 | Medea | 12,941 |
| 8 | Inflexible | 117,548 | 33 | Archer | 12,268 |
| 9 | Collingwood | 89,546 | 33 | Racoon | 12,268 |
| 10 | Renown | 86,634 | 34 | Æolus | 12,050 |
| 11 | Edinburgh | 83,558 | 34 | Apollo | 12,050 |
| 12 | Barfleur | 69,716 | 35 | Basilisk | 9,702 |
| 13 | Warspite | 64,288 | 36 | Pallas | 8,600 |
| 14 | Ajax | 61,618 | 37 | Algerine | 6,596 |
| 15 | Powerful | 59,396 | 37 | Alert | 6,596 |
| 16 | Devastation | 59,182 | 38 | Barham | 6,280 |
| 17 | Dreadnought | 58,062 | 38 | Barracouta | 6,280 |
| 18 | Edgar | 48,434 | 39 | Fearless | 5,496 |
| 19 | Blake | 47,670 | 40 | Magpie | 3,750 |
| 20 | Conqueror | 44,834 | 40 | Pheasant | 3,750 |
| 21 | Australia | 42,822 | 41 | Haleyon | 2,538 |
| 22 | Royal Arthur | 42,438 | 42 | Alarm | 2,310 |
| 23 | Mersey | 33,891 | 42 | Sharpshooter | 2,310 |
| 24 | Rupert | 26,724 | 43 | Rattlesnake | 1,195 |
| 25 | Talbot | 21,709 | | | |

XVIII.—TOTAL ELEMENTS—SHIPS RANGED ACCORDING TO TOTAL SHELL-CHARGE BURST IN ONE ROUND.

| | | | | | |
|----|--------------------------|-----|----|----------------------|-----|
| 1 | Majestic | 544 | 26 | Comus | 100 |
| 2 | Sans Pareil | 533 | 27 | Talbot | 95 |
| 3 | Benbow | 470 | 28 | Rupert | 90 |
| 4 | Empress of India | 464 | 29 | Champion | 74 |
| 5 | Hood | 459 | 30 | Magicienne | 67 |
| 6 | Camperdown | 419 | 30 | Medea | 67 |
| 7 | Rodney | 419 | 31 | Archer | 64 |
| 8 | Collingwood | 390 | 31 | Raccoon | 64 |
| 9 | Nile | 381 | 32 | Astræa | 59 |
| 10 | Edinburgh | 375 | 33 | Iris | 53 |
| 11 | Inflexible | 330 | 34 | Æolus | 51 |
| 12 | Renown | 290 | 34 | Apollo | 51 |
| 13 | Warspite | 236 | 35 | Pallas | 36 |
| 14 | Powerful | 232 | 36 | Basilisk | 32 |
| 15 | Barfleur | 205 | 37 | Barham | 26 |
| 16 | Conqueror | 202 | 37 | Barracouta | 26 |
| 17 | Ajax | 179 | 38 | Fearless | 20 |
| 18 | Edgar | 178 | 38 | Algerine | 20 |
| 19 | Australia | 174 | 38 | Alert | 20 |
| 20 | Blake | 173 | 39 | Magpie | 18 |
| 21 | Royal Arthur | 164 | 39 | Pheasant | 18 |
| 22 | Dreadnought | 162 | 40 | Halcyon | 11 |
| 23 | Devastation | 161 | 41 | Alarm | 10 |
| 24 | Mersey | 144 | 41 | Sharpshooter | 10 |
| 25 | Carysfort | 113 | 42 | Rattlesnake | 6 |
| 25 | Arethusa | 101 | | | |

XIX.—TOTAL ELEMENTS—SHIPS RANGED ACCORDING TO WEIGHT OF METAL FIRED IN ONE MINUTE.

| | lbs. | | lbs. |
|----------------------------|--------|-------------------------|-------|
| 1 Majestic | 10,904 | 25 Devastation | 1,873 |
| 2 Empress of India | 9,398 | 26 Mersey | 1,831 |
| 3 Hood | 8,894 | 27 Barham | 1,804 |
| 4 Powerful | 8,734 | 27 Barracouta | 1,804 |
| 5 Renown | 7,454 | 28 Conqueror | 1,618 |
| 6 Royal Arthur | 7,429 | 29 Magicienne | 1,402 |
| 7 Edgar | 6,619 | 29 Medea | 1,402 |
| 8 Blake | 6,119 | 30 Arethusa | 1,369 |
| 9 Nile | 5,364 | 31 Rupert | 1,193 |
| 10 Talbot | 5,066 | 32 Carysfort | 1,132 |
| 11 Barfleur | 4,926 | 33 Algerine | 1,084 |
| 12 Benbow | 4,714 | 33 Alert | 1,084 |
| 13 Camperdown | 4,570 | 34 Comus | 1,000 |
| 13 Rodney | 4,570 | 35 Champion | 981 |
| 14 Sans Pareil | 4,092 | 36 Archer | 969 |
| 15 Astræa | 3,878 | 36 Raccoon | 969 |
| 16 Collingwood | 3,405 | 37 Halcyon | 876 |
| 17 Æolus | 3,338 | 38 Iris | 834 |
| 17 Apollo | 3,338 | 39 Alarm | 724 |
| 18 Pallas | 2,529 | 39 Sharpshooter | 724 |
| 19 Warspite | 2,511 | 40 Fearless | 569 |
| 20 Edinburgh | 2,269 | 41 Basilisk | 400 |
| 21 Australia | 2,316 | 42 Rattlesnake | 327 |
| 22 Ajax | 2,055 | 43 Magpie | 300 |
| 23 Dreadnought | 2,039 | 43 Pheasant | 300 |
| 24 Inflexible | 1,938 | | |

**XX.—TOTAL ELEMENTS—SHIPS RANGED ACCORDING TO
TOTAL ENERGY OF PROJECTILES FIRED IN ONE
MINUTE.**

| | Foot-tons. | | Foot-tons. |
|--------------------------|------------|-----------------------|------------|
| 1 Majestic | 323,592 | 25 Mersey | 42,382 |
| 2 Empress of India | 237,438 | 26 Barham | 40,300 |
| 3 Powerful | 232,682 | 26 Barracouta | 40,300 |
| 4 Hood | 229,871 | 27 Conqueror | 39,308 |
| 5 Renown | 195,706 | 28 Inflexible | 39,198 |
| 6 Royal Arthur | 185,327 | 29 Rupert | 31,069 |
| 7 Edgar | 166,212 | 30 Magicienne | 30,010 |
| 8 Blake | 151,680 | 30 Medea | 30,010 |
| 9 Nile | 137,905 | 31 Arethusa | 28,340 |
| 10 Talbot | 128,821 | 32 Algerine | 26,980 |
| 11 Barfleur | 121,260 | 32 Alert | 26,980 |
| 12 Camperdown | 120,145 | 33 Halcyon | 21,530 |
| 12 Rodney | 120,145 | 34 Champion | 21,321 |
| 13 Sans Pareil | 103,397 | 35 Archer | 20,588 |
| 14 Astraea | 92,630 | 35 Raccoon | 20,588 |
| 15 Collingwood | 83,700 | 36 Iris | 20,172 |
| 16 Benbow | 82,394 | 37 Comus | 19,380 |
| 17 Æolus | 80,690 | 38 Alarm | 16,420 |
| 17 Apollo | 80,690 | 38 Sharpshooter | 16,420 |
| 18 Warspite | 60,870 | 39 Carysfort | 15,176 |
| 19 Edinburgh | 57,675 | 40 Fearless | 13,816 |
| 20 Pallas | 56,720 | 41 Basilisk | 9,702 |
| 21 Australia | 51,916 | 42 Rattlesnake | 7,970 |
| 22 Devastation | 51,246 | 43 Magpie | 7,500 |
| 23 Dreadnought | 43,750 | 43 Pheasant | 7,500 |
| 24 Ajax | 43,146 | | |

**XXI.—TOTAL ELEMENTS—SHIPS RANGED ACCORDING TO
TOTAL SHELL-CHARGE BURST IN ONE MINUTE.**

| | lbs. | | lbs. |
|--------------------------|-------|-----------------------|------|
| 1 Majestic | 1,312 | 21 Ajax | 193 |
| 2 Powerful | 1,107 | 25 Conqueror | 186 |
| 3 Empress of India | 952 | 26 Magicienne | 169 |
| 4 Hood | 884 | 26 Medea | 169 |
| 5 Renown | 864 | 26 Barham | 169 |
| 6 Royal Arthur | 792 | 26 Barracouta | 169 |
| 7 Edgar | 708 | 27 Rupert | 158 |
| 8 Blake | 634 | 28 Arethusa | 151 |
| 9 Talbot | 589 | 29 Inflexible | 146 |
| 10 Nile | 506 | 30 Algerine | 133 |
| 10 Barfleur | 506 | 30 Alert | 133 |
| 11 Sans Pareil | 481 | 31 Carysfort | 113 |
| 12 Camperdown | 450 | 32 Archer | 111 |
| 12 Rodney | 450 | 32 Raccoon | 111 |
| 13 Collingwood | 395 | 33 Comus | 100 |
| 14 Astraea | 390 | 34 Champion | 97 |
| 15 Benbow | 381 | 35 Halcyon | 92 |
| 16 Æolus | 342 | 36 Iris | 77 |
| 16 Apollo | 342 | 37 Alarm | 73 |
| 17 Edinburgh | 297 | 37 Sharpshooter | 73 |
| 18 Pallas | 291 | 38 Fearless | 67 |
| 19 Warspite | 284 | 39 Rattlesnake | 56 |
| 20 Australia | 283 | 40 Magpie | 36 |
| 21 Dreadnought | 213 | 40 Pheasant | 36 |
| 22 Mersey | 203 | 41 Basilisk | 32 |
| 23 Devastation | 194 | | |

XXII.—TOTAL ELEMENTS—SHIPS RANGED ACCORDING TO NUMBER OF ROUNDS FIRED IN ONE MINUTE.

| | No. | | No. |
|----------------------------|-----|-------------------------|-----|
| 1 Empress of India | 444 | 24 Talbot | 147 |
| 2 Majestic | 361 | 25 Magicienne | 146 |
| 3 Powerful | 363 | 25 Medea | 146 |
| 4 Hood | 360 | 26 Rupert | 143 |
| 5 Sans Pareil | 349 | 27 Arethusa | 122 |
| 6 Barfleur | 340 | 28 Archer | 118 |
| 7 Nile | 318 | 28 Racoon | 118 |
| 8 Camperdown | 316 | 29 Fearless | 116 |
| 8 Rodney | 316 | 30 Inflexible | 92 |
| 9 Royal Arthur | 298 | 30 Barham | 92 |
| 10 Renown | 290 | 30 Barracouta | 92 |
| 11 Edgar | 289 | 30 Algerine | 92 |
| 12 Collingwood | 288 | 30 Alert | 92 |
| 13 Blake | 275 | 31 Conqueror | 89 |
| 14 Benbow | 262 | 32 Rattlesnake | 86 |
| 15 Dreadnought | 253 | 33 Iris | 69 |
| 16 Australia | 235 | 34 Alarm | 68 |
| 17 Edinburgh | 202 | 34 Champion | 68 |
| 18 Ajax | 199 | 34 Halcyon | 68 |
| 19 Devastation | 198 | 34 Sharpshooter | 68 |
| 20 Warspite | 191 | 35 Carysfort | 14 |
| 21 Astræa | 181 | 36 Magpie | 12 |
| 22 Æolus | 173 | 36 Pheasant | 12 |
| 22 Apollo | 172 | 37 Comus | 10 |
| 22 Pallas | 172 | 38 Basilisk | 8 |
| 23 Mersey | 165 | | |

XXIII.—PROPORTIONATE ELEMENTS—SHIPS RANGED ACCORDING TO WEIGHT OF HULL PER 1000 TONS OF DISPLACEMENT.

| | | | |
|-------------------------|-----|----------------------------|-----|
| 39 Iris | 385 | 19 Astræa | 561 |
| 38 Arethusa | 391 | 18 Barham | 573 |
| 37 Sharpshooter | 435 | 17 Royal Arthur | 576 |
| 36 Archer | 450 | 16 Australia | 577 |
| 36 Racoon | 450 | 15 Powerful | 597 |
| 35 Fearless | 474 | 14 Inflexible | 614 |
| 34 Alarm | 475 | 13 Warspite | 619 |
| 33 Medea | 485 | 12 Rodney | 610 |
| 33 Pallas | 485 | 11 Barfleur | 617 |
| 33 Algerine | 485 | 10 Renown | 619 |
| 32 Alert | 497 | 9 Benbow | 650 |
| 31 Magicienne | 505 | 9 Rupert | 650 |
| 30 Mersey | 511 | 8 Dreadnought | 651 |
| 30 Apollo | 511 | 8 Collingwood | 651 |
| 29 Rattlesnake | 514 | 8 Devastation | 651 |
| 28 Basilisk | 516 | 7 Edinburgh | 664 |
| 27 Halcyon | 548 | 6 Sans Pareil | 665 |
| 26 Magpie | 521 | 5 Camperdown | 677 |
| 25 Pheasant | 529 | 5 Conqueror | 677 |
| 24 Blake | 533 | 4 Empress of India | 681 |
| 23 Æolus | 538 | 3 Hood | 682 |
| 22 Barracouta | 539 | 3 Ajax | 682 |
| 21 Edgar | 555 | 2 Majestic | 683 |
| 20 Talbot | 560 | 1 Nile | 713 |

XXIV.—PROPORTIONATE ELEMENTS—SHIPS RANGED ACCORDING TO WEIGHT OF ARMOUR PER 1000 TONS DISPLACEMENT.

| | Tons. | | Tons. |
|----------------------------|-------|-----------------------|-------|
| 1 Nile | 371 | 5 Collingwood | 302 |
| 2 Dreadnought | 327 | 6 Camperdown | 295 |
| 3 Empress of India | 321 | 7 Ajax | 256 |
| 4 Devastation | 317 | 8 Edinburgh | 250 |

**XXV. — PROPORTIONATE ELEMENTS — SHIPS RANGED
ACCORDING TO NUMBER OF TORPEDO-TUBES
PER 1000 TONS DISPLACEMENT.**

| | | | | | |
|----|-----------------|------|----|---------------------|------|
| 1 | Rattlesnake.. | 7.61 | 23 | Bartleu | 0.66 |
| 2 | Alarm .. | 6.17 | 24 | Sans Pareil .. | 0.57 |
| 3 | Halycon .. | 4.67 | 25 | Renown .. | 0.56 |
| 4 | Fearless .. | 4.43 | 26 | Talbot .. | 0.53 |
| 5 | Sharpshooter .. | 4.08 | 27 | Royal Arthur .. | 0.52 |
| 6 | Archer .. | 1.69 | 28 | Empress of India .. | 0.49 |
| 6 | Raccoon .. | 1.69 | 28 | Hood .. | 0.49 |
| 7 | Pallas .. | 1.55 | 29 | Rodney .. | 0.48 |
| 8 | Medea .. | 1.42 | 30 | Camperdown .. | 0.47 |
| 9 | Magicienne .. | 1.35 | 30 | Benbow .. | 0.47 |
| 10 | Barracouta .. | 1.26 | 31 | Blake .. | 0.44 |
| 11 | Apollo .. | 1.17 | 32 | Collingwood .. | 0.42 |
| 12 | Æolus .. | 1.11 | 33 | Majestic .. | 0.33 |
| 13 | Barham .. | 1.09 | 33 | Nile .. | 0.33 |
| 14 | Iris .. | 1.07 | 33 | Inflexible .. | 0.33 |
| 15 | Mersey .. | 0.98 | 34 | Powerful .. | 0.28 |
| 16 | Conqueror .. | 0.96 | 35 | Ajax .. | 0.23 |
| 17 | Arethusa .. | 0.93 | 36 | Edinburgh .. | 0.21 |
| 18 | Astræa .. | 0.91 | 36 | Devastation .. | 0.21 |
| 19 | Carysfort .. | 0.84 | 37 | Dreadnought .. | 0.18 |
| 19 | Champion .. | 0.84 | 38 | Basilisk .. | 0.00 |
| 19 | Comus .. | 0.84 | 38 | Algerine .. | 0.00 |
| 20 | Edgar .. | 0.81 | 38 | Alert .. | 0.00 |
| 21 | Rupert .. | 0.73 | 38 | Magpie .. | 0.00 |
| 22 | Warspite .. | 0.71 | 38 | Pheasant .. | 0.00 |
| 22 | Australia .. | 0.71 | | | |

**XXVI. — PROPORTIONATE ELEMENTS — SHIPS RANGED
ACCORDING TO I.H.P. NATURAL DRAUGHT PER
1000 TONS DISPLACEMENT.**

| | | | | | |
|----|-----------------|-------|----|---------------------|-----|
| 1 | Sharpshooter .. | 3,401 | 27 | Australia .. | 982 |
| 2 | Alarm .. | 3,086 | 28 | Pheasant .. | 953 |
| 3 | Rattlesnake .. | 2,571 | 29 | Magpie .. | 894 |
| 4 | Halycon .. | 2,336 | 30 | Bartleu .. | 857 |
| 5 | Medea .. | 2,142 | 31 | Carysfort .. | 840 |
| 6 | Apollo .. | 2,058 | 31 | Champion .. | 840 |
| 7 | Æolus .. | 1,939 | 31 | Comus .. | 840 |
| 8 | Barham .. | 1,912 | 32 | Warspite .. | 833 |
| 9 | Magicienne .. | 1,864 | 33 | Rupert .. | 827 |
| 10 | Powerful .. | 1,760 | 34 | Renown .. | 809 |
| 11 | Pallas .. | 1,747 | 35 | Collingwood .. | 737 |
| 12 | Raccoon .. | 1,695 | 36 | Camperdown .. | 725 |
| 13 | Iris .. | 1,609 | 36 | Conqueror .. | 725 |
| 14 | Astræa .. | 1,605 | 37 | Sans Pareil .. | 716 |
| 15 | Blake .. | 1,444 | 38 | Benbow .. | 707 |
| 16 | Talbot .. | 1,428 | 39 | Ajax .. | 693 |
| 17 | Edgar .. | 1,360 | 40 | Rodney .. | 679 |
| 18 | Fearless .. | 1,265 | 41 | Majestic .. | 671 |
| 19 | Archer .. | 1,242 | 42 | Edinburgh .. | 637 |
| 20 | Royal Arthur .. | 1,208 | 43 | Empress of India .. | 636 |
| 21 | Barracouta .. | 1,202 | 43 | Hood .. | 636 |
| 22 | Basilisk .. | 1,196 | 44 | Nile .. | 628 |
| 23 | Arethusa .. | 1,162 | 45 | Dreadnought .. | 600 |
| 24 | Alert .. | 1,145 | 46 | Devastation .. | 589 |
| 25 | Algerine .. | 1,017 | 47 | Inflexible .. | 547 |
| 26 | Mersey .. | 987 | | | |

**XXVII.—PROPORTIONATE ELEMENTS—SHIPS RANGED
ACCORDING TO COAL SUPPLY, LEGEND WEIGHT,
PER 1000 TONS DISPLACEMENT WITH MAXIMUM
SUPPLY ADDED.**

| | | | | Tons. | | | | | Tons. |
|----|--------------|----|----|-------|-----|----|------------------|----|---------|
| 1 | Sharpshooter | .. | .. | 217 | 231 | 22 | Dreadnought | .. | 110 211 |
| 2 | Iris | .. | .. | 209 | 209 | 22 | Royal Arthur | .. | 110 166 |
| 3 | Carysfort | .. | .. | 197 | 197 | 23 | Warspite | .. | 107 134 |
| 3 | Champion | .. | .. | 197 | 197 | 24 | Inflexible | .. | 101 109 |
| 3 | Comus | .. | .. | 197 | 197 | 24 | Barracouta | .. | 101 — |
| 4 | Mersey | .. | .. | 185 | 222 | 25 | Conqueror | .. | 100 100 |
| 5 | Racoon | .. | .. | 183 | 268 | 26 | Talbot | .. | 98 — |
| 6 | Blake | .. | .. | 166 | 166 | 27 | Collingwood | .. | 94 126 |
| 7 | Fearless | .. | .. | 158 | 189 | 28 | Halcyon | .. | 93 93 |
| 8 | Algerine | .. | .. | 152 | 152 | 29 | Devastation | .. | 91 150 |
| 8 | Rattlesnake | .. | .. | 152 | 190 | 29 | Astræa | .. | 91 229 |
| 9 | Medea | .. | .. | 142 | — | 30 | Edinburgh | .. | 90 103 |
| 10 | Archer | .. | .. | 141 | 268 | 31 | Rupert | .. | 88 88 |
| 11 | Pheasant | .. | .. | 139 | 139 | 32 | Rodney | .. | 87 116 |
| 12 | Basilisk | .. | .. | 136 | 116 | 33 | Camperdown | .. | 84 113 |
| 13 | Magicienne | .. | .. | 135 | 203 | 33 | Benbow | .. | 84 113 |
| 13 | Alert | .. | .. | 135 | 203 | 34 | Majestic | .. | 80 124 |
| 14 | Australia | .. | .. | 134 | 160 | 34 | Ajax | .. | 80 110 |
| 15 | Magpie | .. | .. | 130 | 130 | 35 | Barham | .. | 76 — |
| 16 | Arethusa | .. | .. | 128 | 232 | 36 | Nile | .. | 75 100 |
| 17 | Alarm | .. | .. | 123 | 123 | 37 | Sans Pareil | .. | 71 114 |
| 18 | Apollo | .. | .. | 117 | 164 | 37 | Barfleur | .. | 71 118 |
| 19 | Pallas | .. | .. | 116 | — | 38 | Renown | .. | 63 — |
| 20 | Edgar | .. | .. | 115 | — | 39 | Empress of India | .. | 63 98 |
| 21 | Eolus | .. | .. | 111 | 155 | 39 | Hood | .. | 63 — |
| 22 | Powerful | .. | .. | 110 | 211 | | | | |

**XXVIII.—PROPORTIONATE ELEMENTS—SHIPS RANGED
ACCORDING TO NUMBER OF GUNS PER 1000
TONS DISPLACEMENT.**

| | | | | | | | | | |
|----|--------------|----|----|-------|----|------------------|----|----|------|
| 1 | Rattlesnake | .. | .. | 13.33 | 25 | Eolus | .. | .. | 4.72 |
| 2 | Alert | .. | .. | 10.41 | 26 | Edgar | .. | .. | 3.94 |
| 3 | Algerine | .. | .. | 9.52 | 27 | Royal Arthur | .. | .. | 3.89 |
| 4 | Sharpshooter | .. | .. | 8.16 | 28 | Sans Pareil | .. | .. | 3.72 |
| 5 | Pheasant | .. | .. | 7.94 | 29 | Talbot | .. | .. | 3.57 |
| 6 | Archer | .. | .. | 7.90 | 30 | Barfleur | .. | .. | 3.23 |
| 6 | Racoon | .. | .. | 7.90 | 31 | Collingwood | .. | .. | 3.15 |
| 7 | Fearless | .. | .. | 7.59 | 32 | Warspite | .. | .. | 3.21 |
| 8 | Magpie | .. | .. | 7.45 | 33 | Blake | .. | .. | 3.11 |
| 9 | Alarm | .. | .. | 7.40 | 34 | Rodney | .. | .. | 3.10 |
| 10 | Basilisk | .. | .. | 6.83 | 35 | Camperdown | .. | .. | 3.01 |
| 11 | Champion | .. | .. | 6.72 | 36 | Empress of India | .. | .. | 2.96 |
| 12 | Barracouta | .. | .. | 6.32 | 37 | Majestic | .. | .. | 2.95 |
| 13 | Pallas | .. | .. | 6.21 | 37 | Powerful | .. | .. | 2.95 |
| 14 | Carysfort | .. | .. | 5.88 | 38 | Benbow | .. | .. | 2.83 |
| 15 | Medea | .. | .. | 5.71 | 39 | Renown | .. | .. | 2.75 |
| 16 | Mersey | .. | .. | 5.67 | 40 | Rupert | .. | .. | 2.57 |
| 17 | Halcyon | .. | .. | 5.60 | 41 | Hood | .. | .. | 2.54 |
| 18 | Barham | .. | .. | 5.46 | 42 | Nile | .. | .. | 2.51 |
| 19 | Magicienne | .. | .. | 5.42 | 43 | Edinburgh | .. | .. | 2.44 |
| 20 | Australia | .. | .. | 5.00 | 44 | Ajax | .. | .. | 2.30 |
| 20 | Apollo | .. | .. | 5.00 | 45 | Dreadnought | .. | .. | 2.03 |
| 21 | Iris | .. | .. | 4.53 | 46 | Conqueror | .. | .. | 1.93 |
| 22 | Astræa | .. | .. | 4.35 | 47 | Devastation | .. | .. | 1.92 |
| 23 | Comus | .. | .. | 4.20 | 48 | Inflexible | .. | .. | 1.51 |
| 24 | Arethusa | .. | .. | 4.18 | | | | | |

**XXIX.—PROPORTIONATE ELEMENTS—SHIPS RANGED
ACCORDING TO INCHES OF CALIBRE OF GUNS
PER 1000 TONS DISPLACEMENT.**

| | | | | | |
|----|--------------|------|----|------------------|------|
| 1 | Carysfort | 38.3 | 24 | Astraea | 15.9 |
| 2 | Basilisk | 34.2 | 25 | Edgar | 15.7 |
| 3 | Alert | 32.7 | 26 | Sans Pareil | 15.6 |
| 4 | Pheasant | 31.8 | 27 | Royal Arthur | 15.2 |
| 5 | Champion | 29.8 | 28 | Talbot | 15.0 |
| 5 | Magpie | 29.8 | 29 | Warspite | 14.5 |
| 6 | Algerine | 29.5 | 30 | Collingwood | 13.2 |
| 7 | Archer | 28.7 | 31 | Rodney | 13.1 |
| 7 | Raccoon | 28.7 | 32 | Majestic | 12.8 |
| 8 | Rattlesnake | 28.5 | 33 | Camperdown | 12.7 |
| 9 | Comus | 25.2 | 34 | Empress of India | 12.2 |
| 10 | Mersey | 24.0 | 35 | Benbow | 12.1 |
| 11 | Sharpshooter | 22.9 | 35 | Barfleur | 12.1 |
| 12 | Barracouta | 22.5 | 36 | Blake | 12.0 |
| 13 | Fearless | 22.0 | 37 | Renown | 11.8 |
| 14 | Pallas | 20.8 | 38 | Powerful | 11.3 |
| 15 | Alarm | 20.7 | 39 | Hood | 11.2 |
| 16 | Medea | 20.6 | 40 | Edinburgh | 11.1 |
| 17 | Australia | 19.6 | 41 | Ajax | 10.4 |
| 17 | Magicienne | 19.6 | 42 | Nile | 10.2 |
| 18 | Barham | 19.5 | 43 | Conqueror | 9.9 |
| 19 | Iris | 19.4 | 44 | Rupert | 9.3 |
| 20 | Arethusa | 17.3 | 45 | Inflexible | 9.1 |
| 21 | Halcyon | 17.2 | 46 | Dreadnought | 7.9 |
| 22 | Apollo | 17.6 | 48 | Devastation | 7.1 |
| 23 | Æolus | 16.6 | | | |

**XXX.—PROPORTIONATE ELEMENTS—SHIPS RANGED
ACCORDING TO WEIGHT OF METAL PER 1000 TONS
DISPLACEMENT FIRED IN ONE ROUND.**

| | | | | | |
|----|------------------|-----|----|--------------|-----|
| 1 | Inflexible | 691 | 25 | Arethusa | 238 |
| 2 | Rodney | 553 | 26 | Medea | 234 |
| 3 | Nile | 548 | 27 | Magicienne | 222 |
| 4 | Camperdown | 537 | 28 | Devastation | 220 |
| 5 | Sans Pareil | 516 | 29 | Royal Arthur | 216 |
| 6 | Carysfort | 475 | 30 | Blake | 201 |
| 7 | Benbow | 441 | 31 | Pheasant | 198 |
| 8 | Empress of India | 434 | 32 | Magpie | 186 |
| 9 | Hood | 431 | 33 | Rupert | 184 |
| 10 | Comus | 420 | 34 | Barracouta | 179 |
| 11 | Ajax | 409 | 35 | Iris | 177 |
| 12 | Collingwood | 374 | 36 | Alert | 169 |
| 13 | Edinburgh | 362 | 37 | Talbot | 155 |
| 14 | Mersey | 361 | 37 | Algerine | 155 |
| 15 | Archer | 353 | 38 | Powerful | 154 |
| 15 | Raccoon | 353 | 38 | Barham | 154 |
| 16 | Champion | 341 | 39 | Apollo | 153 |
| 16 | Basilisk | 341 | 40 | Pallas | 149 |
| 17 | Australia | 326 | 41 | Æolus | 144 |
| 18 | Majestic | 324 | 42 | Fearless | 143 |
| 19 | Dreadnought | 309 | 43 | Astraea | 140 |
| 20 | Warspite | 306 | 43 | Sharpshooter | 140 |
| 21 | Conqueror | 304 | 44 | Alarm | 127 |
| 22 | Renown | 254 | 45 | Halcyon | 106 |
| 23 | Edgar | 251 | 46 | Rattlesnake | 83 |
| 24 | Barfleur | 241 | | | |

**XXXI.—PROPORTIONATE ELEMENTS—SHIPS RANGED
ACCORDING TO ENERGY PER 1000 TONS DIS-
PLACEMENT DEVELOPED IN ONE ROUND.**

| | | Foot-tons. | | | Foot-tons. |
|----|------------------------|------------|----|--------------------|------------|
| 1 | Rodney | 15,047 | 26 | Devastation | 6,343 |
| 2 | Camperdown | 14,621 | 27 | Algerine | 6,281 |
| 3 | Sans Pareil | 14,237 | 28 | Royal Arthur | 5,511 |
| 4 | Benbow | 12,759 | 29 | Dreadnought | 5,375 |
| 5 | Nile | 12,482 | 30 | Blake | 5,296 |
| 6 | Empress of India | 11,918 | 31 | Pheasant | 4,967 |
| 7 | Hood | 11,860 | 32 | Rupert | 4,912 |
| 8 | Majestic | 11,608 | 33 | Maggie | 4,658 |
| 9 | Inflexible | 9,894 | 34 | Arethusa | 4,657 |
| 10 | Collingwood | 9,425 | 35 | Medea | 4,621 |
| 11 | Edinburgh | 8,870 | 36 | Magicienne | 4,386 |
| 12 | Mersey | 8,868 | 37 | Iris | 4,292 |
| 13 | Basilisk | 8,292 | 38 | Powerful | 4,182 |
| 14 | Comus | 8,142 | 39 | Barracouta | 3,974 |
| 15 | Warspite | 7,653 | 40 | Talbot | 3,876 |
| 16 | Australia | 7,646 | 41 | Apollo | 3,544 |
| 17 | Champion | 7,472 | 42 | Fearless | 3,478 |
| 18 | Conqueror | 7,231 | 43 | Barham | 3,377 |
| 19 | Ajax | 7,115 | 44 | Eolus | 3,347 |
| 20 | Renown | 7,014 | 45 | Pallas | 3,339 |
| 21 | Archer | 6,931 | 46 | Astræa | 3,222 |
| 21 | Raccoon | 6,931 | 47 | Sharpshooter | 3,142 |
| 22 | Alert | 6,870 | 48 | Alarm | 2,851 |
| 23 | Barfleur | 6,639 | 49 | Halcyon | 2,371 |
| 24 | Edgar | 6,589 | 50 | Rattlesnake | 2,276 |
| 25 | Carysfort | 6,376 | | | |

**XXXII.—PROPORTIONATE ELEMENTS—SHIPS RANGED
ACCORDING TO SHELL-CHARGE PER 1000 TONS
DISPLACEMENT, BURST IN ONE ROUND.**

| | | lbs. | | | lbs. |
|----|------------------------|------|----|--------------------|------|
| 1 | Sans Pareil | 50.9 | 23 | Renown | 22.6 |
| 2 | Carysfort | 47.6 | 24 | Maggie | 22.3 |
| 3 | Benbow | 44.4 | 25 | Royal Arthur | 21.3 |
| 4 | Comus | 42.0 | 26 | Alert | 21.2 |
| 5 | Collingwood | 41.0 | 27 | Ajax | 20.7 |
| 6 | Rodney | 40.7 | 28 | Barfleur | 19.5 |
| 7 | Edinburgh | 39.8 | 29 | Algerine | 19.4 |
| 8 | Camperdown | 39.5 | 30 | Blake | 19.2 |
| 9 | Archer | 36.6 | 31 | Devastation | 17.3 |
| 9 | Raccoon | 36.6 | 32 | Talbot | 17.0 |
| 10 | Majestic | 36.5 | 33 | Barracouta | 16.7 |
| 11 | Mersey | 35.6 | 34 | Rupert | 16.6 |
| 12 | Empress of India | 32.7 | 35 | Powerful | 16.3 |
| 12 | Conqueror | 32.7 | 36 | Apollo | 15.0 |
| 13 | Nile | 31.9 | 37 | Dreadnought | 14.9 |
| 14 | Hood | 32.4 | 38 | Iris | 14.4 |
| 15 | Australia | 31.2 | 38 | Barham | 14.4 |
| 15 | Champion | 31.2 | 39 | Pallas | 14.2 |
| 16 | Warspite | 30.7 | 40 | Eolus | 14.1 |
| 17 | Inflexible | 27.8 | 40 | Sharpshooter | 14.1 |
| 18 | Basilisk | 27.3 | 41 | Astræa | 13.5 |
| 19 | Pheasant | 24.4 | 42 | Fearless | 13.1 |
| 20 | Edgar | 24.3 | 43 | Alarm | 12.8 |
| 20 | Arethusa | 24.3 | 44 | Rattlesnake | 12.5 |
| 21 | Medea | 24.2 | 45 | Halcyon | 10.4 |
| 22 | Magicienne | 22.9 | | | |

**XXXIII. — PROPORTIONATE ELEMENTS — SHIPS RANGED
ACCORDING TO WEIGHT OF METAL FIRED PER
1000 TONS DISPLACEMENT PER MINUTE.**

| | | lbs. | | | lbs. |
|----|--------------------------|-------|----|---------------------|------|
| 1 | Barracouta | 1,142 | 24 | Barfleur | 469 |
| 2 | Alert | 1,130 | 25 | Mersey | 452 |
| 3 | Algerine | 1,033 | 26 | Nile | 447 |
| 4 | Barham | 986 | 27 | Benbow | 444 |
| 4 | Sharpshooter | 986 | 28 | Rodney | 443 |
| 5 | Pallas | 982 | 29 | Camperdown | 431 |
| 6 | Apollo | 981 | 30 | Comus | 420 |
| 7 | Royal Arthur | 964 | 31 | Australia | 415 |
| 8 | Æolus | 927 | 32 | Champion | 413 |
| 9 | Talbot | 904 | 33 | Pheasant | 408 |
| 10 | Edgar | 900 | 34 | Sans Pareil | 390 |
| 11 | Alarm | 894 | 35 | Magpie | 385 |
| 12 | Astræa | 889 | 36 | Fearless | 360 |
| 13 | Halcyon | 818 | 37 | Collingwood | 358 |
| 14 | Majestic | 731 | 38 | Basilisk | 350 |
| 15 | Blake | 678 | 39 | Warspite | 326 |
| 16 | Empress of India | 664 | 40 | Arethusa | 318 |
| 17 | Hood | 623 | 41 | Conqueror | 260 |
| 18 | Rattlesnake | 622 | 42 | Edinburgh | 251 |
| 19 | Powerful | 615 | 43 | Ajax | 237 |
| 20 | Renown | 603 | 44 | Iris | 224 |
| 21 | Archer | 517 | 45 | Rupert | 219 |
| 21 | Raccoon | 517 | 46 | Devastation | 200 |
| 22 | Medea | 500 | 47 | Dreadnought | 188 |
| 23 | Magicienne | 475 | 48 | Inflexible | 158 |
| 23 | Carysfort | 475 | | | |

**XXXIV. — PROPORTIONATE ELEMENTS — SHIPS RANGED
ACCORDING TO TOTAL ENERGY OF PROJECTILES
FIRED PER 1000 TONS DISPLACEMENT PER
MINUTE.**

| | | Foot-tons. | | | Foot-tons. |
|----|--------------------------|------------|----|---------------------|------------|
| 1 | Alert | 43,891 | 26 | Barfleur | 11,548 |
| 2 | Algerine | 42,136 | 27 | Camperdown | 11,334 |
| 3 | Barracouta | 25,506 | 28 | Medea | 10,717 |
| 4 | Royal Arthur | 24,068 | 29 | Mersey | 10,464 |
| 5 | Apollo | 23,732 | 30 | Pheasant | 10,204 |
| 6 | Talbot | 23,003 | 31 | Sans Pareil | 9,875 |
| 7 | Edgar | 22,613 | 32 | Australia | 9,806 |
| 8 | Æolus | 22,413 | 33 | Magpie | 9,316 |
| 9 | Sharpshooter | 22,340 | 34 | Champion | 8,959 |
| 10 | Pallas | 22,027 | 35 | Collingwood | 8,810 |
| 11 | Barham | 22,021 | 36 | Fearless | 8,744 |
| 12 | Majestic | 21,717 | 37 | Basilisk | 8,292 |
| 13 | Astræa | 21,245 | 38 | Comus | 8,143 |
| 14 | Alarm | 20,271 | 39 | Benbow | 7,971 |
| 15 | Halcyon | 20,121 | 40 | Warspite | 7,905 |
| 16 | Blake | 16,853 | 41 | Arethusa | 6,590 |
| 17 | Empress of India | 16,780 | 42 | Carysfort | 6,376 |
| 18 | Powerful | 16,382 | 43 | Conqueror | 6,340 |
| 19 | Hood | 16,245 | 44 | Edinburgh | 6,122 |
| 20 | Renown | 15,846 | 45 | Rupert | 5,716 |
| 21 | Rattlesnake | 14,900 | 46 | Devastation | 5,492 |
| 22 | Magicienne | 13,562 | 47 | Iris | 5,408 |
| 23 | Rodney | 11,664 | 48 | Ajax | 4,981 |
| 24 | Archer | 11,631 | 49 | Dreadnought | 4,043 |
| 24 | Raccoon | 11,631 | 50 | Inflexible | 3,299 |
| 25 | Nile | 11,549 | | | |

**XXXV.—PROPORTIONATE ELEMENTS — SHIPS RANGED
ACCORDING TO SHELL-CHARGE BURST PER 1000
TONS DISPLACEMENT PER MINUTE.**

| | lbs. | | lbs. |
|-----------------------------|------|------------------------|------|
| 1 Alert | 139 | 22 Mersey | 50 |
| 2 Algerine | 127 | 23 Barfleur | 48 |
| 3 Pallas | 113 | 23 Pheasant | 48 |
| 4 Barracouta | 107 | 24 Carysfort | 47 |
| 4 Rattlesnake | 107 | 25 Sans Pareil | 46 |
| 5 Talbot | 105 | 26 Magpie | 44 |
| 6 Royal Arthur | 102 | 27 Rodney | 43 |
| 7 Apollo | 100 | 28 Collingwood | 41 |
| 7 Sharpshooter | 100 | 28 Champion | 41 |
| 8 Edgar | 96 | 29 Nile | 42 |
| 9 Æolus | 95 | 29 Camperdown | 42 |
| 10 Barham | 92 | 29 Comus | 42 |
| 11 Alarm | 90 | 29 Fearless | 42 |
| 12 Astræa | 89 | 30 Warspite | 36 |
| 13 Majestic | 88 | 31 Benbow | 35 |
| 14 Halcyon | 86 | 31 Arethusa | 35 |
| 15 Powerful | 78 | 32 Conqueror | 30 |
| 16 Blake | 70 | 33 Edinburgh | 29 |
| 17 Renown | 69 | 33 Rupert | 29 |
| 18 Empress of India | 67 | 34 Basilisk | 27 |
| 19 Hood | 62 | 25 Ajax | 22 |
| 19 Archer | 62 | 36 Devastation | 20 |
| 19 Racoon | 62 | 36 Iris | 20 |
| 20 Medea | 60 | 37 Dreadnought | 19 |
| 21 Magicienne | 57 | 38 Inflexible | 12 |
| 22 Australia | 50 | | |

**XXXVI.—PROPORTIONATE ELEMENTS — SHIPS RANGED
ACCORDING TO NUMBER OF ROUNDS FIRED PER
1000 TONS OF DISPLACEMENT PER MINUTE.**

| | No. | | No. |
|-----------------------------|-----|------------------------|-----|
| 1 Rattlesnake | 163 | 21 Blake | 30 |
| 2 Alarm | 96 | 22 Camperdown | 29 |
| 3 Alert | 95 | 23 Arethusa | 28 |
| 4 Sharpshooter | 92 | 23 Champion | 28 |
| 5 Algerine | 87 | 24 Nile | 26 |
| 6 Fearless | 73 | 24 Talbot | 26 |
| 7 Pallas | 66 | 24 Rupert | 26 |
| 7 Archer | 66 | 25 Powerful | 25 |
| 7 Racoon | 66 | 25 Hood | 25 |
| 8 Halcyon | 63 | 25 Warspite | 25 |
| 9 Barracouta | 58 | 26 Majestic | 24 |
| 10 Medea | 52 | 26 Benbow | 24 |
| 11 Apollo | 50 | 27 Renown | 23 |
| 11 Barham | 50 | 27 Dreadnought | 23 |
| 12 Magicienne | 49 | 27 Ajax | 23 |
| 13 Æolus | 47 | 28 Edinburgh | 21 |
| 14 Australia | 42 | 28 Devastation | 21 |
| 14 Astræa | 42 | 29 Iris | 18 |
| 15 Mersey | 40 | 30 Pheasant | 16 |
| 16 Edgar | 39 | 31 Conqueror | 14 |
| 17 Royal Arthur | 38 | 31 Magpie | 14 |
| 18 Sans Pareil | 33 | 32 Inflexible | 8 |
| 19 Barfleur | 32 | 33 Basilisk | 7 |
| 20 Empress of India | 31 | 34 Carysfort | 5 |
| 21 Rodney | 30 | 35 Comus | 4 |
| 21 Collingwood | 30 | | |

XXXVII.—SUMMARY TABLES—TOTAL ELEMENTS. SHIPS
RANGED IN RANK FOR DISPLACEMENT WITH
RANK FOR OTHER ELEMENTS CONTRASTED.

| Type of Class. | Rank for Displacement. | Rank for Weight of Hull. | Rank for Locomotive Elements.* | Rank for Gun Power.† | Rank for Torpedo-Tubes. | Rank for all Elements.†† |
|-----------------------|------------------------|--------------------------|--------------------------------|----------------------|-------------------------|--------------------------|
| Majestic | 1 | 1 | 16 | 1 | 3 | 5 |
| Powerful | 2 | 5 | 1 | 3 | 4 | 1 |
| Empress of India .. . | 3 | 3 | 11 | 2 | 1 | 2 |
| Hood | 3 | 12 | 11 | 4 | 1 | 3 |
| Renown | 4 | 6 | 8 | 5 | 1 | 4 |
| Nile | 5 | 4 | 16 | 9 | 4 | 6 |
| Inflexible.. .. . | 6 | 7 | 15 | 26 | 4 | 13 |
| Dreadnought | 7 | 8 | 18 | 20 | 6 | 13 |
| Camperdown | 8 | 10 | 11 | 11 | 3 | 7 |
| Benbow | 8 | 10 | 13 | 13 | 3 | 9 |
| Barfleur | 9 | 11 | 19 | 8 | 1 | 9 |
| Sans Pareil | 10 | 9 | 17 | 7 | 2 | 7 |
| Rodney | 11 | 12 | 14 | 11 | 3 | 10 |
| Collingwood | 12 | 14 | 9 | 14 | 4 | 11 |
| Edinburgh | 13 | 13 | 20 | 17 | 6 | 16 |
| Devastation | 14 | 15 | 22 | 25 | 6 | 18 |
| Blake | 15 | 18 | 2 | 12 | 4 | 8 |
| Ajax | 16 | 16 | 26 | 22 | 6 | 19 |
| Warspite | 17 | 17 | 18 | 16 | 2 | 14 |
| Royal Arthur | 18 | 19 | 4 | 6 | 4 | 6 |
| Edgar | 19 | 21 | 3 | 10 | 2 | 8 |
| Conqueror | 20 | 20 | 26 | 27 | 2 | 21 |
| Australia | 21 | 23 | 11 | 17 | 4 | 15 |
| Talbot | 21 | 24 | 5 | 15 | 5 | 12 |
| Rupert | 22 | 22 | 30 | 31 | 4 | 21 |
| Astrea | 23 | 25 | 10 | 18 | 4 | 16 |
| Arethusa | 24 | 29 | 16 | 23 | 4 | 22 |
| Mersey | 25 | 26 | 18 | 23 | 4 | 20 |
| Iris | 26 | 31 | 14 | 36 | 4 | 24 |
| Æolus | 27 | 27 | 7 | 19 | 4 | 16 |
| Apollo | 28 | 28 | 6 | 21 | 4 | 17 |
| Magicienne | 29 | 30 | 14 | 29 | 4 | 22 |
| Medea | 30 | 32 | 12 | 29 | 4 | 22 |
| Pallas | 31 | 34 | 21 | 24 | 4 | 23 |
| Carysfort | 32 | 34 | 29 | 32 | 6 | 26 |
| Champion | 32 | 31 | 29 | 33 | 6 | 27 |
| Comus | 32 | 34 | 30 | 37 | 6 | 29 |
| Barham | 33 | 35 | 25 | 30 | 6 | 25 |
| Archer | 34 | 37 | 25 | 35 | 5 | 27 |
| Raccoon | 34 | 38 | 24 | 35 | 5 | 27 |
| Fearless | 35 | 39 | 29 | 38 | 1 | 29 |
| Barracouta | 35 | 36 | 31 | 30 | 6 | 28 |
| Basilisk | 36 | 40 | 32 | 41 | 7 | 33 |
| Halcyon | 37 | 41 | 28 | 38 | 3 | 30 |
| Algerine | 38 | 42 | 33 | 36 | 7 | 32 |
| Alert | 39 | 43 | 35 | 36 | 7 | 34 |
| Alarm | 40 | 46 | 27 | 39 | 3 | 31 |
| Magpie | 41 | 44 | 36 | 43 | 7 | 36 |
| Pheasant | 42 | 45 | 37 | 43 | 7 | 37 |
| Sharpshooter | 43 | 47 | 23 | 40 | 5 | 31 |
| Rattlesnake | 44 | 48 | 34 | 42 | 4 | 35 |

* i.e., I.H.P., speed, coal supply, coal endurance.

† i.e., No. of guns, total calibre, weight of metal, energy, shell-charge, speed of fire.
Last four, per minute.

†† i.e., the summary of the four previous columns.



XXXVIII.—SUMMARY TABLES—PROPORTIONATE
ELEMENTS. SHIPS RANGED IN RANK FOR
DISPLACEMENT WITH RANK FOR OTHER
ELEMENTS CONTRASTED.

| Type of Class. | Rank for Displace- ment. | Rank for Weight of Hull. | Rank for Locomotive Elements. | Rank for Gun Power. | Rank for Torpedo- Tubes. | Rank for all Elements. |
|---------------------|--------------------------------|--------------------------------|-------------------------------------|---------------------------|--------------------------------|------------------------------|
| Majestic | 1 | 2 | 36 | 21 | 33 | 17 |
| Powerful | 2 | 15 | 5 | 27 | 35 | 16 |
| Empress of India .. | 3 | 4 | 35 | 25 | 28 | 17 |
| Hood | 3 | 3 | 35 | 30 | 28 | 20 |
| Renown | 4 | 10 | 27 | 30 | 25 | 17 |
| Nile | 5 | 1 | 37 | 36 | 33 | 27 |
| Inflexible | 6 | 14 | 30 | 45 | 34 | 32 |
| Dreadnought | 7 | 8 | 31 | 44 | 33 | 31 |
| Camperdown | 8 | 6 | 26 | 33 | 30 | 19 |
| Benbow | 8 | 9 | 29 | 38 | 30 | 26 |
| Barfleur | 9 | 11 | 31 | 29 | 23 | 19 |
| Sans Pareil | 10 | 6 | 32 | 31 | 24 | 18 |
| Rodney | 11 | 12 | 30 | 32 | 29 | 24 |
| Collingwood | 12 | 8 | 21 | 35 | 32 | 20 |
| Edinburgh | 13 | 7 | 33 | 40 | 37 | 29 |
| Devastation | 14 | 8 | 40 | 43 | 37 | 33 |
| Blake | 15 | 24 | 1 | 23 | 31 | 15 |
| Ajax | 16 | 3 | 39 | 42 | 36 | 30 |
| Warspite | 17 | 13 | 24 | 37 | 22 | 20 |
| Royal Arthur | 18 | 17 | 9 | 11 | 27 | 10 |
| Edgar | 19 | 21 | 8 | 12 | 20 | 8 |
| Conqueror | 20 | 5 | 34 | 41 | 16 | 20 |
| Australia | 21 | 16 | 13 | 22 | 22 | 13 |
| Talbot | 21 | 20 | 10 | 14 | 26 | 12 |
| Rupert | 22 | 9 | 38 | 39 | 21 | 27 |
| Astrua | 23 | 19 | 12 | 13 | 18 | 9 |
| Arcturion | 24 | 38 | 14 | 34 | 17 | 24 |
| Mersey | 25 | 30 | 11 | 17 | 15 | 13 |
| Iris | 26 | 39 | 6 | 38 | 14 | 22 |
| Æolus | 27 | 23 | 7 | 10 | 12 | 3 |
| Apollo | 28 | 30 | 4 | 7 | 11 | 3 |
| Magicienne | 29 | 31 | 5 | 16 | 9 | 8 |
| Medea | 30 | 33 | 2 | 15 | 8 | 6 |
| Pallas | 31 | 33 | 13 | 5 | 7 | 6 |
| Carysfort | 32 | 34 | 19 | 26 | 19 | 23 |
| Champion | 32 | 34 | 19 | 20 | 19 | 17 |
| Comus | 32 | 34 | 20 | 32 | 19 | 25 |
| Barham | 33 | 18 | 18 | 8 | 13 | 5 |
| Archer | 34 | 36 | 15 | 9 | 6 | 11 |
| Raccoon | 34 | 36 | 10 | 9 | 6 | 8 |
| Fearless | 35 | 35 | 16 | 19 | 4 | 14 |
| Barracouta | 35 | 22 | 23 | 4 | 10 | 7 |
| Basilisk | 36 | 28 | 22 | 28 | 39 | 29 |
| Halcyon | 37 | 27 | 17 | 11 | 3 | 6 |
| Algerine | 38 | 33 | 22 | 2 | 39 | 20 |
| Alert | 39 | 32 | 25 | 1 | 39 | 21 |
| Alarm | 40 | 34 | 11 | 7 | 2 | 4 |
| Maggie | 41 | 26 | 31 | 24 | 39 | 30 |
| Pheasant | 42 | 25 | 23 | 18 | 39 | 28 |
| Sharpshooter | 43 | 37 | 3 | 3 | 5 | 1 |
| Rattlesnake | 44 | 29 | 14 | 6 | 1 | 2 |

In the foregoing tables, the ships are grouped in classes under the names of typical ships, as follows :—

MAJESTIC, Magnificent, Prince George, Hannibal, Victorious, Illustrious, Cæsar, Jupiter, Mars.

POWERFUL, Terrible.

EMPRESS OF INDIA, Repulse, Royal Sovereign, Ramilies, Resolution, Royal Oak.

HOOD.

RENOWN.

NILE, Trafalgar.

INFLEXIBLE.

DREADNOUGHT.

CAMPERDOWN, Anson.

BENBOW.

BARFLEUR, Centurion.

SANS PAREIL.

RODNEY, Howe.

COLLINGWOOD.

EDINBURGH, Colossus.

DEVASTATION, Thunderer.

BLAKE, Blenheim.

AJAX, Agamemnon.

WARSPITE, Impérieuse.

ROYAL ARTHUR, Crescent, Gibraltar, St. George.

EDGAR, Hawke, Theseus, Grafton, Endymion.

CONQUEROR, Hero.

AUSTRALIA, Galatea, Narcissus, Orlando, Undaunted, Immortalité, Aurora.

TALBOT, Eclipse, Minerva, Venus, Juno, Doris, Dido, Isis, Diana.

RUPERT.

ASTRÆA, Bonaventure, Cambrian, Charybdis, Forte, Fox, Flora, Hermione.

ARETHUSA, Phaeton, Leander, Amphion.

MERSEY, Severn, Thames, Forth.

IRIS, Mercury.

ÆOLUS, Brilliant, Indefatigable, Intrepid, Iphigenia, Pique, Rainbow, Retribution, Sirius, Spartan.

APOLLO, Andromache, Latona, Melampus, Naid, Sappho, Scylla, Sybille, Terpsichore, Thetis, Tribune.

MAGICIENNE, Marathon, Melpomene.

MEDEA, Medusa.

PALLAS, Phoebe, Philomel, Pearl, Katoomba, Mildura, Wallaroo, Tauranga, Ringaroöma.

CARYSFORT, Constance.

CHAMPION, Cleopatra, Curaçoa.

COMUS, Cordelia, Conquest.

BARHAM, Bellona.

ARCHER, Brisk, Cossack, Mohawk, Porpoise, Tartar.

RACoon.

FEARLESS, Scout.

BARRACOUTA, Blanche, Blonde, Barossa.

BASILISK, Beagle.

HALCYON, Harrier, Hussar, Hazard, Dryad.

ALGERINE, Phoenix.

ALERT, Torch.

ALARM, Antelope, Circe, Hebe, Jason, Jaseur, Niger, Onyx, Renard, Speedy.

MAGPIE, Redbreast, Redpole, Widgeon, Lapwing, Ringdove, Goldfinch, Thrush, Sparrow.

PHEASANT, Partridge, Peacock, Plover, Pigeon, Pigmy.

SHARPSHOOTER, Spanker, Speedwell, Salamander, Seagull, Sheldrake, Skipjack, Gossamer, Gleaner, Boomerang, Karakatta.

RATTLESNAKE, Sandfly, Spider, Grasshopper.

Vice-Admiral The Hon. Sir EDMUND R. FREMANTLE, K.C.B., C.M.G. : I cannot say that I feel in the least competent to discuss this lecture. I regret that this paper was not put into our hands before we arrived at this Institution. Everyone must be certainly aware that all these numerous tables, of which we only see a portion on the wall, require considerable time to consider and to verify, so as to enable us to discuss them with any effect. I must, therefore, premise that my remarks will be more of a general character than anything else. Now, the lecturer has, so far as I can see, speaking generally, laid considerable stress upon the medium gun fire; but he has gone further, and he has spoken of light gun fire. He speaks, on several occasions, of small Q.F. shell, small Q.F. guns, but he does not explain, and, perhaps, he will explain, whether he was referring to 3 and 6-pounders, or whether he was referring rather to the medium size, such as the 4.7 and the 6-inch gun, especially in referring to the Yalu action. He also did not appear to me to give that value to speed in evolution and in action which I should have expected. I now come to the tables. I confess that I have not followed them closely, and I have not been able to do so. We know that the lecturer read a paper at the Institute of Naval Architects last year, and I have had the advantage of reading that, and to a great extent, as far as I understand, he has adopted many of the arguments he used on that occasion. Now, I venture to think that arranging ships according to their place by the 1,000 tons and giving value to the number of guns, and to the calibres of guns in accordance with that, was a mistake. There are two things which, naturally, in drawing up these tables the lecturer had before him. The first would naturally be that his facts should be correct. Now, we know Admiral Colomb here, and we know him as a speaker of great care, and, as a rule, he marshals his facts carefully before us and gives us facts we can rely upon. I am sorry to say that in so far as he has trusted to Lord Brassey's book he has not had the facts before him, and he has made very great mistakes. As for Lord Brassey's book I must refer to that. We all know how valuable it is, how much we go to it for information, and, generally speaking, correctly for information; but certainly in the questions of coal capacity and the number of miles which a ship is able to run on the area of action, it is full of grave errors. I will just quote some of those ships which were under my orders. It used to be rather a joke between the captains and myself when I used to say, "I see you can run 4,850 miles," the real fact being, that they could only make a passage of 2,000 miles, and then were obliged to coal. Take four vessels, the "Archer," the "Porpoise," the "Brisk," and the "Cossack"—sister-ships, exactly alike, so far as I know—I have had the whole of those four ships under my orders. Their capacity is precisely the same, yet you will find the "Archer" and "Porpoise" credited with 475 tons and an area of action of something like 7,000 miles; while the "Brisk" and "Cossack" are accredited with 325 tons, and an area of action of 4,850, and I can say from experience that if you were to reduce by one-half the lower proportion, *i.e.*, the 4,850, you would

be about right. The coal capacities given of other ships are equally wrong. Undoubtedly a higher capacity is shown for the older ships than the new ships, and the reason is, the mistake has been found out—sufficient allowance had not been made for different things: this capacity had been given on a sort of general ground, and in some cases the “legend weight” is mentioned, and in other cases the whole weight. I find, for instance, the “Edgar” class are credited with stowing 857 tons, but to my certain knowledge they always filled up to 1,300; on the other hand, the “Thunderer” is credited with 1,600, and the “Devastation” with 1,800; and when you come to the “Revenge” or the “Centurion,” the “Centurion” is about right, 1,240; but for some reason the “Revenge” is only 900, but you will find that she takes in 1,800 tons. Therefore, I am afraid the facts are not at all correct as regards the coal capacity. To turn to another subject, let us see how Admiral Colomb has dealt with the facts, as in many cases I am afraid he has not dealt quite fairly with them. He has taken all the guns and lumped them all together. A number of 3-pounders he has taken as equal to a 46-ton gun. I venture to say no comparison of this sort can be of any value. So far as I understand him he has taken three 4-inch guns as equal in capacity, as far as one table is concerned, to a 12-inch gun. Surely that cannot be correct. I therefore venture to think we have not got the tables drawn out so as to command either our assent or our confidence. This is such a very important question (the title of the paper is so extremely good, the “Elements of Force in War-ships”), that it requires to be worked out thoroughly, and it would be of such value to us if it was worked out thoroughly, and Admiral Colomb is a man who is so capable of dealing with it in that thorough and complete way in which we should like to have seen it dealt with, that I cannot but regret that the tables are inaccurate. I wish simply, in conclusion, to show what I mean with reference to the “Elements of Force in War-ships.” We have at present building, in the “Powerful” and “Terrible,” two extremely fast, and extremely large, cruisers, of what so many people think the enormous size of over 14,000 tons. They carry twelve 6-inch guns and two 9·2 guns; they are capable of steaming 22 knots, and though I believe their guns will be very fairly protected, and they have a protected deck, they have no side armour whatever. There is a vessel building at Elswick, the new “Esmeralda,” for the Chilians, of 7,000 tons, about half the size, intended to go 24 knots; she will carry sixteen 6-inch guns and two Q.F. 8-inch guns, and will have a belt of 6 inches. Now, what we should like to know from the authorities is what we gain for those 7,000 extra tons. We do not gain speed, we do not gain protection, we do not gain gun-power, but there is something very likely that we do gain, and undoubtedly our constructors have not designed this ship without intending to gain something. It is a very large order, 7,000 tons, and apparently we gain nothing except in coal capacity, as we can see the gun-power, the protection, and speed are inferior to the 7,000-ton ship. I could only wish this criticism was more complete, but very possibly I must close with an apology. I have not, as I have said, had time to be able to master these elaborate tables, which I have no doubt have taken Admiral Colomb a long time to prepare; and I can only hope my criticisms have not been justified, and that he will be able to make a full reply to what I have said.

Admiral The Right Hon. Sir J. C. D. HAY, Bart., K.C.B., D.C.L., F.R.S.: No doubt we are all very much obliged to Admiral Colomb for the great pains he has taken in putting this matter before us. I will not venture to criticise the paper. My gallant friend on my right has had more recent experience of fleets than I can presume to say I have had. But there are one or two points which I think Admiral Colomb could enlarge on with benefit to his paper, and one in particular is the classification of ships according to their draught of water, which has not been taken into consideration in this matter. That particular instance of the “Edgar” and the “Majestic” is a case in point. Your lordship held the highest appointment which a British subject can hold in the East. Now, if two foreign “Edgars” had got through the Suez Canal

and devastated the coasts of India, it would have been very unsatisfactory to you to receive, a telegram to say the "Majestic" had been sent in pursuit of them, for she could not get through the Suez Canal. Following the practice of our forefathers, which is alluded to in the gallant admiral's paper, I think that that element ought to be taken into consideration; and, although it is very satisfactory, I have no doubt, to have these very large ships, if they are not useful everywhere, as our Empire is world-wide, I think the limit of size ought to include the limit of draught of water; and I believe we should build no ship which cannot go through the Suez Canal or into the St. Lawrence. That limit is 24 feet. Now that the question is being considered of largely increasing the Navy, I believe I am justified in saying that that matter must have been under the consideration of the Admiralty, for I observe the ships which are recently being built are of a smaller class, and their draught of water will fulfil the condition which I have been speaking of. I conclude, therefore, by saying that the gallant admiral's paper and the information which he has elaborated so carefully for us would be of still more use if he would add that element of draught to his classification of the value of our ships.

Captain C. ORDE BROWNE, late R.A. (*Lecturer on Armour Plates, Artillery College, Woolwich*): I must apologise for trespassing upon a naval audience, but I have been working on one branch of the paper which Admiral Colomb has brought out, that is, the energy of fire, and upon that point I want to ask one or two questions. In taking the energy of fire of each gun and the number of rounds per minute, of course we are doing the only thing that gives due weight to the speed of Q.F. ordnance, and I take it that the Q.F. armament that ships now have is of very great importance, seeing that in many ships the Q.F. guns give considerably more energy per minute than the heavy guns, and it depends upon the speed with which they fire. In fact, I do not see much value in the single-round comparison. Then, with regard to fixing the rate, on which so much must depend. Did I understand Admiral Colomb to say that he had given to some of his Q.F. guns—say the 3-pounders—as great a rate as forty or fifty rounds per minute?

Vice-Admiral COLOMB: I gave the 3-pounders a rate of forty rounds.

Captain C. ORDE BROWNE: I have obtained rates from the "Excellent" and other sources, but, as far as I could learn, nothing was to be depended on for actual service exceeding ten rounds per minute. I suppose the exigencies of service would tell on the rate of the quick-firing more than the slow-firing, which makes it desirable not to over-estimate the former. Should you consider the low estimate thus taken totally wrong?

Vice-Admiral COLOMB: You are the best authority on that matter. My object was to draw you on the subject.

Captain C. ORDE BROWNE: I fear I cannot possibly accept that compliment, but I will mention one or two things that I have noticed. I have taken the greatest rate at ten rounds a minute; but I daresay the rounds of the heavier pieces may be nearly the same as Admiral Colomb has stated. I considered the cases of a certain number of foreign ships, and I should be very glad to get the Admiral's opinion as to the right method of dealing with them. I have assumed that they had very much the same guns as ourselves, because, although I do not believe that their Q.F. guns can fire at the same rate, or are as well served at present as our own, yet practically, when it comes to actual service, I suppose the ships that would be put to the front would get the best guns they could, and that sooner or later their guns would come to something very near our own; so that if you want to compare the armament of one type of ship with another, the course is to give all credit for having brought the most advanced guns firing to somewhere about the same rate and giving similar results. The results that come out in comparing foreign ships with our own are interesting. I do not think anyone would realise in looking at the battery as put down belonging to a

ship, how much depends on a slight increase or decrease in calibre. I have found, for example, a ship which is commonly credited as being a very powerful cruiser with powerful armament work out very badly, because the guns were of smaller calibre than usual. This brings out the value of applying the actual test of figures employed by Admiral Colomb. To take an opposite case, the "Esmeralda" has the most extraordinary energy of fire of any ship I know. Her energy of fire, as far as I could get the rates from the "Excellent," is such, that it is sufficient, if it was put in proper shape, to lift the entire ship more than a foot a second. I shall very much like to hear Admiral Colomb's answer as to the relative power of such a vessel as the "Terrible," compared with the "Esmeralda." Of course there is one element in the "Terrible" which must be allowed for in comparing other features, viz., the distance she can steam, which, as we have been told, is very long. The distance put down in "Brassey's Annual" for steaming on her own coal, is more than a great circle of the world (in fact, 25,000 miles), and that, I take it, is what has pulled her down to a great extent, in other respects, because her great bulk must take a great deal of engine-power to drive her at a high speed. There is another question I should also like to ask Admiral Colomb. It appeared to me, going into the question of total energy of fire, that if you take different classes of ships—that is battle-ships and cruisers—there is a great difference in the character of fire that must be considered. In a battle-ship there is very much greater power of penetration depending on the existence of very heavy guns, while in cruisers the energy of fire may be enormous at times, but it is delivered by comparatively light guns and consists of a great number of very much lighter blows. The same difference, indeed, exists between the heavy and Q.F. armaments so that it appeared to me as if on service there would be a kind of duplicate fight going on, and that Q.F. guns of most ships must be engaged against the lighter parts of an enemy, say at each other or against the conning tower, whereas the heavier guns would, in all probability, be engaged in attacking the vital parts of the ship. I take it that one shell from a very heavy gun would not produce a proportionate effect if it was fired into a light part of her enemy, whereas it might have the power of sending her to the bottom if it was delivered at a vital part. As we stand at present, making a great allowance for obliquity of impact, the power of our heaviest guns (especially the 12-inch wire guns) is sufficient to perforate any ship if it got an opportunity. This state of matters deserves notice; it was not true some years ago. It was not true, for example, in the days of the "Dreadnought" and "Inflexible." No doubt, Admiral Colomb will give a clear answer about the tables. I fancy that they are drawn up more correctly than Admiral Fremantle seemed to think.

MR. ROBERT NIVEN: I do not rise to make any criticisms, but just to say it seems rather remarkable, as we have gone so much upon detail, that the very important *principle* which I understand Admiral Colomb has enunciated, and towards which he has been trying to *feel his way*, has not been criticised more. I should very much like to hear, from some of those who are qualified to speak, their opinion as to whether Admiral Colomb is on the right line with the *principle* in question—that, viz., *of trying to discover the most effective kind of battle-ship by adjusting her, in proper proportion, relating to each other the various elements of force*. I understood him to say there are certain data, elements of force, which he has not obtained, whether through his own fault or the fault of others I don't know, but I should be glad to hear some expression of opinion from those here presumably able to form an opinion as to whether he is working on a *right principle*. The point I am referring to is contained in the following passage:—"Of course, we can say that any ship which exceeds in all these elements is the more powerful ship; but our ingenuity and calculation may be exercised in considering how far diminution of one element in any ship is compensated by an increase of another, so as to make one ship equal, or more than equal, to another in fighting force."

He puts the same point in a different way in other parts of his paper, but with the same result. I shall be glad to hear the principle thus enunciated criticised.

Vice-Admiral COLOMB: I think my old friend Admiral Fremantle had me on the hop when he spoke of the lateness of the appearance of the paper. As a matter of fact, when you undertake to do a job which you think is going to take three weeks, and it takes you three months, you are naturally a little behind-hand. That is my unfortunate condition, but I make every apology for it, because I am quite aware that in a paper bristling with abominable figures, such as this is, it is not possible to attack it unless you have a look at the figures beforehand, or at any rate, have some notion of what the lecture is about. I think I had better leave the question of the value of light guns to Admiral Fremantle's judgment when he comes to read the paper carefully. I think he will see that what I am doing all through is trying not to speculate, but as Mr. Robert Niven said just now, to feel my way to a condition which we have not yet reached. I undoubtedly take the light guns as developing energy and shell fire, and all the rest of it, according to their rapidity of fire, just as I have the heavy ones, and I do that because we have not got any other means at first of dealing with the matter. If I were to take the effect of a broadside of the mixed character we now have as upon the side of the "Majestic," I should come, I think, to Captain Orde Browne's view, that in reality there are two targets, and that you cannot shut out the view of the effect the very light guns may have, any more than you can shut out the effect of the very heavy guns. I am quite prepared to admit I may, in the method I have pursued, be giving an undue place to light guns, but then the object of such a paper is not to assert a fact, but to offer a statement for criticism. You, therefore, make your statement the best you can put forward, on purpose that the Service may argue it out, and see and try how much it is wrong this way, and how much it is right the other way, and so on. The paper I read at the Naval Architects last year was not understood. It was not understood to be a tentative paper—that I was then beginning to feel my way. I know more about the subject now a good deal than when I wrote that paper, but the *raison d'être* of the proportionate tables may be still misapprehended. I think I have got Captain Orde Browne with me on that point—that really you must come to the proportionate quantities of force or else you cannot properly compare ship with ship. On the subject of the figures, I am able to speak very much more distinctly. There is not a single figure, except what relates to the guns, that is taken from Lord Brassey's "Annual." The whole of the figures Admiral Fremantle spoke of are taken direct from the Estimates. But, of course, you have variation in the Estimates, especially when classes of ships were long in designing and long in completion, and in dealing with figures you have to take simply the best official figures you can get, and I do not think the figures I have used in compiling these tables can be very strongly criticised. For coal supply, for instance, I have avoided altogether the total capacity. I have kept entirely in drawing up the tables to the legend weight, and on the legend weight hang all the details of the ship—her draught of water, speed, coal endurance, and everything else are based on the legend weight as far as the estimates show; therefore the figures, however incorrect they may seem, must be held to as official figures, bearing the very highest authority. The lumping of the guns together is, of course, a part of my method. It may be right or wrong. It is a point open to argument. I throw it out as it were for the Service to settle whether or not the thing can be worked out in that way. Sir John Hay spoke chiefly of the draught of water and the Suez Canal. I am sure the Admiralty never lose sight of that point, and I do not doubt for a moment that in the arrangement he speaks of in reducing the draught of water the Suez Canal is to a great extent in view. But then it would be excessively difficult to introduce into such complex tables as I have prepared the further complication of draught of water. After all, I have considered that ships are fighting in the open sea where draught of water does

not come in. I should have to consider not the tactical value, so to speak, of fighting power, but the strategical value, if I were to include draught of water. I am exceedingly glad to think I have Captain Orde Browne's high authority to a great extent on my side. I think he fully understands what I am driving at. I heard that he had done something of the same kind himself, but the pressure of getting this paper up in time prevented me from ascertaining what he had done, prevented me even from communicating with him as I should like to have done and as I proposed myself to do many times. But he agrees with me, I think, generally, that fire per minute, and the lumping the weight of metal, and the energy and shell power, and so on, is almost a necessary method of calculating.

Captain C. ORDE BROWNE: I do not see what else you can do.

Vice-Admiral COLOMB: With regard to foreign ships one of my objects, of course, is there. I am not criticising anything in the least degree, I was trying for myself, and afterwards for the Service, to get at the facts and to put them together in such a form that they could be used, and would, perhaps, stir up minds more competent than my own to face the subject and get to the bottom of it. Unquestionably what Captain Orde Browne has said about the comparison of force in foreign ships and our own is the thing to be done. It does give us a certainty about our actual naval position which we cannot get otherwise. I hope and trust that Captain Orde Browne will follow out the matter, as he is much more competent than I am to do it, and that we may get from him some further development of the views I am putting forward. He would do it with a knowledge and authority which I cannot pretend to. With regard to diminished energy for small calibre, certainly one of the things that struck me was that the moment you begin to drop your calibre you begin to lose, out of proportion apparently to the weights in the gun. It comes to the same thing again: you must have your guns of a certain calibre, or certain average calibre, or you do not get the result out of them. But I am not competent really to go into the matter thoroughly on that point. The armament of the "Powerful" was spoken of by Admiral Fremantle and also by Captain Orde Browne, but I thought Captain Orde Browne somewhat answered what Admiral Fremantle said. It is in the lighter armament—she being a cruiser—that I suppose it is understood she ought to shine in. As the target offered to her will not generally be an armoured target, it is her light armament which brings her up in the scale. There is a statement in the Naval and Military Notes of our JOURNAL which might be worth while reading. It says: "The armament of the 'Powerful' will consist of two 9·2-inch guns, twelve 6-inch Q.F. guns," which is a large number, and "sixteen 12-pounder Q.F. guns." There we come to a development of this light fire.

Vice-Admiral Sir E. FREMANTLE: The 7,000-ton ship will carry sixteen 6-inch guns. You say a "large number" when the "Powerful" is carrying twelve: my objection is a vessel half her size is carrying four more.

Vice-Admiral COLOMB: She has a light armament of sixteen 12-pounder Q.F. guns, and twelve 3-pounder Q.F. guns. There is a very large proportion of light armament, as if the designers had laid stress where I am rather inclined to lay it, upon a numerous light armament. But then, I think, we must bear in mind this, that the question I dwelt on—the proportionate large quantities of extra ammunition for the Q.F. gun—tells really against its power. I think we know that the "Powerful" has enormous stores of ammunition, and very likely the difference may be accounted for in that way. I must thank Mr. Robert Niven for his expression, because he puts it exactly as I understand it. I am "feeling my way," and I hope, however clumsily I may have proceeded thus far, that stronger and fitter hands, and stronger and fitter brains, will make the path clearer in following it up.

The CHAIRMAN (the Earl of Northbrook): I am sure I am only expressing the feeling of everyone here present in saying that we are greatly indebted to

Admiral Colomb for the paper which he has read to-day. The great pains he has taken and the time he must have given to compiling these tables, and the clear explanation he has given of them, command the thanks of all of us; and I must add that his ability is only equalled by the modesty with which he has expressed himself in answering the observations which have been made, and in only claiming that he has taken a step forward in a work of very considerable interest and undoubted difficulty. I was greatly struck with the last paragraph of his paper. He says:—"The general result of my somewhat laborious examination of the fighting power of our fleet is to confirm me in my old belief that we are, in all cases, both with guns and ships, seeking for the happy mean, which, when it is found, cannot be bettered." I think no one could have more tersely and clearly expressed the extreme difficulty of the task which is imposed upon the Admiralty in settling upon the annual shipbuilding programme, and I do not think I am misrepresenting the general feeling of the Service in saying that I do not believe there has ever been a time when confidence could with greater reason be placed in the members of the Board of Admiralty. We have at the Admiralty men of great ability, who will give the best consideration that can be given to these very difficult questions with a full knowledge of the requirements of the Service.