Some Aspects of Coast Defence

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REAR-ADMIRAL H. F. CLEVELAND in the Chair.

SOME ASPECTS OF COAST DEFENCE.

By Lieutenant-Colonel J. R. J. JOCELYN, R.A.

THE tactics of coast defence is a wide subject, involving much that an engineer or a sailor is more qualified to deal with than an artilleryman, so that I propose to confine myself to my own arm; but even with this restriction, time will not admit of anything like completeness of treatment, and I feel obliged to crave indulgence for a certain want of coherence and continuity that, doubtless, will be detected in my remarks. I would, however, plead in excuse, that coast defence is no longer an unfamiliar subject, in view of the many excellent lectures that have touched upon it in this theatre, during the last five years, and, in addition; that it is possible, I shall best employ the time at my disposal, in directing attention to certain points of interest or importance, at the present time.

The fighting units of coast artillery may be simply stated: the smallest is the group, which should be composed of two or more pieces, under the command of a group officer; an assemblage of two or more groups constitutes a fort, under a fort commander; while two or more forts, make up a section, under a section C.R.A. All the guns of a group should have the same field of fire, all the groups of a fort should command the same waterway, all the forts of a section should fire on the same line of approach. There are other officers, and other commands and modifications of commands, but this is practically the chain of responsibility, and the object of the organization is to bring every piece into action, with its proper ammunition, as soon as it can bear on an enemy, to keep it in action till all objectives are disabled or out of range, and to accomplish this end as quickly as possible.

Certain subjects connected with this essentially artillery aspect of coast defence may be presented to you, as pegs whereon to hang discussion; they are as follows:—The selection of guns and mountings; the placing of guns; the control of guns; the choice of ammunition; the laying of guns; what we may expect from guns; the action of guns at night; requirements for training personnel. I do not propose taking them *seriatim*, but in such order as will most conduce to brevity and clearness.

I. *The Laying of Guns.*

In order to lay a gun correctly, the range and training which will cause the projectile to hit the objective must be known. Now no range or position finder in existence, is able to give us this information. Something else is necessary.

The Three Service Methods of Gun Laying.—There are three Service methods of gun laying, known as Cases I, II, and III, each of which, in turn, becomes suitable, as conditions change.

Case I.—The tangent scale is raised to the *proper height*, and the gun layer is responsible for line and elevation. The position finder (P.F.), or the depression range-finder (D.R.F.), can be employed to measure the distance of the object. The advantages of this method are, that it is independent of rise and fall of tide, and is more accurate than quadrant elevation; also from a high site, errors in range, are minimised by its use. The disadvantages are, that it depends greatly on the visibility of the object, and personal error is apt to creep in. As the gun layer is obliged to jump clear before the gun is fired, and as it is more difficult to keep on the object than when only laying for line, it is less rapid than Case II; it is unsuited to salvo fire, and is awkward at night, on account of the difficulty of seeing the graduations of the scale.

At present Q.F. guns have always to be fired by this method; it should be employed for all guns, when the range is not accurately known, or if instruments break down, or are out of adjustment.

Case II.—The *proper quadrant elevation* is given to the gun, under the superintendence of the gun captain, while the gun layer, standing on a sighting step, lays the gun for line by aid of straight-edged sights.

The P.F. or D.R.F. can be used to measure the distance of the object. The advantages of this method are, that the gun can often be laid correctly when the view of the object from the gun is much obscured; the division of labour, in laying, eliminates personal error, and tends to speed and accuracy; it is convenient for salvo fire and night work, the gun layer remaining on the step, when the gun is fired, and having no scales to alter. Its disadvantage is, that if the correct range is not known, the resulting error will be greater than with Case I. Case II is the normal method.

Case III.—The sights are not used, and the gun is laid by quadrant elevation and training arc, for what is called "predicted firing." It is only possible with the P.F. This instrument can be made to pre-

dict the *proper range and training* at which to fire, before the time for firing arrives, this information being exhibited on group dials, which are in electric communication with the instrument. Quadrant elevation is given under the superintendence of the gun captain, while the gun layer sees that the mounting is traversed, until its pointer is at the proper position, over the graduated arc, on the gun floor. At the proper time, the gun is fired electrically. The advantages of this method are; that a gun can be fired at an object totally invisible to, or only seen with difficulty from, the gun floor, as long as it can be made out, by the telescope of the instrument. The invisibility may be due to smoke, haze, or the way the gun is mounted or placed; the partial invisibility, to long range or temporary meteorological conditions, such as a hail storm beating in the face of the gun layer. Its disadvantages are, that in general, guns shoot better and more rapidly when laid by aid of the sights, especially if there is any great "displacement" or distance, between the instrument and the group it serves. There are other technical points that I need not touch on. This method would be used with advantage for direct long range salvo fire, and, at all times, when guns are specially mounted for high angle fire; occasionally it possesses advantages at night, and must always be resorted to, when laying by direct vision is impossible. It is, in every case, a valuable alternative to the other cases.

Now, in all three cases, the *proper range*, and in Case III the *proper training*, in addition, must be exhibited on the group dials. Either the P.F. or the D.R.F., when in proper adjustment, can measure with great accuracy the distance between an object and the pedestal on which the instrument is placed; the former can, in addition, determine the distance between the object and the pivot gun of the group; but more than this is required; the fort commander is obliged to apply certain "corrections" to the information, given by the instruments.

The Powder Correction.—Great strides have doubtless been made in the manufacture of powder, and, if only proper precautions are taken in sorting and weighing, very regular shooting may be looked for, on any given day, from any given batch of powder; but the strength may vary from time to time, and generally a correction has to be made, at any rate at first, until the guns get warm. We may, however, note in passing, that bad results are often ascribed to what is called "error of the day," which are really due to bad adjustment of instruments, defects in loading, and the like. The powder correction has to be considered, with all three cases, whether P.F. or D.R.F. is used.

Tide Correction.—Whereas tangent elevation is unaffected by height of site, quadrant elevation scales have to be made out for each fort; they are constructed, so as to be suitable for the height of the work, above mean tide; alterations in the level of the latter will sometimes cause serious alterations in range. The necessary allowance will increase with the difference from mean level, in the height of the tide, and the sharpness of the angle at which the shot strikes the

water. Other things being equal, low sites and short ranges increase the importance of this correction. It must always be considered in Case III, and also in Case II, whether P.F. or D.R.F. is used. It does not come in to Case I.

The Correction for Travel of Objective.—This correction must be considered in Cases I and II, whether P.F. or D.R.F. is made use of. We will take the case of the D.R.F. first. Before the group officer orders any range to be put on his guns, he must compensate it for the difference between the distances of the object from the instrument and the pivot gun, and this he does by applying a "group difference," previously laid down, which depends on the displacement and the way the gun is pointing (see Fig. 3). Having regard then, to the time, when it will be his duty to fire, and also to the way the range is changing, as shown on the group dials, he gives a certain range, corrected for difference, to his guns, and orders them to fire when the range itself appears on the group dial. But before this can take place, the following course is followed. The observer at the telescope, T (see Fig. 1), follows the object, while another man watches the range drum of the instrument, and calls out ranges, in such a way and at such intervals, as may have been ordered by the fort commander, and in obedience to these calls, a third individual moves a large dial, close to the instrument, known as the fort commander's dial. A fourth individual copies on the group dial, the movements of the fort commander's dial. When his selected range appears on the former, the group officer orders his group or gun to "commence firing." The gun layers see that their line is correct, and throw up their arms in Case II, or quickly finish their laying and jump down in Case I; at either of these signals, the gun captains involved, order their guns to fire, and the Nos. 4 pull the lanyards.

Next suppose the P.F. is finding the range. Almost the same procedure is followed, except that the group officers have not to correct for displacement. The observer at the P.F. telescope, T (see Fig. 1), having manipulated the instrument as ordered by the fort commander, follows the object and the group dial exhibits ranges. These are called out, at intervals, by the dial readers, and when the selected range is heard, the group officer orders his group to commence firing, and gun layers, gun captains, and Nos. 4 proceed as above detailed. The P.F., thus, saves group difference and three of the operations, necessary in the former case.

The time taken up in this transmission of the range is called the "time of firing," and depends on the fort and the smartness of the men.

After the gun is fired the "time of flight" has to elapse before the shot strikes, and both during this period, and the "time of firing" the position of the object may alter, the necessary allowance depending on its speed and direction. This correction is not required with Case III.

In addition to these corrections for range, there are others that refer to training.

Training Corrections.—In Cases I and II, either with P.F. or

Fig. 2.

Fig. 1.

Fig. 4.

Fig. 6.

Fig. 3.

VERTICAL TARGETS.

Fig. 5.

	Free board.	Beam.	Length.
Torpedo Boat	3	11	134'5
Torpedo Gun Boat	8	21'7	196
First Class Cruiser	10	45	346

D.R.F., these corrections are made by giving a certain amount of deflection on the leaf of the back sight. They are necessitated by the effect of wind and the angular travel of the object during the time of flight, in Case II, or the time made up of the latter and that taken by the gun layer to complete the laying, in Case I. In addition, if the bow or stern wave is made use of as a lay point, deflection may be necessary, to bring the projectile to a certain part of the ship. In Case III not only have the above effects to be considered, but drift has also to be taken into account, as the gun is not laid by aid of the sights.

The Responsibility of the Fort Commander.—Now, with the exception of the group difference, all these corrections have to be evaluated and applied, either by or under the authority of the fort commander. Not only has the range to be measured by the instrument, but the net correction has to be arrived at, and matters so arranged that it is not a distance only, but a corrected distance, that is transmitted to the group dials. So also as regards training; the gun layer is responsible either for the line over the sights or the position of the pointer, but the fort commander governs the movements of the deflection leaf, or takes measures, in Case III, that the necessary corrections are embodied in the transmitted training. No instrument absolves the fort commander from this responsibility; corrections always have to be made, they only differ in kind. When firing has commenced, observation is the great aid to correction; but the above disturbing effects are not *constant* in their influences, and have always to be borne in mind. It is unfortunate that but little real experience in observation of fire can be gleaned from our so-called "service practice."

The Position of the Fort Commander.—Now arises this question: as the correction and observation of fire is so difficult a matter, how can its performance by a fort commander, be reconciled with efficient and disciplinary control of his men? My contention is, that the two things are perfectly compatible, if proper arrangements exist in the work, and if the officer is able to regard matters from the standpoint of their relative importance for the time being. The first necessity is a properly chosen station, inside the fort, for its commander, its requirements being as follows: There should be a clear view of the waterway commanded by the fort; in an open work, gun emplacements should be in sight, if possible, but at all times they must be within easy reach; there should be a pedestal for a D.R.F., an instrument that should always be at hand, whether the P.F. is installed or not, but the distance of this pedestal from the farthest group should not exceed 200 yds., for if it is greater one set of group differences will not be sufficiently accurate for all ranges; the station should be roomy, weather proof, clear of the blast of the guns in firing, and be provided with a table to hold maps and other useful articles; it should be connected, electrically, with that of the section C.R.A., while easy means for communicating ranges, orders, &c., of the kind best suited to the individual work, should exist between the fort commander and his subordinates. Sometimes two stations of this sort should be provided, either for the avoidance of smoke or other reasons. In an open work it is often possible for a fort commander to have the

greater part of the armament under his eye; in a casemated work, he is bound to be on the roof, but even there, he is practically as much with his men as if he were actually on the gun floor, where probably two detachments at most would be aware of his presence. The true power of an officer over his men is obtained by his methods of dealing with them and their knowledge of his character, and the conviction that he will know how the work is going on, when not actually on the spot. It is only during firing that he need be at his station, but in action it is no more necessary for him to be looking after petty details of drill, than it is for a squadron leader in a cavalry charge, to concern himself with the dressing of the rear rank. We must demand something from discipline. I put it forward as an axiom, that as long as a fort commander is inside the work, he is in touch with his men.

When the P.F. is being used as the range-finder an apparent difficulty arises, in carrying on the work, from a station as above described, but it *is only an apparent difficulty*. In order to obtain the full value of this instrument, it is generally installed outside the fort, so as to be removed from the effect of 'smoke,' and, formerly, it was the invariable custom for the fort commander to place himself at this observing station, leaving a sub-commander to represent him in the work. Now it must be understood that each group of guns has its own P.F., and the "gifted individuals" who work them are not "trained officers of iron nerve and wide experience," but simply young gunners or N.C.O.'s of good eyesight and intelligence, who are instructed as "specialists," and paid as such; they are, in fact, glorified gun layers. Moreover, most works, where the P.F. is installed, have two or more groups, and as it was impossible for the fort commander to be with more than one instrument at a time, he usually stationed himself in some convenient central position, whence he could see the waterway and communicate with his observers, by voice or orderly, generally by the latter. There is no reason he should not do, from his station in the fort, all that he used to do at the observing station, and at the same time have a most efficient control over the fire.

We have just commenced to use portable telephones, and last year very good results were obtained with the Siemens-Halski, when officers were not afraid to use it. In the past, telephones have been discredited a good deal by bad selection and improper usage. Lines seldom go out of order; they should be laid permanently, and admit of being tapped readily, terminals being placed at all necessary places. Receivers, transmitters, bells, &c., should be kept in store, and joined up only when the fort is got ready for action; it is essential that all their parts should be easily accessible to inspection, nothing closed up permanently, and all "gym crack" fittings forbidden. Telephony has made great progress in civil life, it should be easy to supply the wants of the coast artillery.

••The essentials, then, are good telephones and sufficient practice,

¹ By placing guns and instruments at different levels, mists, peculiar to certain localities, are prevented from interfering with the laying.

and that being understood, the fort commander should be at no disadvantage, as far as his observers are concerned, and be also in the best place for fire control. The method works with the greatest ease, when this officer speaks directly to a sub-commander at the observing station, telephone orderlies and all the old cumbrous method, being discarded.

Moreover, it may sometimes happen, that certain corrections can be better made by a sub-commander at the P.F. observing station, or even by the observer himself, than by the fort commander. At such times, the latter should not hesitate to avail himself of their services; the utmost flexibility of procedure should not only be allowed, but be practised, for, whether it be permitted or not, assuredly the fort commander will avail himself of it in action, not from any want of respect for established order, but from the force of circumstances. In making use of the eyes and positions of his subordinates he delegates but does not abrogate his functions; he should always hold the strings, for his office is to command, but, as they say in the law, *qui facit per alium, facit per se*.

Gun Laying with Time Shrapnel.—There is a fourth method of laying, which might be employed with time shrapnel against quick objectives. It consists in preparing salvos of time shell for several suitable ranges, following either with P.F. or D.R.F. and firing, when a certain range, corrected as usual, comes on the dial, the gun layers having kept the sights on, for line.¹ Electric firing from the P.F. observing station could sometimes be used with advantage.

Gun Laying without a Range-finder.—If the gun is any height above the sea, 100 ft., say, or over, a combination of quadrant and tangent elevation serves as a rough range-finder; that is, the quadrant elevation, for some range, short of an approaching object, is given to the gun, and the tangent scale is run up to the corresponding graduation, and the gun is fired when the line over the hind sight and fore sight passes through the object. I believe Colonel French, late Chief Instructor at Shoeburyness, has been working at a range-finding sight on this principle; if successful it would appear to fulfil a desideratum with Q.F. guns.

Under this heading of the "Laying of Guns," I wish to draw attention to the following points:—

1. That the "fighting" of guns in a fortress differs materially from either sea or field service, and points to the necessity for regimental training.
2. That continual and more extensive practice is required by officers in choosing the proper methods of fighting their guns and changing, without friction, from one system or "case" to another.
3. The necessity for a common-sense view of the duties of fort commanders, so that they should not be tied down by pedantic considerations.

¹ It is only at very short ranges, and when the object is moving swiftly across the guns, that this presents any difficulty.

4. *The fallacy of laying down anything like fixed universal rules in the matter of communications.*
5. *The necessity for experiments to find a suitable telephone.*
6. *The proper understanding of the real use and position of range instruments.*

II. *The Choice of Ammunition.*

This is, generally, the duty of the fort commander. At one time there appeared to be a good deal of complication connected with this subject; we will soon, I think, be content with very simple rules, and the first of them would be, that the normal projectile for coast artillery is a common shell with a direct action fuze.

Common Shell.—The efficiency of this projectile is unquestioned; (1) against horizontal targets, at long range, or when fired from guns mounted for high angle fire, especially in salvos, and (2) against all unarmoured or lightly-armoured portions of the vertical target. There is, however, a point which appears doubtful to some, and which, at all events, would be better for elucidation. Since, in the case of direct fire against a ship carrying any armour, common shell striking the vertical protection, near the belt, would be wasted, our object should evidently be to pitch the shells well up, so as to secure hits above the impenetrable portion. Now come the questions—How will common shell behave that fall on an upper deck at angles of, say, less than 10° ? What will their effect be, if burst by striking deck hamper? Can we count on their penetrating the structure to any great extent before they burst? Seeing that the deck, especially to guns on a high site, furnishes the greater part of the virtual target, as the enemy approaches, the possibility of its efficient attack, by direct fire, is very important. From this it appears that shells should be as heavy as possible, and it is open to question if it would not at times be wise to adopt reduced charges to ensure a steeper fall for the projectiles.

Armour-piercing Shot.—With regard to armour-piercing shot, I think it is fully realized that, unless the armour is very much over-matched, they should not be used. The comparative immunity the *Huascar* enjoyed, with her $4\frac{1}{2}$ -in. iron plates, against the 9-in. guns of the "*Shah*," has already been quoted in this theatre. Indeed, there appears to me but two occasions when the use of the armour-piercing shot is indisputable: (1) When, by use of high angle fire, we can make sure of penetrating the horizontal armour of an anchored ship; (2) when battle-ships are pressing home an attack, and their range and position render their "vitals" vulnerable. This, of course, leaves out of consideration a lucky shot under the belt during a roll, which, I presume, is a matter of pure chance. Of the above alternatives, the second is not likely to occur often, but suppose it were to, it appears to me that even then, all but the heavier guns should fire common shell or percussion shrapnel against the deck—perhaps, but certainly against any insufficiently-protected portions, or the vertical target.

Shrapnel Shell.—That shrapnel shell, with a percussion fuze, could often be used as common shell, has always been recognised; but, not long ago, time-shrapnel was a discredited projectile; it may be the natural answer to a torpedo-boat attack. It is said that the balls are effective up to 300 yds. from the point of burst, but as their individual weight varies in different heavy shells from 2 oz. to 8 oz., it appears desirable to determine by experiment, what is the lightest ball that can be relied upon to penetrate modern torpedo-boat plates up to 3,000 yds. range, say. Naturally the lighter the ball the greater their number, and the more extended their effect. The next question would be—What height above plane should the shell burst to be most effective against the actual target presented, for I think it would vary with the class and position of the boat. When the balls of a shrapnel strike the water, their "pattern" may be enclosed in an elongated oval, something like the figure (see Fig. 2.) The relative dimensions of this figure vary, of course, with the range and height of burst, but it is found, I believe, that the balls are much more closely packed towards the rear, and that about half would fall within the shaded area, which may roughly be described as circular. Experiments of this sort could well be carried out over a sand range, and from their results, local schemes could be drawn up, which would depend on armament, waterway, and probable line of attack.

Case Shot.—This is a deadly projectile, at close range, against anything floating that is not absolutely protected. However, opinions differ as to its efficacy against light armour, such as torpedo-boat plates; experiments appear necessary in order to lay down limits of power and range, and also to determine the best sort of ball.

Cartridges.—On mobilization, as soon as a fort is confided to an officer, the largest batch of cartridges of similar brand should be examined and weighed, and the whole of the ammunition should be carefully inspected and arranged, so that by no chance should any alteration in its service take place, without the fort commander's knowledge. Rounds at known ranges should be fired as occasion offers.

Under the heading of "Choice of Ammunition," I wish to draw attention to the following points:—¹

7. *Can vessels be efficiently attacked by the direct fire of common shell and percussion shrapnel on their upper decks, and how far can we utilize reduced charges?*
8. *With regard to our own defences, are there many places where the close attack of battle-ships is possible or probable, and how far should this affect the equipment of armour-piercing shot?*
9. *Are there occasions where a blow from a solid projectile would be more detrimental to an unprotected ship than a common shell of the same calibre burst inside her?*
10. *The necessity of experiments to obtain data as to time-shrapnel and case shot.*

¹ These points are numbered consecutively through the lecture to facilitate reference.

III. *The Control of Guns.*

The objectives of coast artillery are either (A) vessels at anchor or (B) vessels in rapid movement.

Under A may be classed—

- (1.) Ships carrying out, at long or medium range, a systematic attack on forts, or attempting to bombard something defended by the forts.
- (2.) Ships supporting by their fire other ships attempting to run past the forts.
- (3.) Ships that have anchored at short range to effectually crush forts.

Under B may be classed—

- (1.) Ships that attempt to run past and at the same time fire on the forts.
- (2.) Ships that attempt to run past without firing.

Control by Section C.R.A.—In A (1) systematic fire tactics could be opposed to systematic attack: careful identification of the enemy would be carried out, and objectives and even projectiles would be notified to fort commanders: the section C.R.A. would hold a rigid control as long as possible, and distribute his fire to the greatest advantage. The usual installations of telephones and charts, or telephones and indicators, meet the requirements of this service.

In the case of A (2) the control could not be so rigid; the duties of the section C.R.A. would be restricted to seeing that while the supporting ships were kept under fire, the true attack was not neglected.

In case of A (3) taking place, control would have passed into the hands of the fort commanders, as it must whenever the objectives have rapid movement; then, control by the section C.R.A. would be liable to lead to confusion.

Looking at what our probable duties in war will be, from a common-sense point of view, it appears to me that in the majority of cases the duties of this officer will be more preparatory than executive, but they are duties of the highest importance. Apart from those of any military commander, he must see that his section is properly organized and prepared, that ammunition is sorted and ready, that range-finding arrangements and communications are complete, and possible breakdowns provided for; he must take especial care to keep himself in touch with coastguard stations, &c. Immediately on mobilization, he would consider the plans that should have been drawn up in peace time for his guidance, and see how they should be utilized or modified, in view of present events, and then, he should explain to all his fort commanders, as far as it is possible, what their action should be, in case of probable eventualities. Here naval assistance would be invaluable.

Coast defences designed to prevent ships running past, would usually have the section C.R.A.'s position well advanced: he would

thus, when an attack was imminent, be often able to send useful information to his subordinates: during the actual attack he might find it necessary to draw attention to any vessel that appeared to be escaping punishment, but beyond this he could scarcely go. If the time for interference and non-interference is not thoroughly understood, great confusion might arise, especially if an officer, new to the work, suddenly found himself in command. The telephone is a dangerous plaything.

Control by the Fort Commander.—In the great majority of cases, the fort commander will control the fire of his fort; that is to say, he will exercise full discretion as to when, what, and where to fire, *except* in so far as he is restricted, either by orders previously given, or by the propriety of the section C.R.A. keeping the control in his own hands, as above explained. There should be a normal method laid down for fighting each fort, but the fort commander should always be ready to change the "case" or mode of firing, whenever occasion demanded, and he should have a plan ready, in his head, in case of breakdown in any part of his gear. As long as he is engaging one objective he can keep the complete control in his own hands, and it is evident, in such a case as B (2), when the ships cannot return his fire, he can give his whole attention to the waterway; in special cases, as when guns are mounted for high angle fire, and fought by a P.F. placed at a distance, he would even leave his men and go to the observing station. The officer responsible for the fire must see the waterway, *coûte que coûte*. But if a fort has to engage two objectives simultaneously, the fort commander can, himself, only direct the fire against one; he must give up the control of the guns engaging the other to some officer, who, in that case, will practically exercise the functions of a fort commander. Each objective engaged requires at least one range-finding instrument.

Under this heading of "Control of Guns," I wish to draw attention to the following points:—

11. *In many places elaborate measures for identification and indication of objectives are useless, if not mischievous.*
12. *In each locality, a line of action should be sketched out for the section C.R.A. by superior authority.*
13. *Schemes of defence should be drawn up of a practical nature, so as to be useful to officers of the rank of fort commander, new to the locality; great advantages would accrue if there could be more collaboration between officers of the rank of section C.R.A. and C.R.E. and representatives of the Royal Navy, in these matters.*

IV. The Placing of Guns.

The Site.—Efficient protection should always give way to efficient working: both are attainable when a high site is chosen. The higher the site, the more accurate the gun, the larger the virtual target, and less bad effect is caused by errors in range or elevation and mistakes of all sorts; deck attack is easier, range finding is more

accurate, and a suitable place for the D.R.F. can usually be found. In fact, the ranging of guns, when no high ground is available, is a difficult matter, not only on account of the unsuitable station that must be given to the fort commander, but also because the special depression range-finder for low sites is unreliable, if not more than 30 or 40 ft. above the sea, unless it is kept in the most perfect adjustment and used for ranges not exceeding 2,000 yds. It is to be hoped that the horizontal P.F. will get us out of what, at present, is a difficulty. In addition, with a high site, an attack cannot be pressed home, which, we are told, is considered by many sailors the proper way to deal with forts.

Q.F. guns should always be placed high for the following reasons:— They have often to be fired at an unmeasured range; tangent elevation and a high site minimize the effects of errors in estimation: the method referred to as Colonel French's can be applied, and may solve a great difficulty. Shots from a Q.F. gun striking the deck of a torpedo-boat are apt to glance, and yet these craft offer an almost horizontal target; now the higher the site the less this liability will be. Mine-fields, booms, &c., are often protected by Q.F. guns on either flank; if the latter are placed near the sea level, as is sometimes advocated, accidents from cross fire may well occur, which could be prevented were the guns higher up; at the sea level they would also be at a disadvantage, as compared with those on board ship, whereas command would in many cases ensure immunity, at all events, from short range fire. As their trajectory is flat, it is said that when placed low, their fire will have a long dangerous zone; it must, however, be remembered, that their axes will, as a rule, have to be at least 5 ft. above mean tide, and this, added to the curvature of the trajectory, small though it be, will tend to diminish the zone in question: in addition, all shots that do not hit the narrow freeboard or small conning tower of a torpedo-boat will probably glance.

Grouping Guns.—The guns of a fort should be collected into as few groups as possible, subject to the following conditions: all guns in a group should practically have the same field of fire: they should be of the same calibre and nature, they should not occupy a greater frontage than will admit of their being efficiently overlooked by the group officer, nor must this be of such a length that at extreme trainings there should be any serious difference of range between the flank guns of a group, all the guns of which are fired at the same range. This frontage should never exceed 40 yds. (see Fig. 3). It is also desirable that, when a group has fired its salvo, it should be possible to reload and lay, without the detachments being endangered by the fire of neighbouring groups; at extreme trainings also, individual guns will interfere with each other; this matter should be carefully considered in designing the fort.

Q.F. guns ought, as a rule, to be grouped clear of a fort; their commander practically exercises the function of a fort commander.

The points I wish to draw attention to under this heading of the "Placing of Guns," are:—

14. *The importance, in all cases, of a high site.*
15. *The necessity for greater attention to the requirements of group control in placing guns.*

V. *The Selection of Guns and Mountings.*

Type of Gun.—Common shell being the normal projectile and shell power our principal means of offence, it appears to me that, with a certain sum of money to spend, there should be a very strong reason indeed for substituting a gun of weaker shell power, for an old type gun of greater shell power. It is, I believe, a fact that a 6-in. B.L. gun on a H.P. mounting costs the same as a 10-in. R.M.L. on a barbette, while the weight of their respective common shell bursting charges are as 1 : 3, giving the new gun the advantage of its cast steel shell. If, now, a cast steel shell were made for the older gun, and seeing that effect of burst varies somewhere as the square of the weight of powder, surely, of the two, the 10-in. gun would be, by far, the most effective, if the two classes of mounting were both permissible from other causes. Moreover, there would be but little difference in the rate of fire.

Mounting.—With regard to mountings, they should be as simple as possible; a little weight or general unwieldiness may be forgiven as long as they can be worked by hand and do not require much supervision. On mobilization, we shall have to depend on a good deal of untrained assistance. Our beautiful H.P. carriages I look on, as necessary evils, only to be resorted to from dire necessity.

Guns for High Angle Fire.—Likely anchorages for an enemy can most efficiently be defended by guns mounted out of sight, inland, worked by Case III, in connection with a well-advanced observing station. No vessels in existence could remain under an efficient fire of this kind for any length of time. In applying it, range presents little difficulty, but training has to be carefully considered, on account of the great effect of wind and drift. If dynamite guns can only be perfected, they seem to have, here, an ideal rôle.

Q.F. Guns.—In certain places, the newer type heavy Q.F. guns would constitute, of themselves, an efficient defence: they are simply medium ordnance superbly mounted. In addition to these, however, there has been a tendency of late to exalt the use of the lighter and mere auxiliary types, at the expense of the ordinary armament. No doubt, as weapons they are excellent, but where shall we get men to work them, especially in the early days of mobilization, without denuding the heavier guns of their detachments? In the hands of untrained men Q.F. guns are worse than useless. I am also of opinion that many of the objects they are supposed to fulfil, could be equally or better carried out by case or shrapnel. I do not believe in firing them into haze or smoke to "sweep" a waterway; there would be a certainty of great waste of ammunition and a probability of considerable danger. They have their place, no doubt, but should not supersede, to any great extent, the heavier guns: they should be on cone mountings and be fired from the shoulder; field carriages are

unsuitable for coast work, and mobility would only be a source of confusion, especially at night. Coast artillery has no mobility, it must depend on its long arm and its heavy blow.

Case-shot Guns.—When it is required to cover with *mitraille*, the neighbourhood of a boom, the opening of a harbour or a mine-field, close at hand, special guns, to fire case shot, are an efficient means of defence: if on opposite sides of an approach, they should be mounted with traversing stops to prevent any chance of their firing into each other. See Fig. 4.

The question of choice of guns is a large one, and, to a certain extent, outside the scope of this lecture, I, however, wish to draw attention to these essentially artillery aspects of it:—

16. *The desirability of heavy shells and simple mountings.*
17. *The difficulty of efficiently manning a great number of Q.F. guns and the possibility of the guns of the forts themselves performing many duties, apt to be assigned to the Q.F. guns.*
18. *The use of case-shot guns for protecting waters within short ranges.*

VI. What may be expected from Guns.

Possible Accuracy.—Gunnery in peace has the following advantages over gunnery in war:—The nerve strain of battle is absent: there are no casualties: there is no surprise: there is no fatigue: the work is seldom done in really bad weather, and scarcely ever at night; observation of fire is not interfered with by any confusion, as to where a certain shot comes from; the objective is never hidden by smoke, and, on account of the danger, practice is never carried on, when fog and haze exist; ranges change so slowly, on account of the speed and direction of the target tugs, that the difficulties of corrections for travel, do not crop up and are not realized. On the other hand, as each round is so expensive and consequently so few are allowed, all firing has to be carefully used for instruction: detachments never fire a large number of shots under the same conditions; observers, gun layers, methods of firing, &c., are continually being changed: the targets fired at are small as compared with ships, and real rapidity is interfered with, from safety considerations. While there is thus something to be said on both sides I think the great difference between peace and war should be fully realised, and I, for one, would be very loth to form in my own mind any ambitious theory; at the same time, I feel that the power of the guns is apt to be underrated.

I have myself seen some excellent results at a Hong Kong target, going 8 or 9 knots, such as 20 rounds, fired from five guns in 7½ minutes, all falling inside a virtual target, 12 ft. high by 30 ft. broad; and last year the whole of the practice in the Isle of Wight, some 500 rounds—practice which was chiefly instructional, and sometimes carried out in a way that precluded accuracy for line—gave us one hit in every three rounds, on a target 12 ft. high by 31 ft. long. However some of these results come under the head of “calculated hits;” that is the line and the longitudinal error were observed, and the hit was determined, by the known angle of descent. Discredit has

sometimes been thrown on this manner of scoring, so I will put some results before you, which were obtained on a *record* target, actual hits only being allowed to count. The target was 36 ft. long, 12 ft. high in the middle, and 9 ft. high, for a distance of 12 ft. at each end. (See Fig. 5.) It was so heavy, that it had not a greater speed than 5 or 6 knots, and ranges changed but slowly, giving an average of 2,200 yards. Against this target six companies of the southern district, carried out their competition practice, each company firing on a different day. They together furnished 6 fort commanders, 6 range-finding detachments, 22 group officers, 44 detachments, and consequently 44 gun captains and gun layers; of the last, half were chosen by the officers commanding companies, and half were determined by lot from the registered layers of the companies. Each company fired 16 rounds from 4 guns; one weak company only furnished 4 detachments, so that each of these fired 4 rounds; but in the other cases group officers and detachments were changed after each had fired *two rounds only*; half the rounds were by single gun and half by group salvo.

The weather on the six days varied from windy and rainy days to almost perfect ones, and from those again to days on which there was a dazzling glare in the gun layers' eyes.

The firing took place from Sandown Fort, an old casemated work whose interior arrangements were very defective; the guns were 10-in. R.M.L., 30 ft. above the sea. Case II and D.R.F. were employed, the instrument being on the roof, about 45 ft. above mean tide. Reduced charges were used, which, according to the range tables, reduced the accuracy, very nearly 50 p.c.; at all events there was no doubt that the wind had considerable effect on the high trajectory. There was, occasionally, interference from smoke and fouling of ports, but the average of the actual times taken by each company, was $12\frac{1}{2}$ minutes. Of the 96 rounds fired, 44 were hits upon the target. For the sake of comparison, I have put to scale, on the figure (see Fig. 5), the virtual targets presented by this record target, and by a 1st class torpedo-boat, a torpedo-gun boat, and a cruiser, taken from the "Naval Annual."

Effect of Smoke.—A great deal has been said about the effect of smoke in obscuring a range: it is of course all a matter of wind, or rather the absence of wind; a gentle breeze blowing down the range is the most annoying; thus, one of the companies above referred to, was stopped for $2\frac{1}{2}$ minutes, owing to the slowly moving smoke, drifting in the same direction as the target. But as far as this went, there was only one bad day in the six; a high wind soon clears off the smoke: I have seen, in some night operations, the effect of barrels of pitch, being lighted on a ship's deck, so as to enclose her in a veil of smoke; dense clouds rose up all round her, and though she was passing through an area, illuminated by many thousands of candle power, we could see absolutely nothing of her hull. We, however, knew her range, approximately, from her position in the channel, for now and again, we could see shadowy lines, which we knew to be her masts, and we could easily have fired on her with effect. I think the effect of smoke is apt to be exaggerated.

Under this heading of what we may expect from guns, I wish to draw attention to the following points:—

19. *May we not now claim that in daylight, with well trained men, actual hits on a target representing a ship, should be numerous, in view of the experience detailed above, where many of the conditions were the reverse of favourable and the target so comparatively small?*
20. *Is it not now time to qualify that oft quoted and very sweeping dictum that "for ships to run past forts, where no obstacles exist, is a comparatively easy matter"?*

VII. *The Action of Guns at Night.*

Respectable opinions vary greatly as to what can and cannot be done by an enemy, under cover of fog or darkness. It is, I fancy, very much a question of locality, and here, the guidance of our naval confrères would be invaluable in drawing up schemes of defence; for the brain of an ordinary landsman reels in presence of the many *ex cathedra* statements that are made.

Electric Lights.—The question of electric lights is in an unsatisfactory state. There was a beautiful theoretical simplicity about our early idea, of noting vessels as they passed through a fixed beam, and passing them on from light to light, the whole being controlled by the section C.R.A. This would be a patent method for rendering torpedo-boat attacks easy. The creation of a large and brilliantly illuminated area, which was also tried, might work well if a very large number of pieces bear upon a narrow obligatory place of passage. It seems to me, however, impossible to make certain of stopping, at night, a swarm of torpedo-boats, gallantly pressing home an attack, by defences at one portion only, of a channel. Where the defences have depth it is a different matter, the advanced guns putting those in rear on the *qui vive*. What amount of depth of defence will render a channel secure is, I fancy, at present doubtful; it would depend, in a great measure, on the answers to some of the questions already referred to. From what I have seen of night operations, I am convinced that, as a rule, search lights are more convenient than fixed beams. Colonel Watkin's dials have given us an excellent means of controlling them from any station, but as a rule I should prefer to see them normally under the fort commanders, subject, of course, to any orders the section C.R.A. may give. We should, however, not leave the arrangements for electric lighting to be settled under the pressure of imminent war. It is no easy matter to place them safely to the best advantage, and the present uncertainty is a serious embarrassment to the preparation of practical schemes of defence. It is of course a matter of expense.

Electric lights might be supplemented by parachute lights, fired from mortars. Two or three specially constructed mortars of small weight, placed at a fort commander's station, might give him the means of keeping his front illuminated, during the progress of a

torpedo-boat attack. This could easily be determined by experiment.

Illuminated Sights.—This is also a pressing question; there are many technical reasons why Case II is better than Case I at night, so electric gun sights should be of the straight-edged pattern. A contrivance of this sort was unofficially tried, with success, at the Isle of Wight two years ago; there does not appear to be any difficulty about the matter.

An illuminated tangent sight is a necessity for Q.F. guns: we had a modification of the naval sight in use, but we found that it was impossible to lay, with a full sight, as by day. This is very important from our point of view, and a simple alteration was proposed by one of our assistant instructors, Sergeant Kirby, recommended and sent forward; I have not heard of it since. It would also be well if the elevating wheel of this sight could be manipulated by a man, other than the gun layer, so that the latter could keep his line, while the elevation was being altered, either by direction of the gun layer or the group officer or fort commander. It would also seem desirable to experiment with combined quadrant and tangent elevation, as before noted. On many nights in the year you can lay perfectly with electric sights, without search lights or other artificial illumination; on many occasions their absence renders the guns useless. It is a technical matter, and, in my opinion, they are a crying necessity.

Microphonic Detectors.—If these instruments can be perfected they would render the defence, by case-shot guns, an easy matter by night.

Identification of an Enemy and Rules of Traffic.—The measures to be taken at night, to distinguish between friend and foe, have, no doubt, been thought out for each locality. It would, however, be wise to familiarize officers with the procedure that will be in force in war, or, at all events, to let them think it over. At the present moment, the question "What am I to do if I see or hear a swift objective approaching?" would be a matter of considerable embarrassment to many fort commanders.

The points I wish to draw attention to under this heading of "Action of Guns at Night," are as follows:—

21. *The necessity of the immediate placing of the E.I. question on a more stable basis, and of experimenting with parachute lights, &c.*
22. *The necessity of providing and practising with electric sights.*
23. *The necessity of the junior ranks, being accustomed to realize in peace the procedure that will be followed in war, as to the identification of approaching vessels.*

VIII. Requirements for Training Personnel.

Companies of Royal Artillery.—Individual training has its uses, but by far the most valuable kind is that, where officers and men work together in units. The late improvements in this respect are well known, as far as the Garrison Artillery is concerned; but it is very difficult to carry out efficient training with the present allowance of

ammunition; there is, however, little likelihood of its being increased. The panacea is the establishment of practice batteries, so organized that 64-pr. projectiles can be fired by all the different methods and cases. But this must in no way interfere with familiarizing all hands with the forts themselves.

It is not the actual firing of a few guns in a fort of any size that effects this; a group of guns is practically the same thing, wherever it is placed: what really is of value, is the testing the communications and range finding arrangements of a work, and a very great deal can be done by manning, as for war, without actually expending ammunition. Testing of mountings and familiarizing men with them is fully met by "station practice," but the larger works, often from lack of men, often from barrack accommodation being mixed up with gun floors, have, in certain respects, to be neglected, with the result that no one knows how they should be fought.

Militia Artillery.—The training of the Artillery Militia has relatively advanced *pari passu* with that of the regulars; they now settle down quickly into a fort, and usually do very good work; it is, however, often the case that in each brigade there are one or two officers, who seem to absorb the greater part of the good of the training, leaving a residue who do not attain to anything like the same efficiency. Now in a fighting force we want a good general average. It also is a pity that no means seem to exist, for keeping up the knowledge obtained, periodically; but, speaking generally, in the Militia, we have a magnificent reserve.

Volunteer Artillery.—The training of the Artillery Volunteers has not progressed as it might have, and this is certainly not the fault of the Volunteer officers, who so freely give us their money, time, and intelligence. But there has been for this force, as far as I know, no training of the unit, which is the only real training for Coast Artillery. Some of the officers may have seen, as from a Pisgah, a land flowing with range and position finders, but the greater part of the force are still in the house of bondage, trying to make bricks without straw:

There is no doubt that officers of both Militia and Volunteer Artillery want more help in their training. The literature of a new subject is not always easily understood; the tools of the trade require to be handled, and, perhaps in the past, there has been a little over elaboration, so that many an anxious student has found himself in the position of the man of Ethiopia, who when asked by the Apostle "Understandest thou what thou readest?" replied "How can I, except some man should guide me?"

The points I wish to bring to your notice are—

24. *The necessity for practice batteries.*
25. *The desirability of testing the communications and the handling of our larger works.*
26. *Facilities for Militia officers to keep up their knowledge between trainings.*
27. *That the Volunteer Artillery, whom we shall have to depend on in*

the early and dangerous days of mobilization, should have more opportunities for practical training, and more ammunition to fire.

When the Council of this Institution did me the honour of asking me to read a paper on Coast Defence, I was very pleased to accept the invitation. 'Three years' experience of a practice camp has convinced me that the efficient service of the guns of a fortress is one which cherishes and produces the highest military qualities: smartness, coolness, self-reliance, and discipline; and I find, in the subject of Coast Defence, much to admire, much to interest, and much to learn. Our present position is accurately represented by a clever little picture, by whom I know not, which was supposed to show the state of the Field Artillery. In it, a gunner stood firmly planted on the Rock of Progress, but his boots were still encumbered by the mud and slime of the Slough of Despond, out of which he had struggled. In the distance towered the Peak of Perfection, but his road, even to its base, was barred by a yawning chasm, the Abyss of Fads. Still the drawing was full of hope, for over this ugly gulf was thrown, a strong plank of Common Sense.

Major F. G. STONE: I rise with some diffidence, as a junior officer, at the commencement of this discussion. I am sure we must all feel grateful to Lieut.-Colonel Jocelyn for giving us the benefit of the latest ideas on the question of coast defence obtaining at our most highly valued camp of instruction. Colonel Jocelyn's arrangement of "pegs" on which to hang discussion is a very happy thought upon which I congratulate him. I am glad to see that as regards "laying" the advantages of Case II are fairly given; in advocating the use of Case II whenever possible the lecturer is reflecting the opinion of every practical coast gunner that I have met. As regards the position of Fort Commander—for I observe that the familiar term is adhered to, as opposed to "Fire Commander"—I cannot quite agree with the lecturer that in Case III the Fort Commander should be in the Fort. I take it as an axiom that Case III would never be employed where Case II is possible, therefore when Case III is adopted it implies that there is difficulty in the observation of the target from the Fort. The responsibilities of the Fort Commander are clearly laid down in the lecture, and it is difficult to see why these responsibilities should be delegated to a sub-commander in the Fort Commander's P.F. observing station, in order that the Fort Commander may remain in the work and be nominally in touch with his men. I will quote the lecturer's own words in support of my argument. "In action it is no more necessary for him to be looking after petty details of drill than it is for a squadron leader in a cavalry charge to concern himself with the dressing of the rear rank." The very conditions which render Case III necessary, instead of Case II, appear to me to be so many arguments in favour of the Fort Commander being in the P.F. observing station in order to assume the higher functions of command, delegating the mere supervision of the details on the gun floors to a sub-commander. "Gun laying without a range finder." Under this head the adoption of a well-known principle is advocated: this principle has been ingeniously worked out practically by Colonel French. I have had some experience of this device, and cannot concur in thinking it suitable for Q.F. guns: it is too slow in operation, depending as it does on a succession of predictions and being non-continuous as a range finding instrument. I believe that Q.F. guns will find their range much more rapidly by trial shots; this, however, could easily be proved by trial. I believe I am reflecting naval opinion on this matter. I believe the best range finder for Q.F. gun is the Q.F. gun itself. Of course any range finder or position finder which might give approximate range, if it happens to be handy, would be of great value in order to determine the elevation for the first round. Under the head "cartridges," the following statement is made: "Rounds at known ranges should be fired as occasion

offers." May I suggest to Colonel Jocelyn as an amendment to this, "Rounds with a time fuze should be fired as occasion offers;" in other words, let us get some data as to how our fuzes will burn before going into action, as if we begin firing time shrapnel at a moving object without such data, our fire may be wasted. The subject of time shrapnel is a difficult one when considered relatively to a moving target. The plan of loading certain guns with shrapnel, fuzed for a certain range, can only meet the very simplest case, viz., that of ships being compelled to keep a certain course without deviating much to right or left; in other words, running through a channel. It is, moreover, somewhat wasteful of armament, as it amounts to holding certain guns in reserve for a special phase of the fight when their fire might be valuable all through the fight. The subject is somewhat severely "let alone" in the drill book. It is not stated who is responsible for length of fuze or correction of fuze, nor how correction for different groups in the same fort, firing at the same target, can be carried out. To my mind the best way would be for one or two trial rounds to be fired, that is before the action commences, and the Fire Commander, or F.C., to give the necessary correction for the day, e.g.—"10 per cent." That order goes to all the group officers. The control of the shrapnel fire at a moving object should then naturally fall to the group officers who would set their fuzes according to the group range at which they intended to fire their next salvo, when orders have been given by the F.C. for shrapnel firing by group from right or left, as the case might be. The F.C. could assist the group officers by informing them of the position of burst so that a further possible correction might be made in the setting of their fuzes the next round. I cordially agree with the lecturer as to peg No. 15. The opinion of the C.R.A. ought to carry great weight in the selection of sites, &c., in order that this requirement may not be lost sight of, that is to say, grouping the guns, making your site with the view to get the largest number of guns into the group, and at the same time not extending the guns on either side more than the minimum amount allowed by Colonel Jocelyn as a requisite which would very likely be lost sight of by any but an artillery officer accustomed to supervise the fighting of forts. I cannot agree with the lecturer in his strictures on the extended employment of light Q.F. guns in opposition to the case and shrapnel fire from heavy guns at torpedo-boats. I have trained detachments to use Q.F. guns, and have no hesitation in saying that their manipulation is much more readily learnt by any intelligent non-commissioned officer or gun-layer of Volunteers than is the more complicated service of a 10-inch R.M.L. gun, taking as it does a detachment of 15 men. There is an immense saving in the number of men required, which in another way Colonel Jocelyn made a great point of. You can do the same work with far fewer guns. There is no tendency to slurry when engaging a rapidly moving object, inasmuch as the layer knows that if his first or second shot does not hit there is no harm done, since the third and fourth will probably fall on the target, and from the nature of Q.F. guns he can follow that target with a continuous running fire which can be kept up and corrected with ease the whole time the target is within range. This certainly is not the case with the heavy gun, where he practically puts all his eggs into one basket, viz., the basket of that one shot. The typical gun for work against torpedo-boats appears to me to be the 1-pr. Maxim with automatic action. This gun is not in our service, I believe, though I cannot understand why it is not introduced, it being in every sense the most economical and efficient weapon for the purpose advocated.

Colonel F. T. LLOYD: I cordially agree with Major Stone in eulogizing the system which Colonel Jocelyn has adopted of giving us certain pegs on which to base our discussion on the subject which he has so ably brought before us this afternoon, because I think it will keep us from dwelling too much upon what I cannot help calling the fads of artillerymen, which I am afraid are very numerous. Among the number of points which Colonel Jocelyn's lecture raises, I must select one or two of the more prominent. The position of the Fort Commander is a very important question, and one that I have always had very much at heart. I am told by artillery officers that if the F.C., as he is called, does not put himself on the gun floor with his men, he will lose all control of them: they will not think very much of an officer who does not share their danger and their work. My view of a F.C. is that he has to fight his guns to the best of his ability, and in order to do that, he

must place himself where he can best observe not only the effect of his own fire but the action of the attacking force, whether ships or men. All other considerations must give way to that most important duty. What will suit the Isle of Wight will be very unsuitable, perhaps, for Garrison Point Fort, or the new defences at Aden, Malta, or Gibraltar; and, again, the treatment of these must differ from such a line as that connecting Southsea Castle with Eastney Fort, where we have a number of 6-in. B.L. guns spaced very widely, and where there are exceedingly difficult questions of command involved. As to gun laying with time shrapnel, I really do not think that that is a very effective projectile against any probable attacking force. I do not quite see how you are to decide at what point it will be best to open fire; and you have also this difficulty, that you have half a dozen guns laid with different lengths of time fuzes, and at different elevations, and if your vessel does not come within the range of those elevations and the scope of those time fuzes, your guns are practically spiked, they are useless; you cannot draw the charge, because of the gas-check. A system of that sort cannot be a successful one. We had better rely in these cases on quick-firing guns. As to the use of shrapnel generally, that must depend upon the nature of the target, for time shrapnel, even by day, would probably be useless against anything but boats. I think percussion shrapnel or even unfuzed shrapnel may be used with effect at moderate ranges, against unarmoured ships and the unarmoured portion of armoured ships, and they would be a most valuable projectile. With reference to the preparation of a scheme of defence, Colonel Jocelyn says: "In each locality a line of action should be sketched out for the section C.R.A. by superior authority." There I am rather at issue with him. He says "sketched out," and I daresay he only means hinted at; but I think that the section C.R.A. is the man on whom should devolve the preparation of those schemes of defence, and that those schemes should be most carefully thought out by the local authorities, who must not allow themselves to be too much hampered by so-called general principles. I say with a full sense of my responsibility that the local authorities *must* have a free hand for every work of defence, and must, in short, work out their own salvation, in conformity with, but not in subjection to, general principles. They are the responsible people, and on them should devolve the scheme of defence. Major Stone dealt with objections to Colonel French's process of range finding. One of the great objections to it was that in the case of heavy guns, the same process had to be repeated every time the gun was fired, on account of the recoil. If it had not been for that, I think his suggestion was a very valuable one. Now, a word or two about the selection of guns and mountings. Colonel Jocelyn compares the 6-in. B.L. gun with the 10-in. R.M.L. gun, and so far as the power of their shells is concerned, of course I agree with him, but I think he must take into consideration not only the weight of shell that can be poured in in a given time, but the localities in which it is proposed to place these hydro-pneumatic mountings. They are intended mainly for low sites, where in the presence of Q.F. guns, 10-in. R.M.L. guns, whether firing through ports or open embrasures or *en barbette*, could hardly be used in the present day; their detachments would be obliterated in a very short time; therefore these hydro-pneumatic mountings are forced upon us, but should be reserved for low-site batteries. I now go on to point 20. "Is it not now time to qualify that oft-quoted and very sweeping dictum that for ships to run past forts, where no obstacles exist, is a comparatively easy matter?" I do not think I am guilty of a breach of confidence if I allude in the most general manner, of course, to a confidential document which has just been issued by that very authoritative body, the Committee on Naval and Military Defence. They deal with this very subject of ships running past forts, very briefly and very much to the point, and I think those who are interested in that matter could not do better than study the decision which is there laid down as to that very point. The gist of it really is that ships will not run past forts unless they can obtain a space beyond the forts out of gun fire, wide enough to turn in, in order, I presume, that they may run back, so I think the cases of running past will not be of very frequent occurrence.

Colonel JOCELYN: Is the probability of their running past discussed in the paper?

Colonel LLOYD: No, but they will not attempt to run past unless they can turn

in an undefended area. Colonel Jocelyn suggested parachute lights for night work. I do not think they will be found very satisfactory. Parachute lights have been used, as everybody in this theatre knows, for many years past, up to a large calibre, and the objection to them has been that the area which they light is very small, and that the light thrown over that area is but a mere glimmer. They have been pretty well abandoned, both for the defence and attack of fortresses, and have been superseded by star-shell. Before leaving the subject altogether, I think it would be well if some of the distinguished officers present would be willing to throw some light upon the following points that I have still to touch on. We must consider first, when arranging for coast defence, what would be an enemy's object in approaching any point of our shore—I do not say the shores of England, but the shores of any part of our Empire. These objects can be very briefly specified. First, the acquisition of a port or fortress as a naval or military base—that covers a great deal of ground; secondly, for raiding purposes, either by torpedo-boats or cruisers; and, thirdly, to enable them to land at an unprotected portion of the coast line, in fact, for invasion. Now, the *consensus* of opinion generally points, I think, to the teaching that the navies of foreign Powers will make no attempt on any of our fortified places so long as they are thoroughly well manned and armed. We shall have no recurrence in this country nor at any of our coaling stations, I trust and believe, of the experience of Alexandria in 1882. I think that may practically be dismissed so long as we keep our armaments up to date and our men drilled. But raiding by torpedo-boats and cruisers is highly probable, and will be a great feature in the war of the future. The third object is landing at an unprotected portion of our coast line is possible, but unlikely; but any one of these may be forced upon a foreign Government either from political necessity or some popular movement, so that we may consider that we have to face the possibilities of every one of them. As to the first of them, what we require most for our ports is the protection and the perfecting of our communications—telegraphic, telephonic, whatever they may be. They are not costly; they bear no sort of proportion to the cost of our forts and guns and stock of ammunition, and yet they are not perfected, and very slow progress is made with them. Then the provision of the cheap adjuncts which are required for satisfactorily working a system of guns, whether placed in a fort or in isolated emplacements; and, lastly, we want more elasticity in the scheme of defence. I do not think it does to lay down—and Colonel Jocelyn mentioned this—any hard and fast rules as to the position of a Fort Commander or details of that kind, which ought to be settled on the spot. We want elasticity; we want the F.C. to be supreme in his district. The section C.R.A., as he is called, is the officer who initiates the whole thing, who plans the scheme in conjunction with his advisers, and the F.C. is the individual who carries out that scheme. The section C.R.A. is a purely consultative and administrative officer, and has practically nothing to do with fighting the guns, except to give the F.C. such information as comes to his knowledge. That is my view of it. Another thing in which we fail is rapidity of fire. Our artillery fire is far too slow. We must encourage, by every possible means, rapidity of fire, and rapidity of fire cannot be insured without those adjuncts of which I spoke just now. It is hardly necessary to insist upon the necessity, but if we consider for one moment the advance of artillery science and the progress of science generally connected with steam power, quick-firing guns, and so on, what would have done very well 30 years ago, when we had 68-prs. as our best armament, will not do now when we have 6-in. Q.F. guns. As to the question of torpedo-boats and other craft at night, I am afraid we are terribly behindhand. No satisfactory scheme for stopping torpedo-boats going up a channel has yet been devised, and it would appear that we must rely for stopping them on some sort of mobile defence, in fact we must rely upon the navy. I cannot see at present that any arrangement which we have made from the shore, except in covering very narrow channels, has been the least satisfactory. I come last to the landing on our shores, and I have only a word or two to say on that point. Our policy at the present time is that in case of an attempt at landing on our shores, our force is to be concentrated in inland positions. I think the principle of that is exceedingly good, but it should not be enforced to the entire exclusion of the occupation of the coast line. On my part of the coast, in the South-Eastern

District, we have, as you all know, a very extensive series of Martello towers, and I cannot help thinking the ancient masonry of which those towers are composed would prove a very effective obstacle to anything but very heavy guns. They are not very large, and on the greater part of that coast, as you are well aware, large ships cannot come in close to the coast line. Every vessel that came in close enough to fire at them would have to be of very small draught. I do not think we must depend the least in the world for prolonged defence on these towers, because they could be breached or taken by assault, but they might be utilized by having a Q.F. gun and a machine-gun mounted in each of them. They should have a garrison of about 7 men. I have worked out the prime cost of arming the number of Martello towers which are available for this purpose, and it comes to something like 150,000*l.*, including a stock of ammunition. That is not a very large expenditure, and I think for the sake of delaying, if only for 24 hours, the advance of an enemy inland, something should be done to check them at our frontier. That 24 hours would be of incalculable value for purposes of mobilization, and for the concentration on the inland positions of the large force of Regulars and auxiliary troops which we expect will be placed there.

Colonel RICHARDSON: It is rather difficult to criticise a paper with which in the main you agree. The chief difficulty that a lecturer on coast defence meets is the fact that one general system does not suit the requirements of every locality. It is very natural for anybody who writes a lecture to found general principles on his own experience, but his own experience, as a rule, is only that of a few places, and therefore it is very difficult to dogmatize. In some minor instances I disagree with him. He lays down that all the groups of a fort should command the same waterway, and all the forts of a section should fire on the same line of approach. How does he reconcile this axiom with the case of the breakwater fort at Plymouth, which fires over two waterways? With Case I, he says, fire is more accurate than with quadrant elevation. I feel he is talking only of the service method; but I maintain quadrant elevation might make shooting perfect. What we want is a hydro-chronometer which is simple, which has large divisions, and a movable scale and zero to compensate for tide and powder error. That, you might say, is a very difficult thing to get, but I have seen that sort of hydro-chronometer. Captain Donohue, I.O.M., produced one some years ago. It was quite in the rough, but some little practice took place with it, practice of most remarkable accuracy. Again, the lecturer says, "quadrant firing is only possible with the P.F." I think it is quite possible that with any R.F. good results might be obtained. I am glad to see Colonel Jocelyn has adopted the term "Fort Commander." As to their proper position, we get a difference of opinion. Major Stone and Colonel Lloyd both think they should be well away from their men, but I cannot see the slightest difficulty in their being generally inside their forts. They can control the fire equally well and yet be with their men, so near them that they can at any time visit them. I have seen no difficulty about it anywhere, except in the case of high angle fire, when I think F.C.'s must be as near to the target as they can be, so as to see fire effect well. The lecturer lays down that there should be a pedestal for the D.R.F. I think there ought to be many of these D.R.F.'s in every fort. It does not follow that you are only going to engage one ship. In peace practice we fire at only one target, or at most at two. We have not very many men, and the consequence is we are apt to think that one D.R.F. is all that is required; but some groups will be silent because there are not enough D.R.F.'s in our forts. I am very much in accord with the lecturer as to his ideas of how communications should be worked, except perhaps on one or two minor points. As to the pegs he gives us on which to hang discussion, I agree with the principles of very nearly all of them, and merely propose to touch slightly on those with which I cannot quite agree. The first is No. 5, where he speaks of the necessity for experiments to find a suitable telephone. I cannot help asking, Why telephone? because the telephone is a very bewildering instrument, at the best, in wind or noise, and I think we have found that the telegraph, or perhaps the printing telegraph, is better. I quite agree, however, that some experiments should be carried out to find out the best instrument for our wants. Then as to the choice of ammunition, he says the normal projectile for coast artillery is a common shell

with a direct action fuze. The common shell is certainly the normal projectile, but I think, if we do have a direct action fuze, it should be slightly delayed. There is no difficulty in that, because fuzes with very great delay have been produced. In No. 7 he asks, "Can vessels be efficiently attacked by the direct fire of common shell and percussion shrapnel on their upper decks, and how far can we utilize reduced charges?" Our object is always to cripple a ship, and not to kill a few men. We want really to break up or sink the ship itself; the men must follow, and therefore we should not use reduced charges. Some people think shrapnel should be used against unarmoured ships, but it is unlikely that shrapnel will cripple a ship so much as the very large charge contained in common shell. Admiral Cleveland has seen quite lately common shells fired causing frightful destruction behind plates, quite enough man-killing effect without a few weak bullets added to it. Then with regard to No. 8, I suppose there ought to be a few armour-piercing shot, in case any ship was foolish enough to come up close and engage a well found fort, but otherwise I do not think there is any place where ships will attack us at very close ranges if we are properly prepared. It is all going by theory, but it is difficult to conceive an instance in which a solid projectile striking an unprotected ship would do as much harm as 20 or 30 lbs. of powder or high explosive bursting inside her. Then we come to No. 10. I do not know that time shrapnel in the ordinary sense will ever suit our purpose very well. Of course I suppose the lecturer means for use against torpedo-boats chiefly. This brings in rather a large question, which necessitates a good deal of thought. The navy have elected to meet the attack of torpedo-boats with Q.F. guns, but I am not quite sure whether Q.F. guns are the best for coast artillery purposes. I should like to see this discussed instead of the mere question of time shrapnel. I have heard opinions expressed in the navy that the mere penetration of the outer skin of a torpedo-boat will not stop it; it is too big game to be stopped by small shot, you want a big smashing bullet for it. That I do not know, but I think, both in the coast artillery and in the navy, each man holds his own theoretical opinion, for want of real war experience. In many cases of narrow channels, rapid-firing case guns would probably be very awkward things for torpedo-boats delayed by booms or other obstacles. Some of the enormous number of hits must prove effective. The lecturer appears to have touched rather lightly on the most difficult problem with which coast artillerymen have to deal, and that is the defence (which Colonel Lloyd laid some stress on) against torpedo-boat raids; that is the only thing we have now left to provide against if our heavy armaments are kept efficient; but here again we have not real experience to guide us. I was very anxious a little while ago to start a small torpedo-boat-opposing school, but I unfortunately could not get the funds to do it. We should have learnt a very great deal if we had devoted ourselves to producing extremely swift moving torpedo targets, perhaps covering them with some sort of light armour, and trying what we really could do by night and day. We might have found, perhaps, that the Q.F. gun is the best defence. I do not think the navy yet realize what will happen in an engagement where torpedo-boats come on quickly, how in the act of self-defence they will peg away into each other with these Q.F. guns, which have very long range. I know we coast artillery will not be long allowed to fire into opposite shores, into towns, &c. Under the head the "Control of Guns," No. 11, he says, "In many places elaborate measures for identification and indication of objectives are useless, if not mischievous." I think that in all places if these means are too intricate they are mischievous, but in most places a simple system, such as Captain Orde Browne has been good enough to work out for us, could not do harm, whether you use it or not. No doubt some will use it, and I hope we shall get it issued soon. "In each locality a line of action should be sketched out for the section C.R.A. by superior authority." That line of action is laid down fairly well in our drill book. The section C.R.A. ought to be an officer of some considerable experience, and if he is too much tied by rule he won't act at all. Then the lecturer says in No. 13 that "Great advantages would accrue if there could be more collaboration between officers of the rank of section C.R.A. and C.R.E. and representatives of the Royal Navy in these matters." The result would be the coast artillerymen would have a great many advisers. I have

a good many friends in the navy, and I get a good many different opinions from them. Are we to have one section working one way and another the other way, according to the opinions of their respective naval advisers? I do not think that is desirable. The best way is for the C.R.A. to be in communication with the principal naval authority of the district and then give his orders. The C.R.A. of the district must be the head, he must have everything under him; it won't do for each junior to go his own way. Then as to Nos. 14 and 15, I hold very strong opinions. I think the lecturer is very sound throughout, especially in laying stress on a high site wherever it can be obtained. There are lots of places where we see high sites available for all-round fire, and a lower site chosen. There is some mention made about the automatic sighting of Q.F. guns. There are sights already invented that would do very well indeed, if made practical; they only want working out. If anybody will make the trunnion sight movable instead of the tangent sight, he will see how very easily an automatic sight can be devised. It was first suggested by a Volunteer officer, Captain Grant, a very clever man, some years ago, and I cannot see at all why his ideas should not be enlarged and adapted to range finding with Q.F. guns. It would be perfectly automatic. On this system, whenever you laid the gun correctly on the object the gun was ready to fire a shot at the range required. It is a very promising idea where high sites are available. I agree with the lecturer about the utilization of old guns. I suppose he was thinking of G-in. H.P. when talking of substituting guns of weaker shell fire for the old type guns. Many of our old type guns are slow in firing, but they are cheap and never get out of order. I disagree with Major Stone that the Volunteers cannot work them; I think they work them very quickly and very well.

Major STONE: I did not imply that at all. What I said was it is easier to train a detachment with your quick firers than the detachment of a 10-in. gun which consists of 15 men.

Colonel RICHARDSON: The Q.F. gun takes very long training, and an enormous number of rounds must be fired before you can expect the men to hit; whereas with the 10-in. anybody can shoot well. We do not get much ammunition for 10-in., but we make very good practice. Owing to its two motions the quick-firer proves very difficult to any man, even though he is a good layer with ordinary guns. Elaborate guns will certainly be sooner out of order than the old simple weapons. Then about Q.F. guns, how they should be placed. The lecturer says they should be on cone mountings and fired from the shoulder. With that I quite agree. They should be cone mounted, put on a truck, to move where you like to selected positions. He says "Coast artillery has no mobility." You can get it in that way; we could bring any number of Q.F. guns to any required spot. We find that they fire very well from trucks. You have only to run a railway round about the works and you have very considerable mobility. I am glad he has called attention to the ill effect of smoke being exaggerated. I am a very strong advocate for smokeless powder, but smoke does not so very often interfere with shooting. Then about ships running past forts. I believe history will always repeat itself and ships will always have the power of running past forts. It is only a question if the defences are very efficient; if they are, ships will not do it without receiving a very great deal of damage, and will they run the risk of losing a very large fraction of their power for nothing? What are they going to do when they get by? Are they going to run into a lot of submarine mines? I do not think they will attempt to run past except in fairly open channels. As for electric lights, we want experience. The small, trilling trials that we have had have taught us little; but I agree with the lecturer that search lights are far more effective than fixed beams. I quite agree with him that search lights for the fighting of a fort should be under the F.C. every bit as much as his guns. On the question of illuminated sights, I see he hints that they must be electric sights. There is a great craze for electricity; it is to do everything; but I have a sort of idea that the simplest sight, and the best, would be one perhaps in which electricity had nothing whatever to do. The thing we want is not so much an electric sight as a perfect sight, which can be altered in its brightness so as to suit different states of atmosphere. We want something we can use effectively by night. I quite agree that on many nights you can lay perfectly with ordinary sights, without search lights or any artificial

illumination. I go further. I believe there are very few nights in the year in which you could not lay guns without the electric light; and there is one form of lighting up a channel that never seems to have been noticed, that is putting lights on the far side of it. You can see a ship perfectly well in shadow, and you can use the range finder. The lecturer thinks the subalterns, or the younger officers, the junior ranks should be accustomed to realize in peace the procedure that will be followed in war as to the identification of approaching vessels. Well, there used to be a good old rule that hardly ever failed. It has stood the great test of war. Fire a shot ahead; if the ship stops she is probably friendly, if she does not let her have it. She will either stop herself, or we shall stop her. The necessity for practice batteries I quite agree with; we ought to have more practice batteries, because of the difficulties of our home ranges, but I would not have a practice battery at all if it had the effect of preventing us practising from service batteries. Then there is "The desirability of testing the communications and the handling of our larger works." At one place the lecturer has made the statement that nobody knows how some of these large works are to be handled. I have a fair experience of our forts, but I do not know where this state of things exists.

Major F. B. ELSLIE, R.A.: As regards the Fort Commander's corrections, Colonel Jocelyn has enumerated, *seriatim*, a formidable number of these, for tide, for travel of objective, for powder, for time of flight, and so on. These are doubtless all necessary, but I should like very earnestly to put forward that to attempt to treat them each as separate corrections is somewhat misleading, as practically these various corrections have to be merged into one at any given moment. The attempt to treat them separately is very discouraging to officers who have to be Fort Commanders—as it induces the feeling that the task is more difficult than it is in reality. The officer should make his corrections on seeing where his projectiles are falling, without reference to what may be the exact cause or causes of any error he sees. If when firing at a moving object he sees his projectiles strike beyond and behind his object, he should simply correct his range and deflection, instantly and boldly, by what he estimates as the amount of the error, and carry on the firing without a pause. This plan saves a lot of time, and I am sure if it were always put in that way, we should train our Fort Commanders quicker and easier than we do at present, for it is confusing and discouraging for a man to feel that he has such a lot to think about at critical moments. Secondly, seeing that corrections are unavoidable, I should strongly advocate taking up the subject of applying them mechanically. It is very difficult for anyone, however well trained, to apply these corrections in his head, and this is a weak point in our system. It can be done mechanically, and if our authorities will only take it up as a subject to be considered, I have no doubt that a very good result could be arrived at. One other point is that Colonel Jocelyn apparently expresses a preference for the heavy shell of the 10-in. R.M.L. on the grounds that it is a bigger shell. That is perfectly true, and the gun is a good gun, but in these days when the objective is likely to be under fire such a very short time, it surely is more important to fire with rapidity. You may waste two or three shots from the very best gun, and rapidity of fire is probably more important than a great big shell which is wasted if it does not hit the object. Fourthly, as regards fuzes, which have been mentioned in the discussion, I cannot think that time fuzes, used as such, can ever be very manageable in coast artillery work. But it is very important to be able to expend your shell, if possible, after ricochet, to prevent it damaging friends, so if some time action could be appended to the direct action fuze so that the shell, if it missed the object, would be expended automatically at long range, it might simplify the matter of cross fire in narrow channels. Lastly, about Q.F. guns, there is no doubt that the rate of fire is, in these days, of the highest importance, and the more their command is simplified the better. I quite agree with Major Stone that the proper range finder for the Q.F. gun is the Q.F. gun itself: these guns should also, as put forward by Colonel Richardson, be used in groups of a mobile nature, that is to say, the guns could be transferred to different points. If you tie yourself hand and foot with every gun in a fixed position some attack of an unforeseen nature may find a weak spot. If the lighter Q.F. guns are properly mounted, and movable, we shall have in our hands a great

power for defence. The effect of a group of four 6-prs., well handled, is very great, and it would be a very good thing if we were supplied with more of these for coast purposes.

Colonel C. H. COLES: I should like, as a Volunteer artilleryman, to say a few words, especially as an officer who has not only "stood on the top of Pisgah," but has also entered into "the land flowing with range and position finders," and to say I thoroughly endorse the suggestions made by Colonel Jocelyn on the subject of training the Volunteer artillery. Although the Volunteer artillery commenced to learn the duty of coast defence immediately the Red Book was issued, still a course at one of the schools of instruction enables us to grasp the spirit of the system a great deal better, and I would recommend such a course to any officer who can spare the time. The idea of 64-pr. practice batteries and more ammunition will commend itself to all, especially to those brigades which are stationed near sea ranges, but in places like London, where we are 50 miles from a practice battery, the difficulty of travelling expenses comes in very heavily. The Government only grant travelling allowances on one occasion for one man per annum. I would, with very much deference, with regard to the training of artillery, offer the following suggestions:—In the first place, that guns of the same nature that the Volunteer artillery are called upon to man in the forts generally—9-, 10-, and 11-in. guns—should be issued, say, in the proportion of 1 to 300 men; those guns should be complete, with mountings, fittings, &c. By this means much valuable time would be saved by instructing the men in gun drill at their own drill stations, thereby enabling the unit to proceed at once with the drill series or service practice when in the forts. My contention is that it is really a waste of valuable time to have to instruct Volunteer gunners in the drill of these guns in the forts, the drill of which they ought to learn at their own drill stations, but which at the present time they are unable to do, because the guns are not forthcoming. Let us have a certain number of guns complete; they may be dummy guns, but let the mountings and fittings be complete, so that the men may know them thoroughly. Secondly, with regard to London, where there are 2,000 garrison artillerymen, I would suggest that Tilbury Fort should be more utilized as a drill station. I think Volunteer artillery companies might go down there five or six times in the year and carry out the drill series of the competitive practice, and possibly the annual gun inspection of the companies might take place down there. Thirdly, that in the practice which is carried out at Sheerness the firing should be as nearly as possible in accordance with the regulations for Service practice. I think these suggestions might be adopted without incurring large expense, and the ideas of the lecturer, with which I agree, might be made thoroughly workable.

Colonel JOCELYN, in reply, said: It is very late, and if I pass rapidly over the points various officers have raised it is from no want of feeling that there is a great deal to be said about those points, and some of them I should like to take time to amplify if possible. I would like to touch, however, upon one or two things, because I have been misunderstood as to my phraseology, and first, with regard to what Major Stone has said about the F.O. being in his observing station and carrying out corrections of fire; what I want to say is that the F.C., when he goes into his fort, does not know perhaps whether he is going to use Case I, Case II, or Case III, and he ought to be able to use any one at any moment as the necessity arises. In order to do that I do not think there is any cause for him to be in the fort. I never had the opportunity of seeing Colonel French's sight, and I bow to what Colonel Stone and Colonel Lloyd have said about it. I merely drew attention to it because I thought the laying of Q.F. guns at night, where the continuous R.F. is not always possible, might solve what appeared to us all the other day a great difficulty. Then with regard to the Q.F. guns; I myself do not know very much. Major Stone said you can do the same work with them with fewer guns. If he meant to say that you could do the same work with the Q.F. guns that you could do with the heavy guns I should like to know what he meant. With regard to the training of men, there is no difficulty whatever in training Volunteer artillery to work heavy guns when you have specialists existing in all the districts to do the special work, such as laying and so on, and I think it is much easier to train men with heavy guns than with Q.F. guns. With regard to what Colonel Lloyd said, the whole point of my lecture

was that what suits one place may not suit another. I am dead against tying down anybody. With regard to the section C.R.A. and the preparation of the scheme of defence, what I meant was that I have seen the mere fact of a man being supplied with large charts, with groups, squares, &c., has a tendency to make him interfere with the F.C., to give him objections, and to say, "What square are you on?" which is useless in a channel or in any place where there is an easier and speedier means of identification. I think Colonel Orde Browne's work with regard to what he has done for ships is most valuable. I did not mean to underrate it for a single instant; all I meant was, if you put a lot of tools into the hands of a man who is very apt to play with them, there may be danger. I think some officers will understand what I mean. I know the hydro-pneumatic carriage is forced upon us with some low sites. What I meant was I should like always to use the heavy shell when I could get it. With regard to rapidity of fire from 6-in. and 10-in. guns, I myself do not think there will be much difference. I have not had much experience with hydro-pneumatic mountings, but did I understand it would be slower firing with the 10-in. than with the 6-in.?

Colonel LLOYD: Yes.

Colonel JOCELYN: I bow to your opinion, because I have not had much experience.

Colonel LLOYD: I am sorry I cannot give you the figures.

Colonel JOCELYN: There is a great deal to be said for that, and I at once admit that rapidity of fire is of the highest importance. I think we ought to bear in mind the value of a live shell, that is what I meant. Then there is a point that Colonel Richardson mentioned with regard to deprecating naval advice to the section C.R.A. and the section C.R.E. We know that officers commanding artillery stations have the benefit of this conversation with Admirals and so on, and they seem to derive a great deal of benefit from it, and I cannot see why the junior ranks should not benefit in the same way. I only once in my service had the opportunity of close connection with the navy and the Engineers, all combined in the same operations in the Isle of Wight. It lasted for four or five days, and I learned more in those four or five days than I did in four or five years at any other time. I found it of the greatest use to hear what they had to say and to discuss matters with them. With regard to the mobility of machine-guns, of course Colonel Richardson and Major Elmslie have both spoken from what they have seen as to moving guns on trucks. There may be many cases in which that is excellent, but I have not seen it. I am only judging from my own point of view, that running about with Q.F. guns in the night may possibly lead to confusion. I do not want to draw any comparison between shrapnel and Q.F. guns, except in so far as this, that I do not think we know what shrapnel will do, and I merely want to have some experiments to find this out. I do not think I have been understood by some officers. They thought I was going to load up the gun and wait for the ship to come. A F.C. would have to use his wits. If he saw ships preparing to run through he would be perfectly certain to get the range. He could use his gun for other purposes until that time came. It does not take long to order guns to be used with shrapnel for a certain range. Then, with regard to correction, I do not think anybody will accuse us of frightening F.C.'s, for it is our object to make everything as simple as possible: and as far as doing it mechanically, I have written a paper in our own proceedings about that, which is merely another peg for somebody to see what can be done in putting on corrections for speed mechanically, because in certain forts the corrections are very important; and I do not quite go with Major Elmslie in saying you can correct from one shot to another, because the conditions change. I have a case in point. Here is a gun 14 ft. above mean tide, the corrections for travel are from 5,400 to 1,000: they vary like this, -125, -95, -50, -25, 0, +5, +25, +50, +100, +125, all on the same line. I do not think you can shoot well if you do not consider these things separately. There is the result of two corrections, and I do not think at all events the F.C.'s of the Southern District would feel that they have been in any way bothered by correction. If you can do it automatically by all means do it. Captain Crampton, the gunnery instructor at Cork Harbour, wrote the other day about an automatic time correction, and I should very much like to see it tried. I am all for doing everything automatically and

making things as simple as possible. The only gist of my lecture was that what are merely matters of theory should be supported by practice.¹

The CHAIRMAN (Admiral Cleveland): It now devolves upon me to close the discussion. I suppose I ought to give a summary of the criticisms which have been

¹ With regard to the discussion that has taken place, I should like to make the following remarks. As to Colonel Richardson's criticism on my definitions of the "fighting units," I am aware that they were not quite complete. My object was to state the case as briefly as possible; a section may sometimes have to deal with two lines of approach, just as two fields of fire may be commanded by various guns in the same fort; but one S.C.R.A. and one F.C. can only deal with one of these things at the same time; should a section be simultaneously attacked from two lines of approach, the S.C.R.A. would have to delegate the charge of a portion of it to a subordinate, and if a fort is obliged to fire, simultaneously, on two fields of fire, there must be practically two F.C.'s. This is what I meant by "modifications of command."

Under the heading of laying of guns, I gave an account of certain corrections. It appeared to me that Major Elmslie misunderstood my object in doing this; I wished to bring out the real use and position of our instruments. I have always tried to simplify the duties of the F.C.'s. At the same time I feel sure that no peace practice brings out the real difficulties that may occur on service in correcting fire.

When I said that "predicted firing" was only possible with the P.F., I meant that this was the only Service method.

Colonel Lloyd objected to the firing of shrapnel time shell, as described in the lecture; it may, however, be worth experimenting with. I do not think the guns should be loaded until a suitable objective is in sight; but, in a given channel, certain obligatory ranges can be selected, and the shells got ready for loading. If the objectives were sunk, or turned back, before they reached the range the guns were prepared for, the latter can always be fired off and the shells got rid of that way.

As to Colonel French's sight, I have only heard of it, but never seen it. I cannot help thinking it would be useful, with Q.F. guns on cone mountings, in certain places.

With regard to Major Stone's remarks about the position of the F.C. when using P.F. Case III, I can only say that I think he should be in the fort then, as at most other times, if it was only in order that he may be able to change from one system of firing to another, as occasion may arise. Flexibility of procedure can only thus be obtained. Quite apart from this, there are other very important considerations which demand his presence there.

As to choice of projectile, I am very sorry no naval officer gave us the benefit of his advice.

With regard to the control of guns and identification of objectives, I by no means meant to underrate the valuable work Captain Orde Browne has done; on the contrary, I think it should be carefully studied by all officers of coast artillery. My meaning was, that somewhat complicated means for fire control would be better absent from a section C.R.A.'s station, when from the nature of the case such control would not be possible in action.

With regard to choice of guns, I wished to emphasize the importance of heavy shell; the example I gave was intended to start a discussion. I fully admit the importance of rapidity of fire, and it is always insisted on in the Isle of Wight; at the same time I think, as a rule, two salvos of 10-in. shell would be more effective than three of 6-in.

I know the question of Q.F. guns *versus* shrapnel is a very vexed one; my object was to demand experiments with the latter; the data on the subject is, as far as I have been able to ascertain, very meagre, and the decision as to which is best is much too important a one to leave to theoretical discussion only.

I mentioned parachute lights, as I had seen their trial recommended by at least two officers of experience; I was sorry to hear from Colonel Lloyd that his experience was dead against them; at all events the star-shell might be tried.

bestowed upon this able paper, but I do not intend to do so. The time is late and the subject matter too technical. In all the lectures on this subject which I have heard or read, there appears to be one weakness, that is, the authors do not seem to have a very definite idea what the *nature* of the attack upon our coast defences will be. My opinion is, that so long as we hold the supremacy of the sea (and I hope we shall never lose it, for if we do, no amount of coast defence will save us), the most probable nature of attack against which the forts guarding the approaches to our naval roadsteads should be always prepared, is the sudden and continuous rush of torpedo-boats; I do not think you will get anything more formidable than that; and it is to meet that particular form of attack that I should like to see some definite and settled plan of defence. Whether it is to be met, as Colonel Richardson suggests, by firing case-shot from heavy guns or by Q.F. guns, is a technical question, but one that certainly ought to be definitely settled. With your permission I will tender your thanks and the thanks of the Institution to the lecturer for the very instructive lecture that he has given us.

MAXIM, NORDENFELT 3PR. Q.F. GUN.

NON-RECOIL GALLOPING CARRIAGE.

Mark D.

Firing Position.

Scale $\frac{1}{4}$ "