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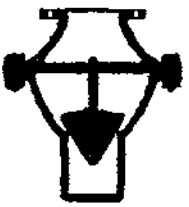

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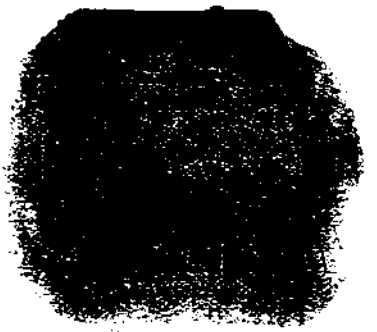

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CONTENTS.

Authors alone are responsible for the statements made and the opinions expressed in their papers.

1. Demolition of Permanent Way.

2. Demolition of a 9" Pile.

Photography of Demolitions

EXPERIMENTS IN THE PHOTOGRAPHY OF DEMOLITIONS.

By Lieut. P. S. Greig, R.E.

The report on the various works and experiments carried out by Royal Engineer units during the Annual Field Works Course should as far as possible be illustrated by photographs; but as regards demolitions the regulation asking for such records is more honoured in the breach than in the observance.

In the case of Railway Companies, when experiments in the destruction of rails and permanent way have to be carried out with the accompaniment of flying sleepers and jagged pieces of metal which may be deported with considerable violence to more than 100 yards away from the site of the explosion, the problem of supplying the photographs asked for becomes somewhat difficult; and prudence is generally regarded as the better part of valour. A great prophet was once confronted with a similar problem. As the mountain would not come to Mahomet, Mahomet had to go to the mountain. Likewise if man cannot photograph an explosion, the explosion must needs photograph itself.

Armed therefore with

(1) A profound belief in the theory of probabilities
and (2) A photographic thirst for 'explosive' knowledge and results,

I resolved recently to risk a Special B Newman & Guardia camera against the (possibly) evil machinations of guncotton, and to photograph from a near coign of vantage the demolition of a piece of railway line.

The track on which the 53rd (Railway) Company experimented consisted of 105-lb. rails spiked down to 9′ sleepers placed 2′ 9″ centre to centre—a total length of 120′ being laid down for the purpose in a clearing in Woolmer Forest.

The charge consisted of 3 slabs of wet guncotton (the weight of each slab being 1 lb. 14 oz.) placed vertically beneath the sleeper nearest to the junction of two rail lengths—the joint being unfished (*Fig.* 1).

A protective shelter, formed out of sleepers and arranged as in *Fig.* 1, was erected above the joint—not to act as a tamping to the charge in any way, but merely to guard against flying splinters of iron finding their way into the lens of the camera.

Some 12 yards away from the forthcoming scene of disaster a small bombproof shelter of sleepers was erected to safeguard the camera (*Fig.* 2). *Fig.* 3 illustrates more plainly than words the subsequent

arrangements, over which the rank and file of the 53rd Company displayed a vast amount of interest.

The safety fuze having been ignited, we retired some 100 yards away from the sphere of action and lay low, every man behind his own fir tree. Needless to say, the indifference on the part of the guncotton as to the subsequent fate of a valuable lens was simply sublime.

On our return, however, we found all had gone well and exactly as anticipated. The upward force of the explosion had snapped the wire (A) at the point (*a*) where it had been fastened on to the rail; and the fishplate B had fallen on to the indiarubber bulb C, thus releasing the shutter of the camera which had previously been set at its minimum exposure, *i.e.*, 1/100 second. The result is shown in *Photo* 1. Note the flying sleepers, particularly the crossed pair in the centre of the disturbance, and the half-broken one in the right-hand top corner of the print.

The law of probability asserted itself, and the camera came scathless through the ordeal, though a 9′ sleeper sailed merrily just above the bombproof shelter and severely barked the trunk of a neighbouring fir tree, while a piece of the lower flange of the rail, some 2′ in length, described a beautiful curve over the tree tops and was subsequently found firmly bedded into the ground 120 yards away from the site of the explosion.

The actual damage done to the line was

(1). Track shifted 1 rail length (24′) in each direction and spikes drawn.
(2). A length of 2′ of rail broken off just above where the charge was placed; the other rail not damaged.
(3). 2 sleepers destroyed, 4 displaced.
(4). A crater 2′ in depth formed.

Aquatic demolitions are probably accompanied by less danger to onlookers than any others, and for this reason are the easiest to photograph.

The upheaval consists of a vertical column of water, which goes up with the swish of a rocket, bearing on its crest the débris which generally falls back again more or less in its original position. The less the depth at which the charge is placed the greater the spectacular effect.

Photo 2 shows the blowing up of a 9″ diameter pile, the charge, consisting as before of 3 slabs (5¾ lbs.) of guncotton, being fastened to a board and sunk to a depth of only 3′ below the surface of the water.

The pile was cut clean in two, the upper portion of it being borne aloft at the top of the column of water, where it can be seen in the photograph.

The exposure was 1/100 second as in the first instance. A shorter exposure would probably have produced better results in both cases.

AUTOMATIC PHOTOGRAPHING OF RAIL DEMOLITIONS.

Scale 1 in. = 4 ft. (1/3).

Note.—The force of the explosion snaps the wire A, causing the fishplate B to fall on the indiarubber bulb C, thus taking the photograph.

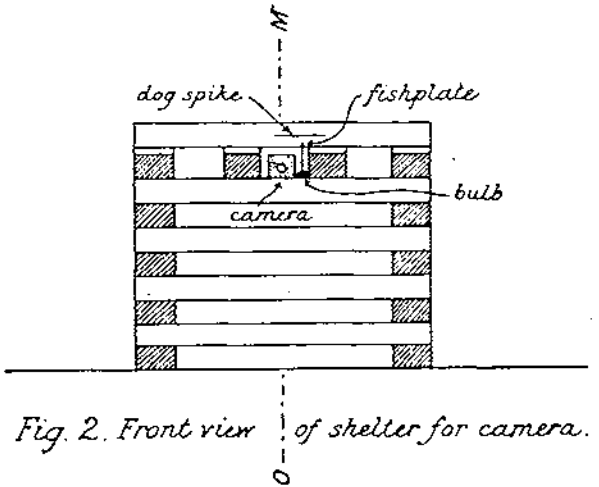

Fig. 2. Front view of shelter for camera.

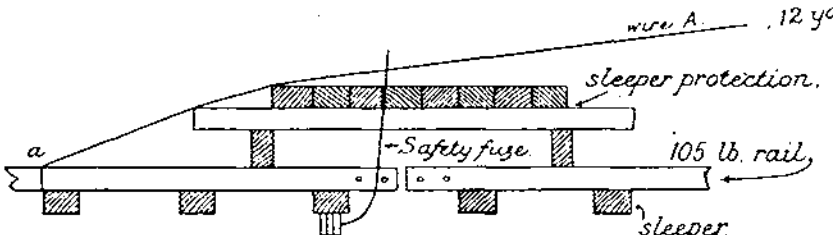

Fig. 1.

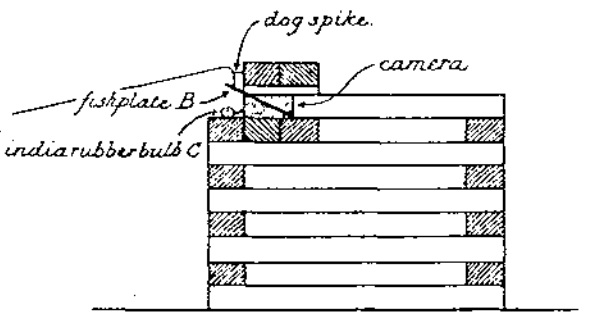

Fig. 3. Cross section on OM, Fig. 2.

THE IRISH HOUSES OF PARLIAMENT, DUBLIN.

By Lieut. W. P. Pakenham-Walsh, R.E., R.S.A.I.

The Parliament House, Dublin, now the Bank of Ireland, is undoubtedly one of the finest buildings in the Kingdom, and is of special interest to the Royal Engineers owing to its construction having been carried out by members of the Corps.

The Irish Parliament had previously met at Chichester House, which stood on the same site; but in 1723, the condition of the building being unsatisfactory, a Committee was appointed to report on the subject and to estimate for the erection of a new Parliament House.

No steps, however, were taken till 1727, when it was found that the walls of Chichester House overhung dangerously. On January 11th, 1728, the House of Commons voted £6,000 towards providing materials and commencing work, and appointed a Committee to consider plans.

On April 30th, 1728, it was resolved that Chichester House was the most convenient site and Thomas Burgh, Chief Engineer and Surveyor General, was desired to prepare and lay before the Lord Lieutenant a plan for the new building.

It would appear, however, that Burgh delegated the matter to Edward Lovet Pearce, a captain in Neville's Dragoons, who later succeeded him as Chief Engineer and Surveyor-General; but I have been unable to ascertain whether Pearce at this time held any office on the Engineer Establishment.

Pearce has been accused of having obtained the design from Richard Castles, architect of Leinster House and other buildings in Dublin, and of refusing him his share of the credit and fees; and some artists have considered that Castles' style is recognisable in this edifice. But all contemporary writings, including a poem on the laying of the foundation stone by Henry Nelson, published in a broadsheet in 1730, and Dr. Delany's poem "The Pheasant and the Lark," credit Pearce with both the design and construction; and the Parliament undoubtedly considered it so, for he alone is mentioned in the official records, though Burgh probably supervised the plans.

The earliest accessible authority for this accusation is the following extraordinary pseudonymous work, printed for private circulation about 1736 (three years after Pearce's death), the author of which admits he had a grudge against Pearce for opposing him in a lawsuit.

Eques auratus qui et Architectus Regius: architectus, si ad aedes, quas extruxerat, spectes, imperitus; si ad scelera, peritissimus. Miles

etiam, et Capitanei titulo insignitus est: sed et rei militaris et virtutis omnis expers.

Mœchus autem fuit strenuus, ac stipendia in eo bello meruit, nequaquam laborans de aetate contubernalis—Alieni appetens et profusus mutuum argentum rogavit undique, nec solvendo erat. Cum nusquam inveniret mutuum, vim armorum adhibuit, et de bonis extraneorum praedatus est. Castellus sive Castles fuit Architecton, cujus consilio studio et labore nixus Perseus aedificavit Senaculum Dubliniense. Postea vero, cum amplissimis et indebitis prœmiis a Senatu donatus sit, pactam mercedem Castello denegavit.

Quis bene qui novit Persei insidiasque dolosque,
Temperet a satyrâ? Regis se jactat in aula;
Ingenioque opifex aliene vivere doctus,
Quas non edidicit, sibi Perseus arrogat artes:
Cui res, et titulus, cui crevit fama labore
Pauperis, heu! Castelli: ac dum bis mille Senatus
Decernit, digno quota pars donatur amico,
Omnia quae fecit, solusque meretua honorem!
Sic vos non vobis! *

On the 11th June, 1728, Pearce submitted the following estimate to the Lord Lieutenant :— †

"In obedience to your Excellency's commands I have prepared the within list of particular materials necessary to be provided towards building the Parliament House in Dublin, according to my plan, which his Majesty, your Excellency, and the honourable House of Commons have been pleased to honour with your approbation. Some other materials will remain unprovided, but may be procured in time when the building shall be begun, and I humbly conceive that what I now lay before you will employ the six thousand pounds given by Parliament."

List enclosed:—

306 tun of oak timber.
610 tun of fir timber.
2000 common deals.
200 best deals.
11140 hogsheads of lime.
400 cartloads of sand.
393 hogsheads of lime for plastering.
30 tun of plaster.
70 tun of lead.
300 foot of stone steps.
28944 load of building stone.
12644 thousand of bricks.
400 weight of solder.
36 tun of iron.
4354 foot of Bristol crown glass.
159 thousand of slates.
16 thousand of oak laths.
32 thousand of deal laths.

Chichester House was demolished in December, 1728. The foundation ceremony of the new building was carried out in state by

* Gilbert's *History of Dublin*, Vol. III. 1861.
† Gilbert's *Account of the Parliament House, Dublin.* 1896.

the Lords Justices in the absence of the Lord Lieutenant, and is described as follows in a contemporary publication.*

The "firſt stone was laid at the *south* side, on *February* the 3d, 1728–9, by the Lords Juſtices, together with ſeveral of the Nobility, and Members of Parliament; attended by the Yeomen of the Guard, a Detachment of Dragoons, and another of Foot. In the body of which stone was laid two Silver Medals, with effigies of their preſent Majeſties, KING GEORGE and QUEEN CAROLINE, and over the medals was laid a plate of *Copper* on which is engrav'd the following Inscription:—

Sereniſſimus et Potentiſſimus Rex
GEORGIUS Secundus
Per Excellent. Dominum
Johannem Dominum Carteret, Baron de Hawnes
Locumtenentem
Et per Excellent. Dominos
Hugonem Archiepm Armachan,
Thomam Wyndam Cancell:
Guliel. Conolly Dom. Com. Prolocut:
Juſticiarios Generales.
Primum hujuſce Domus Parliament Lapidem
Poſuit
Tertio die Februar: Anno Dom.
MDCCXXVIII.

"And their Excellencies the Lords Juſtices were pleas'd to leave on the *stone* a Purſe with twenty-one *Guineas*, which the aforeſaid Captain *Pearce* the *Architect*, distributed among the *Craftſmen*, to drink towards the Healths of their Majeſties, the Prince of *Wales*, and the Reſt of the Royal Family."

A Parliamentary Committee, appointed to inquire into what progress had been made in the building, reported in November, 1729, that they "could not help observing, with the greatest pleasure, an uncommon beauty order and contrivance in the building; and that the same had been carried out with unusual expedition and diligence, that the money expended thereupon had been laid out with the greatest frugality and the accounts thereof kept in a most regular and orderly manner." The Committee further observed that "the Director appointed by the Government had attended the said work from the beginning with the utmost application and had thereby saved a large sum to the public, which in the course of such work, by the ordinary method, must necessarily have been expended, and at the same time had charged nothing for his own great expenses skill and pains."

When this report was brought up on November 22nd, 1729, the Commons unanimously voted £1,000 to Capt. Pearce "for the

* *The Constitutions of the Freemasons*, by John Pennell. Dublin, 1730.

care and pains he had taken in contriving and carrying on the building of the new Parliament House."

At Burgh's death on the 18th December, 1730, Pearce was appointed to succeed him as Chief Engineer and Surveyor General during the King's pleasure.* He at this time had a seat in the Irish House of Commons as Member for Ratoath.

The first Session in the new Parliament House was opened in state on October 5th, 1731, by Lionel, Duke of Dorset, Lord Lieutenant. In December of the same year the Commons resolved to address the Viceroy that an additional sum of £1,000 might be paid to "Edward Lovet Pearce, Esq., in consideration of the care and pains he had taken in carrying on the building of the Parliament House, and shall take in finishing the same." The House of Lords at the same time unanimously resolved that "Captain Edward Lovet Pearce, Surveyor General of his Majesty's Works, had shown true ability skill and good workmanship in the building of the Parliament House and had executed his office with great fidelity, care and diligence."

Pearce was knighted in 1732. He died in the following year at his house at Stillorgan, and was buried in Donnybrook Church. The works of the Parliament House were finished under the superintendence of Arthur Dobbs, M.P. for Castle Dobbs, Lisburn, who succeeded to the post of Chief Engineer and Surveyor General.†

The expenditure on the Parliament House up to December, 1735, including the £2,000 granted to Pearce and £490 paid pursuant to Act of Parliament to the proprietors of buildings which obstructed the approaches, was £28,471 10s. 5½d.‡

A Parliamentary Committee, appointed in the same year to inquire into the progress made, resolved "that Sir Edward Lovet Pearce, late Engineer and Surveyor General, and his executrix, Anne, Lady Pearce, had faithfully and honestly accounted for the several sums by him received for building the Parliament House."

In November, 1737, there still remained unfinished all the portico from the architrave upwards, with its roofing and ceiling, part of the carving of the voluta columns, the whole pavement within the colonnade, the pavement in the area before the portico with the balustrade and iron palisade to enclose it, pursuant to the plan, and the House of Commons voted £5,461 4s. 0d. to complete these and other necessaries.

The whole edifice as originally designed was completed in 1739; and, the Parliamentary Committee having resolved that Arthur Dobbs had acquitted himself with great care and frugality in finishing the building, the House of Commons in 1741 voted him £250 for his care and pains.

* Patent January 16th, 1730. 4 George II. 3.a. pars. d. R. 40.
† Patent May 2nd, 1734. 7. 2a. pars. f. R. 43.
‡ Gilbert's *History of Dublin*, Vol. III.

The Parliament House as originally designed consisted only of that portion shown black on the plan in the accompanying Plate, the houses of Dame Street and College Street (Westmoreland Street did not then exist) adjoining the Piazza on each side.

Additional rooms with wing wall and the Corinthian portico to the House of Lords in the new Westmoreland Street on the east side were erected in 1785, James Gandon being the architect. This is the most striking feature of the building, as the rest of the edifice is Ionic. It was added by special direction of the House of Lords, principally to avoid the necessity of a flight of steps caused by the falling away of the ground on this side. Some years later the corresponding wing on the west side, in Foster Place, with an Ionic portico and a circular colonnade 12 feet distant from the wall, of the same order and magnitude as the columns of the portico, was designed by Colonel Sam Hayes, M.P., a relative of Burgh, and built under Gandon's supervision.

The House of Commons was destroyed by fire on February 27th, 1792, and rebuilt with considerable alteration.

On the Union of the Parliaments of England and Ireland in 1801 it was proposed to use the building as a lecture hall for Trinity College. But this proposal was rejected for fear of riots between the students and the townspeople, and it was finally leased in 1802 to the Bank of Ireland for £40,000 and an annual ground rent of £240.

It was then much rebuilt and altered, the colonnade on the west side being walled up, and half pillars added to the wing wall on the eastern side to make them symmetrical. It was finally opened as the Bank of Ireland on June 6th, 1808.

The following description of the building by Thomas Malton, an English artist who visited it after the fire in 1792, is quoted by Gilbert in his *History of the City of Dublin*.

"The Parliament House of Ireland is, notwithstanding the several fine pieces of architecture since recently raised, the noblest structure Dublin has to boast; and it is no hyperbole to advance, that this edifice, in the entire, is the grandest, most convenient, and most extensive of the kind in Europe. The portico is without any of the usual architectural decorations, having neither statue,* vase, bas-relief, tablet, sculptured keystone, or sunk panel to enrich it; it derives all its beauty from a simple impulse of fine art; and is one of the few instances of form only expressing true symmetry. It has been with many the subject of consideration, whether it could not have been rendered still more pleasing had the dado of the pedestal above the entablature been perforated, and balusters placed in the openings; but those of the best taste have been decidedly of opinion it is best as the architect has put it out of his hands.

* The three statues now in position were erected after the building became the Bank.

"This noble structure is situated on College Green, and is placed nearly at right angles with the west front of the College. The contiguity of two such structures gives a grandeur of scene that would honour the first City of Europe.

"The inside of this admirable building corresponds in every respect with the majesty of its external appearance. The middle door under the portico leads directly into the Commons House, passing through a great hall, called the Court of Requests, where people assemble during the sittings of Parliament, sometimes large deputations of them with, and attending petitions before the House. . . ."

Malton then proceeds to describe the new Commons House, recently erected to replace the one destroyed by fire; and then continues—

"All around the Commons Room is a beautiful corridor, which communicates . . . to all the apartments attendant thereon, which are conveniently disposed about, committee rooms, rooms for clerks, coffee rooms, etc.

"The House of Lords is situated to the right of the Commons, and is also a noble apartment; the body is forty feet long, by thirty feet wide, in addition to which, at the upper end, is a circular recess thirteen feet deep, like a large niche, wherein the throne is placed, under a rich canopy of crimson velvet; and at the lower end is the bar, twenty feet square. The room is ornamented at each end with Corinthian columns, with niches between. The entablature of the order goes round the room, which is covered with a rich trunk ceiling. On the two long sides of the room are two large pieces of tapestry,* now rather decayed; one representing the famous Battle of the Boyne, and the other the Siege of Derry. Here the House assembled, from below the bar a high scene of picturesque grandeur is presented: and the Viceroy on his throne appears with more splendour than his Majesty himself on the throne of England."

This room, with the corridor round the Commons House, is the only part of the interior of the building which remains in its original condition. It is used by the Directors of the Bank as their Board Room, and a statue of George III. takes the place of the throne.

The old Commons House was an octagon inscribed in a square of sixty feet side, with a gallery all round protected by tall Corinthian columns and an iron balustrade; the whole surmounted by a dome, popularly called the "Goose Pie" in uncomplimentary reference to the legislators.

The illustrations originally appeared in the Christmas, 1906, issue of *The Lady of the House* (Dublin), to the publishers of which I am indebted for the loan of the blocks and for permission to reproduce them. I am also indebted to Sir Thomas Drew, W. J. Chetwode-Crawley, Esq., LL.D., and E. MacDowell Cosgrave, Esq., M.D., for kind assistance and information.

* Made specially for this room in 1733.

COAST DEFENCE.

By Capt. G. Walker, R.E.

Some recent articles upon this subject in the *R.E. Journal* have advocated a system of "Continuous or End to End" Coast Defences. The problem which the writer of the articles has set himself to solve is how to arrive at the cheapest method of protecting the coasts of Great Britain against the assaults of an enemy.

Coast Defence is indeed a thorny subject to deal with, because of controversies that have raged around it and the lack of knowledge possessed by those who enter almost blindfold into the fray.

The defence of any country with a coast line frontier depends upon two factors :—first its power of military action at sea, and second its power of preventing landings upon the coast by means either of fixed defences or mobile troops.

These two factors cannot be dissociated from one another, for upon them collectively depends the military strength of a nation. The term *military* is here used in its widest sense as embodying the combined power of the Sea and Land Services of a nation.

It may be accepted as an axiom that the relative strengths of these two defensive factors are inversely proportional to one another. That is to say, the greater the Naval strength of a nation the less will be its requirements in the matter of provision of purely land defences.

Some twenty years ago the question of Coast Defence *versus* the Power of the Navy was debated with considerable energy at a military institution in London, with the result that the opposing sides found, much to their mutual satisfaction, that they had been misunderstanding each other grievously and were really more or less in agreement as regards the above principle. They agreed that their services were complementary and that the one had to provide for the weaknesses of the other.

Taking this principle as a starting point all schemes of Coast Defence must be worked out with due regard to it, and also to the geographical and strategic conditions of each particular case. The actual siting and organisation of the defences of any particular locality depend upon tactical considerations, such as the class of attack likely to be brought against the place and the conformation of the ground. There is also a financial aspect, since it is essential to arrive at the best means of defence at the lowest cost consistent with effectiveness.

To lay down any definite method of Coast Defence as the best is most undesirable, for what may be the best in one place may be folly in another.

'Defence not defiance' is a common phrase. It is believed to embody the quintessence of international morality; but from a military point of view it is paradoxical. The essence of all good defence is defiance in a certain sense. Not a defiance which is always seeking an affront; but such a condition of preparedness and efficiency as will enable a nation to hit rapidly and hard, so that the aggressor may lose the initiative and the defender may be enabled to open the ball by attack.

Apparently therefore the first consideration should be to perfect means of attack, the second to protect the base or bases from which attacks are to be delivered.

As at present organised the British Empire has its centre in the British Islands. From Great Britain emanates the general policy of the Empire, and all its military strength is drawn from thence. Hence the defence of the Empire really centres round our islands, and the great defence problem which we Englishmen have to face is that of defending these islands from attack.

From our geographical position we can only attack our enemies after we have crossed the sea. The first essential then in our scheme of defence is a Navy that shall be supreme at sea; the second is an Army which may be transported oversea, under cover of that supremacy, to prosecute the war across our frontier; the third is such security for the island base, in the way of coast defences and mobile troops, as will free the offensive forces from anxiety as to their base of operations.

We now come to the actual defensive works, that is the works of which the rôle must largely be passive and which will really act as barriers until offensive action for their relief can be taken by mobile forces.

In order that the power of offence of the Navy may be preserved and the spirit of the nation maintained, the following classes of places must be protected:—

1. Naval Ports and Dockyards.
2. Commercial, Manufacturing, and Shipbuilding Ports.

These are, so to speak, the strategic points in the coast line; and they must be defended in such a way as to enable them to remain intact for some considerable time without assistance.

After having secured the strategic points in the line, the protection of the intervals between them is the next step to be considered. These intervals will vary greatly in length and character and will have to be carefully considered.

We will now proceed to consider in detail the system of defence in the three cases just mentioned.

Naval Ports.—The defence of these will depend upon their situation and the class of attack that may be expected, which latter will depend on the value of the prize to be obtained.

All such ports must be prepared for defence on both the sea and the land sides, for they are notoriously weaker on the land than on the sea fronts; that is the odds against the attack are much greater on the sea than on the land. An enemy who is determined to attack such places will almost invariably try and land clear of the coast defences, so as to take them in rear. It will be with such an object in view that the so-called "raiding" attacks will most probably be delivered; for such raids must from their organisation strive to gain, as rapidly as possible, some great object, such as the destruction of a dockyard or the seizure of a port for further disembarkations.

This question of the defence of land fronts is one which has caused much controversial argument. But it seems unreasonable to neglect any defensive measures round important points, on the assumption that the Navy will prevent any attack, when the object of defending the ports at all is to free the Navy from the responsibility of protecting them.

The garrisons of these Naval Ports also require consideration. As these places are extremely liable to sudden attack, the artillery and engineers of the garrison must be regular troops told off for the purpose in time of peace. Auxiliary troops, whose principal shortcoming is the lack of power to manœuvre, would serve for the infantry portions of the garrisons.

Commercial Ports, etc.—These will not require to be so heavily protected as Naval Ports, as the strength of the attack that is likely to be brought against them is not so great as in the former case. Much however will depend upon local circumstances and the situation of the ports with regard to the enemy's Naval bases.

What has to be aimed at is that they should afford a safe refuge in which merchant ships can unload their cargoes of food. It is also essential that there should be a sufficiency of such protected commercial ports on all the coasts, so as to make incoming merchant ships as independent as possible of the effects of a temporary loss of our sea supremacy in any of the narrow waters surrounding these islands. This last point is most important, as we depend entirely for our food supply upon sea-borne food stuffs and upon our food supply depends our power of resistance.

The Intervals between Defended Ports.—An open coast line is a strategic obstacle barring the advance of an invader. The proper method of defending such an obstacle is, not to line the obstacle with a cordon of troops or defences, but to arrange mobile troops in rear

of the obstacle in such a manner as will enable them to concentrate in superior force at the threatened point.

To do this properly is a difficult problem and its solution depends upon :—

1. Accurate Means of Information.
2. Rapid Means of Communication from the Interior to the Coast.
3. Efficient Organisation of the Land Troops.

With a coast obstacle, the first must be supplied by the Navy. The sea service must in this case act as the eyes and ears of the land service, and unless there is real co-operation between the two in this respect the scheme of defence must break down.

The second must be provided by the construction and maintenance of strategic lines of rail, telegraph, and telephone. Besides these an effective scheme of railway transport must be worked out ready for emergency, so that there may be no delay in forwarding troops to their destinations.

The third point is the organisation of the Land Defence Army.

The capabilities necessary for this force may roughly be said to be :—

(*a*). To be able to mobilise rapidly with full war equipment.
(*b*). To be capable of rapid movement.
(*c*). To be capable of manœuvring and marching well, and generally to be as well trained and disciplined as their potential adversaries.

These three desiderata point to a regular and permanently organised force, for untrained troops will not possess the necessary cohesion, power of rapid movement, and discipline.

As regards its military organisation, this force will require everything that an ordinary field army requires, but with a larger number of heavy mobile guns so that it may be able to prevent the hostile transports closing in to the land.

This Land Force may have to act by one or both of the two following methods :—

(i.). Concentrate to oppose a landing.
(ii.). Concentrate to crush a force already landed.

In the first case the numbers necessary at the critical point will not be so great as in the second.

A landing in the face of determined opposition is a most difficult manœuvre. It has been but seldom attempted in the past, and even more seldom has it been successful. An invader will invariably attempt by demonstrations to mislead the defence as to the actual point selected for disembarkation, and the facility with which he can do this is one of the advantages of invasions from the sea. The

certainty and rapidity with which steamships can reach their destinations affords the invader much greater power of surprise action than in the past. Also the actual disembarkation can be carried out much more rapidly than before.

On the other hand the increased power and range of mobile artillery, and the increased volume of fire that can be developed by modern arms of all kinds, greatly enhance the difficulties of the invader; for he will have to anchor his transports further from the land, perhaps in exposed positions, and the distance over which the troops will have to be brought in small craft will be very much increased. It is during this last phase of the landing operation that the troops will be most liable to heavy loss.

These considerations emphasize the necessity for the defender receiving early and accurate information as to the locality of the attempted landing, and of possessing ready means for assembling troops there at short notice. It may even be desirable to have permanent garrisons, and possibly fixed defences, at certain points on the coast, other than large ports, where landings would be easy and to which it might be difficult to get field troops with sufficient rapidity.

In working out the disposition of the troops told off for the defence of the intervals between defended ports, the coast should be divided into sections, as is done in any other defensive position; the general reserves in this case being concentrated in such situations as will enable them to strike at any force which may break through the coast line.

The sections of defence will be long, and no attempt should be made to disperse the defenders. The cordon system of defence is radically unsound, and the only method is to concentrate the defensive troops of a section so that they can easily reach any threatened point in their line. The strength of the troops in any section will depend on the probable strength of an invading force. This latter, in these days of ships with a large carrying capacity, may amount to 40,000 to 50,000 men; but it must be remembered that this force cannot develop its strength until it is actually landed and that a much smaller number of men properly handled will make its landing impossible. It has been stated, more or less authoritatively, that a landing can be effected within an hour of ships coming in sight of land. This possibly is true for the advanced troops, but hardly so for very large numbers.

We come now to the case in which the invaders have either eluded the first line of coast defence troops or have effected a landing in spite of opposition. A hostile army landed in the country must be dealt with by ordinary field operations. All available troops must be concentrated to oppose it either by direct attack or by moving against its communications with the coast. Which method should be adopted will depend upon actual circumstances. But every effort

must be made to make the attacker's existence impossible, and in this the naval forces must co-operate by preventing any further assistance coming to him by sea.

To sum up, the scheme for the Coast Defence of England should include—

1. A Navy that can practically ensure sea supremacy.
2. A military Striking Force for offensive action in the enemy's country.
3. Fixed Defences for Naval and important Commercial Ports, the garrisons for which may be partly regular and partly irregular troops.
4. A Home Defence Force of regular troops to protect the country from raiding forces which may elude the vigilance of the Navy.

One word is desirable in conclusion regarding what we English euphemistically call a "raid." The general public seem to consider a "raid" as a marauding party which can only do small damage and that only if undisturbed—perhaps a burglar is a better simile. This is an unfortunate view to take, as it is an absolutely false one.

Raids will no doubt vary in strength according to their objective; but it should be clearly understood that the term 'raiding force' covers any force which is self-contained and which can dispense with communications with its base for the period deemed necessary for the fulfilment of its object. It is not a question of size but of organisation; and therefore we shall be deceiving ourselves if we believe that the raids, of which we hear so much, will only be made by forces of insignificant strength.

As regards the objectives of raids against England, perhaps the less said the better: one or two may be mentioned—such as the destruction of a Naval dockyard which cannot safely be assailed from the sea, the coercion of the national or a provincial capital, the seizure of a port to act as a base for the landing of an invading force. At any rate it is easily seen that far from there being no object in raiding England there are many possible ones, and we should therefore be prepared for any eventuality.

Neglect of precautions is the most fertile of all causes of disaster in war; and it is a most dangerous policy to definitely eliminate any possible circumstance from defensive calculations on account of its improbability. On the other hand really unnecessary provisions are also undesirable, not only on account of expense, which should be a minor point, but also because they tend to complicate matters and to hamper the action of commanders.

The first step in these matters is the evolution of a well-balanced scheme of defence, and the second is the provision of forces adequate to carry it out.

SOME DEDUCTIONS FROM STAFF TOURS.

By CAPT. R. H. MACDONALD, R.E.

ORDERS.

STAFF TOURS derive much of their benefit from the kindly criticism of our own and other's mistakes, and the discussions which arise from the orders issued and the probable situations which would result.

Sixty-five orders were criticised during a Staff Tour last year in the Scottish Command, and the following is a summary of the errors commented upon by the Directing Staff. These errors may be roughly divided into three classes :—

1. Errors probably due to inattention or a want of care.
2. Errors probably due to a want of practice or training.
3. Errors of judgment.

The following may be placed under class 1 :—

1. (*a*). Heading of orders omitted. *Once.*
   (N.B. The number given after each is the number of times the error was commented upon by the Directing Staff).
   (*b*). Address of O.C., or Place where Reports are to be sent, not given or insufficiently described. *Fifteen times.*
   (*c*). No information, or incorrect information, given as to movements of other forces of own side. *Seven times.*
   (*d*). Time of starting not given. *Once.*
   (*e*). Unit to detail a detached force not named. *Once.*
   (*f*). No orders given for part or parts of the force. *Three times.*
   (*g*). Orders issued to part of the force which had previously been left behind. *Twice.*
   (*h*). Force ordered to halt, and in the same orders practically the whole of it ordered to march out in detachments. *Once.*
   (*k*). Subordinate's orders clash with those already issued by superior. *Four times.*

The following may be placed under class 2 :—

2. (*a*). Intentions of O.C. omitted. *Once*
   (*b*). Map used not stated. *Once.*
   (*c*). Starting point not ordered. *Four times.*

(*d*). Roads used in concentration not detailed. *Three times.*
(*e*). Orders for the withdrawal and position in line of march of previous night's outposts not given. *Once.*
(*f*). Commanding officer of a detached force not named. *Once.*
(*g*). Commanding officer of a detached force not informed by which units his force is to be provided. *Six times.*
(*h*). Orders for baggage not given or incomplete. *Three times.*
(*k*). Insufficient orders regarding ammunition and rations. *Seven times.*
(*l*). Definite order given without definitely detailing anyone to carry it out. *Once.*
(*m*). Communication between parts of a force with other friendly forces at hand not ordered. *Three times.*
(*n*). Boundary of responsibility not fixed. *Once.*
(*o*). Orders for outposts on arrival not issued. *Once.*
(*p*). Orders issued by superior which should have been left to subordinate to issue. *Three times.*
(*q*). Practically or physically impossible orders given. *Four times.*
(*r*). Ambiguous, vague, or indefinite orders given. *Eleven times.*
(*s*). Orders issued in an obsolete form. *Seventeen times.*

The only errors commented upon in the final report of the Tour under class 3 are :—

3. Second line transport ordered to march too near fighting column. *Twice.*

But many others were verbally commented upon at the daily conferences.

The above list does not comprise all the errors made, many minor errors being passed over after having been noted and criticised several times. But it shows how easy it is to make mistakes, and, in a rough way, what mistakes are likely to be made under a certain amount of pressure for time and office facilities, supposed to represent service conditions ; and a study of it is a good reminder of what to avoid.

The scheme this year was a more simple one, and the movements less complicated. Nevertheless much of the improvement shown in the writing of operation orders was certainly due to the lessons of last year.

This year the main errors commented upon were :—

(i.). Vague and indefinite orders given.

(ii.). Omission to clearly indicate the starting point.

(iii.). Omission to clearly specify when the head of the main body is to pass the starting point.

(iv.). Use of indefinite terms such as "daybreak," "dawn," "nightfall."

ACCESSORIES.

Among the minor benefits to be derived from Staff Tours is the practical demonstration of the application of some of the latest types of accessories, such as maps, motor cars, typewriters, etc., to war.

By practical use over ground the weak points of the employment for strategy of even the best maps, unless assisted by good local intelligence, are made plain.

The advantages and disadvantages of issuing typewritten orders can be practically demonstrated.

And a practical acquaintance is made with the various designs, speeds, and uses of motors.

MAPS.

The maps used this year were Bartholomew's reduced survey maps for tourists and cyclists, one inch to the mile, and coloured on the "layer" system, like the map of Sweden on Plate 4, *Manual of Map-Reading and Field Sketching, 1906*, only with a green colour for the lowest "layer." This difference makes the system more confusing, and not so satisfactory as that used for the map of Sweden.

On the whole, both these systems appear a little confusing. A more ready way to give a correct idea of country at a glance would be, perhaps, to have the contours shown and numbered as in Plate 3 of the same *Manual*, and the hachures developed as follows:—

(*a*). Hachures to be shown in blue, the same colour as rivers, instead of the present colour.

(*b*). Each blue hachure line to be drawn from just below one contour to a point just above the next lower contour, and to be finished off there with an arrowhead; the whole line to follow the direction in which water would flow, supposing it to be raining hard at the time.

The little spaces, containing the contours, between the ends of the hachures and the arrowheads on the hachures would prevent them being mistaken for rivers or streams. In this way each hachure, both by its length and its direction would give a correct idea of the slope of the ground; and terminating, as of course they all would, in streams or rivers, they would give a complete and accurate idea of the whole country.

MOTOR CARS.

Motor cars have come to stay, but are not quite to perfection yet. Their uses and organization are also not quite thoroughly understood by every staff officer.

When organizing a staff ride, the list of the cars to be used should include their pace and peculiarities. Then, as soon as the work for the day had been detailed, it would be easy to see which cars to use for the various parties, the fastest cars (in the absence of other reasons to the contrary) of course being detailed to go the longest distances.

The larger question of the employment of motors on service is in more competent hands. Only one point, on which I have seen nothing yet mentioned, might be noted here as having been practically demonstrated during Staff Tours. That is, the impossibility of riding in an open motor on a cold day and going hard across country on foot in the same clothes.

Men going by motor car must have, in addition to their ordinary great-coats, an air-tight overcoat; and I think these overcoats should be part of the equipment of every motor car used for military purposes. When men get out of a car they should always take off these overcoats and leave them in the car, the driver being responsible that this is done and that the coats are then properly stowed. The number of these overcoats should be the same as the maximum number of men the car can possibly carry, and they should be stored in peace time like reservists' clothing, ready for immediate use.

TYPEWRITERS.

The advantages of the use of a typewriter, both in war and peace, are so many that every officer is recommended to buy and learn how to use one.

There are many good typewriting machines now in the market; the "Empire" is all round a good machine and as likely to be met with on service as any other. In any case it is better to be familiar with one with a universal keyboard, so as to be able to use the styles of machines most likely to be met.

Duplicating typewritten work has been greatly simplified and improved of recent years.

Typewriting can be carried on in a train or closed motor car, if a fixed table is provided.

It might be well to notice here the difficulty of typing strengths of forces in the quarter margin. Even using all the authorized abbreviations the quarter margin is a most inconvenient and insufficient space to use for this important part of orders, and it is a cause of confusion and difficulty to both receiver and writer of orders in this form. In order to avoid confusion with the text of the orders, the strengths of the forces have to be all huddled together on the left edge of the paper, and are difficult to understand and sometimes lost altogether. The quarter margin was never intended to be used in this way.

Another drawback to this method of putting the strengths in the quarter margin is the waste of space, all of which is important, as two sheets of orders to be duplicated instead of one means more than twice the amount of time required for preparing orders for issue.

Take, for instance, the following order, an actual one extracted from the orders issued during the Staff Tour this year, and which is printed at some length as it contains another point which will be referred to later.

RED.

OPERATION ORDERS BY BRIGADIER-GENERAL A——, COMMANDING RED FORCE.

No. 4.

(Bartholomew's ½-inch-to-mile map).

Middleton House, South of Borthwick,
24th October, 1906.

1. GENERAL SITUATION.—As per narrative.

2. INTENTION.—The Brigadier-General Commanding intends to push back both the Blue forces, and also to cut their communications with Berwick-on-Tweed.

3. ORDERS TO FIGHTING TROOPS.—Mounted Brigade to follow Blue Cavalry, and give him no rest, whichever road he may take, and prevent him moving north *viâ* Eddleston.

The force under Colonel X—— (less Mounted Brigade) will march at 6 a.m. to Peebles or 1 mile east of that town if possible.

The force under Colonel Y——, with an additional 1½ Squadrons 1st Lovat's Scouts, will march with all despatch to Lauder with the object of cutting the enemy's communications with the sea, keeping in constant communication with Headquarters on the Edinburgh-Stow road.

The remainder of the force will follow the Blue Eastern Force on the Edinburgh-Stow road.

Advance Guard.
(Not in order of march).
Under Colonel Z——.
½ Squadron 1st Lovat's Scouts.
Lanark Field Coy. R.E.
2 Batts. Scottish Border Brigade.
1 Battery R.F.A. (Howitzer) Brigade.

Main Body.
(In order of march).
Scottish Border Brigade (less 2 Batts.).
R.F.A. (Howitzer) Brigade (less 1 Battery).
Heavy Battery.
A. & S. H. Brigade (less 3 Coys.).
Ammunition Columns.
Field Ambulances.

Rear Guard.
1 Coy. A. & S. Brigade.

Escort to Supply Columns and Second Line Transport.
2 Coys. A. & S. Brigade.

Distribution as per margin; head of main body to pass summit 900 at 6 a.m.

Outposts to join main body after advance guard has passed through them.

Interval between advance guard and main body, 1 mile.

Colonel Y——'s force to carry three days' rations.

All ammunition to be completed. Men to carry 150 rounds per man.

4. ORDERS TO OTHER UNITS.—The Second Line Transport and Supply Columns under Captain Pigott will follow 1 mile in rear of Field Ambulances.

All sick and wounded to be sent back to Edinburgh from Borthwick, and from Biggar to Glasgow.

* * * * * * etc.

It comes out clearer in print than in duplicated typewriting, as it was actually issued in this case, and the bad spacing may not be so apparent; but in the original copy it is obvious.

A simple way to avoid this would be to begin the first line detailing each separate body without allowing the usual quarter margin. For instance, taking the latter part of order No. 4 above, instead of typing it as shown above, it might be typed as follows:—

The remainder of the force will follow the Blue Eastern Force on the Edinburgh-Stow Road.
Distribution.
Advanced Guard. (Not in order of march). Under Colonel Z——.
½ Squadron 1st Lovat's Scouts.
Lanark Field Coy. R.E.
2 Batts. Scottish Border Brigade.
1 Battery R.F.A. (Howitzer) Brigade.
Main Body. (In order of march).
Scottish Border Brigade (less 2 Batts.).
R.F.A. (Howitzer) Brigade (less 1 Battery).
Heavy Battery.
A. & S. H. Brigade (less 3 Coys.).
Ammunition Columns.
Field Ambulances.
Rear Guard. 1 Coy. A. & S. Brigade.
Escort to Supply Columns and Second Line Transport. 2 Coys., A. & S. Brigade.
Head of main body to pass summit 900 at 6 a.m.
Outposts to join main body after advance guard has passed through them.
Interval between advanced guard and main body, etc.

This method does not waste space. It renders the orders easier to type, easier to read, and clearer in every way.

PRACTICE AND THEORY.

Having looked at some of the points practically demonstrated, there is one theoretical point which was brought out during these Staff Tours.

Take the orders quoted above, issued by the G.O.C. Red Force, on the 24th October, 1906.

The following is a rough idea of the situation on the evening of that date:—

Red is divided into two separate portions—

The Mounted Brigade, and
The Main Body.

Red's Main Body, after fighting all day and suffering severely, have driven back the enemy; and are now bivouacked on the field, keeping touch with the enemy with Lovat's Scouts, who are the only mounted troops with the Main Body. In considering the following point, the Mounted Brigade do not come into the question at all, as they are fully occupied 20 miles away.

The orders were issued at 5 p.m. The sun set at 4.41 p.m., and rose at 7.5 a.m. on October 25th.

The Advance Guard is detailed—"(Not in order of march). Under Colonel Z——"—and consists of ½ a Squadron of Lovat's Scouts, a Field Coy. R.E., 2 Battalions of the Scottish Border Brigade, and a Battery from the Howitzer Brigade.

The Main Body is ordered to start at 6 a.m., and the Advance Guard to be 1 mile beyond.

Colonel Z——'s actual orders were for Lovat's Scouts to pass the same starting point as that detailed for the Main Body at 5.14 a.m. and to reconnoitre 2 miles ahead of the Main Body, the Van Guard to pass the point at 5.15 a.m., and the Main Guard at 5.20 a.m.

Colonel Z—— is in command of the Scottish Border Brigade on the 24th, and his orders to command the Advance Guard reach him after dark.

His Brigade Staff have their own work to do, and he has no mounted men under him to act as orderlies.

He does not know where Lovat's Scouts are, and they have no idea where Colonel Z—— is.

The same applies in a similar way, but in a less degree, to the Field Company R.E. and the Battery.

The remainder of the force he has to get away at 5.20 next morning consists of two battalions of his own brigade, so there is no difficulty about them. But it is very improbable that his Advance Guard orders would have been "Dictated to representatives of units concerned" at 7.30 p.m.—as they were theoretically—or that the ½ Squadron of Lovat's Scouts could have received their orders, and retraced their steps in the dark to the starting point, and been ready to start at 5.14 a.m. the next morning.

The point is, that theoretically the G.O.C. was right in leaving Colonel Z—— to arrange his own order of march; but practically, in cases of this sort, it would be better for the superior to detail the order of march, and let the subordinate take over the force he has to command as a going concern when it marches off in the morning. There would then be no difficulty, as the G.O.C. has orderlies going to the commanding officers of units, in any case, with his orders; and he also knows the requirements of the case better than Colonel Z——; and Colonel Z——will sleep more comfortably.

THE MAIN OBJECT.

In conclusion the following are some of the remarks made by the General Officer Commanding-in-Chief in Scotland in 1905.

"The main object of a Staff Tour is, of course, to prepare Officers for war by bringing home to them some of the points with which they would then have to deal.

In the present instance, seeing that perhaps 90 per cent. or more of the Officers engaged had little or no previous experience of these exercises, the General Officer Commanding-in-Chief also wished to demonstrate that a Staff Tour is not a thing to be avoided for fear of showing up one's ignorance, but rather an opportunity to be eagerly seized for increasing one's knowledge and experience, as far as this can be done under peace conditions, without fear of ridicule or harsh criticism."

The main object was attained as far as I was concerned, and I learned more in the inside of a week on a Staff Tour than I learned during the rest of the year on other peace training.

MEMOIRS.

MAJOR E. W. HUMPHRY, LATE R.E.

"ON the 6th instant at the Royal Hospital, Chelsea, Edward Wood Humphry, Major, R.E., aged 74."

The above notice appeared among the deaths in *The Times* of the 8th June. To the greater part of the readers of *The Royal Engineers Journal* the name of Edward Wood Humphry can be little more than a name, so many years had he been a recluse in the Chelsea Hospital.

But those whose first commission was in the Bengal Engineers, those who remember the stirring days in Northern India in 1857–58, who remember Duncan Home and Philip Salkeld, Elliot Brownlow and Pat Stewart, they can hardly forget the tall slender figure of Edward Humphry: delicate from the day he landed in India, with a serious rather sad cast of face, but full of high courage and soldierlike instincts.

Humphry went to India in 1854, and was sent up to Rurki and thence on to Lahore and Peshawar.

From the frontier he was summoned in 1857 to join the army before Delhi, but the city was captured before his arrival, and he was sent out with a column under Major-General Showers to the Riwári District to hunt down the rebels and restore order. The forts of Jhujjar, Riwári, Kanauj and Balabgurh were captured by this force and destroyed, Riwári being blown up with the enemy's gunpowder. The only other Engineer officer with this force was Lieut. E. T. Thackeray, then a young subaltern, now Colonel Sir Edward Thackeray, V.C., K.C.B. They had no trained sappers with them and their work was very arduous.

After Showers returned to Delhi, Humphry was attached to a column under Colonel Gerard, and while on the march, in an encounter with the enemy near the village of Narnaul, he was acting as his orderly officer. In the column was a newly raised regiment of Pathan cavalry, who happened just then to have no English officer to command them. Humphry was sent to order them to charge, and seeing some hesitation among the troopers he placed himself at their head and bore straight down upon the enemy. The Pathan is not generally devoid of courage, but whether it was that they were recruits, or that they did not recognise who Humphry was, they stood fast, and allowed the gallant fellow to charge alone. He was

knocked off his horse and received innumerable sabre cuts, but was fortunately rescued ere it was too late. An effort was made afterwards to get him the Victoria Cross, but unfortunately when he was fighting for his life Gerard himself was mortally wounded and there was no one to recommend him.

After Colonel Gerard's death Sir Thomas Seaton took command of the column, and Thackeray was sent out from Delhi to take Humphry's place while he was recovering from his wounds. This took some time, but he was sufficiently recovered to go into Lucknow with Lord Clyde, and to serve through the hot weather campaign of 1858 in Rohilkhand. It was after this campaign, in July, 1858, that I first joined the Sappers at Rurki and made Humphry's acquaintance. He was our Adjutant, always well mounted and correctly dressed. He was full of kindness to us "griffins"; and when, two months after, the Sappers were ordered on service again and I had very few rupees wherewith to buy a tent, he gave me half of his one, and I shared it with him for some months.

Ours was one of several Brigades sent out with the object of clearing the rebel mutineers out of Oudh and driving them across the river into Nepál. Their forces were broken and there was not much fighting left in them, so the Sappers were soon sent back to Rurki and my connection with them ceased.

Humphry continued for several years as Adjutant of the Sappers, but he never recovered the shock of his wounds, and he suffered frequently from fever and dysentery. At last he was granted sick furlough, and according to a common practice at that time he went to Australia and Tasmania instead of going straight home. This was probably a serious mistake, for he required the best doctoring and nursing available, and it was not easily to be had in those days in the Colonies. Humphry was never able to return to India. For some time he acted as Secretary to the Royal United Service Institution, but even that work was more than he could accomplish, and in 1870 he was appointed Captain of an Invalid Company at the Royal Hospital.

There he remained for 37 years or exactly half of his life. At first he kept a horse, and was fond of riding. Then he used to take exercise in a hansom cab, but for many years past he was confined to his quarters. His health was wretched all this time. He underwent several serious operations, and the marvel was that he lived at all. At times he suffered great pain, but he never grumbled.

He read a great deal, especially of military subjects, and took a warm interest in all questions of his old Corps. It was a great pleasure to him when an old Indian friend looked him up, but latterly he had few visitors.

One piece of good fortune he did have, in the tender care with which for many years he was nursed by a very good and faithful

servant, Rebecca Hollander. But for her he must have died long ago.

Living in the neighbourhood I used generally to see Humphry once a week, and I seldom left him without feeling I might never see him again. Last January I went abroad for four months, and when I parted with Humphry he said to me "I cannot say I hope to see you again, for I hope I may be at rest before then." But I found him still alive on my return, although confined to bed, and in continual discomfort if not suffering. It was touching to see his patience and submission to the divine will. He rarely spoke of religion, but his simple faith was that of the centurion: when the Great Commanding Officer spoke the word his servant would be healed. Who can blame him that he longed for that word? He said to me once "I hope it is not wrong to wish to die." When the order for release came at last I am sure that those who loved him were thankful.

COLIN SCOTT-MONCRIEFF.

MAJOR-GENERAL C. T. HAIG, LATE R.E.

CHARLES THOMAS HAIG, who died at Southsea on June 29th last, was born in 1834, and was educated at the Kensington Grammar School. In 1852 he won an East India cadetship, which had been offered by Sir Henry Willock, a director of the East India Company, as a prize to be competed for by the Kensington boys, and it was this success at school that led him to enter the army.

Haig joined the Military College at Addiscombe, and in the final examination he passed out third of his batch, Jeffreys being first and Clem Browne second. His commission in the Bombay Engineers was dated 8th June, 1854. After two years under instruction at Chatham he sailed for India, and landed at Bombay on 5th July, 1856, the hottest time of the year. On arrival in India he was appointed to the Bombay Sappers and Miners at Poona.

At the end of 1856 war was declared against Persia, and the Government of Bombay was called upon to despatch a force to the Persian Gulf. Sir James Outram was appointed to the command, and the force assembled in Poona in November, 1856. The Bombay Sappers and Miners were directed to join Outram, and Lieut. Haig was placed in command of a company. Outram's force embarked from Bombay on 19th January, 1857, and landed at Bushire in the Persian Gulf fourteen days later.

Without any delay Outram marched inland, and met the Persian army fifty miles from the coast. On 8th February, 1857, the Battle of Khooshab was fought, the Persians being completely routed; Haig was present throughout the action.

After this victory Outram returned to the coast, and re-embarked his force at Bushire. Two days later his fleet of transports entered the mouth of the Euphrates. Outram now decided to attack Mohumrah, the Perso-Arab city that stands at the confluence of the Euphrates and Karun. On the morning of March 25th the sloops and frigates bombarded the town, mortars being fired from rafts; at 9 a.m. Outram decided to land, and by 2 p.m. the whole of his force had disembarked. After the advance on the town had commenced, numerous dry creeks became filled with water by the incoming tide, and these impeded the movements of the artillery and stopped communication between columns. But the Persian opposition was feeble; Outram's assault was crowned with success, and by evening the town of Mohumrah was in possession of the British Army. Haig was present with the Bombay Sappers at the bombardment and capture of Mohumrah.

He returned to India with his Corps in October, 1857, and subsequently received a medal and clasp for Persia.

Twelve days after his return to Poona, he started in command of a company of Bombay Sappers to join the Rajputana Field Force. This force, under General Roberts, was advancing northwards into Rajputana to suppress rebellions which had broken out under the influences of the Indian Mutiny and of the fighting at Delhi and Lucknow. Lieut. Haig became staff officer to General Roberts. He was present at the Siege of Kotah and took part in the assault and capture in March, 1858.

In September, 1859, Haig was appointed to the Trigonometrical Survey, and joined the triangulation party in Kathiawar. Parts of Kathiawar were however in rebellion, and Haig served during the winter with the Okhamundal Field Force, which was employed in quelling disturbances. He was present at the Siege of Dwarka in December, 1859, and was wounded on the day the city was taken. For his services in the field he received the Mutiny medal with clasp.

From 1860 to 1866 Haig was extending the principal triangulation over western India. He showed himself an accurate and rapid observer, and acquired an intimate knowledge of optical instruments. On one occasion he was observing with the great theodolite from the top of a high tower, which had been erected for the triangulation; having finished his evening observations he retired to his tent, leaving the theodolite in position at the top of the tower. He rose early to get some observations at sunrise, but found that the whole tower had collapsed, and had buried the great theodolite in its ruins. Haig had not been responsible for the construction of the tower, and a committee of enquiry exonerated him from blame.

In 1864 an incident occurred, which, though Haig himself thought little of it, is worthy of mention in any notice of his career for the light it throws upon his character. Now a captain, he was proceeding

with two civilian assistants of the survey from Bombay to Surat in a steamer, the *Lowjee Family*, which was crowded with native passengers. A few hours out of Bombay the ship encountered a storm, and showed at once that it was leaky and unseaworthy. The skipper suggested to Haig that they should take to the boats, and that, as there was but little room, the native passengers should be left to their fate. Haig insisted that they must all sink or swim together. Having deposed the skipper, and assumed command of the steamer, he addressed the passengers and tried to allay their panic; he appealed to them to assist him, placed guards over the boats, and endeavoured to stop leaks and pump water out of the hold. He took the helm himself, and for a whole day steered only with the object of preventing the ship being swamped. His difficulties were increased by the presence of cholera amongst the passengers, and one of his European assistants contracted and died of the disease.

After thirty hours the storm began to abate, and Haig decided to steer for land; he did not know where he was, but felt sure he could strike the coast. When he approached the land, he ran the steamer ashore at high tide, and thus enabled the passengers to escape when the tide went out. Haig's sense of humour was so keen that he was unable to take seriously the eulogistic descriptions of his heroism that appeared in the Indian newspapers. The reflection that he might have committed an offence against the laws of navigation never troubled him; and the suggestion that his action in deposing a ship's captain might be held in law to be piratical only intensified his amusement.

In 1871 Haig was appointed to the charge of the topographical survey of Guzerat, and for thirteen years he superintended this work, the period covering his successive promotions to major, lieutenant-colonel, and brevet colonel. Guzerat is an immense area of flat wooded country; its survey presented difficulties, and Haig was led to adopt special methods and even to create a special school of topography. In after years he used to speak of his Guzerat school as a bad one for training, and as only applicable to flat forests: the substitution of traverses for triangulation, he would say, or of chaining for plane-tabling was hateful.

It may be questioned now whether his criticisms of his own school were fair. Methods of survey must be adapted to suit the countries under survey, and no one method can be laid down as universally applicable. Triangulation and plane-tabling may be scientific, but in flat forests they are not practicable. In order to triangulate wooded plains a surveyor must either raise himself and his instrument by trestles above the tops of the trees, or he must cut innumerable lanes through the forests. But neither the one alternative nor the other will be practicable, so long as the time and cost of a survey have to be limited. Many of Haig's successors in India, who have

started with his objections to traversing and chaining, and who have determined to carry triangulation everywhere, have found themselves beaten by wooded plains and driven to follow the Guzerat methods.

In Guzerat Haig had to face another problem of survey, which has tried the ingenuity of many. The settlement department of Bombay had made chain surveys of Guzerat on a large scale before Haig's topographical survey had begun. The Government objected to the whole country being surveyed twice, and Haig was instructed to utilise the settlement's surveys in the preparation of his topographical maps. He found that the settlement maps had been designed to indicate fields, holdings, and village boundaries, which were of no topographical value; but that they had omitted hillocks, mounds, ravines, and variations in slope, which constituted the main features of topography. Haig was in entire agreement with the principle that it was waste of money to make separate surveys of the same country for revenue and for topographical purposes, but he never succeeded in devising an acceptable scheme of combination. Full of hope and resolution he had attacked the problem, but he failed to solve it.

In 1881 Colonel Haig was appointed one of the British commissioners at the International Congress of Geography, which assembled at Venice. In 1884 he became head of the trigonometrical branch of the Survey of India.

He became substantive colonel in November, 1886, and major-general two years later. He left the Survey in 1889, and in April, 1891, he retired after nearly 37 years' service.

General Haig married in 1864 Katharine, daughter of Mr. J. N. Walker, of Bedford, and leaves two daughters.

In his religious views General Haig belonged to the sect commonly known as the Plymouth Brethren. He had studied the Bible in Hebrew and Greek, and his knowledge of it was profound.

TRANSCRIPTS.

COAST DEFENCE *VERSUS* SHIPS.*

THE subject of coast defence has of late aroused much attention in military circles. This is satisfactory as showing that the importance of the question is beginning to be realised, and that coast defence is coming to the front at last.

The combat between forts and ships may be regarded (*a*) from the artillery point of view, (*b*) from the purely tactical point of view. The two questions are closely connected, since the result of tactical undertakings against defended harbours usually depends upon the fire effect of the forts upon the ships and vice versâ. But there are many possible cases in which one of these two factors, fire effect and tactics, may so far outweigh the other that the minor factor may be neglected. From the higher military standpoint we have to consider the total result rather than the component factors which affect it. The discussion of such cases would carry me beyond the limits of the present essay; so I will therefore confine myself to the separate discussion of the two factors. But it must be borne in mind that in actual war the two factors will have to be considered in combination.

(*a*). FIRE EFFECT.

The fire effect of artillery depends principally on the striking energy and on the probability of hitting.

As regards the first, the artillery armament of coast forts is designed to serve the same purpose as that of naval guns, namely to attack ships. We may therefore assume that the high-velocity guns of the ships and of the forts are of the same power, and we may confine our attention to the probability of hitting.

Assuming that the guns on either side are in all respects equal, there is one important matter which affects their relative probability of hitting, and this is their command or relative height above sea-level. The accuracy of a gun is measured by its 50 per cent. rectangle; but the rectangles of two similar guns, opposed to each other, are only equal when both guns are on the same horizontal plane. When, as is usually the case, the fort guns have greater command than the ship guns, so that the latter shoot upwards and the former downwards, then they cease to be on equal terms.

The target of a ship gun is the gun emplacement and the adjacent blinded

* Extracts from an article by Major S. Mielichhofer, Austrian Artillery, in the *Mitteilungen über Gegenstände des Artillerie-und Geniewesens*, January, 1907.

cover, both of which constitute horizontal targets. To compare these with that afforded by the ship, we must reduce the latter to a horizontal target; that is, we must consider it as the projection of the exposed portions of the ship upon a horizontal plane, namely the surface of the water. For practical purposes we may neglect the lateral dispersion and consider only the 50 % length zone. This zone must be calculated not with reference to the horizontal plane passing through the muzzle, but with reference to planes above and below the muzzle, namely the fort emplacements and the water-line of the ship respectively. For our present purposes it will be sufficient to assume the principle of the rigidity of the trajectory, to take the 50 % length zone in the plane of the line of sight, and to reduce this to its projection upon the horizontal plane passing through the point of impact.

It is evident that when firing downwards the actual 50 % zone is shorter than the theoretical zone measured along the line of sight; whilst when firing upwards the reverse is the case. In other words, firing downwards increases the accuracy of a gun, while firing upwards decreases it. This gives the gun in the high-sited fort a certain advantage over the gun on the ship.

On further consideration it will be seen that the value of this advantage is not only a function of the angle of sight, due to the command of the battery, but also a function of the range. That is, in the case of the fort gun the longitudinal dispersion, or error, is reduced by the height of the fort but increases with the range. In the case of the ship gun, shooting upwards, the longitudinal dispersion is immoderately great at short ranges, and then decreases as the range lengthens up to a certain point, after which the normal error of the gun predominates over the modifying effect of the angle of sight. (The writer supports this statement by a Table which gives the length of the 50 % zone for a Krupp 28-c.m. (11-inch) coast defence gun at different ranges and different heights above sea-level). This table shows that the most favourable range for ship guns against a battery 25, 50, or 80 mètres high is 4,000, 5,000, or 6,000 mètres respectively. At these ranges the error of the ship guns is least and that of the fort guns is greatest; in fact the former does not much exceed the latter. At greater ranges the error of the ship guns further increases and places them at a still greater disadvantage with reference to the fort guns.

Assuming, then, that the command of the fort is within the ordinary limits of 25 to 80 mètres (82 to 262 feet) above sea-level, then the best fighting distance for the ships will lie between 4,000 and 6,000 mètres. As an instance, we will take a coast defence battery with 4 heavy guns; this may be considered as a gun-platform with an effective depth of 20 mètres, including the crest of the parapet, and any hit on this area would seriously affect the working of the guns. But few coast batteries would offer such an extent of vulnerable area. As against this we will take a ship with a free-board of only 4 mètres (a very low estimate) reduced by calculation to a horizontal target at the water-level. (The author gives a Table of the length of the dangerous zone, corrected for height of gun above sea-level, for different ranges; the virtual length of

the horizontal target formed by the ship; and the percentage of hits which would in his opinion be made under service conditions, viz. about ¼ of the theoretical percentage). From this Table two facts may be deduced. The first is that, as already deduced from the 50% zones, the best fighting range for a ship is from 4,000 to 6,000 mètres, according to the height of the fort. The second is that, as the range increases, the percentages of hits made by the fort gun and the ship gun tend to approximate. This is only natural, since as the range increases a given difference of height becomes of less importance; at an infinite range the ship and the fort might be considered on the same horizontal plane.

From the naval gunner's point of view it would be a mistake to consider only the chance of being hit by the fort. This would mean fighting at extreme ranges, at which the ship would make but few hits. What is required is to determine a fighting distance at which the ship will make a tactically sufficient percentage of hits, while the percentage made by the fort will be sufficiently reduced. And this distance lies between 4,000 and 6,000 mètres (4,400 and 6,600 yards).

Several writers have recently advocated an opposite policy, namely that the fleet must dash forward rapidly to close ranges of 2,000 to 3,000 mètres. It is contended that, if they can succeed in maintaining themselves at this close range, the effect of their fire upon the forts will be decisive with the greatly increased power of modern guns. As we have seen, from an artillery point of view this contention is unsound. For not only would this course increase the relative percentage of hits made by the fort, but these hits would be more effective owing to the increased penetrative and destructive effect of the fire at close ranges; and this would seriously reduce the attacker's effective force in the final stage of the combat, namely forcing the inner line of the enemy's defences.

On the other hand, it will be the duty of the coast defence artillery to prevent the ships from maintaining themselves at the above determined favourable range of 5,000 to 6,000 mètres. And this will have to be effected principally by howitzer fire, since at 6,000 mètres even heavy guns will hardly penetrate armour. Generally speaking, the duty of flat-trajectory guns will be to support the howitzers. Since they cannot hope for any great effect from each individual round, they must endeavour to secure effect by making a large number of hits.

During this distant phase of the combat auxiliary coast-defence guns will have plenty to do. For battleships expose a great surface of vertical unprotected side, and complete armour protection is still considered an impossibility. Even if any Power were to introduce complete armour, yet its older ships would remain long enough in the service to afford a field of utility for existing medium-calibre coast defence guns.

(*b*). TACTICS.

This is a purely naval question. If the fleet endeavours to approach to close range and thence to pour a great volume of fire upon the forts, it is probable that the ships will strike the outer edge of the zone of

mines. It is idle to neglect this possibility and to base naval tactics upon a hypothesis of clear water. In order to advance to the close-attack position the minefield must first be swept clear; and the process of clearing the minefields must be simultaneous with the fight for the close-attack position, which fight will be carried on from the most favourable artillery position as defined above.

Clearing the minefields to secure a safe approach is one of the most difficult and dangerous operations which the Navy is called upon to execute. When the channel is cleared it would be a gross violation of tactical principles not to utilize this success at once for the true object of the attacking fleet; this object is the destruction of the enemy's ships in harbour, not the attack of his coast defences. The latter is merely an incidental combat in which it is necessary to engage, in self-defence, until the channel into the harbour has been cleared.

This is confirmed by the tactics of the Japanese fleet before Port Arthur. In this case, both on account of the difficulties of the channel, and because the Russians had not yet assembled the whole of their naval forces at the theatre of war, there was no question of forcing an entrance. It was necessary either to force the ships in harbour to come out and fight, or else to destroy them in harbour by siege artillery fire. Consequently Admiral Togo took very little notice of the coast defence forts.

The tactics of an attacking fleet may be summed up as follows:—As soon as a sufficiently wide channel has been cleared through the minefield, the fleet must advance straight from the 5,000-mètre position to attack the ships in harbour. It is useless to stop and fight the forts at close range, for two reasons: firstly, because, as we have seen, such an attack is less effective than an attack from 5,000 mètres; secondly, because such a proceeding is a mere waste of time. At this critical moment the attacking Admiral must have only one object in view, namely the destruction of the enemy's ships; he must absolutely disregard the coast forts and their guns.

FIRE EFFECT AND TACTICS COMBINED.

If we now consider the factors of fire effect and tactics in combination, we find that they are in no way opposed to one another. Artillery science shows that the ships should fight at a range of 5,000 to 6,000 mètres from the fort, and that their fire effect suffers if they fight at closer range. Tactical science shows that it is a waste of time to take up a second position at close range, and that the advance should be from the main fighting position straight into the harbour.

There is another point which affects the tactics of the attack. Under normal circumstances the ships can only reckon upon a small percentage of hits on high-sited forts or even on forts at a moderate height above the sea. It is improbable that they will be able to destroy or completely silence the forts. The ships carry comparatively few rounds of ammunition, and this is difficult to replace. Therefore the duel between ships and forts is not a battle fought with the object of destroying the

forts, but rather an operation undertaken to prepare and to cover another operation of the fleet, namely clearing the minefields. By engaging the forts and drawing their fire the attacking ships endeavour to prevent the forts from interfering with the clearing of the channel.

From the defender's point of view it would be a mistake to concentrate the whole power of the defence on the duel with the ships; the most important phase of the fight is the defence of the minefield.

From these premisses we may deduce the extent and nature of the defensive armament of a harbour which has to be defended. We must first consider the attacking force of our probable adversary, the construction of his ships, and the number and power of his guns. We can then calculate the probable number of hits that he will be able to make; and we must then arm our defences so that our forts can make at least an equal number of hits in order to maintain their superiority. Knowing the probable percentage of hits that our own guns will make, we can calculate the number of guns that we shall require to engage an adversary of given strength. This question, and the allotment of guns of different calibres to the defences, must be dealt with in a separate essay.

THE CRISIS IN FORTIFICATION.*

THERE has been a considerable amount of correspondence in the French Journals recently as to the actual value of the fortifications on the German frontier, in view of the power of artillery firing high-explosive shells. M. Lanessan, the late Minister of Marine, advocated their strengthening by a liberal use of concrete and shields. General Langlois, replying in the two following letters, gave his views on modern requirements.

Sufficient account does not appear to be taken of the material obstacle of a good ditch well flanked by counterscarp galleries and caponiers. These defences were found nearly impossible to destroy by bombardment at Port Arthur, and should give the required check to the assaulting infantry after the bombardment has ceased.

A barrier fort should only be constructed at a vital point; and then its purpose would be fulfilled if it delayed the enemy's movements by making it necessary for him to accumulate ammunition and develop a regular attack.

A comparison with Ch. IX. of the first (1890) edition of Sir George Clarke's *Fortification* is interesting.

E. G. GODFREY-FAUSSETT.

I.—(*a*). EVOLUTION OF THE DEFENCE OF FORTRESSES.

There has not been any revolution modifying abruptly the conditions of war, either in battle or in siege operations. But there is constantly an evolution more or less slow, and very steady, which permits a judicial mind, endowed with a certain amount of perspicuity, to predict the future by a study of the past.

By not having thoroughly comprehended this evolution we have made mistakes in the past, the country is alarmed, and in our fear we are perhaps going to make mistakes quite as serious and much more costly than those already made. This can be explained by taking two examples.

Immediately after the war of 1870–71 France, in her depression, took steps to protect herself by creating a regular wall of China on the menaced side. This was fatal from a psychological point of view: it is like a beaten dog who hides himself behind a piece of furniture and thinks himself safe. We then established on the Eastern frontier a regular system of fortresses, including the great entrenched camps of the first line (Belfort, Epinal, Toul, Verdun), which were intended to bar the principal routes of invasion, and to leave passages that would be the only means of approach for the enemy and could be easily defended by our field armies with their flanks well supported. This idea was a very good one.

* From articles in *Le Temps*.

But we have added to this system by joining up these fortresses, Belfort to Epinal and Toul to Verdun, by a series of 'barrier forts' with the idea of barring all the secondary approaches. This was an error. In point of fact, when we built these forts, we ought to have foreseen that the defence of such shell-traps, held by weak garrisons incapable of action in the field, would be impossible for more than a short time; high-angle fire with large projectiles had already given a death blow to poorly-protected forts, and we ought to have foreseen the effects of high explosives, for their study had begun; but we took no heed. Now we see, late in the day, that our barrier forts offer a most precarious resistance, and we are asking for millions to bring them up to date; to do this would be as ruinous as it would be unfortunate, and the more deplorable as there is great need of more urgent expenditure elsewhere.

As to the entrenched camps, pessimists, who have not understood the remarkable evolution in fortification, and who hold the idea (which is correct from a certain point of view) that it is easy to paralyse one or more of the forts of an entrenched camp, conclude that our fortresses have no value.

This error arises from the fact that they do not understand that field fortification tends more and more every day to become a substitute for permanent fortification. Forts, since they have become very vulnerable, no longer constitute the solid groundwork on which the defence is based; the nature of this groundwork has changed, and it now chiefly consists of the light works for infantry and artillery which lie between the forts. A large fortress, and a strong one too, can now be made without any of these forts with their costly steel shields and concrete. And why? Because:—

1. The perfection of firearms, especially the rifle, has given to ordinary field fortification an extraordinary power of resistance, due to the fire, not to the obstacle.

2. These light fortifications escape to a great extent the effects of the artillery of the attack, not because they are strongly built, but because they are so extended. They present so great a surface that to break down the defence an enormous amount of ammunition would be required.

3. Permanent fortifications, on the contrary, consisting of forts of high profile but of small area, can offer only a feeble resistance to large shells charged with high explosives.

Such is the evolution which many people cannot even yet see clearly. In 1877 the fortress of Kars, defended by a strong garrison well provided with artillery, was stormed by the Russians in a single night; and at the same time Plevna, an open town rapidly transformed into an entrenched camp by field fortification only, held the Muscovite armies in check. These events ought to have made such people reflect, and to have opened their eyes; but there are none so blind as those that won't see.

To make myself clear I will set forth the stages of the evolution which has occurred in the defence of fortresses.

Before the invention of powder, a simple keep, of small area but fairly high and of good masonry, with a small and nearly passive garrison,

defied the assaults of an attacker who was unable to destroy the material obstacle, namely the wall.

Directly artillery became powerful enough to menace the walls seriously, the defence could no longer rely on the obstacle, but had also to consider fire. Then fire, to utilise its power, demanded extended ramparts; fortification began to grow; and works developed into polygons with long sides.

When a breach was made by guns it became difficult to defend it directly. There occurred to the defenders the idea of placing behind it a simple rampart of earth, like a field work, well equipped with muskets and guns; as soon as the enemy reached the breach he was received by a vigorous fire immediately followed by a counter-attack with cold steel. It was thus that fortifications, which had already been lengthened and lowered, had to gain depth.

At the same time, thanks to the help of the guns on the ramparts, the besieged began to make themselves felt outside by short sorties within the range of their own guns; the theory of operations outside the fortress was born; this was remarkable later at Belfort in 1871.

Lastly, the increasing range of the attacking artillery forced the artillery of the defence forward, so as to keep the fortress itself out of fire; and advanced works were made, which were gradually moved further out, and are known as 'detached forts.' The fortress is now an 'entrenched camp,' whose perimeter tends constantly to increase.

(*l*). BARRIER FORTS.

This continuous evolution, caused by the growing development of fortresses, becomes faster or slower according to the rapidity of progress in armament. At present it is very rapid; for that reason it is perhaps the more difficult to grasp. It condemns in the most decided way the use of small isolated forts, without operations outside the fort. This law of evolution was not comprehended when Barrier Forts were built in France.

In order to protect personnel and matériel from the effects of artillery fire traverses and parados have been multiplied; but these protecting screens have now become a veritable danger from the high-explosive shells instead of a protection. In point of fact these shells, when they strike (say) a parados explode there, and act like a large fougasse, of which the projectiles, stones and splinters, cover like a shower of shrapnel the infantry banquettes and the gun emplacements. If they fall on a traverse the great shells sweep away everything between two neighbouring traverses. It has been hoped to give a certain value to isolated forts by placing garrison and matériel under shelter in vaults protected by concrete or steel shields; fortification, after being made of low profile, has become subterranean. By describing what we believe to be the method of attacking one of these small works we will show the uselessness of concrete and steel structures in them.

Barrier forts are small isolated works, of an area suitable to the small size of the garrison (2 or 3 companies of infantry with a few guns) but nevertheless large enough to offer to the enemy's artillery a target which it cannot miss.

Take the most modern type of fort. The barracks are covered by great masses of concrete, and their doors open into narrow paths whose depths beneath ground-level depend on the thickness of the concrete; from these paths the defenders ascend the ramparts by ladders or ramps.

All the guns are placed in steel turrets, fixed or disappearing, bedded in very solid concrete. The gunners, in their turrets, see nothing; their target is given them by co-ordinates. For this purpose observers stationed in blinded look-out posts take bearings of points where targets appear, and indicate them by telephone to the battery commander, who is himself in a casemate; this officer transmits to the guns, also by telephone, the directions for fire, and the aiming is done mechanically.

Ditches surround the fort, and, to safeguard them, guns in casemates, placed generally at the salients, enfilade them throughout their length.

Here is our idea of the possibility of taking such a work by main force in a very short time, utilising only a field army with the addition of field howitzers of about 6" calibre. We will suppose that the attacking troops consist of one brigade of infantry, with 3 field batteries, and 3 batteries (12 guns) of howitzers throwing a shell of about 40 kilograms.

Once the troops are placed under cover, ready to assault, a heavy bombardment would commence, which could easily throw into the fort, each minute, at least

24 high-explosive shells from 6" howitzers
60 do. from field guns
60 shrapnel from field guns,

a total of 144 projectiles. So great is the intensity of fire that can be sustained so long as ammunition lasts. What would be the result?

Let us take the worst case, and suppose that the shields, the concrete, and even the observing stations resist this hurricane of projectiles; let us neglect also the effects of blast, and those of the poisonous gases from the mélinite shells. It will be admitted at once by anyone who reflects that it will be absolutely impossible for the defenders, while such a bombardment lasts, to do any useful shooting with gun or rifle. In fact the mask of smoke produced by the bursting of 60 shrapnel per minute along such a short front will prevent the observers from seeing anything; and even if they could see anything it would make little difference to the situation. One has only to consider how telephone messages are hindered by the least sound in a turret to realise that their use would be completely out of the question during the incessant uproar of 84 high-explosive shells falling in the fort each minute. The artillery of the fort would be annihilated; it would be blind and deaf.

As for the infantry, it would be quite impossible for them to come out of their cover while the intense bombardment lasted.

It follows that the infantry of the attack would have an excellent opportunity of approaching the fort and getting right up to the ditch. Not till then would the attacking artillery have to cease its fire so as not to touch its own side. This will be the moment for the infantryman to

come out of his cover. But he cannot get quickly up to the rampart to receive the assailants; the points of issue from the barracks are partly blocked by earth blown down by the explosions, the steps are destroyed; he must cross or get round the enormous craters made by the shells. So the attackers, who will have prepared and carried with them the necessary means for crossing the ditch, will be in the fort before the defenders have reached the ramparts. Then there will be bayonet fighting, five or six to one.

All the concrete masses that one could add would in no way change the situation; they would only make it more difficult for the defender at the moment of assault.

Therefore for us to incur any expense in bringing up to date our barrier forts would be pure folly. These works are incapable of resisting modern artillery, German or French, because they do not admit of operations outside. Their conception was false and illogical.

Nevertheless these forts can be utilised as *points d'appui* for an army which can fight on their line. There is no harm in keeping them, so long as no expense is incurred beyond that for necessary repairs. If the army should have to give battle on this side of their line, there must be no hesitation; the barrier forts should immediately be evacuated, and demolished if possible.

One of our barrier forts however has no *raison d'être* at all, I mean Manonviller, which is completely isolated and at a spot where the enemy can arrive about the same time as ourselves. This fort should be destroyed at once, for it can only serve to place in the enemy's hands an easily gained trophy, without having done any good.

To the assault which we have just discussed the objection might be raised that it would be very costly in ammunition. In certain cases it would probably be possible to reduce this; moreover, even under the above conditions it would not be excessive. Let us count it up. When we examine the greater number of the barrier forts we find that the attacking infantry could get, under cover, near enough to reach the fort itself in a march of ¾ hour, or an hour at most, often in much less time. It would be necessary then to carry on the bombardment for an hour, say 1½ hours or 90 minutes. This would correspond to a weight of 215 tons of ammunition, or the load of one ammunition column, not more.

Evidently one could do it more cheaply; but it is better to take precautions, and one must not forget that every untimely economy of ammunition means expense in men. In an enterprise of this nature it is preferable to expend a large sum so as to ensure success with the least loss of human life.

To sum up, as far as isolated forts, such as our barrier forts, are concerned, M. de Lanessan is perfectly right: fortification is vanquished by artillery; but not French fortification by German artillery in particular; the fact is general. If the Germans had these barrier forts, they too would be vulnerable, just as weak as ours; but they have not got any. With them the engineers have been more foreseeing than with us, unless, as is more probable, the higher authorities have decided the matter.

II.—ENTRENCHED CAMPS.

A modern entrenched camp is composed of a main work, around which, at a distance of about 3½ miles, are placed large forts, which are at least 3½ miles apart from each other. These forts are strengthened with concrete and steel, and armed with heavy ordnance, *e.g.* 6″ guns in turrets. Individually, each fort would be as weak as a barrier fort; but what modifies their military value is that the troops of the entrenched camp can operate outside them.

Outside the forts there are, firstly, in the intervals between the forts, a whole series of works:—

(1). A large number of batteries. Some, on the crests, are armed with guns specially designed for the close defence. Others, behind the crests, well masked from the enemy's view, are armed with powerful guns or howitzers which can come into action with indirect fire during every phase of the siege.

(2). Works for infantry made in advance. These are nearly invisible it is true, but can be located by the enemy in time of peace.

(3). A very great number of temporary trenches, or simple field works. These trenches, which are almost invisible, are protected by an immense network of wire entanglements, which nowadays can be placed over a great area in a short time.

Such is the principal line of defence, the strength of which is not localised in the forts.

Secondly, in front of this, resistance will be made on a first exterior line, 1½ miles in front of the forts, and organised with all the resources of field fortification. This line derives its strength partly from the fire from the rifles and guns which defend it directly, and partly from the help of all the artillery of the forts and the intermediate batteries. In this way is utilised the difference of range between gun and rifle, as was done so well by Denfert-Rochereau at Belfort. In one word *fire* has become the principal means of defence.

What then, in this first period of the siege, can the heavy field artillery of the attack (howitzers of 6″ and mortars of 8″ calibre), with their maximum range of 6,500 yards, do against the forts? Nothing, or next to nothing. As long as the exterior line is held no serious damage can be done to the forts without long range guns, that is, without a siege train. This is indispensable for another reason; as long as the guns of the forts and the intermediate batteries are not weakened, the exterior line, well defended by energetic men, can keep the attackers far off the main work. Possibly, indeed probably, the concealed guns will give the attackers more trouble than those in the forts.

The capture of the exterior line of defence is definitely a field operation, and we shall see later how little use heavy field artillery is in an operation of this sort. If the exterior line is broken at any point, the attacking infantry at once find themselves (so to speak) alone under the converging fire of all the batteries of the principal line of resistance, and are at the mercy of a vigorous counter-attack by the reserves. Also, if the defenders know how to use their reserves, and if their artillery know

how to seize the right moment for 'rafales,' the first line of defence will be taken and re-taken many times before the attacker gets definite possession of it. That is what happened recently at Port Arthur. During the whole of this phase long-range guns are essential to the attack. We could no more take Metz or Mayence with Rimailho guns than the Germans could take Toul or Verdun with their heavy field artillery.

After a greater or less length of time the exterior line will however be definitely taken by the enemy, who can then bring against the forts his heavy field artillery as well as his siege guns. Let us suppose that the forts are not only reduced to inaction, as we have seen in the case of barrier forts, but even annihilated, though that is perhaps an excessive hypothesis. Much is still needed before the place is taken; the enemy can only get there after having silenced the intermediate batteries, and stormed the infantry works and trenches which cover all the area. This will be very difficult for him, and will require a great effort. Masked batteries are very difficult to locate; artillery duels in Manchuria, when both sides were invisible, went on eternally without decisive result. As to the trenches, their safety from the guns lies in their great extent. In fact one must realise that the strength of resistance lies more in *invisibility* and in *extension* of numerous and relatively feeble objectives than in accumulation of concrete and armour. For the latter an engine of destruction will always be found which will get the better of them; they have never more than a transitory value of short duration, and do not justify their expense.

The time is not far off when it will be understood that, for concreted and armoured forts, it will be better to substitute large works offering long lines of trenches of light profile, well protected by large areas of obstacles, mutually supporting each other in depth, and well supported in rear by a large number of masked batteries. Here is a distinct piece of evolution which is disregarded by those who ask for millions for armour and concrete.

In an article in *Le Matin* M. de Lanessan does not explain the anomaly that one may be the enemy of armour in forts, but may wish for shields for field artillery. The explanation however is easy, and I personally take all responsibility for it.

Armour in fortifications has for its object the sheltering of personnel and matériel from explosive shells of large calibre; but, as we have seen in the preceding article, the only effect it has is to render the gunner deaf and blind; it has to be surrounded with concrete, and so offers an easy target to the shell. Also there always comes a time, as projectiles get more and more powerful, when they get the better of armour.

Applied to field artillery, shields are a logical consequence of absence of recoil. The object of the shield is to protect the personnel from shrapnel and rifle bullets, and a long time will pass before the bullet can pierce the shield. Shields almost entirely escape from the destructive effect of heavy explosive shells, because they present a small target, and would require for destruction an inadmissible amount of ammunition. None the less the shield will have had its day when it is met by a shell of

small calibre but high-explosive power, for then the destruction of a battery will not require an undue weight of ammunition.

We conclude from this study that our entrenched camps, even though inadequately armoured, as people perhaps wrongly maintain, are capable of long defence by a garrison of sufficient strength, firm, well provisioned, and well commanded.

Does this mean that our fortifications cannot be improved? Far from it; but, so as not to squander our resources, we must see that all our improvements obey the law of evolution that we have formulated. The most urgent needs are the following:—

(i.). To make a start with such of the works necessary for the defence of the first exterior line as there will not be time to construct after the arrival of the enemy before our frontier fortresses. This outlay is of supreme urgency. The expense is not great; it only means the purchase of a certain amount of land; the works themselves can be carried out by the garrisons; the practice in digging will be good for them.

(ii.). To have on the spot in the forts supplies of wire entanglement. This is also a comparatively small expense.

(iii.). To increase the supply of stores, particularly of filled shell, smokeless powder, and incendiary shells of small calibre.

(iv.). To increase the number of field guns. These should form the principal armament of fortresses, for they have to fight only against light field works or troops. The matériel exists, our old guns of 1890.

For the price of installing a single turret all the necessities we have enumerated could be provided.

Assault.—So far we have considered the regular attack on an entrenched camp, that is to say the attack when the assailants are only slightly stronger than the defenders. A few words on the attack without preparation—*i.e.* the assault—will perhaps not be out of place; anyhow they will make us realise what we have to fear and what to hope.

If one wishes to take an entrenched camp by assault—that is to execute in a short time a task which would take several months of regular siege—one must logically have greater strength proportionately to the time one saves; in other words it is necessary to obtain a crushing superiority. This should be well understood; some people do not see it in a true light. One must give credit for great courage to explain the untimely assaults of the Japanese against Port Arthur; for, *not having the necessary means for a regular siege*, they tried to carry the place by main force, *following the German method*. Here is indeed disconcerting logic. What! One is not strong enough to break down a defence in several months, and that is a reason for trying to do it in a few hours! If that is the German system it is a very dubious one, and it certainly is not ours.

There may be great advantages to be gained by storming a fortress; but let us not be deceived, it can only be done by making in a few days almost as great sacrifices as would be entailed by a prolonged siege.

The siege of Sebastopol was so protracted because the allies had not the requisite superiority; the attack only numbered 140,000 men against 115,000 Russians, 800 guns against 1,500. However, let us suppose that we had been able to pour into the town in two days the million projec-

tiles which were actually used in a year (1,100,000 to be exact): it is very likely that the fortress would have fallen in 48 hours. That would have been impossible with the small number of slow-firing guns which we used. Nowadays the rapid increase in the rate of fire facilitates more and more the sudden annihilation which is required for an assault. We can illustrate this in the following way.

With a regular army of several corps and all the necessary siege equipment we can rapidly press the defenders back on the line of forts; this cannot be effected without great sacrifices of men and stores. This done, and the enemy confined to his forts, we can quietly establish a series of siege batteries round the place, so that we can menace it all round at the same time; and we can collect the attacking forces, without their being discovered, in the section where we wish to attack. During this period, a matter of days not hours, we can bring an enormous quantity of ammunition to the batteries. It is only when all these preparations are made that we can overwhelm the fortress unexpectedly by a fire of indescribable brutality, under the shelter of which the infantry can assault. A fire of extreme violence is in fact the best shield for the attacking infantry. It must produce a real crushing effect, not only on one point, as in the attack of a barrier fort, but along the whole of a considerable front; and not only for an hour, but very possibly for several days.

We consider however that an assault is an economical method. In a regular siege the defence is given time, in the necessary pauses, to repair damaged fortifications, to fill and fuze shells, to re-stock the batteries, to reinforce the menaced section, etc. The defence generally counts much too much on being given times of respite; at each gun for instance there is kept only enough ammunition for a slow fire for one or two days. Under a heavy attack the artillery of the defence will run short of ammunition in a short time, and will not be able to bring up more. That is one of the reasons which makes possible the operation we are considering. That is why we insist on the necessity for increasing the provision of filled shell, *i.e.* shell ready to be fired immediately.

From what has been said it will be seen that, if the assault is an operation of some hours, its preparation demands many days, perhaps weeks. The length of time depends on the railways available for bringing up the ammunition and the means of transport from the depôt to the batteries.

REVIEWS.

CONCRETE-STEEL BUILDINGS.

By W. N. Twelvetrees.—($7\frac{1}{2} \times 5$. 10s. Whittaker).

This book is intended to be a companion work to *Concrete-Steel* by the same author, in which he dealt with the Theory and Practice of Reinforced Concrete Construction on general principles.

He now describes in detail various Buildings which have actually been constructed in this material in this and other countries. These buildings comprise dock sheds, railway goods stations, locomotive sheds, warehouses, manufactories, workshops, flour mills and granaries, hospitals, hotels, houses, churches, theatres, and public halls. The floors, walls, columns, and roofs are analysed, with special details peculiar to each building; so this small book contains an accumulation of data which must prove most valuable to those who may have to design similar works.

In some cases the dimensions are compared with those required for similar details in other materials, and the great adaptability of reinforced concrete to solve most varied problems in construction is impressed on the mind as one follows the descriptions of the buildings brought under review.

A valuable chapter on the causes of failures which have been from time to time reported, and which have undoubtedly shaken confidence in this material, shows most conclusively that the failures have been due to ignorance and carelessness rather than to any weakness of the material itself.

The method and results of practical tests on the actual structures described are given, and these all go to show that, where employed with intelligence and under efficient supervision, reinforced concrete meets all the claims that are made for it.

The extent it is being used in this country may be gauged by the list of some 450 buildings which is given as an Appendix.

A good index makes reference easy, and completes a valuable addition to the literature on this subject.

J. Winn.

OFFENCE NOT DEFENCE; OR ARMIES AND FLEETS.

By CAPT. C. HOLMES WILSON, R.F.A.—(5 × 8. 169 pp. 5s. George Allen).

The author's object in writing this book is to show the interdependence between fleets and armies.

An island power cannot exist without a fleet. But unless it also has an army to defend its shores, the fleet will be hampered with coast defence duties, and cannot therefore fulfil its proper rôle—namely offensive action against the enemy's vessels.

Beginning with the fall of Carthage, the author shows that the command of the sea is only the first step towards victory; the decisive blow has always been struck on land. History teaches us that, no matter how overwhelming our naval preponderance may be, we cannot conquer until we take the offensive with our army.

J. E. E. CRASTER.

STATE RAILWAYS: OBJECT LESSONS FROM OTHER LANDS.

By E. A. PRATT.—(1s. P. S. King & Co., London, 1907).

Mr. Pratt has written several books on Railway matters, and in those concerning *The Organization of Agriculture* and *German v. British Railways* he has had a certain amount to say about such businesses as State undertakings.

The *brochure* under review aims more particularly at showing the results of nationalization of railways, with an eye to measures proposed to Parliament. Almost half the book is taken up, however, with a translation of a series of articles by M. Marcel Peschaud on the Belgian State Railways, in which that author has been at some pains to review the results of state ownership in that country as affecting the Public, the Employés, and the State. It may be remarked that he shows pretty clearly that they have been far from ideal: indeed, by way of contrast, he instances "the two principal industrial nations of the world, the United States and Great Britain, keeping to the system of ownership by Companies."

The question involved in this discussion is really that of individualism *versus* socialism, and takes the form of an argument by analogy and example as to the results to be expected should the system tried elsewhere be extended to our own country. Mr. Pratt makes it abundantly clear that, even supposing a maximum efficiency in operation were attained, it would be essential to have serious safeguards against political influence. Again, Government, in its capacity as a model employer, is at a disadvantage compared with a lay administration, which has a strong inducement to get the best financial results out of its business (Government is scantily grateful for savings, we know, particularly when it has "financial years" to reckon with) and is urged by the pressure of competition to make the most mutually advantageous bargains it can with traders. Experience

with or in Government administration leads to the conclusion that such control as a representative government requires implies a multiplicity of regulations, not readily varied to suit the kaleidoscopic changes of commerce. We have some recollection of an account of the complex system for control of Rates existent in France.

Even where the State merely owns and controls the lines its action in supervising the regulation of rates and conditions of working is apt to be very tedious and arbitrary. In Germany, and indeed on other Continental State Railways, the idea of favouring trade by manipulation of rates has resolved itself to some extent into encouragement thereby of certain classes and routes of traffic only—to the disadvantage of the small trader almost as much as in the U.S., where preferential rates to the great trusts are said to have done so much to facilitate their dominance. Government control, in fact, is apt to tend to partiality as compared to purely commercial working.

Political influence is often a very serious matter, both by reason of concessions urged for political reasons (to catch votes in fact), either in the direction of improved conditions for employés, lines to serve particular districts, or special services of trains, and in other ways. One notes that on Government lines it seems to take a larger staff, commonly at less rates of pay, to do the same work as on similar commercially worked lines. Equivalent efficiency is not proved.

In Colonies of course the conditions are not the same as in the more thickly populated Home countries. Lines are needed to develop the territories where private enterprise is not forthcoming, and, as has been ably pointed out, there is nothing like a railway line to accomplish the peaceful settlement of a new land and provide it with a permanent base of communications. But in many places the State has been guilty of enormous extravagance in the expenditure of large sums in making first-class lines at the outset, where railways intended to give a return on the capital expended would have been constructed—as across the Western States and Canada—as cheaply as possible at the outset, relying on increasing traffic to justify betterments. A large initial capital outlay must be something of a millstone round the neck of a Colony.

C. E. VICKERS.

FORTIFICATION:

ITS PAST ACHIEVEMENTS, RECENT DEVELOPMENT, AND FUTURE PROGRESS.

By SIR GEORGE SYDENHAM CLARKE, G.C.M.G., F.R.S. 2nd Edition.—(9×6. 18s. Murray).

Since the first edition of this book appeared in 1890 the point of view of an English writer on Fortification has materially altered.

Four considerable wars, in all of which land defences have had a part, have given us a mass of information on the design and use of fortification, with the result that many of the views that Sir George Clarke then

attacked with so much vigour are now extinct. He has consequently been able to omit parts of some of his earlier chapters, and to devote more space to the probable design of works in the future.

What originally aroused his wrath was the complexity given to the permanent works of fortification, which in his opinion was unnecessary or even harmful. To prove his case he adopted the historical method and showed that the more complicated works did not necessarily hold out longer than the simpler ones, and that sometimes a place attacked in modern days with weapons more powerful than those which it was designed to meet made a very good resistance. He thus demonstrated that the essence of the defence did not lie in the elaboration of the works but in the skill and determination of the garrison. As these varied, so did the works, in a greater or less degree, fulfil their purpose.

The new edition is divided into two parts, dealing respectively with Land and Coast Fortification.

The first seven chapters are devoted to the consideration of sieges in broad outline, beginning with those of Marlborough and Eugene and coming down to that of Kars in 1877, with a view to arriving at some idea of the real value of the different permanent systems compared with provisional works erected to meet the conditions of the moment.

In these chapters the author certainly proves his point, namely that much thought, labour, and money had often been devoted to non-essentials, that is, to refinements of trace and of construction which did not practically affect the duration of the defence; while roughly-made works, thrown up to meet an actual emergency, often did extremely well, as they conformed as closely as they could to the real requirements of the situation.

The eighth chapter deals with proposals for permanent works, which are mostly of the date of the first edition, *i.e.* 1890, when the dread of high-explosive shells was strong in all continental nations and cupolas and iron defences were much discussed and even largely used at Liège and Bucharest. Since then the H.E. shells have not done all that was expected of them in war. It was characteristic of the difference of attitude towards military subjects in England and on the Continent that, while there was much anxiety expressed at that time in France as to the condition of the frontier forts, in England no one appeared to care anything about the matter.

Chapter IX. deals with experiences in South Africa and at Port Arthur, and Chapters X. to XII. give the author's conclusions as to the effect of modern weapons and methods of war on the design of fortresses in the future.

The last six chapters are devoted to Coast Defence. Of these, Chapters XIV. and XV. respectively give an interesting sketch of the evolution of Coast Batteries and of Ships of War after the introduction of armour. The remaining chapters contain the author's views as to the use and design of Coast Forts. This is a matter on which he is specially competent to pronounce an opinion, as he was for 7 years Superintendent of the Royal Carriage Dept., during which time several great improvements were made in the mountings for coast defence guns.

Permanent Land Fortification appears now to be almost extinct in the British Empire; for though we have long land frontiers, yet for various reasons it is either unnecessary or undesirable to erect permanent works of defence along them. Temporary fortification, however, has become a part of the ordinary operations of war; and as the principles underlying both are the same, the constructive part of this book has from that point of view a practical interest.

Sir G. Clarke rightly avoids laying down any cut-and-dried design for a fortress. This must depend mainly on local conditions; but, speaking generally, he would put infantry redoubts, provided with good obstacles and bombproof cover, in the key points of the position; independent of these, he would build any magazines, bombproofs, and concrete emplacements which may be certain to be required; and he would attend very carefully to the communications, planting trees and hedges, where necessary, to conceal them. The filling in of the position with field works and trenches would be left to be carried out when the place is put in a state of defence.

He lays great stress on adequate supplies being provided and on matured preparations being made in peace time, such as mapping the ground around the place and making designs for the intermediate works.

He also points out, only too truly, that these preparations would be not less, but more, difficult than building elaborate forts. For one thing it would require complete harmony among all arms as to the best way of defending a position. Also much money would be required to purchase the land upon which to build scattered works and for making roads and plantations. One can speak from experience on this point, for screened communications are not altogether unknown in British fortresses. Also there is often great difficulty about getting adequate maps prepared. In fact, as Sir George puts it, "organization" comes first.

The construction and command of a fortress should be treated as a single and independent work to which the commander and his staff should be able to devote their whole attention and for which they should be responsible. Within reasonable limits of cost what they wish should be done; and they should be kept fully supplied with information as to the trend of modern improvements in material and organization. At present, away from the War Office, there is a thick fog in these matters.

With improved organization Sir G. Clarke's fortress might get built; without it, never—except under stress of war, when the possibilities are severely limited by the necessity of making the best of what one has got.

In the account of the siege of Port Arthur a slight error may be noted, as it has a practical bearing on one of Sir G. Clarke's leading principles, namely that of invisibility. At p. 118 he states that "Loopholes were largely used, and were sometimes combined with overhead protection." I think that for "sometimes" should be read "always." It was one of the most striking points in a view of the works to see the miles of trenches with overhead cover encircling the hills from one flank of the lines to the other. Invisibility undoubtedly suffered, but protection against shrapnel bullets seemed to be considered of primary importance. This is a case of practical experience. It must however be remembered

that the Russians did not aim much at invisibility in the case of their artillery and possibly did not trouble much about it for the infantry.

The advantages of invisibility are incontestable, particularly in connection with shrapnel fire, so it should be our aim to devise means of combining both forms of protection.

Sir G. Clarke is not fond of ditches as a defence; and it is no doubt true, as he says, that the entanglements used at Port Arthur, owing mainly to the want of suitable wire, were not so formidable as such obstacles might be made. It is, however, a fact that the only three forts which were attacked by mining were those provided with rock-cut ditches. The capture of these was only effected after the most desperate efforts had been made to storm them, during which some Japanese actually succeeded in entering them by means of scaling ladders, but were all shot down upon the parapet.

The description at p. 107 of the defences of Port Arthur gives an idea of greater completeness than was actually the case. The Russians had devoted most of their efforts to the east and north fronts; on the west Fort (*e*) was not quite finished at the end of the siege, while (E) and (F) were, I believe, hardly begun.

Sung-shu-shan, which the author classes as an intermediate work (*c*), was as strongly made as Erh-lung-shan (C) on its right, and was one of the forts attacked by mining. Although the two works were near one another they had distinct fields of action.

Port Arthur undoubtedly presents a strong case in favour of Sir George Clarke's contentions; namely, that permanent works should be simple in design; that a large amount of the defences may be thrown up when required, and thus made to conform to the tactical situation; and that the success of the defence mainly depends on the skill and determination of the garrison. The Russians had the determination in themselves and the skill in General Kondratenko. When he was killed they surrendered.

Turning now to Coast Defence there is little to object to in the general policy laid down in Chapter XIII. that for the British Empire only moderate coast armaments are necessary and that the 9·2-in. B.L. gun is the heaviest that need be mounted. The scale is not a very high one; but one could wish that it was generally carried out in practice. "The somewhat higher standard" which the author considers "is justified at Naval Bases such as Singapore and Hong Kong" is hardly attained; at least their defences are not up to the humble scale advocated in the preceding para. as applicable to all the Colonial ports which it is necessary to defend.

The recent reductions of the garrisons in the outlying portions of the Empire have left most of the ports incapable of defending themselves against a serious attack from the land side; this, as Sir G. Clarke remarks at p. 176, is the way in which Coast Defences almost invariably fall. Presumably the Admiralty consider that they can guarantee the safety of the ports until the garrisons can be reinforced. They should, however, take out additional troops at an early period of a war; for if, owing to any misfortune to the Navy, a port became open to attack, the reinforcements could no longer be securely transported to it.

It must have become very difficult to prepare satisfactory schemes of defence. With a half garrison, it might be best to abandon and blow up a fort which would be very useful if there were an adequate number of men to hold it; and in the uncertainty of what the actual fighting garrison would be, it might be very difficult to decide on the best line of action to adopt.

With regard to the withdrawal of submarine mines from the Coast Defences, we may agree with the author that the gun is in almost all cases a sufficient deterrent against ships attempting to enter a harbour, particularly when its inner waters are confined or tortuous; but where a vessel can run in at a high rate of speed, guns firing on interior waters should be provided. Ordinarily, ships would be too precious to risk on such an operation; but since there is now no absolute obstacle as there formerly was, the case might occur when it would be worth while to take the chance—for example, if there were transports in the harbour ready to attack an enemy's territory.

The author's last word is rightly on the supreme importance of organization in Coast Defence. This is a place in which absolute readiness to act at the very shortest notice is the only standard to aim at. An attack may come at the very outbreak of war, and constant practice is the only way to train the personnel.

We Engineers should welcome this book written on a matter which specially concerns us, by an author who has the art to make a technical subject clear and attractive and whose qualifications are known to the public. As he says, Fortification has long been treated as a mystery; and in consequence the most drastic changes can be made in our defences, and therefore in our state of preparation for war, without people generally having any idea whether they are good or bad. This is a very unsatisfactory state of things.

The ultimate political force in this country is public opinion; and if that opinion is non-existent or ill-informed on any particular point, there will not be a stable state of affairs with regard to it. It may result in the most momentous decisions being taken in a hurry, through some wave of feeling passing through the country. A book like this helps to inform those who are interested in the preservation of the Empire, and thus to create a body of thought which will tend to preserve a fixed policy in matters of fortification.

J. F. LEWIS.

NOTICES OF MAGAZINES.

ENGINEERING NEWS.

July 4th, 1907.

A REINFORCED CONCRETE BUILDING WITH SEPARATELY MOULDED MEMBERS.—At the works of the Edison Portland Cement Company, N.J., it was desired to enlarge the kiln houses by a ferro-concrete structure. The circumstances, however, required that the inside of the building should be kept clear of centring so as to allow of the simultaneous erection of the kilns with the walls and roof. A system of moulding the members and slabs separately, and erecting them much in the same way as a framed building, was therefore adopted. This of course implies that continuous reinforcement through the joints is not practicable; but the building is a simple one-storied affair with a flat or nearly flat roof. The methods of making the stanchions and girders are the most interesting features, and there are one or two points worth noting about the methods of erection.

The stanchions are square in section, each containing four twisted steel reinforcing bars, tied together by straight ties at short intervals. The top of each is splayed or bracketed out to carry the roof girders—it being necessary of course only in the case of the inside stanchions to bracket out on both sides.

The roof and floor slabs were first made flat on the ground. It was found that a floor slab, 7′ × 50′ 8″ × 8″, would form a convenient base on which to mould five roof slabs, 7′ × 10′ × 4″, putting 2″ fillets between each section, soaped paper being laid down to keep the surfaces separate.

It was similarly found that the stanchions and roof girders could be so laid out that the space between three stanchions on the flat left the right moulds for two girders, without any casing except to stop the ends, soaped paper separation again being used. Seventeen of the stanchions which had only one bracket each were moulded in fives, the spaces left between three others suitably separated sufficing as moulds for two more.

The stanchions were erected into pockets left in the concrete foundation blocks, and were raised by means of an eye-bolt let into the top of the column. All the columns were placed in position before any of the roof girders were lifted. In the first girders moulded no special means for lifting were provided, and consequently they had to be jacked up to get cramps under. Those subsequently moulded had eye-bolts put in.

The paper used to separate the masses of concrete in moulding answered its purpose well, but took a good deal of trouble in removing. It was found best to soap the paper just before commencing to concrete in.

C. E. VICKERS.

NATURE.

June and July.

THE SHAPE OF THE EARTH (*p.* 223).—Whatever the internal constitution of a planet may be, it is certain that, owing to the mutual gravitation of its parts, great stresses will be developed within it. Lord Rayleigh has shown that a homogeneous spherical planet, of the same size and mass as the earth, could not exist unless the resistance to compression of the material of which it is composed were at least half as great as that of steel. If the resistance were less than a quarter of that of steel (so that the substance was less compressible than mercury but more compressible than glass) such a planetary body would be unstable, both as regards concentration of mass towards the centre, and also as regards displacements, by which the density is increased in one hemisphere and diminished in the opposite hemisphere. No matter how small the resistance to compression might be, the body would not be unstable as regards any other type of displacements. If the resistance to compression were small enough for a spherically symmetrical state of aggregation to be unstable, the density of the superficial portions would be less than the mean density, and the centre of gravity would not coincide with the centre of figure. If the planet were at rest under no external forces, a shallow ocean resting upon it would be drawn permanently towards the side nearer the centre of gravity, so that there would be a land hemisphere and a water hemisphere.

The average resistance to compression of the materials of which the earth is composed can be deduced from the observed velocity of propagation of earthquake shocks, and it is found to be greater than that of any known material at the surface, a result clearly associated with the increase of resistance under great pressure. There is, therefore, no tendency to gravitational instability at the present time; but the actual excess of the mean density over that of surface rocks, and the fact that a very large proportion of the land lies within a great circle having its centre in South-Eastern Europe, suggests that the resistance to compression was once much smaller than it is now. This suggestion offers a possible dynamical explanation of the fact, that the centre of gravity does not coincide with the centre of figure, and the maintenance of the Pacific Ocean on one side of the globe is due to the eccentric position of the centre of gravity.

Other important causes have shaped the lithosphere, or rocky nucleus of the earth. The moon was once very near the earth, and the day and

the month were once nearly equal. The earth was then drawn out towards the moon into the form of an ellipsoid with three unequal axes. The direct result of the rotation and attraction of the moon would be to give to the lithosphere the shape of an ellipsoid differing slightly from the ellipsoidal figure of the geoid. If the centre of gravity coincided with the centre of the figure, the lithosphere would protrude from the geoid near the North and South Poles and in two equatorial regions at the opposite ends of its longest equatorial diameter.

Now it is known that the actual contour-line at mean-surface-level (1,400 fathoms below sea-level) divides the surface of the globe into two regions of equal area—the continental block and the oceanic region. The first is practically continuous, and there are two great ocean basins, one containing the deep parts of the Atlantic and Indian Oceans, and the other the deep parts of the Pacific.

The displacement of the surface as a whole is accounted for by the eccentric position of the centre of gravity, and this eccentric position must be regarded as a survival from a past state in which the resistance to compression was too small for a spherically symmetrical configuration to be stable. The ellipsoidal figure is accounted for partly by the rotation and partly as a survival from a past state when the day and month were nearly equal. The main features of the existing division of the surface into continental and oceanic regions can thus be traced to the operation of simple dynamical laws.

MARCONI-GRAMS FROM MARS (*p.* 203).—Mr. Marconi says that there is no truth in the statement, which has been freely published for the last year or two, that mysterious signals have been received at Cape Char from probably some distant planet. There is, in the first place, no wireless telegraph station at Cape Char. The stray or vagrant electrical effects, which do manifest themselves from time to time at wireless telegraph stations, are due to atmospheric discharges or other natural causes.

"REINFORCED CONCRETE" (by C. F. Marsh, *p.* 123).—This material is not used in this country to anything like the extent to which it has been employed both in America and on the continent of Europe, but much of the opposition to its use is now steadily declining. It is absolutely necessary to employ only the best material in connection with the concrete, and the materials must be of uniform quality and the concrete well and carefully made. Part IV. of this work deals with the practical construction of the necessary moulds for beams, floors, arched ribs, chimney shafts, pipes, sewers, and reservoirs. A full and complete account of the experimental researches and the data deduced therefrom, which form the basis of all calculations necessary in designing, is given in a convenient form. Photographs of many large buildings and handsome arched bridges are produced. Every engineer and architect who uses reinforced concrete on anything like a large scale will find this work a most useful book of reference. In 1890 the total production of concrete

in the United States was under half a million of barrels, whereas it is now about 30 millions of barrels.

August, 1907.

THE GREAT AFRICAN ARC OF MERIDIAN (*p.* 319).—Sir David Gill, of the Royal Observatory, Cape of Good Hope, in his recent address to the British Association, says that the completion of the Great African Arc on the 30th meridian has been the dream of his life. The gap in the arc between the Limpopo and Rhodesia has now been filled up. The German Government will complete the chain along the eastern side of Lake Tanganyika; and Capt. Lyons, who is at the head of the survey in Egypt, is engaged in carrying this arc southwards from Alexandria with energy and vigour. The arc when completed will extend from Cape l'Agulhas to Cairo, thence *viâ* the eastern shore of the Mediterranean, and there meet the triangulations of Greece itself, the latter being already connected with Struves' great arc, which terminates at the North Cape in Lat. 70° N. This will constitute an arc of 105° in length, the longest arc of meridian that is measurable on the earth's surface.

The standard of measurement, "the mètre," is *not* one-millionth of the earth's quadrant in length, as it was intended to be; it is merely a certain piece of metal approximately of that length, which changes by age, by temperature, and according to the azimuth in which it is used. For these reasons it is *now* described as a piece of metal whose length at 0° C. at the epoch A.D. 1906 is = 1,553,164 times the wave-length of the red line of the spectrum of cadmium, when the latter is observed in dry air at the temperature of 15° C. of the normal hydrogen scale at a pressure of 760 m.m. of mercury at 0° C.; the error in this determination is *within* one part in ten millions!

The discovery of the remarkable properties of the alloys of nickel and steel, and, from the point of view of exact measurement, the discovery of the alloy which we now call "invar," is specially valuable. Wires made from "invar" have the arrangement of their constituent molecules practically permanent, and may, with their attached scales, for considerable periods of time be regarded as nearly invariable standards. With proper precaution these wires can be used for the measurement of base lines of the highest geodetic precision at one-twentieth of the time and cost of the older forms of measurement.

STELLAR PARALLAX (*p.* 323).—To extend exact measurement from our own solar system to that of other suns and other systems may be regarded as the supreme achievement of practical astronomy. Our nearest neighbour amongst the stars, α_2 Centauri, one of the brightest stars in the southern hemisphere, has been found to have a parallax of 0″·76, or is distant about $4\frac{1}{3}$ light years; its mass is known to be almost exactly equal to that of our sun; and its spectrum being also identical with that of our sun, we may assume that it appears to us of the same magnitude as would our sun if removed to the distance of α_2 Centauri. But the average star of the same apparent magnitude as α_2 Centauri has a

parallax of only 0″·10; so that our sun, if removed to a distance equal to that of the average fixed star of the first magnitude, would appear to us but a little brighter than a star of the fifth magnitude.

Again, there is a star of only 8½ magnitude, which moves with a velocity of 80 miles a second at right angles to the line of sight and is about the same distance from us as Sirius, but it emits only one ten-thousandth part of the light energy of that star. Sirius itself emits about thirty times the light energy of our sun, but it, in turn, sinks into insignificance when compared with the giant Canopus, which emits at least 10,000 times the light energy of our sun. Proper motion rather than apparent brightness is the truer indication of a star's probable proximity to the sun. Every star of a considerable proper motion yet examined has proved to have a measurable parallax; hence the idea that the apparent parallactic motions of the stars, as produced by the sun's motion in space, can be utilised for determining stellar parallax. It has been shown that, at least for extensive parts of space, there are a nearly equal number of stars moving in exactly opposite directions. It may be assumed then that the mean of the peculiar motions is 2,000 for these parts of space.

As the distance of any group of stars found by the parallactic motion is expressed as a unit in terms of the sun's yearly motion through space, the velocity of this motion is one of the fundamental quantities to be determined. If the mean parallax of any sufficiently extensive group of stars were known, we should have at once means for a direct determination of the velocity of the sun's motion in space.

The material for this determination is gradually accumulating. But even with the comparatively scant material available, it now seems almost certain that the true value of the sun's velocity is about 19 kilomètres per second, corresponding to a yearly motion of the sun through space equal to four times the distance of the sun from the earth.

W. E. WARRAND.

REVUE DU GÉNIE MILITAIRE.

July, 1907.

AEROPLANES.—A continuation of the previous articles. The position of the centre of pressure varies with the velocity of the wind. Any change in the velocity of the wind tends to tilt the aeroplane and destroy the equilibrium of the system.

This can be obviated by attaching the car to the aeroplane by means of a bridle, one end being fastened to the front edge and one to the rear edge of the plane. The rear half of the bridle is made elastic, so that any sudden increase of wind pressure on the aeroplane causes it to stretch. The weight of the car is thus thrown onto the front half of the bridle, and

so transferred to the front edge of the aeroplane. This counteracts any tendency to tilt upwards.

The same result may be produced by utilizing the increased wind pressure on the body of the car. For this purpose the car is suspended from a curved rocker, which rolls forwards on the aeroplane as the car is swung back by the force of the wind.

An aeroplane may also be steadied in a variable wind by means of an automatic double horizontal rudder. This consists of two planes. The first is narrow, and pivoted at its front edge; it is placed in front of the aeroplane. The second is broader, and is placed in rear of the aeroplane; it is geared to the front plane, so that any decrease in inclination in the front plane produces an increased inclination in the rear plane, and *vice versâ*. The combined action of these two planes maintains the aeroplane at a uniform inclination.

Transverse stability may be obtained by fixing to the aeroplane another plane at right angles to it, to act as a keel. The same result is produced by using two planes joined together at an angle—to form an open V in cross section—instead of a single aeroplane.

The author describes several methods by which aeroplanes may be prevented from oscillating; but as he only gives one incomplete diagram, his explanation is not easy to follow.

In conclusion he gives the following as the essential conditions for a successful flying machine:—

1. A combination of planes, which are in stable *equilibrium* when gliding in calm air.
2. A car suspended below the aeroplanes by means of elastic ties. The position of the car with regard to the aeroplanes must be under the control of the aeronaut.
3. Movable rudders, both horizontal and vertical.
4. Automatic apparatus for ensuring longitudinal and transverse stability—elastic bridles or automatic horizontal rudders.
5. A motor, of which the thrust is taken by the car.

J. E. E. CRASTER.

RIVISTA DI ARTIGLIERIA E GENIO.

May, 1907.

THE USE OF TOOLS FOR INFANTRY AND THE METHOD OF CARRYING THEM.—By Spaccamela, Colonello del genio.—Light tools, spades and small pick-axes, have lately been adopted in our army for infantry troops. This provision has remedied a defect, which the writer had for 20 years endeavoured to demonstrate, notwithstanding the aversion with which his proposal was entertained by the greater part of the officers of the army. This aversion has almost disappeared, and the change of ideas is certainly due to the

Anglo-Boer and Russo-Japanese wars, and to the enormous progress of firearms in general and more especially of rifles.

The regulations for the instruction of the sappers give the following rules regarding the construction of the trenches :—

"Field entrenchments are constructed by the troops whose duty it is to hold them. Generally they may be allotted to companies, separated at wide intervals to allow free scope for offensive action.

"The following is the method of instruction :—

"All the companies employ on the work all the men provided with light tools. The men with shovels are extended in single rank at 5-c.m. intervals along a line traced by the officer; those with pickaxes are placed in a second line, at convenient intervals, at places where the earth is hardest; the pioneers, equipped with heavy tools, should be placed at one end of the trench, or at points, such as salients and re-entering angles, where the construction offers more difficulty.

"Generally the troops should not dig for more than half an hour at a time. In the execution of the work it should be the duty of the commander of the companies to arrange for the necessary intervals for rest.

"The men not employed on the excavation of the trenches should cut and collect boughs and branches for disguising the parapet.

"Trenches for men firing kneeling should be completed in half an hour; those for men standing, continued from the former, in about half an hour more."

In the opinion of the writer these regulations err technically for the following reasons :—

The men are placed at a disadvantage through being crowded and elbowing one another when using short tools. They would do better work if they were allowed to work more freely and each individual were able to adopt the position best suited for his own physical capacity. It is proved by experience that such freedom of the limbs requires a good interval between man and man, and 5 c.m. (2 ft.) is insufficient.

The duration of the work, half an hour, is excessive. Spade work greatly tires the ordinary soldier, owing to the continuous bending and to the uncomfortable position that he has to assume while digging and removing the earth. When threatened by the enemy's fire he ought to be able to work with energy and with the greatest alacrity.

In the stress of combat the troops should not be overfatigued; on a tired man moral effect becomes more marked, and the moral condition of the soldier is one of the most important factors in accuracy of fire.

Experience has repeatedly shown that, to obtain the best result without fatiguing the soldier, the duration of work should be 10 or 15 minutes, with a rest interval of the same time. Possibly the regulations have fixed the duration of work at half an hour, because it has been found convenient that the trenches for fire kneeling should be constructed by the same relief.

The instructions err tactically for the following reasons :—

With the 80 spades provided a company will construct a trench about 48 m. in length, which may be increased to 58 or 59 m. by the pioneers of the company. This front is quite insufficient for a company on war strength, even assuming that it has not more than 200 rifles. The line of

troops may have to be in readiness to advance at any moment to the attack, or else to remain some time on the defensive.

To-day all tacticians are in agreement that for attacking troops a much more extended front is required than was the case formerly. Von der Goltz says: "The Anglo-Boer war has destroyed the belief that victory should be sought in the massing of troops, and has taught that this has no effect in modern battles. This is perhaps the most important revelation of that campaign, and is likely to have great influence in the development of the art of war in Europe." The tendency to extended fronts is also confirmed by the Russo-Japanese war. Modern writers are of opinion that if the mean density in the attack is one man per pace, a great fire effect can be attained without the men impeding one another. The Germans and Austrians now allow 150 paces for a company at war strength.

But it is not advantageous to construct trenches of this length, because of the difficulty of adapting them to the ground, and because long lines are more liable to enfilade fire which leads to heavy losses.

Trenches should preferably be constructed in the following manner:— In all squads the men with shovels are extended in single rank, in the direction given by the leader, at intervals of $2\frac{1}{2}$ shovel lengths, *i.e.* about 1·56 m. apart. Some paces in rear are placed other men ready to relieve them.

Each man excavates as quickly as possible a trench for firing lying down, which requires from 10 to 15 minutes for a length of 1 mètre, and is then relieved. The new relief completes this trench for the whole length required, and may be able to commence deepening it for fire kneeling. The work then proceeds, the men being changed every 10 or 15 minutes, until the trench is complete for fire kneeling.

The writer gives further details and also sections of trenches on a scale of 1/50, and he sums up as follows:—

(*a*). It is advantageous that the workers with light tools should be relieved every 10 or 15 minutes instead of every half-hour as formerly.

(*b*). The intervals between the men should be about 1·56 m. or $2\frac{1}{2}$ spade lengths.

(*c*). The trenches should generally be constructed by squads and not by whole companies. They can thus be adapted to the ground and give greater elasticity and ample room for reinforcing the front or increasing or diminishing the intervals between trench and trench, so as to lessen the losses that may occur and also render easier the arrangements for protection against enfilade fire and splinters of shells.

(*d*). It is of advantage in war time to distribute light tools to all the men of the front rank of each company.

(*e*). Bags should be supplied so that the tools may be carried without danger of being lost.

June, 1907.

THE ACCIDENT TO THE MILITARY BALLOON AT THE REVIEW AT ROME.— The inauguration of the general firing practice, which is held on the day of the Statute, was marred by a most unfortunate accident that deprived

the army of the services of a very distinguished officer, Capt. Arnaldo Ulivelli of the special brigade of Engineers.

Every year at Rome on the occasion of this review the aerostatic park of the specialist brigade takes part in the parade with a captive balloon. After the march past the balloon makes a free ascent.

This year the usual review was held on the Farnesina, where the King and Queen were present to inaugurate the great competition of arms. An aerostatic park with a balloon of 240 cubic mètres was posted on the right bank of the Tiber, a little way up the valley of the Ponte Molle.

During the review the balloon remained captive at a height of about 20 mètres, with a subaltern officer in the car. After the review it was lowered and prepared for the free ascent.

In accordance with the orders received from the divisional commander the free ascent was to be made at the moment when H.M. the King left the practice camp at the conclusion of the ceremony, Capt. Ulivelli being the aeronaut in charge.

At about 11 o'clock, while His Majesty was engaged in reviewing the march past of the Bersaglieri regiment and the volunteer cyclists, a sudden violent gust of wind disturbed the anchorage ropes and fastenings of the balloon. In consequence of the damage done, and of the subaltern officer's report that owing to the violence of the wind it was impossible to restrain the inflated balloon, Capt. Ulivelli decided to anticipate his orders and gave the order to let go.

The sky in the morning was heavy and there were signs of rain, but no symptoms of storms with electrical discharges. It was only at about 11 o'clock that there formed above the Via Cassia a kind of storm zone with dark clouds. The wind in the lower regions of the atmosphere, although blowing lightly in the direction of the storm zone, was not a cause of anxiety and it seemed as if the balloon would be carried free of the storm. But at a height of about 200 mètres the balloon, meeting a diverse air current, changed its direction and drifted perceptibly towards the locality of the storm. When it reached a height of about 900 mètres and was near the great black cloud, the onlookers saw what appeared to be a light in the lower part; and immediately afterwards the balloon was enveloped in flame and was precipitated towards the earth, partly sustained during its fall by the edges of stuff not yet ignited, which caused it to act as a parachute. It was at once evident that the balloon had been set on fire by some electrical discharge.

The balloon fell in the Via Cassia. The shock to the car, although lessened by its meeting first a telegraph wire and then a hedge, was such as to render the unfortunate aeronaut quite unconscious. He was carried in a motor to the hospital of S. Giacomo; but in spite of all possible care and attention he died about two hours afterwards, to the great grief of the officers of the brigade.

EMPLOYMENT OF TELEPHONES ON THE FIELD OF BATTLE.—In Germany and Austria much attention has lately been paid to providing a sufficient number of telephones and operators to the army. At the German Imperial manœuvres in 1905 and 1906 experiments were carried out

to facilitate the means of communication between the general staff and the troops during a battle. Experiments were also made in Austria for communicating with the units of artillery.

In these countries the press is much interested in this question, and has published many articles on the subject. Among these there was one worthy of note in *Pester Lloyd*. This was reproduced in the *Internationale Revue über die gesamter Armeen und Flotten*, from which the following translation has been taken.

The great extension of the fields of modern battles is a natural consequence of the increased range of modern guns and rifles and of the extraordinary increase in the number of the combatants in comparison with that of past times. During the last European wars the influence of the commanders over their troops was reduced by the great distances involved. The commander-in-chief could not exert his will in a great modern battle, in which hundreds of thousands of combatants were engaged, or employ his forces in the best way for success. It was impossible for him to exercise control over events, he could only allow things to take their natural course, because means were wanting for communicating his orders to the different portions of the field.

Since that time the distances have still further increased. This is an unavoidable consequence of the increased efficacy of fire weapons; for their accuracy has reduced the depth of formations and has led to a great extension of front.

It follows that units of combat, relatively small, occupy so much space that the commander is unable to keep them under his control. Recognising this it is natural that there should be a lively desire to possess a technical auxiliary means by which this grave defect may be remedied.

Judging from the experience of recent wars the sending of messages by cavalry or by orderlies on foot is very hazardous, since it is evident that such means of communication are at the mercy of the fire directed upon them. The use of acoustic signals must be excluded owing to the confused noise produced by quick-firing guns. It has been reserved to the inventive genius of the Japanese to find a very practical solution to this embarrassing question. It may be possible in peace manœuvres to keep control over extended areas by the usual means of communication, and for such operations a change would not be absolutely necessary. Real warfare, however, shows the impossibility of transmitting orders during the combat by means of orderlies and proves the necessity of other means.

Now in the Russo-Japanese war we find the commanders of divisions communicating freely through the telephone to all the infantry regiments under their orders, a system that always gave the best results. Although it might seem doubtful if it would be possible during a battle to lay telephone wires so that they would not be destroyed by the enemy's projectiles or by the continuous passing of men, horses, and vehicles, and if the necessary calm could be obtained to receive or transmit telephonic messages, the experience of this war shows otherwise. The thin wires of the field telephones remained intact in spite of the numerous occasions

on which they might have been destroyed, and the messages could be understood notwithstanding the confused noise of battle.

If it is found useful to provide telephonic communication between the general staff of the division and its component units, it may be equally advantageous to provide it between the brigade commanders and their battalions, and also between battalions during the combat. Regiments should also be able to maintain communication with detached groups on the flanks, etc. If the telephone is useful for infantry regiments it may also be indispensable for units of artillery.

The personnel required for working the field telephone is very small, because of the lightness of the wires and the simplicity of the instruments.

The experience of great wars shows that battles are not decided in one day, and the general-in-chief by a judicious use of the telephone may be able to exercise a decisive influence on the progress of the combat.

EDWARD T. THACKERAY.

CORRESPONDENCE.

KLIP RIVER BRIDGE, GLENALLAN, O.R.C.

ARMY HEADQUARTERS, PRETORIA,
22nd July, 1907.

DEAR SIR,

The following extract from a recent report on the Klip River, Vrede District, Orange River Colony, may be of interest to some members of the Corps :—

"There is one bridge over the river, namely a wooden trestle at Glenallan (1413), on the road between Vrede and Botha's Pass. This bridge was built by the Royal Engineers during the late war ; and though it has been on several occasions totally submerged in the late floods, it is still standing and is in good order."

Yours faithfully,
R. S. MCCLINTOCK,
Capt. and Bt. Major, R.E.

The Editor, *R.E. Journal.*

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An Appreciation of the Situation on the eve of the Waterloo Campaign. From the point of view of an Officer on Napoleon's Staff, by Capt. C. F. Moores, A.S.C. (Pamphlet. 8vo. Portsmouth).

History of the War in South Africa, 1899—1902. Compiled by Major-General Sir Frederick Maurice, K.C.B., with a Staff of Officers. Vol. II. (9½ × 7, with separate case of maps. 21s. Hurst & Blackett).

Japans Krieg und Sieg. Politisch-militärische Beschreibung des russisch-japanischen Krieges, 1904–05, von Oberst. Gädke. (Fol. Berlin).

La Guerre Russo-Japonaise: Enseignements Tactiques et Stratégiques. Traduit de l'allemand de Major Löffler par Lieut. C. Olivari. (8vo. Paris).

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On War, by General Carl von Clausewitz. Translated by J. J. Graham. New edition, revised and brought up to date by Colonel F. N. Maude, C.B. 3 vols. (21s. Kegan, Paul & Co.).

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a. Clerk of the House of Commons' Office.
b. Coffee House
c. Speaker's Chamber.
d. " Drawing Room.
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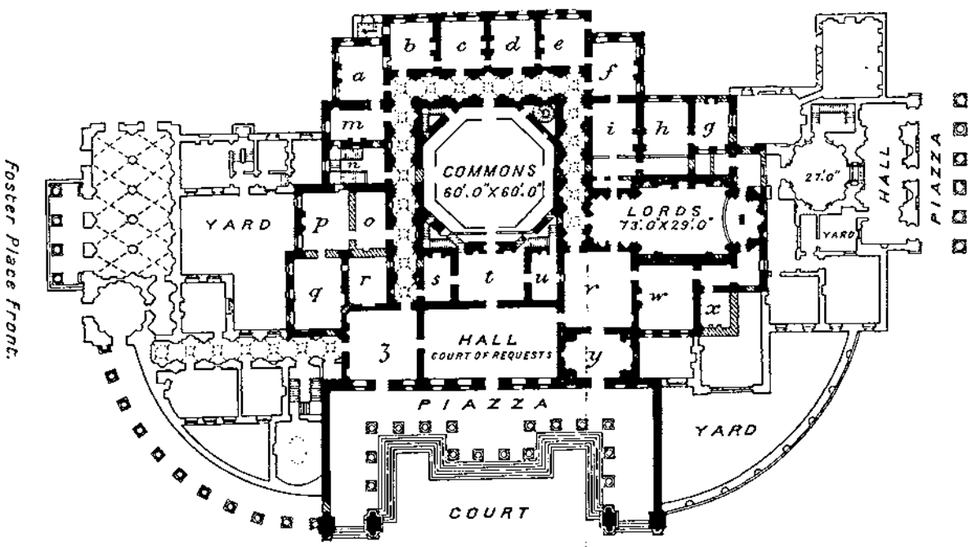
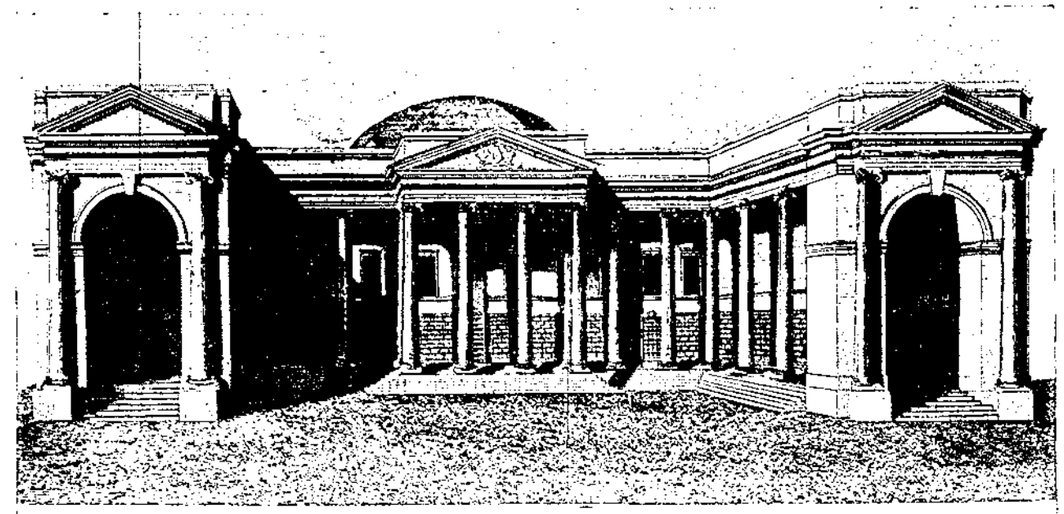
g. Clerk of the House of Lords' Office.
h. Committee Room.
i. Messengers' "
m. Clerk of Committees' Office.
n. Journal Office.
o. Store Room.
p. Little Committee Room.
q. Great Committee "
r. Housekeeper's "
s. Sergeant of Arrests' Room.
t. Lobby.
u. Gentleman Usher's Room.
v. Conference Chamber.
w. Robing Room.
x. Lord Chancellor's Robing Room.
y. Lobby.
z. Hall.



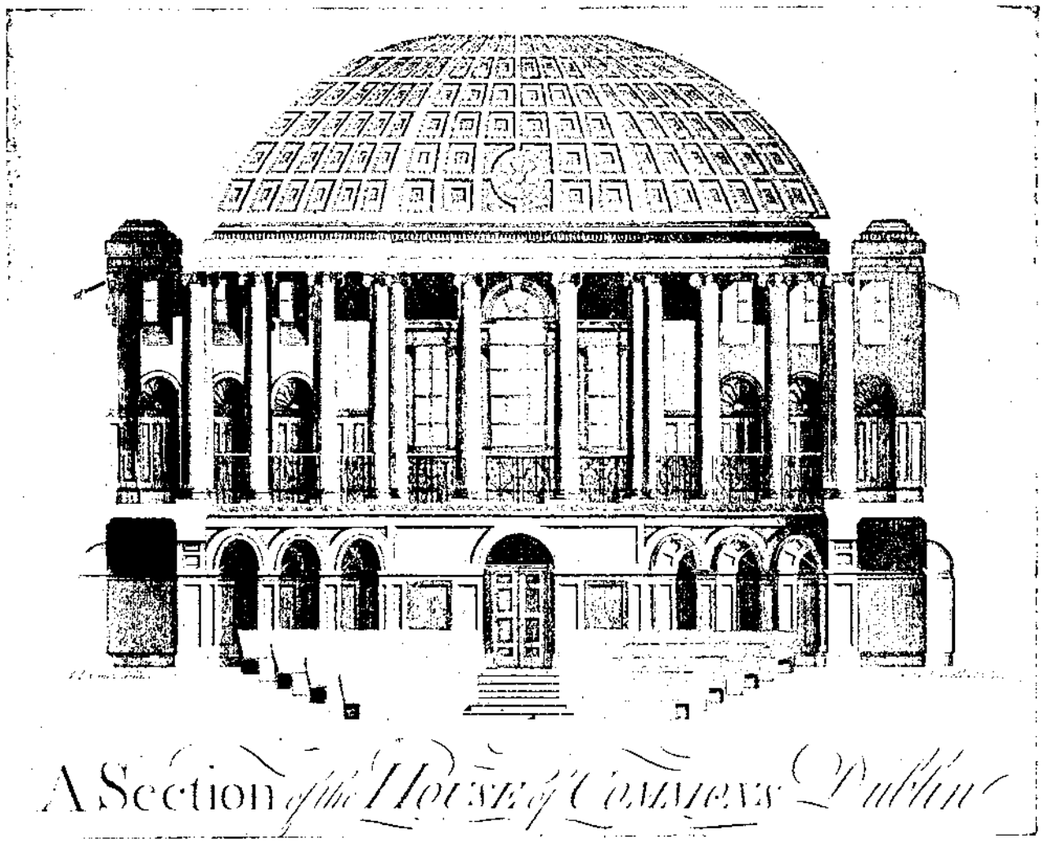
The black portion represents the original building.
The hatched portion represents parts of the old building removed on reconstruction.

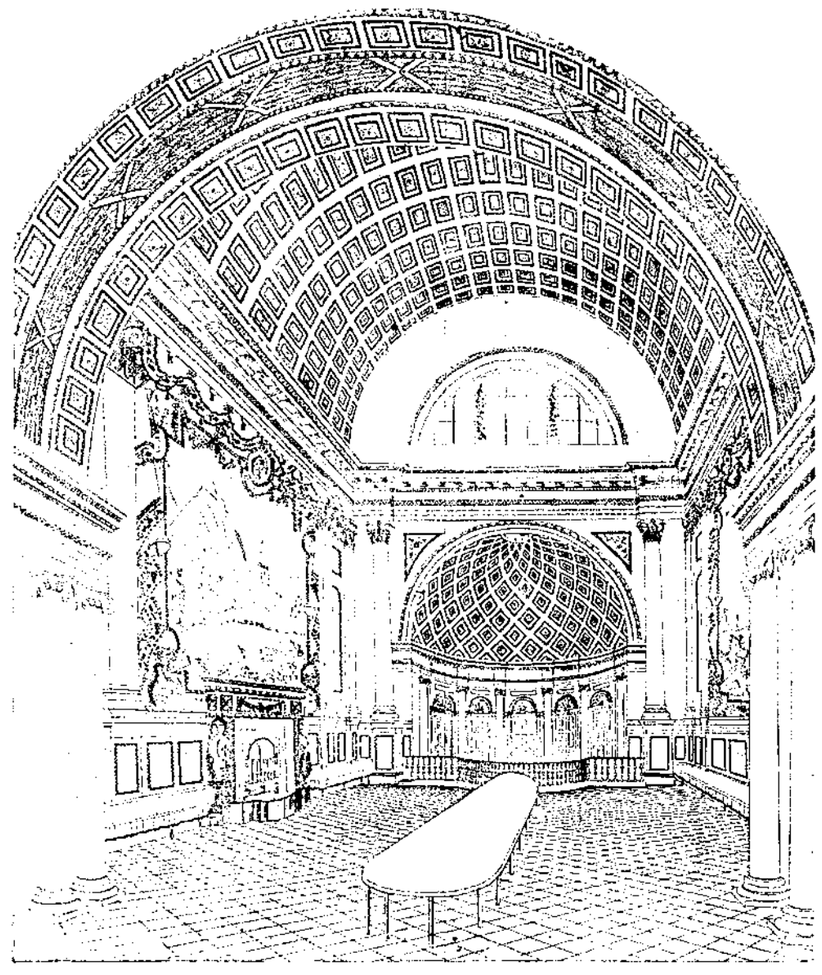
GROUND PLAN OF THE HOUSES OF PARLIAMENT, DUBLIN, BEFORE THE FIRE OF 1792.



PARLIAMENT HOUSE DUBLIN.

THE OLD HOUSE IN THE DAYS OF GRATTAN'S PARLIAMENT.
Showing the "Goose Pie" Dome.





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*Capt. R. G. Parker, Rl. Lancaster Regt.
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,, B. D. L. G. Anley, D.S.O., Essex Regt.
Capt. R. S. Hamilton-Grace, Durham Light Infantry.
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,, J. K. Cochrane, Leinster Regt.
,, R. L. Ricketts, Indian Army.
,, W. K. Bourne, Indian Army.
,, F. W. Lumsden, R.M.A.

The following Officers received nominations:—

Capt. H. C. Bickford, 6th Dragoon Guards.
Capt. C. J. C. Grant, Coldstream Guards.
Capt. W. D. Wright, V.C., Royal West Surrey Regt.
Capt. C. H. Harington, D.S.O., Liverpool Regt.
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Capt. and Bt. Major N. J. G. Cameron, Cameron Highlanders.
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SANDHURST, JUNE, 1906.

FIRST	A. G. Armstrong	5,541	129th	R. P. T. Ffrench	3,827
48th	H. G. Gauntlet	4,515	181st	C. W. Molony	3,445
67th	D. Macdonald	4,299	186th	P. J. I. Synnott	3,386
89th	W. G. Bagot-Chester	4,115	190th	R. M. Aylmer	3,339
90th	A. G. Ottley	4,109	197th	O. Gough	3,262
93rd	A. P. Williams-Freeman	4,094	201st	P. W. J. A. Stomm	3,151
115th	D. M. Black	3,940	213th	B. W. Molony	2,881
125th	W. J. King-King	3,846			

WOOLWICH, JUNE, 1906.

31st ... ... J. S. Barkworth 6,483

DECEMBER, 1905.

SECOND	H. G. MacGeorge	7,196	16th	R. Crofton	6,330
FOURTH	G. Walton	7,046	45th	D. Stephenson	5,899
FIFTH	H. A. Cox	6,967	54th	J. Kennedy	5,711

This was the First Examination under the new regulations, and our pupils secured THREE out of the first FIVE places.

MILITIA COMPETITIVE, MARCH, 1906.

A. E. Hardy	2,304	W. F. Anderson	1,947
N. H. Hutcheson	2,105	D. C. Robinson	1,879
F. D. Frost*	1,949	F. A. Bowring	1,876

*Read partly at the Army College, Aldershot.

ARMY QUALIFYING, 1906.

Nineteen passed.

Special Arrangements have been made for the Army Qualifying in next Examination.

Sole Advertisement Contractor:
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