This article was downloaded by: [University of Alberta]
On: 22 October 2014, At: 16:58
Publisher: Routledge
Informa Ltd Registered in England and Wales Registered
Number: 1072954 Registered office: Mortimer House,
37-41 Mortimer Street, London W1T 3JH, UK

Royal United Services Institution. Journal

Publication details, including
instructions for authors and
subscription information:
[http://www.tandfonline.com/
loi/rusi19](http://www.tandfonline.com/loi/rusi19)

The Moncrieff System Applied by Hydropneumatic Gun-Carriages to Harbour Defences

Colonel A. Moncrieff C.B., F.R.S.
Published online: 11 Sep 2009.

To cite this article: Colonel A. Moncrieff C.B., F.R.S. (1884) The Moncrieff System Applied by Hydropneumatic Gun-Carriages to Harbour Defences, Royal United Services Institution. Journal, 28:126, 629-656, DOI: [10.1080/03071848409424339](https://doi.org/10.1080/03071848409424339)

To link to this article: [http://
dx.doi.org/10.1080/03071848409424339](http://dx.doi.org/10.1080/03071848409424339)

PLEASE SCROLL DOWN FOR ARTICLE

Taylor & Francis makes every effort to ensure the accuracy of all the information (the "Content") contained in the publications on our platform. However, Taylor & Francis,

our agents, and our licensors make no representations or warranties whatsoever as to the accuracy, completeness, or suitability for any purpose of the Content. Any opinions and views expressed in this publication are the opinions and views of the authors, and are not the views of or endorsed by Taylor & Francis. The accuracy of the Content should not be relied upon and should be independently verified with primary sources of information. Taylor and Francis shall not be liable for any losses, actions, claims, proceedings, demands, costs, expenses, damages, and other liabilities whatsoever or howsoever caused arising directly or indirectly in connection with, in relation to or arising out of the use of the Content.

This article may be used for research, teaching, and private study purposes. Any substantial or systematic reproduction, redistribution, reselling, loan, sub-licensing, systematic supply, or distribution in any form to anyone is expressly forbidden. Terms & Conditions of access and use can be found at <http://www.tandfonline.com/page/terms-and-conditions>

Friday, April 25, 1884.

ADMIRAL THE RIGHT HON. SIR JOHN C. DALRYMPLE HAY,
BART., C.B., M.P., &c., &c., Vice-President, in the Chair.

THE MONCRIEFF SYSTEM APPLIED BY HYDROPNEU- MATIC GUN-CARRIAGES TO HARBOUR DEFENCES.

By Colonel A. MONCRIEFF, C.B., F.R.S.

SOME attention is now being given to a very important but hitherto practically neglected subject—the defence of our commercial harbours at home, and our coaling stations and strategic harbours abroad. It has been intimated that the Government contemplates asking a vote of two millions for these purposes: it therefore seems a fitting moment to review the subject of coast fortifications and their armament, and to consider in the light of modern requirements which is the best and most effective way of spending the money.

It is needless for me to dilate on the magnitude of the interests involved at our great commercial ports. That was admirably done last month in this theatre by Colonel Sir Charles Nugent.¹ This paper relates to but one detail—although an important one—of the great subject which he handled with so much ability. It is equally needless before such an audience to occupy time in demonstrating the vital importance of defending the coaling stations upon which depends the ability of your fleet to keep the sea.

It has been calculated that at Liverpool there is 400,000,000*l.* worth of property which a hostile fleet could burn and destroy, and if we add the mischief that might be done in the Clyde and the Tyne alone, we shall reach a figure considerably in excess of the National Debt.

In case of war the fleet would have abundance of work without defending our ports, and were that its chief occupation, the fact would remain that no more costly system of defence could be chosen. At many points in our widely scattered possessions great wealth is concentrated in highly valuable sites, and in spite of the utmost vigilance incalculable damage might be done by an active and daring enemy. As for the coaling stations, each one lost would not only be a heavy deduction from our own strength, but a great addition to that of our foes. Modern changes in naval warfare have at once increased their value and added to the risks attending their present defenceless condition.

The supply of garrisons to defend these distant coaling stations will

¹ "Imperial Defence," by Colonel Sir Charles H. Nugent, K.C.B., R.E. See Journal, No. CXXV.

be a much greater tax on our resources than the first expense of fortifying and arming them, not only because the yearly expense of the garrison capitalized is greater than that first cost, but from the difficulty in this country of supplying trained men for such a purpose. It would therefore be of first importance by all possible means to design these defences on the system which will give the greatest efficiency with the smallest number of men. Any system which exposed the garrison to the risk of heavy casualties from naval fire would for such positions be particularly inapplicable. To select any system open to such an objection in place of one giving adequate protection to the men would obviously be to disregard both true economy and efficiency.

In my last paper on this subject, read and discussed here on the 15th March, 1875,¹ to which, and to that of 9th June, 1873,² this paper is supplementary, I referred shortly to the other elements in harbour defence. On this occasion the method of mounting the artillery is that to which I propose to confine my remarks. The reasonable hopes and expectations that were expressed by me on the last occasion have been so completely disappointed, and that part of the subject in which I am most interested since then so much neglected, that it is with a sense of lost opportunities that I now address you.

I feel, however, that the subject is so important a one to the State and to the tax-payer, that it is my duty to continue the ungrateful task on which I have been so long engaged. There is this difference, however, between the time I lectured here last and the present—that then this country was in advance of others in the application of hydro-pneumatic Moncrieff gun-carriages, whereas now we are left behind; these carriages are now not only used on land fortifications abroad, but also afloat, working successfully with guns up to the weight of 40 tons.

Professional men do not now advocate the concentration of heavy artillery. The advantages of dispersing and concealing the guns is more generally conceded, while the importance of placing the magazines so as to be quite invulnerable by direct fire is fully appreciated, as well as the value of increased lateral range coupled with protection. I regret, however, that the best means of procuring all these advantages is left in the background here as much, or more so, than it was then, while the responsibility for this rests exclusively on one department of the War Office.

In order to lay down some common ground on which all will agree, and on which the subject can be discussed, I submit that the principle on which commercial harbours can best be defended is that one *which will give the most efficient protection and the greatest offensive power with the smallest garrison*. As a secondary consideration, but still important one, on that system *which is most economical*.

The principle thus defined I think embraces the whole question, and is therefore a safe criterion by which to judge the comparative merits of each system available for *Harbour Defence*.

¹ Journal, No. LXXXI, p. 357, *et seq.*

² Journal, No. LXXIV, p. 592, *et seq.*

It is perhaps desirable now to refer shortly to what has been done for the *Attack*—what progress has been made in naval armament—since I last spoke on the subject in this theatre about nine years ago.

1st. Naval artillery; as then predicted, has been greatly increased in power. It is now a question, I believe, whether the magnificent iron casemate and shield batteries, which form the prominent features in our coast defences, are as sufficient for their purpose as when they were constructed—whether they are strong enough to resist the heaviest projectiles now employed in foreign navies without being strengthened by additional thickness of iron and by increased strength of the external walls to protect the magazines. These works are sometimes criticized alone from a modern point of view; in common fairness, however, what Sir Charles Nugent mentioned last month should be kept in view, viz., that at the time some of them were designed a 68-pr. gun of 95 cwt. was the heaviest gun in the Service. But now, for instance, a notice appeared in the “*Times*” the other day, that the Italian Government had ordered from Krupp forty 121-ton guns.

Perhaps, however, the most important advance that has been made since 1869 is in the development of machine-gun fire from ships. By referring to Captain Lord Charles Beresford's masterly paper, read here on the 15th June, 1883,¹ it will be seen that this formidable method of attack has been carried further in foreign navies than in our own. I quote one pregnant sentence from this paper. “The disproportion between England and France, however, in the machine-gun question is still further increased to England's most dangerous disadvantage by all the French machine-guns throwing shells, whereas the English have no machine-guns except those firing bullets.” It is well to note the bearing it has on the question before us. Machine-guns can pour their projectiles in a constant stream on any desired points which are visible from the sea, and men cannot work or even live exposed to this incessant stream of bullets, which range from musketry size up to 6-pr. and even 9-pr. shells. These guns, moreover, are not only carried on the decks, but some are also carried on the tops, so that they can attack low shore batteries with greater command. Wherever there is a definite object to aim at, such as a gun mounted *en barbette*, or the port of a shield or casemate, this stream of bullets may be expected occasionally to reach it correctly, even although directed from a moving platform.

What may be the exact moral and physical effect of this incessant stream of fire on the men, and what the injury it will inflict on the *barbette* gun-carriages and breech-loading mechanism, it is somewhat difficult to say; but I have no doubt it will be an important element in producing results for the attack—more particularly when machine-gun shell fire is employed.

In any case it would be a great error in providing harbour defences to ignore, or not to provide against, this new and formidable method of attack. Any neglect in this respect is calculated to cause

¹ Journal, No. CXXI, p. 601, *et seq.*

a great waste of life in the defence, and would probably render the guns almost useless, because men cannot act with sufficient coolness, lay guns with deliberation, and aim with the same accuracy, when they are exposed to a stream of bullets or the *débris* of shells, with but slight protection from their effects.

It is very unlikely that the full complement of highly disciplined gunners will always be available to man these batteries, but even the best disciplined men could not be expected to make sufficiently good practice under such circumstances.

Means have been lately devised for giving the men more cover than formerly in barbette batteries, by traversing the guns after each shot to one side, and loading them whilst depressed. This method, which is called *side loading at depression*, has its own advantages and defects. A portion of the gun-carriage and the gun itself is, however, always exposed to view in this as well as in all other barbette batteries, and necessarily also to shot and shell. They thus afford a correct and easy mark for machine-gun fire, the shells from which will search the greater part of the gun emplacements.

Now that it is possible to direct a continuous stream of fire against any visible object, the importance of depriving the enemy of any visible and definite object to aim at is of paramount importance, because by removing any such object, the accuracy of that kind of fire is reduced, and its deadly stream is more likely to be wasted on points where men are not working.

Loading at depression, without traversing, which method is applied to short muzzle-loading guns, gives the men no doubt better cover, but on the other hand, it, as well as side loading at depression, defines the position of the gun, by raising its large breech—its exact position is thus made more prominent while the gun is being loaded.

It may be said that any advantage gained by loading at depression in either method, has been neutralized by the improvements in naval artillery since 1869—especially in machine-guns. So that, so far as barbette batteries are concerned, the question remains very much as it was when Admiral Sir F. W. Grey's Committee reported on the Loan works fifteen years ago, except, perhaps, in one detail, viz., the height at which barbette batteries are admissible. This may have been modified by the practice of using machine-guns on the tops of ships, thus giving them relatively greater command.

As guns mounted on any kind of barbette batteries are exposed, and the gun-carriages and men serving them partially so, they are liable to be silenced by naval fire, both at long and short ranges.

Before naval artillery had nearly reached its present development, barbette batteries were condemned for all important positions near the sea level, otherwise the great iron-plated works would not have been proposed for such positions, and constructed thereon at great expense, and obviously such expense would have been unjustifiable. All barbette batteries which had not a certain height above the sea were considered out of the question, as quite unequal to meet naval attack, even at that time when naval artillery was by no means what it is at present. It is necessary to keep in view the important

fact that the increased range of naval artillery alters the vertical angle at which the attack can be made on shore batteries, and thereby also the conclusions arrived at as to what constituted sufficient command for barbette batteries.

All these considerations, I think, point to this conclusion, viz., that the deliberate abandonment of barbette batteries for important positions on sea faces, at the time the iron-shielded works were constructed in this country, was justifiable and inevitable, and that the reasons for continuing this abandonment, notwithstanding the contrivance of *depressed loading*, are as potent and as conclusive now as they were at that time, if not more so.

I venture to think that the more this matter is investigated the more clearly it will be seen that the above conclusion, first arrived at before the Loan works were designed, is sound and well founded. If so, we may dismiss once and for all the thought that any wise, safe, or true economy is to be got by placing guns in important positions, *en barbette*, for any kind of harbour defence, and that unless these batteries have the proper command to make them comparatively safe, they are likely to be a deception to the uninitiated in time of peace, shambles to their defenders in the time of war, and when most required, unequal to the work for which the batteries are constructed. Let us therefore go on to the other alternatives which are available.

Shield and casemate batteries take the most important place for that purpose in this country. It is on that principle that our most valuable positions at home are defended, and much faith is reposed in the system of which they are the main feature. That system may be said to consist of opposing force to force—in neglecting the exposure of the works to observation, and to direct fire, making them strong enough to resist it, and in massing the heavy guns of the defence. The works representing this principle are magnificent, and will remain monuments of our wealth and of the resources of this country in iron, and in the skill to apply it. They, including iron land turrets, form undoubtedly an alternative, although an expensive one for the artillery defence of the commercial harbours. Two-gun turrets of sufficient strength to resist new guns now cost, I understand, about 45,000*l.* each, without the magazines or foundations.

The remaining alternative, which is the one I advocate, one which I might almost describe as created by myself, is that carried out by means of disappearing carriages, used in the manner I shall proceed shortly to describe.

I cannot do better than use the exact words I employed to describe my system at the Royal Institution of Great Britain on May 7th, 1869. It will at any rate show you that I press no new nor crude idea, and that my views on the general principle involved remain unchanged, after all the experience I have had in applying it:—

“It must be borne in mind that batteries intended to engage ships are obliged to meet an enemy who can move his position to that quarter where he is least exposed, who can continue in motion while he is con-

ducting his attack, and who can seek out the most vulnerable face of the land-work to operate upon.

"In constructing such batteries it is first of all necessary to make them of sufficient strength to resist the guns of ships which are the most powerful that can be made.

"It is next required that these batteries should be constructed in such a manner that they can direct their fire with rapidity and precision in any direction in which the ships can take up their position.

"And lastly, it is required that they should mount guns of sufficient weight and power to be formidable to the heaviest ironclads.

"In former times guns *en barbette* were preferred for this purpose, because they met the two first requirements alluded to; that is to say, that from not being confined by embrasures or ports, they were able freely to follow their floating enemy, whatever position he might take up, naval fire at that time being neither so correct nor so formidable as to make such batteries unserviceable. The case, however, is now completely changed; for not only have guns been improved, but ammunition also; and heavy shells are most destructive. Rear-Admiral Porter, of the United States Navy, in a report on coast defences, says, 'Such guns, *standing so high up*, are just the objects that naval gunners would delight to explode their shrapnel against, and from my experience in naval gunnery, the third shell would kill every man at the gun.'

"Von Scheliha, in his treatise on coast defences, says, 'Guns mounted *en barbette* may always be silenced by an ironclad.'

"This form of battery, therefore, is disposed of.

"We shall now examine the difficulties connected with the other alternatives. Common masonry batteries have been condemned as worse than useless, as they would only make the ship's fire more destructive than if directed against guns *en barbette*.

"Next comes the expensive alternative which has been adopted, viz., iron shields, casemates, and turrets.

"The battery is in the position of a knight who must either expose his vitals to his enemy's lance or put on armour that paralyzes his sword arm.

"There is as much protection in the power of being able to strike as there is in being able to guard.

"As naval actions are likely to be short and decisive, it must have appeared extremely doubtful whether it was worth purchasing increased safety at the expense of losing the attacking power.

"My solution gives a system capable of mounting the heaviest artillery, while it simplifies the vexed question of fortification. It gives protection without the expense of using iron, and free lateral range to the guns without exposure.

"The system is indeed a simple one; it does not require either brute strength or heavy expenditure for its application; nor does it need mighty forges to weld iron walls to protect our guns and gunners; it only calls to our aid the simplest and most docile forces of nature.

"Instead of trying to meet force by force, I make my guns bow to the inevitable conditions which science has imposed; and instead of wasting energy, money, and skill in attempts to raise a buttress against the new artillery, I employ the hitherto destructive force of recoil to lower the gun below the natural surface of the ground, where it can be loaded and worked in security and in comfort; and, at the same time, I have made that destructive force so much my servant that I compel it at my pleasure to raise the gun again into the fighting position whenever it is required.

"The principle on which the carriage is constructed is the first and most important part of the new system, because on it depends the possibility of applying the other parts. This principle may be shortly stated as that of utilizing the force of the recoil in order to lower the whole gun below the level of the crest of the parapet, so that it can be loaded out of sight and out of exposure.

"The second part of the system, viz., the profile of the batteries, is of the highest importance, because, unless it is attended to, great advantages are lost.

"This, unfortunately, makes the system extremely difficult of adaptation to existing works. In order to get the full advantage of it, no exterior slope of parapet should be exposed to the view of the enemy. This prevents him from being able to tell whether the fire be correct or wasted, and affords no means to him of correcting error.

"The battery in fact is masked; so that at some distance, or in dull weather, a moving ship would have considerable difficulty in laying her guns on one battery, and still more difficulty if there were several batteries judiciously placed for the purpose of deceiving the eye.

"It can easily be understood that the slightest error in elevation would either carry the shot harmlessly over the battery or else cause it to ricochet off the glacis or superior slope.

"In fact, when the gun is down, the enemy has nothing to aim at but an undefined horizontal line.

"Up to the present time the new system has only been considered as an improvement, and its value has only been estimated as an adaptation to existing forts, and there are no proposals for applying it *per se*.

"I am extremely anxious to impress on you and on my countrymen that its full value cannot be seen in this manner, and that it suffers injustice by being thus treated. I trust its proper use will be fully discovered before the inevitable lesson is dictated by war, and that it may be applied in works expressly designed for it, and not merely adapted to its use.

"The third part of this system consists in its application to given positions, the disposition of the batteries, and method of working them in concert with or in support of each other.

"If I might be excused for using the paradox, the system for coast defence consists in the absence of any defined system; that is to say, instead of making large regular forts, and forcing surrounding circumstances into harmony with them, every accident of the ground in this case would be seized where available, and small batteries, consisting

of a few guns, or even one powerful gun, laid down so as not to take away the natural aspect of the position.

"These guns would be disposed in such a manner as to retain as much as possible for the defence the advantages of a free lateral range, converging fire, and different amounts of command. In other words, the method consists in placing in position the heaviest and most powerful artillery to the greatest advantage, making that the first consideration, and afterwards protecting the batteries, by separate and distinct arrangements easily devised by Officers on the spot, against assault by any force that ships might land for that purpose.

"The dispositions of defensive batteries such as those I have very imperfectly attempted to describe would not be complete without good arrangements for internal communications, not only by roads, but by telegraph, with a clearly laid down and simple method of working them; that is, not liable easily to go wrong, nor to lead to mistakes, and which would not require very high skill.

"Such arrangements would increase the power of the defence, and indeed would be necessary with the detached system.

"I have accordingly given them some attention, and designed a general plan of laying off the ranges and working the telegraphs, which will make it possible to supply simultaneous information.

"The system I refer to (which has been submitted to the Director-General of Ordnance) would apply to any position, but its particular application would vary in each case."

Pray note that the paper I quote from was read and published fifteen years ago.

To resume,—Broadly speaking, batteries constructed on sea faces must belong to one of three different systems. In this paper I shall continue to designate these as the 1st, 2nd, and 3rd alternative.

1st. That of barbette, which has been discussed and may now be dismissed.

2nd. Iron-plated works.

3rd. The Moncrieff system, *i.e.*, the one carried out by means of disappearing carriages, and which I designated "protected barbette" the first time that I lectured in this theatre.

To prevent confusion I may here mention that the term "protected barbette" is mine. I contrived the expression as an appropriate name for my system, by which it was for many years well known. Recently, however, the "depressed loaders" appropriated this term for their ingenious contrivance, and gave the name "disappearing principle" to my system. I note the implied compliment, and the laudable desire to arrive at the same result, and humbly accept the title of "disappearing;" still confusion is caused by applying the term "protected barbette" to a different system from the one to which it first belonged, and giving it to one which leaves the gun always entirely exposed to the enemy's fire.

The question at issue which, after all that has passed, has yet to be solved, a question on which a good deal depends, is, which of the three alternative systems ought to be preferred in future harbour defence. To put it otherwise, *which system will give the most efficient*

protection and the greatest offensive power to the smallest effective garrison.

I repeat the expression, "which system ought to be *preferred*," or which can best be relied on to give the required results with the greatest advantage and economy? No doubt there are exceptional cases in which local conditions may make a particular system peculiarly applicable, and these cases must be dealt with on their own merits.

Putting aside, however, for the present, exceptional cases specially adapted for any one method, allow me to press for a decision on the main question at issue, to which I shall confine my remarks, and which I conceive to be a deliberate selection of that system which is best adapted for meeting the necessities of harbour defence, especially at the most vital points. Such points as will, on the one hand, be exposed to the most overwhelming cannonade from the ships, and on the other hand give the artillery of the defence the greatest lateral play to its guns, and the greatest opportunity of delivering telling fire within the position. That system which will enable a few gun detachments with comparative safety to themselves to offer the most formidable menace to vessels in attacking, whatever position they may take up. The system in fact which should give its own character to the main features of the defence.

I submit that if a decision be arrived at on this broad and fundamental basis—a decision not qualified by doubt or uncertainty—the designs for protecting coasts and harbours from naval attack could be carried out with a prospect of more satisfactory results than if it is left undecided. Each system requires different handling, and the manner in which the defence of a position will be designed by the engineer and conducted by the artilleryman will consequently be greatly determined by this decision. The price at which it can be efficiently fortified and defended I shall endeavour to show is also largely affected by the same decision.

The three main features of the Moncrieff system (or 3rd alternative) which distinguish it from the iron shielded batteries are these:—

1. With the 3rd alternative, the battery itself and the magazines are absolutely invulnerable by direct fire, however close the ships may approach, or however powerful may be their guns.
2. It presents no definite object to aim at except at the moment the gun is up, and therefore fire cannot be directed on it with the same precision as on the other.
3. The guns have unlimited lateral range.

1. An inspection of the plans (Plate XIX) will show that the position of the magazines in the pierced parapets of shield batteries, which can be breached by direct fire, is not free from danger, and that a port, or the gun in the port, is always open to shot, shell, and machine-gun fire. How far the mantlets are proof against the latter I do not know. The men are therefore, especially from the exposed position of the magazines, by no means so completely protected as they are in a Moncrieff battery. This fact finds expression in the official Report of

a Committee who investigated this point. (See Report, dated 23rd July, 1872.)

2. The importance of having a battery masked while in action does not seem to have been appreciated very highly in this country, judging by the manner in which most Moncrieff carriages have been placed. Notwithstanding this fact, I affirm that whoever neglects this condition, when using disappearing carriages, deliberately throws away the most valuable feature which they possess—a feature that ranks for value quite in the same line as the strength of iron used in shields, although they are produced at great expense. I should almost say this constitutes a condition more valuable than the strength of iron plates, because it not only entirely defeats direct fire, as they can scarcely succeed in doing, but by making it next to impossible to hit the mark, or when hit to do harm, it also discourages and embarrasses the naval gunner in a way that no iron works can do. It gives him no clue whatever to determine whether he is inflicting an injury or wasting his fire.

On this last point the opinion of sailors is particularly valuable.

The 3rd feature of the Moncrieff system is its unlimited lateral range. Now, the unlimited lateral range, or play of the guns, possessed also by iron turrets, but paid for in their cases at an exorbitant price, costs nothing in Moncrieff emplacements. If, therefore, it costs 45,000*l.* in a turret, and is advantageous at that price, it is surely worth something in the other case. This free lateral range, coupled with protection, is indeed a most valuable property. It has its greatest value when the system is properly applied—and it is not properly applied unless full advantage be taken of free lateral range—which has not yet been correctly estimated. I am fully justified in this statement, because the official estimates of its value are based on the adaptations, and not on proper applications. These adaptations preclude the possibility of taking the full advantage of free lateral range; they are indeed mostly positions that were previously arranged for embrasure guns.

It is quite obvious that if a harbour is to be defended there will be sometimes sites which would afford a lateral range frequently four times greater than can be got by firing from any embrasure or port; and that it would be an exceptional case if any gun could not be utilized for at least double the maximum lateral range of an embrasure.

If the selection of the disappearing system or 3rd alternative, based on these obvious advantages, were frankly announced, the Department of the Director of Artillery could not continue their present policy of stopping any extension or illustration of the system by simply preventing a suitable carriage from being tried. It ought, I think, to be distinctly stated here by me, and known by you, that the Department of the Director of Artillery, and they alone, have by this means stopped, and are now stopping, its application. In the interests of economy—not to speak of efficiency—the engineer would, in designing the works and laying down his emplacements, avail himself of disappearing carriages for heavy guns if he had them, especially at

distant coaling stations, where the supply of men was the most serious consideration; and in positions where it was essential to give the men as much protection as possible, because fewer guns would be required, and they would thus be more efficient; but if these carriages are not available for the only heavy guns he can employ for coast defence, he is of course forced to use the 1st and 2nd alternatives.

The minimum estimate of a highly experienced engineer Officer, viz., his Excellency the Baron von Scholl, who made long studies on this subject, and from whom I quoted more fully in my last paper, is, that one half the guns could be dispensed with. He says: "Considering now that the effect is highly dependent on security, I would always say that, for instance, two guns upon your carriages are equal to four guns upon common carriages. This is a very considerable advantage, not only in saving money, but what deserves more attention, in economy of men, who are always the dearest article, and especially when they require such a careful instruction as those who have to work heavy guns."

The words of the Report of the Committee on Moncrieff carriages on the same subject are "one gun mounted on a Moncrieff carriage may do equal work with two or more guns mounted behind shields;" and they also reported "that in their opinion the system will be found particularly well adapted for the defence of the great commercial harbours."

If any value is to be attached to these formal and official statements, it follows that a large decrease in the garrisons, corresponding to the decrease in guns and in batteries, could be obtained by the proper employment of the disappearing system or 3rd alternative. In this country, at any rate, this is no matter to be neglected, for the supply of trained men is a limited one, and if the opportunity of employing the 3rd alternative is not seized when the fortifications are laid out and executed, a permanent unnecessary strain on our resources in money and in men is the consequence. The expense of such a course may be estimated, but the injury inflicted by an unnecessary absorption of men in time of war cannot be estimated. I submit that this is too serious a consideration to be jostled out of sight as a mere detail of no importance, and that it is trifling with the subject to keep it out of view when making a comparison with the iron-shield system.

In 1869 a Committee was appointed to inquire into the construction, condition, and cost of the fortifications erected, or in course of erection, under 30th and 31st Victoria and previous statutes, of which Admiral the Hon. Sir F. W. Grey, G.C.B., was President. By referring to the Report of that Committee, it will be seen that great importance and value was attached to the Moncrieff or disappearing system. That is the 3rd alternative under our consideration. Embodied in the Report, page 24, there is a Return signed by Sir Wm. Jervois, R.E., headed "Return showing the works in which it is proposed to adopt the Moncrieff gun-carriage system, the armament, nature of defence for the guns, and costs of the designs, as previously

approved and as proposed to be modified according to Moncrieff system."

This Return shows that in the comparatively few places where it was deemed advisable to adapt the Moncrieff gun-carriages to the works under consideration, a saving in the cost of these works was effected by their employment of 254,159*l.*, or over a quarter of a million sterling. To this, however, should be added, for the purpose of comparison, another sum of 69,924*l.*, which had to be expended in undoing work already executed, which was rendered useless by the new carriages.

Sir F. W. Grey's Committee, limited by their instructions from the Minister of War, confined their attention exclusively to adaptations of the Moncrieff gun-carriages to four classes of existing batteries, and no estimate was made by or for them of the saving which could be effected by the system when applied to a new position. The great object of attention at that time was the completion on the best methods available of the fortifications erected or in course of erection. It was too late to alter all these works, the carriages were therefore adapted to a few of them.

These circumstances, under which the Moncrieff system was first taken up, have had a most unfortunate effect on its application in this country, from which it has not yet recovered. Although disappearing carriages are advantageous thus used, it is no exaggeration to say that the method of applying them, as a mere adaptation to existing works, deprived them of the greater part of their efficiency. The saving in money which the system is calculated to give was, for the same reason, reduced to a fraction of what it might have been. Had the new system been as developed as it is now, and the works not commenced, they might have been completed on the new system with greater offensive and defensive power than they possess, with much fewer guns, and efficiently defended with a considerable reduction of the artillery garrison which is now required to man them.

At the time Sir F. W. Grey's Committee was sitting, and the above estimate showing a saving of a quarter of a million was made, the Moncrieff system, or in other words the system which is carried out by means of disappearing carriages, was only represented by counterweight carriages for 7-ton muzzle-loading guns. It can now be applied with ease by means of hydropneumatic carriages to guns of any weight or power (Plate XX) (it is already used up to guns of 40 tons). These carriages, moreover, are superior in nearly every respect to counterweight carriages, and were therefore strongly recommended by me to the Ordnance Department when I was in their employment for all heavy guns, as soon as I had matured the inventions and conquered the mechanical difficulties which then surrounded this new application of my system.

The price of a hydropneumatic carriage for an 18-ton, or any heavier gun, is about half the price of a counterweight carriage for the same gun. It is much less complicated, occupies less room, gives better cover, and those at any rate for which I am myself responsible, are more difficult to put out of order than a counterweight or com-

mon Service carriage. The height of the interior slope in their emplacements allows of a splinter-proof cover, when such is required, which is completely out of reach of direct fire, and the conditions of these carriages are favourable for the application of hydraulic loading whenever it may be introduced to economize labour in working very heavy guns.

I am indifferent, however, as to what kind of Moncrieff, i.e., disappearing carriages are employed to carry out my system, provided they are efficient; and I do not recommend any one type—but the best that can be produced.

For these reasons, and because there is not time to go into any details, I shall on this occasion confine my remarks entirely to the general question. I may only observe that the passage from counterweight to hydropneumatic agency is a great stride in advance, and that all the recommendations by Committees in favour of using the counterweight carriages apply with still greater force to the use of hydropneumatic carriages with heavy guns; and I have no hesitation in strongly recommending them as the most suitable, efficient, and economical, for carrying out the Moncrieff system in harbour defence.

After all the expenditure that has been incurred on Committees and experiments with Moncrieff (or disappearing) carriages since 1867, after seven different and distinct Committees have investigated and approved of that system, and although there are many Moncrieff carriages mounted in our defences, there is not—incredible as it may seem—one case in Great Britain of a proper application of the system to show of what it is capable. This is indeed sufficiently remarkable, and it is not fully explained by the circumstances above stated. It will not be considered less so when I mention that in 1868 the Ordnance Select Committee, of which General Lefroy was President, recommended that some situation well adapted for the Moncrieff system should be selected for a battery of not fewer than five heavy guns, and a comparative estimate be made between the expense of a Moncrieff battery for this situation, and one for iron shields for the same number of guns. A Report was also made by Lord Northbrook's Committee in 1869, and again by the special Committee on Moncrieff carriages, of which General Eardley Wilmot was President, in 1872, both of which recommended that I should be allowed opportunities of seeing, and of expressing an official opinion on the plans of the new works; and, as previously mentioned, the latter Committee pointedly recommended the system for the defence of the commercial harbours.

These recommendations have had no results; no such battery as that recommended has been made; no designs—except for adaptations to the old system—have been submitted to me; and I am not aware that the system has been considered for harbour defence.

In the Report, dated 23rd July, 1872, it was recommended in the following words:—"Should it, however, be contemplated to project new works for the defence of important positions, or to supplement existing works by others of the present type, the Committee are

strongly of opinion that the designs should be reconsidered with a view to the employment of the Moncrieff carriage; and they would suggest that, with the object of securing harmony between the designs both of works and carriages, Major Moncrieff should be afforded an opportunity of expressing his opinion officially upon the plans that may be proposed."

General Sir J. L. Simmons and Colonel Sir C. Nugent last month in this theatre, in relation to our defences, stated that the Government have not yet adopted any of the recommendations, either of the last Royal Commission or those of the Commission on Commercial Harbours. The Department of the Director of Artillery acts, I presume, on the same principle with regard to the Committees appointed by the Secretary of State for War. There is, however, this rather important difference between the two cases—money is required to carry out the recommendations of a Royal Commission on Defences: whereas in the other case the money has already been spent, and the stage when money can be saved has been reached or nearly reached.

Committees have sat and experimented for fifteen years on this subject at great expenditure to the State; and their recommendations, if carried out, would have saved, and can now save, money on a large scale. The Report, which chiefly bears on expense, recommended the application of the 3rd alternative to commercial harbours, not alone for increased efficiency, but also for economy. Such recommendations, however, remain a dead letter so long as the Ordnance Department refuses disappearing carriages wherewith to carry them out.

To illustrate this, we shall suppose that the two millions are voted this Session, and that that sum is to be expended on harbour defence. That portion devoted to the batteries, as matters stand, can only be spent on a most expensive system—with which it can therefore go but a very short way—on a dangerous system calculated to waste the lives of its defenders, and likely enough to be useless when vigorously attacked, or else the recommendation of the Committee on Moncrieff carriages must be carried out. This last course, however, would not involve cost but, on the contrary, a large saving, because the system it would introduce is—

1st. Cheaper than the other efficient alternative, gun for gun.

2nd. If properly applied a smaller number of guns might fairly be expected to do the same work: thus saving the price of guns and batteries in that proportion.

3rd. Chiefly, however, would it be a saving, because in addition to all this, the artillery garrison might also be reduced in the same proportion.

The economy so obtained under the heads of guns, of batteries to mount these guns, and of men to fight them is so large, that it assumes a character of national importance in fortifications of any great extent.

The economy within reach under the first head is trifling. The Department of the Director of Artillery, however, appear to confine their attention to the first head. At any rate they abstain from any comparative experiment with shield batteries, have never supplied

carriages for any work, however small, that would illustrate the larger saving, and persistently refuse the only possible means that can now supply such an illustration.

This by itself is to be regretted, but the case becomes worse when the Department avail themselves of the absence of any such illustration as a justification for neglecting the system which alone, without sacrifice of efficiency, can produce this economy, and waste eight valuable years in this attitude. The mere act of delay in such a case induces the belief that something was found wrong to justify it; it will almost appear incredible that the reverse of this was the case. The Engineers and the Navy are dependent on the Department of the Director of Artillery for guns and gun-carriages, but do not always look on the requirements of the Service from the same point of view. I request you to consider in the case of coast works what this delay might involve should any sudden demand for armament arise.

The Department no doubt is entitled to consider everything problematical until it is demonstrated by an example; but are they justified in refusing at the same time the recommendations of important Committees to afford such an example? Are they justified in continuing to manufacture only for a system which is most expensive to the State, while repeatedly and firmly refusing to make and try one 18-ton hydropneumatic carriage belonging to another system which has been officially reported to be superior in both efficiency and economy to the one they employ? Are they justified, after great expenditure by the State on experiments both with counterweight and hydropneumatic carriages—successful beyond the most sanguine expectations of those who initiated them, experiments extending over many years—to suddenly arrest progress the moment it touched a point at which important results could be obtained?—in fact, to stop the application of the new system as soon as it reached those guns that are now employed in iron works, particularly when the special application which they stopped embodied a great improvement on counterweight as applied to heavy guns?

This was, however, done, and every appeal year after year to obtain the reasons for the decision, or a statement of any objections to the special application by those who could analyze it, were sternly refused.

Having complied with every test, been subjected to every ordeal, and delay, which the opponents of the 3rd alternative could suggest, or contrive, are they at last justified in only obtaining their end by an unexplained exercise of power which their position enables them without question to exert, and to maintain, in stopping the manufacture of a single gun-carriage which is not of an accepted type? This, too, while knowing that both the Works Department and at one time the Navy were waiting for the trials thus arrested.

The Department of the Director of Artillery is doubtless convinced that there is no occasion to abandon their policy of opposition to the 3rd alternative, or to doubt the merits of those more expensive, or less efficient methods, which they calmly continue to apply. For they have not only refused urgent appeals requesting that an hydro-

pneumatic carriage for the Service pattern 18-ton gun might be made and tried, but have actually gone out of their way to prevent it being made and tried at the expense of others, after a good deal of that expense had been actually incurred. This repression is adhered to while knowing the wants of the Works Department for many positions; nor was it for want of information as to the value to the Service of an efficient carriage of this kind that such an inexplicable measure was taken.

The Department of the Director of Artillery may believe that such a carriage would not succeed for their special wants, but that belief is not quite justified by simply refusing to see whether it would succeed or not, and declining in every case to state their objections to it or what these wants might be.

The absence of a proper application of my system to a suitable position—for which the Department is responsible—is thus used as the justification first for ignoring its value, and next for refusing to apply it to any heavy gun now suitable for iron shield works; and then the absence of its application to such a gun, for which also they are responsible, is made the justification for continuing to manufacture gun-carriages for iron turrets, casemates, and shields, and may possibly yet be used as a justification for reversing the decision as to barbette batteries, which first created the necessity for iron works.

This policy has now been consistently carried out for *eight* years, and I have no doubt whatever that, notwithstanding the damage it has already inflicted, the Department looks with complacency, and without the slightest self-reproach on the success their policy has achieved; for it has not only continued the old methods, *i.e.*, the 1st and 2nd alternatives, but by their manner of stopping the new one, *i.e.*, the 3rd alternative, they have brought it into discredit, and created a presumption that it has somehow failed.

I hope that I have succeeded to some extent in demonstrating that the 1st of the alternatives is more likely to benefit our enemies when they attack us than ourselves, and that the 2nd alternative is more likely to benefit a few great manufacturers than the public.

The Royal Engineers have many cases to provide for in which efficient Moncrieff carriages for 18-ton or heavier guns would be most valuable. They would know well how to avail themselves of the advantages of the system to which these carriages belong; but the Department of the Director of Artillery have taken the most effectual means of forcing them to employ one of the two other alternative systems, and therefore to design their works more or less on the methods required for these, as without disappearing gun-carriages for heavy guns there is no other resource.

It may here be mentioned that the 3rd alternative is of more importance in our Colonies than at home, because with less money and fewer men a larger area has in their case to be defended, and that defence has to be conducted by citizen soldiers. The Colonies, however, depend on the mother country for *matériel*. In their case it is rather hard that a Department over which they have no control should, without reasons adduced, refuse to look at an alternative specially

suitd for their requirements. They cannot afford to risk unnecessarily the lives of their volunteers, or to pay for the luxury of iron plates as the mother country does. They want works, however, in which they—like true Britons as they are—can stand to their guns against all comers.

General Scratchley, who is well known to you, besides his long connection with the War Department and the Royal Arsenal, has had in recent years, with Sir William Jervois, more actual experience in studying and applying coast defence to new positions than perhaps any Engineer Officer in England. For this reason I asked his opinion, and with his permission now give his reply, which, had I received it sooner, I should have made the text of this paper.

“15th April, 1884.

“My dear Moncrieff,

“You ask my opinion on the ‘disappearing’ system of mounting guns in coast batteries. My reply is, that I have always been in favour of the plan of effecting this by means of hydropneumatic carriages. In my opinion there can be no question that the system is vastly superior to either the simple barbette or side loading methods. In most cases guns can be mounted on disappearing carriages more conveniently and certainly more securely and efficiently than by those plans, but there are certain cases where it is found necessary to place guns at points of vital importance in casemates or even in turrets.

“The disappearing system lends itself to the dispersion and concealment of the armament, and the adoption of varying levels for the guns—three conditions which should always be aimed at, and have been accepted without question by military engineers. An attempt is being made to bring these conditions forward as something never thought of before. The reason why it has not been found practicable to apply them in their entirety to modern works in England is mainly due to our having adhered to the old-fashioned modes of mounting guns in coast batteries. Obstacles have been placed in the way of experiments with disappearing carriages, with the result that we are no further advanced now than we were ten years ago.

“In protesting against this policy of obstruction we should be careful to put the saddle on the right horse.

“So far as I can judge the blame cannot rest on the Engineers. They cannot adopt the system and modify their plans until the Artillery accept the disappearing carriages and the War Department is prepared to supply them. I am told that some gunners object to the hydropneumatic carriages on the grounds that they are complicated and require extra care and attention. I believe this is a complete mistake, and that these carriages will be found not to require any more care and attention, or special skill on the part of the men working them, than the present Service pattern carriages and traversing platforms. But even admitting that they do, I think it mere foolishness to continue the use of appliances which are admitted to be most defective, as exposing the gunners to an unnecessary and dangerous extent, simply on the ground that the proposed system may give more

trouble. At any rate the point can easily be settled by experiment at a moderate expense. As to the question of the cost of the hydro-pneumatic carriages, it is possible that they may be more expensive, but is this a consideration which should stand in the way of all improvement?

"I advocate the system, not only for all new works, but for existing works where it may be decided to introduce guns of the new type, or new carriages may have to be provided. Existing barbette emplacements can be readily modified without great outlay to receive the disappearing carriages.

"Believe me, yours very truly,

"P. H. SCRATCHLEY.

"Colonel Moncrieff, C.B."

No one, I think, can accuse me of impatience in this matter—indeed I often reproach myself for dereliction of duty to the public in not having sooner appealed. But as there is now again the possibility of expenditure on a larger scale than usual, and also of a repetition of the old policy, which my present protest may possibly prevent, I avail myself of this opportunity to state for your information, for that of the House of Commons, this country, and the Colonies, especially those who are interested in and responsible for public expenditure, that in this class of expenditure the interests of the public have not been sufficiently considered, and that the whole subject has been treated in a spirit that could only lead to one result, and that prejudicial to the Imperial defence, whether of coasts, coaling stations, or harbours.

This policy is not that of any one set of officials, it is a permanent policy. I desire to be absolutely impersonal in what I have to say, in order to make the case sufficiently complete and explicit, and more especially to explain the delay, which produces erroneous impressions.

As the representative of the 3rd alternative before you, and probably the only person able to challenge—with full knowledge of all the facts—the policy adopted towards it, I now formally protest, in the interests of the public, against the way in which this important matter has been treated since I recommended that the 3rd alternative should be carried out by means of an improvement on counter-weight;—against the refusal to make, or to allow to be made, an experimental carriage for an 18-ton gun with this improvement; against the neglect to make a comparative trial with shield batteries, or any trial with such guns as are used with shields; and for thus favouring unfairly the 1st and 2nd alternatives at the expense of the 3rd.

I formerly referred to the War Office Committees and the use made of their Reports. I have had some considerable experience with these Committees. I have always succeeded in the end with a Special Committee. If a proposition be true, such a Committee is not likely to endorse the contrary; my success, however, has invariably been the signal for their abolition, and the appointment of another Committee to take up the same subject. This again being repeated, the

same thing follows, and so on. The Ordnance Department have very naturally their own views, and as a corporate body the lapse of time does not make them old—time to them is therefore not of importance. If a Committee does not report according to their views, the subject can be handed to a new Committee—each one in succession has in my case—as far as it was concerned—been abolished when it nearly arrived at all my conclusions. At last, when I pressed the Ordnance Department to adopt a great improvement on the counterweight carriages, for which only I had, in their opinion, been employed, viz., that of hydropneumatic carriages for harbour defence, I was myself abolished—that is, my services were dispensed with as their adviser on the subject, with of course the desired result, which has been partly explained.

It is possible to disregard and to abolish Committees and individuals, but what cannot be abolished are principles founded upon truth, *magna est veritas et prevalebit*. If true that the earth will deflect the heaviest projectile striking within a certain angle; that a superior slope *en glacis* is better against such a projectile than the strongest iron shield; that the vertical error is greater than the horizontal one in artillery fire; and that my system abrogates the old law rendering an increase of protection a decrease in offensive power; and the converse, so long will the system which benefits by these laws be superior to those which do not.

Time has not altered these conditions, my conclusions are as sound as when they were first arrived at and expounded, and I ask, has not the improvement of artillery in the meantime confirmed them, and weakened the case of the two first alternatives? In all that time the Ordnance Department have not been able openly to allege one serious defect in my system to justify their neglect.

It is a noteworthy fact that sailors, who conduct the offensive, that soldiers of the greatest experience, and all those who have carefully studied this question, are at one in regard to the 3rd alternative.

It is true, on the other hand, that the Department of the Director of Artillery do not love it. I fear it has given much trouble. I have recently been informed that it is so obnoxious in that quarter that rather than allow one specimen to be produced, which might lead to its general application to harbour defence, some of the Officers of the Department would prefer to apply the improved barbette batteries for this purpose. It is evidently a waste of energy to convert Special Committees and to enlist outside professional opinion—it is the Department of Director of Artillery itself that has to be converted. An engineer friend of mine, of rank and great experience, discussing the matter with an artilleryman, who confessed to having the War Office opinion on this subject, observed to him that five minutes under machine gun-fire, in his favourite battery, would entirely convert him.

In the interest of the Service I devoutly wish for the conversion of the Department of the Director of Artillery, although not with so unkind an ordeal. If the public only knew the magnitude of the interests involved, or if the subject were not shrouded in technical

terms, and obscured by a mass of confused and contradictory arguments which conceal its real nature, perhaps some equally effective but less violent method of conversion might be applied. They may, however, some day be converted by deputy, by the slaughter of their juniors in time of war. I hope this may not be when it is too late.

I know that some whom I now address may sympathize with the exclusion of the 3rd alternative from our coast fortifications. Notwithstanding this I am certain it is the system of the future. The authorities have already entailed a heavy loss on the State by delaying its application to heavy guns, and it is quite possible that millions of money may yet be wasted, and many valuable lives be sacrificed, because it has not been applied; but I now predict, with the voice of one whose enthusiasm, though not his faith, is extinguished, but whose knowledge I hope is increased, that, although I may probably not live to see it, there are some present in this theatre who will live to see my system generally adopted for this purpose, a time when it will be acknowledged superior to all existing methods of fortification for harbour defence.

Captain ORDE-BROWN (late R.A.): I should like to ask Colonel Moncrieff a question, which I think would naturally be raised by this paper, namely, if the whole opposition to his system has laid so entirely with our War Office, how is it that it has never been adopted by foreign Powers? One could understand that as far as the Colonies are concerned, the difficulties raised by our Director of Artillery would practically defeat its introduction; but with reference to foreign Powers, that would not be the case, and perhaps Colonel Moncrieff can tell us what opinions they have given on the subject.

Admiral BOYS: I have only a few words to say about this paper. I should first like to correct an error which Colonel Moncrieff has fallen into with regard to the construction of the gun-carriages for the Navy. He said that the Navy depended upon the War Office for the construction of their gun-carriages. That is an error, because at the present time the gun-carriages for the Navy are entirely under their own control. The War Department only constructs for them the same as any manufacturer might do, as the Admiralty have taken that department entirely into their own hands. With regard to the system for the defence of commercial ports, it happened to be my duty three years ago to go round the commercial ports as a member of a Defence Committee, and there appeared to me to be no opposite view or no second opinion, but that in certain positions the disappearing system is the best one for the defence of mercantile ports, because by adopting that plan the guns can be dispersed, and in attacking them from ships when the guns are down for loading, and there is only a green slope up to the gunpit, there is nothing to be seen and no distinct object to aim at. I must say my own impression is that there has never been opposition to the Moncrieff system by any special department, but that it has hitherto only been successfully carried out up to a certain size of gun. I know at this moment the Moncrieff system is adopted for 7-inch guns upon the counter-weight system, in the defences of the Bristol Channel, and I should like to ask Colonel Moncrieff as to that point, because my impression has been, not that the system has been put on one side, but that the details have not been successfully carried out for the heavier nature of guns. I wish moreover to ask what is the heaviest kind of gun that has been actually experimented on, or has been successfully mounted upon *Moncrieff's* hydropneumatic system?

Lieutenant-Colonel A. W. DUNCAN, R.A.: I myself practised with one of the first guns mounted upon Colonel Moncrieff's principle, and I candidly confess that, as an Officer of artillery, I would far sooner fight a battery of guns upon his principle than upon any other. There is no comparison in my opinion between the

Moncrieff system and the system of defending guns by means of iron shields. What Colonel Moncrieff has said with regard to machine-guns is most undoubtedly true, and I have no doubt whatsoever as a practical man that his system has enormous advantages. My impression has all along been that the great objection to it has arisen from the enormous iron interests in this country, and perhaps not a little from official jealousy.

Admiral RYDER: Colonel Moncrieff lays great stress on the advantage which he claims for his system, on account of the magazines being under the *terrepleine*, and he points out as a great disadvantage to the other alternative, that their magazines are above the *terrepleine*. I should like to ask whether it is essential that their magazines should be above the *terrepleine*, for it seems to me it would be just as easy for them to put their magazines below as it is for him. I should also like to ask how many of Colonel Moncrieff's guns are mounted by the Government. I think every engineer and every artilleryman who has studied the question has come to the same conclusion, namely, that for the defence of harbours, as the Americans learned to their cost, scattered guns are the most effective. Some of us saw in the Wasp Battery at Sebastopol guns mounted above a certain elevation, and scattered in such a way that you could not see where they were, and could not point your guns at them. This is how the guns should be placed to defend harbours. There is no difference of opinion about that. Scattered guns are the guns of the future for harbour defence, and Colonel Moncrieff steps in with what he thinks—and many persons agree with him—is the best way of mounting single guns. I should fancy there is very little difference of opinion about that. I am very sorry that we are not favoured with the presence of Sir Lintorn Simmons, a distinguished engineer Officer, who has, I believe, strong views on this point. Whether being on active service his mouth is closed, I do not know, but I believe he has always supported Colonel Moncrieff's gun-carriages most warmly and strongly. The Royal Engineers wish to have single guns in pits on disappearing carriages for harbour defence, but are not allowed to have them. The Carriage Department cannot or will not make them. I have listened with the greatest care to the paper, and it does seem really very astonishing that after seven Committees have reported, all agreeing and confirming, as far as I understand, the views of the gallant Officer who has written this paper, still the mind of some person or department is so "thickly plated," that Colonel Moncrieff cannot get his shot into it. I have noticed in my experience that it is sometimes a mistake to prove your case too thoroughly; it annoys people. I have felt it myself when a person proves to me that I am so absolutely wrong that I cannot say a single word in my own defence; it is utterly detestable, and I am tempted to hate the man who does it, and oppose him more and more. Probably that may have something to do with this case.

Captain CHARLES JOHNSON, R.N.: Will Colonel Moncrieff kindly tell us what the cost of mounting a gun on his system would be? Because we all know that that has a good deal to do with the question.

Admiral SELWYN: I was going to rise on that very question of economy. There is no proposition or syllogism in logic so well established as that the cheapest way of doing what will not answer is to do nothing at all. Now a shield battery, which is made at one epoch while guns are always advancing in power, and is to be fired at at some other unknown epoch, is in the position of being one of those things which necessarily cannot answer for the purpose for which it is designed. At the moment at which it is attacked, it cannot be armed with an equal plate in thickness or value to the gun brought against it, because it takes longer to build forts or put shields on them, or even to restore better kinds of shields, than it does to make guns and bring them against it. So that the whole shield question fails entirely *ab initio* in comparison with the Moncrieff system, because it never can be in a position to answer, while the Moncrieff system must be always in a position to answer. No possible gun that can ever be brought against a Moncrieff battery can have a greater effect than the guns in use at the time it is built. You may have a shot of unlimited size, but earth is a shield of much greater resisting power than all the things which man can bring against it. There is no difficulty whatever as regards the engineering part of the question, even in revetting by an artificial glacis the existing forts. On that ground alone there is no comparison whatever between the

best protection by shield and the ordinary protection which the Moncrieff batteries give. When it comes to the question of disposing of the guns *en barbette*, and protecting those who serve them, I confess I always thought that when the artilleryman who had to serve the gun was there, it was necessary that the gun should be there also, and if the gun is to be exposed to shot which may overturn it in a second, what is the use of the men being there, they might just as well have been killed as far as that gun is concerned, though of course they might go to work on some other battery? Therefore I cannot approve of the so-called new idea of making a protected barbette with a gun which is turned sideways in order to be loaded, remaining rather more exposed during the loading than during the firing, provided only the men are out of sight, the gun always being in sight, and always offering a mark to aim at. The one thing that a sailor has no opinion of is firing at something that he cannot see. I do not think any of us like to have to aim at an object that we cannot see, though it was once done successfully at Ismailia, from the masthead direction. I should like to ask, supposing we went to war to-morrow, how long it would take to build forts in places which we should discover were likely to be attacked, not only existing harbours and ports, but places where you might probably expect an offensive movement with great effect, and which have been neglected because there was not money enough to provide the contractors with their wages. Admiral Ryder has thrown out a very valuable suggestion, namely, that Colonel Moncrieff should not make himself too offensive by being too much in the right, and perhaps he could not do better than to introduce some form of defensive work in which a great deal of iron and an enormous quantity of masonry, and therefore large contracts should still be required, because then a great deal of the opposition might disappear. If scientific Committees when appointed are not to be listened to, for what earthly reason do scientific Committees exist? Why do we give training in theory to the best men in the country that examination can discover, and then set them to work on Committees to decide what ought to be done, if afterwards there is some shadowy power behind, or department which prevents the recommendations of the most scientific Committees being listened to? I know that, however shadowy that power may be, it constitutes the greatest real danger that a nation can suffer from. At every meeting that I have attended in this Institution where this question has been brought before it, there has been a consensus of opinion which all the trials have justified. Why then is it that we have still to regret this opposition? Strong vested interests may have something to do with it; there may be something in the idea that a profession is unwilling to accept teaching from the outside; there may be something in the idea that our present system secures magnificent theorists but very bad practical men, and that they hate practical men because they upset theory. It must be recollected that in a matter of this kind John Bull submits for a long time to deception, but he is very apt to get angry after a long course of it, particularly if it is accompanied by incapacity, either in his servants or in his governors, and that anger is unmistakably shown. It may result in the sweeping away of a whole profession or a whole department, and substituting better men, the country saying, "We will rather not have such a profession if by it we cannot gain the results we expect. If it gives us all profession and no practice, if the nation is left at a critical moment without proper defence, because you, the professors, have not been able to arrange in your own minds whom you should listen to, we shall hold the whole profession responsible, although the acts may have been those of individuals."

Colonel MONCRIEFF: Perhaps Mr. Anderson will be able to answer Captain Orde Browne's question about foreign Governments.

Mr. ANDERSON, C.E.: I am not a military man, and therefore I feel a difficulty in addressing an assembly such as this. But I have had to make Moncrieff carriages, and therefore I may be presumed to know something about them. The drawings on the wall show a carriage for a pair of 12-inch B.L.R.G. of 40 tons weight, which have stood the test of eight years' service very well indeed. Last June I visited St. Petersburg at the request of the Russian Admiralty to advise them as to the best form of carriage for their heavy ordnance. I submitted several plans to the Committee appointed to consider the matter, and a modification of the Albani carriage was approved, and recommended for adoption to the Minister of Marine. The

Minister objected to the recommendations on the ground that they had already a first-rate disappearing carriage in the Black Sea, of which the very best reports had always been received. That carriage was for two 40-ton guns on the Moncrieff system, and he saw no reason why they should not adhere to that plan. He further said he should go to the Black Sea himself in the autumn and look into the matter personally. He did go to the Black Sea. He went on a cruise in the circular ironclad "Vice-Admiral Popoff," on board of which the Moncrieff gun-carriages were fitted, and the result was that the system has been adopted for the new Russian ironclads for mounting the 12-inch 50-ton guns, 35 calibres long, with a muzzle velocity of 1,950 feet a second. I have not the smallest hesitation in saying that the carriages for these fine weapons will act quite as well as the ones they have already had. The fact is, the theory is so plain and clear, that there is no difficulty whatever in mounting guns of any size, and a carriage on the hydropneumatic system for a 16-inch 80-ton gun has already been worked out for coast defence, and is exhibited on the wall (Plate XX). I can quite endorse what Colonel Moncrieff has said about the difficulty of getting a hydropneumatic carriage for a big gun tried in this country, for I myself offered General Campbell to make gratuitously a carriage to be tried at Shoeburyness if the Government would lend me an 18-ton gun to try it with. The offer was refused.¹ The Ordnance Department undoubtedly had the opportunity of trying the experiment free of all cost if they had pleased so to do. There is one subject which I think ought to be made public as much as possible, and that is our ignorance as to the effect of heavy fire on revolving turrets. My experience as a mechanic of a good many years' standing leads me to think that the revolving turrets which are being put up in some places are landing us in a fool's paradise. The sufficiency of the turrets to resist heavy fire should be tested by trying what a shot from the "Inflexible" would do against the turrets of Dover harbour. My belief is that the turret would be so damaged by a single 16-inch shell that it would be impossible to work it any more: at any rate the experiment, though it will be a costly one, is worth trying. We are putting a pair of most costly guns into a turret, and we do not know in the least what will happen when it is struck by a heavy shot. The experiments made a great many years ago with the "Glatton" go for nothing now, because they were made with comparatively light artillery; but any one who has seen, as I have, the destruction wrought at Alexandria by the heavy shot of the "Inflexible," will, I think, admit that the experiment should be tried, especially if the revolving turret system of defence is to be further extended.²

Mr. B. F. HAWKESLEY: I should apologize as a layman, in no way what-ever connected with the Service, for venturing in this assembly to make even a single observation; but it is impossible for a taxpayer to have listened to what has been said to-day, and to have heard from the members of the Services who have spoken of the enormous saving which by common consent the adoption of the Moncrieff system would effect for the country, without expressing utter astonishment that it has not been adopted by the proper departments. It is impossible, I say, for a layman having any knowledge of this subject to understand why with Committee after Committee reporting, as I understand these Committees have done, in favour of the Moncrieff system, and recommending that experiments should be tried, no practical step has been taken. Colonel Moncrieff is not informed that as the result of the consideration of the War Department of the Reports of these Committees, his system is considered to be a failure. He is simply told that the recommendation of the Committees will not be adopted, and he himself, as he graphically put it, is abolished. That abolition took place in the year 1875 at the very time when, by the substitution of hydropneumatics for counterweights, the application of the Moncrieff system to heavy guns was matured. In 1874 Committees recommended that experiments

¹ Colonel Moncrieff also made similar offers.

² The energy of one of the bolts of the "Inflexible" striking, say, at 2,000 yards' range, would be represented by the whole of the Dover turret, which weighs 750 tons, rising 16 feet into the air. Is it conceivable that no derangement would result from such a blow?

should be made as to the application of the Moncrieff system by means of hydropneumatics to carriages for siege guns, and also for heavy guns. The reward to Colonel Moncrieff was the termination of his service engagement with the Government! However, subsequently two siege carriages were made by Colonel Moncrieff at the expense of the Government. Those two carriages were reported upon in January, 1890, by the Committee on Siege Carriages, presided over by Colonel R. Curtis, R.A., and what do they say? "The Committee consider that basing their opinion on the trial they have carried out, this (the hydropneumatic) principle is suitable for the Service, because there is no danger or fear of explosion by the use of air at the pressures necessary for working these carriages." Here is an absolute recommendation, but nothing is done.¹ As to the recommendation that the applicability of the system by hydropneumatics to heavy guns should be tested by experiments, we have heard from the lecturer and Mr. Anderson that the Government would neither experiment nor lend an 18-ton gun for the purpose of experiments being carried out at the expense of others! How is all this to be remedied? I do not know how the matter can be brought home to the proper authorities. Is the remedy to be sought in Parliament or at the bar of public opinion, for it is the public who are the interested parties? When taxpayers are told, as we have been told to-day, that because a system favourably reported upon and recommended is not adopted, the country is deprived of the opportunity of saving a quarter of a million of money, it seems perfectly unintelligible that they should not have the means of insisting upon the system being promptly adopted, and the saving effected. It so happens that nine months ago the utility of the Moncrieff system, as applied by hydropneumatics, came before the Privy Council, Colonel Moncrieff having applied for an extension of his patent protecting this application. The Government appeared by the Attorney-General, and stated that they attached the greatest value to the Moncrieff system, not merely as applied by counterweight, but generally, and in connection with the case before the Council, particularly to the application of hydropneumatics, and contended that by virtue of a bargain made with Colonel Moncrieff in 1869, on the recommendation of Lord Northbrook's Committee, they were entitled to the hydropneumatic application of the system, notwithstanding the termination of the Colonel's service engagement with the Government. At that moment there was a Bill before Parliament introduced by the Government, by which the reservation invariably inserted in Letters Patent in favour of the Crown was proposed to be abandoned, provision being made that inventors should be remunerated when their inventions were used by the Crown on terms to be settled, in default of agreement, by the Treasury. That Bill passed into law, and is now in force. Notwithstanding the view that the introduction of the Bill showed the Government to take of the privileges of inventors, they attached so much importance to Colonel Moncrieff's invention, that they induced the Privy Council to insert in the Renewal Letters Patent a stipulation that not only the Government officials, but any manufacturer in the United Kingdom who contracted for the supply of ordnance and projectiles to the Government, should be at liberty in executing the contract to use the invention without the payment of any royalty or charge whatever. Is there no means by which pressure can be put upon the Government? It occurs to me there should be a practical outcome of discussions of this character. There has been no sort of defence made. We are told that this is the very best system, and yet no attempt whatever is made, as far as I can see, to get it introduced into the Service properly and in its entirety. I would respectfully ask whether it is possible by any means which are at the disposal of this Institution to bring the matter more prominently before the Government.

Colonel MONCRIEFF, in reply, said: Captain Orde Brown asked whether the system had been applied by foreign countries. In answer to his question I refer to the remarks of Mr. Anderson. I also beg to inform him that the system is applied to my knowledge in other countries; it is now applied without reference to me, and

¹ It has since been ascertained that six siege carriages have been made by Messrs. Easton and Anderson under Colonel Moncrieff's superintendence for the Government.

therefore I cannot give full particulars. Unfortunately the delays which have been caused at home have prevented my deriving the advantage from its application outside which I might have otherwise got. The largest guns mounted, and which have now been successfully worked for a long time, are 40-ton guns; the largest contemplated are 80-ton guns, the drawings of which are on the screen (Plate XX). Admiral Ryder asked me if there was any necessity for placing the magazines in the shield batteries in a different position from those in the Moncrieff. Of course it is of great importance to have the expense magazine on the same level as the gun, so that the inconvenience of carrying the ammunition should be reduced as much as possible. You will observe in the Moncrieff battery the gun is worked below the surface level, and the magazine is on the same level on which the gun is worked. In the case of shields, the magazine is relatively to the gun also on the same level, but the shield emplacement is necessarily entirely above the surface of the ground, while the Moncrieff is below the surface, and consequently quite protected. In answer to Captain Johnson as to the cost of the Moncrieff system, it is less gun for gun than the shield system. It can indeed be efficiently constructed for much less than a shield battery, for it may consist of any materials, in fact, there is no reason why the Moncrieff gun, provided the foundations are strong enough, should not be fired over the simplest form of earthwork. It is not even necessary to use concrete. The form which is used in permanent works by the English Government for Moncrieff emplacements, and which I believe to be the best, is simply a dome of concrete costing a very moderate sum. With regard to the carriage itself, I should say that a Moncrieff carriage should cost very little more than an ordinary Service carriage and platform for the same class of gun. Admiral Ryder asked how many guns there were mounted in England. I may say that since I left the Department, I have had the greatest difficulty in getting any information about my system. I do not know in the least where or how my system has been applied. All I know is that while I was in the Department 7- and 12-ton guns on Moncrieff counterweight carriages were mounted in the defences of the Severn, Cork Harbour, and other home stations, and that the Moncrieff carriages were also used in Bermuda and other Colonial stations, that since I left the Ordnance Department, the Artillery Department have been manufacturing Moncrieff counterweight carriages in the Royal Arsenal for various positions, and that I have supplied hydropneumatic carriages for siege artillery, which are now in the Service. I regret that I am not in a position to give you the statistics of my own system. Perhaps Mr. Anderson will answer the question as to the cost of carriages more definitely.¹

¹ There was not time to read the following letter addressed to me eight years ago by a distinguished Officer—alas! no longer here; but it bears so directly on the subject, that I make no apology for inserting it.

March, 1876.

(Copy).

Letter from Admiral Sir H. Codrington, G.C.B.

Dear Major Moncrieff,

I regret much to hear that you have not yet had the opportunity of developing your admirable system of mounting guns as you proposed, especially the heavier guns, on the hydraulic principle. The experiments which I saw of that principle in actual practice at the butts at Woolwich some time since leave no doubt on my mind as to its efficiency, and as to its application to still heavier guns, and I cannot understand why a system so advantageous to the public service, both as to efficiency, and also in an economical point of view, should not be fully and fairly gone into.

As an old naval Officer, I have had to consider carefully the question of our men-of-war having to cope with batteries, especially with those constructed in late years.

I quite admit the general principle that, in these days, a ship is not equal in power to a battery, and should not be committed unaided to a duel in a fixed position with a battery of approximate gun-power.

Again, there are positions where a ship threading a narrow channel is at the

Mr. ANDERSON : I think in heavy guns, where you must use hydraulic apparatus of some kind or other, the Moncrieff gun-carriages would cost about 25 to 30 per cent. more than the ordinary open barbette or casemate carriages, but it is a mistake to compare the Moncrieff carriage with an ordinary carriage by itself; you must compare the relative cost of complete batteries. Although a Moncrieff carriage in itself is 25 per cent. dearer, I should think the emplacement for an ordinary carriage protected by armour or turret would be about five times dearer than a Moncrieff emplacement, so that the case of a complete battery would turn out enormously to the advantage of the Moncrieff carriage, especially when the defences are widely spread, as they should be. A bank of earth of any kind is all that is required for the Moncrieff gun; the revetments shown on the diagrams are simply to bring the gun more completely under cover. The foundation required for the pivot at the bottom is not much, the horizontal strain due to the recoil of the gun

greatest disadvantage compared to a battery of even small power that rakes that passage.

But there are circumstances in which the fire of a ship choosing her position on the weak side of shore defences may run them with comparative impunity to herself.

It is not merely with old works that this is the case; but I refer to modern works, some casemated, and others beautifully built, and strengthened with heavy iron armour. It is easy, but therefore unnecessary to give instances, for which we need not go far.

In contrasting your system with the iron casemate system, I take that which I consider the highest and best development of yours, namely, the hydraulic system of mounting.

First of all, as to the expense of constructing and fitting of batteries and guns, the difference is of course immensely in your favour.

I need not go into figures, but the contrast is well worthy the attention of the House of Commons when the question of new defensive works comes before them.

But as a naval Officer I dwell on the comparative efficiency on service of the two systems.

The extreme thickness through the face of these modern iron casemated works at the embrasures reduces very much the lateral range of training the guns; and consequently a battery of nominally great power, if attacked by a ship from some point on which few, if any, of the battery's guns can be trained to bear on its enemy, may prove really inferior to that floating assailant which can bring her whole broadside to bear on what is comparatively the blind side of the battery. But where is the blind side of a battery really constructed on your system? There is nothing on the parapet to limit the arc of training right or left; and no enemy could approach it, or place himself within range of it without meeting its full power wherever he might be. Then comes the question, is your system of mounting guns limited in its application as to weight of gun?

Looking at the enormous increase of weight of gun that each year brings forth, the counterpoise plan would have probably become too cumbrous and expensive; the guns are in fact outgrowing it.

But the hydraulic principle has done so well in the heavy gun with which it has been tried, and gives such promise of success with still heavier guns, that it is most desirable that it should be thoroughly tested by its application to heavier guns in succession.

It is not only as a matter of economy in gun and in battery, but also as a question of real efficiency in action, that I do hope you may yet have an opportunity of having your hydraulic system of mounting guns fairly and fully tested.

Believe me, dear Major Moncrieff,

Yours truly,

H. J. CODRINGTON,
Admiral.

112, Eaton Square,
15th March, 1876.

Major Moncrieff.

being moderate. On that diagram is represented a carriage which is being tried now at Shoeburyness. I have attempted to cheapen it as much as possible, to meet the objections of the Department, by making a cast-iron pneumatic cylinder of moderate weight, but I have met with two accidents already, due to the treacherous nature of the material. This carriage is supposed to be a typical arrangement for a coast defence battery. Unfortunately it is adapted to an obsolete short 6·6-inch M.L.R.G., instead of one of the modern heavy pieces of ordnance. On the wall is a diagram of an excellent carriage for a 6-inch B.L.R.G. (Plate XXI), which was submitted to the Department by Colonel Moncrieff, but not adopted. If the Department really wants the right thing, there it is.

The CHAIRMAN: After the very interesting lecture that we have had from Colonel Moncrieff, I am sure the very least that I, as your Chairman, can be expected to do is to move him a vote of thanks. I may be permitted to observe that having occasionally presided here, and having attended many lectures, I have seldom seen an occasion on which there was such an unanimity of agreement. I have heard no criticism which would require any reply. Questions have been asked, but the replies seem to have been satisfactory, and we have now before us the fact that a more economical and a more efficient system of arming our coast defence has been put before the public by certain Committees, and that at this moment it is not adopted. That I believe is the absolute fact which is introduced to the notice of the public after some fifteen years of experiment and of attempts to introduce a system which would be more economical and more efficient than any other. An honourable gentleman has asked how it is that this is not made known to the public, and has suggested that another place to which I belong is one of the places where it might be discussed. I venture to say that no discussion there is likely, so far as I know, to have even an opportunity of being heard, and that if it were, I suspect the individual who introduced it would find himself in the same position as the seven Committees. But I see a noble friend of mine here who is an authority in these matters, and there is another place where subjects of this sort might be introduced with some advantage, and where the public mind might be awakened to an intelligent perception of the advantages of Colonel Moncrieff's system. It is not for me to suggest that course, but I must say that the publication of the lecture to-day, the favourable reception of the lecturer in this theatre, and the absolute absence of any hostile criticism in a society so constituted that the most severe and the most relentless critics might have been expected to be present, must, I think, assure the public that the lecturer has to-day done his duty to the public in making the suggestions which he has done, and I can only hope that the public may insist upon their adoption. I am sure I am but performing my duty in thanking Colonel Moncrieff for this most interesting lecture which he has given us.

Fig. 1.

E

Fig. 2.

Fig. 3.

Fig. 4.

Fig. 5.

Fig. 6.

Fig. 7.

Fig. 8.

Circuit Closer for Land Service.

Fig. 9.

Automatic Pistol and Alarm.

Fig. 11.

Fig. 10.