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CONTENTS.

SOMMAIRE.

NOTICES.

All correspondence connected with the *C. M. Review* should be addressed to the Secretary, R.S.G., Kingston.

Communications intended for publications in the next issue of the *C. M. Review*, must reach the Editor not later than the 20th of the month.

NOTE.—Officers of the Militia are requested to kindly forward to the Editor, for insertion in the "Militia Item" column, any information respecting their own regiments which they think might be of interest to their brother officers.

List of useful scientific books for sale, published at the Royal School of Gunnery, Kingston, Ont:—

	Cents.
Canadian Militia Field Artillery Manual, (by Lt.-Col. T. Bland Strange)	75
Retrospect of the late Franco-German War (same author)	50
9 Pr. Field Gun Drill, (extract from C.F.A.M.,)	10
Rules for Competitive Practice for Artillery	15
Mortar Drill	15
Heavy Ordnance, (drill and exercises)	15

AVIS.

Conformément à la loi, toute personne qui reçoit un journal et qui ne le renvoie pas, se trouve abonnée de droit.

Les personnes qui auraient quelques communications à nous adresser sont priées de nous les envoyer avant le 20 de chaque mois.

Les personnes qui désirent entrer dans la Batterie "B" sont priées de se présenter au Commandant, Kingston, tous les jours de 10 heures à midi, ou de lui envoyer leur demande avec leurs certificats de bonne conduite. Il faut aussi qu'elles sachent lire et écrire qu'elles jouissent d'une bonne santé, que leur hauteur ne soit pas moindre de 5 pieds 4 pouces, la mesure de la poitrine de 34 pouces. Enfin, nous les prévenons que les ouvriers charpentiers, menuisiers et forgerons ont une extra paie de 20 cents par jour.

La Batterie "B" informe le public militaire qu'elle tient à sa disposition les ouvrages de *drill* pour le *smooth bore*, le mortier, les canons rayés etc., ouvrages imprimés par les presses de l'Ecole Royale d'Artillerie sous la haute surveillance du commandant.

The Canadian Military Review,
OCTOBER 1ST. 1880.

The Staff and the Militia.

Now that the Government contemplates making changes in the administration of the Militia staff, it might not be inopportune to consider the special claims and qualifications of those officers of our colonial force who might seek such positions, through vacancies occuring, incidental upon the action of the Department at Ottawa.

In years gone by, when our service was in a crude state, and no system of instruction in force, whereby its officers were enabled to perfect themselves and qualify in the many details pertaining to the profession of arms; the officers forming the militia staff were, in the generality of cases, naturally and properly chosen from gentlemen holding commissions in Her Majesty's regular army, the judiciousness of which act is proved by the services they render in bringing about that state of efficiency which exists in many of the infantry battalions throughout the country; but now after the number of years our present system of colonial defence has been in existence, and the talent and money spent in developing its organization, it is high time our service should be able to furnish its own staff and other instructional officers, and those gentlemen who have for years past patriotically devoted themselves in assisting the country to call into existence our colonial army of forty three thousand men, should unquestionably have the first claim to any military patronage which may fall into the hands of the Government.

In the question of selection, however, a serious consideration arises as to the special qualifications that fits an officer to act upon the staff, for besides being a thorough military man in every sense of the word, he should be perfectly conversant with army signalling, the latest method of telegraphy and heliography, and be able to use the instruments connected with same, also military sketching, military and topographical reconnaissances, surveying and plotting, field works and fortifications, transport work, etc., with a good knowledge of military history and the modern systems of tactics, and strategy and the latest inventions in arms of precision and military appliances generally.

But, although perhaps at this moment there are few amongst us who have given our minds to acquire this knowledge, there is no reason whatever that in the future those perfectly qualified in all these various details should not be found in every battalion throughout the Dominion. Nothing could be more easy than for the authorities to establish a staff course of instruction at the Royal Military College, Kingston, at which officers of the Militia might be afforded the opportunity of attending and qualifying in all the branches of military scientific study, their examination merit entitling them to positions on the staff or other employment, as vacancies occur from time to time. The Government must not forget that the present officers of corps and regiments contribute in a great measure to the actual creation of the force, by the energy, time and money they devote in drilling and keeping their men together, and if qualified, are certainly entitled to commands and positions in their own establishment over all outsiders.

The Army Camp of Europe.

A million men are sleeping under canvas and marching at autumn manœuvres in Europe while waiting for the note of war. France alone puts into the field this month 18 army corps, any one of them nearly as large as the little English army, and on the German frontier are grouped two French cavalry divisions. In the new tactics a French regiment includes 2,400 men, in three battalions, of four companies each, and this force advances to the attack spread like a fan, with its first line of skirmishers a mile in advance of the main body, which stands ready for the confused rush in which Sir Garnet Wolseley says every modern battle must end. The situation in Turkey contains all the element of a general European war, and at almost any moment there may be an outbreak in the armed camp.

Canadian Progress.

We have been afforded an opportunity of inspecting the maps of the north-west provinces, showing the route of the Canada Pacific Railway from Lake Superior to British Columbia. These maps, including that of Manitoba, are the result of the surveys of Colonel Dennis, now the Deputy Minister of Interior, who is at present in England in connection with the work regarding which Sir John Macdonald and his Ministers are about, we trust, to make successful arrangements. The maps are, up to the present time, all the reliable knowledge of the geography of that country we have, a great deal of knowledge which has been obtained from astronomical observation effected under the direction of Colonel Dennis when Surveyor-General, and latterly under the direction of Mr. Lindsay Russell, the present Surveyor-General of Dominion Lands. It is not generally known that the Government of the Dominion, not content with a railway through American territory, have determined to take a short cut through their own provinces and have commenced the tremendous task of a line from Fort William, on Lake Superior, to the Pacific, taking Manitoba *en route*. This line has had portions allotted to contractors, and the first 100 miles from Fort William to English Stations is completed. Two contractors are hard at work on the next portion of 150 miles to Kewaydin Station, on the north of the Lake of the Woods, and the 150 miles will be completed in 1882. It might appear as if this was a fair beginning, but at Kewaydin Station we come upon 150 miles of railway to Winnipeg, actually completed and with the trains running. From Winnipeg, the capital of Manitoba, the real start across the vast and fertile prairies begins, and here we find 230 miles in hand, to be completed in 1882. Other portions have been let to contractors along the surveyed route until the Thompson River is struck on the west coast; along the valley of the river 120 miles of railway to Burrard Inlet will be finished in 1882. It is being pushed on with energy, some 4,000 men being engaged on the works. After leaving Winnipeg the line takes a great sweep north-west through the vast region of fertile land suitable for growing wheat. It is not only that wheat can be grown here in enormous quantities, but the quality is so excellent that in order that their flour for shipping may bear the brand A1 the millers of Minneapolis, in the United States, are purchasing Manitoba wheat that its hardness may, when mixed with that of a lower grade, so improve it that the American flour may pass in the highest grade. "We may fairly expect," says Mr. Weldin his valuable journal, "that a few years will witness the fulfilment of the prediction that the great prairie lands of Canada will be the granary of the Old World, and that the teeming millions of Great Britain need not look beyond her own colonies to supply the deficiency of her home population." In this country we can well understand the enthusiastic zeal of the Canadian Ministers in the noble task they have set themselves; and certainly, if great talent and energy will succeed, they are certain to carry the Canadian Pacific Railway to a successful issue. One of the maps shows the whole province of Manitoba divided into farms of 160 acres each. The prairie land is shown distinct from forest lands, and each farm as it is occupied is painted black. Thus at a glance can be seen the surprising immigration which has set in, and on which Lord Dufferin has dwelt so eloquently. Lord Beaconsfield was, however, the first in England to point to the fact that Americans emigrated to—may we say it?—our British province of Manitoba. It has already been pointed out in these columns that the excellent harbour of Esquimalt, is opposite to the terminus of the Canadian Pacific Railway, and that the fine coalfield of Nanaimo are close to Esquimalt. Since then we have ascertained on good authority that no coal mines exist on the American coast south of British Columbia, and that the coal for steamers and other purposes at San Francisco is drawn from the Nanaimo mines. Last year's delivery amounted to over 110,000 tons. We have also heard on good authority that should Esquimalt be adopted by the Imperial Government as an Imperial station, such as Halifax is, the move would be popular in Canada. We commend this to the Royal Defence Commission. A chance is now offered which, if not taken advantage of, may pass away for ever. The commanding position of the Pacific, the noble harbour, the solitary coal mine combined, with the terminus of a railway which is being constructed from our base of operations on the east coast of North America, these points have no doubt been long taken into view by the able men on the Royal Commission, but they will not regret to learn that any move on their part in its direction they wish will be popular with the people of Canada.—*London Morning Post.*

Militia Items.

—The 65th Battalion has been inspected by the General commanding.

—A company of the 6th Fusiliers has just carried away the prize in a general competition with the various battalions in the Montreal district for smartness and efficiency in drill.

—Col. Van Straubenzee, D.A.G., and Col. Worsley, B.M., inspected the 57th Battalion, on the 15th ulto. This regiment paraded in full marching order, (an unusual thing with volunteers) and went through their work to the entire satisfaction of the inspecting officers, who complimented the officers and men upon the appearance and discipline of the corps.

—During the past month, Colonel Strange, R.A., D.I.A., accompanied by Capt. Chas. Short, B.B., C.A., has been on a tour of inspection throughout the Western District, when the following Field and Garrison batteries of artillery paraded for inspection, and also carried out their annual firing practice, viz: the Toronto, Welland, and Durham Field Batteries, and 1st Provincial Brigade of Field Artillery, (Guelph), and the Port Hope Battery of Garrison Artillery.

—The Port Hope garrison battery, under the command of Major Guernsay, were out during the past month for its annual drill. The men were placed under the instruction of Drill-Sergeant Howard, of "B" Battery, Kingston. The drilling was principally carried on in the drill shed, but gun drill took place on the old cricket ground at the lake shore.

—The review at London of the 26th Battalion by Major-General Luard took place at the northern end of Waterloo street in an open field. The Collegiate Institute cadets received a half holiday and joined in under the direction of Mr. Houston. The cavalry also participated under the control of Major Fred. Peters, Deputy-Assistant-Adjutant-General, and Brigade-Major Moffat put the men through their facings, and at the close complimented them on the proficiency obtained. The camp broke up this morning at daylight.

Shell practice of the Toronto Field Battery.—On Saturday afternoon the Toronto Field Battery completed their annual drill by shell practice at the Woodbine Park. The good shooting of Wednesday was followed up by the rest of the men, and at the close the score was the best on Canadian record, and one that will be hard to beat anywhere. The four first places were won respectively by Gunner Mason, 43 points; Major Gray, 41 points; Gunner Thompson, 40 points; and Gunner McFarlane, 39 points,—with several others among the thirties and close behind. The time was also considerably ahead of past years, eighty rounds being fired in 86 minutes, or two minutes and ten seconds better than last year. The total score was 489 points, and when compared with 414 points that won first prize for the Shefford (Que,) Field Battery in 1879, shows that the Toronto boys could give a good account of themselves if called to the front. When it is considered that the target is only six feet square, and placed at a distance of 1,500 yards, civilians will have some idea of the shooting that completely riddled it.—*Toronto Mail, Sept.* 20.

[This is not correct; the Ottawa Field Battery, Major Stewart, made a score of 517 points at its annual practice this summer.—Ed. C. M. R.]

Defence of Great and Greater Britain.

Imperial and Colonial Responsibilities in War.

In a matter of such vital importance as Imperial Defence, the main question at issue is this. How to secure with economy, yet truly and efficiently Imperial safety? War sweeps away all "castles in the air," all false sentiment, and leaves nothing standing but bare, naked facts. It crumbles to dust false ideas and false hopes, and consolidates the power of one Empire by scattering to the winds the fanciful delusions of another. Therefore, in considering questions relating to defence, it is most important not to trust sentiment too far, but to weigh calmly and carefully practical arguments.

The Imperial position and dangers to which it is exposed, and the stategical operations necessary for its safety may thus be briefly epitomized:—

(1) The fallacy that colonial defence can be considered as an abstract question, or that national defence can be limited in its meaning to the defence of the United Kingdom.

(2) The principle of "home" or "local," or "domestic defence," if indiscriminately applied, as it has been by the wholesale creation of forces which cannot be moved from the soil on which they are raised, must produce Imperial weakness, not Imperial strength.

(3) That the United Kingdom is merely the "grand base" of the Empire," that for this reason it must be rendered secure, not only from capture but also from having its communications cut near home. Were the latter contingency to happen it would be helpless as regards itself, while it would cease to be of any value to the rest of the Empire with which it could not then communicate.

(4) That even supposing the United Kingdom secured both against invasion and the interruption of its water roads near home, there yet remained to be effectually guarded against as pressing and as serious a contingency, viz: partial investment by an enemy operating against one or more of its communications, with the other portions of that Empire of which it is but the heart and citadel. For example, an opposing naval force operating with St. Helena as a base, at the crossings of the South Atlantic, would cut the whole of Imperial communications round both Capes, and were the Suez Canal to be blocked at the same time, the whole Empire, except Canada and the West Indies, would be locked out from its grand base, and the United Kingdom would be partially invested.

(5) That we can only secure the Imperial water roads, first, by a firm, strong grasp at all times of the points which command them; second, by fleets adequate to the requirements of keeping free and open the lines between the points.

(6) That those fleets would be paralyzed in their action if the points between which they are to operate are not held by military forces sufficient to render the protection of the sea-going fleets unnecessary; or, if there are not in addition at these points, stores of coal and means of repair adequate to the requirements of the fleets of which they are the base.

The reasons for these conclusions will be found stated in this paper. They have never been disputed, and though they were most unpopular eleven years ago, because we could think of nothing at home but our own personal safety, they are now happily attracting attention. The "génie" of the British Empire is rising out of the "pot" of the United Kingdom in which it was too long confined. May this "spirit" never be "asked to go back to show where it came from," and let us hope the time is approaching when Englishmen will cease to talk of their "country," and at all times and under all circumstances act as citizens of a Great United Empire.

On the conclusions referred to are rested the following propositions:—

1. That as the Imperial strategic points had been and are utterly neglected, the colonies should combine and force on the attention of Parliament and Governments

the necessity of providing means for their security and of increasing their naval resources.

2. That a commission properly consituted on an Imperial basis, should be appointed to inquire into this matter, and that such a commission might determine the just limits between Imperial and colonial responsibilities in the question of defence: and that thus might be prepared the way for a federation of the war forces of the Empire for purposes of defence.

3. That an absolute and pressing necessity exists for the erection of a great Imperial dockyard at the other side of the world, which would relieve the pressure on home dockyards and fulfil duties they cannot in war perform, and in peace offer commercial advantages of construction and repairs to ships of the mercantile marine.

4. That some change appears necessary in the administration of our war forces, because as the protection of Imperial roads is partly naval and partly military, there is no one controlling power over both; the Admiralty may scatter fleets in one direction, the War Office tie up military forces in another, but there is no power to combine the two, and without such combination each branch of our war power of defence would be helpless.

5. *That as the communications of the Empire are the common property of all its compound parts, each portion, according to the use it makes of them, has a direct interest in their defence, and should contribute to that object.*

Lastly. That forces created for the defence of "home" must "survey the Empire," in order to behold that which they are to defend.

Before, however proceeding further I will give two passages from that remarkable paper. "Fallacies of Federation." which must be taken in conjunction with what I have already quoted. "It must be borne in mind," says Mr Forster, "that so long as any colonies are British colonies the British Government is bound to protect them and would protect them in case of war . . . . and Great Britain is also bound to bear, and could not avoid bearing the chief cost of such war." Taking this last passage in connection with the general statements of the address from which it is extracted, I conclude the chief cost means the whole cost, less only the expense of such local and purely defensive works the colonies choose to create or maintain. Any colony may or may not provide means of defence. The British Government cannot, in an Imperial sense, compel it to do so, nor exercise control over the constitution or distribution of such local forces or means of defence,—if created,—beyond colonial limits. The fact of a colony not adopting of its own free discretion means of defence adequate to its requirements, or to the best of its ability, simply increases the responsibility of the British Government. The responsibility, therefore, of the Government at home in the matter of defence becomes greater in exact proportion as a sense of responsibility on the part of the colony diminishes. The less a colony does, the more must the United Kindom do. Now this is not a matter merely between an apathetic colony and the mother country, but it affects every portion of the Empire, because the extra war power necessary to put forward for the safety of that colony is just so much deducted from the force available for the protection of other Imperial fragments.

The question to be first settled is this: What is protection? What is defence? It is really only chasing shadows to devise schemes for the protection of our colonies; it is only a dreamer's fancy to arm for defence and to emblazon flags with "Self-reliance," if we are not clear what it is we have to protect what it is we have to defend. Are we going to protect the unity of the Empire, or merely to prepare to save what we can out of a possible wreck? Are the strong to defend themselves and let the weak perish? Are Englishmen behind "increased and stronger harbors and coast defences" at Sydney to regard with complacency the capture of Fiji; to hear without dismay the capture of King George's Sound; or that the foe had established a base of operations at New Guinea, or in still more suitable positions on some of the neighboring islands? I feel certain the able writer of the article would in the presence of such contingencies be inclined to think that the honor, wealth, and supremacy of magnificent Sydney was concerned "first and principally," and that so long as Sydney could spare a single man or had a single shilling available to help to prevent such a catastrophe she would not have done her duty did she not spend that shilling and dispatch that man. I rather fancy that the writer now so strongly in favor of rooting all military power of defence to the particular soil on which it is raised, would then fling away his pen and carry a sword across the sea for the safety and honor of that Sydney he so dearly loves.

I do not ask for "standing armies in the colonies." I only submitted that the several parts of the Empire should come to a common understanding as to the defence of the Imperial strategic points, such, for example, as Fiji and King George's Sound, and in proportion to the extent to which their honor and wealth is concerned in the security and efficiency of those positions, so should they contribute in common with the mother-country to their maintenance and safety as Imperial strongholds.

If the colonies think it wholly and solely the duty of the people resident in the United Kingdom to provide for the safe-keeping of these Imperial keys, they should insist that they do it; they should not allow measures vital to their own safety to be so completely neglected. There is no use concealing the fact that the British Government, labouring under the pressure of home constituencies possessing all the power, cannot be reasonably expected to move far in such a matter except supported by counter-pressure from without. It is idle to forget that if cavalry and field artillery be deducted from the strength of the regular army—our only movable force—the number remaining would not provide the strategic points of the Empire with garrisons, much less furnish expeditionary forces, which the colonies imagine we can at any moment "throw on any shore." The Imperial roads cannot be kept open unless such places are secured independently of the protection of sea-going fleets, and therefore if the mother-country and her colonies do not come to some common and really Imperial understanding as to how these places are to be provided with sufficient garrisons, adequate defences, and naval resources, a great war will find our fleets helplessly watching their bases, while home and colonial merchant ships are being chased over the ocean like hares by *Alabama* greyhounds.

The problem of Imperial security cannot be solved by disintegrating that which is common to all, it is a burden resting proportionately on every fragment of the Empire, and distinctions are not those of responsibility, but simply of practical ability.*

The weak must bear their burden according to their strength. The problem is one, not of division, but of adjustment. The misfortune is that Imperial policy has been directed, not towards adjusting the burden, but has really thrown it down, leaving the United Kingdom and the colonies to cut off bits here and there according to

*AUSTRALIA.—"But while we have no control over any diplomacy, no word to say about the Eastern question, or any other question, no power to determine whether we shall go to war or remain at peace, there is no political reason for asking us to defray the cost of a war in which we have no voice, and perhaps no interest. There is nothing in this view of the case that is selfish; it is simply a corollary from the admitted doctrine that taxation and representation go together."—*Sydney Morning Herald*, August 3rd, 1877.

selfish, mistaken instincts of self-preservation, and the result is that much of it remains repudiated by both. No one can say on whom the heavy remainder belongs, whether to the mother country or to the colonies. We will not pick it up, because we have taken all the "home defence" out of it we require; the colonies will not touch it, because they have cut off as much "domestic defence" as they think they want. To understand what that remainder is, it is necessary to examine closely our existing arrangements for the defence of our Empire.

"Trade follows the flag," and the flag that waves triumphant over Sydney and King George's Sound will determine the nationality of the trade on the great districts of ocean of which they are the "strategic points." This is not a thing merely affecting the interests of those Englishmen who happen to reside at those particular places. It "first and chiefly" concerns Australasia, and is of vital importance to the whole British Empire. Thus does this principle of "home or local defence," indiscriminately applied, place an Imperial burden on a few individuals, not because they are alone interested, but simply because they have the misfortune to live at places of Imperial strategic importance. Such points are most liable to attack because they offer enormous advantages as naval and military positions. When attack is resolved upon it will be delivered with such imperial or national impetus as may be deemed sufficient to offer reasonable prospects of success. The means of attack will be furnished by the available resources of a great nation; the nature and amount of force employed for the purpose will be determined by the necessities will be estimated by our means and methods of resistance. Concentrated energy of Imperial or national power may be brought to bear on the point selected for attack. Now, suppose either Vancouver's, King George's Sound, Fiji, Newcastle, Sydney, or any other point be so selected. If our power of military resistance at such points be regulated not with reference to the Imperial importance of the position, nor to the nature and extent of defensive work to be done, nor yet by the possible force of attack, but simply by a rule-of-thumb system of arming and drilling whatever Englishmen happen to live there, the result of contact is not a matter for speculation or for hope—it is a miserable certainty. The simple truth is that power of attack means power of concentration; and if in defence power of concentration be absent, weakness is opposed to strength, and a very natural result follows "the survival of the strongest."

The advantage to be gained by such an operation is an Imperial or national advantage, while under our "home defence" arrangements the military resistance to be overcome would be but fragmentary, or, in other words, colonial. The principle of local defence, which prevents the concentration and combination of the whole war power of Australia, is one of the strongest possible inducements for attacking favorable positions there, in order to reduce each colony in succession.

Again, all colonies are not practically taking the same view of preparations for defence. Some are doing much towards providing military means to resists attack, others are doing little or nothing. In a general war, are the people of the United Kingdom to help those who helped themselves," or are their efforts to be chiefly directed to protecting those who by their own neglect have rendered themselves more tempting objects of attack? Without some binding federal arrangement as to the distribution, organization, and maintenance of war power, the colony that buried its talent in peace may in war reap the solid advantages of assistance from us at the expense of others who meanwhile have made ten. But, more than [illegible], are the residents in the United Kingdom to be left to give or hold assistance at will, and be free from any binding federal obligations? Or are they to be expected to have real Imperial strength without power to draw from the whole Empire; in proportion to the resources of its several parts, real Imperial power? If there be distinctness of responsility in war, these questions must be answered. They must not be left to be settled when war comes, to chance and English spirit." Sentiment without system means in these days defeat and disaster. To take a practical illustration. Canada, with a population of some three and a half millions, furnishes an example to the English race. Her commercial progress in peace does not blind her to the necessity of being prepared for war. She takes a calm view of her position, and arranges to meet possible events. She taxes her financial resources, and calls on all her sons to do their duty, and willingly do they respond. Possibly some day or other, the eyes of the world will be fixed on North America, watching a life and death struggle for the honor of the English name. In such a case are other fragments of the Empire to despatch correspondents to give interesting accounts of the proceedings and—nothing else. The naval power of the United States, drawn from 10,000 miles of Atlantic coast, would, if we do not prevent it, be concentrated on the St. Lawrence. Considering that an Englishman in Canada bears a far heavier military burden than an Englishman in the United Kingdom, surely in common justice, we would be bound to sacrifice our whole naval power rather than permit her being invested by blockade. This involves our sending, besides a naval force superior to hers, a strong war garrison to Halifax, and a movable and purely military force for strategical coast distribution, and for counter attack. But let us turn to the South; are we then to leave Bermuda without force, and abandon to their fate the English West Indies? Our only movable military force which is also the reserve for India, is but 100,000. This force would be at once absorbed by requirements in the West Atlantic. We may be in no danger of invasion at home, and sorely pressed for troops abroad, but meantime we shall have a military force of 300,000 men in the United Kingdom, which the principle of "home defence" has made it impossible for us to move. It is illegal to send them where they are required, therefore they must remain where they are not wanted, and look on at Englishmen being slaughtered, with the calm consciousness that, thousands of miles away from the fight, they are striking examples of the principle of self-reliance, and fulfilling Imperial responsibilities in war.

Our fleets, however, will want other things besides military garrisons at their bases. In these days they will need dockyards near at hand, providing sufficient means of repair; and they will require a sure, steady, and certain supply of coal and telegraphic communication.

To protect the trade lines in the Pacific Ocean, with its 70,000,000 square miles of water, we shall in war require an enormous fleet. That fleet should be entirely independent of Atlantic dockyards, and a great Imperial dockyard at the other side of the world is a most apparent necessity.

Though Australia and New Zealand are first and chiefly concerned, it is not merely a colonial want. Every portion of our Empire has an interest in that ocean, and therefore such a dockyard is a great Imperial requirement. If it be said our Empire cannot afford to create such a dockyard, then let us quietly haul down the Union Jack in the Pacific before we are ignominously compelled to strike it. But before doing so, it may be worth considering whether it would not be a better alternative to abolish one of our home dockyards, and remove the officials, plant, and sufficient reserve ships to Sydney, the natural Portsmouth of the Pacific. The loss at home would be more apparent than real. Though there would be one Royal dockyard less at home, the pressure both in peace and war of the maintenance of fleets for half the world would be removed. The resources of private yards at home are so [illegible]

mous that not only can they meet the demands of the mercantile marine in its busy time of peace, but they can turn out war vessels for our possible enemies, by scores. They would be idle in war, and available for the construction and repair of war ships. There are no such private naval resources away from English shores, and therefore at present for aid, for reinforcements, and for maintenance the enormous Pacific fleet responsible for the safety of half the world must in war rely on private and public yards crowded together in a small island in the north-west corner of the Atlantic ocean! To use a homely phrase, "all our naval eggs are in one basket," and though we may lay them one side of the globe, the communications on the other may be exposed or shut out from us while they are being hatched

(To be continued.)

Military News.

—Sir Garnet Wolseley's opinion on drill, a highly valuable one, it is needless to add, is a good deal in accordance with that of the first French conquerors of Africa, who sought to make their men limber and ready, rather than to look to parade movements and appearance on drill. It is to be remembered that the seeming stiffness of the British soldier was borrowed from the school of England's royal and loyal ally, Frederick the Great.

ROYAL COMMISSION ON DEFENCE.—The Royal Commission on the Defences of the Colonies and India will not conclude their labours for two or three years. The evidence already taken shows and extraordinary lack of anything like a systematic plan for the protection of imperial commerce. Vancouver's Island and the Australian colonies are absolutely at the mercy of the Russian Pacific fleet. It is expected that the first report of the Defence Commission will assume the character of a confidential document for the information and guidance of the Government. A point of some interest connected with this circumstance is the movement which has been lately started by the Agents-General of the Colonies in London to bring about closer relations between the mother-country and her dependencies. The programme of that scheme includes not only tariff and emigration questions, but also the question of colonial defence.

—The German military and naval authorities are evidently determined that the shores of Germany shall be rendered as secure against attack as they can possibly be made. Assuming in any future war Germany found herself opposed to an enemy mistress of the sea, the latter might possibly, were the shores of the Baltic and North Sea unprotected, attempt to reach Berlin by landing an expeditionary force at some convenient point, establishing there a naval base of operations and advancing thence on the capital, while the bulk of the German army might be employed in defending some distant frontier. Accordingly of late years the German shores have been closely studied. fortifications have been constructed at the points which seem to lend themselves most to attack, and a system of defence has been carefully worked out, and arrangements for resisting attack have been perfected as far as possible even to the minutest detail. Last month strong detachments of the troops who, in the event of war, will be called upon to garrison the coast defences of the empire were exercised in target practice with the heavy guns mounted in the works. The exercises were continued for fourteen days; the value of the ammunition expended exceeding, it is estimated, a quarter-of-a-million marks, or £12,500. The heaviest gun used during the firing was the 28-centimetre Krupp piece, which weighs 27½ tons, and which, according to calculations made by German artillerists, can at a range of 360 yards sends its projectile through the most strongly protected part of the side of any ironclad afloat, with the exception of the "Dandolo," "Duilio," "Ajax," "Agamemnon," and "Inflexible." The 40-centimetre Krupp gun, which, it is stated can pierce an iron plate 24 inches thick at a distance of 4,000 metres, and which, therefore, can at that distance send its projectile through the armour of the strongest man-of-war of any navy, is, however, about to be added to the armament of some of the more important of our coast fortifications; but the manner in which they are to be mounted has not yet been definitely decided upon.

—Colonel Feiss, in an essay upon the military organization of Switzerland, states that the Confederation possesses an army of 202,477 men, consisting of 4,316 officers and 101,109 soldiers of the elite, and of 3,648 officers and 93,506 men of the landwehr. Colonel Feiss, who enters very fully into the questions of pay and exemption from service, says that the proportion of recruits unable to read or write was about one in six last year, and that for the last four years the proportions of recruits rejected as physically unfit for service has been steadily diminishing; while 57 per cent. were passed in 1877, the percentage fell to 49 in 1878 and 1879, and to 43 this years. The largest proportion of qualified recruits has always come from the cantons of Geneva, Vaud, Haut-Valais, Thurgau, Zurick, Appenzell, and St. Gall, but there has been a considerable falling-off even in them of late.

—A German medical paper gives a list of some of the most notable instances where in weather such as we have lately had bodies of troops on the march have suffered severely from the heat. During the Seven Years' War, when Frederick the Great was marching from Marienstern upon Bautzen, no fewer than 300 men died on one day—the 6th of August, 1760—from sunstroke. On the 21st of May, 1827, while the Guard Corps was manœuvring between Berlin and Potsdam, the men, exhausted by the heat, "fell down in masses" on the road, and the whole force became a mere rabble, some struggling on in vain attempts to keep their places in the ranks, others lying down and dying by the wayside. On the 8th of July, 1853, at the conclusion of some manœuvres in the camp of Beverloo two battalions were ordered to march to the adjacent station of Hasselt to proceed by special train to Brussels; but before the former place could be reached so many men had died from sunstroke, or had fallen down exhausted by the heat, that of the 600 men originally comprised in the two battalions 150 only arrived at Brussels. Assistance was sent from Hasselt on the state of affairs becoming known, and throughout the night the bodies of those who had died from sunstroke and the bodies of those who had fallen down exhausted were brought in on wagons and carts sent out to collect them. In the following year a column of Prussian troops suffered in a similar manner, and during one of the marches of the French army in the Dobrudscha an equally great mortality ensued. In the campaign of 1866 the troops engaged suffered very little from the heat and in the war of 1870-71 there were also comparatively few cases of sunstroke, but during the operations connected with the occupation of Bosnia, large numbers of men fell victims to the heat, a single Austrian regiment marching from Brod to Derwent on the 30th of July leaving behind 320 men, thirty-one of whom died almost as they fell down exhausted. The summer of 1873 was exceedingly hot on the Continent, and many soldiers succumbed to the heat on the line of march or during exercise in the field; but this year, although the season has again been a warm one, comparatively few cases of sunstroke among troops have been reported, owing presumably to the additional precautions now taken in every army when men are exposed to the sun, and to the attention which has been given by army doctors and others to the investigation of the preventive measures to be adopted.

LECTURE ON THE PRINCIPLES WHICH SHOULD GUIDE THE CONSTRUCTION OF HEAVY ORDNANCE, AND ON THE MATERIALS FOR THE SAME.*

It cannot be too strongly affirmed that formulæ are but the expression in accurate language of physical law; and yet we find it asserted by the Woolwich Authorities, as it is in their last Red Book, that the law of distribution of strains "is not exactly known," that there are two laws the results of which vary from each other by 50 per cent. and that *one* of them which is indisputably wrong is simpler than the other, and yet that its results have been shown to be fairly trustworthy in practice, and yet again in the same sentence that the actual tension "probably lies somewhere between the two results."

If there be any who advocate the use of solid steel guns they would do well to reflect that while they are providing a strong and costly metal to resist the initial strain which may be represented by 4,233 lbs. per cubic inch, they are employing the very same costly material where the strain will not exceed 1-4th of that amount.

BUILT-UP GUNS.

Here we have a series of concentric cylinders, shrunk one over the other so as to distribute the strains more equally.

By the formula which I have given elsewhere the various strains are calculated.

If then the maximum be within the limit of elasticity of the material it is evident that this gun will never fail.

But if the dimensions of the rings be not calculated by the proper formula so that the shrinkages be suitable to the modulus of elasticity, a very different state of affairs would exist.

In this case one or more of the rings may be strained beyond its elastic limit, a permanent set may take place, each successive firing may increase the derangement of the strains, and finally by increasing the strain in the inner tube it may give way by pricking.

This has been the fate of many of the Woolwich guns, and amongst others the celebrated 81-ton gun

The strength of a built-up gun, if properly designed, increases as the number of concentric rings increases, thus if six rings were used instead of three the diagram of strains would be approaching to Fig. 2, upper dotted lines, and if the system of wire were adopted it would be practically a straight line at the top.

The cost of construction increases very considerably with the number of rings, as does the probability of error from imperfect workmanship, whilst with wire there is no extra cost of construction, and no accuracy of workmanship is required as the initial strains are not the result of shrinkage, but are actually measured as the iron is coiled on.

Moreover steel in the form of wire is much stronger than in larger masses, and the extra cost per ton of the wire would be much more than compensated for by the lesser weight of material and the greater facility of its application.

In a gun of many concentric coils, and especially a wire gun, we can so adjust the initial strains that the tension on the inner tube during explosion may be reduced *ad libitum*, and indeed it may always remain under compression.

I believe therefore that chilled cast iron might be used for the inner tube and the rifling cast in it and afterwards ground out by an emery lap.

The Elswick guns are certainly stronger than the Woolwich guns, because the rings are more numerous and more carefully adjusted. The same may be said of Sir Joseph Whitworth's gun were the successive coils laid on with proper shrinkage.

In his 38-ton gun Sir Joseph has four coils over the tube at the powder chamber against two in the Woolwich.

The maximum strains would be as follows:—

Woolwich gun, steel tube	.. .. ..	7·22 *tons.*
" 1st iron coil	.. .. ..	9·33 "
" 2nd " "	.. .. ..	13·74 "
Whitworth steel throughout	.. .. ..	10·00 "

It is therefore evident that the Woolwich gun with a very inferior material outside the tube is strained in the second coil beyond the elastic limit and permanent set would take place.

I have probably said enough to convince you that the Woolwich gun is of very faulty construction, and those who are interested in the question will find this fully demonstrated in my late paper on the construction of heavy ordnance.

Before leaving the question of construction I must make a few further remarks about shrinkage, regarding which I cannot but think there still exists a good deal of misconception.

For instance, it seems to be thought by some that when the gun is at rest all the tension of the outer rings must be supported by the inner tube and therefore that the amount *of possible tension* is limited by the compression which the thin inner tube will bear.

This is altogether erroneous, because the compression is not borne solely by the inner tube, and by properly proportioning the thickness and shrinkages of the rings we can distribute the compression pretty much *ad libitum*.

Again, I find it stated by Major Morgan in the paper which he read here on "Breech loading and Muzzle Loading for Guns," "that the utmost strength that can be obtained by shrinkage is *to double the strength which would be given by the same material without shrinkage.*"

I must entirely dissent from such a statement, and without going into calculations in this place, I will point to the drawing, Fig. 9, which shows the strength of a gun 12 inches bore and 22½ inches thick, built of a material the elastic limit of which is 19 tons per square inch. The full lines represent the strains *under firing when* the material is strained to 10 tons per square inch, and when the five concentric rings are put on with a proper tension. In this state the gun will resist an internal pressure of 24 tons per square inch.

Sir William Palliser advocates a soft yielding material for the inner tube, and he is right, for such moderate pressures as will not give the tube a permanent set, and when he has a heavy mass of cast iron outside.

He would be right also in applying such a tube to the Woolwich guns as at present constructed, or to any hooped gun constructed as it is without proper regard to initial tension. In such a case the yielding soft tube would gradually accommodate itself to its position, and in doing so would vary and possibly to some extent equalize the discordant strains among the outer rings, and the tube would not crack as the steel tube of the Woolwich gun does, and the gun might last a very long time under severe trial, but none the less would it be (all but certainly) undergoing a gradual deterioration, and its fracture might come unawares and probably be attended with fatal consequences.

Sir William Armstrong on the other hand advocates a hard steel tube and yielding iron rings outside.

Here again if the rings are properly proportioned he may make a good gun. If they are never strained beyond the elastic limit and if the steel tube also is also under the same conditions, then it matters not how hard it is, the gun will never fail by bursting.

Nay, so far as it is true that the nature of the material and its behaviour is regulated by the tensions, that a chilled cast iron inner tube bound round with steel wire or ellipsed in steel rings or even iron hoops properly, properly proportioned, would make a perfectly safe gun.

EFFECT OF HEATING.

It is maintained by some eminent men that this heating is due to the actual transmission of heat from the powder gases to the interior surface of the gun, and thence by conduction through its mass.

This I hold to be entirely erroneous. Very little heat is so transmitted and the greater part of the heat set up is due to the vibration of the molecules of the material set up by the sudden application of the force of the explosion

As I had the misfortune to differ altogether from Dr. Siemons on this point during the late discussion at the Institution of Civil Engineers, I wrote to Professor Tyndall asking his opinion. In his reply he did not give any opinion of his own, but informed me that Count Rumford had made a special investigation on the subject, and that his conclusions agreed with mine. I have since referred to Rumford's paper, which is not in the old edition of his Works, but is contained in the new edition published in 1870 by the American Scientific Society.

His experiments are very interesting and conclusive, but there is one thing which at first sight seems to militate against the theory, and that is that the heating effect is greater when the charge is fired without a shot and even without a wad. This however is really confirmatory of the theory.

1st. Because under these circumstances the temperature of the gases thus being uncompressed, is lower.

2nd. Because the rapidity of their escape being greater, the time of contact is less.

The real reason of the increase of heating is that the velocity of the impact is enormously increased, although its statical intensity is very much less.

A pressure of 100 tons per square inch applied very gradually, say in 10 seconds of time, would set up very little heat, but a pressure of 1 ton applied at a velocity of 6,000 or 7,000 feet per second would generate a great deal, and thus it is that the lower pressure of the unconfined powder gases acting with the enormously increased velocity, sets up more heat than the higher pressure guns when confined by a wad and heavy shot in front of it.

Rumford's experiments, therefore, entirely confirm my own view.

But I can carry the matter further and show that independent of experiment we may conclude that it must be so.

Heat can only pass from one medium to another at a certain rate, that is to say, only a certain number of units of heat can enter a square foot of steel or iron in a second of time. This number of units depends *firstly* upon the nature of the material. It is different in lead or copper from what it is in iron or steel.

It depends *secondly* upon the state of the absorbing surfaces. According to Professor Tyndall the rate of absorption is equal to the rate of radiation, and this is very much less in a polished surface than in a rough one.

3rd. It depends upon the difference of temperature of the media but not directly on the difference except when these differences are very small.

See experiments on loss due to radiation.

That a considerable degree of heat is set up is, however, indisputable, but unfortunately, we do not know the law of distribution, nor the degree of its intensity.

As, however, it is due to the sudden strains induced in the material, we may conclude that the rise of temperature at any part is proportionate to the induced strain.

In the next place, we may assume that the rise is instantaneous throughout the mass. It has been suggested that the strain must take time to travel through the mass of the gun, that in fact it is a wave passing from the interior to the exterior, and decreasing in intensity as it goes on, and that if the gun was thick enough, the interior might have returned to its normal state before the strain reached the outside, but in the thickness we have to deal with in guns, such a consideration may be neglected.

The velocity of transmission of the strain would be not less than 11,000 or 12,000 feet per second, so that as regards the time the pressure is inside the gun the period of transmission through two feet of material would be quite unimportant, and may be practically considered as instantaneous, or rather that the whole of the strains, and therefore the whole of the heat, is set up throughout the mass at once and the same time.

Now it may be shown from the formula, that if the whole of a built-up gun be heated by any given amount, say 1000 Fahrenheit, the strains would remain unaltered, provided all the rings were properly proportioned, and this would also be the case in a gun built according to the formula, and especially so in a wire-built gun.

If, on the other hand, the rings be put on haphazard or by rule of thumb, the increase of temperature may seriously affect the strains, and this is a new element of danger in the Woolwich guns, and all others unscientifically put together.

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*Lecture delivered at the United Service Institution by James A. Longridge, M.I.C.E.

I may further remark that inasmuch as the change of strains in the material, and the attendant change of temperature is not uniform throughout the alteration of condition in the structures will be of the more importance in guns when the change is *per saltem* than in those when it follows a uniform law, and hence it is that in guns consisting of many hoops (and especially in wire-built guns), the matter is much less important than in guns consisting of only two or three rings.

Now in the gun of many coils, these alterations would be very much less, and the wire-gun, they would follow a uniform law which might easily be allowed for in the original construction, so that by firing a charge without a shot, the gun would at once be brought up to its maximum state of strength, or very nearly so, and subsequent firing would make little or no difference.

The effect of heating, therefore, may be fully provided against in a gun built according to formula, but might have very serious consequences in one built up hap-hazard.

Having thus laid down the general principles of construction, I will briefly refer to one or two systems of gun making in illustration.

I regret that I am not able to say anything beyond what I have already said with respect to Sir William Armstrong's system, owing to my not having received in time the information which Captain Noble has kindly sent me as to the dimensions and shrinkages employed at Elswick.

I must therefore confine my remarks to Sir Joseph Whitworth's and Sir William Palliser's guns, and I begin with Sir Joseph Whitworth's.

SIR JOSEPH WHITWORTH'S GUN.

Formerly Sir Joseph used to build up his guns of concentric rings or hoops, made slightly taper and forced one on the other by hydraulic pressure.

By the extreme accuracy of workmanship for which Sir Joseph's establishment has so long been justly famed, there can be no doubt that if the calculations are correctly made, a very excellent gun could be made in this way, though of course it would be costly; but Sir Joseph has such perfect confidence in his compressed steel that he does not now deem it necessary to avail himself of the additional strength which would be obtained by putting the successive hoops on under shrinkage, so that in fact his present gun, although built up of successive rings for the sake of convenience, is in the same condition relative to internal strains as would be a solid gun of the same dimensions and materials.

Admiring, as I do, Sir Joseph's material, I think he is not giving either it or himself fair play in thus abandoning the true principle of coil construction.

(To be Continued.)

Scientific Notes.

—The average velocity of light is 185,000 miles per second.

—A cubic foot of air weighs 535 grains. Water is 825 times heavier than air. A cubic foot of water weighs 62½ lbs., a gallon 6 32-100 lbs.

—Platinum has been drawn into wires only one thirty-thousandth part of an inch, visible to the eye, and one mile's length weighing only one grain.

—The speed of an electric spark, travelling over a copper wire, has been ascertained by Wheatstone to be two hundred and eighty-eight thousand miles in a second.

SOUND.—Is the effect produced upon the ear when air is set in motion within certain limits of rapidity. Audible sound begins when about thirty-two vibrations per second are made, and ceases when about 40,000 vibrations per second are reached. In an organ, the deepest note has thirty-two vibrations per second, the highest, 3809. The compass of the human voice is, on an average, about two octaves. Deep F of a bass singer has 87 vibrations per second; upper G of treble, 775.

The number of vibrations corresponding with the middle C of a musical instrument is 522 per second. An octave below, half the number; an octave above, twice the number.

Sound travels at the rate of 1100 feet per second in a still atmosphere. The distance in feet between an observer and the point where a stroke of lightning falls, may be known by multiplying 1100 by the number of seconds that elapse after the flash is seen until the sound is heard.

The force of expansion of solids by heat is enormous. Thus iron, if heated from 32° F. 212°, expands ·0012 of its length, to produce which change of length by mechanical means would require a force of 15 tons.

GUNPOWDER.—Composition:—75 saltpetre, 10 sulphur, 15 charcoal. Average specific gravity of the various sorts used in the Engineer Service to water as ·898 : 1.

Average weight per cubic foot	=	56·42 lbs.
" " inch	=	·053 lb.
" " "	=	·5288 oz.
Cubic content	100 lbs =	1·773 cubic foot.
"	1 lb. =	·0177 "
"	" =	30·6374 cubic inches.
"	1 oz. =	1·915 "

The heat developed at the moment of explosion is 4664° Fahr., and the resulting gas pressure, if the powder closely fills the chamber, is 40 tons or 89,000 lbs. to the square inch.

Careful experiment by De Saint Robert with rifled canon of 3½ inches bore, 8½ lbs shell, 1½ lbs powder, gives 1300 ft. velocity per second, or a little over 900 miles per hour, for the shell when it leaves the mouth of the canon, which is equal to a force of 219,000 foot-pounds, or a little less than seven horse power. But the heat actually developed by the above amount of powder corresponds to almost thirty-two horse-power of work; *seventy-nine per cent.* of [illegible] the total.

HORSE-POWER.—When Watt began to introduce his steam-engines he wished to be able to state their power as compared with that of horses, which were then generally employed for driving mills. He accordingly made a series of experiments, which led him to the conclusion that the average power of a horse was sufficient to raise about 33,000 lbs. one foot in vertical height per minute, and this has been adopted in England and this country as the general measure of power.

A waterfall has one horse-power for every 33,000 lbs. of water flowing in the stream per minute, for each foot of fall. To compute the power of a stream, therefore, multiply the area of its cross section in feet by the velocity in feet per minute, and we have the number of cubic feet flowing along the stream per minute. Multiply this by 62½, the number of pounds in a cubic foot of water, and this by the vertical fall in feet, and we have the foot-pounds per minute of the fall; dividing by 33,000 gives us the horse-power.

For example: A stream flows through a flume 10 feet wide, and the depth of the water is 4 feet; the area of the cross section will be 40 feet. The velocity is 150 feet per minute—40 × 150 = 6000 = the cubic feet of water flowing per minute. 6000 × 62½ = 375,000 = the pounds of water flowing per minute. The fall is 10 feet; 10 × 375,000 = 3,750,000 = the foot-pounds of the water-fall. Divide 3,750,000 by 33,000, and we have 113 21-33 as the horse-power of the fall.

The power of a steam-engine is calculated by multiplying together the area of the piston in inches, the mean pressure in pounds per square inch, the length of the stroke in feet, and the number of strokes per minute; and dividing by 33,000.

Water-wheels yield from 50 to 91 per cent of the water. The actual power of a steam-engine is less than the indicated power, owing to a loss from friction; the amount of this loss varies with the arrangement of the engine and the perfection of the workmanship.

MOLECULES.—A molecule is the smallest mass into which any substance can be subdivided without changing its chemical nature.

All substances are aggregations of isolated molecules.

A piece of gold having six plane surfaces, each one inch square is called a cubic inch of gold, and looks as if it solidly filled that space. But it is not solid, for it is composed of individual molecules, which are separated by comparatively wide intervals.

Molecules are, to use the language of Sir William Thompson, "pieces of matter of measurable dimensions, with shape, motion, and laws of action." A molecule of glass, as measured by this philosopher, is one five hundred millionth part of an inch in diameter.

Equal volumes of Substances, when in a state of gas, and under like conditions, contain the same number of molecules.

The number of molecules in a cubic inch of any perfect gas, at 32° F. and 30 ins. barometer pressure, is one hundred thousand millions of millions of millions, or 10^{23}.

The molecules of bodies are never at rest, but have a constant motion. The molecules of a gas confined in a vessel have great energy, are always flying about at a high velocity but in straight lines. They strike against each other and rebound, they drive against the inner walls of the vessel, and the force of this impact against the walls we call the pressure of a gas.

At a barometer pressure of 30 inches, or 15 lbs. to the square inch, temperature 32° F., the molecules of hydrogen have a velocity of 6037 feet per second, or over 4000 miles per hour. The energy of a pound of hydrogen, under the above conditions, is equal to that of a cannon-ball of the same weight having the same velocity.

A cubic inch of water may by heat be expanded into gaseous form, or steam, occupying the space of a cubic foot. In both forms the same number of molecules of water are found; but in the gaseous condition, the molecules are much more widely separated than in the liquid; so widely, in fact, that a cubic foot of alcohol vapor together with a cubic foot of ether vapor may be introduced into the vessel—or, apparently, just as much of the alcohol, and just as much of the ether, as if there were no water vapor present. All these vapors remain separate; they do not chemically unite.

A Big Score.

The Toronto Field Battery' Figures Eclipsed—Big Work by the Montreal Field Battery.

QUEBEC, Sept. 27.—The Montreal Field Battery fired to-day in the Dominion competition, and succeeded in making the highest score of the season, if not on record, in the Dominion, being a total score of 555, therefore beating the Toronto battery by 73 points. Lieutenant-Colonel Stevenson, in command of the battery, is highly delighted at beating the score of the Toronto boys. The firing party of 16 men, commanded by Lieutenant-Colonel Stevenson and Capt. Oswald; arrived here yesterday morning and went to the citadel, where they were most hospitably received and entertained by the officers and men of "A" battery. Contrary to the usual custom here, they found that they had to take their guns and targets down to the Island of Orleans, and when there, to put the latter in position previous to firing. All of which was formerly done in advance while Col. Strange commanded here. The weather was heavy and rainy nearly all day, there being only two or three hours of sunshine in the forenoon, but nevertheless the shooting was excellent throughout. The three highest scores were:—Sergeant Hastings, 43; Sergeant Ma..h, 12, Gunner Moffat, 41. *Toronto Mail.*