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Publisher: Routledge
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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>

Naval

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Published online: 11 Sep 2009.

To cite this article: Lient. C. D. BonaHan R.E. (1894) Naval, Royal United Services Institution. Journal, 38:200, 1141-1170, DOI: [10.1080/03071849409418613](https://doi.org/10.1080/03071849409418613)

To link to this article: <http://dx.doi.org/10.1080/03071849409418613>

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NAVAL AND MILITARY NOTES.

NAVAL.

Home.—The following are the principal appointments which have been made: Captains, A. D. Acland to "Australia;" F. W. Fisher to "Orlando;" C. R. Arbuthnot to "Crescent;" H. Rose to "Indus." Commanders, A. M. Farquhar to "Buzzard," reappointed; C. Windham to "Fearless," reappointed; F. G. Stopford to "Tartar."

The new torpedo-gunboat "Harrier" has completed her steam trials satisfactorily. She went through her eight hours' natural draught trial on the 28th August; there was no difficulty in exceeding the 2,500 I.H.P. stipulated for in the conditions of contract. The speed results, for which the contractors do not hold themselves responsible, were agreeably surprising, for whereas the "Halcyon" and "Hazard," of the same type as the "Harrier," obtained on their natural draught trials speeds of 16.9 knots and 17.1 knots respectively, the "Harrier" made at least 18 knots. The estimated speed of these vessels at load draught, with clean bottoms and in smooth water, is 17 to 17.5 knots, so that the results on this occasion were especially gratifying. For eight hours' steaming the mean results were:—Steam in boilers, 150 lbs.; engines, 143 lbs.; vacuum, starboard, 26.9, port, 26.8 inches; revolutions, starboard, 229.5, port, 228.1; indicated horse-power, 2,696 (the guaranteed horse-power being 2,500); air pressure, 0.84 of an inch.

On the 11th of September the four hours' trial under forced draught was carried out equally successfully. There was no difficulty in attaining, and even exceeding, the contract force of 3,500 H.P., and as far as speed is concerned the vessel also proved herself a success. She ran easily 19 knots per hour, being 1.3 knots more per hour than was recorded of the "Halcyon," a sister ship engined by the same contractors. The mean results were:—Steam in boilers, 149 lbs.; in engines, 141 lbs.; vacuum, starboard, 27.6 in., port, 27.1 in.; revolutions, starboard, 255.1, port, 252.7; I.H.P., 3,592; air pressure, 1.77 in.; speed by log, 19 knots. The "Halcyon" is as soon as ready to proceed to Portsmouth from Plymouth, where she will be subjected to a series of progressive trials and special tests.

The new torpedo-boat destroyer "Lynx," built and engined by Messrs. Laird, of Birkenhead, has completed her trials successfully. She is a sister vessel to the "Ferret," also lately completed by the same makers; their engines, with slight modifications, are the same as those made by the same builders for H.M.S. "Rattlesnake" in 1886, and the Argentine boats "Espera" and "Rosales" in 1890. The boilers, however, are of the Normand water-tube type. The trials of the "Lynx" gave the following results: Speed on the measured mile, 27.15 knots; mean speed for three hours, 27.01 knots, the contract speed being 27 knots. The bunker capacity is 70 tons, and the engines are of the triple-compound type, with cylinders 19 in., 29 in., and 43 in. in diameter, with 18 in. stroke.

The trials of the new 2nd class cruiser "Flora" do not appear to have been so satisfactory as was reported at the time. A report was sent to Whitehall for the consideration of the Admiralty, and it is stated that their lordships are so displeased with the results recorded that they have directed the attention of the machinery contractors to the necessity of rendering the vessel more efficient.

During the steam trial considerable difficulty was experienced with the eccentrics and piston-rod guides, and the bearings heated to such an extent as to make it necessary to throw water on them to keep them cool. On the forced draught trial the back pressure on the low-pressure cylinder shown on the indicators was regarded as excessive. A high air pressure (rising to a maximum of $2\frac{1}{2}$ in.) was found to be necessary to obtain 9,000 indicated horse power provided for in the conditions of contract. The results point to an unnecessarily large consumption of coal, which cannot be regarded as satisfactory, as the economical working of the machinery at all powers is of the greatest importance. The contractors, in reply, point out that they were not altogether responsible for these results, which were due in a great measure to the hurried manner in which the trials were carried out. They state also that the difficulty in question was due to the insufficient water supply for the ordinary water service, through scoops having been omitted on the inlets; but these have since been fitted, and no further difficulty should be experienced. Referring to the excessive back pressure on the low-pressure cylinder, and the high-air pressure necessary during the forced draught trial, the contractors say, "Knowing that the crew had to be withdrawn from the 'Flora' for the manoeuvres three days after the natural draught trial, there was insufficient time to refill the boilers with fresh water after that trial, which we should have done had there been time. As a result of the condition of the water the boilers were priming almost continuously throughout the whole of the forced draught trial, which, we think, accounts in the main for the excess in the back pressure on the low-pressure cylinder, and the higher air pressure required in the stokehold. The latter was also considerably augmented by the coal being much dirtier than we anticipated, and we feel assured that under ordinary conditions, and with the coal usually supplied to Her Majesty's ships, the working of the machinery will be found perfectly satisfactory."

Great secrecy is being observed with regard to the pneumatic gun trials at Milford Haven. The authorities appear to believe that the new weapon is one of the most effective ever designed. The "Harpy," which is being used as a target ship in connection with the experiments, has been specially fitted for this service by the dockyard authorities at Devonport, and the cost of both material and labour will be defrayed by the War Office. In addition to being fitted with hawsers and slings to facilitate the work of raising her in the event of her sinking, 500 water-tight casks have been stowed between decks to increase her buoyancy. Spars have also been fitted over her side, which, when rigged out, will be capable of suspending explosives 100 feet from the vessel. The Ordnance Committee, under whose direction the experiments are to be carried out, have already arranged a programme of trials for which the ammunition and stores to be supplied will include 16 15-in., 29 10-in., and 64 8-in. shells, filled and fitted with fuzes; six charges of wet gun-cotton, each 250 lb. in weight, with a 2-lb. primer of dry gun-cotton, and nearly 50 dummy shells.

Series I of the programme, which was commenced as soon as the "Harpy" had been moored off Dale Point, was the trial of projectiles of the pneumatic gun against the target ship. The vessel is moored in 60 ft. of water, and during the trials will have her boilers working at full pressure, this being arranged by the engine-room staff on board before leaving the ship. A number of 250-lb. charges (the bursting charge of the 10-in. projectile) will be exploded consecutively at a depth of 25 ft. The first charge was to be fired at a horizontal distance of 100 ft. from the ship's side, the second to be at 80 ft. distance, and the third to be at 60 ft., unless the results of previous rounds should indicate a variation from this arrangement to be advisable. Should the machinery and boilers be still serviceable, two or three additional charges will be exploded at closer ranges, to be decided according to the results of the previous charges. During these trials a naval engineer will inspect and report upon the condition of the steam pipes and boilers after each explosion, and an official from the Dockyard Constructive Department will perform a similar duty with reference to the hull, although it is not anticipated that the hull of the ship will be seriously damaged by the first series of experiments.

The keel-plate of the "Prince George," 1st class barbette battle-ship, was laid down at Portsmouth, on the 10th September. Owing to her great length, it was necessary to reduce the gradient of the blocks, partly to demolish the plate-bending tactory, and to sink the roadway under her prow to facilitate the conveyance of material. Her stern also projects so far beyond the slip that it will only be possible to advance the lower work at low tide. The "Prince George" is a sister ship of the "Majestic," and consequently is of somewhat larger dimensions than those of the ships of the "Royal Sovereign" class. Her length will be 390 ft., her breadth 75 ft., and mean load draft $27\frac{1}{2}$ ft., with a displacement of 14,900 tons, while the total weight of the protective material of the hull (including the protection of the auxiliary armament and protective deck) is to be greater than the corresponding weight in the "Royal Sovereign." The thickness of the side armour has been reduced from 18 in. of compound plating to 9 in. of Harveyized steel armour. The battle-ship will carry four 12-in. breechloaders, contained in two barbettes, and the mountings will be so arranged that the guns can be loaded in any position by manual power. But the main armament will be carried 4 ft. higher than the guns of the "Royal Sovereign," with increased freeboard in proportion. The secondary armament will consist of twelve 6-in. and 28 smaller quick-firing guns. Bilge keels, 200 ft. in length and 3 ft. in depth, will be fitted. The contract for the engines has been placed with Messrs. Humphrys, Tennant, and Co. They are to develop 12,000 horse-power under forced draught, and 10,000 with natural draught, and are estimated to give the ship a speed of $17\frac{1}{2}$ and $16\frac{1}{2}$ knots.

According to the "Naval and Military Record," since the introduction of Harveyized armour for plating battle-ships and cruisers, the dockyard officials have been put to their wits' ends to devise some means for drilling the necessary holes for securing the plates in place. The drills now used become damaged in working the hard prepared plates; in fact, very little working of the Harveyized armour is sufficient to render the drills useless. It has now been suggested that the holes required in the plates should be fused by means of voltaic electricity, and the Admiralty so far favour this suggestion that they have given directions for the necessary plant to be supplied to each of the home dockyards. At Devonport, arrangements for fusing the holes are to be made at once, and the plant will consist of a set of 400 ampère electric light machinery (Willems-Siemens combination, last used in the ill-fated "Victoria," battle-ship, and transferred from her to Malta Dockyard before her last cruise), and one of the four boilers recently removed from the "Sharpshooter," gunboat.

A well-known name passes away from active service in the fleet; the "Himalaya," the oldest vessel on the effective list, has been paid off, and is to be sold out of the service, although it is stated that her hull now is as sound as when she was bought 30 years ago. She was built in 1853 by Messrs. Mare and Co., of Blackwall, for the P. and O. Steamship Company, but in July, 1854, the Admiralty, being anxious to secure a suitable vessel for the conveyance of troops to the Russian war, purchased her for £130,000. Since then she has been continuously employed as an Imperial troop-ship, her longest rest being in 1881, when she was supplied with new engines and boilers by Messrs. Maudslay, Sons, and Field, at a cost of 33,000*l*. Since her purchase money was paid (at which time she was completed for sea) she has cost in maintenance and repairs over 500,000*l*.

It is now reported that the "Assistance," whose hull is in very good condition, will not be put up for sale, but is to be attached as tender to the "Asia," the depot ship for stokers at Portsmouth, which is at present very overcrowded; the engines and boilers of the ship are to be left in her, and kept ready for use, in case of her services being at any time required.

Another interesting Return has lately been presented to Parliament by the Admiralty, and, as it is short and useful for purposes of reference, we reproduce it

for the benefit of readers of the Journal, who may not have an opportunity of seeing the original. It is entitled:

"RETURN of Seagoing War Ships in Commission, in Reserve, and Building; and showing the Naval Expenditure, Revenue, Tonnage of Mercantile Marine, and Value of Seaborne Commerce of various Countries for the year 1893:"

"And, RETURN showing Naval Expenditure on Seagoing Force, the Value of Seaborne Commerce (exclusive of Interchange with the United Kingdom), and the Revenue of British Self-governing Colonies for the year 1893 (in continuation of Parliamentary Paper, No. 396, of Session 1890-91, and of No. 372, of Session 1893)."

(See facing page.)

The Lessons of the Engagement off the Yalu. (Reprinted by permission from "The Times.")—Sir,—There is—it may be freely admitted—no small presumption in asking you to find room for a letter on the engagement off the Yalu after the very able manner in which it has been dealt with by the writer of the article on "The War in the East" in "The Times" of this morning. An event like the recent engagement, however, is so rare, and the consideration of it is of such great importance to a naval people like ourselves, that you may be willing to admit to your columns another and rather more minute discussion of its details. Such a discussion has been made possible by the valuable telegram in "The Times" of yesterday from your Special Correspondent at Chefoo, to whom every student of naval warfare in this country ought to be grateful.

The composition of the contending fleets—as reported in the telegrams from both sides published during the last few days—is given in the following tables, which are taken from Lord Brassey's "Naval Annual" for the present year, except as regards the two Chinese gunboats. These are assumed to be of the "Epsilon" and "Zeta" type, and their tonnage and armament are taken from Brassey's "British Navy," vol. i, 1882. In the statement of the guns, light pieces, such as the 12-pr. of the gunboats and field and boat guns in other ships of both fleets, are omitted, for they were probably not used:—

RETURN of Seagoing War Ships in Commission, in Reserve, and Building; and showing the Naval Expenditure, Revenue, Tonnage of Mercantile Marine, and Value of Seaborne Commerce of various Countries for the latest Year for which Information is available.

COUNTRIES.	SEAGOING WAR VESSELS.												Aggregate naval expenditure.	Aggregate revenue.	Aggregate tonnage, mercantile marine (vessels of 100 tons gross and upwards).	Value of seaborne commerce.	Remarks.
	IN COMMISSION.*				IN RESERVE.*				BUILDING AND COMPLETING FOR SEA.*								
	Battle-ships.	Coast-defence ships (armoured).	Cruisers (armoured and un-armoured).	Other ships not torpedo-boats.	Battle-ships.	Coast-defence ships (armoured).	Cruisers (armoured and un-armoured).	Other ships not torpedo-boats.	Battle-ships.	Coast-defence ships (armoured).	Cruisers (armoured and un-armoured).	Other ships not torpedo-boats.					
BRITISH EMPIRE.																	
United Kingdom.....	24	4	63	78	15	12	53	46	7	—	15	51	£ 17,402,742 (a) (1892-93)	£ 90,395,377* (1892-93)	Tons. 11,563,997 (1893-94)	£ 681,826,448 (1893)	(a) Figures show tons of rupees. The official rate of exchange for 1891-92 was 1s. 6½d.; for 1892-93 it was 1s. 4½d.
India (i)	—	1	—	1	—	1	—	1	—	—	—	—	295,153 (a) (i) (1892-93)	89,143,283* (a) (1891-92)	42,016 (net) † (1892)	103,263,941 (a) (b) (1891-92)	(b) Excluding trade with the United Kingdom, and necessarily counting inter-colonial trade twice over.
Self-governing Colonies (b)	—	—	4	2	—	1	2	4	—	—	—	—	268,602‡ (i) (1891-92)	43,037,178* (1891-92-93)	1,059,071 (net) † (1892)	88,512,868 (b) (1891-92)	
Other Colonies.....	—	—	—	—	—	—	—	—	—	—	—	—	—	6,116,658* (1891-92)	113,587 (net) † (1892)	53,400,000 (b) (c) (1891-92)	(c) Total trade.
Total British Empire... }	24	5	67	81	15	14	55	51	7	—	15	51	17,666,497	228,692,496	12,778,669	929,039,257	(d) Approximate only, the Returns making no distinction between seaborne and overland traffic.
France.....	18	4	31	24	9	10	18	15	9	—	16	4	10,901,858 (1891)	134,560,000 (1891)	1,052,022 (1893-94)	271,972,000 (1892)	(e) Estimated normal revenue.
Russia.....	5	—	6	9	—	14	7	27	9	2	2	3	5,249,280 (1891)	93,467,000* (1891)	492,202 (1893-94)	64,142,000 (1891)	(f) Does not include vessels engaged in Lake trade.
Germany.....	8	—	13	6	—	13	15	6	7	—	1	1	3,696,149 (1890-91)	62,661,000* (1890-91)	1,735,683 (1893-94)	211,402,000 (1890)	(g) Includes border trade.
Italy.....	9	—	5	14	—	4	10	21	3	—	8	2	3,834,816 (1891-92)	70,319,000* (1891-92)	796,247 (1893-94)	46,293,000 (1891)	(h) Includes Her Majesty's vessels for the protection of floating trade in Australasian waters.
Spain.....	1	—	10	50	—	1	1	2	1	—	7	8	889,000 (1891-92)	31,179,000 (1891-92)	564,404 (1893-94)	64,636,000 (1891)	(i) Includes Her Majesty's ships and vessels for the naval defence of India.
Austria-Hungary.....	1	—	5	5	—	—	5	15	—	3	2	—	1,039,806 (1891)	97,981,000 (1891)	298,674 (1893-94)	22,850,000 (1890)	(k) There are no Returns for Hong Kong and Gibraltar. The trade of Hong Kong with countries other than the United Kingdom is estimated at upwards of £40,000,000.
Netherlands.....	1	7	4	41	—	10	5	23	—	3	—	—	1,178,542 (1892)	10,970,000 (1892)	442,071 (1893-94)	65,044,000 (1891)	(l) From the "Victorian Year Book, 1892."
Portugal.....	1	—	2	23	—	—	—	6	—	—	—	—	590,000 (1892-93)	10,513,000 (1892-93)	104,394 (1893-94)	14,186,000 (d) (1890)	(m) All figures for the commerce and revenue of the Colonies are from Board of Trade Returns.
United States.....	—	—	13	11	—	15	11	7	6	5	5	3	4,362,291 (1891-92)	153,417,000* (1891-92)	1,005,960 (net) † (1890-91) (f)	373,358,000 (1890-91)	(n) Of this total, £15,330,857 was ordinary expenditure; £2,065,900 was expenditure under the Naval Defence Fund (outside Navy votes), and £5,985 expenditure under the Imperial Defence Fund.
China.....	2	1	12	48	—	—	—	19	—	—	—	1	?	18,413,000 (e) (1893-94)	48,189 (1893-94)	88,000,000 (d) (1891)	(o) Includes a contribution of £50,000 for Her Majesty's ships in Indian waters (this arrangement is still under consideration), and £50,000 on account for Her Majesty's ships and vessels for the Naval Defence of India. The amount to be paid under the last head will in future be £59,600 annually. The balance of Rs. 195,163 represents expenditure on the Royal Indian Marine.
Japan.....	1	—	17	10	—	—	4	—	—	—	—	1	2,267,811 (1891-92)	16,155,000 (1891-92)	173,283 (1893-94)	23,742,000 (1891)	
Chile.....	1	2	4	4	—	—	2	2	—	—	1	—	?	4,030,000 (1892)	108,626 (1893-94)	28,392,000 (c) (1890)	
Brazil.....	2	—	3	14	—	2	—	—	—	—	—	—	779,628 (1891)	25,720,000 (1891)	196,981 (1893-94)	65,016,000 (c) (1890)	
Argentina.....	3	2	2	9	—	—	1	4	—	—	1	—	382,321 (1892)	23,580,000 (1892)	54,454 (1893-94)	46,067,000 (1890)	
* The first three columns in each division are based on Parliamentary Return No. 465 of 15th December, 1893. The fourth column contains the number of "other ships" to which a present fighting value may be assigned.																	
													From the "Statesman's Year Book." Those marked * from Board of Trade Returns.	From Lloyd's Universal Register. Those marked † from Board of Trade Returns.	From Board of Trade Returns. Figures for Brazil from the "Statesman's Year Book."		

RETURN showing Naval Expenditure on Seagoing Force, the Value of Seaborne Commerce (exclusive of Interchange with the United Kingdom), and the Revenue of British Self-governing Colonies for the latest Year for which Information is available.

COLONIES.		Naval expenditure on seagoing force.†	Year.	Value of sea-borne commerce, exclusive of inter- change with United Kingdom. (m)	Year.	Revenue. (m)	Year.	Remarks.
		£		£		£		
British North America.....	{ Canada.....	—	—	14,750,000 (d)	1891-92	7,586,686	1891-92	† The annual Australasian contribution of £126,000 for Her Majesty's vessels for the defence of floating trade in Australasian waters is included in these figures, the distribution being as follows:— £
	{ Newfoundland.....	—	—	2,082,986	1891	392,586	1892	
	Total..... £	—	—	16,832,986 (b)	—	7,979,142	—	
British South Africa.....	{ Cape Colony.....	—	—	2,119,438	1892	4,495,344	1891-92	New South Wales..... 37,850 Victoria..... 37,414 Queensland..... 13,260 South Australia..... 10,527 Western Australia..... 1,722 New Zealand..... 20,489 Tasmania..... 4,932
	{ Natal.....	—	—	1,290,783	1892	1,392,455	1891-92	
	Total..... £	—	—	3,710,221 (b)	—	5,887,799	—	
Australasia.....	{ New South Wales....	109,169 (l)	1891	26,210,875 (g)	1892	10,501,104	1892	£126,000
	{ Victoria.....	84,025 (l)	1891-92	16,982,500	1892	6,963,292	1892-93	
	{ Queensland.....	25,269 (l)	1891-92	7,400,769 (g)	1892	3,445,043	1892-93	
	{ South Australia.....	22,896 (l)	1891-92	9,950,865 (g)	1892	2,538,995	1892	
	{ Western Australia....	1,722 (l)	1891	1,285,061	1892	543,888	1892	
	{ New Zealand.....	20,489 (l)	1891-92	4,226,920	1892	4,389,251	1892	
	{ Tasmania.....	4,932 (l)	1891	1,986,671	1892	787,764	1892	
	Total..... £	268,602 (l)	—	67,999,661 (b)	—	29,170,237	—	
Grand Total..... £		268,602 (l)	—	88,542,668 (b)	—	48,037,178	—	

The Chinese Fleet.

Ships' names.	Displacement. Tons.	Armour (in inches).		Guns.	Torpedo dis- charges.	Speed, knots.
		On belt.	On turret, barbette, or battery.			
Ting-Yuen ..	7,430	14	12	Four 30.5-cm., two 15-cm., eight machine	2	14.5
Chen-Yuen..	7,430	14	12	Four 30.5-cm., two 15-cm., eight machine	2	14.5
Lai-Yuen ...	2,850	9½	8	Two 8½-in., two 6-in., seven machine	4	16.5
King-Yuen..	2,850	9½	8	Two 8½-in., two 6-in., seven machine	4	16.5
Ping-Yuen ..	2,850	8	5	One 10.2-in. Krupp, two 6-in., eight Q.F.	4	(?) 16.5
Chih Yuen..	2,300	—	10	Three 8-in., two 6-in., seven Q.F., two 47-mm. Q.F., eight 27-mm. Q.F., six machine	4	18.0
Ching Yuen.	2,300	—	10	Three 8-in., two 6-in., seven Q.F., two 47-mm. Q.F., eight 27-mm. Q.F., six machine	4	18.0
Tsi-Yuen ...	2,355	—	—	Two 21-cm., one 15-cm., nine machine	4	15.0
Chao Yung..	1,350	—	—	Two 10-in., four 4.7-in. Q.F., seven machine.	3	16.8
Yang Wei ..	1,350	—	—	Two 10-in., four 4.7-in. Q.F., seven machine.	3	16.0
Kwang Kai..	1,030	Hull partly of wood		Three 12-cm. Q.F., eight machine..	4	16.5
Kwang Ting.	1,030	Hull partly of wood		Three 12-cm. Q.F., eight machine..	4	16.5
Gunboat	440	—	—	One 11-in.	—	10.0
Gunboat	440	—	—	One 11-in.	—	10.0
Six torpedo-boats	—	—	—	—	—	—

The Japanese Fleet.

Ships' names.	Displacement.	Armour (in inches).		Guns.	Torpedo discharges.	Speed, knots.
		On belt.	On turret, barbette, or battery.			
Matsushima ..	Tons. 4,277	—	12	One 32-cm., 11 12-cm., five 6-pr. Q.F., 11 3-pr. Q.F., six machine	4	17.5
Itsukushima..	4,277	—	12	One 32-cm., 11 12-cm., five 6-pr. Q.F., 11 3-pr. Q.F., six machine	4	17.5
Hasidate....	4,277	—	12	One 32-cm., 11 12-cm. Q.F., six 3-pr. Q.F., six machine	4	17.5
Chiyoda	2,450	4½	—	Ten 12-cm. Q.F., 14 4.7 Q.F., three machine	3	19.0
Fuso	3,718	7	9	Four 24-cm., two 17-cm., five machine	—	13.2
Hiyei.....	2,200	4½	Hull composite	Three 17-cm., six 15-cm.	—	13.0
Takachiho...	3,650	—	—	Two 26-cm., six 15-cm., two (?) Q.F., 10 machine	4	18.7
Yoshino	4,150	—	—	Four 6-in. Q.F., eight 4.7-in. Q.F., 22 3-pr. Q.F.	5	23.0
Naniwa.....	3,650	—	—	Two 26-cm., six 15-cm., two (?) Q.F., 10 machine	4	18.7
Akitsushima.	3,150	—	—	One 32-cm., 12-cm. Q.F., six machine	4	19.0
Akagi	615	—	—	One 24-cm., one 12-cm., two machine	—	12.0
Saikio Maru.	—	—	—	"Fitted with guns as a cruiser."	—	—
Four torpedo-boats	—	—	—	—	—	—

Lord Brassey's lists do not contain the number in the crew of a ship, so that I am not able to give them; but there is reason to think that the Japanese were—though, perhaps, not largely—superior in number of officers and men to the Chinese. The "Ping-Yuen," "Kwang Ting," and the two gunboats might, perhaps, be excluded from the list of Chinese vessels, as, owing to their having been "detached to guard the entrance of the harbour," they took little part, and apparently no effective part, in the action. The gunboats are of a class not designed for employment in fleet actions; and it is difficult to imagine for them any other occupation in that off the Yalu than hampering the movements of their more mobile consorts, if they ranged themselves in formation with them. The only recorded instance of the gunboats' participation in the fight is that of firing the last shot in the action "when the enemy were out of range." The two Chinese gunboats and the Japanese "steam packet" "Saikio Maru," which had been fitted up with guns as a cruiser, will therefore be omitted from the comparison of the respective forces which I am about to make.

The Chinese Fleet carried 98 guns, including quick-firers of the smaller natures. The Japanese Fleet carried 178. The number of machine-guns carried by the Chinese was 81; by the Japanese 54. As far as number of shot goes, the Japanese

could direct against their enemy a fire greatly superior to his. This superiority was even greater than would appear merely from the foregoing figures; because, whilst the Chinese had only 56 Q.F. guns of all natures, the Japanese had no less than 123. Even these latter figures do not express with sufficient precision the real superiority in amount of fire which the Japanese could bring to bear on their opponents. The Chinese had only 14 Q.F. guns of 4.7 in. calibre, the 12-cm. piece being considered as of that calibre, to which it approximates closely enough for the purposes of the present comparison. The Japanese had, as against the 14 of the Chinese, no less than 59 Q.F. guns of 4.7 in. or higher calibre. In view of the character of the action—which, as stated in your article of this morning, “was fought at comparatively long range,” when the smaller quick-firers could rarely be need with effect—the superiority of the Japanese fire, at all events in the number of shot discharged and the consequent reasonably greater probability of hitting, appears to be overwhelming.

The Chinese had the superiority in one particular of their gun armament which is occasionally affirmed to be all-important, viz., in heavy guns. Of the 98 Chinese guns no less than 27 were “armour-piercing” of and above 8-in. calibre.

Of the 178 Japanese guns, only nine were of a higher calibre than 7 in. The Chinese had the superiority in another particular of their armament, which also is sometimes affirmed to be all-important. They had 42 torpedo-discharging arrangements against 32 Japanese.

In one element which we have become accustomed—during the last 25 years, that is—to hear extolled, viz., greater size of individual ships—the Chinese were superior. The united tonnage of the “Ting-Yuen” and the “Chen-Yuen”—14,860—exceeded by more than 2,000 tons the united tonnage—12,831—of the three largest Japanese ships—the “Matsushima,” “Itsukushima,” and “Hiasidate.”

The Japanese had the advantage of their opponents in speed, but to a less extent—all things considered—than might be expected. The number of knots shown against each ship in the lists is, of course, only a “best possible,” and is equally delusive for both sides; but it can be used for purposes of comparison. Omitting the gunboats for the reasons already given, it is seen that the lowest speed with which any Chinese ship is credited is 14.5 knots; whereas three Japanese are of less than 13.5. In a general action the relative slowness of even a few individuals must lower the general rate of speed of the fleet; and it may be taken for granted that the speed of the Japanese never came anywhere near that attributed to the “Yoshino,” or even that attributed to the “Takachiho” and the “Naniwa.” Notwithstanding all this, the Japanese had so much the greater speed that they were able to “play round” their opponents to some extent. It ought to be added that it is probable that the Japanese ships, or many of them, had been longer out of dock than the Chinese. What this would imply will be readily understood by any one who is acquainted with Chinese and Japanese waters, and has observed the great rapidity with which ships’ bottoms get foul, and the diminution of speed caused thereby.

From this survey of the characteristics of the two fleets, it may be perceived that each fairly represented a different principle. The principle represented by the Chinese was that advocated by the school which puts matériel above personnel, for their fleet contained the biggest ships, the less numerous but heaviest guns, and the most extensive torpedo armament. The principle of which the Japanese may be taken as the representatives is that of the school which appeals to history and experience, and not to theories evolved out of the inner consciousness of people without practical knowledge of the sea, and which maintains that the human factor is both the most important and the unchanging factor in war, which must in its broader features remain much what it has always been.

The lucid comments on your Chefoo correspondent’s telegram contained in “The Times” of this morning, render it unnecessary to describe the various movements during the battle with the same minuteness as that with which the composition of the contending forces has been discussed. The engagement took the following form:—Admiral Ting, with 10 ships in some formation not exactly known, but not single line ahead, started at a seven knots speed to meet the approaching Japanese fleet, which, sooner or later, getting into single line ahead, passed round

the starboard, or right flank, and astern of the Chinese fleet, and, coming up on its other flank, steered in the same direction as that in which it was proceeding, and continued to exchange with it an animated gun-fire, scarcely ever at close, and generally at very long, range. The Chinese fleet in the course of the fight got broken up into two parts. One consisted of the two large barbette ships, which were engaged by seven of the principal Japanese ships. The latter moved round an outer circle, usually at long distance from a smaller and inner circle, around which the Chinese barbette ships moved. At the same time a kind of independent action was going on between the five inferior Japanese ships and four Chinese cruisers. The Chinese made one attempt to ram, and discharged one torpedo from a ship, and three from a boat. The attempt to ram resulted, it is claimed, in damaging, though not in destroying, the opponent attacked. The rammer herself was afterwards sunk, it was believed, by gun-fire. All the torpedoes discharged were ineffective. The Japanese tried to use neither the ram nor the torpedo. Besides the "Chih Yuen," the "Lai Yuen" and "Chao Yung" were sunk by shot, and the "Yang Wei" was run aground, to avoid foundering in deep water. The Japanese flagship "Matsushima," which had taken her station in the centre of her line, was so severely injured that Admiral Ito had to shift his flag to the "Hasedate." The "Hiyei" was forced out of action for a time, and the armed packet steamer "Saikio Maru" had to go out of action altogether. The mast of the "Akagi" was shot away, and by its fall killed the captain and two men, all of whom were in the top.

The action lasted about four hours and a half, according to the Chinese, and fully an hour and a half more according to the Japanese. The battle of St. Vincent, it may be remarked, lasted from 11 h. 31 min. A.M. till 3 h. 52 min. P.M.; or, if we include the "few comparatively harmless broadsides" exchanged by the "Britannia" and "Orion" with the Spanish lee division, till 4 h. 50 min. P.M.—that is to say, less than five hours and a-half. The "First of June" began at 9 h. 24 min. A.M., the general firing ceased at 1 h. 15 min. P.M., and the action was over at 2 h. 30 min. P.M., having thus lasted just over five hours. The battle of Trafalgar was practically decided between noon and 2 P.M.; but the last of the captured ships struck just five hours after it began. These instances have been taken quite at random. The similarity of duration of these battles, differing so much in character, is not without interest. The Japanese left the scene of action, but returned the next day and fired a torpedo into the stranded "Yang Wei." The victory was certainly theirs, though their disappearance from the scene and the unmolested withdrawal of the Chinese transports explain, if they do not justify, the Chinese assertion, that it was they who had won the day, notwithstanding their losses.

The action was fought out entirely with guns. "The quick-firing guns gave the latter (the Japanese)," says the Chinese report, "an immense advantage, scattering showers of splinters, frequently setting the Chinese ships on fire, and riddling everything that was not protected." As an illustration of the greater chance of hitting that falls to the lighter guns, we have a statement of the number of shots fired from the heavy and from the 6-in. guns of the Chinese barbette ships. The eight 12-in. guns fired 197 rounds, or less than 25 apiece; the four 6-in. guns fired 268 rounds, or 67 apiece. The greater rapidity and accuracy of the Japanese fire—as was expected by those to whom the dominating effect of more rapid firing and more frequent hitting was known from historical record—afforded them more efficient protection than thick armour. The 12-in. armour of the Chinese barbette ships was intact; but their slightly protected 6-in. guns were also uninjured. From this it is difficult to see of what use the extra thickness of armour was. It would seem that it was never hit by an "armour-piercing shot;" and it supplies a useful practical illustration of the value of Sir George Clarke's suggestion ("Fortification," &c., p. 239), that the superficial extent of thick armour is so reduced in many so-called "armour-clads" that the protection given by it is due not so much to its impenetrability as to its small extent, which renders it unlikely to be hit.

The Chinese made a deliberate attempt to keep their bows turned towards the Japanese, in all probability in order to avail themselves of the highly-developed bow fire of their two barbette ships. The result of this action ought to be a warning to the confident people who advocate a heavy bow fire, to remember that all

statistics of it should be accompanied by an estimate of the loss in broadside fire which must result from developing bow fire beyond certain limits.

Of top fire we have no reports. It would be interesting to know if its effect was neutralized by the long range at which, as a rule, the action was fought.

The total Japanese loss is officially reported as 77 killed and 160 wounded. Out of a crew in each case probably less than a fourth of the number of Japanese engaged, the "Bellerophon" had 49 killed and 148 wounded, and the "Majestic" 50 killed and 143 wounded, at the Nile. At Trafalgar, out of a nearly similar crew, the "Colossus" had 40 killed and 160 wounded. Loss of life, at least on the part of victors, as also was shown at Lissa, therefore appears not likely to be as severe in modern sea-fights as in those of former days. The "Matsushima," it is true, is reported to have lost two officers and 120 men killed and wounded. The proportions as given must make us doubt the accuracy of the figures; but it may be admitted that her loss was heavy, though less so than that of the British frigate "Java" in her action with the "Constitution."

Superior rapidity and accuracy of fire bore the fruit which they have always borne in war, at any rate since the day when they brought about the defeat of the Invincible Armada. This superiority, as has always been the case, would have been barren of result had not the Japanese been sufficiently practised in manœuvring at sea to enable them to avail themselves of its effect. As in all really decisive general actions, as far back as history can tell us about them, the battle was not won by fighting single ship against single ship, but by concentrating a larger number of ships—as has been previously shown—against a smaller.

Your obedient servant,

September 29.

A NAVAL OFFICER.

Argentine Republic.—The new torpedo-cruiser "Patria," built and engined by Laird Brothers, of Birkenhead, has been put through her official speed trials with eminently successful results, the procedure of the trials being similar to that laid down by the British Admiralty, armament and all normal weights on board. The official natural draught trial was made off Liverpool on August 24th, during boisterous weather and with a heavy cross sea, when, during eight hours' continuous steaming, 17.6 knots was attained with 201 revolutions. During six consecutive runs over the base between the outer lightships 17.91 knots was recorded, which was one-quarter knot in excess over contract. A further trial under natural draught was made on the 31st August over the measured mile on the Clyde, when four runs were made at 190 revolutions (which it was estimated would give 17.5 knots, the contract speed), with the result that 17.72 knots was recorded, with 11 revolutions per minute less than when running the trial in Liverpool Bay. The full power forced draught trial of three hours' duration was run the same day, when a mean speed of 20.57 knots with 233.5 revolutions per minute was attained, exceeding by 1 knot the guaranteed speed of 19.5 knots. There was an almost entire absence of vibration of the machinery and in the ship. The "Patria" is a cruiser similar to the "Halcyon" and "Harrier" class in the English Navy, but, on the recommendation of Messrs. Laird, the Argentine Government decided to have the poop and forecabin joined, forming a complete spar deck, which adds much to the general comfort and seaworthiness, makes it possible to place the broadside guns fully 7 ft. higher above water, and affords accommodation available for the carrying of troops when required, whilst the larger engine power gives a knot per hour greater speed. The "Patria's" principal dimensions are:—Length, 250 ft.; beam, 31 ft. 6 in.; draught of water, with armament and all normal weights on board, 10 ft. (the screws do not project below the line of keel), with a displacement of 1,070 tons. Bunker capacity for 250 tons of coal, or 4,000 knots range of action. The machinery, condensers, &c., and general arrangements are similar to the builders' well-known type of high-speed engines of which those of the "Rattlesnake" were the original. There are four boilers of the dry bottom locomotive type, worked on the closed-stokehold system, the air pressure for full power not exceeding 2½ in., each set of engines and boilers being in a separate compartment.

The armament consists of two 4.7-in. Armstrong Q.F. guns; four 8-pr. and two

3-pr. Maxim-Nordenfolt Q.F. guns carried on the spar deck, and two 1-in. machine-guns on the bridge, whilst there are five torpedo-discharges, one bow tube and four broadside tubes, carried on the main deck, worked through specially designed ports, the torpedoes being the latest 18-in. pattern made by Whitehead of Fiume.

Austria-Hungary.—We are enabled now to give details (Plate 52) of the last armour-plate trials at Witkowitz. In accordance with the contract specifications of the War Ministry (Marine Section) agreed on with the Witkowitz firm for the delivery of armour plates, a plate is selected for trial from each 300 tons of armour before its final acceptance. The plate selected from the first delivery was a homogeneous nickel-steel plate, 6 ft. by 6 ft., and 10·8 in. thick, and was tested by the Naval Commission on the 12th June last, at the proof butts at Witkowitz, with the following results (p. 1151).

The Commission reported that the trial plate had fulfilled the conditions of the contract in every respect.

A comparison with the standard plate tested in November last shows that the acceptance plate gave on the whole better results than the former, as it was in no case completely penetrated, and not even a surface flaw was visible in it. Further, the acceptance plate was pierced by the 15-cm. steel shell to the extent of only 128 mm. on the average, as against 220 mm. in the standard plate. ("Mittheilungen aus dem Gebiete des Seewesens," and other sources.)

In view of the fact that even Austria can now hold her own in the manufacture of armour-plates against English firms, it may be interesting to note that, according to a statement made the other day before the Hungarian Delegation, by Admiral Baron von Sterneek, the Minister of Marine, with the one exception of coal, the Austrian Navy is quite independent of foreign countries. "It has always been the endeavour of the Admiralty," said the Minister, "to draw our supplies from native industry. We obtain all our shipbuilding material at home, although the price is higher than it is, for instance, in England. Through the support and mutual efforts of foundries, we have ourselves succeeded in making, not only the heavy projectiles for armoured ships, but also all the armour-plates we require. Ropes and sails, which we were formerly obliged to obtain from abroad, are now procured exclusively from native manufacturers, a great part of the supply coming from Hungary."

The Government has decided to build six new 1st class torpedo-boats, for the construction of which a sum of 103,000*l.* has been assigned.

The manœuvre squadron, which has now been broken up at the conclusion of the season, was this year composed of the following vessels:—

First Division—Rear-Admiral J. Hinke. Battle-ships "Kronprinz Erzherzog Rudolf" (flagship), "Kronprinzessin Erzherzogin Stephanie," and "Tegethoff."

Second Division—Rear-Admiral H. I. H. Archduke Karl Stephan. "Prinz Eugen" (flagship), "Kaiser Max," and "Don Juan d'Austria."

Cruiser Division under command of Captain Thewalt—

1st class protected ram-cruiser "Kaiser Franz Josef" (flagship).

Torpedo-cruisers "Tiger," "Lussin" and "Sebenico."

Torpedo-avisos "Satellit," "Planet," "Trabant."

Depôt torpedo-ship "Pelican."

Squadron store-ship "Pola."

Workshop depôt ship "Gigant," and 14 first-class torpedo-boats.

Denmark.—The 3rd class protected cruiser "Heimdal" was launched at Copenhagen on 31st August, in presence of the King and Queen, many members of the Royal Family, the Queen of Greece, and other high personages. The "Heimdal"

TRIAL ON THE 12th JUNE, 1894, OF A 10.8 INCH NICKEL STEEL PLATE AT WITKOWITZ, AUSTRIA.

FRONT VIEW.

REAR VIEW.

Witkowitz, 13th of June, 1894.			Date.
15° Centrigade.			Temperature of air.
270 mm. homogeneous nickel-steel plate with six bolts. 50 mm. bolts on a wooden backing of 50 cm.			Fixing of plate.
15-cm. 35-calibre long gun, Mark 1886, on broadside mounting.			Gun used.
3	10	1	No. of the shot.
Streiteben steel shell, 3·5 calibres long.			Kind of projectile.
51 kilogrammes.			Weight.
Prismatic powder, Mark 1886, delivered 1892.			Quality of
16·5 kilogrammes.			Weight of
603·5 metres.			Striking velocity.
2,426	2,296	2,420	Gas pressure.
Shell in fragments, a small part of the point sticking. Measurable indentation, 158 mm.	Shell in pieces, point in a mushroom form, sticking. When falling out after Shot 3, the indentation proved to be 137 mm.	Shell in pieces, point like mushroom, sticking. When the point fell out after the third shot, the indentation proved to be 80 mm.	Observations with regard to projectile.
No cracks whatever, funnel-like indentation of 300 mm. diameter, and, as far as measurable, of 158 mm. depth. On the back side, bulge of 9 mm. height.	No cracks whatever, funnel-like indentation of 265—275 mm. diameter and 37 mm. maximum depth. On the back side a bulge of 5 mm. height.	No cracks whatever to be seen. On the front side a funnel-like indentation of 275—290 mm. diam. and 88 mm. (maximum) depth. On the back side nothing to be seen.	Observations with regard to plate.
Ditto. At this shot the points of the two first shells fell out.	Ditto.	Distance of plate from muzzle, 60·5 metres; recoil of gun, 5·40 mm.	Note.

is a sister of the "Geiser," launched in 1892. Another vessel, the "Hekla," of the same tonnage, but 2½ ft. shorter, and with 5 ft. more beam, was launched in 1890. The "Heimdal's" dimensions are as follows:—Length, 257 ft. 6 in., beam, 27 ft. 6 in., and with a mean draught of 11 ft. 4 in., a displacement of 1,280 tons. Her engines are to develop 3,000 I.H.P., and to give a speed of 17½ knots. The ship is built of steel, with a double bottom, and an armour deck 1½ in. thick. The armament will consist of two 6-in. Krupp guns, four 3-pr. Q.F. guns, six machine-guns, and four torpedo-tubes.

The arming of the new sea fort of Middelgrund at Copenhagen (of which we gave some details in the August Notes) is now nearly completed. It stands on the Middle Ground Shoal, about 3 miles from the mouth of the harbour, and is in telegraphic and telephonic communication with the other forts and the capital. The armament consists of 30 guns, of which five are 30·5-cm. (12-in.) Krupp guns, which throw a projectile of 725 lbs., and have a range of about 7 miles. Each of these guns has an arc of training of 263° seawards. There are further 12 17-cm. (6·8-in.) guns, and the remainder are Q.F. guns of a somewhat smaller calibre. The garrison will be composed of 700 men, of whom 500 will be artillery, 140 infantry, and 60 men of the naval mining corps, who will man a division of torpedo-boats, which will be stationed in the small port which has been formed adjacent to the fort. In peace-time the garrison will be accommodated in well-ventilated quarters, lit by electricity, and in war-time in shot-proof casemates. The magazines are 60 ft. below the gun platforms, and the ammunition and projectiles will be transported to the different batteries by means of lifts and small railways. The fort is provided with numerous steam and dynamo engines, as well as with a powerful accumulator battery, which will supply the 500 electric lamps in the fort for several days. ("Die Reichswehr.")

Experiments with a new form of torpedo-net cutter are being carried out at the submarine-mine station at Bramonäs by order of the Danish Minister of Marine. The "torpedo scissors," as the appliance is called, are the invention of a Danish naval officer. They are fixed at the head of the torpedo, and their action depends upon its speed. Having effected a breach in the net, the scissors fall aside and allow the torpedo to pass on and strike a ship's side. The experiments are stated to be so far successful, and the invention is regarded as hopeful.

France.—The following are the principal promotions and appointments which have been made:—To Rear-Admiral, Capitaine de Vaisseau C. H. Fournier; to Capitaine de Vaisseau, Capitaine de Frégate Charpentier. Vice-Admirals—Humann to Ministry of Marine as Chief of the Staff of the Navy, Vignes as Inspector-General of the Navy, De la Jaille to command of the Active Division of the Mediterranean Fleet, Alquier to command of the Squadron of the North, Gervais to command of the Squadron of the Reserve in the Mediterranean, Brown de Colstoun as Maritime Prefect of the 5th Arrondissement (Toulon). Rear-Admirals—Montesquiou-Fézensac as Chief of the Staff of the 1st Arrondissement Maritime (Cherbourg), Maréchal as Head of the Hydrographical Department, Mac-Guckin de Slane to command of the 2nd Division of the Active Squadron of the Mediterranean. Capitaines de Vaisseau—Pradier to "Formidable," Pucel to "Richelieu," d'Hombres to superintend the fitting out of "Valmy," Boutet to command of submarine defences at Toulon, de Sales de Banières to "Caïman," Rouvier to "Magenta," Le Borge de Kerambosquer to "Hoche." Capitaines de Frégate—Goëtz to "Coëtlogon," Noirot to "Dumont-Durville," Campion to "Dupetit Thouars," Salaun-Penquer to "Romanche," Gervais as Chief of the Staff to Rear-Admiral Mac-Guckin de Slane, and Lacournée to "Européen."

("Le Moniteur de la Flotte.")

We regret to have to record the death of Rear-Admiral Le Bourgeois, commanding the 2nd Division of the Active Squadron of the Mediterranean Fleet, which

THE NEW FRENCH TORPEDO—Aviso "D'Iberville." 925 TONS. 5,000 I.H.P.

took place at Toulon on the 15th September. His loss is much felt, as he was considered to be one of the most competent Flag Officers in the Navy. The deceased officer is the second Rear-Admiral in the Mediterranean Fleet who has died with his flag flying during the last 18 months, Rear-Admiral Buge having died on board his flagship the "Dérastation" on the 17th February of last year.

("Le Temps.")

The new torpedo-avisos "D'Iberville" (Plate 53), having completed all her trials at Rochefort, has left to join the Active Squadron of the Mediterranean Fleet, where she will take the place of the "Lévrier," a vessel of the same class, but of an older type, which will be placed in Reserve at Toulon. The dimensions of the "D'Iberville" are as follows:—Length between perpendiculars, 263 ft. 6 in.; beam, 26 ft. 6 in.; and a mean draught of 10 ft. She has a displacement of 925 tons, twin-screw triple-expansion engines of 5,000 I.H.P., and four Lagravel and d'Allest boilers. The ship was built at St. Nazaire at the works of the Société des Ateliers et Chantiers de la Loire, was laid down on the 26th August, 1891, launched on the 11th September, 1893, and finally completed her trials in August of this year. On a six hours' run, with the engines developing 1,800 I.H.P. and making 207 revolutions a minute, the mean speed was 15.8 knots, with a consumption of coal of about 1.5 lbs. per each H.P. developed; on an 18 hours' run, with 3,313 I.H.P. and 258 revolutions of the engines, a mean speed of 19.3 was obtained, the consumption of coal being about 2 lbs. per each H.P.; on the four hours' run under forced draught, 5,000 I.H.P. was developed, and with 292 revolutions a speed of 21.6 knots was maintained, the consumption of coal being about 2½ lbs. per each H.P. The armament of the "D'Iberville" consists of one 4-in. Q.F., three 6-pr. Q.F., and four 1.5-in. Q.F. guns, with six torpedo-tubes. The fuel employed was the Anzin briquette, which is made in France from Welsh coal, and has given such excellent results that it is the fuel invariably used now in the torpedo-avisos and torpedo-boats. ("Le Yacht.")

The new 2nd class cruiser "Chasscloup-Laubat" has been commissioned at Cherbourg to undergo her trials. The 1st class battle-ship "Brennus" at Brest is still continuing her trials with apparently satisfactory results; during a six hours' run, with the engines developing 5,700 I.H.P. and making 71 revolutions, a speed of 14.4 knots was obtained. Some successful trials have been carried out on board the 3rd class cruiser "Surcouf" with under-water torpedo-tubes on the system Droznecki; the results are reported to have been so satisfactory that it is likely all the new cruisers will be fitted with them. ("Le Moniteur de la Flotte.")

The Reserve Squadron of the Mediterranean Fleet has been placed "en disponibilité armée" from the 1st of October; the torpedo-cruiser "Wattignies" has been transferred from the Active to the Reserve Squadron of the Fleet, her place being taken by the torpedo-cruiser "Condor" from the Reserve Squadron. The 1st Division of the Squadron of the North, consisting of the battle-ship "Suffren," flagship, the coast-defence ship "Requin," the 1st class cruiser "Jean-Bart," the 3rd class cruiser "Surcouf," the torpedo-cruiser "Épervier," the torpedo-avisos "Lance," and the torpilleurs-de-haute-mer "Averne" and "Dauphin," have also been placed "en disponibilité armée" at Brest, which remains their headquarters; the coast-defence battle-ships "Fulminant" and "Tonnerre," lately forming part of the Squadron, have been paid off and transferred to the 2nd class Reserve at Brest. The 2nd Division of the Squadron of the North, under the command of Rear-Admiral Ménard, will as usual remain with their effective complements complete, and will consist of the cuirassé de croisière "Turenne," the coast-defence battle-ship "Furieux," the 3rd class cruiser "Cottlogon," the torpedo-avisos "Salve," and the torpilleurs-de-haute-mer "Lancier" and "Archer." This division will, as has been already reported, be shortly reinforced on the completion of their trials by the new coast-defence battle-ship "Jemmapes," the new armoured cruiser "Latouche-Tréville," and the new torpedo cruiser "Fleurus."

The 1st class battle-ship "Courbet" was commissioned on the 1st of October to relieve the "Amiral Duperré" in the Active Squadron of the Mediterranean Fleet, the latter ship passing into the Reserve Squadron. ("Le Moniteur de la Flotte.")

The authorities at Brest have received instructions to prepare plans for a small cruiser of exceptional speed and radius of action. She is to steam 23 knots under forced draught, and 20 knots for 24 consecutive hours. The armament is to consist of ten 3.9-in. 28-pr. Q.F. guns and twelve 1.85-in. 3-pr. Q.F. guns. There will be pole masts without military tops. In order to keep the vessel at the same draught of water, arrangements are to be made whereby in proportion as her coal and stores are exhausted water will be admitted to certain compartments. ("Le Temps.")

The following vessels have been commissioned to reinforce the squadron under the command of Captain Bienaimé, in view of operations against Madagascar:—3rd class barrette-cruiser "Dupetit Thouars," aviso-transport "Ronanache," and the gunboats "Gabés" and "Météore." The 1st class cruiser "Isly," lately attached to the 2nd Division of the Squadron of the North, has been ordered to proceed to China to reinforce the squadron in those waters. ("Le Temps.")

We mentioned in last month's Notes that the operations in the Channel were brought to a close by some attacks by the torpedo-boats of the Défense Mobile against the Squadron of the North, while at anchor in Morgat Bay, on the night of the 28th August, and on the next night when the squadron was *en route* for Cherbourg. The following details of the attacks are taken from the "Yacht." The leading idea was as follows:—A hostile squadron (represented by the Northern Squadron in full strength), with command of the sea, is supposed to have attacked Brest harbour without success, and, having suffered a certain amount of damage to some of the ships, it retires to the Bay of Douarnenez in order to effect the most urgent repairs whilst at anchor. The Brest torpedo-boats, under shelter of night, attack the squadron at anchor. The 10 larger ships were anchored in an octagonal formation some 1,500 yards from the shore, while the avisos "Salve" and "Lance," with the four torpilleurs-de-haute-mer and the steam-launches of the squadron, were employed to watch the approaches to the bay, using their search lights to form a cordon of light over the entrance. The night was dark and rainy, but calm. The attacking force consisted of 13 boats of the "Défense Mobile" of Brest, and, in spite of all the precautions of the defenders, several of the boats seem to have succeeded in creeping into the bay without being observed, one of the first torpedoing the "Requin," and not being detected until she burnt her red light and blew her whistle (the sign of a successfully launched torpedo). The next day there was a fresh breeze and a roughish sea; the squadron weighed at 4 p.m., and proceeded at the speed of 7 knots, the maximum speed which the injured battle-ships were supposed to be able to maintain. The six battle-ships were formed in single column in line ahead, with the cruisers, avisos, and torpilleurs-de-haute-mer disposed ahead, astern, and on each flank, as look-out vessels. In consequence of the high sea which was running, it was not expected that the torpedo-boats, which had retreated to Camaret Bay after the attack the previous night, would venture out; but about 10.30 the "Jean-Bart" opened fire. It was, however, too late, as the torpedo-boats were among the squadron, whose officers were forced to admit that most of the individual attacks would have been successful in real action; there seems to be no question as to the skill and daring with which the boats were handled in very unfavourable weather and close to a dangerous coast, and no accident of any kind occurred among the 13 boats which formed the attacking force. M. Weyl attributes this success to the constant exercise at sea, to which the boats of the Défense Mobile at Brest are subjected in all weathers, and to the skill in handling their little vessels and intimate knowledge of the coast, where they have to act, thus acquired by their Commanders.

The Netherlands.—Want of space prevented us last month noticing the launch of the new battle-ship "*Piet Hein*," which took place on the 16th of August. She is one of three ships of a similar type at present under construction, their dimensions being as follows:—Length, 283 ft.; beam, 47 ft.; and with a mean draught of 16 ft. 9 in., they have a displacement of 3,400 tons. The engines are to develop 4,800 I.H.P., giving a speed of 16 knots. There is a complete water-line belt 6 in. thick; the turrets have 9.5-in. armour, and there is a 2.5-in. armoured deck. The armament will consist of three 21-cm. (8.2-in.) guns, two of which are mounted in the barbette turret forward, and the third aft, two 6-in. Q.F., mounted one on each beam, six 6-pr. Q.F., and six 1.8-in. Q.F. guns, with two torpedo-tubes.

On the 12th September the Queen Regent, accompanied by the young Queen of the Netherlands, reviewed in the Texel, off Nieuwediep, the largest squadron that for many years has been assembled in commission in Dutch waters. The vessels in line were the armoured ram "*Koningin Wilhelmina der Nederlanden*," 4,600 tons, launched in 1892, and only lately completed. She has engines developing 6,000 I.H.P., and a speed of 17 knots; three coast-defence armoured rams, the "*Guinea*," "*Stier*," and "*Rainier-Claezen*," of 2,485, 2,040, and 2,500 tons respectively; the two first vessels have a belt of 6-in. armour, and 8-in. armour on the turret forward, in which is mounted one 28-cm. (11.02-in.) Krupp gun, but they only have a speed of 12 knots; while the last-named, launched in 1891, has 10-in. armour on her turret, and carries, in addition to her heavy gun, one 6-in. Q.F., and six smaller Q.F. guns; the coast-defence monitors "*Matador*," "*Luipard*," "*Heiligerlee*," and "*Cerberus*," the first-named of 1,935, and the other three of 1,525 tons respectively; these vessels, although small and of low speed, are heavily armed, the first carrying two 28-cm. (11.02-in.) guns in her turret forward, and the others one gun of the same calibre, besides a complement of Q.F. guns; the 1st class cruisers "*Atjeh*" and "*De Ruyter*," of 3,400 tons; the 4th class cruiser "*Sommelsdijk*," of 1,005 tons; the gun-vessels "*Braga*," "*Heimdal*," and "*Hefring*," the gunboats "*Geep*" and "*Lynx*," and the training-ships "*Nautilus*," "*Argus*," and "*Bellona*," with 10 torpedo-boats. The weather was magnificent, and the unwonted spectacle attracted a large number of yachts and pleasure steamers.

Russia.—Rear-Admiral Skrydloff has been appointed Captain of the Port of Cronstadt in succession to the late Rear-Admiral Razvozoff; it is further reported that Vice-Admiral Tyrtoff has been selected to succeed Rear-Admiral Arclan in command of the Mediterranean Squadron. ("*St. Petersburg Novosti*.")

The 18th Naval Division lately quartered in St. Petersburg has been transferred to Cronstadt, its place in the Capital being taken by the 1st Division. The ships of the Training Squadron completed their cruising period for the year in the middle of September, with the exception of the "*Skobelev*," on board of which the Marines of the Guard are embarked for their summer training, which was to remain in commission another month. ("*Kronstadt Messenger*.")

On the 28th August, in presence of the Tsar, the Tsarina, and other members of the Imperial Family, was launched the new coast-defence battle-ship "*Admiral Senjavin*," she is a sister-ship to the "*Admiral Ushakoff*," which was launched towards the close of last year. Her dimensions are as follows:—Length, 278 ft.; beam, 52 ft.; mean draught, 17 ft., with a displacement of 4,126 tons; the engines are to develop 5,000 I.H.P., giving an estimated speed of 16 knots. Protection is afforded by a 10-in. steel belt, with a 3-in. armoured deck, and 8-in. armoured transverse bulkheads forward and aft. The armament will consist of four 23-cm. (9.2-in.) guns in two turrets protected by 8-in. armour, one forward and one aft, four 6-in. Canet Q.F. guns, six 3-pr. Q.F. and eight 1.8-in. Q.F. guns, with four torpedo-tubes. ("*Kronstadt Messenger*.")

Some important changes are to be made in the constitution of the Mediterranean and China squadrons. Last April we mentioned that the 1st class belted cruiser "Admiral Nachimov" and the protected cruiser "Rynda" had been transferred from the Mediterranean to China; they are now to be followed by the battle-ship "Imperator Nicolai I," and the belted cruiser "Pamjat Azova," while the 3rd class cruiser "Djghite" and the torpedo-cruisers "Gaidamak" and "Posadnik" have also left Cronstadt for Vladivostock.

The places in the Mediterranean of the above-mentioned ships will be taken by the new 1st class battle-ship "Gangut" and the belted cruiser "Vladimir Monomach," with the two new armoured gunboats "Otrajny" and "Gremiastchi," while four torpilleurs-de-haute-mer, the "Sveaborg," "Revel," "Kotka," and "Borgo," have also been sent to that station. The small armoured gunboats are of a special type, and said to be good sea boats; their dimensions are as follows:—Length, 227 ft.; beam, 42 ft. 3 in.; and with a mean draught of 10 ft. 6 in. they have a displacement of 1,500; they have engines of 2,000 I.H.P., which ought to give a speed of 15 knots, but in the case of the "Otrajny," on her trial trip, it is reported that a speed of only a little over 13 knots was obtained. They have an armour belt 4·0 in. thick, and a 1·4-in. steel protective deck. The armament consists of one 9-in. forward, one 6-in. Q.F. gun aft, ten 47-mm. (3-pr.) and 37-mm. Q.F. guns, and two torpedo-tubes; all the guns are well protected by steel shields. The 1st class gun-vessel "Teretz" will also probably be replaced by one of her five sisters from the Black Sea. The new torpilleur-de-haute-mer "Sestoretzk," built by Messrs. Normand, of Havre, has arrived at Cronstadt; she is a vessel 118 ft. long, 13 ft. 2 in. beam, of 75 tons displacement, and has engines developing 1,300 I.H.P., and giving a speed of 24 knots. ("Le Moniteur de la Flotte.")

Turkey.—Two new 3rd class cruisers were recently launched in the Golden Horn named the "Sedd-ül-Bahir" and "Zohaff," and they will replace two obsolete corvettes of the same name. They are of 800 tons displacement, and will be armed with four 5-in. Q.F. guns, six Hotchkiss 3-pr. Q.F. guns, and two torpedo-tubes. Two new gun-vessels and two gun-boats were also launched at the same time, named the "Seyd-i-Deriah," "Shefket Numa," "Rehber," and "Akter." They are all of some 200 tons displacement, and will carry four small Q.F. guns. A torpedo-destroyer of 270 tons, built at the Germania Yard at Kiel, was launched last month, and an aviso of 850 tons, to attain a speed of 21 knots, is also being constructed at the same yard. ("Le Moniteur de la Flotte.")

United States.—The following statement has been made by the Bureau of Ordnance as a result of a publication regarding surface cracks in two of the 6-in. barrette plates of the battle-ship "Massachusetts":—"The matter of surface cracks inherent in Harveyized armour has been thoroughly investigated by the Bureau; several plates in which such cracks existed have been tested ballistically, and in no case was it found that the cracks affected the resisting qualities of the armour. Notably, the 6-in. curved steel plate A-883 (intended for the 8-in. barbettes of the 'Massachusetts'), which was manufactured by the Carnegie Steel Company, and rejected because of numerous surface cracks, was tested by firing at it four shots from a 6-in. gun (two shots with a velocity of 1,800 f.s., and two with 2,000 f.s.), and the test showed that the cracks did not affect in the slightest degree the ballistic efficiency of the plate, notwithstanding the fact that this test was far more severe than that prescribed for the acceptance test of such a plate, namely, one shot with a velocity of 1,472 f.s., and one with 1,659 f.s. The plates referred to in the 'New York Herald' of August 22 are curved 6-in. plates intended for the 8-in. B. L. R. barbettes of the 'Massachusetts.' The surface cracks are of the same nature as those in the experimental plate A-883, and are due to shrinkage during the water tempering, and are not considered of any importance whatever." ("Army and Navy Journal.")

Some very successful tests of the pneumatic dynamite gun at Sandy Hook have been lately made. A 6-in. sub-calibre projectile from the pneumatic gun, charged

with 50 lbs. of explosive gelatine, is reported to have attained a range of nearly 6,000 yds., or over 3 miles, a 10-in. shell 3,500 yds., and a 16-in. 2,500 yds. Tests were made with 8-in. sub-calibre projectiles, charged with 100 lbs. explosive gelatine, 10-in. charged with 200 lbs., and 15-in. with 500 lbs. The tests for accuracy are reported to have been satisfactory, and the fuzes worked properly. In the test for rapidity of fire, starting with the gun open at the loading angle and the first plug on the loading car, the first round was fired in 52 secs. The group of five shots, each weighing 445 lbs., was fired in 8 min. and 45 secs. The contract requirements for this performance are that the first shot shall be fired in 1 min. and 30 secs., and the group of five in 10 min. Ten rounds were fired in the second group. Each plug weighed 556 lbs., being of the same weight as the 10-in. sub-calibre projectile and its charge of 200 lbs. of explosive gelatine. Starting as before, the first round was fired in 39 secs., and the group of 10 rounds in 14 min. and 40 secs. The contract requirements for this group are—first round in 2 min., and the group in 27 min. Ten rounds were fired in the third group also. The plugs weighed 1,160 lbs. each, and each represented a 15-in. full calibre projectile, with its charge of 500 lbs. of nitro-gelatine. With the same conditions of starting as in the other two groups, the first round was fired in 46 secs., and the group of 10 shots in 15 min. and 36½ secs. The contract requirements for this group are—the first round in 3 min., and the group in 40 min. The firing time for all the 25 shots was 39 min. 30 secs.; contract time, 77 min. This shows that the firing was done in about half the time the Company had contracted for.

("Army and Navy Journal.")

Concerning the failure of a Harveyized armour plate, Mr. F. Cremer, of the American Metallurgical Works, Phoenixville, Pa., whose speciality is tungsten, its alloys and combinations, writes as follows:—"The nickel Harveyized steel is simply an alloy consisting of steel, nickel, and chromium, nickel being added to increase the toughness, chromium to increase the hardness of the material. Theoretically, no objections could be raised, but as chromium is exceedingly brittle, counteracting the effect of the nickel, and at the same time very hard to melt, a lack of uniformity in the plates is unavoidable. Parts of the plates will have a higher percentage of chromium than the one intended, and when struck by a projectile will cause a shattering of the plate into minute fragments. If we can add another metal capable of imparting to steel its hardness without annulling, an armour plate will have been found. Fortunately, there exists such a metal which metallurgists call tungsten or wolframium. The hardness which steel, and even the much less brittle wrought-iron, derives from it is little short of marvellous; any degree of hardness can be obtained without impairing the effect of the nickel. Tungsten is more fusible than chromium, and a more uniform casting can be obtained; but if it were not, slight irregularities would not involve such risks as are necessarily due to the use of chromium. In this case slight differences in hardness would be the only effect. Tungsten is used in every kind of steel where at the same time hardness and toughness are called for. The famous Damascus steel and our best tool steels, blades, razors, &c., all contain it in a greater or lesser amount, and its applicability to the manufacture of armour plates is obvious. There are strong reasons, too, for attributing the well-known excellence of Krupp's armour plates, whose composition is kept a secret, to the use of this metal. It is true, experiments with tungsten in this line have never been made in this country, but the national interest imperatively demands that they should be made. If, contrary to all expectations, they should fail, no harm would result, but if successful, an immense benefit would be derived therefrom for the nation."

("Scientific American.")

MILITARY.

In the June number for this year we published a short notice of Captain Carter's essay on "Mountain Warfare," based on the statements which had appeared in the "Pioneer," and which, to the best of our knowledge, remained uncontradicted. This notice has produced the following letter from the Council of the United Service Institution of India, which we give below in full without comment:—

"No. 987.

"United Service Institution of India.

"Simla, 28th August, 1894.

"The Secretary,
"Royal United Service Institution,
"London.

"Dear Sir,

"The attention of the Council of the United Service Institution of India has been drawn to an editorial note which appeared in the notices of books appended to the 'Journal of the Royal United Service Institution,' dated 15th June, 1894, in which it is stated that Captain Carter's essay on 'Mountain Warfare' was disqualified from receiving the gold medal of last year owing to the fact that the form and type of the journal was altered, and that Captain Carter was in ignorance of this fact when he competed for the medal. The Council now desire me to point out that the true facts of the case were as follows:—

"The conditions for the Prize Essay of 1893 appeared in the 'United Service of India Journal' for July, 1892, and the type and form of this journal should have been the model for the competitors.

"Captain Carter's essay was printed in a different type to that in use for the journal, but calculating its length according to the type ordinarily employed, it still considerably exceeded the prescribed length of 32 pages, and was, consequently, disqualified.

"No change, sufficient to affect the point at issue in Captain Carter's case, has been made in the type of the journal for many years.

"I trust you will be able to correct the statement alluded to.

"Yours faithfully,

"L. C. COLOMB, Captain,
"Secretary United Service Institution
of India."

Home.—*Notes from the Report of the Small-arms Penetration Committee, 1893-94* (reprinted by permission from the "R.E. Corps Journal").—The above Committee was presided over by Colonel T. Fraser, C.B., C.M.G., R.E., and the three rifles tested by it were the Lee-Metford 0.303-in. bore, with a bullet of 215 grains, sectional density 0.3346, specific gravity 10.481, and a muzzle velocity of 1,975 to 2,000 f.s.; the Mannlicher 0.256-in. bore, with a bullet of 160 grains, sectional density 0.3188, specific gravity 10.401, and a muzzle velocity of 2,300 to 2,400 f.s.; and the Martini-Henry 0.450-in. bore, with a bullet of 480 grains, sectional density 0.3386, specific gravity 10.916, and a muzzle velocity of 1,270 to 1,300 f.s. The cordite gave muzzle velocities sometimes differing by 100 f.s. The velocities of the Mannlicher fell off very much during the firing of 1,000 rounds, owing to the erosion of the barrel. The Lee-Metford was not affected after firing 3,000 rounds. The ammunition for the Mannlicher and Lee-Metford was about the same in bulk for 150 rounds, but those of the Mannlicher weighed 7.271 lbs., against 8.807 lbs. for the Lee-Metford.

The main advantage of the Mannlicher is the greater flatness of its trajectory, and consequently greater margin at the decisive ranges. Thus the 6-ft. margins at 1,000 yds. are, for the Mannlicher 168 ft., for the Lee-Metford 156 ft., and for the Martini-Henry 82 ft. So long as the very small bullet now in use is effective against troops, the importance of this length of margin outweighs all other con-

siderations. As regards accuracy of fire, when once the sighting was obtained the Mannlicher was very good, and was rather better at 1,000 yds. than the Lee-Metford.

Effect on Brick Walls.—The small-bore rifles easily penetrated a 9-in. brick wall with $\frac{1}{2}$ -in. boards at the joints, though the bricks resisted the bullets. At 100 yds. the joint of a 9-in. wall and seven $\frac{1}{2}$ -in. deal boards were penetrated, and at 400 yds. some of the bullets penetrated the joints of the wall and two $\frac{1}{2}$ -in. deal boards. At 600 yds. the bullets passed through the joints of a $4\frac{1}{2}$ -in. wall and seven $\frac{1}{2}$ -in. boards beyond, and at 400 yds. bullets passed through the joints of a 14-in. wall and two $\frac{1}{2}$ -in. boards.

At 200 yds. 200 rounds breached a 9-in. wall so that a man could get through—the hole in the wall measured 24 in. by 15 in. At the same range it took 1,028 rounds, mostly in volleys of 50, to make a smaller breach in a 14-in. wall.

A wall with $\frac{1}{2}$ -in. joints of hard mortar was found to be practically impervious to the new small-bore bullets. Hence, brick walls for defences should be 9 in. thick and have fine joints set in cement. It might be added that, for such a purpose, the bricks should break joint horizontally as well as vertically.

Two thicknesses of $2\frac{1}{2}$ in. of bricks, breaking joint, placed between boards, was bullet-proof at 100 yds., though if several bullets strike the same spot they pass through in turn, after smashing up the bricks. Thus, two rows of ordinary bricks, breaking joint, each brick having a thickness of $4\frac{1}{2}$ in., if kept between boards, will stop any bullets at all ranges.

Sun-dried brick walls (as used in India) 18 in. thick are bullet-proof, except after continued firing, such as 220 rounds fired in 11 volleys at 50 yds. range. Curiously, in such walls the mean penetration increases gradually from 5 in. at a range of 3 yds. up to 15 in. at 400 yds., and then slowly decreases, the reason of this being that at 3 yds. range the bullets became spherical, at 50 yds. the points became knots, while at 500 yds. the shape was unaltered.

A wall, 9 in. thick, of burnt tiles set in mud, was penetrated at ranges between 200 and 900 yds. by the small bores, but is safe against the Martini bullet. As in the previous case, the penetration increased with the range for some hundred yards. Volleys of 10 rounds were found to penetrate where single shots failed. This is probably owing to some of the bullets arriving in succession, the earlier ones preparing the way for those following. A similar 14-in. wall can be penetrated by a small-bore, especially at the joints. A 24-in. sun-dried brick wall appears to be quite proof a short time after the setting.

Fresh (green) mud walls require to be at least 4 ft. in thickness to stop bullets at any ranges.

Penetration into Steel.—With mild steel or wrought iron a thickness of $\frac{7}{8}$ (0.44) in. is required for safety; but at ranges over 60 yds. a 0.206-in. plate of hardened steel (weighing 8.75 lbs. per square foot) will stop a Lee-Metford bullet. Against the Mannlicher, a $\frac{1}{4}$ (0.25) in. plate of hardened steel is required at short ranges; this is the plate recommended for sap shields. But at 500 yds. a plate of hardened steel of less than $\frac{1}{4}$ (0.088) in., weighing only 3 lbs. 10 oz. a square foot, resisted all the small-bore bullets; this plate is recommended for field artillery shields against musketry, if such be ever adopted, as artillery are not likely to engage infantry at ranges under 500 yds.

Penetration into Timber and Sand, Loam, Shingle, &c.—The new small-bore rifles with sheathed bullets have a much greater penetration than the Martini bullets at ranges under 1,500 yds. At about 1,500 yds. the respective penetrations are about equal, while at longer ranges the Martini-Henry has a greater penetration. The shorter the range, and the harder the material, the greater is the difference in the results of the Martini-Henry and the small-bore rifles (see annexed table).

Against the small-bore sheathed bullets, green timber has only about the same resistance as dry. From the annexed table it is clear that at ranges much under 1,000 yds. timber baulks and standing trees will not generally offer much protection, except against ricochets, though at longer ranges they will suffice.

As regards sand, in firing at 3 yds. the Mannlicher bullet, with its high muzzle velocity, smashed up, and so had but little penetration, and the Lee-Metford

Summary of Average Results with .303-inch Lee-Metford, .256-inch Mannlicher, and .45-inch M.H. Rifles.

Rifle.	Range in yards.	Angle of departure.	Drop of 1 in.	Time of flight.		Thickness of materials. Proof at a given range.										Remarks.	
				Calculated remaining velocity. ¹	Observed.	Hard steel.	Mild steel.	Oak.	Elm.	Trunk.	Timber.	No. of 1-in. fir boards.	Sand.	Clay.	Loam.		Flintshire 2-in. boards.
0.303-inch Lee-Metford, 1,975 f.s.	3	—	—	f.s.	secs.	ins.	ins.	ins.	ins.	ins.	ins.	ins.	ins.	ins.	ins.	ins.	ins.
	25	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	100	—	—	1.68	0.159	27½	33	36	48	—	20	42½	28	3	18	—	—
	500	—	—	1.079	1.044	17	21	24	40	—	16	42½	24	3	18	22	—
	1,000	1 32	22.55	787	2.639	—	13	13	24	—	15	40	21	3	15	18	—
	1,500	3 16	10.8	603	4.887	—	6	9	16	—	14	38	18	3	15	16	—
	2,000	5 0	6.0	458	7.750	—	3	4	8	—	13	36	15	—	—	—	—
0.256-inch Mannlicher, 2,285 f.s.	3	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	25	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	100	—	—	2.114	0.133	—	32½	42	40	—	12	40½	14	3	12½	14½	—
	500	0 42	27.1	1,297	0.863	—	28	32	30	—	12	40½	11	3	12½	14½	—
	1,000	1 7	10.63	871	2.328	—	17	19	14	—	12	40½	11	3	15	20	—
	1,500	2 53	5.45	671	4.259	—	6	8	7	—	15	38	15	2	13	—	—
	2,000	5 15	2.4	517	8.863	—	3	4	3	—	12	36	12	—	—	—	—
0.45-inch M.H. Rifle, 1,907 f.s.	3	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	25	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	100	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	500	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	1,000	2 49	13.8	3,311	0.166	—	17	19	14	—	12	36	12	—	—	—	—
	1,500	5 15	5.45	871	2.328	—	12	12	12	—	12	36	12	—	—	—	—
	2,000	9 15	2.4	517	4.259	—	9	9	9	—	9	36	9	—	—	—	—

¹ Muzzle velocities used in calculations:—Lee-Metford, 2,000 f.s.; Mannlicher, 2,400 f.s.

² The same oak baulks were used in this case.

³ This applies to moist tenuous clay. If the latter be soft and wet, a greater thickness will be required.

⁴ The bullets break up at the short ranges, hence the greatest penetration into sand and loam is obtained at about 500 yards.

⁵ The clay in this case was very hard and dry, and a greater thickness of moist clay would be required.

A thickness of 20 inches of compressed cotton will just stop the Lee-Metford bullet at short ranges. The penetration diminishes rapidly with increased range.

A thickness of 18 inches of compressed cotton is sufficient to stop the Mannlicher bullets, which all break up at short range.

These results are taken from the experiments made in 1873-80, with the exception of those marked *, which were obtained in 1894. The Martini-Henry bullet is just stopped at 50 yards by 20 ins. of compressed cotton.

showed signs of smashing up. This points to a limit of muzzle velocity, beyond which any given bullet will be ineffective against sand cover. The penetration of the Lee-Metford into sand between boards is less than 18 in. at any range. The penetration of the Mannlicher at the shorter ranges is still less, owing to the breaking up of its bullets.

A thickness of 3 in. of the large flint shingle of Dungeness between boards smashed up all the bullets, and stopped them penetrating, even at the shortest ranges; but a greater thickness of fine shingle was required to do so.

The new bullets penetrate $3\frac{1}{2}$ ft. into moist tenacious clay at the shortest ranges, and 28 in. into loam.

A compressed cotton bale, 20 in. thick, end on to firer, was not penetrated by any of the bullets at 25 yds. range, though some penetrated when the bale was placed with its side to the firer. At 500 yds. the penetrations were $7\frac{1}{2}$ and 13 in. respectively for each position of the bale. The Mannlicher bullets broke up before they had penetrated half-way.

The general result as to the penetrations with the new small arms seems to be that, with improved steel, the same thickness will suffice as with the Martini-Henry, though more is required with ordinary mild steel.

Timber, *per se*, is no longer of any use as cover at short ranges, owing to the great thickness required, and growing timber will no longer give the protection it does at present. On the other hand, a much smaller quantity of timber, in the form of boards, made into troughs or wooden boxes, or hurdle troughs with shingle or sand between, will completely stop the new bullets. Stockades of planks with sand, shingle, or dry brick cores will now replace the heavy timber baulks formerly used. In the absence of shingle, a few inches of the macadam of roads will supply the necessary core.

Not much alteration is required in sand parapets to resist musketry, but damp clay parapets must be considerably thicker, and those of loam must also be increased, unless a hard core is inserted.

A navy coal sack containing coal 12 in. thick is impenetrable.

N.B.—The calculated remaining velocities given in the table are probably too low, because the penetrations obtained into loam at 3,500 yds. would hardly have been attainable with such low remaining velocities. Probably, as is found with the Martini-Henry, the remaining velocity increases after a certain range, owing to the gain from gravity being greater than the loss from air friction. It may also be noted that up to 3,000 yds. with the Lee-Metford, and up to 2,000 yds. with the Mannlicher, the observed times of flight are less than the calculated ones. These remaining velocities and times of flight were calculated from Bashforth's tables, but no coefficient of reduction was used.

Times of Flight.—As regards times of flight, the new arms are very superior to the Martini-Henry. Thus while with the Martini-Henry the bullets keep ahead of the sound of discharge up to about 800 yds., with the Lee-Metford and Mannlicher this occurs up to about 1,600 yds. Up to 1,500 yds., the Mannlicher has smaller times of flight than the Lee-Metford, but beyond that range the Lee-Metford has the smaller times of flight. This is a remarkable result, as the Mannlicher has the greater sectional density of the two rifles. This points to some air retardation, possibly skin friction, which increases relatively to the smallness of the bore.

A consequence of the smaller times of flights of the new bullets is, that at the longer ranges the new bullets are exposed to the influence of wind for a less time. Against this, however, is their smaller specific gravity, which diminishes slightly with the bore.

Extreme Ranges.—The greatest observed range (3,760 yds.) was obtained with the Lee-Metford with 29° elevation, and a strongish rear wind, while on the same occasion $23^{\circ} 15'$ elevation gave a range of 3,500 yds. But in a perfect calm, at sea level, a range of 3,500 yds. was obtained with elevations varying from $27\frac{1}{2}^{\circ}$ to $28\frac{1}{2}^{\circ}$. This shows that in the previous case the wind increased the range 250 yds. At 3,000 yds. and over, wind is the dominating factor. On calm days 29° elevation gave 3,575 yds., 32° gave a maximum of 3,650 yds., 36° gave 3,575 yards, and 45° gave 3,350 yds. These statistics show that 4,000 yds. is beyond the extreme

range of the Lee-Metford under ordinary circumstances, but the bullet will kill up to the extreme range.

It was found that when the same range was obtained with different elevations, the times of flight varied with the elevations.

The extreme range of the Mannlicher could not be ascertained from the difficulty in hearing its bullet strike, but it is not considered to range as far as the Lee-Metford, because on the day that the Mannlicher required 15° elevation to range 3,000 yds., the Lee-Metford only required 12° 17' elevation.

Ricochet and Deflection Experiments.—At ranges under 100 yds., on a level surface of very smooth, hard sand, with the new bullets the mean rise was 1·3816 times the mean drop, while with the Martini-Henry the mean rise is double the mean drop.

On level turf, at 1,000 yds., the mean rise of the Lee-Metford was about three times the mean drop; at 1,500 yds. about 1·5 times; at 2,000 yds. about twice, though many of the bullets on level turf did not rise, but entered the ground; at 2,500 yds. 0·43 times, but only 5 per cent. of the bullets ricocheted off the turf, and these did not range more than 200 yds. from the strike; at 3,000 yds. and over no bullets ricocheted off the turf, though there were a few ricochets off shingle at this range.

At 1,500 yds., with the Mannlicher the mean rise was about 2·3 times the mean drop. No ricochets from turf were observed at 2,500 yds. and over.

In these experiments most of the bullets which ricocheted appeared to upset.

On land, at short ranges, the deflections of the new bullets with a left-handed twist occurred both to right and left, the mean being only about $\frac{1}{4}$ as great as with the Martini-Henry, which averaged 1 in 100. The maximum observed deflection was only 1 in 114 to the right. With the Martini-Henry, all the deflections are to the right.

Angles of Descent.—The main advantage gained in the new small-bore rifles is the relative flatness of their trajectories, which are throughout very superior in length of margin to that of the Martini-Henry. At 1,500 yds. the Lee-Metford and the Mannlicher have about the same drop, viz., about 1 in 10·4, after which the drop of the Mannlicher relatively increases. The drop was very much influenced by the strength and direction of the wind. This fact must be borne in mind in dealing with the recorded drops. However, for practical purposes, the following formula, due to Capt. C. F. Close, R.E., gives a fair approximation to the angles of descent of the Lee-Metford bullet between 1,000 and 3,000 yards range, viz.:—

$$\text{cot. angle of descent} = 1 \cdot 4 \times 2 \left(\frac{3,000 - \text{range}}{500} \right).$$

Strategy and Tactics in the East (by permission from "The Times").—Whatever other lessons we may draw from the Korean war as far as it has gone, there is one which most people seem to draw either consciously or unconsciously. Event after event has been following the tracks that thinkers on these matters had marked out for them beforehand, and the immense national value of such studies has been proved to the hilt. Much of what has been written on naval strategy and tactics of late years has been contested, sometimes warmly, and a considerable body of authorities have regarded such studies as very theoretical, more especially those which relate to naval tactics. But, now that we have seen the so-called theories applied, misapplied, or not applied at all, a distinct tendency becomes apparent to assume that there never was any dispute, and that we had all of us consistently supported the value of such studies, and consistently admitted the justness of the conclusions to which they led. Where we are likely to err now is in too readily admitting what we before denied; and in forgetting that it is knowledge of the methods by which the conclusions have been arrived at, even more than the conclusions themselves, which we ought to secure, in order to make any future conclusions we may draw as true as those seem to be which we have already drawn.

But in considering the lessons of the war in the present state of our information, there is a duty and a difficulty. If we wait until we have full and accurate in-

formation on every point, the minds to which we would appeal will have grown cold. If we use false information, we shall mislead. We must use our criticism as not abusing it. We must stick to the broad facts which can scarcely be wrongly reported, and, if we accept details which may possibly be misrepresented, we must not press them too far, and we must leave loopholes for escape.

It is well to remember that the great principles of naval strategy, which are now so constantly in our minds and on our tongues, were absent from the minds and tongues of every one of our countrymen for a long course of years. They were so familiar to our forefathers, from constant employment, that they never thought of leaving us a note of them. As the statesmen and warriors of the great war died away, their principles died with them, and the new generation grew up with ideas of naval war which were as fallaciously fanciful as those of the trade union secretary who recently attacked Lady Burdett-Coutts on the subject of industry. Thirty-five years ago we do not find a word of all that which now we are sometimes inclined to pass by as platitude. We either did not then study the question, or we studied it the wrong way. It would have been impossible for any Englishman 35 years ago to have written the letter which appears over the signature of "A Student" in your issue of the 29th ult. A hundred years ago most naval officers, if called upon, would have said it was all a matter of course. But the mere fact of its being necessary to write such a letter now shows that such truths are more on our lips than in our minds; and, not having a firm grasp of the methods by which our conclusions have been reached, we toss them about as isolated statements which after all may bear a good many different meanings. But really the conclusions all hang together. Each one by itself is arrived at (1) by the reason of the thing, (2) by the reason of other things from which it is impossible to separate it, and (3) by the appeal to experience or history.

Let us trace the events of the war in view of the conclusions which had been previously formed. Before the superiority of one fleet over the other was in any way established, the general tendency in this country was to suppose that the determining factor in the results of the war was the abstract weight or power of China, and a little country like Japan was thought to be very rash indeed. It had then to be pointed out that the abstract power of China was not in question. As far as the immediate results of the war were concerned, it was a question whether China could bring this power to bear at a given time and place. The occupation—perhaps one ought to say the conquest—of Korea was the objective, and both countries were almost equally free to pour troops into it, if the navy of the one did not interfere with the transport of the other over sea. If China could successfully interfere with Japanese transport over sea to Korea, there was an end of the first phase of the war. China would make her power felt at the proper place and time; she would put her troops into Korea in greater numbers than Japan could, and the attention of Japan would be turned from the invasion of Korea to the defence of her own waters. If, on the contrary, Japan interfered with Chinese transport over sea, Japan would land her troops in superior numbers. But this would not necessarily end the first phase of the war, because China had a land route as well as the sea routes, over which her troops could proceed. If it was a short and easy route, she might still make her power felt at the right place and in sufficient time. If it was a long and difficult route, it lost its consequence. Korea, with the sea routes to it closed, became to China what it would have been to Japan had the condition of sea routes been reversed. Japan would win in Korea with an ease much greater than we won in the Crimea, because she had been able to stop the original assemblage of Chinese troops there, and because the land route to Korea was much more inconvenient than the land route to the Crimea. Thus we had the reason of the thing confirmed by our Crimean experiences. The Japanese "naval threat" was sufficient, not only to stop Chinese transport by sea to Korea, but to lead the Chinese to doubt their naval power altogether. They were satisfied to keep the command, as they called it, of their own waters, and Japan had just the same freedom towards Korea as we had towards the Crimea.

When we had arrived at this stage there was a tendency to look for indiscriminate fighting in a jointly occupied territory. It was forgotten at first that the reason of the thing showed that there could not be common territory between

the two armies, and that, as the Japanese had access to all the ports of Korea, while the Chinese had access by only one route, from which they could not be cut off and continue to live as a force, it behoved them to fall back to such territory as was not contested, and where their one route was behind them. Here we had the reason of the thing supported by the experience of the Peninsular War to guide us. Unless the Chinese frankly evacuated Korea altogether and left the Japanese in full possession, it became certain that somewhere in the north of Korea a great military battle would be fought, which would be, strategically, Vittoria over again, and would determine in whose possession Korea should remain. I understand that military strategists consider that the fighting of that battle could not have proceeded on the lines it did in the days of the Peninsular War, because, I suppose, of the power of the electric telegraph in binding distant wings in simultaneous movement. The reason of the thing promised such methods, and I suppose Königgrätz furnished the model, if other land battles did not.

Thus we had Yamagata after Ping-Yang, as Wellington after Vittoria, with an open sea behind him, with supplies coming to him from ports close at hand, and with the enemy retreating before him out of the country he had conquered.

We have seen now that, from the reason of the thing, supported by abundant historical analogy, all that has happened so far was bound to happen, and that, had the Chinese based their action on these *data*, they would have known that, unless they began the war either by striking directly at the Japanese fleet or at least by striking at their transport near their own shores, they would seal their doom. They would fail to use their power at the proper time and place, and its abstract immensity would prove of no sort of value to them.

But, though they had failed to take possession of the Japanese sea routes, could they not treat the sea as common territory, and run an army across it by means of strong convoy? The reason of the thing, as commonly set forth, was, that if it was to be done, it would be best not to use any convoy at all. It would not be possible to run a large army across, with or without convoy, because attention was sure to be attracted. But, when a thing was to be done by evasion, it was worse than useless to risk a valuable defending fleet, as if it was to be done by force, a fleet which by the hypothesis could not win. It was not to be doubted, on the reason of the thing, that China might run a great many transports full of troops across at odd times, and if no one was looking. Humbert had landed in Killala Bay; the battalion of *forçats* had debarked in the Bristol Channel; Hoche's army, or the greater part of it, could easily have landed in Bantry Bay if it had not been afraid to do so. If done at all, it was to be done by stealth and not by fighting; it would be wrong to risk a naval force at the same time with the army. The frightful exemplars were Medina Sidonia, Napoleon, and Persano.

But the Chinese, in spite of reason and experience, united to their 7,000 troops a fleet which, though the finest they could collect, they admitted by their whole conduct to be inferior to that of the Japanese. Whether they would escape notice depended on the sort of look-out the Japanese kept; whether they would be brought to action would depend on the scattered or concentrated state of the Japanese Fleet. But, if the latter was inferior by reason of dispersion, the Chinese Fleet was simply losing an opportunity to restore the fortunes of the war. No one could foretell the event, of course, because no one could say whether or not the Japanese would avail themselves of the extraordinary blunder the Chinese were committing. In the result they did use their opportunity. The Chinese were brought to an action as unlikely to help them in any way as Camperdown was to help the Dutch. They were thoroughly beaten; they lost a considerable portion of their navy. It must be months before they can take the sea again, and probably their loss will leave them too weak to do it if they could.

So far does strategy carry us. Had the tactics of the two fleets anything to say to the result of the battle, or was winning and losing simply due to single ship manœuvring, to good shooting, and coolness? In spite of authoritative dislike to those preliminary studies on paper which must precede experiment, some such study has been constantly given in England with published results. In one of these studies, 22 or 23 years old, we find it laid down that a fleet should never approach another in any formation approaching "the line abreast"—that is, in

what a soldier would understand by "line." And the reason given is this:—It might easily be that for a time the opposing fleet, in mistake, or to deceive, might advance in a similar formation. But, if the opposing fleet meant to win it would suddenly turn the ships together into a "line ahead," which in essence is a military "column," towards either flank, or it might be, by separating into two columns, towards both flanks, of the advancing line abreast. Time, under the circumstances, would not permit the line abreast to make any counteracting movement, and the fleet in line ahead would pass one or both wings, with ship after ship pouring their fire into it or them, while the whole fire of the ships in line abreast, except the one on the extreme right or left, would be masked by their friends.

There does not seem now to be any doubt that the Japanese won their first advantage by pursuing the exact tactics that were laid down for them 22 years ago, while the Chinese made their advance to meet a fate which they were told they would meet all these years ago. I notice everywhere quite a ready tendency to blame the poor Chinese for their blunder, now that it has been exposed in practice so many years after it was exposed in theory. But I have not yet seen it recalled that, when Tegetthoff used the same formation at Lissa—even down to Ting's reported slightly angular change in it—there was nothing wrong seen in it. The lesson of the whole thing appears most momentous at this point. Because the slightly angulated line abreast was victorious at Lissa, it was highly to be commended; because it evidently was conducive to defeat at the Yalu, it is to be condemned. We are in face of the danger I mentioned at the beginning. We are in danger of approving or condemning, not on reasoned grounds—which must generally be to our national advantage—but on the instinct of the moment, supposing that what succeeds is right and what fails is wrong, which is sure to be, at some time or other, to our national disadvantage. Tegetthoff's mistake passed because the Italians did not understand how to take advantage of it. Ting's mistake did not pass, because the Japanese admiral had either thought it all out on paper beforehand, or instinctively saw how to turn it to his advantage.

To conclude, let us look how we are nationally concerned at this very moment, and how the designers at Whitehall are under the instruction of Admiral Ito, while the builders at the dockyards might be taking warning by Admiral Ting. Admiral Ito, either because he had studied the theory of naval tactics, or because the theory came to him as a practical revelation during the approach of the Chinese Fleet, abandoned his bow fire. We, with the reasoning against it, over and over again repeated for more than 20 years, have stuck to it like men. Not a month ago you published from correspondents two very strong condemnations of the Admiralty, because, as alleged, the bow fire of our ships is inferior to that of the French. The English tacticians, who have never ceased to exclaim against the provision of excessive bow fire as mere waste and mischief, have based themselves on this syllogism. Bow fire in fleets can only be used in the line abreast and its analogues; the line abreast can never be adopted, because of its danger. Therefore, bow fire ought to be neglected. At the moment I do not see what answer can be made to this conclusion.

Austria-Hungary.—In the dislocation of the troops concentrated for the Imperial manœuvres, large demands were made on the railway companies. The 1st Corps, 760 officers, 21,000 men, 320 horses, and 30 wagons were despatched in 24 trains and delivered at their respective stations in 24 hours. The 9th Corps were delivered in the same time, and required 25 trains for 600 officers, 15,200 men, 350 horses, and 45 carriages.

France.—In order to make room for the 161,477 men available for service in this year's contingent, 25,000 men of the contingent of 1891 and 36,000 of 1892 will be furloughed on the 8th November of this year. Of the 161,477 to be enrolled this year, 125,477 will serve their full three years, and the remainder be dismissed after one year's training.

Land has been acquired for a permanent camp of exercise in the vicinity of Laon; an infantry brigade will be permanently quartered there.

Considerable difficulty is still experienced in completing the colonial troops; to supply the vacancies caused by the transfer of 7,300 men to the reserve this year, only 2,429 volunteers came forward. It is proposed to ask the Chambers to sanction a premium of 1,500 fr. to each man who will prolong his service to nine years.

The formation of the two new artillery regiments, rendered possible by the transference of the pontooning duties to the engineers, began on the 1st of this month. The 39th Regiment, consisting of 9 batteries, will be quartered at Toul. The 40th will have 6 field batteries at Verdun, 6 field batteries and 1 horse battery at St. Mihiel, and 2 horse batteries at Stenay. This brings the artillery of the 6th Corps up to a total strength of 52 batteries, viz., 9 horse, 41 field, and 2 mountain batteries, in all 312 guns.

General Saussier is forming a school for the further training of cavalry reserve officers within the district of Paris; already 600 applications to attend it have been received. ("Revue du Cercle Militaire," No. 32.)

According to "The Times" correspondent with the French Army during the last manoeuvres, the attack was normally delivered as follows:—"The shooting line and supports are amalgamated from the first, and the battalion is formed in two lines, two companies in each, each company initially in a line of sections in column of fours at twice deploying interval. The front is covered by scouts, 16 to each company, thus the normal frontage of a battalion in attack is equal to its front two deep. The distance between the following lines at first is from 300 to 400 yds. The procedure in an attack is as follows:—On coming within the zone of artillery fire, the above formation is assumed, and in it the battalion approaches, as quickly as possible, the enemy's position. On arrival at about 1,200 yds. from it, the columns of fours form front in single rank, and the leading line of the battalion then becomes a single rank of men, elbow to elbow. In this formation is continued up to 700 or 800 yds. when fire is opened, and from this point the advance is continued by alternate companies or even larger units, but no doubling is allowed, and every effort is made to keep the men in hand and in good wind. Within about 500 yds. individual fire is the rule; beyond that range volleys by sections. The second line companies did not usually reinforce the first line until the latter were preparing for the assault by magazine fire at about 200 yds. range. . . . A most striking point was the absence of depth in the formations, even at the decisive points of the attack, as regarded the troops actually making the attack and under fire. A long front, long enough, if possible, to envelop the enemy's flank, seemed to be the point aimed at. Each new accession to the shooting line carried it a little farther forward, until the last reserves gave the final impulse for the assault. . . . On the defensive, frequent counter-attacks were made by the firing line in the old French style.

"From the larger tactical point of view, the most noteworthy feature was the methodical manner in which the attack of the infantry was prepared. In rear of the line of guns, and out of sight of the enemy's position, the infantry were formed for attack as they came up from the marching columns, and not until the artillery had sufficiently prepared the attack was the signal for the advance given. Once launched, the troops moved on through the line of guns and straight for the enemy's position, with the utmost celerity and steadiness, never wavering and seldom pausing until the decisive fire position was reached."

From the above it is evident that the new regulations have effected a complete change, and one of the utmost importance in French infantry tactics. This is the attack in line in its highest development, identical in principle (if not in detail) with the Frederician method. The idea of the "blow" contrasted in the sharpest manner with the method of "attrition," the keynote of the Napoleonic system copied and applied by the Germans in 1870. How enormous the change has been will be realised by contrasting Captain Maude's account of the French manoeuvres of 1891, in "The United Service Magazine" for December of that year. In these manoeuvres the method of "attrition" was pushed to its utmost con-

sequences. The troops entered the zone of fire in a succession of small echelons, which presented the best possible target to the enemy's fire, the least possible fire effect in reply, and the utmost possible guarantee of disorder and want of control. Assuming the above account to be correct, and we have no doubt that it is so, then the French, by their new regulations, have effected the greatest revolution in infantry tactics since the days of Leuthen, and are now ahead of anything in Europe, though the Germans run them very close indeed.

Germany.—All reports go to show that the changes of uniform recently introduced in the infantry have stood the test of the manœuvres well. The total reduction of weight carried is 6·5 kilos., say, 14 lbs.

Italy.—The Commission appointed to determine the best range-finder has, after long and searching experiments with all known models, finally approved the "Pavese," a reflecting instrument, alleged to require no base and no tables, about the size of an ordinary watch. The "Souhier" and "Parravicino" appear to have come next in merit. The average error of the "Pavese" is given at 0·5 per cent., and it is being manufactured by the firm of "Salmoiraghi," at Milan.
(*"Militär Wochenblatt,"* No. 81.)

Japan.—We would venture to recommend an attitude of suspended judgment to our readers with regard to the Chino-Japanese War. Ten days ago the believers in the night attack as the one solution for all tactical difficulties were in high feather, but already the arrival of contradictory reports from the theatre of war have upset their premises. If Ping-Yang proves what a successful night attack may achieve, Asan shows how easily it may fail, and with what serious results. At the latter place, a correspondent of "The Times" tells us, two Japanese divisions, having lost their way in the dark, fired into each other for some time without discovering their mistake, and meanwhile the bulk of the Chinese withdrew. Seeing that the Franco-German War was fought out at our very doors, and we are only now, after 23 years, beginning to get at the actual truth, will it not be as well if we take our time before coming to conclusions on the very unsatisfactory evidence as yet before us?

Russia.—According to Russian papers, the section of the Trans-Siberian Railway from Tcheliabinsk to Omsk (450 miles) was opened for passenger traffic on the 25th August. During next year it is hoped to complete the line as far as Krasnoïarsk, 1,400 miles from Tcheliabinsk. The great girder bridges across the Tobol, Ichim Irtych and Ob cannot be ready before 1896. Meanwhile temporary wooden structures have been erected, which have to be removed at the time of the spring ice floods. (*"Revue Militaire,"* Sept.)

United States.—*Report of the Chief of Ordnance, U.S.A., 1893* (reprinted by permission from the "R.E. Corps Journal").—This report is issued in a volume of some 700 pages. It commences with the report by Brigadier-General D. W. Flagler, Chief of Ordnance, to the Secretary of War, of the principal operations of the Ordnance Department during the fiscal year ending June 30th, 1893, and this is supplemented by various appendices, consisting of the reports and plates from which his report is compiled.

Several of these reports are of considerable interest:—

No. 14.—Tests of smokeless powder for small arms.

These tests were made at the Frankford Arsenal, on the following powders:—

(1.) Wetteren. (2.) Rifleite S.R., S.V., by Smokeless Powder Company (England). (3.) B.N.F. (4.) Peyton. (5.) Leonard (numerous samples). (6.) Du Pont. (7.) Axtell. (8.) Troisdorf. (9.) Alters.

Of these, the Axtell and Alters powders were found to be entirely unsuited for military use, owing to insufficiency of velocity obtained, and other causes.

The results obtained with the other powders are tabulated for comparison.

I.—*Velocity and Pressure.*—For neighbouring velocities the following pressures were developed, the 220-grain bullet being used, unless otherwise noted:—

Powder.	Number of shots fired.	Charge.	Mean velocity at 50 ft. from muzzle.	Mean variation.	Mean pressure per square inch.
		grs.		f.s.	lbs.
Leonard, sample "N" .. {	5	32	1,991	22.0	Under 32,000
	7	33	2,037	10.2	32,500
Leonard, sample "J"	6	31	2,019	13.8	33,500
Peyton	6	37	2,013	18.5	31,500
Troisdorf	7	35	1,953	12.6	34,000
Wetteren	9	37	1,962	19.6	33,500
Rifleite	9	39	1,969	21.6	45,500
B.N.F.	12	34	1,932	10.5	47,000
Du Pont	5	35	1,964	9.0	54,000

II.—Test for Moisture.

Powders exposed to Moisture for 24 hours.

Powder.	Loss in velocity.	Pressure reduced per square inch.	Increase in weight of powder.
	f.s.	lbs.	per cent.
Peyton	40	2,000	0.64
Leonard, sample "N"	100	5,000	3.18
Leonard, sample "J"	100	5,000	2.97
Troisdorf	100	7,000	1.64

Powders exposed to Heat for 24 hours.

Powder.	Gain in velocity.	Pressure increased per square inch.	Loss in weight.
	f.s.	lbs.	per cent.
Peyton	10	4,000	0.238
Leonard, sample "N"	50	6,000	1.69
Leonard, sample "J"	—	5,000	0.246
Troisdorf	50	10,000	1.29

Conclusions.—The Rifleite, B.N.F., and Du Pont powders are inferior to the others, as they give higher pressures without compensating advantages. The Wetteren gives very fair results, but the pressure is high for the moderate velocity obtained, and the irregular granulation often causes considerable variation in velocity. The Troisdorf gives lower pressures than the Wetteren for the same velocity, and seems to be equal to it in other respects, but requires a very strong primer to ignite it.

The Leonard and Peyton powders give the best results as regards pressures and velocities, the Leonard giving the greater uniformity of velocity, and the Peyton

seeming to be less affected by heat and moisture, and of the two Leonard powders, "N" is thought, on the whole, to have given the best results.

This powder is formed in strings like cordite, and cut into uniform grains. Its composition is given thus:—Nitro-cellulose and nitro-glycerine, with an organic substance of vegetable origin as a restrainer. These ingredients are placed in a vat, in proper proportions, and dissolved in acetone, the subsequent operations being similar to those employed in the manufacture of cordite.

The results obtained with cordite, for comparison, are:—A charge of 30 grains, which gives a muzzle velocity of 2,000 ft. secs., and a pressure per square inch of 33,600 pounds, compare favourably with this powder, while climatic influences are claimed to effect no material injury to its ballistic qualities.

No. 19.—Effect of small calibre rifle projectiles upon animal tissue and bone, by Lieut. Benet, Ordnance Department, U.S. Army.

(1.) *Object of Experiments.*—To compare the effect of bullets of large and small calibres upon the same parts of the human body, at ranges up to 2,000 yds.

(2.) *Arms and Ammunition used.*—0.45 Springfield rifle. Charge, 69 grains black powder and 500-grain lead bullet.

0.30 Springfield rifle. Charge, 37 grains Wettern smokeless, and 220-grain lead bullet, with German silver jacket.

(3.) *Method of Conducting Experiments.*—Owing to the improbability of striking the part of the cadaver desired at the actual range in a reasonable number of shots, the experiments were conducted in a proof gallery, the cadaver being placed at a distance of 63 feet from the muzzle of the rifle.

The normal velocities obtained at the actual ranges were simulated by using a carefully-worked-out series of reduced charges. The ranges thus simulated were 2,000, 1,500, 1,200, 800, 500, 350, 250, 150, and 100 yds.

Two hundred shots were fired under these conditions, and eleven plates are attached to the report showing the effects upon certain characteristic bones by the 0.30 bullet, and ordinary and extraordinary deformations of this bullet.

Of the eight plates devoted to the photographs of bones (tibia and femur) struck by a bullet, all of them show complete perforation by the bullet; it is noticeable that six struck at 1,200 yds. show only slight fissuring, while three at 2,000 yds. show bad fractures.

Lieutenant Benet makes the following deductions. Comparison of wounds inflicted by the two bullets:—

(a.) *Zone of Explosive Effect.*—This zone was observed to extend to 350 yds. with the 0.30 bullet, and only to 250 yds. with the 0.45 bullet. Where these effects were noted with the small calibre bullet it was generally found that it was badly deformed, and that the jacket had been wholly or partially stripped off; still, cases did occur in which the bullet was little deformed or not at all. It is safe, however, to state that with an undeformable bullet the occurrence of explosive effects will be less frequent, and possibly the extent of the zone much reduced.

(b.) *Zone of Perforation.*—The effect of the small calibre bullet upon the bones was not as severe as that of the 0.45. There was less shattering, and sometimes complete perforation of the bone with little or no splintering. In the joints and soft parts the wounds inflicted by the small calibre bullet were less severe, and partook of the nature of subcutaneous wounds.

(c.) *Zone of Contusion.*—Owing to the small remaining velocity in this zone, the results obtained here could not be simulated.

(d.) *Summary.*—These experiments seem to be at variance with some made in France and England, in which the effect of the small calibre bullet on bones were said to be appalling, but this was probably due to the fact that horse bones were used, which are more resistant than human ones, and break up the bullets more easily.¹ The general deduction to be drawn seems to be that from a humani-

¹ The difference may also be due to the fact that reduced charges, giving smaller velocities within the barrel, will not give the high rotation to the bullets which they would have in reality. In fact, this consideration very materially reduces the value of the American experiments. At the same time, the above result is

tarian point of view the general introduction of the small calibre is to be desired, and that the severity of wounds would be still further lessened by a bullet undeformable at the highest velocities by contact with human bones.

Appendix 43.—On the modern infantry rifle, by Captain S. E. Blunt, U.S. Army, contains a detailed account of three selected breech actions:—The Mannlicher, model 1892 (Holland), the English Lee-Speed (Marks I and II), and the Krag-Torgensen, U.S., 1892 model.

The Mannlicher Captain Blunt considers the best of what may be termed multiple loaders. Unlike other Mannlichers, the bolt in this arm rotates.

His objections to the Lee-Speed action are—(1.) The rear locking lugs, which may ultimately produce sufficient buckling to interfere with the movement of the bolt. (2.) The partial compression of the main spring by the forward movement of the bolt, which thus brings the work on the operator. This, however, requires so slight an effort that it cannot be considered a serious objection, while the first has not been practically noted in the rifles issued.

The Krag-Torgensen fulfils all theoretical requirements of a magazine arm, and seems to give great satisfaction. It has forward locking lugs, a continuous bolt, and the main spring is compressed by the rotation of the bolt only.

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exactly what experience against living game would lead one to expect. Our suggestion is that in future inventors should be invited to shoot dangerous game in India, on foot. The survivors' inventions only to be considered.—EDITOR.