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THE ROYAL ENGINEERS JOURNAL.

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CONTENTS.

163

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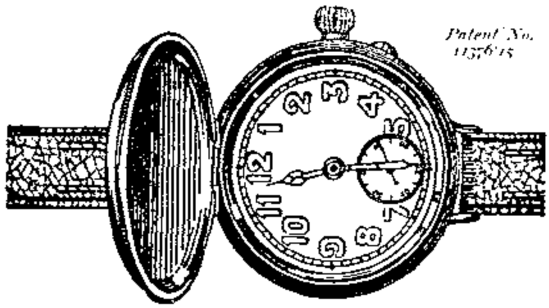

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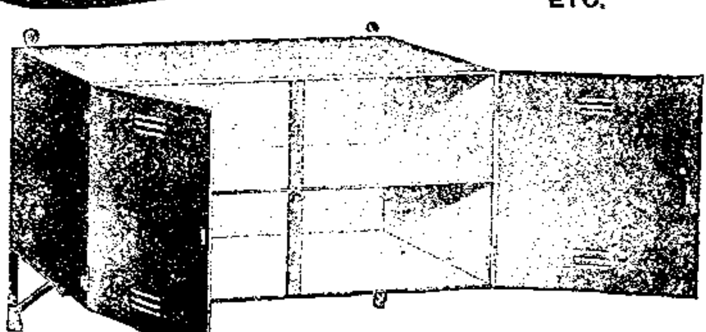

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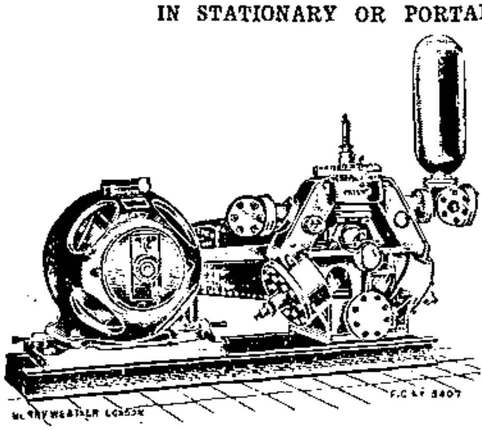

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CONTENTS.

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DEEDS OF THE ROYAL ENGINEERS.*

(Continued from the April number of the "R.E. Journal").

CHAPTER V.

THE BLOWING IN OF THE KASHMIR GATE AT DELHI.

THE Mutiny of the Sepoy Army in India in 1857 led to a war in which for the first time the officers and men of the Royal Engineers fought side by side with the Engineers of the East India Company's service. The result of the war was the extinction of that great company, and the absorption of its forces, including its Engineers, into the Imperial Army. At the Siege of Delhi—the greatest single feat of arms in the whole campaign—the only Engineers employed were those in the service of the East India Company.

The outbreak of the Mutiny occurred at Meerut on the night of the 10th of May, 1857.

Having first murdered their officers, the rebel soldiery set out for Delhi, about 35 miles distant. On the 12th May they entered the city, where they were joined by the city mob. A massacre of Europeans took place on the same day. A party of twelve officers and ladies escaped from the city and made their way to Meerut, where they arrived in an exhausted and destitute condition.

One of the party was Lieut. Philip Salkeld, of the Bengal Engineers. His cheerfulness and equanimity under these trying circumstances tended much to keep up the spirits of the party.

Steps were at once taken to organize a force for the recapture of Delhi.

General Sir Henry Bernard was told off for the task, and arrived before Delhi and pitched his camp in rear of the ridge on the 8th June.

The force he brought with him consisted of 3,000 European soldiers, some Ghurka and Sikh battalions and 150 men of the Sappers & Miners.

Major Baird Smith, of the Bengal Engineers, was ordered to Delhi in the last week of June to take up the duties of Chief Engineer.

He arrived before Delhi on the 3rd July, and urged the immediate assault of the place.

General Barnard did not concur. He was probably ill at the time for he succumbed to cholera two days afterwards. Major-General Reed who succeeded him was ill when taking over and was obliged

* Compiled in the R.E. Record Office.

to resign on July 17th. He was succeeded by Brig.-General Archdale Wilson. A retreat was at this time under discussion, and it required all Baird Smith's energy and enthusiasm to sweep away Wilson's doubts and to persuade him, as he wrote to him, " to hold on like grim death until the place is ours."

On the 20th August Lieut. D. C. Home, of the Bengal Engineers, arrived by forced marches of 20 miles a day from the Punjab with a reinforcement of two companies of Muzbi (Sikh) Pioneers.

On the arrival of a siege train on September 5th Baird Smith in consultation with Capt. Alexander Taylor, his second in command, submitted a plan of attack which was approved.

The first siege battery was commenced on the night of September 7th ; others rapidly followed until 56 guns opened fire. On the morning of the 14th September the assault was delivered, the points of attack being the Kashmir Bastion, the Water Bastion, the Kashmir Gate, and the Lahore Gate.

The columns of attack were composed as follows :—

No. 1.—Under General Nicholson, 1,000 men, with Lieuts. Lang and Medley, of the Engineers, and Bingham, Assistant Engineer.

No. 2.—Under Brig.-General Jones, 61st Regt., 800 men, with Lieuts. Greathed, Hovenden, and Pemberton, of the Engineers.

No. 3.—Under Colonel Campbell, 52nd Light Infantry, 1,000 men, with Lieuts. Home, Salkeld, and Tandy, of the Engineers.

No. 4.—Under Major Reid, commanding the Sirmoor Battalion, 780 men, with Lieuts. Maunsell and Tennant, of the Engineers.

Reserve under Brig.-General Longfield, 1,200 men, with Lieuts. Ward and Thackeray, of the Engineers.

These columns had all fallen in by 3 o'clock on the morning of September 14th, at the place of rendezvous, Ludlow Castle. During the night the enemy had filled up the breaches with sandbags. It became, therefore, necessary to clear these away by fire from the batteries before any assault could be delivered ; the guns opened accordingly, and continued playing till daybreak. It had been arranged that the 60th Rifles, under Colonel Jones, should move forward first of all, and, under cover of the trees and brushwood, creep as close to the ramparts as possible, and from thence keep down the fire of the defenders while the columns advanced. The cheers of this party, when they began to move, were to be the signal for the guns to cease firing.

The main interest as an Engineer operation centred in the blowing in of the Kashmir Gate for the entry of the third column, to which, as has been said, Lieuts. Home, Salkeld, and Tandy were attached. The duty devolved on the two former, assisted by sundry non-commissioned officers of the Bengal Sappers. Cooper gives a very vivid description of the incident, commencing thus :—

" At the head of the third column stood the gallant exploding party, consisting of Lieuts. Salkeld and Home, of the Engineers, Sergts. Carmichael, Burgess and Smith, of the Bengal Sappers, Bugler Hawthorn, of the 52nd L.I." (who accompanied the party to sound the advance when the gate was blown in), "and eight native Sappers, under Havildar Madhoo, to carry the bags of powder. At the edge of the cover" (the brushwood which stretched to within a short distance of the ramparts), "the powder bags had been transferred to the European soldiers. Here stood the heroic little band, forming a forlorn hope, feeling themselves doomed to almost certain death, waiting in almost agonized suspense for the appointed signal. It came, the firing suddenly ceased, the cheer of the Rifles rang through the air, out moved Home with four soldiers, each carrying a bag of powder on his head, close behind him came Salkeld, portfire in hand, with four more soldiers similarly laden, while a short distance behind came the storming party, 150 strong, followed up by the main body of the column in rear."

There was a gateway outside the ditch, then the drawbridge, which was so much shattered as to be difficult to cross, and behind it the main gate with a wicket, which at the time was standing open. Home and his party passed over what was left of the bridge, deposited the powder bags against the gate, and dropped unhurt into the ditch, only two or three shots having been fired at them. By the time that Salkeld with his party arrived, the garrison had recovered from their panic, and perceiving how few the assailants were, and what their object was, poured a deadly volley upon the little group at a distance of only 10 ft. Salkeld had by this time laid the other four bags, and was about to apply the port fire when he was shot through the arm and leg. He then handed the port fire to Sergt. Burgess, bidding him light the fuze. Burgess was shot dead before he could obey the order, on which Sergt. Carmichael dashed forward, seized the port fire, and succeeded in igniting the train. The next instant he, too, fell mortally wounded. On this, Sergt. Smith pushed forward, but finding the train already ignited dropped into the ditch, where the bugler had by this time conveyed the wounded Salkeld. Here the party crouched for a few most anxious moments, awaiting the result. This soon declared itself. A terrific explosion was followed by the crashing in of the massive gate, which was shattered to pieces, the gallant little bugler Hawthorne sounded the advance, the stormers with a ringing cheer dashed in, and the Kashmir Gate with the Main Guard behind it was secured.

This now celebrated spot is hallowed by the memory of the heroic deed of September 14th, 1857; and a monument to those who fell on the occasion has been erected on the spot by Lord Napier of Magdala. It was indeed worthy of record. The advance was one to almost certain death. The crowd of mutinous soldiery within could hardly fail to shoot down those who were attempting so daring a deed, and it was a matter of bare justice that the survivors should receive the coveted decoration of the Victoria Cross. Salkeld lingered for two days and then died of his wounds, whilst Home, who had passed unscathed through the ordeal, most unfortunately lost his life a very short time afterwards by an accident, whilst blowing up the fort of Malagurh.* Lieut. Tandy, the only remaining Engineer officer attached to the column, was killed during the fighting in Delhi itself after the storming of the Kashmir Gate.

CHAPTER VI.

THE 23RD COMPANY, ROYAL ENGINEERS, IN THE INDIAN MUTINY AND IN CHINA.

THE following account of the doings of the 23rd Company in India and in China from 1857 to 1860 is taken from an account written by the late Lieut.-General Sir Gordon Pritchard, K.C.B., who served as a subaltern in the company during those years.

"In the beginning of the year 1857 war was declared between England and China.

"Lord Elgin was appointed Plenipotentiary, and an expeditionary force was organized.

"The 23rd Company of Royal Engineers, with Capt. Augustus Clerke, Lieuts. Lennox, E. D. Malcolm, and G. D. Pritchard, Assistant Surgeon Henry, and 120 non-commissioned officers and men, with war equipment joined this force.

"The 23rd Company embarked on the 23rd April at Woolwich, on a small sailing ship called *The Captain*. This ship was only just large enough to carry the company, with its escalading ladders, entrenching tools, etc.

"The company, with its equipment, was landed at Singapore on the 25th July, 1857. The Indian Mutiny had broken out on the 10th May, just ten weeks before we reached Singapore. The wildest rumours were afloat, namely, that India had been lost to the British, and that every European in the country had been massacred. Lord Elgin at once decided to send all the troops bound for China to India. The company remained at Singapore until the 1st September, 1857, when, with two batteries of Royal Artillery, it embarked on board H.M.S. *Sanspareil*, commanded by Capt. (afterwards Admiral Sir) Astley Cooper Key, R.N., and steamed for Calcutta, which place was reached on the 18th September, 1857.

"These were the first troops to arrive in India after the Mutiny had occurred. The 23rd Company, R.E., was 'Primus in Indis' of that corps. To our surprise, we found affairs not so bad as had

* Porter's *History of the Corps of Royal Engineers*, Vol. I., pp. 479—481.

been painted. Calcutta was peaceful, but the native troops had, as a precautionary measure, been disarmed. It was strange to see the native sentries 'shouldering' only a ramrod.

"In the beginning of October the Grenadier Company of the 93rd Highlanders, with the 23rd Company of Royal Engineers, entrained at Calcutta, and after travelling about 100 miles, detrained at Ranigunj. This was the only line of railway then in India. From Ranigunj these two companies proceeded by bullock dak, *i.e.*, in country carts covered with awnings, and drawn by bullocks. During our march we passed the holy city of Benares, and, crossing the River Jumna by a bridge of boats, entered the city of Allahabad.

"A force composed of the Naval Brigade, a few companies of the 23rd and 53rd Regts., some of the Highlanders, and some artillery, with the 23rd Company, R.E., the whole under the command of Colonel Powell, now made rapid marches towards Cawnpore, stopping only for meals and short rests, in the direction of Futtehpore, distant about 60 miles.

"Colonel Powell, on arriving in the vicinity of Futtehpore, ascertained by means of a reconnoitring party that the enemy were entrenched about two miles ahead. He then ordered the 23rd Company to advance in skirmishing order, one half of the company on the right, the other half on the left of the road, supported by the infantry and the Naval Brigade. Entering a plantation of Indian corn higher than our heads, the enemy opened upon us with shrapnel, fired from two of their guns at the other side of the plantation. The rushing of the shot through the Indian corn created a great noise, and one could not see those of our fellows who were struck down. On reaching the other side of the plantation, we saw that Colonel Powell, who had ridden up the road, had been shot dead. Seeing the two guns about 200 yards ahead, Lieut. Lennox ordered the 23rd Company to charge. This was done in gallant style, the gunners being bayoneted at their guns, and the guns captured. The entrenchment was soon afterwards carried, the rebels bolting before our men could get at them with the bayonet. After Colonel Powell was killed, Capt. William Peel, V.C., R.N., of H.M.S. *Shannon*, assumed command.

"The force continued its march to Cawnpore. Here we inspected the house where 230 women and children had been slaughtered, and examined the well into which their bodies had been thrown. This 'Slaughter House' the Royal Engineers demolished.

"The Commander-in-Chief, Sir Colin Campbell, arrived at Cawnpore soon after the above-mentioned force had reached the station. A *tête de pont*, to protect the bridge of boats, made over the river Ganges by Sir Henry Havelock's force, was now completed on the south or Cawnpore side of the river. The 23rd Company, assisted by infantry, performed this work.

"On the 30th October, 1857, a force, numbering about 4,000 officers and men, crossed a bridge of boats and entered Oudh, which was full of rebels. The Commander-in-Chief was himself in command. The line of direction was due north towards Lucknow, where Outram and Havelock were besieged. After one or two smart skirmishes and the capturing of a few villages, the force arrived at Alum-Bagh, just outside and south of the city of Lucknow, on the 13th November, 1857.

"The first relief of Lucknow had already been carried out by Sir Henry Havelock, who was now himself besieged in the city. At the time of this first relief a small force had been left by him in the Residency, a building just north of the city. Sir Colin Campbell, the Commander-in-Chief, now decided to avoid the native city and to march round its eastern side, resting his right on the River Goomtee and capturing the large buildings on his route. Soon after the capture of the Dilkoosha, an Italian building of beautiful architecture, a civilian named Kavanagh arrived from the Residency, dressed as a native, with a new code of signals arranged by General Outram. The 23rd Company erected a semaphore on the top of the Dilkoosha, and Sir Colin Campbell was now able to communicate with the besieged in the Residency, telling them his line of attack and giving them orders how they were to assist us. On the 15th November we seized the Martiniere College, and crossed the canal on the 16th.

"After capturing a few more fortified posts, our force, led by a battery of artillery, marched through the village on to the open ground between the Secundra-Bagh and the European barracks, from both of which places a heavy fire was brought to bear upon us. Capt. Hardy, of the Royal Artillery, was killed, and numerous N.C.O.'s and men were struck down wounded. A breach was effected by our guns to the right of the gateway of the Secundra-Bagh, at which the Highlanders entered, followed by the men of the 53rd Regt., Sikhs, and Royal Engineers, who rushed and opened the gateway from the inside. Heavy firing occurred between the rebels, who had run into the centre of the compound, and our men. The building in the centre of the garden, which was full of the enemy, was now attacked. The Engineers set the thatched roof on fire. The rebels rushed out and fought like demons, all being speedily bayoneted by our men in a hand-to-hand encounter. Two thousand of the enemy—*i.e.*, all who were in the Secundra-Bagh—were killed. Our loss was about 400.

"Further severe fighting followed, and on the 17th November, whilst the large tomb and observatory fell to the relieving forces under Sir Colin Campbell, the troops of Generals Outram and Havelock seized the Dil-Aram and Funhud Buksh Palaces.

"Both forces now assaulted, from opposite sides, the Palace of Moti-Mahal, on the roof of which the 23rd Company, R.E., planted the British flag. Having captured the Palace, the forces met, and the besieged garrison of Lucknow was effectually relieved.

"On the 18th the sick and wounded and women and children left the Residency for the Dilkoosha. This retreat was so well carried out that the mutineers were in total ignorance of our movements.

"The startling news now reached us that General Wyndham had been defeated and Cawnpore captured by the Gwalior contingent, which had come up from the south. The Gwalior contingent consisted of the troops of the Rajah of Gwalior, against whom they had mutinied, the Rajah himself being loyal to the British.

"Leaving a force under Sir James Outram at the Alum Bagh to watch Lucknow, we rapidly marched to Cawnpore, distant 42 miles, pitched our camp at night on the north bank of the river Ganges, placed our batteries in position and shelled the town. We found that Cawnpore was in possession of the enemy, but, fortunately, General Wyndham held the *tête de pont* or bridgehead, and the bridge of boats, which the enemy were trying to destroy by floating down the river tarred barrels and rafts on fire. These the Royal Engineers passed through the bridge or otherwise destroyed. Sir Colin Campbell's force, having crossed the bridge of boats and encamped on the east side of the town of Cawnpore, kept up a heavy fire upon the enemy in the town.

"On the morning of the 6th December General Wyndham opened, from the *tête de pont*, a heavy fire on the enemy's left flank. Sir Colin Campbell threw forward his left and attacked the enemy's right and a general advance was made from the centre. After some skirmishes and bayonet charges the enemy bolted down the Calpee Road towards Bithoor, the residence of the Nana Sahib, who had massacred 230 women and children at Cawnpore. Lieut. Malcolm, R.E., with some men of the 23rd Company, marched to Bithoor and raised some treasure from a well at that place. Thus ended the great Battle of Cawnpore, on the 6th December, 1857.

"After a few days' rest a small force, consisting of the 9th Lancers, a troop of Horse Artillery, the 53rd and 93rd Regts., 4th Sikhs, and 23rd Company, R.E., was despatched to Futtehgarh, where it was said women had been blown away from guns and children placed as targets for the rebels to fire at.

"On the 1st January, 1858, the force crossed the Kala Nudee, the enemy firing upon the bridge the whole time. The 53rd Regt. advanced in skirmishing order, supported by the Highlanders, and captured the village. On the next day the force reached Furruckabad, the Rajah of which place was hanged from a tree, he, like the Nana Sahib, having been guilty of some brutal murders of British residents. His fort was afterwards destroyed by mines laid and fired by the 23rd Company. The troops then returned to Cawnpore, where a considerable force, including a siege train, had collected.

Lieut. (afterwards General Sir) Richard Harrison, R.E., here joined the 23rd Company.

"In the beginning of February, 1858, Sir Colin Campbell, having sufficient troops to capture Lucknow, again crossed the river Ganges by the old bridge of boats, fought an action at Meangunj, and reached General Sir James Outram's entrenched camp near the Alum Bagh on the 2nd day of March, 1858.

"The Dilkoosha was again captured, and a battery made by the 23rd Company in front of it to breach the Martiniere. Half the 23rd Company was employed on this duty. The other half, together with the 4th Company, R.E., the whole being under the command of Major (afterwards General Sir) Lothian Nicholson, R.E., constructed a bridge of casks across the river Goomtee, close to the Dilkoosha. General Outram and his force crossed the bridge of casks to the north side of the river. Major Nicholson and the 4th Company, R.E., were placed under General Outram's orders. Capt. Peel's naval guns took up their position in the battery before mentioned, and shelled the Martiniere. General Outram, after one or two engagements, reached a position on the north side of the Goomtee. The 23rd Company advanced by means of sapping to the Chota Imam Bara and the Begum Kothi. All this time the Ghurkhas—who remained loyal throughout the Mutiny—were steadily advancing through the native city. The Kaiser Bagh, of quadrangular form, was seized by the Commander-in-Chief's troops. The 23rd Company, with a party of infantry, cleared this palace, room by room, bayoneting the rebels therein.

"On the 17th March the Shrugood-Dowlah compound was captured, and Shrugood-Dowlah killed. This compound was full of powder carts containing boxes of powder, and large quantities were lying about. Capt. Augustus Clerke, R.E., with the 23rd Company, and Capt. Brownlow, of the Bengal Engineers, some Highlanders and Sikhs, were ordered to destroy this powder. They commenced throwing the boxes down the well in the centre of the compound. The well suddenly exploded, and all the powder in the place became ignited and caused a terrific explosion. The two Engineer officers were mortally wounded, and about 100 of the soldiers—Highlanders, Sikhs, and Sappers—were killed. Capts. Clerke and Brownlow, with 13 men of the 23rd Company, were buried in one grave, their bodies being sewn up in their greatcoats. The last fight of the Siege of Lucknow took place on the 19th March, 1858, when the Moosa Bagh was captured.

"After a short rest General Walpole was sent with a well-organized force to the Rohilcund district, situated in the west of the province of Oudh, to capture the fort of Rooya, held by Nurput Singh. Owing to the oppressive heat, this march was very trying. Consequently the troops proceeded only by night.

"On the 15th April, when nearing Rooya, a heavy fusillade was directed against our force, which spurred us on to the attack. On reaching the ditch of the fort, about 7 p.m., the General caused the 'retreat' to be sounded. The enemy, knowing our bugle-calls too well, returned to the parapets, which they were leaving, and killed more of our men as we were retreating than when we were advancing. Brig.-General Sir Adrian Hope, coming up to command the retreat, was shot through the neck and instantly killed. Our camp was pitched that night 2 miles to the rear.

"The next morning the fort was reconnoitred, and found to be open at the back. It was deserted, the enemy having bolted during the night. This fort was blown up by the Engineers. We then left the place and marched to Shahjehanpur, where we left a garrison, and proceeded thence to Bareilly. On approaching this city, numbers of ghazies, or native fanatics, intoxicated with 'bhang,' rushed out, and, attacking the 42nd Highlanders, pulled its commander, Colonel Cameron, off his horse, and would have speedily killed him had they not been bayoneted by the men of the Grenadier Company of that distinguished regiment. The British troops advanced and captured the city. The heat was now so intense that more men died from sunstroke than from the bullets of the rebels. The 23rd Company was now ordered to Roorkee to recruit its health.

"On the 8th November, 1858, for the fourth time, the British troops crossed the river Ganges at Allahabad, captured the fort of Amithee, and then marched to the plain of Doundeheira where they fought a battle with the rebels under Bani Hadhu, and drove them into the river. Forts Oomreah and Musjeedia were assaulted and captured.

"On the last day of the year 1858, whilst eating our cooked rations, about 6 p.m., orders were issued that the troops were to start at once (8 p.m.), officers mounted, N.C.O.'s and men on elephants in the direction of Nepaul. The troops marched all night. At daybreak on reaching the river Raptee, which separates the British possessions from those of Nepaul, the Ghurka country, we sighted the camp of the Nana Sahib, which was situated on our side of the river. We at once attacked. All his followers fled, crossing by a ford, the Nana Sahib leading them. The 7th Hussars gallantly charged into the river, sabring them in mid-stream. This brilliant action, fought on the last day of the year 1858, may be considered as the last fight in the suppression of the Indian Mutiny. Only a few small skirmishes took place afterwards. The 23rd Company returned to Lucknow and were quartered at the Mousa Bagh."

The following is the inscription on the memorial tablet erected in the Garrison Chapel at Chatham to the memory of the officers, N.C.O.'s and men who lost their lives during the Mutiny:—

SACRED

TO THE MEMORY OF

The Officers, Non-Commissioned Officers and Sappers
of the 23rd Company of Royal Engineers,
who fell in action, or died of Wounds or Disease
while serving in the Indian Campaigns of 1857 and 1858.

AT THE BATTLE OF KHAJWA.

Sapper John Malcolm, 1st November, 1857.

AT THE RELIEF OF LUCKNOW.

Lce.-Cpl. Alfred Germany, 17th November, 1857.	Sapper Thomas Thoms, 24th Nov., 1857.
Col.-Serjt. Philip Morant, 18th Nov., 1857.	2nd Cpl. Peter Duff, 23rd Jan., 1858.

AT THE SIEGE OF LUCKNOW.

Capt. Augustus J. Clerke, 17th Mar., 1858.	Sapper William Robinson, 17th Mar., 1858.
Sapper J. Bunting, 17th Mar., 1858.	Sappers Alfred Smith, Chas. Tucker.
Sappers Geo. Beer, Michael Daily.	Lce.-Cpl. James Slade, 17th Mar., 1858.
Lce.-Cpl. J. Davis, 17th Mar., 1858.	Sapper John Yeo, 17th ,, ,,
Sapper Andrew Fairservice, Mar., 1858.	Sapper John Ford, 18th ,, ,,
Sapper David Northwood, 17th Mar., 1858.	Cpl. Fredk. Morgan, 23rd ,, ,,
Sapper William Outerson, Mar., 1858.	Sapper Edward Swanton, 11th Sept., 1858.

AT THE BATTLE OF BAREILLY.

Sapper Charles Reynolds, 5th May, 1858.	2nd Cpl. Joseph Wren, 5th May, 1858.

DIED OF DISEASE.

Sapper Thomas Hancock, 26th Sept., 1857.	Sapper William J. Harris, 8th May, 1858.
,, Andrew Tait, 27th ,, ,,	2nd Cpl. James Fletcher, 11th ,, ,,
,, Jas. Benford, 8th Oct., 1857.	Lce.-Cpl. Alex. J. Neelance, 18th ,, ,,
,, G. Singleton, 23rd Mar., 1858.	Sapper Richd. Robinson, 24th ,, ,,
,, T. J. Clyma, 23rd Apl., 1858.	Lce.-Cpl. J. Colman, 15th June, 1858.

Sapper Thomas Wyndeatt, 15th June, 1858.
,, David Nicholson, 21st ,, 1858.
Bugler John Noyes, 5th July, 1858.
Lce.-Cpl. John Yolland, 30th Sept., 1858.

Erected by the Officers and Men
of the 23rd Company of Royal Engineers,
1860.

In January, 1859, Capt. Gerald Graham, V.C.,* reported himself for duty at Lucknow, and took over the command of the 23rd Company. Graham had been awarded the Victoria Cross for "determined gallantry at the head of a ladder party at the assault of the Redan on the 18th June, 1855, and for devoted heroism in sallying out of the trenches on numerous occasions and bringing in wounded officers amd men."

On the 22nd October, 1859, Graham was gazetted a brevet major for his Crimean services, and on the 25th of the same month he left India with his company for China, arriving at Canton in November.†

Before the outbreak of the Indian Mutiny in May, 1857, British relations with China were in a strained condition, and the troops destined for an expedition against that country had—as already described—been stopped at Singapore on their way out, and hurried to Calcutta. Since then much had happened, and Canton was now occupied by British troops. In this expedition the French were our allies.

The following account of the doings of the 23rd Company in the China War of 1860 has been kindly supplied by Lieut.-General Sir Gordon Pritchard, K.C.B. :—

"The company, under the command of Major Gerald Graham, V.C., with Lieuts. Malcolm, Pritchard, and Harrison, proceeded by train from Cawnpore to Calcutta, embarked on board Messrs. Jardine & Co.'s opium steamer, *The Lightning*, and proceeded to Hong Kong, *viâ* Singapore. On reaching Hong Kong, the company was transhipped into a river steamer, which carried them to Canton, where they were quartered for the winter. During the winter the Sappers were employed in ordinary barrack repairs. Later the company embarked and steamed for Talienwan Bay, where they joined the 2nd Division, under Sir Robert Napier, and were encamped on one side of the bay. The 1st Division, under General Sir John Michell, encamped on the other side of the bay. Lieut.-Colonel Fisher, R.E., was invalided home, and Lieut. Pritchard took command, and joined the 1st Division.

"The 2nd Division, under Sir Robert Napier, who was an Engineer officer, having landed at Pehtang, came up and advanced to attack the north Taku Fort, on the Peiho River, the 1st Division forming the reserve. The 23rd Company was with the 2nd Division.

"On the evening of the 19th August, before the assault, Sir Robert Napier sent for me and ordered me to command the ladder party for the assault. Batteries were completed, and guns placed therein. The north fort was shelled during the night.

"In the early morning the 23rd Company and Madras Sappers

* Afterwards Lieut.-General Sir Gerald Graham, V.C., G.C.B.

† *Life and Letters of Lieut.-General Sir Gerald Graham, V.C., G.C.B.*, Colonel R. H. Vetch, C.B., p. 141.

paraded in front of the supports, ready to move forward and keep pace with the progress of the attack.

"We had formed ladder bridges with which to cross the wet ditches in front of the fort. These ladder bridges consisted of escalading ladders joined together and mounted on wheels. We also carried some bamboo ladders with which to escalade the fort.

"The attack commenced soon after 6 a.m. .

"The English pontoon bridge, carried by a party of Royal Marines, was met by so heavy a fire that half the carriers were immediately disabled, and the construction of the bridge rendered impracticable. Major Graham was wounded in attempting to carry out this duty.

"Sir Robert Napier then asked if I could cross the ditches with escalading ladders alone. On my answering in the affirmative my party proceeded to the fort under a heavy fire. I placed the ladders across the wet ditches. The Sappers, jumping into the bottom of the ditch, supported the ladders in the centre by holding their hands over their heads. The men were up to their armpits in water. Then, with our bamboo ladders, we ran along the rounds of the escalading ladders, crossed the ditch and escaladed the fort. Sir Robert Napier afterwards said to me: "Well done, Pritchard! This is the first time I have seen a bridge with living piers." The French on the right succeeded in crossing the ditches by means of their ladder bridges, and effected a lodgment on the berm of the fort. On reaching the top of the parapet hand-to-hand fighting occurred between the Chinese and British and French soldiers. After a vigorous resistance, the enemy bolted across the terreplein of the fort and were shot down by the French and by our troops. At 8.30 a.m. this fort, the key of the whole position, was in our hands. Soon afterwards the surrender of the remaining northern forts and the abandonment of those on the south side was complete.

"The following extracts from the despatches of Major-General Sir Robert Napier, K.C.B., refer to the doings of the 23rd Company in the assault on the Taku Fort :—

TANG KOO, *August 26th*, 1860.

SIR,—Having received the sanction of the Commander-in-Chief to commence operations against the fort, I advanced on the evening of the 19th a strong piquet composed as per margin* to the border of the series of canals which surrounds the enemy's position. The Engineers, under the direction of Lieut.-Colonel Mann, R.E., immediately commenced passages across the broad canals to my front and left.

* * * * *

During the night of the 20th the batteries were completed by the Royal Engineers Department, and the remaining canals in my front were bridged so as to give access to the ground, and convert them into valuable cover.

* * * * *

* Milward's Battery, R.A., Madras Mountain Train Battery, 23rd Company, Madras Sappers, 67th Regiment.

At 4 a.m. my column of infantry moved into position . . . the Royal Engineers and Sappers, with materials, were placed under cover in front of the supports.

* * * * *

The passage of the ditch by means of ladders was carried out by Lieut. Pritchard, R.E., and parties of our infantry, effecting the passage of the ditches, some by means of the ladders, and others by swimming, made their way to the gate.

* * * * *

To Lieut.-Colonel Mann, Chief Engineer, and the officers and men of the Engineer Brigade, I feel grateful for the unwearied exertions by which they have carried the construction of necessary works of approach and attack to a successful issue.

* * * * *

I append a list of officers and men whom I would earnestly recommend to the protection of His Excellency the Commander-in-Chief.

List of Officers and Men Entitled to Honourable Mention for Services Rendered in the Attack of the Peiho Forts, 21st August, 1866.

Royal Engineers.—Major G. Graham, V.C., commanding 23rd Company. Recommended by Colonel Mann for his gallant conduct in trying to establish the pontoon bridge under a heavy fire, by which he was severely wounded.

* * * * *

Lieut. G. D. Pritchard.—Gallant conduct in taking up ladders and bridging the ditch under a heavy fire.

After the capture of the Taku Forts, the 1st Division took the lead, the 2nd Division being in reserve. We marched in this order up to Tien Tsin.

The 2nd Division now advanced to the front, under the command of General Sir Robert Napier, who was ordered to capture Pekin. A garden was seized a few hundred yards from the wall of Pekin. A party of the 23rd Company crossed a small stream and painted a white patch on the spot that was to be breached. A battery was made in the garden and guns placed therein, after which an ultimatum was sent into Pekin that if they did not open the gates by noon on a certain date the wall would be breached. Just before noon the gates were opened, and the city of Pekin, the capital of China, was in possession of the British. On the following Sunday news arrived that our French allies had captured the summer palace, situated some miles to the north. The Emperor of China had fled to the mountains to the north. At this juncture Lord Elgin ordered the Summer Palace to be burnt to the ground and the news to be conveyed to the Emperor of China, in order to bring him to terms. Soon afterwards Prince Kunj, the Emperor's brother, came down to Pekin and signed the treaty in the palace inside the capital. This was a gorgeous ceremony. The British troops, in full uniform, marched to the palace to be present at the ratification of the Treaty.

The troops returned to Tien Tsin, and, for their accommodation, I was ordered to seize the Mandarins' houses. Having completed this work, the 23rd Company was ordered to return to England. The company, with Major Graham in command, and Lieuts.

Malcolm, Pritchard, and Harrison, embarked on board Her Majesty's troopship *Adventure* and steamed for England, arriving on the 25th May, 1861."

A characteristic anecdote of Gerald Graham—who commanded the 23rd Company throughout the campaign—is given by Lord Wolseley, in an article entitled "Courage," contributed by him to the *Fortnightly Review*, of August, 1888 :—

"I have heard it said that small men are generally braver than tall men, but one of the most stolidly and immovable brave men I have ever known is several inches over 6 ft. in height. I have often seen him, from pure laziness, when relieved from duty in the advanced trenches before Sebastopol, step out calmly in rear of the parallel where he happened at the moment to be, and take a bee-line for camp, exposed for many hundred yards to a heavy rifle fire from the advanced works of the Russians. He might have walked home through the trenches in safety, but he was too lazy or too careless of his life to go so far round. I remember a curious instance of his imperturbability some years afterwards, when I met him in China. In the assault of the Taku Forts we had to cross two ditches filled with water. One of these was sufficiently wide and deep to require a bridge to be thrown over it. In carrying up a light-infantry pontoon bridge to launch into this ditch, a round shot went through one of the pontoons. To launch it in that condition would have caused it to sink and we had great difficulty in getting the injured pontoon out of the bridge under the close severe fire to which we were exposed from the works behind the ditch. In common with all the other mounted officers, I had left my horse at a safe distance behind under some cover. I was therefore astonished when, upon standing up after working at this little bridge on the ground, to see beside me a very tall man on a tall horse. The position was actually comical, and as well as I remember, I laughed as I saw my cool friend there at the edge of the ditch, a regular cockshot for every Chinaman near him. He said something to me which, owing to the great din and noise at the moment, I could not hear, so moving nearer to him I carelessly put my hand on his leg. He winced a little as I touched him, and calmly saying 'Don't put your hand on my leg, for I have just had a bullet in there," went on with his conversation as if only a mosquito had bitten him. That man is now known to all as Lieut.-General Sir Gerald Graham, V.C., who commanded a brigade at Tel-el-Kebir, and who was afterwards in chief command at El-Teb and the many other bloody engagements which took place near Suakim."

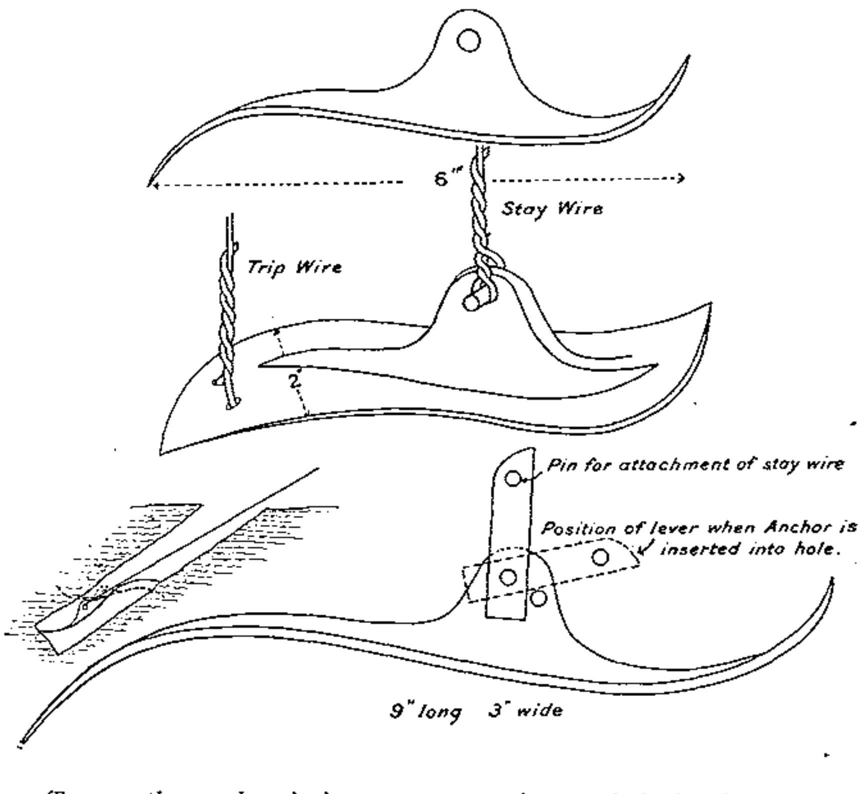
An interesting account of the campaign, including an account of the sack of the Summer Palace, will be found in Sir Richard Harrison's *Recollections of a Life in the British Army*.

A magnificent carved throne was taken from the throne room of the Summer Palace by the 8th Company, R.E., under the command of Capt. C. G. Gordon—afterwards known to fame as Chinese Gordon—and by him handed over to the 23rd Company, by whom it was brought back to England and deposited in the Royal Engineer Headquarter Mess at Chatham.

A USEFUL ANCHOR.

By LIEUT.-COLONEL BERTRAM A. G. SHELLEY, R.E.

THE accompanying sketches show an anchor which can be used either for holding revetments, for staying light telegraph poles or in lieu of pegs for the storm guys of hospital marquees, etc. If used for revetments only one wire, the stay wire, would be required, but if intended to subsequently recover the anchor the second or trip wire is needed.



To use the anchor it is necessary to bore a hole in the ground with an earth augur and to push the anchor to the bottom of the hole short end first. Immediately a strain is put on to the stay wire the points of the anchor bite into the sides of the bore hole and it eventually assumes a position across the hole. To recover the anchor the stay wire is first slackened, and, with an iron rod or piece of piping, passed down the hole. Three or four smart blows are given to the anchor so as to drive it back. This causes a cavity in the ground above the flakes, and a subsequent pull on the trip wire causes the flakes to re-enter the bore hole, and the anchor can be pulled out.

The smaller sized anchor, buried 14 in. in clay, required three men using a tackle consisting of a single and double block to pull it out. The larger anchor under similar conditions withstood five men using two treble blocks.

It was found that unless the pin was used for attaching the stay wire to the anchor the sharp edges of the hole in the latter cut through the wire.

EARTH CONNECTIONS IN WIRELESS TELEGRAPHY.

By CAPT. R. CHENEVIX-TRENCH, M.C., R.E.

I. WHILE it is well known that it is desirable to have a good earth connection for any wireless aerial, the actual effect of this connection on the efficiency of transmission and reception is not so generally recognized, and in consequence its very great practical importance is sometimes underestimated. The question of the general effect of the earth connection in sending and receiving is considered in the following article:—

II. *Sending*:—

(1). In sending, whatever type of apparatus is used, the energy developed in the aerial is expended in two ways:—

(*a*). In radiation, or useful work.

(*b*). In overcoming ohmic resistance of aerial conductors and earth connections, and in inducing currents in the surrounding earth and in neighbouring conducting bodies. All this is wasted work and contributes nothing to radiation. Generally by far the greatest losses under this head are those due to earth resistance. The proportion of energy radiated to the total energy developed in the aerial is the radiation efficiency of the aerial.

Let P be the amount of energy per second developed in an aerial, in watts; P_r the amount radiated per second, and P_e the amount wasted through the various sources given above under heading (*b*). Then $P = P_r + P_e$ and the radiation efficiency of the aerial is

$$\frac{P_r}{P_r + P_e}.$$

If I is the current near the foot of the aerial in amperes and R_r is the resistance due to radiation, in ohms, then

$$P_r = I^2 R_r. \quad *$$

Also if R_e is the resistance due to all the causes under heading (*b*) in ohms, then

$$P_e = I^2 R_e, \quad *$$

* The general practice is here followed of taking the radiation resistance R_r as that quantity which, when multiplied by the square of the R.M.S. current at the base of the aerial, gives the total power radiated. In order to conform to this resistance rating the "wasting" resistance, R_e, is here taken as that quantity which gives the total power dissipated through all other sources when multiplied by the square of the R.M.S. current at the base of the aerial.

so that the radiation efficiency may be shown as $\frac{R_r}{R_r+R_e}$. This shows clearly the great importance of keeping the value of R from all sources as low as possible; for while the aerial ammeter might show an apparently satisfactory reading, yet if R_r were small compared to R_e only a small proportion of the power developed in the aerial would be usefully expended in radiation.

L. W. Austin states that the radiation efficiency may be as high as 50 per cent., in which case R_e is equal to R_r. As this is about the highest efficiency that may be looked for in practice, we may assume that it is only reached with a very good earth (upon which the value of R_e chiefly depends) and with an aerial radiating on its most efficient wave length. This is usually about 1·5 times the natural wave length. With a bad earth connection R_e will be much greater than R_r even at the most efficient wave length, and if, for example, $R_e=5R_r$, as may easily be the case if great care is not taken, the radiation efficiency is only 17 per cent.

The values of the radiation resistance, R_r, and the total resistance, R_r+R_e, of an aerial may be arrived at by the methods given below.

(2). *Radiation Resistance.*—It has been shown* that the power radiated by a hertzian oscillator or dipole is given by the formula

$$P_r=790\frac{l^2}{\lambda^2}I^2 \text{ ....(1)},$$

where P_r is the power radiated, in watts,
l is the length from pole to pole, and
λ is the wave length, in any like units.
I is the R.M.S. current in amperes.

That is, the radiation resistance in ohms is $790\frac{l^2}{\lambda^2}$.

An earthed aerial can be considered as the top half of a hertzian oscillator of which the bottom half is formed by the "reflection" of the aerial, and in this case l is twice the height from the ground to the centre of capacity of the aerial system; we will call this the effective height, h, of the aerial, so that $l=2h$. In the case of an aerial only the top half of the dipole radiates energy and the values of P_r and R_r obtained from the dipole formula must be multiplied by ·5, so that we have

$$R_r=\cdot5\times790\frac{(2h)^2}{\lambda^2}$$

$$=1580\frac{h^2}{\lambda^2}\text{................................(2)},$$

where h is in the same units as λ.

* Hertz; Lodge.

Owing to the distributed capacity of the vertical part of any aerial the effective height is always less than the actual height, which we will call H. In a simple vertical aerial the value of h is about ·4H, though a large tuning coil will reduce this somewhat. In any form of aerial with a very large elevated area the effective height will be practically equal to the actual height. Between these limits the effective height may be arrived at with sufficient accuracy for practical purposes by the following method:—

Let T be the ratio $\dfrac{\text{Capacity of horizontal part of aerial}}{\text{Capacity of vertical part of aerial}}$.

Then if the vertical part consists of a single wire or of parallel wires its capacity may be taken as acting at a height ·4H, and we must find the centre of effect of T units acting at a height H and 1 unit acting at a height ·4H; this is given by the formula

$$h = H\left(\cdot 4 + \cdot 6\,\frac{T}{T+1}\right) \quad \ldots\ldots\ldots\ldots\ldots\ldots(3).$$

If the vertical part opens fanwise to a wide roof area, its capacity will act at a greater height than ·4H and the following formula is more nearly applicable:—

$$h = H\left(\cdot 6 + \cdot 4\,\frac{T}{T+1}\right) \quad \ldots\ldots\ldots\ldots\ldots\ldots(4).$$

In a single wire aerial, or any aerial in which the number and spacing of the vertical and horizontal wires is similar, the vertical part will average a slightly greater capacity per unit length than the horizontal part, owing to its proximity to earth, but the difference is small and for our purposes T may be taken as the actual proportion of the length to the height of the aerial. Where the vertical wires are fewer or at a smaller interval in proportion to their length than the horizontal wires, T will be greater than this proportion of length to height.

Example.—Let us consider for example the radiation resistance of a 2-wire aerial of T shape; height, 40 m.; length, 80 m.; wave length, 600 m.

Here T=2 approximately.

$$\therefore \quad h = 40\,(\cdot 4 + \cdot 6 \times \tfrac{2}{3})\text{ m.}$$
$$= 32\text{ m.}$$

$$\therefore \quad R_r = 1580 \times \frac{32^2}{600^2}\text{ ohms}$$
$$= 4\cdot 5\text{ ohms.}$$

That is to say, if a current of 10 amperes were developed at the foot of this aerial, the power radiated would be given by

$$P_r = I^2 R_r$$
$$= 450\text{ watts.}$$

(3). *Total Resistance.*—The total resistance in ohms, R, or $R_r + R_e$, of any oscillating circuit is given by the formula

$$R=\delta f L \text{ [1]} \quad \ldots\ldots\ldots\ldots\ldots\ldots(5),$$

where δ is the logarithmic decrement per period of the oscillating circuit.

f is the frequency.

L is the inductance in henries.

The value of δ for an aerial may be most easily found by the method due to Bjerknes and Drude. Oscillations are produced in the aerial by means of a spark coil and are induced into a calibrated wave-meter of which the high-frequency resistance is known and which is fitted with a galvanometer.

The coupling between the aerial and the wave-meter should be as loose as possible and the latter tuned to the aerial wave length by obtaining maximum current in the galvanometer. This maximum current is noted, the wave-meter put slightly out of tune and the galvanometer reading taken again.

Then if δ is the logarithmic decrement per period of aerial,

δ_1 is the logarithmic decrement per period of wave-meter,

λ_m is the wave length of wave-meter when in tune with the aerial,

λ is the wave length when slightly out of tune,

A_m is the current in galvanometer of wave-meter when in tune with aerial,

A is the current when slightly out of tune,

we have

$$\delta+\delta_1=2\pi\frac{\lambda_m-\lambda}{\lambda_m}\sqrt{\frac{A^2}{A_m^2-A^2}} \quad \ldots\ldots\ldots\ldots(6).$$

(1). This formula is usually given in the form $R=2\delta f L$, where R is that quantity which will give the total power developed when multiplied by the square of the effective R.M.S. current in the conductor. In the case of an aerial, owing to the variation of the current amplitude throughout its length, the effective value of this current is given by

$$A=\frac{I}{\sqrt{2}}$$

where A is the effective R.M.S. value of the current throughout the aerial and I is the R.M.S. current at the foot.

That is, $P=RA^2=\frac{1}{2}RI^2$

In order therefore to reduce the total resistance R to the same rating as that previously observed for R_r and R_e, we must take half the value given by the above formula and say that $R=\delta f L$. We can then find the total power developed from the formula

$$P=I^2R.$$

The value of δ_1 may be found from the high-frequncy resistance of the wave-meter by the formula

$$\delta_1 = \frac{R_1}{2fL},$$ (2)

where R_1 is the high-frequency resistance of wave-meter, and from this the value of δ may be found.

The resistance required, R, is then given by

$$R = \delta f L.$$

The shunted telephone method is sometimes used for comparing current strengths in the wave-meter, instead of a galvanometer.

Two tests should always be made for the value of $\delta + \delta_1$, one with the wave-meter out of tune on a wave slightly longer than λ_m, the other on a slightly shorter wave than λ_m. Each test should be verified by several repetitions and the mean of the two results taken.

Example.—Let us consider the same aerial as before. Its capacity will be about ·0011 mfds., so that the inductance at 600 m. wave length will be about 9×10^{-5} henries.

Let δ obtained as above have the very probable value in practice of ·4.

Then $R = \delta f L$

$= \cdot 4 \times \frac{10^6}{2} \times 9 \times 10^{-5}$ ohms

$= 18$ ohms

So that $R_e = R - R_r$

$= 13 \cdot 5$ ohms.

And the total power developed in the aerial with 10 amperes current is given by

$$P = I^2 R$$
$$= 1800 \text{ watts.}$$

Also since $P_r = 450$ watts the radiation efficiency is $\frac{450}{1800}$ or 25 per cent.

(4). The above figures are typical of any similar aerial of which the earth connections have not been made with great care in favourable soil. They show a loss of 75 per cent. of the power developed in the aerial, and a bad earth connection could easily give a higher value of δ than ·4 and entail still greater loss of power; 600 m. is about 1·5 times the natural wave length of the aerial, and consequently the wave on which it would radiate most efficiently. On longer waves the efficiency would fall off greatly; for instance, on 1,000 m. the radiation resistance would only be 1·6 ohms, while the

(2). See note (1) above.

total resistance would be rather more than before ; that is, the radiation efficiency would be less than 9 per cent.

As has been already stated, by far the greater part of R_e is, under normal conditions, due to earth resistance, and the only means of materially reducing R_e is by improving the earth connections. With a well-made earth in good soil the value of R_e for the above aerial, on 600 m. wave, might be reduced to 4 or 5 ohms, giving a radiation efficiency of about 50 per cent. Since 1,800 watts is the power developed in the aerial, this improvement in earth connections would increase the power radiated from about 450 watts to about 900 watts. Also as the total aerial resistance is reduced from about 18 ohms to about 9 ohms, the current, $\sqrt{\frac{P}{R}}$, is increased from 10 amperes to 14 amperes.

It is clear that the effect of the earth resistance is not absolute, but depends on the comparative value of the radiation resistance, and the lower the radiation resistance the better the earth connections must be to avoid large losses. Thus a long, low aerial, which necessarily has a low radiation resistance $\left(\text{since } R_r \propto \frac{h^2}{\lambda^2}\right)$ will need very especial care taken over the earth connection if it is to radiate at all efficiently. Fifty per cent. efficiency cannot in any case be expected with an aerial of length greater than about twice its height, and the shape of a directive inverted L aerial imposes a very low value on its radiation efficiency, even with the best possible earth connection.

Example.—For instance, if instead of the aerial previously considered, 40 m. high and 80 m. long, we take one 27 m. high and 108 m. long, which will have about the same natural wave length.

Here T=4 approximately.

$$\therefore \quad h = 27\,(\cdot 4 + \cdot 6 \times \tfrac{1}{3})\text{ m.}$$

$$= 24\text{ m.}$$

$$\therefore\ R_r \text{ at } 600\text{ m. } \lambda = 1580 \times \frac{24^2}{600^2}\text{ ohms}$$

$$= 2.5\text{ ohms,}$$

$$\text{and}\quad R_r \text{ at } 1000\text{ m. } \lambda = 1580 \times \frac{24^2}{1000^2}\text{ ohms}$$

$$= \cdot 9\text{ ohms.}$$

So that an aerial current of 10 amperes would only mean a radiated power of 250 watts and 90 watts respectively. The earth resistance in each case might easily be enough with an indifferent earth to raise the total resistance to about 20 ohms, so that the radiation efficiencies would be only about 12·5 per cent. and 4·5 per cent. respectively. With a good earth these efficiencies might be nearly doubled.

III. *Receiving* :—

The effect of the earth in receiving is much less simple to analyze than in sending, and at the same time the ill-effects of a bad earth connection are less felt. Put very broadly, the matter may be stated thus :—The strength of received signals is proportional to the power collected by the aerial from the passing waves, and this depends mainly on the height and capacity of the aerial, and, to a less degree, upon its properties of re-radiation, since it is a principle that a good radiator is a good absorber. These properties of re-radiation depend largely on the earth connection, as has been shown above in connection with the radiation efficiency, and to that extent a bad earth connection impairs the receiving properties of an aerial.

The fact that receiving is much less affected by bad earth connections than sending is borne out by some early experiments by Admiral Sir Henry Jackson. The following is an extract from his paper which refers to the subject :—

> "Repeated experiments with and without earths on the transmitter and receiver have shown that, in the open sea, signals may be obtained up to 50 or 60 per cent. of the full distance, without earths on the receiver, though such a good proportion is unusual, the average being 30 per cent. A condenser of suitable capacity acts nearly as well as a good earth ; without an earth on the transmitter the percentage of distance has never exceeded 15 per cent."

IV. *Counterpoise* :—

(1). An important side of the subject under discussion is the question of the insulated counterpoise as opposed to the direct earth connection.

(2). *Sending.*—In sending with the counterpoise certain losses are eliminated, namely :—

(*a*). Those due to resistance of contact between earth plates and soil.

(*b*). Those due to the interposition in the dielectric, between the elevated and the buried areas of the aerial system, of the upper layer of more or less conductive earth.

Earth resistance appears none the less in another form and with a like effect on the efficiency of radiation. The space between the counterpoise wires and earth carries a large dielectric current ; the lines of force penetrate the earth's surface to a greater or less depth according to its magnetic and conductive properties and set up earth currents which entail serious energy losses. There are also heavy losses due to direct induction in the soil from the oscillating currents in the counterpoise wires.

These combined losses will often be less than those of the conductive earth connection, unless the latter is a very good one. We may take for example certain stations which were fitted for purposes of comparison with both conductive and counterpoise earths, the former in unfavourable soil. While sending on full power the aerial current with the former was slightly less than with the latter; in other words, the total resistance $R_r + R_e$ with the conductive earth was rather greater than with the counterpoise. R_r was the same in each case, since it was proportional to $\frac{h^2}{\lambda^2}$, so that R_e with the counterpoise was nearly as great as with the conductive earth. Since the counterpoise eliminates all losses due to headings (*a*) and (*b*) above, it follows that the earth losses due to induction are very great.

It appears in practice that a counterpoise aerial has less capacity and more inductance than the same aerial earthed conductively. For instance one of the aerials referred to above showed the following measurements :—

With earth—

Natural wave length	570	m.
Inductance	72,300	cms.
Capacity	·00125	mfds.

With counterpoise—

Natural wave length	570	m.
Inductance	103,000	cms.
Capacity	·000875	mfds.

and like results were noted with the other stations. On any one wave length the smaller capacity and greater inductance of the counterpoise would impart greater persistency to the oscillations, since $\delta = \frac{R}{fL}$.

We may summarize the comparison by saying that with a counterpoise R_e will often have a smaller value, the radiation efficiency will often be greater and the damping of the oscillations always less than with a direct earth connection. In spite of this its effect at a distance will be less than that of an aerial with a good earth, though a good counterpoise will send better than a bad earth. The reason for this superiority of the conductive connection may perhaps be found in the existence of some form of earth-conducted wave which is not present where the counterpoise is used.

On account of its small decrement, however, a counterpoise may often be used with advantage for quenched spark sets. In these sets the oscillations in the aerial decay with its own decrement and are not sustained by a persistently oscillating closed circuit; it is consequently of great importance to keep the decrement from all sources as low as possible.

(3). *Receiving.*—In receiving, the use of a counterpoise instead of a direct earth has a greater adverse effect on signals than in sending. This is accounted for by the smaller capacity of an aerial with a counterpoise, and may also be partly due to its missing some form of earth-conducted energy which is picked up by an aerial with a direct earth connection. A case in point is that of the aerial referred to above, which had both an earth connection and a counterpoise. The earth connection, owing to very unfavourable soil, was a bad one. It was found that the station sent more efficiently with the counterpoise, but received more efficiently with the bad earth connection. Similar results were obtained with other stations.

(4). It is sometimes said that an aerial is less affected by atmospherics when fitted with a counterpoise than with a direct earth connection. This may be so to the extent that an aerial with a counterpoise receives everything less strongly than with a conductive earth. The writer has tried with various stations which could be switched at will from earth to counterpoise, and has been unable to detect any difference.

V. *Methods of Construction*:—

(1). *Conductive Earth.*—The main objects to be attained in a conductive earth are three, namely:—

(*a*). Low resistance in the actual contact between earth plates and soil. This can be gained by the use of sufficient area of earth plate in moist soil.

(*b*). An easy path for the lines of electric force between the elevated area and the earthed area of the aerial. If these have to pass through any distance of semi-conducting soil the quality of the dielectric is impaired; earth currents are set up and energy losses are entailed in consequence. These losses can be minimized by making the earthed area commensurate in size with the elevated area, thereby saving the lines of force from distortion and reducing the distance they would otherwise have to travel through the soil to concentrate on an earth connection of too small an area.

(*c*). Avoidance of losses due to currents set up in the soil immediately below and around the aerial by direct induction from the aerial wires. The best means to effect this is to erect the aerial over damp low resistance soil. If the surface soil is of high resistance an artificial conductivity can be imparted to it by the free use of conductors buried near the surface in the form of extension wires joined to the earth plates, and these are of great assistance even when the soil is naturally of low resistance. This is to a great extent bound up with the former consideration, (*b*), because the extension wires, owing to their connection with the earth plates, will have the effect electrically of increasing the area of contact with moist soil.

With the above objects in view the ideal conductive earth for a permanent station should be constructed as follows :—

A ring of copper or galvanized iron plates should be sunk in a circle with the instrument room at the centre ; the plates should be on edge and bolted together, and should be just below permanent water level ; if the earth is really wet great width of plate is not required, and a complete ring a few inches wide constructed as above is better than the same quantity of copper in the form of large square plates at intervals round the circle.

The perimeter should when possible, with a non-directive aerial, be as great as that of the elevated part. With a roof of great area or great length this entails too large an expenditure of earth plate and labour to be practicable, and in this case the ring should be made as large as circumstances permit. An allowance of 10 sq. metres of earth plate per kilowatt of primary power is sometimes made ; this has at first sight no connection with the size of the aerial, but in practice it is a fair guide because power of a certain order is usually combined with aerials of a certain size.

Connection with the surface should be made at intervals of a few metres round the ring of earth plates, and from these points to the actual connection to the aerial coil in the instrument room the conductors should be carefully insulated. The best method is to carry the wires straight up from the earth plates to insulators some 8 ft. or 10 ft. above ground, and thence at a safe height to an "earth leading in insulator" in the wall or roof of the instrument room. The vertical part leading out of the ground may be of light rod or very thick wire to avoid danger of damage, and it may be guarded by the pole supporting the insulator.

The reason for insulating these radial wires and for making the earth in a circle is that, at the high frequencies employed, even a short length of straight conductor has a very strong inductive back E.M.F., and if any wires take a shorter path to earth than others they will offer so much less opposition to the high-frequency currents that these will concentrate in the shortest wires and cause serious heat losses. This will occur even if the earth connection at the end of the long wires is better than at the end of the short. For the same reason, if a wire makes a bad contact to earth before it reaches the proper earth plate, the current will take the shorter route to earth in spite of its higher resistance.

The above effect has nothing to do with the smaller ohmic resistance of the shorter wires, and should not be confused with it. As an illustration of the back E.M.F. of even a short length of straight wire when high-frequency currents are employed, a heavy spark to earth may be taken from the wire leading to a well-earthed plate, a few feet away from the plate itself.

(2). The ideal earth connection described above is seldom realizable in practice. If damp soil is not attainable all round the station, but only at one side, the earth connection may be made in an arc on that side instead of in a complete circle, and it is better to spend trouble in perfecting the connection where the soil is favourable than in attempting to complete the circle through the unprofitable dry soil. Extension wires could be run back under the aerial from the concave side of the arc. Even if the damp soil is at some distance from the station it would be worth extending the connection to reach it.

Where material or labour is not available for a complete circle of sufficient size, it is better to make the earth along arcs of this circle with intervals between, than to make a complete circle of much too small diameter. For instance, if plates are available to give only 120 ft. length of earth connection they could be arranged either in a complete circle of 40 ft. diameter or in two 60-ft. arcs or four 30-ft. arcs on opposite sides of a circle of 80 ft. diameter. For any but a very small station one of the latter arrangements would be preferable.

Where the soil is only slightly damp, wider plates are required to give greater area of contact, and the allowance of 10 sq. metres per kilowatt may not be enough for a satisfactory connection. Where there is no trace of moisture the above method cannot give a good conductive connection however great is the expenditure of earth plate. In this case the whole of such a system acts very much as a non-conductive counterpoise earth, and if it is of sufficiently large area it will give fair results of such. In perfectly dry earth however the ring of earth plates is of no use conductively and there is no object in insulating the radial wires above ground, so that the best arrangement resolves itself into a system of buried radial wires as numerous as means allow, with no plates at the ends. They are only buried for convenience and safety and may be quite close to the surface. They then amount practically to a superior form of counterpoise, as they can far exceed in number any wires that could be conveniently supported above ground on insulators. Their length should be regulated by the rules given for a counterpoise in paragraph (3) of this section.

Where there is water only at a depth of several metres and the labour of digging a continuous circular trench becomes prohibitive, owing to rocky soil or any other difficulty, plates should be sunk to water level at intervals round the circumference and connected to the centre by radial wires as before. Unless the surface is perfectly free from moisture the radial wires should be carried above ground on insulators. With such a system of isolated earth plates each should be of as great an area as possible and large square plates are needed instead of the narrow strips which are enough in the case of a continuous circle.

In dry shifting sand with water at such a depth that it cannot be reached without shoring up the sides of the trench, the labour required is so great that it is better to sink galvanized iron pipes to water level by means of a pile driver, at intervals round the circumference.

Where water is at a great depth and a well is available, the earth connection may consist of a single large plate lowered to water level. This method is said to have been used with success for some French stations in the Sahara. A single plate cannot be called a good wireless earth in itself, and its success is probably largely due to the fact that the sand or rock through which the well is sunk acts as a dielectric and increases the effective height of the aerial. If this is the case the natural wave length will be increased in accordance with the extra length of aerial, and the best theoretical position for the instruments, where there is greatest current intensity, would be at the bottom of the well.

Where a ring of earth plates is used, especially in soil of poor conductivity, losses due to induction of earth currents from the aerial may be reduced by the use of extension wires referred to above. These should take the form of wires near the surface radiating from the ring of earth plates to cover the whole area beneath the aerial. They should not be used, however, with a conductive earth which is sunk to a considerable depth to reach water, as they would then make an artificial conducting surface at a higher level than the earth plates and so reduce the effective height of the aerial. Any network of wires or system of coarse wire netting is suitable, so long as the principal conductors of the system run parallel to the aerial wires above.

Conductive earths are sometimes made in two separate halves, to enable the earth resistance between the two to be measured by some direct current method. This will, of course, give no measure of the value of R_e as defined in Section II., but it is an indication of the state of the connection as regards conductive contact with earth, and will show if the resistance is increasing owing to the soil drying up, to corrosion of underground joints or any other reason.

(3). *Counterpoise.*—With a counterpoise, the losses due to the resistance of direct earth contact, and to the interposition of partially conducting earth in the dielectric between the upper and lower areas of the aerial system, are eliminated. There remain the losses due to earth currents below the counterpoise, and these losses, as has been shown, may be great. They can be minimized by erecting the station over damp soil and giving the counterpoise sufficient area. It should cover all the ground immediately under the aerial and extend some way beyond in every direction. The natural wave length of the counterpoise should be the same as that of the aerial. This can be attained with sufficient accuracy by making the radial length of the counterpoise nearly as great as the combined vertical and radial lengths of the aerial. This would mean, in an umbrella aerial, that the counterpoise radius should be greater than the aerial radius by nearly the height of the mast.

Whatever the shape of the aerial, the most efficient shape for the counterpoise is circular, with as many radial wires as possible, as in this form it covers the greatest possible area of ground, and this provides a greater area of earth surface to take the currents set up, and so reduces the resistance. Where the soil is of high resistance it can be given an artificial conductivity by the use of a system of surface wires, on the same lines as the extension wires of a conductive earth, but making no conductive connection with anything else. These may be used with advantage even when the soil is good. If the station stands on perfectly dry and non-conductive sand or rock, however, the induced earth currents and the losses due to them will in any case be negligible and the addition of surface wires should be avoided.

The requirements of a good counterpoise are therefore simple and need no elaboration ; they are :—

(*a*). It should be erected over damp soil.

(*b*). It should have the same natural wave length as the aerial and should cover as great an area as possible consistent with this condition, with as many wires as possible.

(*c*). It should be symmetrical; that is, its component parts should be of equal length to ensure even distribution of current.

(*d*). It should be well insulated.

Points (*b*), (*c*) and (*d*) above are always attainable by good design. If damp soil is unobtainable it is more important to cover a large area and (except with perfectly non-conductive soil) to use surface wires.

In a directive station, the use of the ideal circular counterpoise is prevented by its great area, and the counterpoise is usually confined to the space under the aerial.

(4). In both conductive and counterpoise earths conductors of suitable gauge for the current should of course be used to avoid ohmic losses in the wire. These losses may be made so small as to be practically negligible, but their existence should not be lost sight of.

(5). *Earth Mats.*—The earth mat of copper netting which is simply laid on the ground is very common with small portable stations. Though possessing great advantages of portability and simplicity, it has little to recommend it electrically unless it can be laid in mud or on growing grass whose moist roots form innumerable earth contacts. To get the best out of it, at least four mats should be used laid out radially, and they should be as long as possible. A good counterpoise gives better results under nearly all circumstances; but it entails complications of reels of wire, insulators and supports to carry about; it takes several minutes to erect as opposed to the few seconds required to unroll earth mats; it impedes access to the station and it needs a large area of fairly level ground free from bushes which would make contact with the wires.

(6). *Directive Aerials.*—It is said that the directive effect of an inverted L aerial is increased by making the earth connection out towards the distant station. If a conductive earth is used it may take the form of an arc or semicircle of earth plates on this side of the aerial, or extension wires may be run out from a complete earth circle in the direction of the distant station. In the case of a counterpoise any possible advantage of extending it towards the distant station as well as under the aerial is outweighed by the drawback of requiring twice the area for the station.

VI. The foregoing summarizes most of the purely practical aspects of the question. It shows that special attention to the earth connecnections may double or treble the radiation efficiency of an aerial and thus have the same effect as increasing the primary power in that ratio, or reducing to a half or a third the power necessary for any given range with a bad earth connection. The construction of a really good earth is laborious and costly even in the most favourable soil, but it is all capital cost with negligible running expenses, and it saves both the extra initial and running expenses of the more powerful generating plant which would be required with an indifferent earth. Apart from the economic question of comparative cost, it is infinitely more satisfactory from the point of view of the engineer as a craftsman, if he can avoid the clumsiness of overcoming intermediate inefficiencies by lavish expenditure of primary power.

METAL MELTING AND THE FUEL QUESTION.

At the Annual Meeting of the Institute of Metals, held at the end of March at Burlington House, Piccadilly, London, the members present were asked to give their consideration to four most interesting papers dealing with various aspects of metal melting, with special reference to the type of fuel used in the process.

Mr. George Bernard Brook, lecturer in Non-ferrous Metallurgy in the University of Sheffield, began his paper on "Coal-Gas as a Fuel for Melting Non-ferrous Alloys," by stating that gas had always seemed to him the ideal fuel for such purposes. He then proceeded to give particulars of a test undertaken by him, on a large scale and closely following commercial practice, in order to provide reliable data upon which manufacturers could work. From the results of this test the main advantages of coal-gas as a fuel may be summarized as follows:—

1. The absence of dirt and accumulated ashes.
2. The elimination of the difficult and wasteful process of "slagging."
3. Economy in fuel.
4. Convenience.
5. Considerably smaller loss of metal than with solid-fuel furnaces.
6. Reduction in actual fuel costs.
7. Higher speed of melting, ensuring greater output.
8. Superior mechanical qualities of the metal.
9. Reduction of oxidation to the minimum.

Mr. C. M. Walter, B.Sc., of Birmingham, discussed in detail "Metal Melting by Means of High-Pressure Gas," and laid special stress on the point of metal losses, which, he said, should receive full consideration in any comparison of the relative melting efficiencies of various types of furnace plant. He pointed out that very considerable economies had been obtained in the melting of brass with gas-heated furnaces, the regulation of the temperature of which is under complete control, whilst the atmosphere in contact with the surface of the metal is non-oxidising, and any metal spilt over the side of the pot is directly recoverable by the removal of the bottom plate from the furnace; and he gave it as his opinion that the economies effected owing to the reduction of metal losses alone where high-pressure gas furnaces are employed, as compared with solid fuel furnaces, more than outweighs the extra fuel cost involved.

The third paper, by Mr. W. J. Hocking, dealt with "Metal Melting as Practised at the Royal Mint," and gave, among other interesting details, the results of a protracted series of experiments, made with various classes of fuels and burners, which proved that the most satisfactory results as to speed of melting and economy of cost were obtained by the use of coal-gas at low pressure. Mr. Hocking stated that comparative records kept over two periods of five consecutive years, during the latter of which (when gas was used) nearly 10,000 tons of metal were melted and cast into bars for coinage, show an economy in favour of gaseous fuel under each of the following heads: Output (the increase per furnace varying from 88·5 per cent. to 161·1 per cent. with different metals); fuel expenditure (a 3½ per cent. cash saving effected with gas); cost of graphite goods (a 32·6 per cent. reduction effected with gas); and cost of labour (a 20 per cent. reduction).

Mr. H. M. Thornton, M.I.MECH.E., and Mr. Harold Hartley, M.SC., jointly presented the concluding paper on "The Melting of Brass and Copper in a Crucible Furnace with Coal-Gas Fuel," and gave figures to prove that the thermal efficiency of the gas furnace is about five times that of the average solid fuel furnace. In regard to the life of pots, they stated that "In a gas-fired furnace the abrasive action of the solid fuel is eliminated, the direction of flow of the gas stream is under better control, the sulphur content of the fuel is very small, there is no fire to poke, and clinkers have not to be removed from the outside of the pot, so that it is not surprising that long lives can be obtained . . . We should expect a 50 per cent. increase in the pot life when a gas-fired furnace is substituted for one coke-fired." They also hold that "to claim a saving of time for melting of 25 per cent. with a gas-fired furnace, against ordinary practice with a solid fuel furnace, in the melting of brass would not be excessive."

These extracts go to show that the gas furnace is an efficient means for metal melting, and that it will go further there can be no doubt.

REVIEWS.

ARCHITECTURAL BUILDING CONSTRUCTION (Volume I.).

By W. R. Jaggard, F.R.I.B.A., *and* F. E. Drury, F.I.S.E.—(Cambridge University Press. 1916. 6s.).

This text-book for architectural and building students is the first volume so far published of a set of three. It is planned on novel lines. The authors explain their aims at some length in two prefaces, one to the series as a whole, the other particular to this volume, and these may be summarized as follows :—

Building construction should not be divorced from architectural design, and good architecture must be based on intimate and complete knowledge of the materials and component units of buildings. Study of the work of predecessors, including the best modern buildings, is essential. The authors deprecate riding this idea of critical study too hard in the earlier stages of instruction, and recognize that at the commencement "the teacher should be to some extent dictatorial and whilst selecting a well-proportioned and designed study as an example should insist on the construction being shown in a definite manner, although he knows that infinite variety, both in design and construction, is possible." Building construction has hitherto been presented in the form of isolated examples. The authors now take two building designs, specially made for the purpose, which embody nearly all the items necessary for an elementary knowledge of building construction and teach, so to speak, from the structure itself.

The buildings chosen are a brick cottage and a workshop building of brick with a stone frontage. Volume I. deals with all their leading structural details. (Volume II., we understand, will deal with materials, plastering, painting, etc.). There are full detailed drawings in a pocket at the end of this volume and the text is illustrated by many perspective and other drawings of details. The general method followed throughout is to take a subhead such as masonry and explain all the ordinary forms in which it is found in buildings generally, some of the illustrations being photographic. The particular application of previously described types of walling to the masonry in these two buildings is then considered, very clear dimensioned and dissected perspective sketches of details being given. The two buildings are really thoroughly well described in an instructive and interesting manner, and a book of this kind is certainly much brighter reading than a standard text-book such as Rivington, though of course it does not cover such a wide field. In the third volume the authors say that "they intend as far as possible to select examples of established taste and architectural value to illustrate advanced principles of design, maintaining in some cases the constructional details given them by their designer or constructor, but in others adapting the construction in accordance with modern methods and the more extended use of machinery."

Judging by the first volume the whole series promises well, though this system of teaching has its limitations. Within those limits however the keynote of the present volume is thoroughness. It is no mere bookish compilation of details, but a careful study of their practical application, and it should be especially useful for self-instruction. The authors themselves do not claim that the book is sufficient in itself without parallel study of models or buildings and the preparation of measured drawings by the student.

V.P.S.

PAGES D'HISTOIRE, 1914—1915.

(Librairie Militaire Berger-Levrault, Paris, 5—7, Rue des Beaux-Arts).

Continued from the R.E. Journal, April, 1917.

The 106th number of this series is entitled *Le Développement Économique de L'Allemagne Contemporaine;* in it Monsieur Albert Pingaud —Consul General of France—traces the commercial and industrial growth of the German Empire from the time of its foundation in 1871 to the outbreak of the present War in the autumn of 1914. In the opening pages of this volume Monsieur Pingaud tells us that a few months before the outbreak of the present War the late Field Marshal Von der Goltz, having been invited to say a few words of encouragement to the members of a Military League, addressed them and in his speech stated that it lay with them whether the German Empire, founded at the price of such great sacrifices, would continue in the future as something which was permanent or whether this Empire only represented an ephemeral episode in the annals of the world.

Monsieur Pingaud remarks that, at the time of writing, the Armies of the Entente Powers were engaged in a task the completion of which would lead to the realization of the second term of the alternatives above quoted.

The conditions of economic life in Germany are discussed in this volume under two heads: (*a*), The country; and (*b*), its men. It is pointed out that the material prosperity of a country depends on its physical conditions and the characteristics of its people, its natural riches and the labour of its people. So far as the first of these considerations is concerned Germany, in comparison with her neighbours, was at a considerable disadvantage as long as she remained a purely agricultural country. The soil of Germany neither possesses the fertility of that of Italy, nor the suitability for variety in cultivation possessed by that of France, nor the possibility of raising wheat on the scale adopted in Russia, nor even the diverse characteristics possessed by that of the

Dual Monarchy. Germany for a long time seemed, by reason of the poverty of its soil and the unfavourable character of its climate, the most poverty-stricken of the principal nations of Europe; as luck would have it, however, Germany possessed three natural advantages to counterbalance the two disadvantages referred to, advantages which she was able to turn to good account once the era of industrialism made its appearance in the Empire. These advantages are her mineral wealth, her river system and her geographical position.

The above advantages would naturally have counted but for little had it not been that Germany possessed a people of sufficient energy and application to utilize the favours nature had conferred on the Fatherland.

In seeking for the psychological reasons for the success of the German race one is sometimes tempted, says Monsieur Pingaud, to attribute it to good works organization, the excellence of the technical education in Germany, to the close co-operation which has been inaugurated between theoretical science and industrialism on its practical side. He who does not search beyond this explanation of German success runs the risk of confusing the effect with the means employed to produce the same, the principal with the accessory, the sentiments which are the mainspring of German effort with the procedure adopted or the machinery employed. Germany has raised herself to the high level in economical development attained by her alone by reason of the utilization of certain inherent qualities of the Teutonic race, the value of which had already been proved out in other domains of life. There are two qualities possessed by the Teuton in a pre-eminent degree from which spring the others which make for success.

The first of these is that to which the Germans have applied the term *Gründlichkeit*, a term for which there is no exact equivalent in the English language; it means that quality of thoroughness and of tenacity of purpose which enables a man to overcome, by hook or by crook, every obstacle to the accomplishment of an enterprise in hand or of an idea. Monsieur Pingaud points out that, whilst this quality procures those great results which are inspired by powerful efforts, yet at the same time, it does not promote that sense of proportion and moderation in the German, which are alone a real measure of worth and of permanence. Indeed this quality tends to produce a peculiar mental attitude in the faculties of those possessing this quality, an attitude which causes them to concentrate their whole energy on to some single object and their work is, in consequence, cramped, artificial and unstable.

The effects of this faculty of exaggeration is noticeable in every field of enterprise upon which Germany has embarked in the 19th century. During the period of her intellectual greatness (1780—1830), when she was seeking to win over the spiritual side of the world to her school of thought instead of attempting, as more recently, to dominate the material side of the world by the use of the sword, she surpassed all other nations in the fields of speculation and of scientific enquiry. However, by degrees, her philosophers strayed into a nebulous atmosphere and lost themselves as in a maze; in the fields of science they made discoveries in relation to the most intricate matters and propounded the boldest of hypotheses; in the fields of philosophy, they originated one of the vastest of systems and the most arbitrary of theories; in the fields of learning, they exhibited an example of supreme patience and of attention to useless minutiæ.

At the heroic epoch in her military annals, Germany produced Clauswitz, the most rigorous theoretician who has expounded the maxims of war, and later Moltke, the most faultless Chief of Staff, and one who applied the principles contained in the foregoing maxims with the most complete success. But in her blind worship of *force* and in her claim to apply it, as by an iron rule, in relation to international affairs, Germany has raised against herself universal enmity, and she has lost in the political domain all the advantages gained by reason of her military successes.

The second prominent quality in the Teutonic character is the poor regard paid to individual personality which, on the contrary, is held in so high esteem with the Anglo-Saxons. The instinctive tendency that the German possesses to have someone always to lean upon causes him, says Monsieur Pingaud, to be submissive in his relations with his superiors, to seek association with his equals, to be imitative when engaged on work of a constructive nature, and to be assimilative when he transfers himself from his natural environment into a strange or foreign one. It is, however, this second quality which has brought about the high state of organization which exists in Germany in practically every field of enterprise.

It is the absence of individual personality which has made it so easy for Germans to emigrate to lands under a flag other than their own and to accept the *régime* they have found there with complacence; nevertheless, they do not forget the Fatherland; on the contrary, they are the best pioneers of its influence and the most faithful clients of the products of their homeland. The three and a-half million Germans who have settled beyond the frontiers of the Fatherland have contributed in a high degree to its commercial expansion.

To sum up then, when in about 1871, the era of material development was inaugurated in Germany her sons displayed two qualities rarely associated together, a combination which is largely responsible for their success: tenacity of purpose in pursuing their ends, and flexibility of character in the choice of means employed.

Monsieur Pingaud next briefly examines the four phases in the development of Germany in modern times. The first period covered the years 1871 to 1879 and was one of experimentation. Little progress was made during this period; the German efforts to expand commercially were premature and hence proved fruitless. The second period extended from 1880 to 1894; these were years in which to a large extent stock was being taken of the situation. Considerable progress was made; Bismarck's far-seeing policy being largely responsible for the measure of success obtained. His fiscal policy protected home manufacturers, and during the period 1885 to 1890 German exports increased by 50 per cent. The figures relating to German commerce show that during 1884 and 1885, for the first time since 1870, Germany had slightly overtaken France in the commercial field, and in 1887 this advantage was permanently gained, so that in the year last mentioned was partially realized the dream of a "Commercial Sedan," a dream the fulfilment of which had been longed for, since the conclusion of the Franco-German War, by the early pioneers of Pan-Germanism. The third period extended from 1895 to 1907; this was a period of great expansion internally, and during these years the accumulated effort of Germany began to tell decisively in her favour. During this period foreign markets were invaded by German manufacturers, who later established for their country a powerful position in the industrial and commercial world.

The financial crisis of 1907 ushered in the fourth period, which extended from 1908 to the outbreak of the War in 1914. During this period, intoxicated by her previous success, Germany fell a victim to paroxysms of excess leading to over-production; her strength was overtaxed and the fact was exposed that her ambitions soared higher than could be justified by her capacity to play the part she hoped to in this world. The great European War is putting the supreme test on the structure built up by German manufacturers and business men and will result in proving out whether it rests on a solid foundation.

In dealing with the economic development of Germany, Monsieur Pingaud sums up the changes which took place in that country during the period 1870 to 1914 in the following words:—" At the time of her unification she was still very largely an agricultural country; but after four-and-forty years of Empire, she belonged to the industrial type of States, and from this have followed a series of consequential effects of a geographical and social nature, which together have profoundly modified her primitive characteristics." Whereas in 1882 about 43 per cent. of the population of Germany belonged to the agricultural classes, in 1907 only about 29 per cent. did so. During the same period the proportion of the classes engaged in the industrial and commercial spheres increased from 45 per cent. to 56·3 per cent. Germany has during the process of industrialization also been faced with the problem which has troubled social economists in our own islands, namely, the flow of population from rural to urban areas (*der Zug nach die Städte*).

In dealing with the question of the wealth of a nation, it is pointed out that three elements must be taken into consideration; (*a*) the accumulated capital in the country, (*b*) the total annual incomes, and (*c*) the net incomes, after outgoings have been deducted, representing the savings of the nation. Many estimates have been made of the total of the private fortunes in Germany; the estimates of eminent Germans, who have studied the subject, vary from 17,000 millions sterling to 11,500 millions sterling. It would appear that the last-mentioned figure most nearly represents the truth. A similar difficulty has been experienced in obtaining accurate figures relating to incomes; it has been put by one authority at 2,150 millions sterling per annum. So far as any conclusions can be drawn from the figures available, it would seem that since 1870 the accumulation of wealth, as represented by private fortunes, has proceeded at double the rate of the increase in the population of the Empire during the same period.

The remarkable results which have been so rapidly obtained in Germany have brought in their train inconveniences. The more German trade has expanded beyond the frontiers of the Empire the more vulnerable she has become.

The dangers of the situation seem to have escaped observation in Germany or, may be, it was thought that any European war would be exceedingly short and, in any case, foolish Britain would remain neutral and keep open the sea routes for the trade of her most formidable rival in Europe.

In conclusion, Monsieur Pingaud states that there can be no doubt that the industrial development of Germany is not directly responsible for the War, but it has contributed powerfully to the creation of a state of mind in the Empire which rendered it probable, desirable, inevitable. "Far from restraining *military Germany* from following the path which could lead only to a European conflagration, *industrial Germany* has also turned down the same path, hoping thus to find its interests definitely satisfied. The latter possesses then a share in the responsibility for the catastrophe which threatens to annihilate, simultaneously with the destruction of the greatness and political unity of the Empire, the economic results obtained at the price of half a century of uninterrupted labour and of two decades of astounding success."

The 107th number is entitled *Explosions et Explosifs*; it is contributed by Monsieur Henry de Varigny, and forms a very useful handbook on the subject of explosives. In a brief preface the author states that at no time previously has there been such a consumption of explosives as during the present War. The subject, he tells us, is one of immense importance, but, in a work prepared for the public at large, it is naturally not possible to enter into technical and mathematical details. Those who wish for further information are referred to the work of Berthelot, of Sarrau, of Vieille and other authors. The following recently published works on the subject are also mentioned:—

Les Poudres et Explosifs, by L. Vennin and G. Chesneau (1914).

Les Explosifs Modernes, by P. Chalon (1911).

Explosives; their Manufacture, Properties, Test and History, by A. Marshall (1915).

Les Explosifs et leur Fabrication, translated by J. A. Montpellier from the Italian work by R. Molina.

Dictionnaire des Explosifs, translated by M. Désortiaux from the English work by Cundill.

Le Chauffage Industriel, by H. Le Chatelier.

Dictionnaire des Matières Explosives, by Daniel.

La Chimie du feu et des Explosifs, by A. Job.

The contents of the volume under review deal with the following matters:—Definition of explosion; definition of explosive; difference in characteristics of various explosives; speed of propagation of explosion; methods of measuring velocity of propagation of explosion; prediction of the explosive force of a substance; experimental measurements of pressure and energy of explosives; practical tests with explosives; priming of explosives; chapter of accidents; classification of explosives; gunpowder; chlorates, cheddites; fulminates; nitrated cellulose, smokeless powder; nitro-glycerine and dynamite; picrates and mélinite, trinitrotoluol. Sprengel's and Favier's explosive compounds, Schneiderite; liquid oxygen explosives; the ideal explosive.

Monsieur De Varigny in conclusion states that although he has largely referred to the work of Frenchmen in relation to the science of explosives, it would be unjust to overlook the very great part played by British and Italian chemists in this branch of science.

The 108th number is entitled *Les Forces Économiques des Puissances Belligérantes avant la Guerre ;* it contains on a single sheet, prepared by Monsieur B. Fayolle, statistical information concerning the two belligerent groups and letterpress calling attention to the principal items contained on this sheet.

The following is a summary of the more important information on the sheet :—

France and her allies possess more than :—

$\frac{1}{2}$ of the globe, of its inhabitants, of its corn, of its mercantile fleet and of its export trade.

$\frac{1}{3}$ of its coal, of its iron and of its railways.

Germany and her allies possess :—

$\frac{1}{4}$ of the world's supply of coal.

$\frac{1}{5}$ of its iron and of its commerce.

$\frac{1}{10}$ of its inhabitants, of its corn, of its railways and mercantile fleet.

$\frac{1}{25}$ of the globe.

Monsieur Fayolle under the heading " Conclusions " states :

" The three matters in which the superiority of Germany allowed her to declare war against us and to prosecute the same ; the three arms of Prussian militarism are :—

An Abundant Population.
Discipline and Organization.
Extensive Coalfields."

" The three conditions for ensuring to France a durable and fruitful peace are :—

Repopulation.
Reorganization.
Independence in Respect of Fuel."

A brief reference is also made in this volume to the Economic Conference of the Entente Powers held at Paris in June, 1916, and at which Monsieur Clementel, Minister of Commerce and Industry, presided.

This Conference had for its object the adoption of measures which were intended to result in co-ordinating the *unity of economic action* in order to promote to the highest degree *unity of military action.*

The resolutions passed at this Conference are published in the volume under review, as also the names of the delegates sent by the Powers interested.

The 109th number is entitled *Les Chansons de la Guerre.* In a preface, in verse, Hugues Delorme writes of the songs contained in this volume in the following terms :—

Hymnes d'amour et de foi, cris de haine
Clamés bien haut ou fredonnés tout bas,
A vos accents chaque soldat s'entraine
Pour le succès d'héroïques combats,
Et quand du sol de notre douce France
Naîtra la Paix, les verts lauriers au front,
Fêtant l'orgeuil de cette délivrance,
Des chants encor, par milliers la suivront.

The volume contains 53 songs dealing with topical subjects connected with the War. In these verses William II. and the Bosches come in for their share of attention; they are referred to in far from complimentary terms. The verses are, however, for the greater part devoted to matters which are of closer domestic interest to the rank and file of the French Army.

The 110th number is entitled *Les Emprunts de Guerre de l'Allemagne.* In six brief chapters Monsieur André Liesse deals with the methods employed by Germany for financing the War; an appendix is attached containing information concerning Austrian and Hungarian War Loans.

In an introductory chapter, Monsieur Liesse states that when Germany applied the torch which set the present conflagration ablaze, neither her own financiers nor those of any other country can have realized that the expenditure which would be required to cope with the situation would run into thousands of million francs. The appreciation of the situation by the German Great General Staff, as well as by the German economists and financiers, have both proved incorrect; they expected a war of short duration, facts show the falseness of their deductions. At the time hostilities commenced, Germany had adopted certain measures to cope with the financial situation. As is well known she had stored away in gold, in the famous Julius Tower of Spandau, a sum exceeding slightly eight millions sterling and arrangements were in hand to permit the Reichsbank to issue Imperial banknotes equal in face value to three times the authorized note circulation of this institution.

The German people have long been accustomed to paper money and therefore the increase in circulation of notes did not perturb them. The Loan Offices which were opened at the commencement of the War were also no novelty to them; such institutions had already on former occasions been brought into use at times of crises and war, *e.g.*, in 1848, 1866 and 1870—1871.

Problems connected with the mobilization of the national financial resources had not alone been the dominant preoccupation of the German Government but also that of German financiers. Dr. J. Riesser, a Professor at the University of Berlin, who 20 years ago was a Director of the Darmstadt Bank, had long devoted himself to the study of the subject of the mobilization of financial resources, a subject of the utmost importance to Germany. He presided at a conference of German bankers in 1912 and gave very sound advice on the subject. A work by Dr. Riesser was published just before the outbreak of hostilities; in it he urged the necessity for financial preparations being made to meet the contingency of a war, so that a smooth and prompt mobilization of wealth might be effected in order that the Imperial Government might have immediate and abundant funds at its disposal. He took no pains to hide the weaknesses in the organization of national credit and of the banks of Germany. The financial policy recommended for some years prior to the War by all far-sighted men in Germany can be summed up in the following formula:—

Adopt every measure possible which can in any way enable the whole of the assets of all institutions of credit, whatever may be the class to which they belong, to be rapidly rendered liquid in an emergency.

In Chapter II., Monsieur Liesse deals with German and Prussian credit in pre-war days, and the resources to which the Imperial Exchequer and the Prussian Government could resort for funds. He points out that although the wealth of Germany has grown considerably in the past thirty years, yet her credit, as a State, could not be reckoned first class. She had first to abandon the idea of borrowing in respect of public funds at a nominal 3 per cent. per annum; next Imperial Germany and also Prussia had both to realize that they could not obtain subscriptions to their funds even at 3½ per cent. per annum, so that since 1908 they have both been obliged to obtain money for public purposes at a nominal 4 per cent. per annum. The first 4 per cent. loans raised by the German Empire and by Prussia were issued in 1908 at 99·50 per cent. In 1909 and 1911 more confidence in the credit of the German Empire and also of Prussia was shown by the subscribing public, so that in the two years mentioned the Imperial and also the Prussian Government, in floating 4 per cent. loans, were able to fix the price of issue above par, namely, at 102·7 per cent. and 101·40 per cent. respectively. But a slump followed and in 1912 and 1913 both the governments mentioned had to be content to accept subscriptions at 98·60 per cent. and 97·90 per cent. respectively for their 4 per cent. loans.

Lately, considerable difficulty has been experienced by the German Government in borrowing money. German financial policy aimed at placing loans wholly within the Empire, so that the national credit should run no danger of being shaken owing to the action of possible adversaries in a European conflict. German industries and commerce were so prosperous that investments of capital therein afforded a very good return; this factor naturally tended to limit the amounts available for investment in government funds.

The advisability of putting an end to the series of annual loans and the perpetual issue of Treasury Bills on a considerable scale had been realized by the responsible authorities in Germany. Although it was recognized that the credit of the Empire would have been enhanced by the reduction of the National Debt, yet it was felt that insuperable difficulties would be experienced in imposing the necessary taxation in the several Confederated States of the Empire in order to deal with the situation effectually; in consequence, the idea of dealing with the reduction of this Debt had to be abandoned.

Taxation, Monsieur Liesse points out, although an advantageous method for procuring funds for public purposes in normal times, can never yield the enormous sums required for the conduct of a war, and particularly when it is one of long duration. Nevertheless, before the actual outbreak of hostilities, it had been decided by the German Government to impose a special war tax payable in three annual instalments, commencing in 1914; each instalment it was expected would amount to about 18 million sterling. The fact that this extraordinary *direct* tax had been introduced, has naturally imposed restrictions in relation to the other fiscal measures which the German Government are now in a position to take for the purpose of financing the present War. During the past few months Dr. Helfferich has proposed, in connection with the Budget for 1916—1917, to have recourse to new *indirect* taxes in relation to certain articles of food and to transportation; it can only be extreme necessity that has compelled him to look to these supplementary sources of revenue.

The view was expressed in 1911, in the Prussian Upper House, by Herr Von Gwinner, one of the Directors of the Deutsche Bank, that it was a mistaken policy to attempt to meet the whole of the expenditure on a war by a consolidated loan. It is now generally admitted in Germany that, for the sake of the credit of the Empire, one-third of the war expenditure should be met by means of ordinary taxation and that only the remaining two-thirds should be provided for by loans. Since the War expenditure of Germany was up to the end of June, 1916, no less a sum than 2,000 millions sterling, if effect is given to the suggestion that one-third of this expenditure should be met by ordinary taxation, the German people will have to meet additional claims, in respect of ordinary taxation for the first two years of the War, amounting to over 666 millions sterling.

The provision for interest on the consolidated Debt of the German Empire amounted, in the Budget for 1914—1915, to nearly 12½ millions sterling. The nominal value of the securities representing this Debt was at that time approximately 248 millions sterling; adding the value of the floating debt, 16 millions sterling, we get 264 millions sterling as the total National Debt of the Empire. Each of the Confederated States has further a debt of its own; the nominal value of the Consolidated Debts of these States amounted at the period in question to 760 millions sterling and their floating debts amounted to about another 34½ millions sterling, bringing up the total National Debts of the several Confederated States to 794½ millions sterling. Therefore the total National Debts of the Empire and the Confederated States amounted at the time of the War to no less a sum than 1,058½ millions sterling. In the year 1902, these debts did not exceed 680 millions sterling, so that in 12 years the national indebtedness has, in Germany, increased by over 35 per cent.

In Chapter III. an examination is made of the sources to which the German authorities look for subscriptions to the Public Loans.

It would appear that although the Great General Staff at Berlin expected that their bold strategy would enable a decision to be reached in favour of the German arms within three to four months of the commencement of hostilities, there were many financiers who were by no means as confident that the German plans would prove so successful.

Monsieur Liesse in discussing Germany's problem in regard to the financing of the War says that in order to arrive at the financial power of Germany, from an impartial standpoint, it is necessary to dismiss from one's mind the astute procedure, the clever expedients in accountancy and the strong pressure resorted to by the Government in raising loans hitherto; to appreciate the situation correctly, it is necessary, he says, to concentrate attention on four factors of importance, three of them affecting economics and one of them psychology. These factors are:

1. The wealth accumulated in Germany during the past 20 years.

2. The liberation, in the case of certain industries, of their floating capital; these industries having been obliged to suspend operations on the declaration of war.

3. The enormous profits of those industries which are engaged on war work.

4. The real discipline of the whole German nation, which has responded liberally to the pressing calls for financial assistance from the Imperial Government.

Each of these factors is examined in some detail by Monsieur Liesse. He points out that Dr. Helfferich, the present German Minister of Finance, in a brochure pubished in 1914, estimated the capital wealth of Germany at 15,000 millions sterling, but he himself thinks this figure too high, since it has to be borne in mind that Germany has experienced considerable losses in foreign lands through the War. Her mercantile fleet is idle, her export trade has suffered very considerable diminution, stocks and shares have fallen very considerably in value, in neutral countries as well as in Germany. Monsieur Liesse points out that if the wealth of Germany be taken, for argument's sake, at 8,000 millions sterling, it would nevertheless be impossible to mobilize even a small fraction of this sum for war purposes. For instance, the Savings Bank Deposits in Germany amounted in 1914 to 880 millions sterling, but of this sum over 72 per cent. is mortgaged and immobilized.

Further, the floating capital liberated in the industries which have had to suspend operations is no longer available, as it has already been diverted to the extension of munition factories and other enterprises connected with the War.

On the other hand, it is admitted in Germany on every hand that the profits of enterprises providing war material have been enormous, and there is little doubt that a great part of these profits can be looked upon as a sure source from which funds for financing the War can be obtained.

The fourth factor can be dismissed in a few words. In every rank of life in Germany, irrespective of the political groups to which its members may belong, discipline of a highly organized and automatic order exists; it is based on the belief that the Germans are the Chosen People; only untoward events of a very serious nature will shake their self-confidence. As long as this confidence lasts, the Imperial Government need anticipate no serious difficulty in connection with the raising of war funds.

In Chapter IV., Monsieur Liesse deals with the various kinds of securities issued by the Treasury in Germany; in normal times these consisted of *Schatzanweisungen* (Exchequer Bonds), *Schuldverschreibungen* (short term Loan Bonds) and *Reichskassenscheine* (Bills issuing from the Imperial Treasury under Laws of April, 1874, and July, 1913; Bills up to a value of 12 millions sterling have been issued under the authority of these two Laws). Treasury Bills, which carry no interest, were also issued in October, 1914, and September, 1915; from a memorandum drawn up in 1915 it appears that up to the 30th September, 1915, the total face value of these Bills was 9,514 million marks. The certificates representing these Bills are accepted by the German Government in respect of subscriptions to the War Loans.

By a Law of 4th August, 1914, an entirely new form of Imperial Treasury Bill, issued under the auspices of the Imperial Debt Office, was authorized, the certificates being known under the term *Wechsel*, the object of the same being stated to be "to cover the extraordinary non-recurring expenses provided for in the Budget and to reinforce the ordinary floating capital of the Reichsbank." These Bills cannot remain in circulation for a longer period than three months from the date of their issue; they are discounted by the Reichsbank, or other large banks, and are treated in their accounts in the same way as other commercial documents of value. As money raised by loans becomes available the Treasury redeems these *Wechsel* certificates; thus the Government is able to procure funds to meet daily needs without appearing to make an open appeal to the public for funds. Another of the war measures adopted by a Law of the 4th August, 1914, was the creation of Darlehnkassen (Loan Offices) to which reference has been made earlier; the details for the organization of these Loan Offices had been carefully worked out before the outbreak of war. The principal object of these Loan Offices is to make *advances* on documents of title or on goods; the interest chargeable on these advances must not exceed the rate of discount paid by the Reichsbank; the certificates of these Offices have face values of 5, 10 and 50 marks. By a Law of the 31st August, 1914, the Imperial Debt Office was authorized to issue certificates of a similar nature, having face values of 1 and 2 marks. The Reichsbank is in control of the Loan Offices and has been authorized to make advances up 120 millions sterling.

These advances are naturally made on a regular system, with a view to the protection of the lender, the maximum advance in any particular case is always below the full market value of the security against which it is made; for example, the proportions of advance in relation to the full value are in the following cases as stated below:—

Certain classes of documents of title	40 per cent.
Merchandise	50 ,,
Certificates of certain public and communal funds, and of shares and debentures of German railways	70 ,,
Scrip issued by the Imperial Government and Confederated States	75 ,,

The German banks are co-operating closely with the Government at the present time and have been, so to speak, militarized in order the more effectually to mobilize the nation's resources and to handle the War Loans. Dr. Helfferich is said to have shewn great cleverness in the way he has organized the War Loans.

In Chapter V. Monsieur Liesse gives details of the four War Loans raised by Germany up to April, 1916. The first of these Loans was launched between 10th and 19th September, 1914, after the German defeat on the Marne. The German Government and the Great General Staff had naturally taken measures to hide from the public the true nature of the reverse met by German arms on the occasion referred to.

Subscriptions were invited from the public to:—

(i.). *Schatzanweisungen* (Exchequer Bonds) up to the limited amount of 50 millions sterling. The certificates representing this part of the loan carry interest at 5 per cent per annum, the price of issue being 97½ pe cent.; repayment at par between 1918 and 1920 is provided for; and

(ii.). *Schuldverschreibungen* (Loan Bonds) up to an unlimited amount. The certificates representing this part of the loan also carry interest at 5 per cent. per annum, the price of issue being also 97 per cent., but repayment is not to commence in the case of this part of the loan till 1st October, 1924.

Under the foregoing conditions the actual interest earned on the sums invested is in the first case 5·57 per cent. per annum and varies in the latter from 5·33 per cent. to 5·13 per cent. per annum according to dates of repayment of the capital.

No limit was fixed in respect of the second of the above denominations; the total sum obtained by the Government on the above invitation was in round figures 224½ millions sterling.

The second War Loan was launched in March, 1915, *i.e.*, six months after the first loan. The German Government had been persuaded by this date that the duration of the War would be longer than was at first anticipated. On this occasion also the two same classes of security were offered as in the case of the first Loan and at the same rate of interest, viz., 5 per cent. per annum; but the price of issue was raised by 1 per cent. to 98½ per cent. The response of the public brought in in round numbers 453 millions sterling.

In September, 1915, the third appeal was made to the public. On this occasion subscriptions were invited only to the *Schuldverschreibungen.* The rate of interest remained at 5 per cent. per annum, but the price of issue was raised to 99 per cent. The holdings in this loan are neither repayable nor convertible till the 1st October, 1924; the issue was unlimited. This loan brought in 605 millions sterling.

Invitations for subscriptions to the fourth loan were issued in April, 1916, that is to say, the German Government has made its appeals for funds to the public at regular intervals of six months. On this occasion subscriptions both to the *Schatzanweisungen* and to the *Schuldverschreibungen* were again invited; the former carry interest at a nominal rate of 4½ per cent. per annum, the price of issue being 95 per cent., whilst the latter carry interest at 5 per cent. per annum, the price of issue being 98·50 per cent. Repayment of the former is to take place between 1923 and 1932; the latter are not repayable till 1924. The Government received 530 millions sterling from the public on this occasion.

In a chapter headed *Conclusion* Monsieur Liesse deals with "The fatal consequences of false conceptions." He points out that it is difficult from the bare facts recited above to arrive at the value which should be placed on the "*résistance financière*" of Germany. Although Dr. Helfferich has managed to squeeze some 1,800 millions sterling from his countrymen, as subscriptions to the first four War Loans, it cannot be denied that he may still be able to obtain further advances from them on somewhat similar terms. Nevertheless, it is evident from the statements made by Dr. Helfferich in the Reichstag that the German Government has been disappointed in the measure of support it has received in the financial schemes promoted for the prosecution of the War. It is further clear that the German Government is far from being in a position to effect the consolidation of the War Debt, in spite of the official announcements made that such a consolidation would take place shortly. The financial situation is more serious in Germany to-day than in any other country. The political and economical organization which Prussia has been allowed to impose on the rest of the German Empire possesses a congenital vice, in that everything is ordered and regulated by the State, even the grouping of industrial and commercial enterprises which are very often under the absolute control of the Government. This organization it is that has permitted Germany, thanks particularly to the richness of its soil in materials absolutely indispensable to modern industry, to continue to wage war against the Entente Allies for so many long months.

This mechanism, in spite of the excellence of the governing devices fitted to it, possesses the defect that it is dependent on a single control; it can only work automatically. The Government and the political and military publicists of Germany, says Monsieur Liesse, seem to have overlooked the fact that this mechanism does not, in every respect, possess the properties of machines constructed of iron and steel. When once the German masses are disillusioned in regard to the situation as pictured to them, it is likely that this ingenious mechanism will rapidly get out of order, in spite of the power of subjection exercised over the wills of German citizens, owing to the character of German discipline.

In an appendix to this volume a few notes are added regarding the War Loans raised in Austria and Hungary.

Prior to November, 1915, three loans had been raised in each of these countries; in each case at about the same time, *i.e.*, 1st Loan November and December, 1914 (repayable after 1920), 2nd Loan May and June, 1915 (repayable after 1st May, 1925), 3rd Loan October and November, 1915 (repayable after 1st October, 1930). In the case of Austria, the rate of interest is the same for each of these loans, viz., 5½ per cent. per annum, free of taxes. The price of issue has varied from 97½ per cent. in the case of the first loan, to 93·10 per cent. in the case of the third. The *estimated* total amount obtained by the Austrian Government in respect of subscriptions to these loans is stated to be approximately 336 millions sterling. The first and third Hungarian Loans (repayable after 1st April, 1920, and 31st December, 1921, respectively) carry interest at 6 per cent. per annum, free of taxes, the price of issue being respectively 97½ per cent. and 97·10 per cent.; part of the second loan (repayable after 1921) bears interest at 6 per cent. per annum and part of it at 5½ per cent. per annum, the price of issue of the first part being 98 per cent. and of the second 91·20 per cent., for cash payment. The *estimated* total amount of the subscriptions obtained by the Hungarian Government in respect of these loans is stated to be 178¼ millions sterling. The Austro-Hungarian Bank has played an important *rôle* in connection with the flotation of these loans; Loan Banks and Savings Banks have also been utilized for this purpose.

The 111th, 113th and 115th numbers contain the official communiqués, etc., issued by the Central Government to the provincial authorities in France; they are the XX., XXI., and XXII. Volumes (inclusive) which deal with this subject—the 111th number covers the period May and June, 1916, the 113th the month of July, 1916, and the 115th the month of August, 1916. Each of these volumes contains appendices, in which are given summaries of the principal events of the War during the month covered by the communiqués in the same volume.

The 112th number is entitled *L'Esprit Français*, sub-title *Les Caricaturistes*; it contains 129 caricatures and illustrations relating to the War, the majority of them by well-known artists.

A Preface is contributed to this volume by Monsieur D'Arsène Alexandre. Risibility is, he reminds us, a prominent trait in man. Even in his direst misfortune this strange faculty at times overcomes all other feelings in an individual. Laughter represents many moods; there is the laughter of him who braves discouragements, that of him who seeks vengeance, that of him who sets another at liberty. There is not only a laughter which gives expression to supreme joy, but there is also the laughter which sounds the keynotes of the bitterest pangs of bodily pain and even of the uttermost depths of infinite sadness. Sorrow too then can be said to possess its share of laughter.

The caricaturist is, says Monsieur Alexandre, if not the judge, at all events a sort of public crier of the verdict passed by the human conscience on matters of public and private interest. His *rôle* is neither useless nor secondary, for there are cases in which it is not sufficient for a wrongdoer to be reviled and classed by the judgment of history as belonging to the race of Cain. It is necessary, and even well, that wrongdoers, who have shown contempt for humanity, should in their turn be held up to contempt contemporaneously, in order that the hideousness of their offence may be brought home to them. Should this punishment be of a kind that evokes laughter, it will but be the laughter of sorrow.

In the same way that the worst of cataclysms give rise, as Victor Hugo has said, in the hours of the night to a long and dismal roar of laughter, so also has the Great War given birth to a series of incidents, the portrayal of the hideousness of which has been productive of the laughter of derision. The sketches portraying these incidents will form an integral part of the history of these stirring times, forming as they do an interpretation of the sentiments of the populace, or these inspired by their moods of the moment. In order to give a bird's-eye view, so to speak, of the public mind, in relation to the prominent incidents of the War, the editors of the *Pages d'Histoire* series have had the happy thought of collecting in one volume some of the more important caricatures and drawings which have been published since the autumn of 1914. The composition in the sketches republished in this volume is in many cases striking and no one can mistake the bite of the artist's sarcasm, the depth of his contempt where he wishes to deride, nor the depth of his sympathy, the sincerity of his affection where he intends to approve the acts and conduct connected with the situations delineated by his brush or pencil. Monsieur Alexandre compares the situation of 1870—1871 with that of 1914—1915. In the former case Paris was soon cut off from the civilized world, and France by an iron wall of besiegers and later by the tragic events of a civil war. French artists practically in a body ceased to ply their trade; the few who continued to contribute to the Press had no hold on public opinion. To-day it is different. The artists whose works have been appearing since 1914 are men of high talents whose work has been entirely inspired by the public opinion of France. The sentiments to which they give expression are of the purest, brightest and most soul-stirring order.

Monsieur Alexandre next proceeds to say a few words concerning some of the more remarkable sketches appearing in this volume. In conclusion he states that the French satirists realize that, in order that their works may be of the best, they are bound to be guided by and to interpret the human conscience. The War has not brought about any profound modification in human nature. It has, if anything, exalted the more desirable qualities in man and expelled the less desirable. French art on its humorous side should continue, says Monsieur Alexandre, to depict what is best in humanity, that is to say, it should range itself on the side of the weak. French artists have understood and will understand better as time passes by that if caricature is the mirror for exposing wrongdoing, satire their weapon and laughter one of their forms of punishment, this mirror must sparkle and remain clean, this weapon must be as polished as it is sharp, this punishment rapid, striking, decisive. The caricatures and drawings contained in the volume under review fully reach the standard laid down here.

The 114th number is a Diary of the War, being the fourth volume of this kind in the series; it covers the period 1st January—30th June, 1916.

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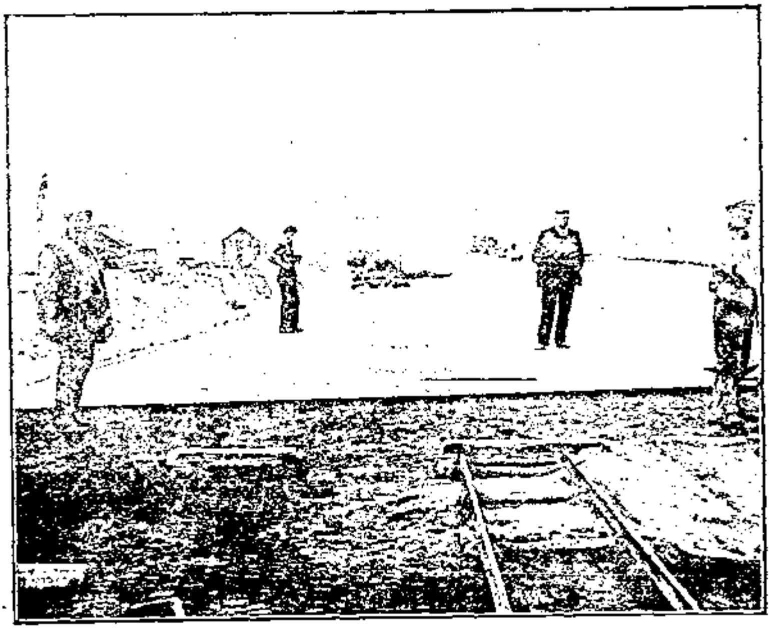

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