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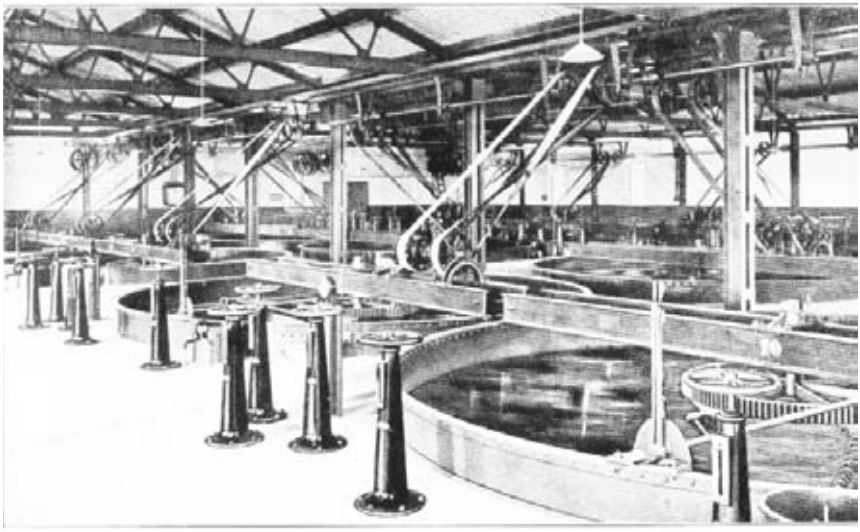


Interior of Filter-House.

THE WATER SUPPLY OF ALEXANDRIA.

By CAPT. D. M. F. HOYSTED, R.E.

THE usual source of drinking water in the land of the Pharaohs is the Nile, which, besides being one of the most historical rivers in the world, is also one of the most polluted, and has consequently been responsible for an incredible number of cases of fatal or dangerous illness.

Alexandria is the first town in Egypt to be supplied with an efficient and up-to-date system of filtration for its water supply, and the inauguration of this work in 1905 formed an epoch in the advance of science in the almost unchanging East. Such an innovation was naturally preceded by many years of discussion, until the Jewell Expert Filter Co. of New York sent a representative to Egypt who offered to instal a model plant, so that the local councillors and engineer might actually see the results which the firm was prepared to obtain for them. This appeal to the senses of the uninitiated among the committee at once overcame all opposition and reluctance, and the order for nearly £80,000 was placed with the American Company. The final convention was signed in July, 1903, the work to take two years.

The Jewell system of sand filtration presents many great advantages over the slow sand system which had previously been considered. Only about one-sixth of the area is required for the same output, the cleaning and washing of the filters is carried out mechanically, and without any workman having to come in contact with the filtering sand. Anyone acquainted with the insanitary habits of natives will appreciate this point.

The main pumping station and filtration works of the Alexandria Water Company are situated on the main road to the suburbs of Ramleh and Aboukir, and are on the outskirts of the town.

This station has to supply filtered water for a population of half-a-million people, and the daily consumption varies from 4½ to 8 million gallons, the maximum amount being required during the hot weather when the Nile is at its lowest level, and consequently in its worst state for purification.

The filters are contained in a covered house, and protected from sun and dust, and in addition there is a regulator for the speed of filtration and pressure, the flow being absolutely constant during the entire run.

Alexandria Water Company.—From the river Nile at Atfeh, near Rosetta, there runs a waterway called the Mahmoudieh Canal, constructed in 1819 by Mahomet Ali. It is 45 miles long, and is used not only for irrigation, but as a means of traffic between Alexandria and Cairo and the intermediate towns and villages, besides being practically a carrier of sewage. From this the water is primarily obtained, and, to obtain sufficient head, it is pumped from it into the company's private waterway called the Farkha Canal, whence it flows direct into three collecting wells at the main pumping station.

Thence it is raised by low service pumps and delivered through a 30″ main to the settling tanks, where it is allowed to rest for at least 6 hours under the influence of a solution of sulphate of alumina, which is injected into the centre of the 30″ main between the pumping station and the settling tanks to allow of thorough admixture.

Coagulant Feed.—This coagulant feed is arranged systematically from the coagulant room in the main building. The sulphate of alumina is hoisted from the store room in the basement to the coagulant room, is weighed carefully, and is carried as required by a small over-head transporter over the coagulant tanks.

The dissolving tanks are made of battens of Cypress wood 4″ wide, as it was found that this wood withstands the action of the chemical very well. These are held together in the form of a cylinder by steel bands without any arrangement for securing close joints. The sides are notched into the bottom.

The chemical is placed in shallow wooden trays with open slat bottoms through which the water rises to dissolve it. There is also a small steam compressor supplying air under pressure for stirring up the solution.

All pipes and fittings are of vulcanized rubber. The strength of the solution is frequently tested before it passes from the coagulant room, as it varies somewhat according to the condition of the water and to the time allowed for sedimentation. Under usual conditions with 6 hours for sedimentation, an admixture of from 15 to 22 parts by weight of sulphate of alumina per million parts of water to be treated, gives excellent results both as regards clarification and bacteriological purification.

Settling Tanks.—There are three settling tanks, each designed to hold nearly a million gallons. At one end common to all three, and connected to each by a 24″ pipe, is a circular distributing basin

containing about 50,000 gallons, into which the whole of the unfiltered water is pumped.

Sluices are provided to enable any tank to be emptied and cleaned independently, and at the inlet of each settling tank there is a semi-circular basin, of 11′ radius, communicating with the settling tank at the bottom.

Each tank is further divided by two masonry walls 2′ thick, one acting as a weir, with a sluice for cleaning purposes only, and the other —the furthest from the inlet—as a baffle plate, being provided with eight openings at the bottom. The outer compartment is provided with a masonry outlet weir, over which only the top film of water passes to the semi-circular outlet basin (similar to the inlet basin), whence it flows to the filter house through a 30″ sluice valve, by a 36″ main.

In addition to this masonry outlet weir, there are two cast-iron adjustable weirs 9′ in length, working in gunmetal guides. Under normal conditions these are maintained at the same level as the masonry weirs, but they can be lowered 12″, until the engine attendant has had time to increase the flow of the water into the settling tanks, in the event of the water becoming low in the settling tanks through a sudden draw-off in case of fire or other unusual occurrence.

Preparation of Site.—In preparing the site for the foundations of the settling tanks and other reservoirs, it was found that practically the whole area was undermined and honeycombed with disused wells and culverts, which had probably been used for the water supply of some former city of Alexandria. It was considered therefore that the best way to attain the desired stability was to flood the entire area, and a temporary 16″ pipe was laid to the centre of the work, and about quarter of a million tons of water was poured upon it. Considerable subsidence at once became evident, and for a month all such holes were filled in from time to time with earth, until no further settlement took place, the water standing at an average depth of 2′.

Then, after the soil was more or less dry on the surface, the whole area was rolled with a 16-ton steam roller, producing a greater pressure per square foot than the soil would be subsequently subjected to by the weight of masonry and water in the tanks. Hydraulic cement concrete was used throughout in construction in following proportions:— Lime and Pozzolana (Santoria) mixed in proportion of 1 to ¾, 2 parts; sharp washed and screened sand, 6 parts; Portland cement, 1 part. The substance of the concrete consists entirely of ancient broken pattern (Chakf), which is found locally in immense quantities, and which is particularly well suited for concrete work on account of its flat sides and sharp angular edges, which afford an excellent band.

The lime and Pozzolana mixture was ground in edge runners. The mixing was carried out in the French method; the Chakf was measured out on mixing tables, about $13' \times 7'$, double boarded to prevent leakage, and the mortar, having been previously mixed in a pugmill, was added in a wet state. The whole was, before being used on the work, throughly mixed by hand labour, at that time comparatively cheap in Egypt.

The inside of the settling tank was rendered with two layers of cement plaster, the first about $\frac{1}{2}''$ thick and composed of 3 parts sharp sand to 1 of Portland cement, the surface being left rough as a key; the second about $\frac{1}{4}''$ thick and composed of equal parts of the same components.

The whole surface of the bottom of the tank was lined with a $\frac{3}{4}''$ layer of bituminous asphalte, so as to render it absolutely water-tight, this being in turn covered with a $2''$ layer of fine cement rendering as a protection against damage when cleaning. The inside surfaces of all walls were further treated with a solution of soap and water, followed by a solution of alum and water, so as to entirely close up the pores of the cement.

Filters.—Each filter (of which there are 18) is $17'$ in diameter and $7'$ in depth, and contains $3'$ of filtering sand supported on a layer of fine gravel. Below this is a cast-iron header about $8''$ in diameter, which passes through the skin of the tank at the bottom and forms the outlet. From this header radiate a number of W.I. branch pipes plugged at the outer extremities, both the header and the branch pipes being buried flush in concrete.

These branch pipes are tapped along the upper surfaces at about $6''$ intervals, and provided with small brass screens standing vertically above the concrete base. There are 900 of these screens, and they take the whole of the filtered water as it passes down through the filter, whilst they leave practically no space in which water might remain and stagnate.

The filter proper is surrounded by an outer shell, leaving a $5''$ annular space all round through which the settled water (*i.e.*, water which has passed the settling tanks) rises and flows slowly into the filter along the whole perimeter. After passing through the filter and out of the $8''$ outlet, the filtered water flows through an automatic Weston Controller, by means of which the effluent is automatically kept constant and the working pressure regulated.

The filters are washed daily, the washing operation being controlled by one man, and being extremely simple and only occupying six minutes in all. The inlet and outlet valves are closed and the wash-out valve which drains the annular space is opened. A wash-water valve is then opened, admitting filtered water—under a head of pressure from a special washout tank—into the main outlet header

pipe, whence it rises through the 900 screens through the bed of sand.

The whole of the filtering skin is throughly churned and broken up by the pressure of the rising water, and the mud and other impurities are swept up over the rim of the filter shell, and are carried away through the annular space and the washout valve to the main drain. At the same time a revolving agitator—consisting of a large circular rake—effectually stirs up the filtering sand to a depth of 2′ 6″. The sand alone remains behind during this upward rush of filtered water, because of its greater specific gravity. The washing is considered complete in five minutes, by which time the wash water running over the annular ring has become clear. The valves are then closed and the unfiltered water allowed to rise to its normal height. The first effluent is run to waste for 10 or 15 minutes, as may be found necessary, so as to remove any slight turbidity which may be left in the filter after washing, and subsequently it is admitted through to the delivery pipe into the clear water reservoir situated below the filters.

Wash-Water Tank.—The necessary head for washing is provided by a circular steel tank, 34′ in diameter by 10′ in depth, mounted on a strongly braced steel structure, and containing 50,000 gallons of filtered water about 40′ above the tops of the filters. It is connected to the wash-water valve of each filter by a 12″ pipe.

The water is supplied by two 10″ centrifugal pumps, and the tank is covered in at the top, and has a covered gangway all round it to protect the water from the effect of the sun. The exact height of water is recorded in the engine room by a Kent electrical recording instrument fixed on the wall.

Clear-Water Reservoir.—The clear-water reservoir under the filters is divided into three compartments, so that any one may be shut off for cleaning purposes without disturbing the remainder. The bottom is made in the same way as that of the settling tanks. The whole reservoir is covered in with expanded metal and cement concrete, supported on steel girders, a sufficient number of inspection traps being provided in the covering. This covering is, in turn, made impervious to water, clean or dirty, by a ¾″ layer of asphalte. Two additional and similar reservoirs are situated on the other side of the pumping station.

The three reservoirs contain 1¾ million gallons of filtered water, about a quarter day's supply for all purposes. Above the engine room there is a chemical laboratory equipped with every requisite for the bacteriological examination of the water and for the chemical examination of the coagulant feed. The water is carefully examined and tested every day; never since the first month of the working of the

new filters has the percentage of bacteria removed been less than 98, while the effluent is considered pure enough for human consumption. This is a great feat to have achieved, with such comparative ease, in the East where pure water is so very difficult to obtain.

I am much indebted for this information to H. R. C. Blagden, Esq., M. I. Mech. Engineers, the Manager and Chief Engineer of the Alexandria Water Company, who very courteously conducted me over the works.

NOTES ON "c" AND "d."

By CAPT. J. E. E. CRASTER, R.E.

1.—NOTES ON "*d*."

ALTHOUGH the following notes are intended to suggest a course of study which should enable a candidate to pass the examination in "*d*" with a good margin to spare, they can hardly be curtailed with safety.

A candidate should start work some six months before the date of the examination. The first thing to do is to read over all the paragraphs in the *King's Regulations* that bear on the subject, and then to obtain the papers set at the last three or four examinations, so as to study the questions set and the examiners' comments on the answers. (The examination papers are bound up with the examiners' remarks, and are published officially).

Most candidates will find that tactics require longer preparation than the other subjects, chiefly because skill in tactics depends upon the possession of military instinct, and instinct is a quality which grows but slowly. If time is available, it is best to begin by reading an easy book on the art of war—Hamley's *Operations of War*, or *Modern Strategy*, by James—and then to read through the *Field Service Regulations*, Part I. When this has been done, the candidate will have some theoretical knowledge of the subject. In order to learn how to put this knowledge to practical use, he should work through some tactical exercises. Griepenkerl's *Letters on Applied Tactics* give a number of simple problems, with their solutions. A point should be made of writing the orders in full for each problem, otherwise little benefit is derived from the exercises.

Griepenkerl's solutions, however, do not always follow the rules laid down in *Field Service Regulations*, and it is better therefore always to read over the part of the *Field Service Regulations* that deals with the problem in question, before looking at Griepenkerl's solution. It is in outpost problems in particular that Griepenkerl's practice differs from ours. It is also advisable to work out several schemes against time, and to get a friend to criticize them.

After tactics, military history will require the most preparation. As a preliminary to the study of the particular campaign selected, it is useful to read a little of the general history of the period. Sanderson's *Outlines of the World's History* will give all the information required in a few pages. This book will be found in most

reference libraries. On most campaigns a number of books have been written, but as a rule there is one which is recognized as a standard work. This book will generally be sufficient for requirements, but if other works can be obtained from a library, the study of the campaign should not be confined to one book only. The official accounts are usually too full and detailed to be of any use for examination purposes.

Throughout the examination a good deal of importance will be attached to the *manner*, as well as the *matter*, of the answers. Even if a candidate has not a distinguished literary style at his command, he may at least avoid grammatical errors, faults in spelling, and slang. The history paper offers the greatest scope for the exhibition of literary style.

Before reading up Military Law, it is advisable to see that the copy of *King's Regulations* is amended and up to date. *Military Law Made Easy*, by Banning, is the best book to study, and all references to the *King's Regulations* and *Manual of Military Law* should be verified. The papers at the end of the book should also be worked through, and the answers compared with those given by Banning.

Organization and administration together form a very large subject, and it is impossible to prophesy which part of it the examiners will select. The books published by Banning and Brunker are both good, and there is little to choose between them. Care should be taken to obtain the latest editions, and to see that they are corrected up to date. No doubt many of the questions in future examinations will bear upon the new *Field Service Regulations*, Part II., and candidates should be thoroughly acquainted with this book.

Military Engineering and Map Reading should not require much study by R.E.'s. After reading through the two manuals once, candidates should be able to judge which are their weak points in these subjects, and they can then concentrate their attention on these points to the exclusion of the rest.

The following is a list of books required in preparing for the examination :—

Field Service Regulations, Parts I. and II.
Manual of Military Engineering.
Manual of Map Reading.
King's Regulations.
Letters on Applied Tactics—Griepenkerl.
Operations of War—Hamley ; or
Modern Strategy—James.
Military Law Made Easy—Banning.
Organization Made Easy—Brunker ; or
Organization Made Easy—Banning.
A Standard Work on the Military Campaign.
The Manual of Military Law.

2.—NOTES ON "*c*."

The examination in "*c*" comprises three subjects :—

(1). Practical Map Reading, Field Sketching, and Reconnaissance	100	marks.
(2). Practical Military Engineering	100	„
(3). Practical Tactics	200	„
Total ...	400	marks.

To qualify it is necessary to obtain ·5 of the maximum in each subject, and ·6 of the total.

The examination is usually conducted in the following manner:— On the first day the candidate is required to make a sketch of about a square mile of country, and to write a reconnaissance report, or reports, in connection with it. The time allowed is six hours. Out of a total of 100 marks for this day's work only 30 are allotted to the sketch, the remaining 70 being given for the report. The sketch is therefore a matter of minor importance, and only a short time should be devoted to it.

A common mistake is to attempt to make an accurate and elaborate plane table or prismatic compass sketch on the ground. This is almost an impossibility. In England the country is so enclosed, and there is so much detail to be supplied, that the most rapid sketcher can hardly map a square mile in six hours; but even if he completes his sketch, he will find he has no time left to write his report, and it is the report that pays.

Each candidate is provided with a $\frac{1}{2}$-inch map, and it is advisable, and permissible, to make an enlargement of this to form the skeleton of the sketch. Fences and contours should be added afterwards on the ground. An enlargement may be made accurately and quickly by ruling the map into squares, as described in the manual of field sketching, but in order to avoid marking the map it is better to employ a sheet of tracing paper ruled into small squares, which can be fastened over the map with drawing pins. A small sheet of glass with cross lines cut on it is a further refinement. As the total area on the $\frac{1}{2}$-inch map will measure less than 1 square inch, a very small piece of glass will suffice.

It is advisable to have a small bottle of *waterproof* Indian ink at hand, so that if time allows the sketch may be inked in. Coloured chalks should not be used till the sketch is otherwise complete, as the chalk lines are easily blurred. In finishing up the sketch the following details are often forgotten :—Heading, scale, north point, destination of roads, nature of crops, signature, place and date.

The report should be written in the form laid down in *Field Service Regulations*, Part I., paragraphs 9, 12, and 16, and, in order that the

candidate may be able to render an exhaustive and accurate reconnaissance report, he should study in particular paragraphs 96 and 130.

The second day of the examination is usually devoted to tactical and engineering problems on the ground. From 10 minutes to half an hour is allowed for deliberation on each problem, and the answer must be given *vivâ voce*. The place is very easily lost on a small scale map, and it is therefore advisable to mark the position referred to in the problem with a pin. Candidates are expected to use the field service pocket-book in answering questions. The index of the pocket-book is very incomplete, and it is preferable to refer to the table of contents at the beginning of the book.

In order that an officer may be prepared to rapidly solve tactical problems, he must have a certain amount of preliminary practice. This may be obtained by working through a book of tactical schemes, such as Needham's *Solutions of Tactical Problems*. Griepenkerl's book is good except as regards outposts. Writing orders also requires practice, otherwise it will be found that some important detail—such as the number of the order or the time of despatch—has been omitted.

The most difficult point that arises is the choice of an artillery position. As a rule the guns are placed too far forward. If a candidate must choose between a forward position and one that seems to him too far to the rear, he will generally be safe in selecting the rearmost.

As regards practical Military Engineering, the candidate should be skilled in knotting, lashing, and field geometry; there is little else that he can be asked to do with his own hands. The remainder of the engineering questions must be answered *vivâ voce* or by means of a hand sketch. The *Manual of Military Engineering* should be followed in answering all questions. Originality is not required.

Questions on the *Manual of Map Reading* are easily answered if the book has been studied beforehand.

Captains who have not got a certificate are required to pass a riding test. This is not a very formidable affair, but if a candidate has not ridden for some time, he should certainly procure a horse and go out a few times to get himself into condition. Trotting along a hard road without rising is the best practice for the riding test.

A BRUSHWOOD GIRDER BRIDGE.

By CAPT. J. E. E. CRASTER, R.E.

DURING the fieldworks course of the Survey Companies this year, a bridge of 18′ span was constructed entirely of brushwood to carry infantry in single file. The road-bearers consisted of two lattice-work girders 20′ long ; the roadway was made of hurdles laid directly on the upper booms of the girders. Each boom of the girders consisted of two horizontal rods laid side by side. The diagonal and vertical struts and ties, composing the webs of the girders, were single rods. The ends of the diagonal and vertical rods were placed between the two rods that formed the boom, and the whole were tightly lashed together with wire. The diagonals were lashed together at the point of crossing.

When the two girders were complete, they were braced together at every 5′ with horizontal and diagonal ties, lashed to the inner sides of the booms. Finally the hurdles to form the roadway were placed on the upper booms and lashed to them.

The completed bridge weighed under 400 lbs. It was carried down to the water and placed in position by four men. The deflection in the centre, when it was fully loaded with 13 men, was about 4″. This weight was equivalent to 100 lbs. per foot-run.

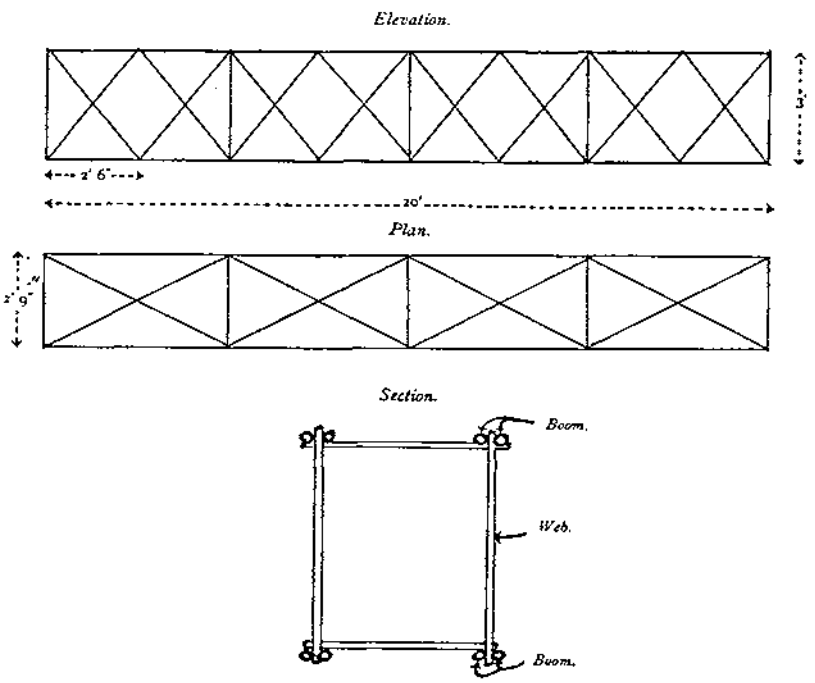
At the inspection held by the Inspector of Royal Engineers the bridge was finally tested to destruction. Under the weight of 21 men the lower booms crushed at one of the points of support. This was due to the girders being placed on round transoms. Had the weight been properly distributed over flat transoms, there is no doubt that the bridge would have stood a much heavier load.

The largest pieces of brushwood used in the bridge were $1\frac{1}{2}$″ pickets.

Before putting on the wire lashings the pickets should be barked and slightly notched at the point of lashing, otherwise the lashings will give through the bark stripping. The quickest and surest method of making wire lashings is to take one, or at the most two, complete turns, and then finish off by twisting the ends together. Continue in this way till there are six or eight complete turns. If frapping turns are necessary, they may be put on in the same way.

The principle of brushwood bridges is capable of considerable development. There is no reason why a bridge of 30 or 40′ span to carry infantry in fours should not be constructed entirely of brushwood.

Brushwood Lattice Girder Bridge.



NOTES ON BLAST TESTS.

By Major C. H. Foott, Royal Australian Engineers.

It being necessary to construct a searchlight emplacement at a point within the arc of fire of one of the 9·2″ guns mounted at one of the forts in Australia, the question arose as to the effect of the blast from the gun upon the buildings, stores, and *personnel*. In order to gain information on this point, a galvanized iron hut, 6′ square, 7′ high, with the seaward side 3′ 6″ high, was erected at a point within the peace safety arc of the gun.

As it was impossible to fire the gun in the direction of the selected site for the real emplacement, owing to settlement on the opposite shore, a seaward site was chosen for the "dummy" emplacement. The site coincided exactly with that of the real emplacement as regards the configuration of the ground.

Inside this "dummy" emplacement the following stores were placed :—Projector, 90 c.m., Mark I., with glass door ; two glasses brimful of water, one on the floor, one on a flimsy wooden case ; three or four small blocks of deal standing on end.

The mirror and lamp were removed from the projector, and sheet iron was bolted to its back to fill up the open end thus left.

The projector was mounted on a large case, to represent the pedestal. In order that, whatever happened, there would not be a missing projector as a result, it was lashed to the pickets of the permanent entanglement. This proved a needless precaution.

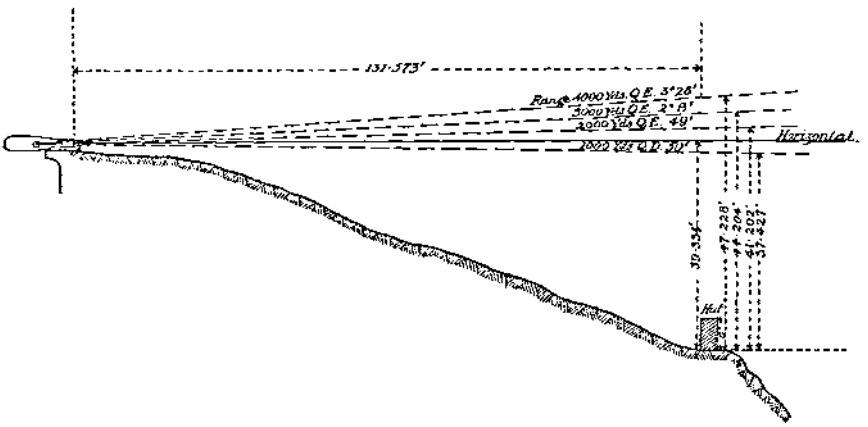
Four rounds of plugged shell with full charges were then fired, the gun being trained in the direction of the projector hut. The first round was fired at an elevation corresponding to 4,000 yards, and blew some sand and grass on to the top of the hut, which successive rounds did not dislodge. No effect whatever was produced on the interior of the hut or its contents—the water was not spilt nor the wood blocks overturned.

Rounds were also fired at 3,000, 2,000, and 1,000 yards, but failed to produce any effect.

The conclusion arrived at was that a reinforced concrete emplacement, with an earth bank on the side nearer the gun, would be safe from blast effect.

During the trial the weather was fine, clear, light breeze blowing at right angles to line of fire ; barometer, 29·90.

A diagram of the vertical angles and horizontal and vertical distances is attached.



Experimental Firing.—Four rounds fired from 9·2 B.L.H.P. Gun over Temporary Projector Hut.

Charge, 16½ lbs. Prism Brown. Weight of Projectile, 380 lbs.

THE ARRIVAL OF THE AEROPLANE.

By COLONEL F. G. STONE, *p.s.c.*, R.A. (*Member of the Aeronautical Society of Great Britain*).

AT Blackpool, on October 22nd, 1909, Hubert Latham demonstrated, to the satisfaction of the most exacting critics, that the aeroplane can ride out a gale of wind; in doing so he has established the claim of the "heavier-than-air" machine to be considered seriously in connection with its employment in military operations. To those who realized the true significance of the wonderful spectacle of a man, in a man-made machine, fighting the wind like a seagull, this performance more than compensated for the generally disappointing character of the Blackpool meeting. For here at last it was proved that a well-constructed aeroplane, correctly designed, in the hands of an experienced and skilful pilot, is not liable to be blown over sideways through loss of lateral stability, and can safely cope with a wind blowing at a rate equal to its own normal speed, without any danger of losing longitudinal stability. Latham declared that Rougier on his Voisin machine and Paulhan on his Farman biplane were equally secure from loss of lateral stability; and further, that he was confident that if he had an Antoinette which would travel at 70 miles an hour, he could safely cope with a wind blowing at the same rate, flying freely in every direction.

At 1.50 p.m. Latham made his start; the force of the wind, as registered by the anemometer, was 24 miles an hour; it was squally, and at times exceeded 50 miles an hour. The normal speed of the Antoinette monoplane on a calm day was 48 miles an hour. Immediately after the mechanics let go, the aeroplane was blown sideways, and carried away against the ground 2′ of the rear corner of the left wing. The machine was at once righted, and got head to wind once more, and now a remarkable sight was witnessed—the mechanics, who usually have to hold back the aeroplane until the signal is given to let go, had actually to push her forward in the teeth of the wind until the tractor screw was able to hold her; this gave one a good idea of the force of the wind. But still more impressive was the beginning of the flight after a run of only 25 yards. The rise from the ground was not the easy, graceful performance which one has been accustomed to see. Instead of a steady, effortless rise up a gentle incline, at a uniform speed, the aeroplane made a succession of spasmodic jumps, and almost seemed to pause for breath between each jump, as the gusts which caught the machine and cast

it upwards also checked its forward travel for some seconds at a time. The flight, twice round the course, lasted 10 minutes 15·25 seconds. Against the wind the aeroplane was at times absolutely held up, and even for a few anxious moments driven back, showing that the force of the wind was more than 48 miles an hour; with the wind behind, a speed of 90 miles an hour was attained. Turning the corners was sometimes a troublesome performance; the aeroplane would seem for a moment to be held by the wind as in a vice, refusing to answer to her helm, and then suddenly she would whip round and face in the opposite direction, requiring to be laboriously brought back again on to the course; occasionally she had to work her way against the beam wind at an angle, to prevent being blown out of her course, and once during the second lap she was carried off about a mile and a-half out of the course by a sudden squall before she could recover herself. At the completion of the second lap the beautiful monoplane glided gracefully against the wind to the ground, and alighted without the slightest jar or shock; she was immediately seized by the mechanics, to prevent her from being blown round.

Latham maintains that the handling of an Antoinette is "simplicity itself." It requires a light hand on the wheels, so that the fingers may be sensitive to their slightest movement; the wings tend to warp themselves, and the hinged stabilizing plane in rear similarly tends to assume the necessary position to correct the flight path. These tendencies are at once detected by a sensitive touch on the control wheels, and all the pilot has to do is to assist or emphasize them.

It was just three months ago that Latham and Levavasseur, the designer of the Antoinette monoplane, were anxiously waiting on the cliffs of Sangatte for a calm day to justify the risk of the Channel flight! This serves as a useful reminder of the rapid progress which is being made in the art of flying, and let it be borne in mind that this progress is principally due to the experience in actual flight which has been gained by the leading aviators, and not to any striking improvements in the designs of their machines, though the improvements in the engines have been an essential factor. It seems clear therefore that if we are to be ready with a corps of skilled aviators to make practical use of the military aeroplane when a suitable one has been designed or adopted, we ought at once to begin to train them on any of the numerous reliable machines which are now on the market. If this were done, we should then have some practical men, who have handled an aeroplane under varying conditions, in a position to advise us in regard to design and construction when the question of adopting a machine for Army purposes has to be settled. There are hundreds of points about the construction and employment of aeroplanes for Army use which will require the most careful consideration and experiment; there is *one* which requires no consideration but much experiment, and that is the training of the *personnel* to handle them.

NOTES ON PILE COFFER DAM FOR LONDON COUNTY HALL EXCAVATIONS.

By LIEUT. G. GUY WATERHOUSE, R.E.

THE London County Hall, of which the plans were passed some few months ago, is to be built on the south bank of the Thames, immediately adjoining the eastern side of Westminster Bridge. The front facing the river is some 800′ in length, and has before it a pathway running on an embankment somewhat similar in design to that on the opposite bank. This embankment will continue the alignment of the one in front of St. Thomas' Hospital and run flush with the bridge abutment, from the roadway of which it will be reached by a flight of steps.

The foundations of this embankment, and of much of the building itself, will be in ground which at present forms mud flats when the tide is low and which is covered by the river at high tide. To enable the necessary excavations to be made, a coffer dam has had to be provided to keep the site dry. This dam, which is at present under construction, consists of a continuous row of sheeting piles strengthened by struts which bear against "supporting piles," thus forming a watertight screen capable of resisting the pressure of the highest spring tides.

Nature of Foundations for Embankment Wall.—A rough section of the strata at the site shows a 16′ bed of Thames ballast overlying the London clay, and this, in its turn, is covered by 4′ of Thames mud.

Experience has proved that Thames ballast forms an insecure base for foundations, as its stability is greatly affected by any alteration of the quantity of water it holds. The foundations for the embankment wall are therefore being taken down to level, 23′ below the surface, *i.e.*, 3′ into the clay. To ensure against percolation of water the sheeting piles are driven to level, 32′ below the surface. The abutments of Westminster Bridge being founded on the Thames ballast, special precautions have had to be taken at this end of the wall, and these will be dealt with later. To keep out the water at spring tides a height of 18′ above mud level is required, and hence we see that the piles need to be 50′ in length (*Fig.* 1).

Piles.—The piles used for sheeting are of best Oregon pine, $14'' \times 14''$, and average 50′ in length. Each pile has cut in it, on opposite sides, two grooves $2'' \times 2''$, and into one of these a $2'' \times 4''$ tongue of hard wood is fastened with 7″ wire nails (*Fig. 2*).

Jarrah wood was tried for some "closer" piles (see below), but proved unsatisfactory, as, although these piles neither crushed nor broke, they frequently cracked straight through the heart, so that it was necessary to remove them.

Shoes.—"King" piles (see *Fig.* 3) were fitted with a special pointed shoe to facilitate vertical driving, others having one of a chisel shape.

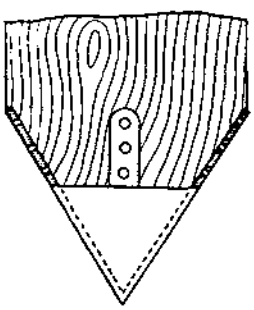
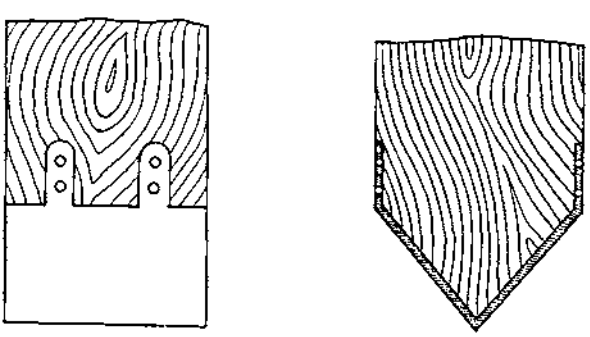


FIG. 3.—*Shoe for King Pile.*



Front. *Side.*

FIG. 4.—*Shoe for Ordinary Piles.*

Driving.—The piles for use were floated inside the staging, and picked up as required by the pile-driving machines. The first piles driven—termed "King" piles—were spaced at from 30′ to 40′. These had no tongue fitted, but had two grooves into which the tongues of adjacent piles fitted, thus ensuring that these latter were driven vertical. Piles were first driven on alternate sides of each

"King," working outwards and afterwards inwards from the sides of the bay. Finally a gap sufficient for one pile was left, those on either side presenting grooves, and into this gap was driven a "closer" pile fitted with two tongues, and, as can be readily conceived, great difficulty was frequently met with owing to this gap being less than 14″, and narrower therefore than a pile. Great care was taken in spacing the "Kings" that this gap should never be too wide.

The London clay proved very refractory, and difficulty was encountered in driving to the requisite depth, owing to the presence of clay-stone, which is frequently quite as hard as many limestones. The principal trouble occurred with the "closers," these occasionally snapping off short, or becoming so inclined that the tongues were torn out of the grooves.

When this occurred it became necessary to draw the pile, which was effected as follows :—A piece of timber was firmly bolted to the pile to be removed, a cross-piece attached to this, and under the ends of the latter one or two hydraulic jacks resting on adjacent piles were applied. The jacks were of 30 or 40 tons. This was a laborious procedure, but was usually completed in a day. Occasionally a stump was so firmly embedded as to defy removal, and in such cases, another piece being bolted to the top, two were driven down solid as one pile.

Pile-heads were hooped with iron for driving, but this was insufficient to prevent much splitting, instances occurring when the same pile needed reheading four and even five times. "Dollies" of hard wood between the pile-head and the "monkey" have elsewhere been tried with success, but were only used here if the pile had sunk below the "monkey" guides. This constant reheading reduced the piles in height, so that when necessary they were brought up to the correct level by the addition of short pieces bolted and dogged both to the pile itself and to the adjacent ones. All joints round such packing, and all leaky spots in the sheeting were caulked with yarn soaked in red lead.

Rate of Working.—To each machine a gang of four men and a fire-boy was detailed, and the average was 10 piles in the week. The "monkey" weighed 27 cwts. and was allowed an average drop of 10′.

Strutting.—It was calculated that the mean pressure on the dam at spring tides is 1 ton per square foot, and in order to distribute this over a large area, struts bearing against "supporting" piles were made use of. These piles were 12″ × 12″, and were driven down to 28′, *i.e.*, 8′ into the London clay, 5′ to 10′ being left showing above mud level. They were spaced at 8′ intervals, and arranged in two rows 20′ apart, the nearest being 20′ from the dam. Each row was

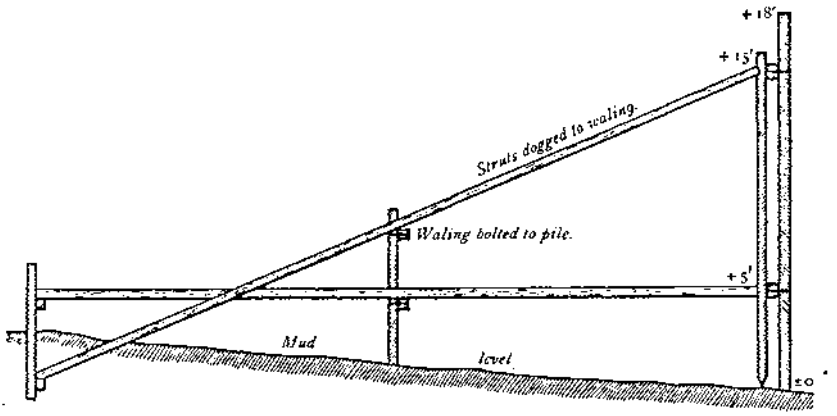


FIG. 5.

twice waled with 12″ × 12″ baulks. The sheeting piles were waled 5′ and 15′ above mud level, and from "soldier" piles placed against this waling every 8′, horizontal and inclined struts were led back to the waling along the "supporting" piles. The strutting was of 14″ × 14″ baulks, dogged to the "soldiers" and waling, the inclined strut being let in to the "soldier." This work could only be carried out when the tide was low, and was very slow, though aided by the use of cranes travelling on the staging.

Use of Caisson.—As stated above, special arrangements for carrying the weight of the embankment had to be made near the bridge abutments, as it was feared that an excavation down to the clay near by, might cause the ballast supporting the foundations to slip away. This has been avoided by sinking a caisson and building up in it a stone pier, whence iron girders will run to the abutment so as to take the weight of the wall.

Iron sheeting was first driven all round the abutment foundations to prevent movement of the ballast, and a 30′ × 20′ rectangular caisson was sunk close up to the sheeting, with its front edge in prolongation of the line of the coffer dam, which was continued up to it, and again beyond between its inner edge and the bridge. A pressure of 12 lbs. above atmosphere proved just sufficient to keep the water out. Here again the clay-stone proved an obstacle to rapid work, and had to be laboriously removed by pick and shovel. The caisson being sunk to level −28′, a concrete floor (1 of Portland cement to 6 of Thames ballast) was laid, and a pier of previously prepared stone built up to mud level. The caisson was then opened, and all removed except the riverward side, which formed part of the coffer dam.

The five girders which are to carry the upper part of the wall are 20′ long and of I-section 20″ × 7½″.

Sluices.—To prevent strain being thrown on the dam before completion, eight $4'' \times 2''$ sluices are left. These eventually will be closed by iron plates held by screwed rods and swivel joints, the screwed part of rod passing through a nut attached to the upper part of the dam.

The work is being carried out by Messrs. Price & Reeves, under the supervision of L.C.C. engineers, and the latter very kindly gave the writer every facility for inspection, and were most ready to answer all enquiries as fully as possible.

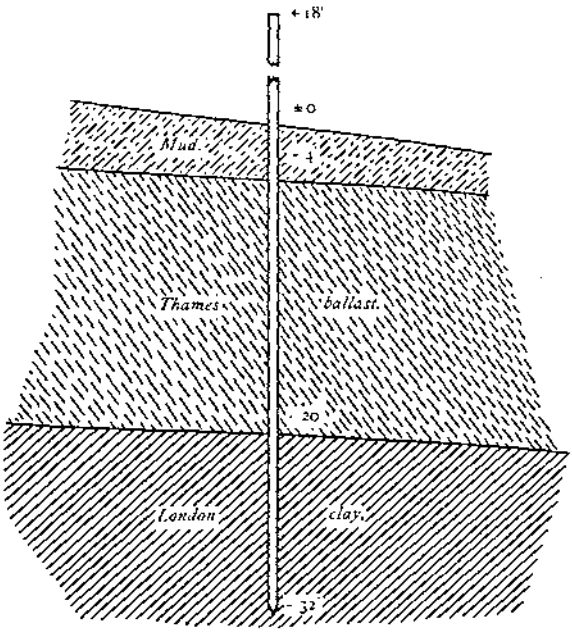


FIG. 1.

Preliminary Staging.—Before work could be begun it was necessary to construct a solid staging on which the heavy pile-driving machines could travel, and $12'' \times 12''$ piles were driven at high tide from pile-driving barges, so as to penetrate some $14'$ into the ballast and stand $14'$ above mud level. Two rows were driven $12'$ apart, each row consisting of individual piles spaced at $12'$, and each pair—and every alternate two bays—being diagonally braced with $12'' \times 6''$ stuff.

Capsills of $12'' \times 12''$ were run across each pair of piles, and road-bearers of similar section supported planking which carried a rail track set to gauge for the machines. All joists were secured by dogs only.

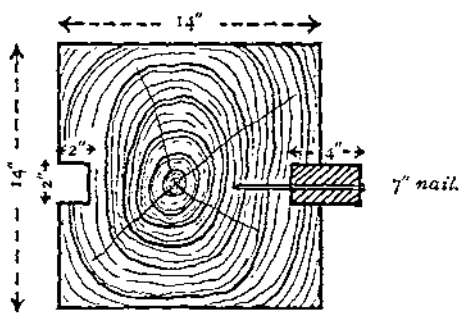


FIG. 2.—*Cross Section of Pile.*

THE FYERS FAMILY.

(*Continued*).

By Col. Robt. H. Vetch, c.b., late R.E.

I now come to the grandchildren and later descendants of Thomas Fyers, Overseer of the King's Works in Scotland. These are so numerous that, in order to avoid confusion, I hope to be able to show them in a genealogical table before I finish my paper. It is only possible to make a brief reference in the text to the majority of them. Of those grandchildren and later descendants who were in the Corps, or distinguished themselves in the service of their country, I may write in more detail.

Since beginning this article fresh light has been thrown on the parentage of Thomas Fyers, Overseer of the King's Works in Scotland. Through the courtesy of Major Evan Fyers, grandson of Major-General Peter Fyers, C.B., Colonel Commandant, Royal Artillery, I have been furnished with information about his forefathers for four generations back, to A.D. 1620. It appears that these immediate ancestors of Thomas Fyers all belonged to Berwick-on-Tweed, and if the theory which I suggested at the outset of this article, that the family originally came from Stratherrick, be correct, the migration must have taken place before 1620.

Thomas Fyers, Overseer of the King's Works in Scotland, was the eldest son of William Fyers, Burgess of Berwick-on-Tweed, and was baptized in Berwick on 27th December, 1714. He himself became a Burgess in December, 1735, I presume on attaining the age of 21 years. Berwick was at that time, as it had been from Tudor days, an important fortress, and it is easy to understand how he may have learnt the art of building and may have been employed on the fortifications of Berwick, and in that way becoming known to the Military Engineers in charge, was passed on to similar work in Scotland.

Thomas Fyers, his wife Elizabeth Falconer, and their son John are all buried in St. Cuthbert's Churchyard, near the Caledonian Railway Station in Edinburgh.

GRANDCHILDREN OF THOMAS FYERS.

The grandchildren of Thomas Fyers to be considered are :—The children of Lieut.-General William Fyers, Colonel Commandant, R.E.; of Major-General Peter Fyers, C.B., Colonel Commandant, R.A.; and of Alexandrina Fyers, wife of the Rev. James Reid.

CHILDREN OF LIEUT.-GENERAL WILLIAM FYERS, COLONEL COMMANDANT, R.E.

By his marriage with Anne Wanton, General William Fyers had ten children, two sons and eight daughters. Two of the daughters died young. Of the children who grew up, Thomas was the eldest, then followed Sarah, to whom we are indebted for the reminiscences, Charlotte, Elizabeth Lydia, Edward, Anne, who died unmarried, Louisa, and Frances. Both sons entered the Corps, and five daughters were married. The three elder daughters became mothers of large families, among whom were several well-known officers of the Services. Of the two younger, Louisa Fyers was born at Gibraltar on the 2nd November, 1794. She was married, in Dublin, to Dr. John Crampton. Frances Fyers was born at Gibraltar on the 15th October, 1797, and was married, in Dublin, in 1817 to Richard Estwick, youngest son of Samuel Estwick, of Portman Square, London, and of Barbados, West Indies, M.P. for Southampton. She died in 1882 at Twickenham, and was buried there. I shall now refer to the other children.

MAJOR-GENERAL THOMAS FYERS, R.E.

Mention has already been made in Mrs. Mann's Reminiscences of the birth of Thomas, the eldest son of Lieut.-General William Fyers, in New York on the 6th January, 1783, and of his christening, when the sponsors were Lieut.-Colonel Morse, R.E., afterwards Inspector-General of Fortifications; Lieut.-Colonel James Moncrieff, R.E., who ten years later fell mortally wounded at the Siege of Dunkirk; and Mrs. Morrison, wife of General George Morrison, Quartermaster-General to the Forces, and Equerry to H.R.H. the Duke of York. It was a matter of course that young Thomas should be a soldier. He was born and bred in a military atmosphere. The life he led at Gibraltar, where everyone was either naval or military, and where even his tutor was the garrison chaplain, confirmed his early desire to enter, if possible, his father's corps. The Reminiscences mention how in due course the little fellow was sent home from Gibraltar to the care of his bachelor uncle and namesake, Thomas Fyers, Treasurer of Malta and Deputy Paymaster in the Mediterranean, then staying in London, to be put to a school to prepare for admission to the Royal Military Academy at Woolwich. The school to which he was sent at the Blue Stile, Deptford, where his sister says that "they

professed" to prepare boys for Woolwich, was a very second-rate place, but at that time there was no other better, and most of the youths who had obtained nominations for Woolwich went to this school to cram for the entrance examination. It was said that they learnt there little of use to them, while they acquired knowledge which they would have been better without.

After two years at school, Thomas Fyers passed the examination and was admitted to the Royal Military Academy on the 15th February, 1797, when he was just turned 14 years of age. He spent three years at the Academy, passing out for Sappers on the 19th December, 1799. But there was no vacancy for him in the Corps, so the Inspector-General of Fortifications, General Morse, who was his godfather, sent him to Gibraltar to serve under his father until such time as a vacancy might occur. The official letter, dated 15th February, 1800, said: "Thomas Fyers, late Gentleman Cadet, is to be employed as Assistant Engineer under your command at Gibraltar till a vacancy occurs in the Royal Engineers. He is to join with all despatch." He seems to have arrived at Gibraltar in January, before this letter was written, and the appointment was dated from the day he arrived. A vacancy in the Corps occurred on the 2nd May, 1800, when he was gazetted a 2nd Lieutenant, Royal Engineers. When the Gazette was promulgated at Gibraltar on the 2nd June, he was appointed Quartermaster to the Royal Military Artificers until further orders. A year later he was promoted 1st Lieutenant by augmentation. In April, 1803, he became Adjutant as well as Quartermaster to the Royal Military Artificers, and in the summer of the following year he obtained four months' leave of absence and went to England.

It is surprising that his sister's MS. makes no reference to the return of her brother to Gibraltar, for the first time as an officer of the Corps, nor of his being present at her wedding in the following year. During his four years' service at Gibraltar he must have seen all his three elder sisters married—one to a Sapper, another to a naval officer, and a third to a Gunner.

On the expiration of his leave in the autumn of 1804, Thomas Fyers was stationed at Portsmouth. While there he made the acquaintance of the Rector of Alverstoke, the Rev. F. Clifton, and his family. Mr. Clifton was a brother of Sir Gervase Clifton, Bart., of Clifton Hall, Notts, the representative of a family that traced its descent back to Alvaredus de Clifton, of the time of the Conqueror. He was promoted 2nd Captain on the 21st September, 1805, and on the 17th March, 1806, was married to Mr. Clifton's eldest daughter, Louisa, born at Alverstoke 23rd July, 1786. The wedding took place at Alverstoke Church, the rector performing the rite.

At the end of the year in which his marriage took place Capt. Thomas Fyers was moved to Chatham to take up the staff appoint-

ment of aide-de-camp to Major-General William Twiss, Commanding Royal Engineer of the Southern District, who was responsible for the special defences then being constructed on the S.E. and S. coasts, the outcome of the threatened invasion by Bonaparte. His first child, christened William, after his grandfather, the Commanding Royal Engineer at Gibraltar, was born at Gillingham, Kent, on the 6th February, 1807. In the following year Fyers was fortunate enough to be selected for active service; and in the short space of three months he probably saw as much hard marching, sharp fighting, and as many of the difficulties as well as of the horrors of war as those who have been through numerous and longer campaigns.

In the autumn of 1808 the British Government decided to despatch an expedition to assist the Spanish armies in the north of Spain in their struggle against the French invaders. To Lieut.-General Sir John Moore, then commanding the British troops at Lisbon, the enterprise was confided. At the same time a force of 10,000 men was assembled at Falmouth, under Major-General Sir David Baird, to proceed to Coruña to join Sir John Moore at whatever place he should direct, either in Galicia or on the borders of Leon.

On the 1st October, while still serving as aide-de-camp to Major-General Twiss, Fyers received orders to join Sir David Baird's division, and he went with it to Coruña. In this present year, when the centenary of the death of Sir John Moore has been celebrated and so much has been written on the subject of his last campaign, it is unnecessary to enter into the details of the operations of the two British forces, which, starting from Lisbon and Coruña respectively, finally joined hands in Leon. It may be briefly stated that Sir David Baird was directed by Sir John Moore, so soon as the equipment, transport, and supplies of his division were organized, to advance to Astorga and be ready to join him when called upon to do so.

In addition to his duties as a Captain of the corps, Fyers was appointed an extra aide-de-camp to Sir David Baird. The Engineers in those days were usually employed in the field as staff officers, in addition to their own technical duties. They acted as intelligence and Quartermaster-General's officers in gaining information for the General about the roads and the country through which the force had to pass. They went a long way ahead of the force exploring the wild and little known country, making topographical sketches, and noting the best routes for the columns to advance by. Thus, on the 24th November, Captain J. Carmichael Smyth, Sir David's Commanding Royal Engineer, writes to his chief from Villa Franca: "The road, or pass, not far from Mauraval, leading also from Astorga to Cacavallos, is a parallel road to the royal road on which Capt. Smith (R.E.). travelled. Of this road he was not aware till he got to Villa Franca. I intend to send Capt. Fyers to examine the road to-morrow."

The complete defeat of the Spanish armies by the French made the situation a difficult one for Sir John Moore, but he effected a junction with Baird's force at Mayorga in Leon on 20th December, and was prepared to move forward. On the 23rd, however, news arrived that Napoleon himself had set out from Madrid with a large army and was hurrying by forced marches to Benevente. Moore decided that in view of the smallness of his force, compared with the French armies, a rapid retreat to the coast was the only possible course open to him. Then began the famous retreat, first on Astorga, then on Coruña, conducted in great haste, in the winter, by forced marches over snow-covered ranges, and in the wildest weather, with a skill and courage that has made it memorable. The retreat was, nevertheless, a succession of horrors, on account of the terrible sufferings of the soldiers, and of the women and children who accompanied the army.

Fyers was present at the Battle of Coruña on the 16th January, 1809, when first his own General, Sir David Baird, was carried from the field severely wounded, and then the Commander-in-Chief mortally wounded, and it was left to Sir John Hope to complete the victory. The following day Fyers embarked with the army for England. On his arrival he found his young brother Edward under orders for Lisbon with Sir John Sherbroke's division, and before many months had passed he saw his father off in the Walcheren Expedition, to which he had been appointed Commanding Royal Engineer.

On his return from Coruña, Capt. Thomas Fyers was stationed at Portsmouth. On the 23rd April, 1810, he was promoted 1st Captain, and in the following year was sent to Guernsey; there he remained three years, and was transferred to Jersey. Altogether he spent six years in the Channel Islands. In July, 1816, he was ordered to Gibraltar. The following entries in Colonel Holloway's Journal mention his arrival:—

> "1816, August 9th, Friday.—Capt. Fyers arrived, to be in this command."
>
> "August 11th, Sunday.—Capt. and Mrs. Fyers, Lieuts. Hotham, Whinyates, and Lempriere, etc., dined with me."

Capt. Fyers spent six years at Gibraltar in his second service there, and two of his children were born on the Rock. In 1819 he received a Brevet Majority. He returned home in September, 1822.

On arrival in England, Major Fyers was unemployed for a short time, after which he joined his father's command in Ireland. In September, 1824, he was appointed Commanding Royal Engineer in Jersey, was promoted Lieut.-Colonel six months later, and remained at Jersey until the end of 1830, thus completing a second six years' service in the Channel Islands. He had now 30 years' service. His family consisted of nine children, the youngest, Amelius Beauclerk,

afterwards a Colonel in the Corps, having been born at Jersey the year before he left.

His next service was as Commanding Royal Engineer in Mauritius. At that time the island was both healthy and prosperous. The abolition of slavery, though in the air, had not yet taken place, a great deal of money was made in the island, and the planters lived in great luxury and were very hospitable. So Mauritius was a coveted foreign station for officers, who also enjoyed there a generous colonial allowance in addition to their meagre pay. Fyers took his wife and most of his children with him to Mauritius, and the name of Fyers became as well known in the island as it had been in his father's time at the Rock. There he remained for over 14 years; all his daughters were married there; one of his sons married and settled in the island; while another son, in the Royal Artillery, was posted to the battery in Mauritius in 1834, and remained in the same garrison with his father for eight years.

Thomas Fyers became a Regimental Colonel in 1837, but he did not return to England until 1845. He was promoted to be Major-General, and retired in November, 1846. He died at Woolwich on the 11th May in the following year. His widow returned to Mauritius and lived on there to a great age, dying on the 6th October, 1881, aged 95 years.

By his marriage with Louisa Clifton, Thomas Fyers had eleven children, six sons and five daughters, viz. (omitting a son and a daughter, who died young) :—

I. WILLIAM FYERS, born at Gillingham, Kent, on the 6th February, 1807. He was commissioned as Ensign in the 11th Foot, North Devonshire Regiment, in 1825. He married at Corfu, on the 31st July, 1832, a Greek lady, Catherine Economede. He died at Santa Maura on the 29th December, 1852, leaving issue :—

(1), Thomas Fyers, who died in 1867; (2), Robert Fyers, formerly in the War Office; and (3), a daughter (Louisa).

II. FRANCIS CLIFTON FYERS, born at Alverstoke, Hants, on the 18th February, 1810. He was commissioned in the 47th Foot, and exchanged into the 4th Light Dragoons. He died at Bomina Kolta, in India, on the 14th December, 1838. He was unmarried.

III. Louisa Fyers, born in Guernsey on the 13th July, 1811; married at Mauritius, on the 24th January, 1834, the Rev. Langrishe Banks. She died in Dublin in 1893. The issue of this marriage was:—

(1). The Rev. William Thomas Banks, born in 1835, who died unmarried in 1868.

(2). LANGRISHE FYERS BANKS, born at Mauritius on the 26th September, 1836, who was for many years Secretary of the Royal Hospital, Kilmainham, Dublin. He married his cousin, Anne Sabine Wainwright, at Bath in 1863, and has issue.

IV. Rose Matilda, born at Guernsey on 30th December, 1812; was

married at Mauritius on the 24th January, 1834, on the same day as her sister Louisa's wedding, to CAPT. CHARLES CORNWALLIS BROWNRIGG, of the 9th Foot. He was born in 1800, and died in 1872 without issue. Mrs. Brownrigg lived to a great age, dying in Mauritius in 1907, aged 94 years.

V. ROBERT MORSE FYERS, born in Jersey on the 9th September, 1815, was commissioned in the Royal Artillery on the 21st June, 1833, as a Second Lieutenant, and posted to the battery in Mauritius in the following year. He was promoted to be 1st Lieutenant in 1836, and continued to serve in Mauritius until 1842. On the 31st August, 1841, he married, at Mauritius, Sophia Charlotte, daughter of the Rev. Mark de Joux. In 1845 he retired upon half-pay, and died at Northampton on the 16th February, 1849. His wife survived him. There was no issue of the marriage.

VI. Thomas Edward Fyers, born at Gibraltar on the 15th January, 1820; settled in Mauritius as a planter. He was twice married. First, at Mauritius, on 31st August, 1842, to Isabella Eliza, second daughter of the Rev. Mark de Joux, and sister of Mrs. Robert Morse Fyers. She died in 1870. Secondly, on the 27th December, 1875, to Selina, widow of R. G. Cummins, and daughter of B. N. Kyshe. She is still living in Mauritius. Thomas Edward Fyers died in 1887, leaving issue by his first wife :—(1). Ada Isabel Fyers, who married George Perromat, and is living at Mauritius with three children, a son and two daughters.

By his second wife Thomas Edward Fyers had three children, two sons and a daughter. One of the sons died young.

(2). The other, Thomas Edward Fyers, born in 1879, is in the Soudan Government Railways.

(3). The daughter, Alice Louisa, born in 1878, married, in 1900, FRANCIS D. THOMSETT, Engineer Commander, R.N., son of Lieut. H. G. Thomsett, R.N., C.M.G., Member of Council at Hong Kong.

VII. Renée Theresa, born at Gibraltar on the 26th January, 1822; married at Mauritius, on the 12th February, 1840, Lieut. HENRY AUSTIN TURNER, Royal Artillery, afterwards Major-General. He was the second son of the Rev. Joseph Turner, D.D. and J.P., Vicar of Duleek and Rector of Raddenstown, co. Meath, and grandson of Timothy Turner, of Dublin, who died in 1785. General Turner died at Bath in 1875, aged 60 years. His widow died at the same city in 1886. There were twelve children of the marriage, but many of them died young, and three were carried off in a few weeks by yellow fever in the epidemic at Barbados of 1852. The survivors were :—

(1). HENRY FYERS TURNER, born at Mauritius on the 8th November, 1840; was commissioned in the Royal Engineers on the 23rd December, 1857, in the writer's batch. As a Colonel he was Commanding Royal Engineer of the North-Eastern District at

York, and later (1894—1897) was Deputy Inspector-General of Fortifications, a post occupied by his great-grandfather, Lieut.-General William Fyers, nearly a century before. He was created a C.B. in 1896. He married, in 1864, Harriet, eldest daughter of the Hon. J. G. Spragge, Vice-Chancellor of Ontario, Canada, and afterwards Chief Justice. She died at Inverness in 1872. Colonel H. Fyers Turner died at Bath on the 17th September, 1909. He had issue:—

(*a*). H. Katherine Theresa Turner; married to Lieut.-Colonel A. C. PAINTER, Royal Engineers. (*b*). HENRY HAMILTON FYERS TURNER, Major, 2nd Lancers (Gardner's Horse), D.A.Q.M.G., Headquarters, India. He married Effie, daughter of Colonel Campbell Ross, of the Bengal Staff Corps, and has issue, a son, Reginald Hamilton Fyers Turner, born in 1897. (*c*). Eleanor Ada Turner, died in 1889.

(2). Eliza Georgina Louisa Josephine Turner, born at Fort George, Grenada, West Indies, on 16th July, 1849; died unmarried at Bath in 1908.

(3). ALFRED HEYLAND PARRATT TURNER, born at St. George's Bermuda, is a Colonel in the Royal Artillery. He married May, daughter of Major-General EUSTACE HILL, Madras Staff Corps, and has a family of four children:—(*a*). Eustine Turner, married to Lieut. C. GOULDEN, R.N. (*b*). HORACE TURNER, Lieut., Indian Army. (*c*). REGINALD AUBREY TURNER, 2nd Lieutenant, Royal Engineers. (*d*). TIMOTHY FYERS TURNER, Cadet, R.N.

(4). Emmeline Flora Theresa Turner; married, first, G. Trask, and, secondly, B. Creasy.

(5). ARCHER LHOYD MARISCHAL TURNER, born at St. George's, Bermuda, in 1860 (twin with preceding), is a Colonel, Royal Artillery. He married Mary, daughter of Lieut.-Colonel E. P. ST. AUBYN, of the 10th Madras Native Infantry. She died in 1907. He has a son—(*a*). Archibald Turner, born in 1898.

VIII. Charlotte Sabine Fyers, born at Jersey on the 11th of November, 1824; married at Mauritius, on the 2nd of February, 1842, GEORGE DRAKE WAINWRIGHT, of the Hon. East India Company's Service, son of the Rev. John Drake Wainwright, Rector of Sturmer, Essex. He died at Bath in 1859, aged 47 years, and his widow died in the same city in 1892. There were six children of the marriage, viz.:—

(1). Anne Sabine Wainwright; married at Bath, in 1863, LANGRISHE FYERS BANKS, Secretary, Royal Hospital, Kilmainham, Dublin, and had issue. She died on the 6th July, 1882.

(2). CHARLES B. FYERS WAINWRIGHT was commissioned in the Royal Artillery as Lieutenant in January, 1867. He died at Sitapur, India, unmarried on 29th May, 1869.

(3). Alice Louisa Wainwright; married Arthur Wilson, of Sandridge

Park, Devon, and has issue, a daughter, Gladys Sabine Fyers Wilson.

(4). Theresa Wainwright; married the Rev. G. Irvine, Vicar of Bulford, Wilts, son of Canon Irvine, of Belfast, and has issue.

(5). George Francis Drake Wainwright, born in 1856, died unmarried at Bath in 1887.

(6). Edward Wainwright, born in London in 1858, is in the Agricultural and Mines Department, Sydney, N.S.W. He married a daughter of Capt. Fanning.

IX. AMELIUS BEAUCLERK FYERS, born at Jersey on 12th July, 1829, Colonel, Royal Engineers, Surveyor-General of Ceylon and Member of the Legislative Council, will be noticed separately. He married, first, at Mauritius, in 1850, Anne Eliza, daughter of Capt. WILLIAM BROWNRIGG. She died at Colombo, Ceylon, in 1869. Second, Adelaide Isabella, youngest daughter of Colonel Forbes Leith, of Whitehaugh, Aberdeenshire, at Colombo, in December, 1872. She died at Aberdeen in November, 1874. Colonel Amelius B. Fyers died at Bath on the 5th April, 1883, having had issue by his first marriage :—

(1). Mary Anne Louisa Fyers, born in 1851 ; married —. Ffinch, of the Ceylon Civil Service, and has issue.

(2). William Amelius Beauclerk Fyers, born in October, 1852, was in the Ceylon Civil Service. He died at Trincomalee in July, 1886. He married, first, Eliza Bogue, by whom he had two daughters and a son, Harry Amelius Beauclerk. Secondly, Cissy Neville, by whom he had Amelius Beauclerk.

(3). Charles Cornwallis Meadows Fyers, born at Mauritius in February, 1854. He was in the Ceylon Civil Service. He married Annie Mitchell, by whom he had three sons and a daughter.

(4). Renée Sabine Fyers, born at Mauritius in July, 1855. She married H. C. P. Bell, Ceylon Civil Service, and had issue, three sons and three daughters.

(5). Laura Isabella Fyers, born at Mauritius in September, 1857. She married C. M. Lushington, Ceylon Civil Service, and had issue, four sons and three daughters.

(6). Henry Francis Clifton Fyers, born at the Curragh, Ireland, in March, 1859. He was in the Ceylon Forest Department. He married, in London, Alice Mary, daughter of James King, of Belsize Park Gardens, and late of the Cape.

(7). Frances Henrietta Fyers, born at the Curragh Camp, Ireland, in October, 1860. She married P. G. PARKINSON, who was, it is stated, an officer in the Army, but I have not as yet been able to trace him. He had issue, three daughters and a son. She died in October, 1890.

(8). Robert Montague Fyers died young.

(9). Adelaide Hay Fyers, born at Malta in February, 1865. She married C. Hodgson, with issue, two sons and two daughters.

(10). Kate Minnie Fyers, born at Colombo, Ceylon, in August,

1867. She married F. Simpson, Ceylon Civil Service, and has issue, two daughters and a son.

By his second wife Colonel Amelius Beauclerk Fyers had—

(11). Amelia Adelaide Wilhelmina Helen, born in Aberdeen in November, 1874.

MAJOR EDWARD FYERS, R.E.

Edward Fyers, the younger son of Lieut.-General William Fyers, was born at Gibraltar on the 8th January, 1791. It may be remembered that his sister Sarah (Mrs. Cornelius Mann) mentions the grand doings that took place at his christening, when H.R.H. the Duke of Kent was his godfather. It may be presumed that the boy followed in due course in the footsteps of his brother Thomas, was sent home at an early age to be put to school, and was prepared for the entrance examination for Woolwich at the Blue Stile at Deptford. It was then usual for those lads who succeeded in passing the examination to go for the first year of their cadetship to the College at Great Marlow, and then join at the Royal Military Academy at Woolwich. Fyers obtained a commission as 2nd Lieutenant in the Royal Engineers on the 22nd April, 1808, and was stationed at Dover.

He was then a little over 17 years of age, and was soon to see active service. In January of the following year his brother Thomas arrived home with the army from Coruña. At this time the British force at Lisbon had been reduced to 8,000 men, under Lieut.-General Sir John Cradock. On the advance of the French into Portugal, Cradock concentrated his small force at Passo d'Arcos, at the mouth of the Tagus, so that in case of necessity he might be in a position to embark his troops. But the British Government had no intention of abandoning the whole continent to Bonaparte, and determined to take vigorous action in the Peninsula. It was decided at once to strengthen Cradock's force. A division, under Major-General Sir John Coape Sherbroke, was despatched to Lisbon, and Edward Fyers accompanied it.

On Sherbroke's arrival at Lisbon he received orders to go on to Cadiz, and offer to land his men and assist the Supreme Junta of Seville in resisting the invader. The Spaniards were too proud to accept the assistance offered, and Sherbroke returned with his division to Lisbon and joined Cradock's command.

Strengthened by this reinforcement, Cradock was able to take up a position at Saccovino, covering Lisbon, and thus give confidence to the Portuguese, who had been in a state of panic. Their apprehensions had been raised by the withdrawal of the British Army from Spain after Coruña, and the subsequent invasion of their country by the French, under Marshal Soult.

By the time Sir Arthur Wellesley arrived in Lisbon to take supreme command of the allied armies, on the 22nd April, 1809, Marshal Soult,

having captured Oporto, was preparing for an advance through Coimbra on Lisbon. Wellesley decided to make a rapid march on Oporto and drive Soult out of it. Edward Fyers was with the army in this campaign. He took part in the passage of the Douro, the capture of Oporto, and the pursuit of Soult, until the French Army had been driven out of Portugal and across the frontier into Spain, with the loss of all its impedimenta, and utterly demoralized.

On the return of the British Army to Lisbon after this brilliant exploit, Wellesley concentrated his forces on the Tagus and arranged with the Spanish General, de Cuesta, to advance on Madrid. He accordingly moved to Placentia in June, where the armies were prepared for further advance. Fyers was with the army in the advance, and was present at the Battle of Talavera on the 27th and 28th July. But when the desertion of General Cuesta and the Spanish Army compelled Wellesley to retire after that battle, and the army was on the line of march, Fyers was seized with a serious illness and sent to Lisbon. This attack culminated in brain fever, and he was sent home in October, 1809. Unfortunately the results of the illness affected him in after life, and from time to time he had a tendency to fits of mental aberration.

He returned to duty at Dover in December, 1809, but he only remained there a short time. In March, 1810, he was moved to Landguard Fort, near Harwich, in the Eastern Military District, and in the following year was appointed aide-de-camp to his father, at that time the Commanding Royal Engineer in Ireland.

Two years later he was sent to Plymouth. On 21st July, 1813, he was promoted 2nd Captain, but the year after he was again attacked by his malady, and had to go on sick leave for a lengthened period. He resided in Edinburgh during part of this time, and he seems so far to have recovered that in 1818 he was attending lectures at the Edinburgh University, and his father began to hope that he was permanently cured.

This was not the case, and a severe relapse in 1819 decided General Fyers to apply for his son's transfer to the Invalid Corps. In consideration of Edward Fyers' services in the Peninsula, the Duke of Wellington approved of the transfer on the 15th December, 1819.

On the abolition of the Invalid Corps in December, 1831, Edward Fyers was placed on the Retired Full Pay List. He was then living in Inverness-shire, and appears to have been in good health, for he applied for a Medical Board with a view to his rejoining the effective strength of the Corps, but he was told there was no vacancy. Five years later he contributed a paper to the *United Service Magazine*. He received a brevet majority on 28th November, 1854, in recognition of his Peninsula service, and on the 12th of the following month he died, unmarried, at Inverness.

SARAH FYERS, WIFE OF MAJOR-GENERAL CORNELIUS MANN, R.E.

Sarah Fyers, second daughter of Lieut.-General William Fyers—his eldest daughter had died young—was born in London on the 2nd December, 1784. She has told her own story, up to the time of her marriage, in her Reminiscences. She married Lieut. Cornelius Mann, R.E., at Gibraltar, on the 15th July, 1801.

Cornelius was the second son of General Gother Mann (1747—1830), who was Inspector-General of Fortifications and a Colonel Commandant of the Corps. He had declined a baronetcy offered to him for his services.*

The elder brother of Cornelius, Gother Kerr Mann, was in the Royal Artillery, and died on passage from the West Indies in 1804. Other brothers were :—John, in the infantry, and Frederick William, in the Royal Staff Corps. The last named was the father of Major-General Gother Mann, C.B., R.E., who died in 1881, and whose daughter married Major D. C. Courtney, R.E. A sister of Cornelius was Miss Ann Mann, well known to some of the older officers of the Corps now living, as the housekeeper at the Royal Military Academy at Woolwich. The Manns, like the Fyers, were a very military family, and they have been well represented in the Corps and in the Services. In the index of the *Army List* for 1812 there are no less than nine Manns given. Through the marriage of Sarah Fyers with Cornelius Mann, several representatives of the Mann family in the Corps are descendants of Thomas Fyers, Overseer of the King's Works in Scotland.

Cornelius Mann was born in Antigua, in the West Indies, in November, 1779. He was commissioned in the Royal Artillery as 2nd Lieutenant in April, 1795, and was transferred to the Royal Engineers in February, 1796. He was favourably reported upon by Major-General F. G. Mulcaster, towards the close of that year, as "a very deserving young man." He went to Gibraltar in May, 1799, and in December, 1802, the year after his marriage, was promoted to be Captain-Lieutenant. In July, 1803, he was ordered home, his brother-in-law, Thomas Fyers, taking over the command of his company at Gibraltar. While at Gibraltar his eldest child, Charlotte Anne, was born. On returning home he was stationed at Fort George, near Inverness, where two more daughters were born. On the 10th July, 1804, he was promoted 2nd Captain, and at the end of 1805 he was sent to Athlone. He was promoted 1st Captain in July, 1806, while at Athlone, where his eldest son, Gother Kerr, was born.

On leaving Ireland in 1811, Capt. Cornelius Mann was appointed aide-de-camp to his father, General Gother Mann, then Inspector-General of Fortifications. This post he held till the end of 1814. He

* See *Dictionary of National Biography.*

had been promoted Brevet Major in June, 1813, and Regimental Lieut.-Colonel in September, 1814. When he came to London he took a house at Lewisham, in Kent, which was a convenient neighbourhood, as his duties lay at the Tower of London. His father continued to be Inspector-General of Fortifications until his death in 1828, and although Cornelius was obliged to cease being his aide-de-camp on his promotion to a regimental lieut.-colonelcy, he continued to be a member of his staff, as he was appointed Assistant Inspector-General of Fortifications and a member of the Tower Committee. He continued to hold these appointments for no less than 16 years. He became a full Colonel in 1825, and as he remained at the Tower for two years after his father's death, it can only be presumed that his services there were deemed indispensable. Thus for 19 years his office had been at the Tower of London and his house at Lewisham, where seven out of his 11 children were born.

In September, 1830, he was sent to Gibraltar as Commanding Royal Engineer, and for seven years Mrs. Mann again occupied—this time as its mistress—the home of her childhood. She was able to recall her own young days, when she and her sisters were married in their teens from the Commanding Royal Engineer's quarter, and to reproduce the situation by marrying two of her own daughters from that house.

Cornelius Mann became a Major-General on the 10th January, 1837, but continued as Commanding Royal Engineer at Gibraltar until the following September. On returning home he was placed on the Unemployed List. He resided at Shooter's Hill with his wife and unmarried daughters. His youngest son, James Robert Mann, was then about to join the Royal Military Academy at Woolwich as a cadet.

Major-General Cornelius Mann died at Shooter's Hill, Woolwich, three years later, and was buried in Plumstead Churchyard, where there is a stone tablet to his memory, bearing the following inscription :—

In this vault rest the remains of
CORNELIUS MANN,
Colonel in the Corps of Royal Engineers.
Died 5th October, 1840.
Aged 61 years.

His wife survived him six years, dying at Binstead, Isle of Wight, on the 6th September, 1846.

There were eleven children of the marriage—six sons and five daughters, viz. : —

I. Charlotte Anne Mann, born at Gibraltar on the 25th June, 1802. She died unmarried.

II. Eliza Mary Mann, born at Fort George, Inverness, on the 23rd

of February, 1804. She married, in 1835, CHARLES DEMPSEY, Army Surgeon.

III. Sarah Mary Mann, born at Fort George, Inverness, on 24th July, 1805. She died unmarried.

IV. GOTHER KERR MANN, born at Athlone, Ireland, on 20th February, 1809. He was a Captain in the Bombay Horse Artillery, from which he retired to settle in New South Wales. He married Mary Hely, and had issue :—

(1). Gother Frederick Mann; married Lucy Campbell, and had issue :—

(*a*). Gother F. Campbell Mann, who married Grace Doyle, and has a daughter, Claire Loyalty Mann. (*b*). Arthur P. A. Campbell Mann. (*c*). Jeffry Campbell Mann. (*d*). Georgina Blanche Campbell Mann, who married Arthur Lungley, and has a daughter, Lucy Joan. (*e*). Elsie Mary Campbell Mann, who married ALEXANDER MACLEAN, Staff Surgeon, R.N. (*f*). Millicent Fanny Campbell Mann; married Robert Logan Ranken, with issue, three sons and two daughters. (*g*). Margaret Campbell Mann; married Francis James Irwin, with issue, one son. (*h*). Dorothy Lorn Campbell Mann; married Lieut. CYRIL CALLAGHAN, R.N. Issue, a daughter.

(2). Leslie Gordon Mann.

(3). Reginald Fyers Mann; married Alice Stewart. Issue, two daughters.

(4). Herbert William Mann; married Mary Brady. Issue, a son and four daughters.

(5). John Cornelius de Saumarez Mann.

(6). Georgina Alice Mann; married Mordaunt William Shipley Clarke, M.A., and has issue :—

(*a*). William Brauthwaite Clarke; married Elinor Harriott, and has issue, two daughters. (*b*). Gother R. Carlisle Clarke, M.B. (*c*). Mordaunt Lindsay Clarke. (*d*). Blanche Mabel Alice Clarke; married the Rev. David Davies, M.A., and has issue, a daughter and a son. (*e*). Nellie Moreton Clarke. (*f*). Nora Katherine died.

(7). Captain Gother Kerr Mann had six other daughters, all unmarried.

V. Alicia Anne Mann, born at Lewisham, Kent, on 21st March, 1811; married on 5th November, 1835, at Gibraltar, Captain GEORGE EDWARD THOROLD, 92nd Highlanders, and had issue :—

(1). REGINALD GOTHER THOROLD, Major-General, R.E. He married Charlotte Elton, daughter of Lieut. J. F. Elton and his wife Charlotte Young, and granddaughter of Vice-Admiral James Young. He had issue, a son and a daughter.

(2). Edith Rhoda Thorold, who married the Rev. E. Cole, and has issue :—

Two sons. (*a*). Rancely Cole, in the Church, and AUBREY DU P. T. COLE, Captain in the 6th Dragoon Guards.

VI. Harriet Louisa Mann, born at Lewisham, Kent, on 25th February, 1813; unmarried.

VII. CORNELIUS MANN, born at Lewisham, Kent, on 18th October, 1815. He successfully passed the final examination at the Royal Military Academy at Woolwich, and was recommended for a commission in the Corps, but died before he was gazetted.

VIII. William Mann, F.R.A.S., born at Lewisham, Kent, on the 25th October, 1817, was, in 1837, appointed Second Assistant Astronomer at the Royal Observatory, Cape of Good Hope, and, 10 years later, First Assistant. He married, in 1853, Caroline, daughter of Sir Thomas Maclear, Astronomer at the Cape. He died in South Africa, leaving a family of six children, three sons and three daughters. Two of the sons and two of the daughters are married.

IX. John Frederick Mann, born at Lewisham, Kent, on the 15th December, 1819, settled in New South Wales. He married Camilla Mitchell, and has had issue:—

(1). Livingstone Mann; married Harriet Shaw, issue, a son and daughter. (2). Gother Victor Fyers Mann; married Mabel Newman, and has a daughter. (3). Mary Emily Blount Alicia Mann; married F. Bell, and has two sons.

X. EDWARD PETER MANN, born at Lewisham, Kent, on the 2nd January, 1822, joined the 92nd Highlanders in 1846. He married Isabella Wright, and had issue:—

(1). Horace Mann; married Madeline Lee, and has issue, a daughter.

(2). Allan Mann; married Nina Brown, and has issue, two sons and four daughters.

(3). Edward Mann.

(4). Alice Georgina Mann; married LEONARD PARTRIDGE, R.N., and had issue, a son (*d.s.p.*) and two daughters.

(5). Edith Mann; married F. WHITEHOUSE, R.N., and has a son, EDWARD WHITEHOUSE, R.N.

(6). Florence Mann; married Captain LUCAS, R.N., and has a son, CHARLES LUCAS, R.N.

(7). Amy Adeline Mann.

XI. JAMES ROBERT MANN, born at Lewisham on the 9th March, 1823, is a Major-General and C.M.G., late of the Royal Engineers. He married, in 1848, Caroline Boyd Geddes, and has had issue:—

(1). GOTHER FYERS MANN, born at Montreal, Canada, in 1849; Lieut.-Colonel, Royal Engineers.

(2). ALLAN CORNELIUS THOROLD MANN, born at Milford, Hants, in 1851, was a midshipman, R.N., and went down in H.M.S. *Captain* in 1870.

(3). Harry P. W. Mann, died young.

(4). Georgina Louisa Mann, born at Mauritius, in 1856; married COLONEL PARKYN, R.A., and has two sons.

(5). James R. G. Mann, died young.

(6). ARTHUR FREDERICK MANN, born at Mauritius in 1859, was in the Royal Munster Fusiliers, and retired as a Major.

CHARLOTTE ANNE FYERS, WIFE OF VICE-ADMIRAL JAMES YOUNG, R.N.

Charlotte Anne Fyers, second daughter of Lieut.-General William Fyers, was born at Gosport on the 8th July, 1786. She went with the family to Gibraltar in the following year, and remained there until after her marriage in 1802. She was a remarkably pretty girl, and was known as the "Beauty of the Rock." She was not much over 16 years of age when she married, at Gibraltar, Capt. James Young, R.N., of Barton End House, near Nailsworth, Gloucestershire, a younger brother of Admiral Sir William Young. Born in 1766, he distinguished himself when, in command of the frigate *Ethalion* (38), in October, 1799, he chased the Spanish frigate *Thetis*, laden with treasure from Mexico, worth £600,000, brought her to action, and, after an hour's running fight, succeeded in capturing her. His own share of the prize money exceeded £40,000. He became a Vice-Admiral of the White, and died on the 8th March, 1833. His widow died at Stanley Hall, Gloucestershire, the seat of her son-in-law, the Rev. S. Lloyd, on the 18th September, 1850, and was buried at Horsley, Surrey.

There were twelve children of the marriage, viz. :—

I. JAMES YOUNG, born 15th March, 1803, was Lieut.-Colonel of the 65th Regiment. He married, in 1846, Ann E. Longworth, and died 16th June, 1882.

II. WILLIAM FRANCIS YOUNG, born on 1st June, 1804, was a Commander, R.N. He married on the 4th June, 1834, the eldest daughter of Josiah Gaston Guest, of Warmington Grange, Gloucestershire. He died on 4th August, 1881.

III. HENRY YOUNG, born on 21st July, 1805, was commissioned in the 24th Foot in 1825, and retired as Lieut.-Colonel of the regiment in 1858. He married, on 8th July, 1831, Rosina Frances, third daughter of Henry Martin, of Sidmouth. She died at Ventnor in 1862, and Colonel Henry Young died at Trematon Castle, Cornwall, the residence of his eldest sister, Mrs. Jervis Tucker, in 1866. He had a family of eight children—five sons and three daughters, viz. :—

(1). Henry Chapman Young, born in 1832 ; died, unmarried, in 1855.

(2). Edward William Young, born in 1833 ; married Geraldine Lloyd.

(3). Rosina Harriet Young, born in 1839 ; married in 1865, at Madras, John Herbert Latham, and had issue, two sons and two daughters.

(4). Augustus Murray Young, born 1841, was in the Church. He died, unmarried, in 1871.

(5). Sophia Young, born in 1842.

(6). Alice Stavely Young, born in 1844; married, in 1867, George Gordon, Esq., and had issue:—(*a*), A daughter, Alice Elizabeth Gordon, who married E. B. Gould, and (*b*), a son, Douglas Gordon, *d.s.p.* Mrs. Gordon died in 1871.

(7). Francis Walter Young; born in 1845; died in 1868.

(8). JAMES BROWNING YOUNG, born in 1847, was a Captain, R.N. He married, in 1879, Margaret, second daughter of the Rev. C. Gambier, and had issue:—(*a*). MAURICE J. D. YOUNG, born in 1880; in the Indian Army. (*b*). Cicely Margaret Young. (*c*). MARTIN YOUNG, born in 1884; in the York and Lancaster Regiment.

IV. Sabine Anne Young, born 27th July, 1806; married at Horsley, Surrey, on the 16th October, 1830, Capt. JOHN JERVIS TUCKER, R.N., afterwards Admiral, D.L., and J.P., of Trematon Castle, Saltash, Cornwall. They had eight children, of whom seven were daughters. The only son and second child was JERVIS TUCKER, born in 1883; he was commissioned in the Royal Artillery in 1854, saw service in the Crimean War, went on half-pay in 1860, and has since retired from the Service. The Admiral died in 1886.

V. EDWARD YOUNG, born in 1808; was a Lieutenant, R.N. He married a Miss Baker, and died in 1842.

VI. CHARLOTTE YOUNG, born on 30th December, 1809; married, first, at Horsley, Surrey, on the 9th July, 1835, Lieut. JAMES F. ELTON, of the 40th Foot. He died about 1844. Second, her cousin, James Kerr, Barrister. By her first husband she had four children:—

(1). FREDERICK ELTON, born in 1836, was commissioned in the Royal Artillery in November, 1854. He served in the Crimea, receiving the medal and clasp, Knight of the Legion of Honour, and Turkish medal; also in the Egyptian Campaign of 1882, for which he was mentioned in despatches, created a C.B., and received the medal with clasp, the 3rd Class of the Medjidieh, and the Khedive's Star. He retired as a Colonel.

(2). Charlotte Elton.

(3). Ada Elton, who married the Rev. —. Hales.

(4). Julia Elton.

VII. Sophia Young, born on 14th February, 1811; married at Horsley, Surrey, on the 14th January, 1837, Lieut. BARTHOLOMEW JAMES SULLIVAN, R.N., afterwards Admiral Sir B. James Sullivan, K.C.B., who died in 1890. She had four children—two daughters and two sons, viz.:—

(1). Frances Emma Sullivan.

(2). Catherine Sabine Sullivan, who married Wallace French.

(3). JAMES YOUNG FALKLAND SULLIVAN, R.N.

(4). Thomas Edward Sullivan.

VIII. Eliza Young, born in 1812, fourth daughter of the Admiral; married the Rev. S. Lloyd, of Stanley Hall, Gloucestershire. He died

in 1863, and his widow some years later (1874 ?). They had four children :—

(1). A son, W. H. Lloyd.
(2). Clara Lloyd, born in 1835.
(3). E. Rose Lloyd, born in 1837.
(4). E. Frances Lloyd.

IX. Louisa Young, born in 1813 ; married on the 30th August, 1835, the Rev. Joseph Henry Jarrard, D.C.L.

X. Elizabeth Young, born in 1815 ; died in 1850, at Clevedon, Somerset, from the effects of a fall from her horse. She was a very handsome woman, but unmarried.

XI. Harriet Young, born in 1817 ; married in 1841, at Horsley, the Rev. George J. Comyns, of Bishopsteignton, Devon. He was Vicar of Exmouth, and later of Ledbury.

XII. Frances Young, born in 1820 ; married, on 6th May, 1840, the Rev. William R. Sweetland, of Newton Abbott, Devon.

ELIZABETH LYDIA FYERS, WIFE OF GENERAL THE HON. WILLIAM HENRY GARDNER, COLONEL COMMANDANT, R.A.

Elizabeth Lydia, third daughter of Lieut.-General William Fyers, was born at Gosport on the 24th February, 1788, while her father was stationed there. She was the baby of the family when soon after her birth they moved to Gibraltar, and she never left the Rock until after her marriage.

Her eldest sister, Sarah, had been married at Gibraltar to Lieut. Cornelius Mann, R.E., on 15th July, 1801, some months before she was 17 years of age. Her sister Charlotte had been married at Gibraltar to Capt. James Young, R.N., in 1802, at a little earlier age, but Lydia outdid them both, and was married at Gibraltar on the 20th February, 1804, when she was not quite 16 years old. Her husband was the Hon. William Henry Gardner, third son of the first Baron Gardner, the famous Admiral, who was rewarded with a peerage for his distinguished services. Born in 1774, he was then a Captain-Lieutenant in the Royal Artillery, in which his first commission was dated September, 1793, and in September of the year of his marriage he was promoted Captain. I have not got a record of his services, but I am informed that he served a good deal in the Horse Artillery, and his war service was limited to the Expedition to Walcheren, in which both his wife's father and uncle served, the latter being his own contemporary in the Regiment.

In the reign of William IV. Colonel Gardner held office in the household of Queen Adelaide. He was promoted to be Major-General in January, 1837, became a Colonel Commandant of the regiment in April, 1846, was promoted Lieut.-General in November of that year, and General in June, 1854.

His wife died in 1849. He survived her some years, dying on the

15th December, 1856, at Bishopsteignton, Devon, where his epitaph may be seen.

They had a family of 10 children, five sons and five daughters, as follows:—

I. Anne Europa Gardner, born in 1804, at Europa Point, Gibraltar, during the plague; married, in 1829, Capt. (afterwards Vice-Admiral) THOMAS LEWIS GOOCH, R.N., born in 1807, third son of the fifth baronet of Benacre Hall, Wangford, Suffolk. The Admiral died in 1876, but his wife died much earlier (in 1839), leaving an only child:—

(1). THOMAS SHERLOCK GOOCH, of Tickhill, York, born in 1831, was a Captain in the Royal Navy. He married, in 1861, Catherine Lydia Mackenzie James, born in 1842, daughter of Capt. JOHN JAMES, 85th Foot, and sister of the late Major-General E. R. JAMES, R.E. Capt. Gooch died in 1897, with issue:—(*a*). Anne Georgiana Sherlock Gooch. She married, in 1886, her cousin, Philip Edward Scholfield (died in 1896), of Maltby Hall, Yorkshire, only son of the Rev. P. Scholfield (died in 1881), Vicar of Goulceby, Lincolnshire, by Georgiana Anne (died in 1878), youngest daughter of Sir Thomas Sherlock Gooch, fifth baronet. (*b*). Catherine Marion Sherlock Gooch. (*c*). JOHN SHERLOCK GOOCH, Major in the Royal Artillery, who married Ella Cecilia Piercy Drury, daughter of Ward Chipman Drury, of St. Johns, New Brunswick.

II. Eliza Gardner, born in 1806; married, in 1830, the Rev. John Buckner, M.A., of Wyke House, Sussex. He died in 1878, and his wife died in 1889. There were four sons and four daughters, the issue of this marriage, viz.:—

(1). Charles Buckner, *d.s.p.*
(2). Georgiana Buckner, who married —. Firminger, with issue.
(3). Minnie Buckner, married —. Sale, with issue.
(4). Augusta Buckner, married —. Gascoyne, with issue.
(5). Anne Buckner.
(6). JOHN BUCKNER, R.N.
(7). WILLIAM BUCKNER, R.N., married.
(8). Richard Buckner.

III. Susan Amie Anne Gardner, born in 1810; married in 1829, at Malta, Lieut. JOHN JAMES, born in 1807, 85th Foot, of Shelford, near Cambridge. He retired from the Army as a Captain in 1837, after 12 years' service, to become a railway engineer, under Isambard Brunel. He took part in the making of the Great Western, Bristol and Bridgwater, Taunton and Exeter, and other railways; he was consequently frequently shifting his home to suit his work. He was a great sportsman, fishing, shooting, hunting, and tandem driving being his favourite amusements. He died from the effects of an accident in the hunting field, in 1850, at the comparatively early age of 42 years. His widow survived him more than 40 years. She died and was buried at Bournemouth in 1891.

Their family consisted of eight children, three sons and five daughters:—

(1). The eldest child, Margaret Louisa James, born in 1830, was unmarried, and died in 1892.

(2). JOHN WILLIAM JAMES, born in 1831, was a Captain in the Navy. He married his cousin, Eleanor Gardner, and died in 1877, leaving no issue. His widow died in 1892.

(3). EDWARD RENOUARD JAMES, born in 1833, entered the Corps of Royal Engineers in December, 1851, and retired as a Major-General in October, 1882. He married, first, Eleanor Fawcett, and had issue one child, (*a*), Eleanor Amie James, born in 1864; second, Sophia Penrose Coode, in 1891. He died on the 14th October last. His services will be separately noticed.

(4). Henry Gardner James, born in 1835; married Catherine Lucy Duncan, with issue, a daughter, (*a*), Marguerite, born in 1875. He died in 1887.

(5). Julia Maria James, born in 1840; unmarried.

(6). Catherine Lydia Mackenzie James, born in 1842; married her cousin, Capt. T. S. GOOCH, R.N., who died in 1897. (See I. Anne Europa Gardner).

(7). Amie Augusta James, born in 1844; married Albert Vandendriesche.

(8). Alice Mary James, born in 1849, was unmarried.

IV. Mary Elizabeth Gardner, died, unmarried, in 1834.

V. WILLIAM BETHELL GARDNER, eldest son of the General, was born in 1815. He was commissioned in the Royal Artillery in 1834. He married in 1840, at Fort St. George, Inverness, Eliza Augusta Anderson, eldest daughter, and co-heir of Colonel Sir Alexander Anderson, C.B. He retired as a Major-General in 1867, and died in 1880. His wife died in 1878. There were 12 children of the marriage —four sons and eight daughters, viz.:—

(1). William Gordon Anderson Gardner, born in 1841.

(2). ALAN GARDNER, born in 1842, served in the Royal Navy. He married, in 1875, Sarah Frances Geddes, daughter of Alexander Geddes. He died in January, 1879.

(3). Eliza Gardner, born in 1845.

(4). Alexander Gardner, died in 1849.

(5). Agnes Gardner, born in 1847.

(6). Susan Gardner, born in 1849.

(7). Mary Gardner, died 1871.

(8). Henry Gardner, died 1854.

(9). Harriette Gardner, born in 1855; married, in 1875, T. Price.

(10). Augusta Gardner, died 1873.

(11). Bertha Gardner, died 1879.

(12). Millicent Gardner, born in 1861; married, in 1882, Donald Cameron, and had issue, (*a*), Sheila Cameron, born in 1884.

VI. ALAN HENRY GARDNER, born 25th August, 1817, Rear Admiral, R.N., and C.B.; married, on 3rd January, 1860, Amy Sophia Elwes, third daughter of John Payne Elwes, of Stoke College, Clare, Suffolk. He died 30th July, 1878, having had issue :—

(1). The Rev. Alan Edward Gardner, born in 1861, Vicar of Bathford, Somerset.

VII. EDWARD CORNWALL GARDNER, born 2nd May, 1820, was a Captain in the Hon. East India Company's Service. He married, on the 14th April, 1843, Louisa Bonamy, daughter of John Bonamy, of Guernsey. He was killed in the second Burmese war in November, 1852, leaving issue :—

(1). Edward Bonamy Gardner, who died in 1864.

(2). Louisa Ellen Gardner, born in 1846; married, in 1877, Lieut.-Colonel BENJAMIN GEORGE HUMFREY, formerly of the 10th Bombay N.I.

(3). Alan Gardner, born in 1849.

(4). Frances Elizabeth Gardner, born in 1850; married, in 1884, Edward Godfrey Seymour Luscombe.

VIII. HERBERT CALTHORPE GARDNER, born 30th August, 1822, Captain in the Hon. East India Company's Service; married, in 1853, Emma Elizabeth Prescott, eldest daughter of Frederick Joseph Prescott, of Oxford Square, London. He died on 28th June, 1857, leaving issue :—

(1). Herbert Prescott Gardner, born in 1854. He settled in Queensland, Australia.

(2). Emma Louisa Gardner, born in 1857. She married, in 1882, James Lindsay Travers, and had issue :—(*a*). James Lindsay Travers, born in 1883. (*b*). Gladys Oliveria Travers, born in 1883. (*c*). Jessie Travers, born in 1886. (*d*). Herbert Gardner Travers, born in 1891. (*e*). Alice Travers, born in 1893.

IX. Augusta Sophia Gardner, born in 1824; married, on 27th August, 1844, Ponsonby Arthur Moore, born in 1816, who died on 3rd May, 1871, having had issue, a son and two daughters :—

(1). Ponsonby William Moore, born on the 29th April, 1846, who succeeded in 1892, as 9th Earl of Drogheda, to his cousin, the 3rd and last Marquis of Drogheda. He married, in 1879, Annie Tower Moir, daughter of George Moir, LL.D., and had issue :—(*a*). Henry Charles Ponsonby Moore, born 21st April, 1884, now 10th Earl of Drogheda. (*b*). Beatrice Ponsonby Moore, born 29th March, 1883.

(2). Lady Agnes Alexandrina Moore, born in 1848; married, in 1873, Sir Robert Anderson, K.C.B., Barrister, Assistant Commissioner of Metropolitan Police, and Head of the Criminal Investigation Department (1888 to 1901), and has had issue :—(*a*). Arthur Ponsonby Moore, born in 1874. (*b*). Alan Seymour Moore Anderson, born in 1876. (*c*). Walter Graham Moore Anderson, born in 1877. (*d*). Matthew Edmond Moore Anderson, born in 1880. (*e*). Alice Mary Agneta Moore Anderson, born in 1885.

(3). Lady Alice Mary Moore, born in 1850; married, in 1870, the Rev. T. Russell Wade. She died in 1871, without issue.

X. HENRY FFARINGTON GARDNER, born 15th May, 1827, was in the Hon. East India Company's Service. He died in 1855.

I fear that the particulars of the descendants of Lieut.-General William Fyers, Colonel Commandant, R.E., which are given after each of the four children of the General referred to in the preceding pages, may be found rather tedious reading for those who are not specially interested in the family, but in that case they will be very naturally skipped. Nevertheless, they are remarkable, not only as showing a notable fecundity in the family, but as recording a wonderful array of sailors and soldiers furnished for the services of the state.

Thus, from four children of the General, the following numbers of officers of the Navy and Army have sprung:—

From Major-General Thomas Fyers	1	officers,	Navy.
	2	,,	Cavalry.
	4	,,	Artillery.
	3	,,	Engineers.
	3	,,	Infantry.
Total	13	,,	Navy and Army.
From Sarah Fyers, wife of Major-General C. Mann, R.E., ...	3	,,	Navy.
	1	,,	Cavalry.
	1	,,	Artillery.
	4	,,	Engineers.
	2	,,	Infantry.
Total	11	,,	Navy and Army.
From Charlotte Fyers, wife of Vice-Admiral James Young, R.N.	4	,,	Navy.
	2	,,	Artillery.
	4	,,	Infantry.
Total	10	,,	Navy and Army.
From Elizabeth Lydia Fyers, wife of General the Hon. W. H. Gardner, Colonel Commandant, R.A.	6	,,	Navy.
	2	,,	Artillery.
	1	,,	Engineers.
	3	,,	Infantry.
Total	12	,,	Navy and Army.
Grand total	46	officers,	Navy and Army.

So that, including the two sons of Lieut.-General William Fyers—Major-General Thomas Fyers, R.E., and Major Edward Fyers, R.E.—there have descended from that officer :—

14	officers	of	the	Royal Navy.
3	„	„	„	Cavalry (including Indian Army).
9	„	„	„	Royal Artillery (including Indian).
10	„	„	„	Royal Engineers.
12	„	„	„	Infantry (including Indian Army).
Total 48	officers	of	the	Navy and Army.

Before going on to an account of the children and descendants of Major-General Peter Fyers, C.B., Colonel Commandant, Royal Artillery, some further particulars of that officer himself, to supplement the rather bald sketch of his career I gave in an earlier part of this paper, will be found, I venture to think, of interest. A grandson of Major-General Peter Fyers, Major Evan Fyers, who has been most kind in assisting me in this part of my paper, has called my attention to *Memoirs of Lord Nelson*, by Joshua White, Esq., of which a third edition was published in London in 1806, and has sent me some notes.

In this third edition appears an advertisement by the author, returning his most grateful thanks to all who had favoured him with communications for the new edition. In this advertisement he says :—

"To Capt. Peter Fyers, of the Royal Artillery, who combines the urbanity of the gentleman with the ingenuity of the artist, his acknowledgments are particularly due. By that officer, who lived for a considerable time on the most familiar footing with Lord Nelson, the author has been favoured not only with many new and important details relative to the engagement before Copenhagen, but the public is likewise indebted to the friendly interest he has taken in the success of this work for a view of the line of defence which protected the Danish metropolis. The sketch from which it is copied was drawn by Capt. Fyers when, in the capacity of Chief Engineer, he accompanied Sir Hyde Parker, Lord Nelson, and the other officers who reconnoitred the Danish line previous to the attack; and, as all the other representations were made up from memory after the action, it is obvious that this circumstance must attach a peculiar value to the engraving now presented to the public, on account of its superior accuracy and truth."

In the narrative of the attack on Copenhagen in 1801 it is stated that immediately after the whole fleet had anchored off Copenhagen, Sir Hyde Parker, Lord Nelson, Capt. Freemantle, Colonel Stewart, the Captain of the Fleet, and Capt. Fyers, Acting Engineer to the Expedition, went in a lugger to reconnoitre the enemy's force. They

persevered in sounding, in spite of a heavy fire opened upon them by the Danes, "until they were satisfied," when they returned to their respective ships. It was on this occasion that the sketch, already referred to, was made, from which the engraving that faces p. 183 in the book was executed.

In a footnote to p. 216 is the following passage:—

"Among the officers who were particularly distinguished by the notice and esteem of Lord Nelson was Capt. Peter Fyers, of the Royal Artillery. . . . In the year 1800 Capt. Peter Fyers, having five bomb-ships under his command, was sent to the Baltic with Admiral Sir Archibald Dickson, in order that the appearance of these vessels off the city of Copenhagen might give weight to the negociations then carrying on by Lord Whitworth, our ambassador at the Danish Court, in consequence of a dispute, which his lordship succeeded in adjusting in an amicable manner.

"On the arrival of Capt. Fyers at Copenhagen, he was invited by Lord Whitworth to his hotel, where he remained about a week. During this interval he availed himself of every opportunity to make himself acquainted with the strength and resources of Denmark, and to obtain such information as might be useful in case of future hostilities with that country. Soon after his return to England his country had occasion to avail itself of the intelligence he had fortunately been so indefatigable in acquiring. He received directions to accompany the armament which sailed in March, 1801, under the command of Sir Hyde Parker, from whom he received the appointment of Acting Engineer to the Expedition."

The following is a copy of the document making the appointment:—

"By Sir Hyde Parker, Knight, Admiral of the Blue, and Commander-in-Chief of a squadron of His Majesty's ships and vessels employed, and to be employed, in the North Sea, and on a particular service.

"Whereas I think it will be highly beneficial to the public service that an engineer should be appointed to the present expedition, not only for the purpose of taking sketches of the coasts, islands, etc., etc., but to do all other duties when landed, otherwise belonging to and required of an Engineer.

"You are hereby required and directed, in addition to your present employment as commanding officer of the Artillery, to take upon you that of an Engineer on the present expedition accordingly.

"Given on board His Majesty's ship *London* at sea, 12 March, 1801.

"H. PARKER.

"Capt. Fyers, of His Majesty's Royal Artillery, ordered to act as Engineer on the present expedition.

"By command of the Admiral,

"B. OSBORN."

On the 31st March, Capt. Fyers, in company with the Admirals, reconnoitred the Danish positions as already mentioned, and made the sketch referred to. A council of war was held on the following day, the 1st April, when a series of questions were put to Capt. Fyers, which are recorded, with their answers, and must have been communicated to the author by Capt. Fyers himself:—

"Q. Can you, with the bomb-ships under your command, get near enough to the city of Copenhagen, particularly to the dockyard, to bombard it to advantage, in spite of these vessels which the Danes have moved in front of the City?

"A. No. The Danish line of defence is so strong, in addition to their batteries, that the bomb-ships would be exposed to total destruction in the attempt, without any chance of success.

"Q. Can you bombard these vessels with such effect as to open to yourself a way to the bombardment of the dockyard?

"A. From the uncertain nature of mortar firing on board ship, it is very improbable that I could do them much harm, and in the attempt I should be expending the ammunition, the great object of which is the bombardment of the City.

"Q. How many of these vessels do you wish cleared away to enable you to get a proper berth with the bomb-ships?

"A. I think if seven of them to the southward were removed I should be enabled to get in so as to range over their dockyard; but the effectual bombardment of Copenhagen would be impossible, unless all of them to the southward of the Crown Islands were cleared away.

"Q. If the whole of them were removed, could you answer for the destruction of the City and dockyard?

"A. Every military, as well as naval, operation must be liable to failure. I cannot, therefore, *answer* for success, but I have the strongest reasons for believing it extremely probable."

It was decided to make the attack the following day. On the morning of the 2nd April, just before H.M.S. *Edgar* led in, Capt. Fyers, who was on board the *Elephant*, suggested to Lord Nelson that it might be of great advantage to have a few carcasses on board the *Elephant* and *Glatton* for their carronades. Lord Nelson at first objected that "his Jacks" would burn their fingers, not being accustomed to the use of carcasse shot. Fyers then proposed to send a proportion of carcasses on board these ships, accompanied by a careful gunner, with directions to instruct the seamen in their use. Nelson consented, and it was due to them that the Danish Commodore's ship, the *Dannebrog*, was set on fire and blew up.

The whole object of the battle of the 2nd April was to make way for the bomb-vessels to bombard the city, in order to compel the Danes to abandon their armed neutrality while the British fleet went for the Russians and Swedes in the Baltic. The destruction of the Danish ships composing the line of defence opened the way for Fyers and his bomb-vessels. These were seven in number, carrying

14 mortars. They anchored within a mile of the dockyard; and the city, the dockyard, and the Danish fleet lay within their range. In this position Fyers remained for three days, every moment expecting a signal to open fire. Thus the compliance of Denmark with the terms offered became a matter of necessity, as the city, the dockyard, and the fleet were at the mercy of Fyers and his bomb-vessels.

After the action of Copenhagen, Lord Nelson presented Capt. Fyers, as a testimony of his friendship, with one of the medals given by him to the officers who served at the Battle of the Nile; also with a print of his head, which Nelson thought more like than any other, and desired Fyers to keep in remembrance of him.* On the return of Sir Hyde Parker to England, Lord Nelson, having succeeded to the chief command, sent a note and his barge to Capt. Fyers, who was most uncomfortably situated in the *Sulphur* bomb-vessel, desiring that he would bring his baggage and swing his cot on board the *St. George*, where Lord Nelson hoped he would live at his table, and take a trip with him to Revel, whither he was going immediately with seven sail of the line. Fyers accepted the invitation gladly, and for three months he was Lord Nelson's guest, experiencing "the greatest affability and kindness" on board the *St. George*, and afterwards in the *Medusa*, on which frigate Lord Nelson hoisted his flag during the Expedition to Boulogne.

In the first attack on the flotilla at Boulogne, Capt. Fyers was wounded in the thigh. The following letters and order of the day, written by Lord Nelson, refer to Fyers and the bomb-vessels :—

"To ESAU NEPEAN, Esq., Admiralty.

"*Medusa*, August 4th, 1801.

"SIR,

"The Enemy's Vessels, Brigs, and Flats (Lugger-rigged) and a Schooner, twenty-four in number, were this morning, at daylight, anchored in a line in front of the Town of Boulogne. The wind being favourable for the Bombs to act, I made the signal for them to weigh, and to throw Shells at the Vessels; but as little as possible to annoy the Town . . .

"The Officers of the Artillery threw the Shells with great skill; and I am sorry to say that Capt. Fyers, of the Royal Artillery, is slightly wounded in the thigh, by the bursting of an Enemy's Shell, and three Seamen are also wounded.

"I am, etc.,

"NELSON AND BRONTE.

"One more of the Enemy's Flats is this moment sunk."

* The original was drawn from life on 8th December, 1800, by de Koster. There is a copy of it in the Royal United Service Institution Museum in Whitehall. Nelson himself wrote of it from Merton on the 2nd February, 1802 :—"There are so many prints of me that it is not in my power to say which is most like the original, for no one of them is like the other, but I rather think a little outline of the head sold at Brydon's, Charing Cross, is the most like me."

"To the SQUADRON.

"5th August, 1801.

"Lord Nelson has reason to be very much satisfied with the Captains of the Bombs, for their placing of the Vessels yesterday. It was impossible that they could have been better situated; and the Artillery Officers have shown great skill in entirely disabling ten of the Armed Vessels out of twenty-four opposed to them, and many others, Lord Nelson believes are much damaged. . . .

"NELSON AND BRONTE."

"To ADMIRAL THE EARL OF ST. VINCENT, K.B.

"6th August, 1801.

"My LORD,

"The wind being easterly, I have determined to give up for a few days my visit to Flushing, and to do my utmost to get the Fencibles afloat . . .

"Capt. Fyers' wound is so very painful, that I am sending him to Deal; I am sorry, at this moment, to lose the services of so useful and zealous an officer. Again and again, I congratulate and rejoice with you on Sir James Saumarez's success.* No small degree of merit must attach itself to your Lordship for nicking the time of sending out that squadron.

"I am, etc.,

"NELSON AND BRONTE."

Space does not admit of further quotations from despatches bearing on the services of Capt. Peter Fyers under Lord Nelson at Boulogne. References to these may be found in *Despatches and Letters of Lord Nelson*, by Sir N. Nicholas. London, 1845. Vol. IV., pp. 432 to 445.

During the time of repose, when Capt. Fyers was recovering from the effects of his wound, which was more serious than at first supposed, he amused himself by superintending the engraving of his drawing of the Danish line of defence at Copenhagen. The publication of this print seems to have excited a good deal of interest, as the following letters from Lords Nelson and St. Vincent show:—

"MERTON, SURREY, April 8th, 1802.

"My DEAR SIR,

"Colonel Suckling has just told me that he has the pleasure of knowing you, and that you had given him reason to believe that you intended favouring me with a visit before your going into Scotland. My relation also tells me that he has seen a proof print of your drawing of the Danish line, which we are all very anxious should come out. It can give offence to no party. Sir Hyde, Freemantle, Colonel Stewart, Doyle, etc., are all enquiring why it is not out. Therefore I have to request you will be so

* The success alluded to is the victory over the combined French and Spanish squadrons off Gibraltar on the night of 12th–13th of the previous month, referred to at length by Sarah Fyers, and celebrated at Gibraltar on her wedding day (see *R.E. Journal* for October last).

good as to tell me who your engraver is, and also the name and abode of your friend who has the management of the print. It will, I am sure, do well. I am glad to hear you suffer no inconvenience from the wound in your thigh. You would regret sincerely the loss of Parker. Longford, I am fearful, will lose his leg. He is still confined by bones continually coming away. With every good wish, believe me, my dear Sir, your much obliged,

"NELSON AND BRONTE.

"CAPT. FYERS, Royal Artillery."

Earl St. Vincent, then First Lord of the Admiralty, on receiving a copy of the print, wrote :—

"I return you many thanks for the engraving of your drawing of the line of defence before Copenhagen, and for the honor of the dedication. I had great pleasure in stating to the Master General of the Ordnance, your meritorious services in the Baltic, which his lordship paid all the attention to that your most sanguine wishes could have taught you to expect."

At a much later date Colonel Peter Fyers published a book of lithographed reproductions of his Sketches of the Highlands, and having sent a copy to Sir Walter Scott, he received the following letter :—

"Sir Walter Scott's respectful compliments to Colonel Fyers, and is greatly obliged to him for the copy which he has received of the picturesque scenery of Loch Lomond and its vicinity, which has vividly recalled to Sir Walter a long train of half-forgotten circumstances of former days. The drawings are done with great spirit and accuracy, if a very unskillful person may presume to judge, and Sir Walter has no doubt that the work will be considered as acceptable to the public as it is creditable to the artist.

"Shandwick Place,
"29th May."

(*To be continued*).

TRANSCRIPT.

THE FINAL STRUGGLE FOR 203-METRE HILL AT PORT ARTHUR.

Translation of an article by Staff-Capt. Kostiushko in the March, April, and May numbers of the *Enzhenernee Zhoornal*.

(*Continued*).

30th November.—During the night the Japanese again made a demonstration in the direction of Pigeon Bay, but without results. At 5.30 a.m. it was noticed that the enemy were cutting the wire entanglement on the southern slope of Visokaya Hill, and in other places where it had been repaired with so much trouble overnight.

The Japanese artillery fire increased in volume before 7 a.m., and on this day it attained the most enormous proportions. On the 30th they both shelled and assaulted the hill in the most determined manner, and neither before nor after did they make such exertions to capture it as on this day.

The weather was clear and sunny; in the still air the constant bursting of the shells completely hid the upper slopes of the hill in clouds of smoke and dust. The hills re-echoed with the explosions of shells, the crackling of machine guns, and the volleys and rapid fire of rifles. General Kondratenko arrived early at the 5th Regiment Headquarters, and through field glasses followed the progress of the fight on Visokaya. Company after company of reinforcements, now almost exclusively composed of sailors, kept on coming up. The telephonists received so many messages from various points along the land front, reporting the fact that from all sides the Japanese were seen to be moving on Visokaya, that they had no time to write them down and despatch them.

At 8 a.m. a desperate attack took place, and the weak point was again the left redoubt. Its defenders were overwhelmed and the Japanese established their flag on it. General Irman, noticing this through his field glasses, sent orders by telephone to "at once drive the Japanese from the left redoubt," and despatched at 8.35 a company of the 28th Regiment, and at 8.45 a company of sailors.

Meanwhile General Tretyakov had already sent the reserves which were with him, in counter-attack against the left redoubt, and the Japanese were driven out. At other points the Russians held their own, yet the Japanese did not retreat, but kept on climbing and planting their flags at various points on the hill, were driven down again, and yet again clambered up with astonishing determination. It is difficult to say how many attacks

were carried out at this time, in fact it was one uninterrupted attack from dawn to midday. Fresh companies came up and melted away with surprising rapidity. The officers of the newly arriving companies were ignorant of the arrangement of the trenches, and consequently General Tretyakov himself had to show them the way and lead their companies into the fight. With marked rapidity and skill he led fresh troops to the most important and dangerous points, and to his action it is due that this most determined assault was gloriously repulsed. His most able assistants at this time were Capt. Stempnevski and Ensign Ermakov.

So many shells fell on the top and the rear slope of Visokaya, that the wires connecting the hill with the 5th Regiment Headquarters and with the town were broken several times. The behaviour of the men of the telegraph company was beyond all praise, and again and again, under heavy fire, they repaired the damage and restored communication. Several of them were decorated on the spot by General Kondratenko for their bravery.

When the telephone was out of action, reports were sent by mounted volunteers. For instance, at 10.30 a.m., when affairs on Visokaya were in a very alarming state, General Tretyakov desired to get into conversation by telephone with General Kondratenko at the 5th Regiment Headquarters. He had just reached the telephone (commandant's) blindage when an 11″ shell fell so near that it damaged the roof of the blindage and cut the wire.

On this General Tretyakov called a mounted volunteer, and sent by him an urgent message that the trenches were wrecked, losses heavy, and reinforcements necessary. As no paper was ready to hand, he wrote this message on a stone.

Owing to the necessity of economizing shells, the Russian artillery was unable to engage with that of the Japanese, and fired comparatively seldom, and then generally at the attacking infantry. The Japanese artillery consequently paid little attention to concealment from view or cover from fire, and, posted within easy range, were able to shell the Russian trenches point blank from morning till night, thereby adding considerably to the difficulties of the defenders. As many as 30 field and mountain guns stood in the open, on the spurs of the Jagged Hills, and in the ravine near Louisa Bay. A Japanese battery standing on Long Hill, at a distance of 1 to 1⅓ miles from the trenches of Flat Hill, caused particular annoyance.

Picture to yourself the state of mind of a rifleman sitting in a trench which is under continual fire from a battery from morning to night. The dust rises in a thick column and fragments of sand-bags fly in all directions. He sees one after another of his brave comrades perish without being able to cause any hurt to the enemy, and with bitterness in his soul awaits his turn to die like his comrades, ingloriously, unnoticed.

The enemy is meanwhile suffering no loss, rifle bullets will not reach him, and the artillery is silent. The rifleman prays to Heaven that the enemy will attack, so that he may at any rate have the satisfaction of seeing them, firing at them, and possibly killing or wounding some of them. But they sit quietly in their trenches at 30 to 50 paces away, and

wait until their artillery shall finally have wrecked the trenches and killed all the defenders.

Of course the men, through their officers, sent urgent entreaties to the artillery to shell such and such a battery and sweep it out of existence. Messages of this description daily came in without end to the head-quarters of the 5th Regiment from various parts of the position, and were passed on at once to the various forts, entrenchments, and batteries. But they were not complied with, as General Biely, finding that his shells were running short, had limited all guns to five rounds each per diem. During the main attacks more rounds were fired, but only with special permission from General Biely. Only the Baranov and the Hotchkiss guns had plenty of shells, but these guns were of small range, and the Baranov guns had the additional objection that they used black powder, and the smoke at once disclosed their positions. Consequently in a work with five or six guns, the artillery commander had to limit himself to firing only from 25 to 30 shells daily, and he therefore considered it his duty not to be drawn into firing at small targets, but to reserve his allowance for use against storming columns, and, with every desire to help the infantry, was obliged to refuse to fire at their request. Occasionally one would take pity and fire two or three rounds, but although naturally these few rounds would do little harm to the enemy, nothing could exceed the delight of the riflemen in the trench. They would exclaim "God bless and preserve that battery!" and with this small encouragement would accomplish their painful, unseen tasks with fresh courage.

To add to the troubles with which these hardly-tried men were overwhelmed, their very trust in their rifles in this miserable fighting went from bad to worse. Cases occurred in almost every company when, at the moment of a Japanese attack, some rifle refused to act. One can hardly appreciate the horror of a soldier who in a critical moment finds that his rifle, his one and only hope, has failed him. This was caused by the fact that the bursting shells filled the air with smoke and dust, which, in the course of a prolonged bombardment, was driven in such quantity into the mechanism of the rifle that it often made it impossible to turn the bolt.

The Japanese, who were waiting quietly in their parallels at a distance of some 30 paces from the trench, would seize a favourable moment and rush forward to the attack. The Russian riflemen, whose arms were kept ready loaded, were able to fire one shot (though this was not invariably the case, for there were many misfires), but on attempting to re-load they would find that they were unable to work their bolts, and so were obliged to rush upon the enemy with the bayonet, without first weakening him with their fire.

And so the men lost confidence in their rifles and took the more willingly to hand grenades, which did not fail them at the critical moment. By the 30th November they had taken such a liking to them that they used them almost exclusively, and with great success, in repelling attacks. On that date alone as many as 7,000 were used on Visokaya Hill alone, and as this expenditure was greatly in excess of the supply, General

Kondratenko, when deciding to send up the seventh thousand, begged the men not to waste them, but to economize them as much as possible. The word "begged" is used intentionally, for the ordinary form of General Kondratenko's orders was "Please, such a one, I beg of you to do so and so."

The grenades were mostly made in the workshop of Lieut. Melik-Parsadanov, but naval Lieuts. Podgurski, Vlasiev, and others also made them, and 800 were prepared by Ensign Ermakov.

The bright sunshine on the 30th November inspired everyone with confidence and a firm belief in success. Each worked honestly, fearlessly, with a feeling that the luck was with him. The gallantry both of the riflemen—especially those of the 5th Regiment, who felt that they must maintain their splendid record and show themselves braver than the rest in the presence of their commanding officer—and of the sailors, was unceasing. A circumstance which contributed to this good result was that, whether acting on his own initiative or on a hint from General Kondratenko, General Stessel sent the former more than a hundred decorations of the Military Order, with which to reward on the spot any who distinguished themselves. This idea gave brilliant results.

At the beginning of the war the men who came into notice in sorties and by deeds of valour, and the wounded who returned to the ranks, were recommended for decorations, but the recommendations were pigeon-holed by the various staffs. For example, those of the 5th Regiment, some dating even from August, were resting peacefully in the headquarters of the 4th Division, and were eventually collected by Colonel Dmitrevski, the chief of the staff of that division, and sent back to the regiment to be arranged in a general roll by companies, and in chronological order of the fighting. It was bad luck that the few invalid clerks, who could be spared from the ranks for work in the 5th Regiment office, had to sit up all night to complete the list, but it was a still greater misfortune that the men, not receiving their rewards and hearing grumbling in the dug-outs at the staffs and headquarter offices, began to lose the hope of ever getting any rewards, and when they saw cases of less distinguished men elsewhere receiving rewards, they lost confidence in the justice of the authorities in considering their actions. "*Bis dat qui cito dat.*" Men volunteered for dangerous enterprises, dreaming that if they escaped alive they would adorn their breasts with the valued crosses of St. George. They performed the exploits, returned alive, were recommended . . . and time passed and the rewards remained a dream! Almost everyone had distinguished himself somewhere, and yet no one had got anything. They felt injured, and ceased to volunteer for sorties. They began to say straight out "Where there are no rewards, do not ask for volunteers; we will go in our turn." And yet the whole success of sorties depends on the men being volunteers, as these alone have the necessary pluck.

In this connection the following order, published by the staff of the 4th Division, may be mentioned:—"Only attacks are to be counted as fighting; the daily interchange of firing is not to be so considered.—Colonel Dmitrevski." It was consequently forbidden to recommend for

decoration wounded men who remained in the ranks during the daily firing, although by their action they ran the risk of being killed or again wounded.

But as soon as the men saw the possibility of obtaining rewards without endless delays, there awoke in them a fresh desire for distinction, and men seriously wounded went back to the ranks after having their wounds dressed, while the numbers who offered themselves as volunteers for even the most dangerous enterprises were so large that it became necessary to cast lots to decide who should be taken.

Tretyakov, to whom Kondratenko entrusted 30 of these crosses for distribution in any cases which might come under his observation, was able to report as follows:—"Crowds of wounded are returning to the ranks, and many men are volunteering for the most dangerous undertakings. Those who have received decorations, by their courage and self-sacrifice, are splendidly influencing their comrades."

The fighting on Visokaya Hill excited the liveliest interest among the inhabitants of Arthur, and the streets of New Town were filled with watchers, who anxiously followed the progress of the fighting. The Commander-in-Chief was not satisfied with the reports of observers who were following the fighting with field glasses from the 5th Regiment Headquarters, but called for information by telephone from the hill itself, and also from Pigeon Bay, whence its western slopes were visible. With all attention so engrossed upon the fighting, Kondratenko did not forget the necessities of those under him, and made arrangements to provide for their wants.

Deeply regretting the error of the 28th November, when the rations had come up too late, he constantly enquired if the men had been fed and whether provisions had been sent up, and on the 29th November he secured a whole horse from the Supply Department, and arranged on the 30th for it to be boiled and cut up into rations, and in this form sent to Visokaya Hill, so that each man up there could draw his portion of bread and meat, and returning to his trench could eat it at his leisure. The value of this consideration was appreciated by the men who had been starving for several days.

At this time the men were getting half a pound of horse flesh twice a week, and on other days only plain porridge and tea, with bread or biscuits. During the fighting it was very seldom possible to get hot food, partly because only two men could be spared for work with the kitchen—a cook and his mate, one of whom had to draw the rations—and these were insufficient to get through the work, and, partly because when the food was ready the fighting prevented the men from attending to it, and when an interval of quiet occurred the food had disappeared, it had either gone bad or had been thrown away for want of vessels to keep it in.

The hot food also gave a lot of trouble, as the men had to go down the hill to get their rations from the kettles, and after eating it had to climb the hill again to their trenches. This took a lot of time, and during the fighting there was no time to spare; each minute was precious, as it was necessary to be constantly prepared to receive the enemy.

Consequently Kondratenko's idea of issuing cold cooked rations proved very convenient, as two or three men were able to bring up the dinners for a whole company. The gratitude to the General of "his overworked and uncomplaining little warriors" knew no bounds.

In many treatises about Port Arthur (all of which, it must be admitted, emanated from one source) an incorrect idea is given of the services of General Kondratenko. The authors endeavour to give him the character of ably carrying out other men's ideas, but this is incorrect. The author of this narrative, who was present with Kondratenko frequently from morning to night in the 5th Regiment Headquarters, both saw and felt that all the wise and inspired arrangements made by him were attributable to himself, and to no one else. He usually first made the arrangements and afterwards reported them to his seniors.

After repulsing the attacks on this day, General Tretyakov was wounded in the back by a splinter and also bruised about the head; but recognizing how great a blow, both materially and morally, his departure would be for the garrison, he paid no attention to his wounds, but remained on the hill doing his duty and earning fresh distinction. When they tried to tell him that in the interests of his health he should go to have his wounds dressed, he answered that he could not consider himself at such a time, when the fate of his position, and incidentally of all Arthur, was in the balance, and that it was not in his power to abandon the hill on which his brave regiment was expiring.

The same shell which wounded the General also struck down the commandant of the hill, Capt. Stempnevski I. After beating off the assault of the Japanese, Tretyakov had just sent a report of what had occurred, and he and Stempnevski, with a few other officers, were standing in his look-out, looking back at a group of men who were collected round the dressing station under cover of the hill. Stempnevski, who had remained with the General and aided him most efficiently in repelling attacks, was in the act of making an entry in his note-book. He had been very careful in noting down every event as it had occurred on Visokaya Hill, and his note-book was a most valuable document, full of details of this historic defence; but, unfortunately, after he was wounded it was left in the telephone blindage, and eventually lost. And so this gallant and methodical worker was employing a spare moment in making notes of the attack just repulsed. Many of the wounded were also crowded close by, having their wounds rapidly seen to in a small niche.

Just then an 11" shell was heard overhead, and before anyone could move it struck the edge of the slope and burst with a deafening report almost in the middle of the group. The force of the explosion threw Tretyakov into the air and then dashed him down so fiercely that he did not at once recover his senses, covering him with earth and small stones. All around, in all sorts of attitudes, and lying one upon another, the whole group lay motionless, and underneath them lay Stempnevski. On all sides were heard groans and harrowing sighs. At the General's feet several of the men lay dead, and with them Ensign Reshetov, of the 2nd Company, 5th Regiment, and a white-coated naval engineer, sitting on the ground, clutching with both hands at his

left groin, was crying aloud with unbearable pain. After about a minute the surgeons, with their assistants and any riflemen who happened to be at hand, were busying themselves among this heap of living human flesh.

General Tretyakov with some difficulty raised himself. They bore the engineer to the dressing station close by, and placed Stempnevski in the niche. The general went up to him and asked him "What has happened to you, Stanislav Julianovich?" "I am badly bruised in the back; I can hardly breathe," answered Stempnevski, closing his eyes. He lay pale and motionless, suffering severe pain. "You must be taken to the dressing station." "No, I beg," answered Stempnevski, and was left lying in the niche. After about an hour he was carried from the hill, and Tretyakov felt that he had indeed lost his right-hand man, for Stempnevski knew Visokaya Hill as no one else knew it, every blindage, every traverse, every yard of it, and therefore his loss was a grievous blow to the General.

By the heroic bravery of the riflemen and sailors, and above all by Tretyakov's skill in applying this quality of the men, and in sending them in timely support of the points where the danger was greatest, this most persistent attack was brilliantly repulsed, in spite of the overpowering superiority of the enemy in both infantry and artillery, and the perseverance with which they had pressed up the hill for four hours continuously. All Arthur rejoiced at the success, and the name of Tretyakov was brought into high esteem. General Kondratenko repeatedly called him "hero" and "brave man," and the 5th Regiment felt great pride in their commanding officer.

The Japanese, exhausted with their four hours' fighting, were driven back, and after midday drew off, and peace lasted for over an hour. Then again fighting burst out, at first artillery fire, and at about 3 p.m. the infantry again attacked Visokaya Hill, and, as in the morning, pressed up it with astonishing persistency. The Russians were so exhausted by their long fight without rest or food that they could hardly move, and for want of reinforcements their position became extremely critical.

As every man who could safely be taken had already been withdrawn from the neighbouring positions, General Irman decided upon a risky expedient, namely, to bring up immediately the 1st Foot Volunteer Detachment, 5th Regiment (80 men), from Entrenchment No. 4 to the 5th Regiment Headquarters.

General Kondratenko reported the want of reinforcements to the staff of the Kwantung Fortified Rayon. At 4.30 Colonel Reiss informed him by telephone that General Stessel advised him to take the fresh troops from Division Hill and replace them by the exhausted troops on Visokaya, as owing to the importance of the latter it would be better to sacrifice Division Hill or Panlunshan.

In accordance with this, the 3rd Company and half of the 7th Company, 5th Regiment, were at once sent for, and it was ordered that the trenches of the 3rd Company should be occupied by 49 men of the 9th Company, 27th Regiment, while those of the 7th Company, and also those

from which the 5th Company had been removed on the 30th November, should be very thinly held by the remaining half of the 7th Company.

At 4.30 the following information was received by telephone at the headquarters, 5th Regiment:—"To General Kondratenko. Copy of Official Report No. 1937, from the Port Commander. The Port Commander communicates herewith news, collected from Chinese sources, that the Japanese will attack to-day and to-morrow, as these are their lucky days. Their killed number 11,000. From the north the Russians are advancing in relief; they took Samson and stormed Kinchow several days ago. The number of killed on both sides is very great, but the men keep up their spirits. The Russians have yellow epaulets and un-Russian faces.—Staff-Capt. Postnikov."

This news was at once passed on by telephone round the positions, but hardly anyone believed it. And yet the yellow epaulets were known to be the mark of the Trans-Baikal Cossacks, and the un-Russian faces seemed to confirm this, as the larger portion of the Trans-Baikal troops were Buryats, of Mongol race; while in Port Arthur there had been for some time confused rumours that a strong force under General Sakharov was advancing to their relief, and that this force included many Cossacks and cavalry generally.

It is not known who was responsible for spreading these rumours, but fresh ones appeared every minute in Arthur, and especially at first had a salutary effect upon the garrison. For example, in August, 1904, when the Japanese for a whole week had been attacking Port Arthur in a most persevering manner, and matters began to look bad for the defenders, news flew round the town that the Vladivostok squadron was bombarding the eastern coast of Japan, that they had burnt the Port of Yokohama, that in Tokio alarm was felt at the nearness of the Russian squadrons, that the Japanese could not get sufficient men to complete their armies, that they had no money for carrying on the war, that the people were murmuring against the increased taxation and would not take service in the armies, but demanded the immediate discontinuance of the war. It was also rumoured that a Japanese squadron had sunk a German ship, and that to hide all traces of their crime they had saved no one, but that a passing French ship had picked up three men, and now France and Germany were despatching their fleets to punish Japan and demand satisfaction. They said that the Russian Manchurian Army was pressing the Japanese from the north; that the Mikado did not know how to remedy his misfortunes, and ordered that Port Arthur should be taken at all hazards, in order that he might discuss conditions of peace with Russia on equal terms!

These rumours had appeared credible because the Vladivostok Squadron had already sunk a Japanese transport which was carrying siege artillery to Port Arthur, and from this everyone looked upon the Vladivostok sailors as heroes, to whom the bombarding of the Japanese coasts would present no extraordinary difficulties! Everyone willingly accepted the rumours, and the spirits of the garrison rose forthwith beyond all comprehension.

Without attributing to these rumours the whole of the Russian success in repulsing the August attacks, it would not be fair to deny them a share in the general result.

But as time went on, and so far from being verified the rumours began to be replaced by the sad truth, they were less readily credited. There is no doubt that those in command at Arthur would have been glad to refrain from publishing these rumours, and would have revealed the truth to the garrison if the truth had been at all consoling!

And so on this occasion the favourable news did not produce on men harassed with this unequal struggle the strong impression which was intended, but there certainly were some who, if they did not believe, at any rate did not dispute the possibility of the approach of a Russian army from the north.

Meanwhile the fighting went on; Tretyakov in spite of his exhaustion made use of all available resources with extraordinary skill, and with incredibly small numbers somehow or other supported the mad onslaughts of the Japanese.

To add to their troubles the growing darkness further aggravated the difficulties of the defenders. Nerves harassed by the four days' fighting portrayed to the men all possible horrors. Thus those on the extreme flank kept on thinking that they were being turned; some saw Japanese already in their rear, and misled their commander by their unverified reports. About 9 p.m. the enemy looked like breaking off their attack, yet they did not retire, but lying down very near the Russian trenches, kept pelting them with grenades.

Tretyakov's report at this time to Irman gives a good idea of the condition of the defenders. This is what he said:—"The enemy are bombarding us heavily with grenades, and keep the men in a state of tension; it is quite impossible to work, the sailors are leaving their places without permission under various pretexts, in spite of orders. Unfortunately all detachments are intermingled, and the officers are ignorant of the ground and the positions of the trenches; for me personally things are very difficult, the men refuse to move, and, worst of all, I am utterly hoarse and deafened from my bruises."

The complaint against the sailors was really deserved by them, for, compared with the riflemen, they were less well disciplined and less enduring. On Visokaya Hill detachments were intermingled, many of the officers had fallen, and superintendence had fallen entirely on non-commissioned officers. The sailors did not like coming under their orders, and often utterly refused to obey them, which provoked quarrels and complaints. The sailors were brave; they charged boldly with the bayonet, and by their valour earned a splendid reputation; but when the Japanese fell back in order to rest and to weaken the Russian defence by the fire of their artillery, the sailors did not consider it their duty to sit still in the ruined trenches, and many of them went away under various pretexts.

During this fighting on Visokaya Hill, probably on the 1st December, cases occurred like the following:—General Tretyakov sent a company of sailors, under Midshipman Samoilov, to drive the Japanese from the

left redoubt. The sailors went boldly to the attack and drove back the Japanese, but then they themselves dispersed. After an hour the General sent Ensign Ermakov with some order to the left redoubt. The latter went off, but came back again quickly with the report that there was no one there! Tretyakov promptly sent a section of riflemen from the reserve, and spent any amount of trouble and anxiety in looking for the sailors. On another day the same sailors again behaved gallantly in an attack, and again earned commendation.

The riflemen were also very brave, but they had not the *élan* of the sailors; this was not their fault, but due to the different conditions under which they were serving:—(1), The sailors were better clothed; (2), they were sent to work for definite periods, while the riflemen worked continuously, because the Japanese were always damaging their trenches. In these cases of course the sailors referred to are not those in companies and detachments which were always employed on the land front, as these served exactly like the riflemen, but those sailors who belonged to the ships, and who formed the general and last reserve, being only sent to the positions on the occasions of especially serious attacks; (3), the sailors were housed in barracks and the riflemen in the trenches; occasional shells flew over the barracks, but the trenches were subjected day and night to the fire of mines, shells, grenades, and machine guns, directed especially at them. The sailors' barracks were situated comparatively far away from the Japanese, while the attackers were within 15, or 30, or 50, or 100 paces of the trenches, so that the barracks were safe from those sudden attacks for which the trenches were only too conveniently situated. From this it will be seen that the riflemen, if they managed to sleep at all, had to do so always with one eye open. Their slumber was disturbed by shells bursting around them, and by the constant fear and anxiety of sudden attack. If the sailors' rest was short, they were able to enjoy it to the full. Their sleep was not disturbed by constant firing, they were not worried about sudden attacks! (4), Finally the sailors received each day salt beef with soup or broth, but the riflemen only twice in the week got a quarter of a pound of horse flesh with their porridge, and on the other five days plain porridge without meat. They improved it at first with Chinese vegetable oil, and later on when this was expended with something else, which the men called paste, but which they did not like, as it disagreed with them abominably.

By these unequal conditions of food, clothing, quarters, work, rest, etc., the riflemen were weakened, reduced in strength, and became so languid that they could hardly drag their feet along. Many found it a very difficult matter to climb the hill, and if it was difficult to move at all, it was considerably harder to advance to the attack. Recognizing this, they set the greatest value on the cover to be found in the trenches and feared to leave it for a moment; they grew accustomed to the arduous duty, and became trusty and experienced defenders of their trenches. There were no complaints that the riflemen left their posts without permission, but there were complaints against them of another kind—that they "refused to leave them"—through physical weakness.

The sailors, who had better preserved their physical strength, were the

best troops for attack, but they were not used to the arduous duties of the trenches and did not recognize the necessity of sticking to their posts. They much preferred charging the enemy to sitting in trenches and perishing from artillery fire.

Besides these there remained a third class of fighting men, namely, those of the Hospital Detachments. The men who joined these detachments had long been accustomed to work among the sick and wounded, who had addressed them always in a most deferential manner. The hospital servants had treated their wounded comrades very unkindly, complying with their requests or not just as they felt inclined. But the wounded had not dared to complain for fear of making matters worse. Thus the hospital rank and file became full of conceit, and grew accustomed to having things their own way. They were practically unaccustomed to rifles, drill, or discipline. And all at once they were called upon to man the positions!

In the first place their companies had no cohesion. The men knew little of one another, and the higher ranks, officers and N.C.O.'s, knew less of those under them. And therefore complaints were made against the Hospital Detachments that they knew little of their work in the ranks and were not well disciplined. Complaints were also heard from the hospitals. The hospital men had been replaced by Town Guards, who knew nothing about the care of the wounded and had not learnt the hospital orders. They tried hard, but having no training they managed the new work badly and incurred complaints from the surgeons.

When he received the reports above mentioned, General Irman, with every desire to send up fresh troops, had not a single man in reserve. But within quarter of an hour the 1st Foot Volunteer Detachment, 5th Regiment, under Lieut. Vasiliev, came up from Entrenchment No. 4 and was immediately sent on to Visokaya Hill.

At 9.30 p.m. the Japanese repeated their attack. On this occasion General Tretyakov's report read as follows:—"The Japanese are advancing, the reserves are expended, the hill is in danger." The half 7th Company, 5th Regiment, under Ensign Moskvin, on arrival from Division Hill, was also sent to Visokaya. The 3rd Company (137 men) was sent to Flat Hill, but afterwards, when it was recognized that that hill stood in little danger, it was sent on to Visokaya.

Meanwhile, for want of reinforcements, neither personal bravery nor the activity of the General could stop the Japanese, who pushed back and overwhelmed the weak groups of the Russians, got on to the saddle, penetrated into the left redoubt, and were on the point of carrying the whole hill (see *Fig.* 5).

Tretyakov had been informed by telephone that reinforcements had been sent up, and he decided to maintain himself somehow. With incredible quickness he ran from one flank to the other, now here, now there, drawing together a few handfuls of riflemen and sailors, and leading them in counter-attack, by which he deceived the enemy, took away their confidence, and weakened their impetuosity. By these contrivances he stopped the advance of the Japanese, and when the rein-

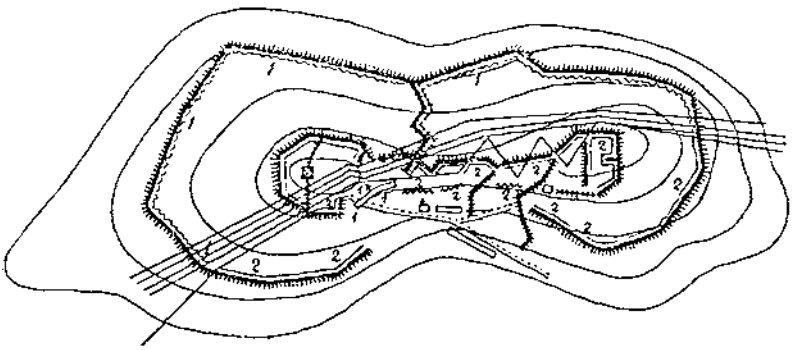


FIG. 5.—*Condition of Visokaya at 9 p.m., 30th November, before the counter-attack.*

forcements arrived, himself took the offensive. He sent the 1st Volunteer Detachment to recapture the left redoubt, and occupied himself with restoring order in the centre. When the half of the 7th Company came up he was able to breathe more freely, and detaching part of the men to reinforce the right redoubt, he personally led the rest to drive the Japanese from the saddle.

The 1st Foot Volunteer Detachment, 5th Regiment, was formed under Lieut. Vasiliev immediately after mobilization. It consisted almost entirely of reservists from Vladivostok. The men were skilful and experienced, and Vasiliev welded them together and inspired them with his own heroic spirit. At Kinchow they suffered little, and were withdrawn, among the last, in perfect order. After this Vasiliev left them, having been appointed to a billet in connection with the regimental arms.

In the bayonet fight on Yupilaza Hill, on the 28th July, the detachment greatly distinguished itself, and lost 1 officer and 44 rank and file. In the subsequent fighting from 13th to 15th August, on Three-Headed Hill, it gallantly repulsed the enemy's attack, and charged several times with the bayonet, losing more than half its strength in killed and wounded. Since then the men had served under several commanders, all of whom had been wounded, in fact it is a curious coincidence that not one of its commanders was killed and not one escaped uninjured.

At one time they were commanded by Ensign (now Lieut.) Vakurin, who twice led sorties from Visokoya, and by blowing up a sap caused great loss to the Japanese. On the 21st October he was surrounded by them and severely wounded, but succeeded in getting away. On the 13th November, Lieut. Vasiliev was withdrawn from his duties in charge of arms to again take command of the detachment.

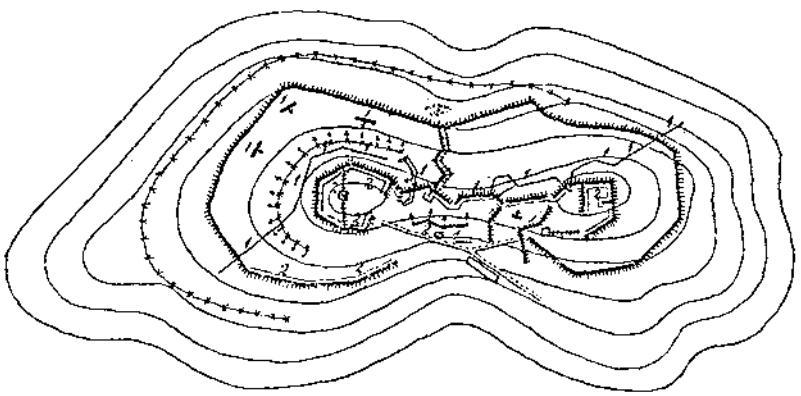
After their several days' rest in Entrenchment No. 4, the detachment arrived at Visokaya Hill looking fit and cheery. The order to drive the Japanese from the left redoubt gave promise of more bayonet work, with which they were all so well acquainted.

After a short and inspiring speech from General Tretyakov, and with their gallant commander at their head, they dashed forward with the

bayonet, thirsting to slay yet more of the Japanese. A wild yell rang over the hill as these 80 chosen fighters, like one man, fell upon the enemy before they could collect themselves and understand what was happening. Was it possible to resist such a united impetuous attack?

All the left crest and the left redoubt were cleared almost immediately. But the Japanese recovered themselves, collected together, and made several gallant attempts to retake the left redoubt; they came against it from three sides, but just then Tretyakov moved on to the saddle with a newly arrived detachment of 2 officers and 160 sailors from the *Retvisan*, and caught them in flank and overthrew them. In other parts also a hand-to-hand fight was going on.

General Tretyakov, in spite of his wound, showed great energy and ability, and once the left redoubt was firmly secured, success soon favoured the Russians, and the rest of the hill was again cleared of the Japanese (see *Fig.* 6).



1—Japanese. 2—Russians.

FIG. 6.—*Condition of Visokaya on 30th November, after the attack of 1st Volunteer Detachment and counter-attack of General Tretyakov.*

At about midnight the joyful news flew round Arthur and raised fresh enthusiasm. Many were the messages of congratulation which were sent to Tretyakov, Kondratenko, Irman, and the other heroes of Visokaya Hill.

After driving off the Japanese attacks on the left redoubt, Lieut. Vasiliev went round his section at the top of the hill, inspiring his men by his words and the example of his personal courage; but at a moment when he was giving some order, with his hat raised on high, a bullet struck him in the right shoulder, his hat fell from his hand, and his men lost their gallant commander. He was at once carried to the dressing station.

Many brave men fell in this unfortunate redoubt, but this must be considered as the price of the preservation of the hill. The Russian losses on the 30th November were very great. The senior surgeon of the 5th Regiment, Feodor Semenovich Troitsky, worked the whole day, from dawn to 10 p.m., in the dressing station under the hill, and

attended to more than a thousand wounded men, after which he lost count. As the slightly wounded either remained in the ranks or went direct to the town without waiting at the dressing station, the total casualties may safely be taken at 2,000 men, or $\frac{5}{10}$ths of those engaged.

Although stretcher-bearers were summoned from every part of Arthur, yet they were unable to remove all the wounded, and drivers having been requisitioned from the town, some volunteer cyclists came up who, combining together in pairs, fastened stretchers between their machines, and in this way carried wounded men to the hospitals. Others got lifts on travelling kitchens and ammunition carts returning to the town, or found their way back in parties, helping one another along. Things were made all the more difficult for the wounded because the Tea Ravine was completely under fire from the Japanese on Visokaya, and movement along it became very dangerous. Cases occurred of wounded men being killed or again wounded in the ravine, and several horses, drivers, and stretcher-bearers were also hit while transporting the wounded to the hospitals in Arthur.

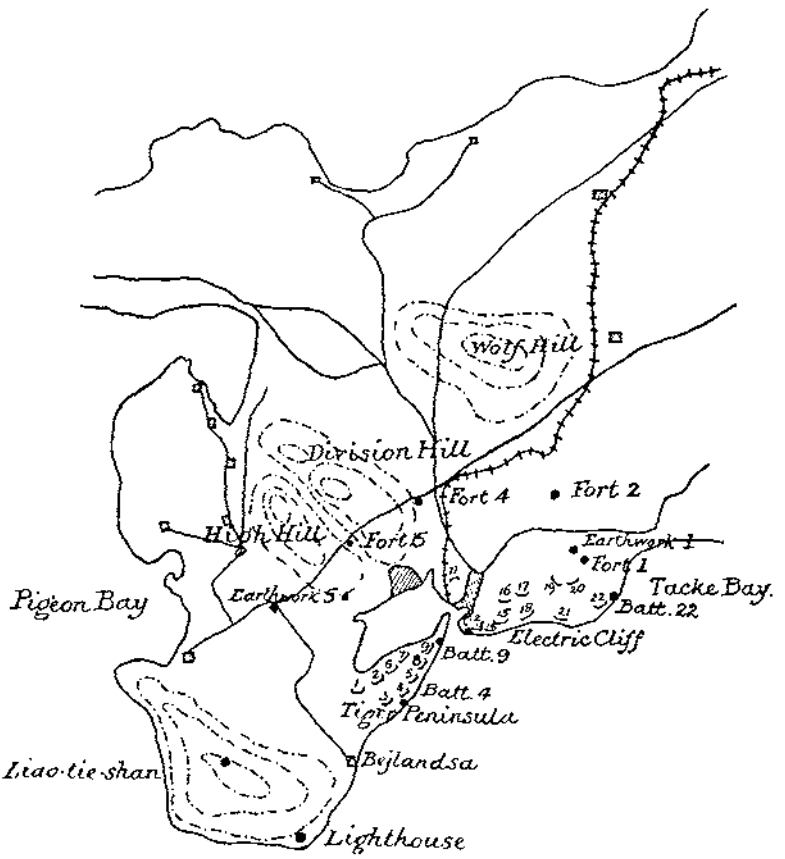
(*To be continued*).

SEARCHLIGHTS: OTHER MEANS OF ILLUMINATION AND TELEPHONES AT PORT ARTHUR.

Translated from the *Mitteilungen über Gegenstände des Artillerie-und Geniewesens.*

1. Disposition of the Searchlights.

There were 12 electric lighting installations in Port Arthur, six for the land front and six for the sea. Three of these were taken from ships in the harbour.



Note. • - *Searchlight.*

They were disposed as follows (see sketch):—

Sea Front.

1. Summit of Liaotieshan ... ... 90 c.m.
2. Liaotieshan Lighthouse (naval light).
3. No. 4 Battery ... ... 90 c.m.
4. No. 9 Battery ... ... 40 c.m.
5. Electric Cliff Battery ... ... 90 c.m.
6. No. 22 Battery ... ... 90 c.m.

Land Front.

1. No. 1 Fort ... ... 90 c.m.
2. No. 1 Earthwork ... ... 75 c.m. (naval).
3. No. 2 Fort ... ... 90 c.m.
4. No. 4 Fort ... ... 90 c.m.
5. No. 5 Fort ... ... 75 c.m. (naval).
6. No. 5 Earthwork ... ... 90 c.m.

2. Notes on the Lamps and Plant.

Electric Cliff and No. 22 Batteries, as well as Forts 1 and 2, had Schuckert arc lamps. The projector of No. 4 Battery had a Kutscherow arc lamp. In all these lamps the carbons were controlled automatically by an electro-magnetic mechanism. The power was supplied by 10-H.P. Nobel steam engines and Derozier dynamos, which supplied 80 ampères at 100 volts.

No. 4 Fort, No. 5 Earthwork, and the Liaotieshan Lighthouse had automatic Schuckert arc lamps, with Nobel petrol motors and Derozier dynamos.

No. 9 Battery had a 40-c.m. hand-worked arc lamp, with a movable steam engine and Siemens dynamo of 40 ampères and 60 volts.

No details are known of the three naval lamps at No. 1 Earthwork, No. 5 Fort, and the summit of Liaotieshan.

3. Range of the Lights.

Experience showed that the range of the lights was as follows:—

90-c.m., 5 to 6 kilometres over sea; 40-c.m. (naval), up to 3 kilometres over sea; 75-c.m. (naval), no figures were obtained, as this light was used over land.

4. The Generating Plant.

The steam engines worked badly and often stopped altogether. The boilers had to be cleaned out every Monday, as the water used was hard and dirty. The Japanese had destroyed the waterworks, and the fresh water obtained from the filters was barely sufficient for the garrison. The petrol motors were old and had many breakdowns.

5. The Searchlights on the Land Front.

The searchlights on the land front at Port Arthur had very exposed positions. As this allowed of their being easily destroyed, especially by any assaulting party, some expedient had to be adopted which would not only give the searchlights cover, but also enable them to illumine the ground close to the fortress. This was done by using tin-plate reflectors, on to which the beam of light was allowed to fall. The light itself was placed in a hollow, often with its back towards the attacker. This system was only used when the attack came close to the lights.

The absence of Iris shutters to shut off the light was found to be most inconvenient.

6. The Lights on the Sea Front.

There was no uniform control of the lights. An officer was allotted to each light, both to superintend the *personnel* and to observe any passing ships. The officers were however too independent of one another, went to work without any fixed system, and were not in communication with one another.

So as not to show up the guardship behind the boom, the lights of Nos. 4 and 9 Batteries had orders to search from the left up to the boom, and Electric Cliff light, from the right to the boom. All the other lights had to search the sea in front of them as follows:—Starting at their maximum depression, they swept from one limit to the other, then elevated a bit and came back, and so on, till the maximum elevation was reached. Thus the whole sea in front of the light was searched from quite close to the light to the limiting range. When a target was discovered the neighbouring lights were also directed on to it, partly to render its forward progress difficult by blinding the steersman, and partly to show it up to the guns. When several targets were discovered, the lights divided them up amongst themselves.

The light on Liaotieshan could not co-operate with that of No. 4 Battery, as its position only allowed it to illuminate the sea to the west and south-west of Liaotieshan.

7. The Desirable Number of Lights and their Distribution.

As can be seen by looking at the sketch, the large portion of sea to the S.W. of No. 4 Battery could only be illumined by the light near that battery, which also had to search the sea to the S. and E. of its position.

As has been already mentioned, the Liaotieshan Lighthouse projector could only illumine the sea to the W. and S. of its position, and, moreover, the beam on the top of Liaotieshan could only light up Pigeon Bay and the sea to its west. Thus a light at Bejlandsa village would have been most desirable, but unfortunately could not be obtained. It is however hard to understand why a searchlight from one of the ships

lying useless in the harbour could not have been installed at Bejlandsa. Subsequently these lights went down with the ships they were on, and were thus lost. How useful such a light would have been was shown in the night 23rd—24th February, when two Japanese fireships came up unobserved from the south of Liaotieshan along the coast in the dead water of No. 4 Battery light up to the water opposite No. 5 Battery, when they were discovered by No. 9 Battery whose searchlight at this period was however not in working order.

Takhe Bay could only be occasionally lighted up by the beam of No. 22 Battery, and even this was not sufficient as there was dead water in the west of the bay. Probably it is due to this circumstance that the Russian torpedo boats, *Lieutenant Burakow* and *Bojewoj*—which were on night duty in the bay—were destroyed on the night 23rd—24th February by Japanese torpedo boats, which had crept unperceived along the coast.

No. 9 and Electric Cliff Battery lights could render but little assistance to No. 4 Battery light, as they had to form a "light obstacle" by crossing their beams. As they had however occasionally to search in other directions, the "light obstacle," or "illuminated area," was not continually in position. The efficiency of this "light obstacle," which was intended to blind attacking ships, was tested by Admiral Makarow himself in a tender and proved entirely successful, as the tender lost its course and was wrecked near Electric Cliff.

From the above it will be seen that the number of lights used was insufficient.

Roughly, considering the range of a 90-c.m. projector as 5 kilometres, the number of lights required can be obtained by dividing the length of coast to be defended by five. Provision must however also be made to illumine all bays and other parts of an irregular coast line. The lights intended for the "illuminated area" should have no other object and should be fixed. Other lights should be movable, or the enemy will make use of a knowledge of their position to steer by, as was here found to be the case from a map captured from the Japanese.

If the lights are not movable, they should be so numerous that alternative ones can be used, so that the enemy is deceived, and yet the illumination is the same.

For the "illuminated area" four lights are best, two in action and two in reserve. Experience showed that the best position of the lights was to one side of and below the battery. Observation from a point above the beam was found to be infinitely better to that from a point below it.

When batteries are situated so low that there is no possible position for a projector below them, the light should be placed well on one side of them.

8. Control of the Lights.

When the number of lights is so great that each battery can have its own beam, it should be controlled by the battery commander. When this is not the case, the lights should be allotted to groups of batteries, and each light placed under the orders of the commander of the group.

The supreme control of the coast defence lights lies in the hands of the coast defence commander, who should be a coast artillery officer. The coast defence commander issues orders and instructions relative to the working of the lights when the enemy has been discovered, and draws up the scheme of changing the lights to deceive the enemy. When he orders a battery or group of batteries to open fire, he hands over to its commander the control of the lights allotted to it.

At Port Arthur there was unfortunately no such centralized control of the lights. The lights were not connected by telephone, and acted either independently or under the command of the commander of nearest battery, who directed them by means of signals on an electric bell, *e.g.*, one ring = swing right; two rings = swing left, etc.

Some of the lights were also occasionally placed under the command of the naval squadron commander, who was on board the battleship *Sebastopol* in the Eastern Harbour up to 10th August. Again, it often happened that torpedo boats returned the same night as they went out. As however nobody but the admiral and naval officer of the day knew the secret signs they were to give to show they were friendly, the batteries had to remain undecided whether to open fire or not until the sign had been obtained from the naval officer on duty in the harbour, and much valuable time was thus wasted. It is believed that the Russian torpedo boat *Silnyj*, which was destroyed on the occasion of a Japanese fireship attack, was probably sunk by Russian batteries, which had no means of readily distinguishing friend from foe.

9. A Suggested Means of Making Use of an Unilluminated Angle.

The following suggestion was made at Port Arthur, but was not put to a practical test:—

Two neighbouring lights agree only to light up to definite limits, so as to leave an unilluminated piece of sea between them, in which one or more torpedo boats assemble. As soon as a hostile ship appears they make for it, taking care however to remain in the dead angle. On reaching a suitable range, or on being discovered, the torpedo boats open fire. If they are unsuccessful, they show their lights, send up a rocket, and return to harbour, whilst the coast batteries open fire on the target.

10. Means of Illumination for Night Work of the Fortress.

In Port Arthur these consisted solely of petroleum lamps or candles, which were both inconvenient and inefficient, and further led to several accidents in the darkness.

11. Telephonic Communication.

The telephone lines in Port Arthur belonged partly to the artillery and partly to the engineers. Owing to lack of *personnel*, only some of the lines could be used.

The communication was very bad, and men were often seen running from one telephone station to another carrying messages. A battery had often to ring up several exchanges to get into communication with one of its "observation instrument" cells, and as one line was often used by several batteries, each had to wait its turn—perhaps for 30 or 35 minutes.

All telephone wires were carried as air lines, and were often cut by shells or inimical Chinese. There were no special "command lines."

A. H. SCOTT.

REVIEW.

MODERN ARABIC STORIES, BALLADS, PROVERBS, AND IDIOMS.

By Colonel A. O. Green, *p.s.c.*

By the publication of this book Colonel Green has done a good service to students of the Arabic of modern Egypt. Those who took up the language about the beginning of the British occupation of Egypt, expended much time and energy which would have been saved if this work had then been on the market. The same applies to Colonel Green's *Practical Arabic Grammar*, which unfortunately did not appear until after many had already, through much labour, overcome the principal difficulties which meet one when first studying the language.

The present work contains an admirable selection of stories, together with literal translations. These translations are so accurate that there is no difficulty in recognizing at once which English word corresponds with which word of the original. There is also an interesting selection of poems and songs, and a valuable collection of proverbs and idioms (also with good translations).

The writer of this review has spent some little time in looking for mistakes or misprints, and has not succeeded in finding any. It is very unusual to find such a high degree of accuracy in a grammar or text-book of any language.

Perhaps a suggestion may be made for the improvement of the next edition, viz., that the system of transliteration should be stated letter by letter, so that the reader may at once ascertain with certainty which Arabic letter corresponds to each letter in the text. For this the author refers to his *Practical Arabic Grammar*. Probably most of those who read the stories will also possess the grammar, but they may not have it at hand. Moreover the author states that he has made "slight modifications" in his method, without saying what these modifications are.

Also, if one wishes to find the translation of any phrase in the middle of a long story, it is difficult to do so. This could be obviated by numbering (say) every tenth line in the text and showing corresponding numbers in the translation, or else by dividing both text and translation into short corresponding paragraphs.

It is a duty to endeavour to criticize the work under consideration in a review, but in this case it seems only possible to find the above minor points, as to which improvement might be effected.

Both the *Practical Grammar* and the *Modern Stories* are quite indispensable to anyone who is taking up modern Egyptian Arabic, and wishes to learn that difficult language with the smallest expenditure of time and trouble.

'A.M.M.'

NOTICES OF MAGAZINES.

FRANKFURTER ZEITUNG.

A FOREIGN CRITICISM OF THE TERRITORIALS.—The issue of the *Frankfurter Zeitung* of 21st August contains an interesting article by "An Old Prussian Officer," entitled "The Difference between Volunteers and Territorials." The author claims a good acquaintance with the British Army, both in the days of the Volunteers and now. He urges, as justification for his article, that here and there the opinion exists that in spite of the South African War absolutely none of the defects in our Army have been altered. "I admit that I myself, after attending the English manœuvres, inclined to this opinion, but I must emphasize the fact that my observations there only extended to the active English Army, and not to the Territorial Army—the creation of the Minister for War, Mr. Haldane."

After expressing a most unfavourable opinion of the late Volunteers, and eulogizing Mr. Haldane for the thorough way in which he had dealt with a difficult question, the author proceeds to describe what he saw on a visit to one of the Territorial camps. The model orderliness in camp was particularly noticeable, and as regards the work, he says: "In front of the camp, under the supervision of numerous officers, the Sapper recruits were busied with laying the field telegraph or finding breaks. In the camp itself was great activity. At one spot the young soldiers (sappers) were having instruction in riding on quite exceptionally good horses, the only fault perhaps being that it was too difficult for the men, many of whom were barely 17. Of course things didn't go as with old and Regular soldiers, but it seemed almost incredible that these young fellows, who were drilled till they dropped, had mounted a horse for the first time only six days previously. While these men—sappers, mark you—were instructed in riding, in another part of the camp a detachment was practising signalling. Other men were being trained in driving. Whoever was not actually training was on camp duty; nobody was idle. There was no question of sparing them, but of curses, shouting, or abuse also no sign. The picture was most instructive, and the English have really no cause to withdraw the camps of their 'Terriers' from the foreigner's eye. These camps would do credit to any army."

It may be asked, he adds, how the preservation of such model discipline did not cause greater difficulties. In the first place it is to be ascribed to the circumstance that the "Terriers" are really willing youths. They would, besides, find themselves nowadays exposed to

heavy punishments in the event of any signs of insubordination. Even the insignificant fact of their being dressed in the comfortable khaki in place of the old variegated uniforms contributes, according to the writer's idea, to the military bearing of the men. The chief reason is however to be found in the fact that the men are treated strictly and on a proper system. The messing is excellent. The relations between superiors and subordinates could not be better.

An army which works like this, says the writer, must succeed. "Of course an annual camp of a fortnight will not be able to produce Regular soldiers, but I am firmly convinced that the 'Terriers' will become, what Mr. Haldane wishes to see made of them, a second line, in which the Regular Army will have an excellent reserve. . . ." The large proportion of officers might surprise one, but it must be remembered that the officers require equally the training, and therefore as many as possible are taken. "After carefully considering all the circumstances, I should think that England has never been nearer her goal of producing an army fit for active service than she is to-day."

E. G. WACE.

KRIEGSTECHNISCHE ZEITSCHRIFT.

1908.

THE RÔLE OF RAILWAYS IN MODERN WARFARE.—In modern warfare, says the writer, there are four distinct uses for railways:—

(i.). For the local mobilization of army corps at their respective headquarters. To ensure the maximum of efficiency, all details for such concentration must be carefully worked out in peace time by the staff and railway officials. Railways will be required not only for the army, but also by the navy, to bring the latter up to war strength in men and coals; this fact must be remembered when working out the mobilization schemes.

(ii.). To concentrate the divers army corps on the frontier preparatory to a combined advance into the enemy's country—which in this case is assumed to be either France, Russia, or Austria. For this purpose several completely independent lines are required, each one of which is given over to one particular unit. There is no more recent example of this use of railways than the war of 1870–71, for in the Russo-Japanese War the Russians had only one line available, whilst the Japanese had to use sea transport. A consequence of this use of railways is that the modern general is somewhat tied in his movements to the line he will make use of, and consequently a careful study of any possible enemy's railway lines in peace time will repay the student should war break out with that country.

(iii.). To carry provisions and men to the army and carry back wounded.

Although many other means of transport, such as animals, heavy motor cars, mechanical transport, and even light railways, may be used,

the permanent line will always be the chief means of transport for an army in the field, and this was proved in a small way in the recent war in S.W. Africa. Again, the necessary siege train to besiege any forts, or *forts d'arrêt*, must need be brought from the base by the railway.

(iv.). For the movement of troops in any operations on interior lines. The writer here points out how very useful railways would be to Germany in the event of a war against both France and Russia, and concluded by remarking that the object of his article is to lay stress on the enormous importance of railways in any modern operations.

FIELD FORTIFICATION IN THE RUSSO-JAPANESE WAR.—This article is a review of several others which have appeared in Russian military journals, and especially of Colonel Tschernik's "Personal Impressions on Certain Questions in Field Fortification by One who went through the War." The decisions arrived at are briefly given as follows:—

(i.). As a general rule, isolated redoubts, which are surrounded with obstacles and have a good field of fire, as well as the trenches close to them, are preferable to a continuous line of trenches with a few points of support; the former must however be able to provide good cover against artillery bombardment previous to the infantry attack. Thus, in his opinion, a completely enclosed entrenchment is still of use in the firing line.

(ii.). Having regard to the rapid rate of fire attainable with modern weapons, the firing line can be weakened and the reserve increased. One man to every two or three paces is regarded as sufficient, and where increased fire effect is desirable, machine guns can be used. The best place for the latter is between the redoubts, and placed a little in rear of the actual firing line.

(iii.). Deep digging must not be overdone in order to conceal a situation; firstly, because men firing from a low command have a restricted field of fire, in which the slightest folds of the ground hide the enemy; and, secondly, because of the difficulty of concealing the excavated earth. If this concealment is not well carried out, it at once betrays a position.

(iv.). The old lesson, that when a village is occupied well-concealed trenches must be dug in front of and near the village, was paid no heed to. The occupation of the edge of the village should only be carried out when the enemy has no high-explosive shell; the Russian quick-firers had only shrapnel. Any convenient building in the village may be used as a keep, so long as it is well concealed, surrounded by obstacles, and not exposed to high-explosive shell fire. For this reason, later in the war, earthworks were used instead of existing buildings.

(v.). So essential is concealment, that all means of obtaining it are fair. The Japanese made use of false positions, and also of sham guns and puffs of smoke like discharges from mortars to deceive the Russians as to their real position.

(vi.). When Q.F. artillery is firing from behind cover, it must make use of special observation posts and of field telephones to connect these to the battery.

1909.

Reinforced Concrete in Military Constructions.—This article begins by showing that to resist the impact of projectiles it appears to be necessary to reinforce concrete in three directions—lengthways, breadthways, and vertically. It then enumerates the well-known advantages of reinforced concrete, and gives the compositions recommended by Professor Drushinin and Colonel Shitkewitsch. The advantage of reinforced concrete from a military point of view, namely that for the same thickness as steel it is four times as strong, is pointed out. For magazines, for piles, for hollow pipes, to serve as drains or mine galleries, for underground casemates or wells, as well as for such supplementary and indispensable buildings as slaughter-houses, gas-producing establishments for balloons, bakeries, cookhouses and stores, and last, but not least, for armouring battleships, reinforced concrete is pronounced to be the proper material; but, remarks the writer, this material only presents all the above advantage if perfectly laid.

A New Airship.—The Danzig Technical High School is designing a new airship on the rigid (Starr) system. The principal difference between this ship and Zeppelin's is that wood instead of aluminium is to be used for the framework. By this means it is hoped to avoid any electrostatic charges or discharges, with the accompanying dangers due to sparking.

Pioneer Manœuvres in Japan.—In September, 1908, important pioneer exercises were carried out, at which all officers of the Engineers who took part in the Siege of Port Arthur were present. The exercises lasted 14 days, and their importance was shown by the presence of such high military officials as the War Minister, Chief of the General Staff, and the Inspector of Staff Duties. In all probability these are but experiments preparatory to the production of a new manual of field fortification.

Other articles are:—The carriages of new high angle fire guns; the new regulations for the foot artillery; the new drill manual for the foot artillery; and an article on a new projectile.

Transport Regulations (*22nd August*, 1908).—This official manual divides transport up into baggage, columns or convoys, and trains. By baggage is meant what we generally design as 1st and 2nd line transport. It is divided into the fighting baggage which always accompanies the unit, and which now, in the case of infantry, engineers, and heavy artillery, includes one field kitchen per company, and into the heavy baggage, or 2nd line transport. Baggage is an integral part of the units themselves, whereas columns and trains are allotted to army corps or reserve divisions only. Columns include ammunition and gas columns. The latter are for the use of the balloon sections. Gas is transmitted from the columns to the section by the exchange of empty gas-containing vessels for full ones. The column also carries repairing materials and a spare balloon, which can be handed over to the sections if wanted.

Trains include transport and supply columns, remount depôts, field hospitals, bakery sections, and the corps bridging train.

The last-mentioned unit belongs partly to the transport troops (corresponding to our A.S.C.) and partly to the engineers. It is commanded by a captain of the transport troops ("train"), whilst the escort is commanded by an engineer officer. The escort is composed of pioneers.

After the trains come the various line of communication trains, manned by transport troops. This manual also deals with the reserve transport battalions, reserve and central remount depôts, and gives plans of the suitable camps or bivouacs for various units.

MACHINE GUNS WITH FIELD ARTILLERY.—Experiments are to be carried out by the 8th Field Artillery Regiment, of the 20th French Army Corps, on the eastern frontier, with a view to seeing how far machine guns, permanently attached to batteries, can replace an infantry escort on the march as well as when in position. It is however pointed out that a machine gun can at the best but strengthen and not replace infantry, as it lacks the latter's offensive power and its adaptability to any position.

AIRSHIPS.—Pictures of the Baldwin airship of the U.S.A. Signal Corps and of the "Nulli Secundus" are given. The maximum speeds of the former during its official trials at Washington were 18 and 21 miles per hour. It can carry two men, one to attend to the machinery and rising apparatus, the other to steer. A description of the "Nulli Secundus" is also given.

A. H. SCOTT.

June, 1909.

THE DISTANT AND CLOSE ATTACK IN FORTRESS WARFARE (*continued*).—*The Close Attack.*—The close attack may be considered to have begun when the attacking infantry has established itself within about 800 yards of the girdle of works forming the main line of defence. This implies that the artillery of the attack has established a certain degree of superiority over that of the defence, but it by no means follows that the latter is destroyed, or even silenced.

In the days of smooth bore guns it was usual for individual guns to engage in a sort of duel—with the idea of dismounting each other by a lucky shot—and the actual destruction of the enemy's artillery might be reasonably hoped for, as each gun offered a good target.

But as long ago as 1870, it was found that such a result was no longer possible, and that better results would be obtained by endeavouring to destroy the gun detachments rather than the guns. To-day it is possible, by concentrating the fire of several batteries upon one hostile battery whose position can be accurately located, to put the guns out of action in a short space of time, but, as a rule, they will only be temporarily silenced. In a well-organized fortress there will be alternative positions in rear to which such guns will be withdrawn, as it is of the utmost importance to the defence to preserve his artillery for the stages of the close attack.

The main defensive position will have been very badly chosen if it does not greatly increase the difficulties of the attack when attempting a further advance, for presumably not only will the ground over which the attack must advance be more thoroughly swept by fire, but also at this period the lighter Q.F. guns of the defence will also come into play. To reply to these it will be necessary for the attack to establish an artillery position within perhaps 1,000 yards of the girdle of defence works. This position will be covered by the attacking infantry, and a large number of guns must be established there.

The further the infantry advances, the more difficult will it be for the long-range guns in rear to continue their fire, and consequently heavier work will be thrown on the field guns in advanced positions.

As the attack draws in, the infantry of the defence must redouble their activity. They will all of course be provided with casemates or some such form of cover, but they must be ever on the alert and ready to leave these and occupy the fire trenches even under the hottest artillery fire, as otherwise they may be too late to ward off an assault.

The Japanese, in the close attack, attempted at first a rapid assault, but were compelled finally to resort to a regular approach by sapping and mining. There may however be occasions when this is not necessary, and much will depend on the activity of the defence and their skill in the use of the rifle.

Thus at Strasburg the French possessed in their rifle a weapon which, properly handled, could have developed such a fire over the foreground up to the first parallel, as would have compelled the Germans to resort to sapping. This is proved by the fact that the French sailors—who formed a portion of the garrison—handled their weapons so well that the Germans in front of them were compelled to take to sapping. But elsewhere the same skill and vigour was not forthcoming.

In general however it must be expected that, in the close attack more than in the distant attack, a systematic approach will have to be resorted to, and the labyrinth of trenches and zigzag approaches will grow more and more like the system in vogue in Vauban's time.

The existence of these numerous covered approaches and positions is likely to cramp the ardour of the attack, and to make the infantry unwilling to leave the shelter of the trenches for a sudden assault. This must be carefully guarded against, and cover in the attack must be only resorted to when absolutely necessary, and then it must be regarded as merely temporary protection, to be abandoned as soon as the slightest opportunity occurs for the employment of more rapid and vigorous means of advance.

The advanced positions of the defence, and also the intermediate works and trenches in the main girdle of defence, are suitable objectives for a less deliberate form of attack; but the manner of attack in each case will vary according to the *rôle* played by the works which are the objective.

Advanced posts, for example, in the vicinity of the main line of defence are generally occupied with a view to fulfilling some definite object, such as bringing fire to bear over folds in the ground which are concealed from the main works. They must not offer any great cover to the attack

should they be captured; neither must they collectively form a connected line which the attack could utilize as a fresh infantry position. They will be usually of low command, but well provided with obstacles. The method of dealing with them will usually be by an enveloping attack, which will overwhelm the comparatively weak garrison.

An example of this is given by the Russian works in front of Erhlung-shan and Sungschushan, which were captured by the Japanese in their first assault on the 26th October, 1904, and at once connected by communication trenches with their approach works.

The works in the intervals between the forts and redoubts of the main position, present quite a different problem as they have no exposed flanks, are closely supported by the forts themselves, and their design, as regards size and shape, has not been subordinated to the fortified works in rear, as is usually the case with advanced posts.

However different and varied these lines of intermediate works may be in arrangement and strength, they may present any of the following common features:—(1), The garrisons will be amply provided with cover during the bombardment; (2), they will be strongly supported by both artillery and machine gun fire; (3), there will be a strong line of obstacles in front of them, which will be effectively enfiladed from the forts or redoubts. In the latter case, the truth of which must be ascertained by careful reconnaissance, a direct assault on the intermediate works only will be generally inadvisable, as the forts or redoubts of the main girdle will then be able to deliver, unhindered, a heavy enfilade fire along the obstacle, thus greatly increasing the difficulties which the attack will experience in passing it.

Even if the pioneers in advance of the assaulting troops have succeeded in cutting gaps for the storming columns, success can hardly be looked for unless the gaps are so wide and numerous that the assaulting troops can advance on a broad front.

Narrow gaps in the line of obstacles compel the assault to be made in deep columns, and these—subjected at once to a heavy frontal and enfilade fire—are sure to be swept away.

In such a case a simultaneous attack on the fort and intervals is necessitated, though the former may be only in the nature of a feint provided it suffices to fully occupy the attention and activity of the garrison of the fort. The attack of one of these forts, or supporting points, needs far more preparation than the attack on the intervals, because in a fort every means is employed which may increase its power of active or passive resistance.

There will be a double tier of fire, as it must be assumed that the covered way—so long neglected—will now be utilized as a line of defence, and made tenable by provision of overhead cover.

Suitably sited casemates will assist the rapid occupation of fire positions at the proper moment. In front of the ditch, which will be enfiladed from counterscarp galleries and thus cannot be passed till the latter are destroyed, and in front of the covered way, will extend an obstacle of considerable depth which will be protected from the fire of the attack by being sunk in a ditch, but which will be exposed to a grazing fire from the rifles, machine guns, and Q.F. guns of the defence.

Before the assault is launched it is essential that this obstacle should be destroyed or removed, as the troops will be quite unable to remove it during the assault itself.

Formerly it was thought that, if the storming columns were provided with the necessary tools and appliances, this work of destruction could be carried out by the stormers themselves, but it is now recognized that this is quite impossible under the heavy fire from the defensive works. It was also thought that the heavy artillery fire of the attack would be able to destroy the line of obstacles—which usually consists of a belt of wire entanglement—by their high-explosive shells, or at any rate to damage it to such an extent that but little would be left for the pioneers to do; and also that the escarp and counterscarp of the ditch could be breached by the same means, so that the tedious process of mining would be unnecessary.

Consequently of recent years no system of countermines was employed in the construction of forts and permanent redoubts.

In fact the general opinion was that no work would remain storm-proof after being subjected to a heavy bombardment from the attacking siege artillery, and that an assault could always be delivered as soon as the attacking infantry had reached within some 300 yards of the works.

The Siege of Port Arthur has proved beyond all doubt that these ideas are entirely wrong.

With regard to the German Army, the author proceeds to question whether it is sufficiently supplied with siege troops and appliances to counterbalance the failure of the artillery to obtain the results expected of it. He states that the pioneers are only trained in fieldworks and bridging, and the old science of sapping and mining has been completely neglected. He points out that troops for such purposes cannot be immediately improvised, as the Prussian experiences before Strasburg clearly showed.

The training of technical troops for siege warfare was considered quite unnecessary in Germany until their pupils, the Japanese, met with their bitter experiences at Port Arthur; and though troops are now trained in this branch of warfare, the author seems to doubt whether they are fitted in numbers or skill to cope with the heavy work which will fall on them in future wars.

The most important question to which an answer is required, is whether under normal circumstances it will ever be possible to launch a successful assault against a modern permanent work from a distance of 300 yards or so.

The desire to bring the siege to a rapid conclusion by a bold and skilful assault, instead of allowing it to drag on for weeks and months, is thoroughly justifiable. Even very serious losses should not deter a commander from such a step, if success is really likely to crown his effort. But a direct assault against a work whose defensive strength is hardly impaired can only succeed when the *morale* of the garrison is of a very low order; in every other case it must fail. The assault on the Perches Redoubts before Belfort in 1871 and the Japanese assault at Port Arthur in August, 1904, are instances of this, characterized by faulty recon-

naissance on the part of the attack and the possession of unimpaired storm-proof works by the defence.

The greater the distance at which the attack attempts its reconnaissance, the greater will be the difficulties to be overcome and the smaller the resultant fruits. At Belfort, owing to the alertness of the garrison, practically no result was obtained.

Even if the reconnaissance of the obstacles to be surmounted is successfully carried out, it is still a matter of immense difficulty to surmount or remove them, and, until the obstacle is removed, an assault promises no success against a valiant defence. Usually therefore recourse must be had to a deliberate siege approach by sapping and mining. During the progress of such an approach the assistance given by the artillery of the attack diminishes in proportion to the progress made by the attacking infantry, as the fire cannot be maintained against the defence works without great risk to the attacking troops.

The further back the position of the siege artillery is, the greater will be the risks from this source, and therefore the great distance at which the attack begins nowadays is all to the disadvantage of the assaulting troops in the last stages.

For this reason some means must be substituted for the support of the artillery at this stage; of what such means will consist is not yet quite clear, but from the experiences of Port Arthur, it seems likely that a largely increased use of hand grenades will be the main feature.

It seems strange that artillery fire should be replaced by the use of such rough-and-ready projectiles, whose efficiency depends entirely on the muscular strength and accuracy of aim of each soldier, yet in other ways as well it is not unlikely that the resources of bygone days will be resuscitated for the siege warfare of to-morrow.

In general, during the close attack the pioneers will give far more assistance than the artillery, and as the attack progresses the work thrown on the pioneers will increase proportionately, while to the infantry will fall the duty of keeping down the fire of the defence and covering the pioneers.

The endeavour to capture the covered way and also to cross the ditch will frequently give rise to a simultaneous advance both above and below ground, as it is only by the latter method that the counterscarp galleries can be destroyed and the ditch crossed.

The pioneers in both the Russian and Japanese Armies showed themselves so unskilled in mining during the Siege of Port Arthur, that all European Powers have profited by the lesson, and are making serious efforts to educate their troops to the required standard in this branch of military science.

Thus the close attack on a modern well-designed and well-equipped fort will undoubtedly consist of a covered approach by sapping and mining; and one of the most marked results of this will be that the *rôle* of the sapper will become of greater importance than that of the gunner, and, according to the author, the silent and hidden work of the engineers underground will at length receive the recognition which has hitherto only been given to the more noisy and visible results of the artillery.

C. OTLEY PLACE.

Nature.

Latitude Observations in Polar Regions (*p.* 339).—To an explorer situated at one of the poles of the earth the stars appear to pass round him in circles parallel to the horizon once in 24 hours, and the altitude of any one star is the same at whatever time it may be taken, provided the atmospheric conditions remain constant. If the explorer could be at either pole during the winter months, the best proof he could have that he had really reached 90° latitude would be by observations of the stars. Should he be able to measure the altitude of a star with a sextant and artificial horizon at not less than 35° above the horizon, and repeat his measurement every three hours during one complete rotation of the earth, and find the altitude to be the same at every observation, he would certainly be at the extremity of the earth's axis. Effects of refraction, which is very uncertain in high latitudes, would be eliminated.

Although it is usually daylight when the explorer reaches his highest latitude and the stars are not visible, much the same plan could be followed with the sun. The sun will pass round him in a circle in 24 hours, and the only change in its altitude will be due to its change in declination, which is given in the Nautical Almanac for every hour. Should it be found then during a series of observations of the sun extending throughout 24 hours, or over a number of hours, that the observations changed just the amount of the sun's change in declination for every hour, the observer would certainly be at the pole.

As regards observations for time taken at or near the poles, the ordinary method of taking sets of altitude of east and west stars fails altogether, for the simple reason that the altitude remains practically the same at all times, and it is impossible to state the *exact* instant of time corresponding to a certain altitude. To get a satisfactory result it would be necessary to use a theodolite firmly fixed for taking transits of the sun or stars. As all meridians converge at the pole, there can be no difference of longitude. An observer exactly over the North Pole would be facing south whichever way he turned.

With a sextant and artificial horizon observations taken at a low angle, such as 10° or 11°, are unsatisfactory. In the first place, it is extremely difficult to make a contact at all, and then the image in the artificial horizon is usually greatly distorted, especially when a glass plate horizon, silvered only on the back, is used. For accurate observations a transit theodolite is necessary, but unless a solid foundation is available on which to place the instrument or the artificial horizon for the sextant, dependable results cannot be procured.

To take advantage of the best condition of the ice and to ensure a safe return, a polar explorer endeavours to reach the highest latitude at an early date, when the sun's declination is only a few degrees. Thus Nansen reached 86° 12′ N. on 7th April, 1895, and on 25th April, 1900, Capt. Cagni reached latitude 86° 34 N.; while Peary and Cook, who have lately claimed to have reached the pole, both made their furthest north in the month of April.

The meridian altitude of the sun would at the pole on 6th April be only 6°, and on 21st April about 11°, and this would not furnish an exact

latitude, even if taken with a first-rate instrument under favourable climatic conditions, much less so when these are not favourable, and when the observations are made with small portable instruments, which alone can be carried by the explorer on his rapid dash to the Pole.

As regards the effect of extreme cold on the refraction correction of the altitude, it may be noted that for an altitude of 11° there is a difference of 1′ for a change of temperature from + 50° to - 60° F.

Sextant observations taken with a glass plate horizon on moving ice would not be trustworthy, for in addition to the probable sources of error above referred to, there may be slow oscillations of the water, tidal or other, that may considerably affect the level of the reflection surface.

W. E. WARRAND.

REVUE DU GÉNIE MILITAIRE.

August, 1909.

THE ENGINEERS AT CASABLANCA.—The conclusion of a previous article. A description is given of the work carried out at Casbah-ben-Ahmed and Settat. Native labour was substituted for military labour as soon as possible, so as to free the troops for employment with the mobile columns. Although no native labour could be obtained at first, it was very soon forthcoming when the Moors discovered that the French paid them fair wages, and treated them well. The Moorish carpenters and masons proved themselves skilled workmen, though the latter had a rooted objection to bonding their walls together. The employment of native labour by the engineers was largely responsible for the establishment of good relations with the native population generally.

MILITARY KITES.—The conclusion of a previous article. The writer deals with the subject under the following headings:—Bridles and the inclination of the cable. Influence of the construction of the kite on the method of fixing the bridle. Altitudes attained by kites lifting a cable. Groups of kites. Launching a group of kites. Lifting power of kites

September, 1909.

THE WORK OF THE ENGINEERS IN THE HAUT GAIR REGION IN 1908.—This article is supplementary to one dealing with the same subject which appeared in a previous number. The French found wire entanglements especially useful in warding off the enemy. After one attack 28 dead Moors were found in a narrow strip of entanglement outside a French blockhouse. The French also used sharpened pickets, boards full of nails, broken glass, and inundations. No information is given as to the utility of these obstacles. A course of loose bricks and large stones was placed on the top of the blockhouse walls, so that anyone attempting to scale the wall would pull the bricks and stones down on his head.

Three fougasses were dug and loaded. A short length of wall was built

over one fougasse, in the hopes that the enemy would congregate behind it. The Moors however held off, and the fougasses were not fired.

The wire entanglements were hung with bells made out of bottles, with the bottoms cut off. Sparklets served for bell tongues. Hand grenades were constructed by lashing together two melinite cartridges, with a detonator and safety fuze attached. Attempts were made to construct grenades that would burst on impact, but these failed, owing to the indifferent quality of the detonators. Flares were prepared by wrapping a stone in palm fibre. When required for use they were soaked in paraffin, lit, and thrown by hand. They burnt for about 10 minutes, and gave an excellent light. Flares of a more permanent nature were made by tarring the fibre. These were difficult to light, had not much illuminating power, and obscured the foreground with their smoke. They were eventually discarded in favour of the paraffin flares.

The walls of the Moorish houses are about 2′ thick, and are made by ramming mud between two planks, which serve as a mould. These walls are absolutely bullet-proof. The most economical method of destroying the Moorish towers was to cut a groove on the inside of the four walls to a depth equal to one-third of the thickness of the walls. A charge of melinite was then placed in the groove in each wall, and all four charges were fired simultaneously.

J. E. E. Craster.

Revue Militaire des Armées Étrangères.

July, 1909.

The Austro-Hungarian Imperial Manœuvres of 1908.—One of the most noticeable features of these manœuvres was that on one side three different languages were used—German by the active army, Hungarian by the honved Hungarian units, and Serbo-Croatian by the Agram (13th) Division. The army and army corps commanders issued orders in German which were translated into Hungarian or Serbo-Croatian by the staffs of the divisions which used those languages. The troops taking part in the manœuvres were distributed as follows:—

The Red Force, under General Fiedler.—2 army corps = 4 divisions and a cavalry brigade, 1 independent infantry division, 1 cavalry division.

The Blue Force, under General Albori, had the same strength and organization.

The composition of the larger units was:—

1 army corps = 2 infantry divisions, 2 pioneer companies, 1 bridging train, 1 telephone section, and 1 cavalry brigade or cavalry regiment.

An infantry division = headquarters, 2 brigades of 3 to 4 battalions each, 3 squadrons, 1 artillery brigade (= 4 gun and 2 howitzer batteries), 1 section of infantry telegraphists, 1 field ambulance, 1 supply convoy.

A cavalry division = headquarters, 2 brigades (each of 2 regiments with 6 squadrons per regiment, 1 troop of mounted pioneers, 1 section of

cavalry telegraphists), 1 machine gun section (4 M.G.'s), 1 cyclist section, 3 horse artillery batteries, 1 bridging train, 1 telegraph section, 1 field ambulance, 1 supply convoy.

An army = headquarters, 2 army corps, 1 infantry division, 1 cavalry division, 1 balloon section, 1 telephone section, 2 wireless telegraphy stations.

The strength of the units was:—Infantry company, 110 to 120 men; 1 squadron, 100 to 120 sabres; field artillery battery, 4 guns; machine gun sections:—Infantry, 2 guns, cavalry, 4 guns; balloon section, 6 officers and 100 men.

Ammunition was served out at the rate of:—Infantry, 70 rounds per man; artillery, 20 rounds per man; pioneers, 5 rounds per man; machine guns, 5,000 rounds per gun; field artillery, 100 rounds per gun; howitzers, 96 rounds per howitzer.

The repartition of the artillery on these manœuvres was an experiment, the object of which was too see if corps artillery could be done away with and the extra guns allotted to the divisions. The proportion of pioneers—2 companies per corps—was also an experiment. Great care was taken to aid rapid communication, as is seen by the large number of telephone and telegraph units. Each field artillery battery also possessed trained telephonists and 9 kilometres of cable.

Cyclists and motor cars were also used to keep up communication. Rewards in money were given to cyclists who proved to be especially efficient as scouts.

Mechanical transport was used by the western group (3 infantry and 1 cavalry divisions) of the Red Force to bring supplies to the regimental transport. A special car to supply petrol, and one to execute repairs were employed.

To supply the above-mentioned troops there were used:—5 petrol road trains, each of 1 engine and 2 to 3 carriages; 15 to 20 steam lorries of different sorts; 2 steam road trains for heavy loads over definite stages. All these vehicles belonged to the War Department.

Cars and motor bicycles were also allotted to the divers headquarters as follows:—Directing staff, 6 and 2; each army corps, 3 and 2 (1 per division); each independent division, 1 car; each independent brigade, 1 motor bicycle. The owners were compensated (1) by getting free petrol; (2), by an allowance of 6 krone per diem for each motor bicycle and 30 to 40 krone per diem per car for 10 days (1 krone = about 11d.).

Field kitchens of 27 different patterns were used. As a result of the manœuvres, it is stated that their place is with the 1st line transport, immediately behind the ammunition.

The wireless telegraph stations each consisted of 5 wagons; 2 for the apparatus and generator, 3 for the mast, and detachment. The mast was 40 to 50 metres high, and a station took two hours to erect, which is considered too long.

The manœuvres lasted three days, and showed that the army was in an excellent state of training, marches of 40 to 45 kilometres being made by some regiments, the casualties being only 1 to 1·5 per cent. The honved units proved to be as efficient as those of the regular army.

Military News of Divers Countries.

Austria and Hungary.—Each infantry company will soon receive telegraphic, telephonic, and signalling stores, which include:—1 microphone, 1 battery of dry cells, 1,500 metres of cable, 4 flags, and 2 lanterns. They can be carried by three men.

At the end of 1909 the Austrian Government, which is in treaty with the Austrian Dirigible Balloon Club, will possess (1) a Parseval balloon—capacity 1,800 cubic metres; (2), a Lebaudy balloon—capacity 3,000 cubic metres. The War Office has moreover bought a large tract of land near Vienna, where a shed and gas works will shortly be erected.

The greyish-blue field service dress adopted by the infantry and honved units in the autumn of 1908, will in future be worn by generals, staff officers, the artillery (field, mountain, and fortress), the survey department, and all officers except those of the cavalry.

Belgium.—The first military dirigible, "la Belgique," was finished in June, 1909. Its capacity is 2,800 cubic metres, and the strength of its motor is 120-H.P.

In spite of a deficit of 5,000 men in the peace and 15,000 in the war establishments, the Government is not disposed to introduce universal military service.

Germany.—Experiments were made at the Musketry School, near Jüterborg, on the effect of infantry fire on a captive balloon. The balloon, a "Drachenballon," 12 metres long, was at a range of 1,150 metres (measured with a telemeter). An infantry company fired 4,800 rounds at it in 5 minutes, with elevations of 1,100 and 1,200 metres. The men fired in sitting or kneeling positions. As this fire had apparently no effect, an instructional machine gun company fired off 2,700 rounds in 2½ minutes with equal lack of success. The total hits was 76.

Italy.—Third report of the Royal Commission of Enquiry. (1). The Commission advise three years' service in the mounted units instead of two, and only one year for certain classes. (2). The question of breeding horses is gone into, and a better stock of stallions recommended. The use of motor cars for transport is advised. (3). The Commission report that the veterinary inspection needs reorganization. (4). The military dowry is abolished, but officers are not to be given leave to marry before 25 years of age.

A. H. Scott.

Rivista di Artiglieria e Genio.

August, 1909.

Apparatus for Examining and Measuring the Properties of Explosives.—In the above review Dr. Mettegang, who is attached to the *Carbonit* manufactory of explosives at Hamburg, gives a description of an apparatus which he has invented for the examination and measurement of the properties of explosives.

important in a lesser degree, as its effect is disguised in the dynamical work of the shock which precedes it.

The following points are therefore of importance:—(1), The composition of the products of ignition; (2), the distribution under solid, liquid, or gaseous form; (3), the highest temperature; (4), the sensibility of the explosive to shock; and (5), the length and duration of the flame.

Apparatus for Measuring the Velocity of Detonation.—A cylinder, capable of rotating rapidly by means of an electric motor, has a toothed wheel soldered on to it, and connects with an endless screw, carrying an index placed above a scale divided into 100 parts.

The number of teeth of the wheel is equal to the number of millimetres in the circumference of the cylinder. So that when one tooth of the wheel marks a gradation on the index, it corresponds with the movement of 1 millimetre of a point on the surface of the cylinder. By means of the index therefore the movements of the cylinder can be approximated to 0·01 millimetre, which, of course, admits of the valuation of very small periods of time. In fact, it is claimed that measurements of $\frac{1}{2}$ of a millionth of a second can be appreciated.

The cylinder is blackened, and at a very short distance from it are two platinum points, each of which is attached to one of the poles of the bobbin, its other pole being attached to the axis of the blackened cylinder. The wires of the first bobbin connect with the source of electrical energy, traversing a series of incandescent lamps (which form the resistance), and passing each to the extremity of a tube 3 metres in length, which contains the explosive to be experimented with. There is also an instrument for measuring the velocity of rotation near to the motor which drives the cylinder.

If the cylinder is now rotated at 50 metres per second and the chosen explosive is placed at one end of the tube and ignited, the explosion breaks the wire of the primary circuit, and produces in the secondary circuit a current which emits a spark between the corresponding platinum point and the blackened cylinder. After a very short time the second wire breaks, and there is another spark, two points—the traces of the sparks—being left on the blackened cylinder. As a matter of fact, instead of two points only, there is a series of consecutive points, owing to the oscillatory manner in which the electricity is discharged. The distance apart of the sparks is clearly defined on the rapidly rotating cylinder, and from this the velocity of detonation can be calculated. For instance, suppose that the marking measured 20 millimetres. The velocity of rotation being 50 metres per second, 0·0004 second would intervene between the production of the two sparks, and this therefore is the time for the transmission of the explosion from one extremity of the tube to the other. The length of the tube being 3 metres, the velocity of detonation of the explosive is $\frac{3}{0{\cdot}0004} = 7{,}500$ metres.

Measuring the Pressure.—This measuring instrument consists of a chamber for the explosion and an indicating apparatus. The "chamber for

explosion" consists of a strong steel cylinder, with an internal capacity of 15 litres, and a weight of explosive of 100 grammes, and a density of charge of 1/150. Explosives of greater density could not be used without damaging the apparatus.

As the cooling due to the internal walls of the cylinder may affect even so limited a density, this inconvenience is remedied by introducing blocks of steel within the cylinder, so as to vary the internal superfices, whilst leaving the volume unaltered.

The chamber for explosion is closed with a cover, and has two apertures, one for the indicating apparatus and the other for an insulator, through which passes one of the wires of the detonating capsule.

The "indicating apparatus" consists of a drum, round which is wound a band of paper or card. This drum is made to revolve by means of an electric motor, and a registering pen is connected with the explosion chamber, and is also in contact with its surface.

To measure the pressure developed by an explosion, 100 grammes of the charge is placed on a light tripod in the centre of the chamber. To this is fixed the detonator, from which wires pass to the commutator. The ignition of the charge is made by means of an electric current of sufficient tension. The current passes first by the commutator—which is necessary, as in the last passage of the current one of the wires leads to the explosion chamber—and thence to the earth. For greater safety a red incandescent lamp is interposed in the circuit. This signals the passage of the current and acts at the same time for the resistance. One of the two wires passes to the explosion chamber, and the other to a point isolated above the drum register, and from this point through the insulator to the detonator in the explosion chamber. The passage of the current takes place only when the drum has acquired the requisite velocity of rotation. During the rotation a small point fixed on the drum touches the pen of the isolated index, allowing the current to pass to the detonator and causing the explosion.

Before the ignition, the explosion chamber is securely closed with a cover. The cord or tape wound round the drum is kept in position by two gummed strips. The drum is now placed in position, and the arm of the register is regulated so that the pen comes lightly in contact with the card. The velocity of the drum, which is rotated by an electric motor, is measured by a chronometer, and also by means of signals of electric contact which are produced in the axis of the motor.

After the explosion the diagram is removed from the drum and measured. The pressure, as shown by the indicator, depends upon the quantity of the explosive, the volume of the chamber of explosion, and the superfices of its cooling walls. The best results are obtained by using a chamber of 20 litres, and reducing to 15 litres, the influence of the cooling superfices having been eliminated, as stated above, by the introduction of one or more steel blocks.

A description is also given of an apparatus for measuring the sensibility of the shock, and of another apparatus for measuring the length and duration of the flame.

EDWARD T. THACKERAY.

In the preface of a work explaining this apparatus, he first of all describes the idea which led to its construction. For more than 20 years, in fact since he was first engaged in the production of explosive material, he has found the absolute want of a convenient system of analysis of the material, and of an apparatus for establishing the different characteristic qualities. A certain number of instruments existed for determining in a complete manner the efficacy of the different explosives, but they made no distinction between statical and dynamical effects. Moreover, they were not adapted for establishing the difference between materials differently constituted, and besides this some of them were of use only when applied to materials of somewhat the same kind.

The process of an explosion is somewhat as follows:—

When a solid body is capable of instantaneous ignition (or detonation), owing to some cause such as detonating capsules, shock, percussion, or high temperature, the phenomenon takes place in a very short time, which differs with different explosives. There is always however an extraordinary elevation of temperature, and a tension of the gaseous and vaporous products which is proportional to their temperature. Also a part of the products may still remain solid.

A certain time is required for the complete transformation of the solid products to gases and vapours during the detonation, and the speed with which this transformation is completed is called the "velocity of detonation."

After the products of ignition are formed, they remain for a short time only in the conditions of high temperature above described. The solid products, as well as the gases and vapours, cool down to the temperature of the surrounding atmosphere. The temperature and the greatest tension of the products of ignition can only be obtained by practice. The highest temperature should theoretically be at the moment of complete decomposition, that is at the end of the first phase of the process of explosion, and the greatest pressure should also occur at the same time.

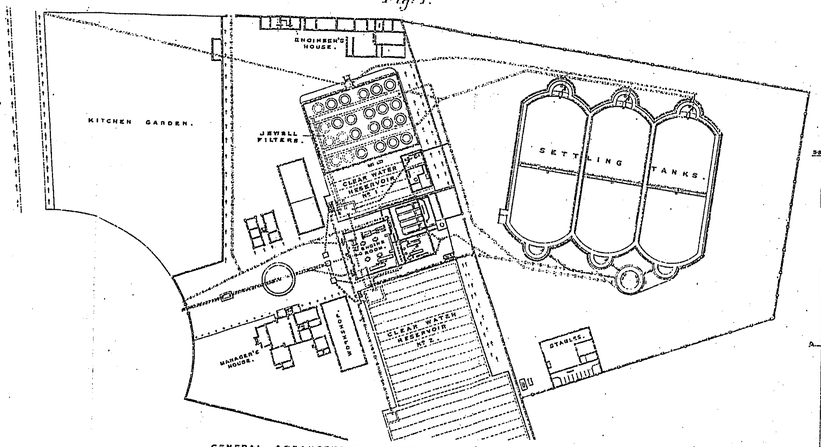
However, at the commencement of the formation of the gas, a cooling influence from the surrounding atmosphere begins to be exercised, and consequently there is a diminution in the greatest theoretical pressure. The two phases of the process are intermingled, but this does not prevent the measuring of the more interesting elements, especially of the velocity of detonation and the greatest pressure.

The first phase of the process is, without doubt, dynamical; the second phase may be considered as statical if the moment of theoretical rest is allowed for, which exists at the instant of greatest heat and greatest tension preceding the successive phases of slow cooling of the products. Also the first phase of the process of explosion takes place with great vehemence. Black powder exploded by a detonating capsule in a closed receptacle has a velocity of detonation of 200 to 300 metres per second. In so-called explosives of security, the velocity varies from 2,500 to 4,000 metres, whilst dynamite, with slow detonation, has a velocity of 4,000 to 5,000 metres, and other kinds even attain to a velocity of 9,000 metres.

From this it will be seen that the most important characteristic of an explosive is its velocity of detonation. The maximum pressure is also

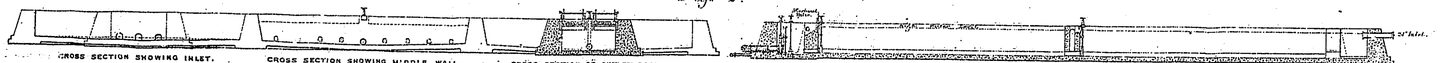
FILTRATION – WORKS: ALEXANDRIA WATER – SUPPLY.

Fig: 1.



GENERAL ARRANGEMENT OF WORKS AT PORTE ROSETTE.

Figs 2.



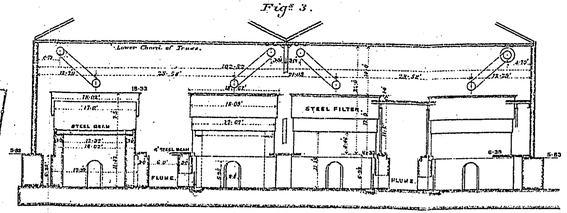
CROSS SECTION SHOWING INLET. CROSS SECTION SHOWING MIDDLE WALL. CROSS SECTION OF OUTLET BASIN.

SECTIONS OF SETTLING-TANKS.

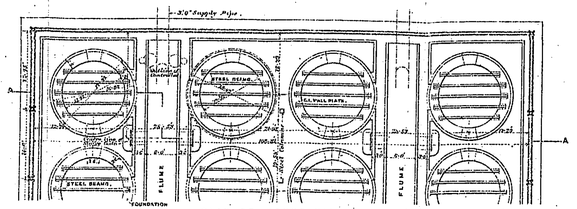
LONGITUDINAL SECTION.

H.R.C.BLAGDEN.

Fig: 3.

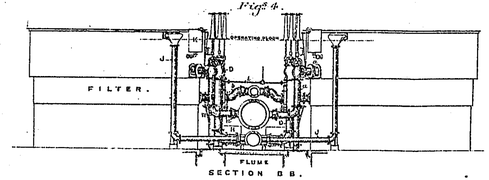


SECTION A A.

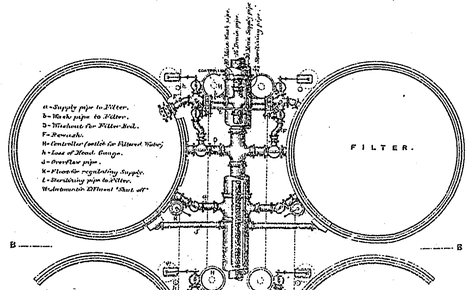


PLAN OF FOUNDATIONS.
FILTER — HOUSE.

Fig: 4.

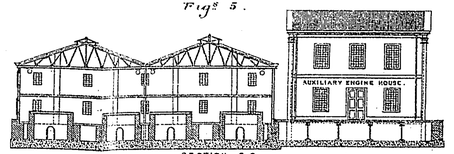


SECTION B B.



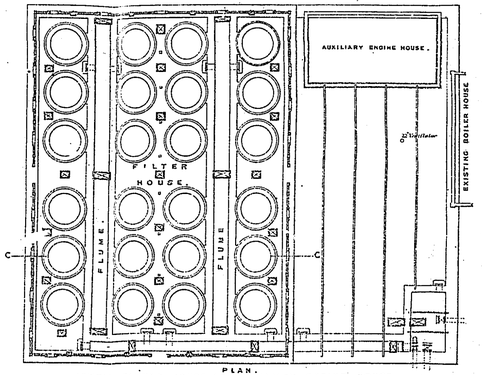
PLAN.
PIPING OF JEWELL FILTER-PLANT.

Fig: 5.



SECTION C C.

SECTION THROUGH OUTLET BASIN OF CLEAR WATER RESERVOIR.



PLAN.
JEWELL FILTER-HOUSE AND AUXILIARY ENGINE-HOUSE