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NEW INDUSTRIES FOR AUSTRALIA

THEIR SCOPE AND POSSIBILITIES

A series of remarkable developments have taken place, both at home and abroad, during the last few days.

(1) To our armies an early victory has now become practically assured; and, with it, Peace—and the home-coming of a large section of Australia's manhood.

(2) The Commonwealth Government has appropriated the sum of £370,315 for the immediate organisation of an air force.

(3) Wireless communication has been established between Great Britain and Australia, and the first direct messages from England received in New South Wales.

(4) The initial work of establishing aerial mail services between Australia and Great Britain has been financed and a survey party has been equipped for an expedition which will commence operations within the next two weeks.

(5) In London Mr. Handley Page has publicly stated that the newest type of aeroplane (bearing his name) is capable of making an aerial voyage from England to Australia within a week.

(6) In Australia the Aeroplane Construction Committee has announced that every type of aeroplane can (and will) be built and engined in Australian factories, entirely from our own natural and industrial resources.

* * * *

The developments above indicated will affect Australia's commerce and communications, both internally and externally, in many ways and in many directions.

The creation of an air force and the national importance thereof are dealt with—at some length—in another section of this journal, our report being based on a personal interview with Major-General Legge, C.M.G., C.B., Chief of the Commonwealth General Staff.

The establishment of direct wireless communication with England will, in peace time, enable us in Australia to transmit and receive massages to and from the opposite end of the world by means of electrical energy which travels at the rate of one hundred and eighty-six thousand miles per second.

The introduction of direct aerial mail services will render it possible for us not only to send important documents, letters and packages to Europe and intermediate countries, but to receive replies thereto in practically no greater length of time than is occupied—under existing postal facilities—by a *single* journey from Queensland to Western Australia.

* * * *

Thus are placed at our disposal the fruits of untold effort on the part of scientists, engineers and organisers throughout the world.

That the community at large may enjoy

to the fullest extent the multiple benefits and advantages of this research and experiment, it is essential that their administration be entrusted only to experts in each particular branch and to others possessing a practical inside-knowledge of these new industries.

Restrictions in war time are imperative and, whether they take the form of a rigid censorship of the press, a rigid control, by the Government, of certain important avenues and media for the conveyance of valuable information, or the temporary restraint of certain equally important inventions, we accept those restrictions to-day with a certain degree of complacency, recognising, as we do, that they are both justifiable and necessary.

Government control, wisely applied and sympathetically exercised is, in some instances, desirable at all times, and will probably not entirely disappear with the removal of war-time restrictions in the wider sense.

But it should not be applied in a manner likely to impede the growth and expansion of our national industries, nor should it be possible for the extent of such control to be determined solely by the recommendations of departmental officers to higher authorities who cannot be expected to fathom the technicalities of a new and intricate branch of industry—and who, for the same reason, are unable to appreciate its manifold possibilities as would others more closely associated with that particular industry.

The question of Government control is by no means new and has presented difficulties not in any way confined to Australia.

A very thorough investigation was held, a short time ago, in the country of one of our Allies. The Government of that country, by conducting its inquiry along unusually broad lines, was enabled to ascertain the views not only of its own officers and of the manufacturers concerned, but also the disinterested opinions of independent investigators and scientists. Evidence tendered by these disinterested bodies proved very conclusively that Government control and restriction, if carried beyond reasonable limitations, must, sooner or later, either paralyse or entirely suspend the development of a new industry which—with these restrictions removed—would confer illimitable advantages upon the general public.

If Government control must be applied to these new Australian industries a broad-minded but effective method should be adopted; this to serve the dual purpose of encouraging their unrestricted use for all legitimate purposes and checking any abuse of them.

The task of establishing and maintaining a control on the lines indicated would, we believe, in itself provide ample occupation for a Government Department. But if—as so often occurs—that same Department, in addition to being controller, should aspire to be exclusive manufacturer, exclusive patentee, exclusive inventor and, finally, exclusive "consumer," the development of that particular industry must undoubtedly suffer, while the Government itself would undoubtedly lose money.

* * * *

It is, therefore, of great satisfaction to all concerned that the present Government has expressed its intention to encourage and stimulate the aeroplane industry in every possible direction, and, further, that the construction of aircraft (together with plant and accessories) for Government purposes will be open to public tender.

By this means the development of the industry will be fostered, for the manufacturer, in addition to securing his proportion of Government work, will be able to build aeroplanes for private and commercial aviators, at the same time establishing an export trade with our neighbouring islands.

This decision will obviate any Government attempt to go into business on its own account, or to endeavour to conduct a large manufacturing industry which must be supported in slack seasons as in full, and which, irrespective of cost, would represent the Government's sole source of supply.

In the case of aeroplane construction the position will be exactly the reverse of that indicated above, for the Government will now enjoy the advantages arising from a healthy competition among the new manufacturers, with the certainty of securing its supplies at lowest cost when such supplies are required, and relieved of all overhead expense when they are not.

Finally, the benefit to the general public will be that instead of being compelled to purchase from a Government Department at an arbitrary price fixed by the Department, they will be able to obtain all their requirements in the open market.

FUTURE OF AUSTRALIAN AVIATION ASSURED

AN INTERVIEW WITH MAJOR-GENERAL J. G. LEGGE, C.M.G., C.B.,
Chief of Commonwealth General Staff

Major-General James Gordon Legge, C.M.G., C.B., Chief of Commonwealth General Staff, has entrusted this journal with important messages for its readers.

Each of us, he affirms, can be of individual assistance in the preliminary work of commercial aviation.

Before detailing the nature of the work to de done by the community we submit a brief biographical sketch of the officer from whom these remarks emanate.

Born in England in 1863, General Legge was educated at Cranleigh College, Surrey and, later, at the University of Sydney

Major-General James Gordon Legge, C.M.G., C.B., Chief of the Commonwealth General Staff.

where, at the age of twenty-four, he took his degree of M.A., followed by that of LL.B. Adopting a military career early in life General Legge served for time on the General Staff of New South Wales and during the South African war commanded the first infantry contingent from that State. quarters as Intelligence Officer. Returning In South Africa he did splendid work, both in the field with his men and at Headto Australia he was appointed Quartermaster-General of the Commonwealth Military Forces and Third Military Member of the Board of Military Administration. From 1904 until 1909 General Legge acted as Aide to the Governor-General. He devoted three years to the organisation of compulsory training in the Commonwealth in addition to personally compiling the Australian Military Handbook.

The title of C.M.G. was conferred upon the General in 1912, and that of C.B. during the present war.

Leaving Australia for the Dardanelles in May, 1915, in command of the Second Division (A.I.F.) he served with great distinction, both on Gallipoli and in France.

General Legge returned from active service in April of last year and has now resumed duty as Chief of the Commonwealth General Staff.

In this capacity he is kept in the very closest touch with every phase and development of Australian aviation. His views on the subject may therefore be accepted without the least hesitation, by those who are able to obtain them.

It has long been the writer's ambition to secure these opinions, although there seemed little or no possibility of obtaining an interview with General Legge in the ordinary way. In August last we paid a visit to Melbourne for that purpose, but without result, for the Chief of General Staff is hedged about with official bodyguards and is either deeply engaged with the Minister for Defence or absent on flying visits to other States.

On September 24 the subject of recruiting in Queensland claimed General Legge's personal attention for two days. On the same day the present scribe also had occasion to visit the Northern Capital and was, by exceptionally good fortune, relegated to a seat on the parlour car adjoining that of the Chief.

The opportunity was too good to be missed, and (need we add?) was availed of to the fullest extent. The General, during the long, tedious journey from Wallangarra to Brisbane, expressed his views on commercial aviation in its many aspects and, after being "warned" that any statement he may see fit to make would later appear in the columns of *Sea, Land and Air* he generously consented to being "interviewed" on behalf of our readers.

Aviation School at Portsea.

The first request was for particulars concerning the instructional school for aviation now being inaugurated in Victoria.

This, we are authorised to announce, is situated at Portsea, in the hitherto unused artillery barracks and in a locality particularly conducive to serious, undisturbed study by reason of its distance from the nearest cinema, skating-rink, race-course or any other distracting influence.

Accommodation is provided for twenty-eight pupils and it is stated that the new school will be fully equipped and in operation by Christmas of this year.

Here will be taught the theory of aeronautics, the subjects including aerial photography, map-making, machine-gunnery, practical rigging, the testing of aeroplane engines, the erection of framework for rigging, the testing and straining of aeroplane wires; everything, in fact, that can be taught "on the ground."

The tuition at Portsea will be continuous, the pupil progressing from subject to subject until the whole of the preliminary groundwork is mastered. He is then transferred to the Central Flying School at Laverton (Victoria) to complete the courses of practical rigging and piloting prior to being drafted overseas.

The instructional staff is composed entirely of experienced officers and mechanics returned from active service either with the Australian Flying Corps or the Royal Air Force.

As chief instructor the budding airmen will have Captain H. H. Kilby who, in a similar capacity at Queen's College, Oxford, has coached a large number of Australian cadets in aeronautical navigation, sending them from England to the various A.F.C. squadrons as full-fledged pilots, observers and flight commanders. While on this subject we may mention that an excellent photographic group of Australian Cadets in training at Oxford, which appeared in the last issue of this journal, was reproduced by courtesy of Captain Kilby, and that in the near future we hope to publish further information from the same source concerning the work at Portsea.

The Aeroplane Construction Committee.

Interrogated as to the likelihood of aeroplanes being built in Australian factories Major-General Legge declared, with deep emphasis, that the question is no longer open to doubt or dispute; its certainty, he added, is fully established.

Outlining the preliminary work already accomplished in this direction, General Legge instanced the activities of the Aeroplane Construction Committee, which, working diligently yet without "noise," under his personal supervision, has appointed an expert to inquire into and report on Australia's natural and industrial resources for aircraft construction.

While it had appeared unlikely that any single private-owned factory would, at this juncture, possess the equipment, plant and other facilities for producing and assembling the hundred-and-one sectional parts of a modern aeroplane, it was considered probable that, by standardising the individual parts and mobilising the industrial resources of several factories, the desired results could be obtained.

Accordingly a Government expert, equipped with drawings and samples of all sectional parts required, made a tour of certain private-owned factories and, at the conclusion of his investigations, reported that the most modern types of plane can be produced in our own factories, complete in every detail; further that the manufacture of engines and of special types of machine tools presents not the slightest difficulty.

"We could start building aeroplanes today," declared General Legge, "but for the initial work of survey, of which I will speak presently."

Not only has the Committee prepared to build on a large scale but is also working out the production of materials in Australia. This will include details as to manufacture of steel rods, linen fabric and other essentials, also experimental tests with a special type of aluminium now employed in the manufacture of automobiles. The materials can, of course, in most cases be imported, but it is in every way preferable to develop our own natural resources, to keep the money in the country and to thus provide employment for our own workers.

The Chairman of the Aeroplane Construction Committee, Major Gibson (formerly Professor of Engineering at the University of Brisbane) is abroad, on active service. In his absence the work is being zealously carried on by Professor Payne, Chief of the Engineering School at the University of Melbourne, and by Mr. G. D. Delprat, C.B.E., General Manager of the Broken Hill Proprietary Company, Ltd.

A scheme is now under way for the erection of an arsenal to be used for aeroplane manufacture. Meanwhile the immediate object of the Committee is, in the words of General Legge, to achieve in a small way what will eventually be done on a large scale in that arsenal.

Donations from public-spirited citizens have greatly assisted the research work of the Committee, the contributions already including one of £3,000 and two of £500.

Australian Timbers.

Australian timbers are particularly suitable for aircraft construction, Queensland maple, Tasmanian pine and Victorian mountain ash being already largely employed for that purpose in British aeroplane factories as substitutes for American timbers. In this connection a series of practical experiments are being conducted in the Engineering schools of the Universities of Sydney and Melbourne. These consist of tests by slow, gradual pressure, by impact and by the application of tensile stress, for the purpose of ascertaining the degree of resilience, resistance, elasticity and durability of each variety of timber.

Further reports deal with the quantity, age, localities and accessibility of the timbers in question. In addition the Committee has at its disposal the records covering investigations of a similar nature made by the Department of Defence in its selection of timbers suitable for the manufacture of rifle-stocks, these records being supplemented by recommendations as to seasoning. It is, we believe, generally known that timber grown on the hill side matures more satisfactorily than that grown on the flat.

Other sections of this pioneer work include the testing of substitutes for petrol and the examination of certain steel-alloys, also a close study of textiles and fabrics and the determination of their respective suitability for the manufacture of aeroplane wings. Many of these tests are conducted in the laboratory and are of a purely analytical nature. From these experiments has been deduced the fact that any scarcity of petrol could be covered by substituting commercial alcohol, distilled from the cactus plant which thrives in wild profusion throughout the Commonwealth. Similarly a timber shortage would be met by the substitution of oxy-acetylene welded steel rods, these latter being now drawn at Newcastle in the Broken Hill Steel Works

Aero-Clubs and their Practical Uses.

General Legge strongly advocates the formation of aero-clubs and asserts very convincingly that these would be of incalculable national value as "stimulants" in the development of aeroplane construction in Australia, and in the exploitation of her resources.

There is an immense amount of preliminary work to be done, said he, in the matter of topographical survey, mapping out areas suitable as landing grounds and for the erection of hangars. The preliminaries involve also the equipping of relay stations and repair depôts, the gathering of information as to the existence and location of wide, open spaces where aerodromes could be erected and equipped, and where the interstate or transcontinental airman could descend for a night's shelter and refill his petrol tanks.

It is anticipated that the provision of landing places will be attended by many difficulties, particularly in districts where most of the "ground" is, in a sense, not really ground at all but simply a dense mass of shrubs. In these conditions a descent from the air could only be effected by the adjustment of extra large wheels, or skids, to the plane.

On the other hand in our vast and only partly explored stretches of country there exist numerous wide, flat-surfaced spaces eminently adaptable as landing grounds for airmen and which could also be built upon. The existence of these spaces, although well known by those living in the vicinity, are not however charted on any reference-map. Equally desirable would be information as to outlying show-grounds, sports-grounds, race-courses, parks and other suitable areas. The collection and investigation of these details would be greatly facilitated by the establishment of aero-clubs, with branches and sub-depôts throughout the Commonwealth. The lead already taken by the Automobile Association for the betterment of motoring conditions generally, could be applied equally well by aeroplane clubs towards the development of commercial aviation. The scope of such preliminary investigation is practically unlimited, for the area to be surveyed and mapped out represents the total ground surface beneath the Australian skies.

General Legge Would Personally Assist.

To the writer's request for a concrete statement on this subject General Legge replied: "You may say this:—

"I shall be delighted to hear of the formation of Australian aero-clubs, because I consider that they can do for us in the air service what the National Rifle Associations do for our land forces. In the event of their formation I would be very happy to advise and assist by every practical means at my disposal; and I would gladly become an active patron of any such club."

Aero-clubs, the General continued, are to be encouraged, for they in turn would stimulate the construction of 'planes for private or commercial purposes.

Any 'plane that can carry passengers can carry bombs.

From a military point of view, said General Legge, it is altogether to the interest of the Government to assist civilian flying, because Australia is a country which can never afford to maintain a really large air service in peace-time on account of the expense involved. The Government will have to apply to the air service the principle which it has already applied to the land troops, *viz.*, supplement permanent forces by citizen forces.

In time of war private-owned aeroplanes would be requisitioned and subsidised for military operations.

In pre-war days Germany subsidised standard types of motor lorries and financed the construction of them. As a result of this foresight she was able, immediately on the outbreak of war, to requisition and mobilise an immense fleet of standardised motor lorries many of which are probably still in use to-day not only on the Western Front but in Palestine and throughout the theatres of the present war.

Reverting to the subject of Australian aerodromes General Legge intimated that a scheme is now under way for the commencement of a chain of aerodromes which, when completed, will cover the whole of Australia at comparatively short intervals.

The route already surveyed, or under-survey, is, we understand, Sydney—Goulburn—Wagga.

Wireless Installation.

Wireless telegraphy, says General Legge, will play an all-important part in our aerial communications. Installations will be made on all aeroplanes and in all aerodromes, relay stations and repair depôts along the line of route. It is considered probable that a standard wave-length will be adopted, both on ground stations and areoplanes. By this means airmen who may have lost their way, either in a fog or during a night journey, will be enabled to obtain their direction by wireless from the nearest aerodrome.

The practical advantages of this system may be illustrated in many ways.

For example, an airman, during a night journey from, say, Melbourne to Sydney, travels into a dense cloudbank beneath an obscured moon. His compass is unreliable. He would immediately send out a call signal, giving the number of his aeroplane. For all aeroplanes will be registered, as in the case of motor cars.

His message, in Morse, may read: "From No. XB 27948. Please give direction nearest aerodrome."

By the use of certain special apparatus the receiving station will be able to determine the approximate bearing from which the airman's message is being transmitted. The reply, which would be instantaneous, would possibly read as follows: "Liverpool 6¾ miles, S.S.W. Lights: two blue, one white. Continue sending."

Steering his 'plane in the direction given the airman would a few minutes later see ahead of him the aerodrome signal of two blue lights and one white, or whatever the colour combination might be. Signal lights would be sent up from aerodromes to facilitate the descent.

Battleplane versus Battleship.

General Legge drew some very striking comparisons between these two factors. It is no secret, said he, that during the present campaign, the number of planes in the air simultaneously is seldom less than two thousand.

One thousand aeroplanes cost no more than one first-class battleship. They can be built far more quickly and—particularly in coast defence—are, for their cost, infinitely more effective.

The crews of one first-class battleship and one thousand battleplanes would be approximately equal in point of numbers, while an equal total bulk of explosives could be carried by either. "But"—added General Legge, putting the position in the form of a direct question—"if a thousand battleplanes attacked one first-class battleship, which would you prefer to be on?"

Just as the express drew into Brisbane station General Legge pointed out that a thousand planes, each carrying ten passengers, could, in two trips, transport an entire division.

* * * *

Two or three weeks after the date of our interview detailed above, a statement appeared in the daily Press to the effect that an early announcement was expected from the Government concerning the steps decided upon for the development of air forces in Australia and that it is intended eventually that all machines, engines and material for their construction shall be produced within the Commonwealth.

In the estimates £370,315 is provided, and £282,700 set aside for expenditure on new equipment, including aeroplanes, motor vehicles, engines and tools, and £50,000 put down to meet the cost of constructing an aerodrome, workshops, and buildings. In addition a sum of £25,465 is set aside for the upkeep of aviation and the instructional staff at the Central Flying School, and £12,160 for contingencies.

Major-General Legge later again emphasised the necessity for establishing aero-clubs throughout Australia. His views on the subject apparently inspired the official board on the staff of the Sydney *Sun,* who invoked the Muse, with the following result; which we reprint with due acknowledgment:—

Presumptuous Caitiff!

Major-General Legge, Chief of the General Staff, is in favour of establishing aero-clubs throughout Australia. His idea appears to be that the Government should encourage the use of the aeroplanes for commercial and sporting purposes.

Is it insubordinate
For a soldier-man to state
Matters really contraree
To a Cabinet decree?
Major-Gen'ral Legge defies
Webster, scorner of the skies.

Webster's wrath will hotly mount,
When his minions bring account
Unto their majestic head
What the General has said;
Webster's is the harsh ukase,
"Man on *terra firma* stays."

"Insubordination foul!"
Then shall William Webster howl,
"Shall mere soldiers dare defy
My immense authority?
When I say the eagle's way
Is not for us, who'll answer nay?"

What will be the Gen'ral's fate
For this treason 'gainst the State?
Treason's penalty we know,
Death, but can the Statutes show
How a postmaster can kill
Daring folk who cross his will?

'Ere in torture Legge shall die
He in mail-bags dim shall lie,
Drop by drop, upon his head
Ink shall fall, blue, black and red,
Night and day *sans* rest he'll hear
Dot-dash-dot within his ear.

"Major-Gen'ral Legge I do
Hereby sternly sentence you,
Not for you the kindly axe.
You shall boil in sealing-wax;
If your bones perchance escape,
They shall hang in stout red tape."

* * * *

Readers desiring to take some active part in the proposed aero-club movement are cordially invited to communicate with the Editor of *Sea, Land and Air,* who will glady obtain on their behalf fuller particulars of the suggested Association.

THE AUSTRALIAN FLYING CORPS COMFORTS DEPOT

The object of this Depôt is to provide comforts, clothing, foodstuffs, tobacco and cigarettes for men of the Australian Flying Corps in France and Egypt, and for those attached to the Training Squadrons in England.

The Depôt is open every Tuesday and Thursday between 10 a.m. and 5 p.m., and workers are always welcome. The work consists of knitting, spinning and making flannel and khaki shirts, "shorts" and other clothing. Wool will be supplied and forwarded to anyone willing to knit for the flying men.

At a general meeting held at the Depôt on October 15 the half-yearly report showed that the following comforts had been despatched:—

721 pairs of socks, 547 shirts, 162 pairs of shorts, 36 overalls, 280 lbs. tobacco, 56,000 cigarettes, 20 cases foodstuffs including butter, cheese, cocoa-and-milk, fruit and sweets, 1,328 Christmas boxes, 2 cases margarine and £40 sent in drafts for the purchase of extra comforts for our airmen.

Amount realised at the Flying Corps stand on Dependents' Day was £77 15s.

The stand will be in the same position in Moore Street, Sydney, on Jack's Day. We are requested to announce that contributions towards stocking the stall will be gratefully received at the Depôt, 59A Wentworth Avenue, or at the Stall on Jack's Day. There will be home-made cakes, jam, fruit, sweets, etc., for sale and a flower stand and lucky dip.

A cinema entertainment in aid of the Funds will be held at the Australian Picture Theatre, Spit Junction, on Thursday, November 14. Tickets 1s. and 6d.

Connected with the Depôt is a shop, situated at 305 George Street, and open every Wednesday for the sale of goods.

All readers interested in the Flying Corps are invited to make their purchases there. Contributions towards stocking the shop will be very gladly accepted either at George Street on Wednesdays, or at Wentworth Avenue on Tuesdays and Thursdays.

The Honorary Treasurer, Miss A. M. Clark, will be pleased to receive monthly subscriptions, a regular income being essential to a maintenance of the supply of comforts.

The Honorary Secretary, Mrs. Hardy, will be pleased to furnish fuller information regarding the work of the Depôt, the President of which is Mrs. David Clark.

Editorial Announcement

"Sea, Land and Air" will, in future, be published on the first day of each month.

AUSTRALIA'S SHIPPING PROBLEMS

Especially Written for "Sea, Land and Air"

By H. W. CURCHIN,
Chief Executive Officer for Commonwealth Ship Construction.

(1) The national importance of shipbuilding in Australia is, I think, obvious. It will be generally admitted that this country has everything to gain if it constructs its own ships within its own boundaries.

The tremendous bill with which Australia is faced for its participation in the war must be met by the exportation of the products from its broad acres. On its primary products and their disposal in the world's markets Australia is dependent. Australia's present and most difficult problem is that of shipping facilities. She cannot obtain anything like the shipping space she requires. Her only alternative is to build.

From my knowledge of shipbuilding and shipbuilding methods in practically all the shipbuilding countries, and from what I have learned from personal observation and in other ways of Australian conditions, I am satisfied that shipbuilding can be made a good commercial proposition.

(2) It may necessitate Governmental subsidy and protection, but it is worth it. American shipbuilding was protected to the extent that ships engaged in the coastal trade had to be of American construction. Japanese shipbuilding is subsidised, German shipbuilding was financed by the Imperial banks and shipbuilding in other countries was assisted by the respective Governments.

Mr. H. W Curchin.

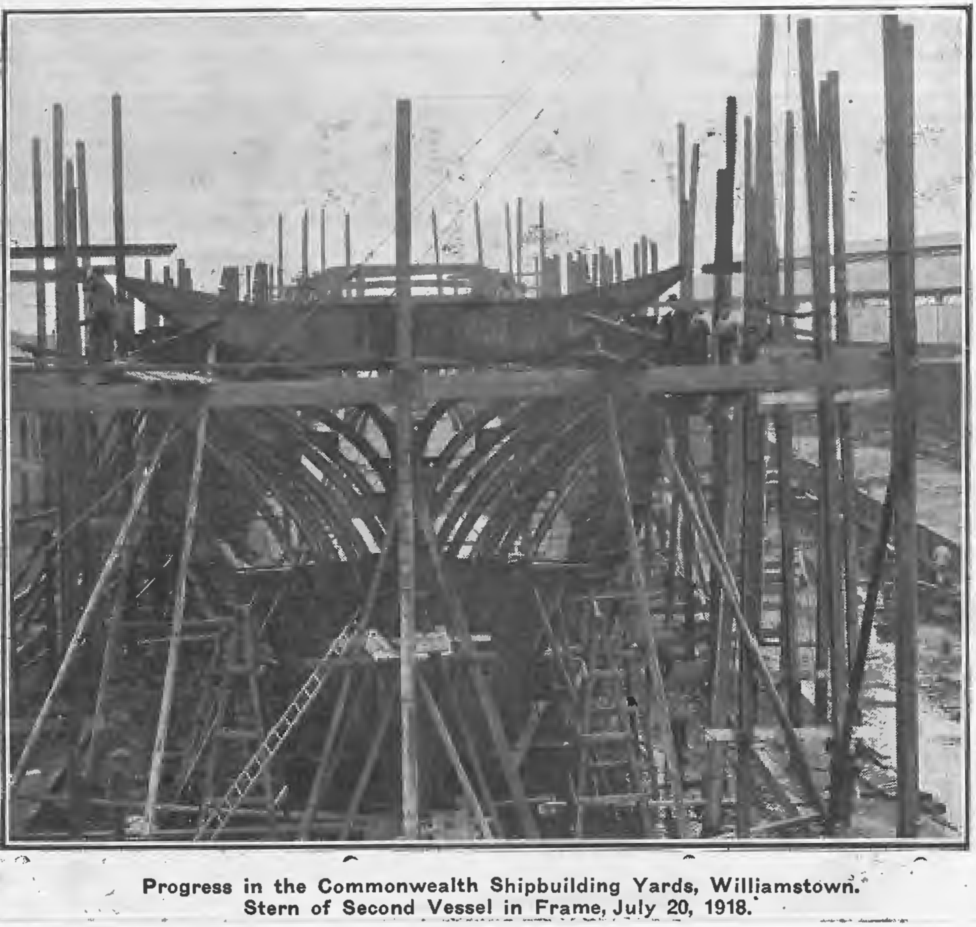
(3) To an island, continent or country, where the only means of external trading is confined to shipping, shipbuilding is an essential industry. The conditions in Australia accentuate this need, having in mind the varied and valuable products, the exportation of which is absolutely necessary to the country's well-being.

Australia has always been at a great disadvantage owing to her geographical position and her long distance from the great markets of the world. In pre-war times this was a serious handicap; after the war is over it will be felt still more. Ship owners will naturally be keenly anxious to secure freight that can be handled and landed in short periods. Short voyages will be eagerly sought after, and there will be unlimited demand for shipping space by the countries of the Old World, to the serious exclusion of the distant countries.

It is, therefore, extremely important that Australia should be up and doing, so that she will be able to provide for herself as much as possible of the shipping she will require, to enable her to export her great and valuable surplus products to the world's markets. If she is not in a position to ship her exportable surpluses she will undoubtedly be left behind in the great race which must take place when the war is over and the great nations of the world have again entered upon the work of replenishing depleted stocks.

Australia stands to lose more perhaps than most countries unless she is awakened to the serious need for straining every nerve to place her shipping in as favourable a position as possible, and the opportunity is now at hand for all concerned to put their shoulders to the wheel, and see to it that no narrow and selfish motive is allowed to stand in the way of this great possibility.

There could be no more opportune time than the present for making a commence-



**Progress in the Commonwealth Shipbuilding Yards, Williamstown.
Stern of Second Vessel in Frame, July 20, 1918.**

ment. Owing to conditions brought about by the war the cost of ships is, in all countries, considerably higher than in normal times. So that Australia now has a splendid opportunity of building ships in world competition on something approaching an equality of terms and conditions.

(4) The position should be regarded from an Australian and Imperial point of view. The opportunity has presented itself to establish this industry with an excellent chance of success. If it is not grasped it may never occur again, Australia's oversea trade would then be dependent, not only on Great Britain, but on Germany, America and Japan and other countries for her export and import trade.

(5) The success or non-success of shipbuilding in this country depends upon three things: (*a*) efficient commercial and technical management, (*b*) the provision of material by Australian mills, and (*c*) a satisfactory return from labour.

(6) The first can be provided; the second challenges the commercial enterprise of Australia and depends partly upon the third; while the third, probably the most important, depends upon the men.

(7) Shipbuilding, to the successful, must be carried out on sound commercial lines, although the enterprise is launched under Government control. We must be in a position to compete with the world. To do so, we must be independent of outside sources for supplies of material, and labour must do its utmost. The primary object of the Government scheme is not to build a few ships at any cost, but to establish upon a firm commercial basis in the building of those ships, an industry which will become permanent.

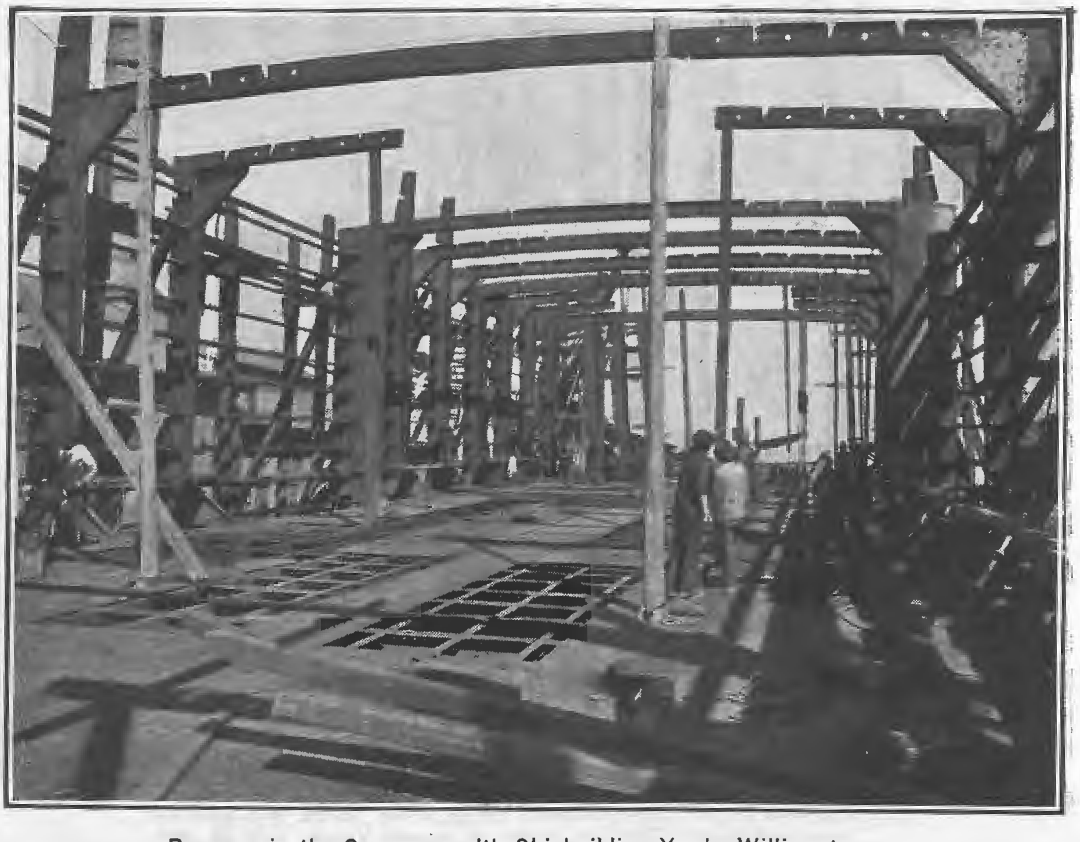
While wages must not be too high they must be on a good level. At the same time labour must give a good return for a good wage. In fact the more money a man earns, the better. High prices or poor labour returns at the commencement will kill the industry as surely as the sun shines, and to pay for unjustified earnings will be something like killing the goose that lays

Progress in the Commonwealth Shipbuilding Yards, Williamstown. Keel and Centre Through Girder of Second Vessel, July 20, 1918

the golden egg. The same remarks of course apply to the manufacturer—material must be provided at a reasonable figure. Exploitation on the manufacturer's part will have precisely the same effect as poor labour returns.

Next to economical construction—this does not infer cheap labour, but good value for money expended—is speed of production. In that again labour is the dominant factor. Speed of output is essential and justifies suitable recognition.

With regard to method of payment, Japan is the only country where nearly all, if not all, labour is paid on a time basis, and it obtains there because labour is abundant and is remunerated on a very low scale. In all other prominent shipbuilding countries a considerable proportion of labour is paid on results—the only equitable method of payment, and the only method which will enable Australia to compete with other countries, even under present conditions. Under the arrangement entered into with the Prime Minister, the shipyard worker is on a better footing than any other that I am acquainted with, having in view all the conditions. He is guaranteed a minimum wage equal to a high time wage, with every prospect of earning a considerable amount more. He cannot be any worse off than before, and has every opportunity of being better off. The abuse of piece work that has undoubtedly occurred becomes impossible under the Prime Minister's scheme and it is an unpardonable mistake to discard what is the only equitable method of payment, because it has been abused; for provision has been made whereby the possibility of abuse has been removed. It may be stated without fear of contradiction that whilst admitting the abuses that have, under certain circumstances, been associated with piece work, time work is subject to at least equal condemnation for the same reason. In addition he is engaged in an industry, not only of national, but world-wide importance, and one that is recognised both in Great Britain and in the United States as being equal in importance to that of a place in the fighting line.



Progress in the Commonwealth Shipbuildirg Yards. Williamst.wn.
"Commonwealth Ship No. 1," August 30, 1918.

Successful commercial shipbuilding in any country depends upon many and varied circumstances, but chiefly upon competition with other countries. The countries actively engaged in shipbuilding (excluding enemy countries of which we have little knowledge) are Great Britain, the United States, Japan, and in a lesser degree France, Holland, Italy and the Scandinavian countries and others on a still smaller scale.

The conditions in Great Britain are somewhat as follows: the quality and quantity of skilled men are far in advance of other countries, material is made at home and is readily procurable in large quantities in normal times.

In U.S.A. skilled labour is not procurable in sufficient quantities to adequately equip the old and new yards. Material, although rolled in large quantities, cannot be obtained in sufficient quantities to fully supply the numerous yards. Wages are on a very high scale.

In Japan skilled labour is at a minimum. Wages are low, but material has to be imported.

In the other countries, while labour is not paid on a high scale, material has practically in all cases to be imported and skilled labour is not over abundant.

Analysing these conditions it must be concluded that Great Britain has considerable advantages over all other countries. Although hitherto wages have been low, there has been an appreciable upward tendency, and it is the opinion of experts that the low standard of pre-war times will not be reverted to. While skilled labour of the widest experience is plentiful, it is not utilised to anything like the extent possible.

In many of the yards mechanical equipment is not of the highest type. This is not a serious disadvantage where unskilled labour in unlimited quantity is procurable or where labour conditions permit a scheme of unrestricted dilution. These conditions do not apply in Great Britain, due do doubt to a spirit of suspicion existing be-

Progress in the Commonwealth Shipbuilding Yards, Williamstown. "Commonwealth Ship No 1," September 20, 1918.

tween capital and labour. Consequently these features considerably handicap the output. It is my considered opinion that with the adoption of newer methods, mechanical appliances and a better distribution of skilled labour of the country, the output of ships is capable of considerable increase.

(8) It is only within very recent times that pneumatic riveting has been adopted and is now only in operation to a very restricted extent. When it is considered that two squads of hand riveters will make three squads using pneumatic tools the obstinacy of the shipbuilders is obvious. Again, the practice in England regarding the employment of platers is subject to serious criticism. We find skilled platers punching and hanging up, neither of the operations calling for highly skilled labour. In addition, a skilled squad of riveters will not only lay up rivets but will screw up plates—work that should be done by unskilled labour.

(9) In U.S.A. there is a limited supply of skilled labour, but by the adoption of mechanical appliances and the judicious blending of the unskilled labour with the available skilled labour, this disadvantage is considerably modified. Wages are on a high plane, and the probability is that they will further increase.

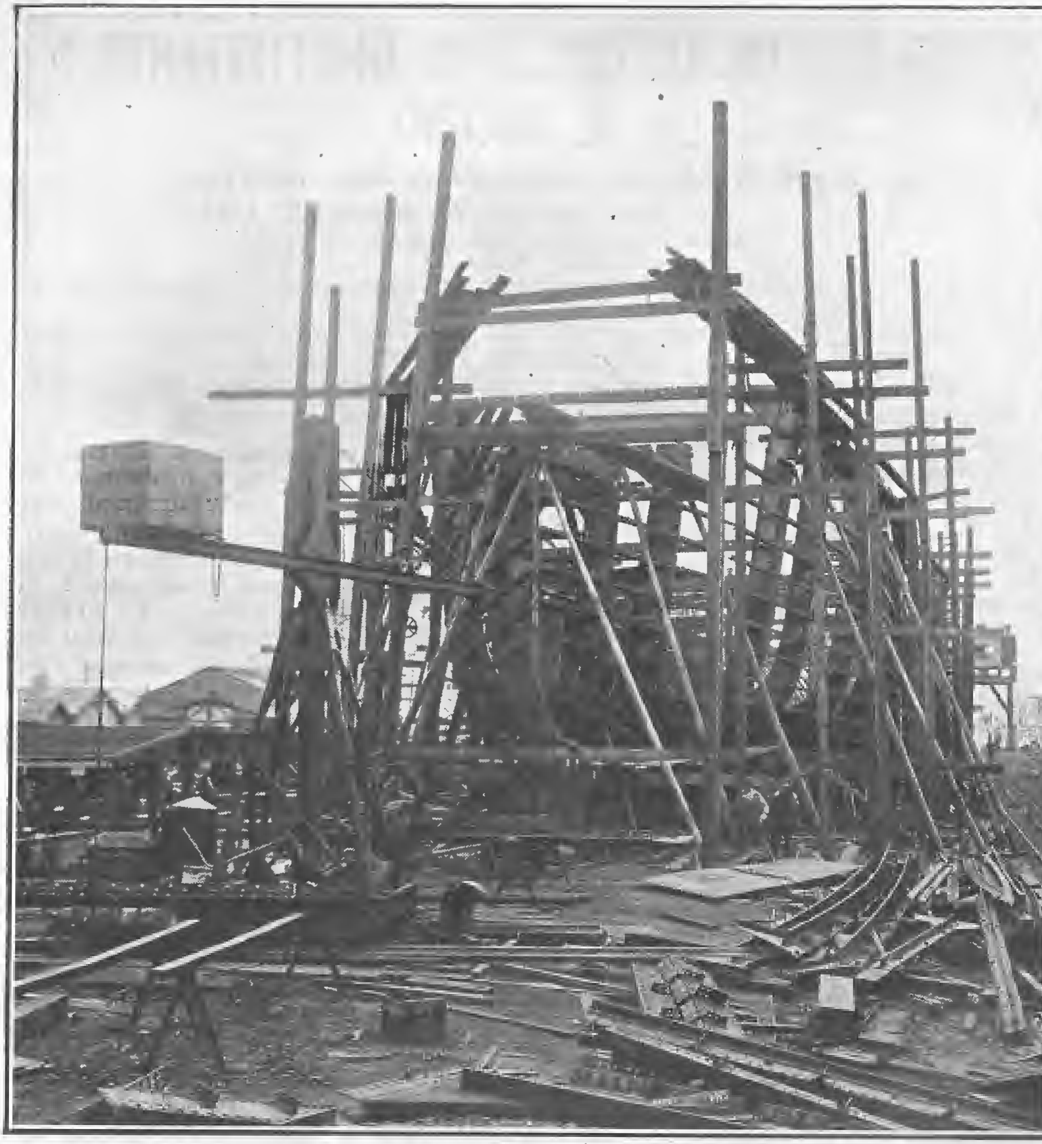
In Japan successful shipbuilding is based on an unlimited supply of unskilled and exceptionally cheap labour and the widest use of the limited supply of the available skilled labour, which counterbalances the disadvantage of having to import materials.

None of the conditions in the countries mentioned will, in their entirety, apply directly to Australia. Here there is a scarcity of what is understood as skilled labour, wages are on a good level and a proportion of material at least has to be imported.

From an investigation of the foregoing conditions it will have to be admitted that successful competition will be somewhat difficult. There is the profound satisfaction that the disadvantages mentioned are subject to amendment. The highly skilled labour can be utilised to the greatest advantage to itself and consequently the output of ships may be increased by the introduction of less skilled labour. Machine riveting and the utilisation to the greatest extent of mechanical tools will dissipate the disadvantages, as far as such means are possible, of the restricted supply of labour. The reasonable level of wages is not a disadvantage, provided always that the labour return is equivalent. Good wages and unrestricted output are advantages; they result in an increase of output and reduce capital charges. The importation of material is an unquestioned disadvantage, applying particularly to a country where wages are comparatively high. Every effort to eliminate this disadvantage is of the greatest importance to the successful prosecution of shipbuilding. Where the raw material is readily procurable the advisability of rolling material is worthy of the utmost and most favourable consideration. A *résumé* of these points would lead to the conclusion that the opportunities for successful shipbuilding in Australia are distinctly favourable subject to the following conditions.

Good and up-to-date technical knowledge, tactful and energetic management, sympathetic consideration, by labour and the management, of all questions relating to output and remuneration, the best use of mechanical appliances by workmen, a reasonable spirit respecting dilution of labour with a view to increasing output and total earnings, and payment by results. It is, however, one of the essentials that steel material be rolled in Australia. With regard to this matter the question arises respecting continuous employment of the rolling mills. If it is found that the full output of Australian rolling mills cannot be used in Australia, the question of exporting to other countries, say to Japan, would appear to be worthy of consideration, and not outside that possibilities of an arrangement, in fact the suggestion may be received most favourably by Japanese builders.

The photographs give some idea of the progress made with the hulls under construction at the Williamstown yard. Equally good progress has been made with three hulls at Walsh Island and one at Cockatoo. Altogether six steel cargo ships are in course of construction, with every prospect of being completed within a reasonable time. As the first plates were not delivered until the end of May the progress may be considered satisfactory, whilst the work would have been much further advanced if steel plates had been obtainable in the necessary quantities. The delay



Progress in the Commonwealth Shipbuilding Yards, Williamstown.
Bow View of Second Vessel in Framing, September 20, 1918.

in the delivery has been due to the home requirements of the United States, the scarcity of shipping, and the embargo on the American railways. It is fully anticipated that within the next few weeks the Broken Hill Proprietary Company will be able to roll all the plates necessary to complete the hull of one of the standard ships and shortly, therefore, place Australia in the happy position of being independent of outside supplies for hull steel.

Messrs. Thompson, of Castlemaine, are making good progress with the three sets of propelling machinery for the Williamstown and Cockatoo Island hulls, and the engines at Walsh Island are also well advanced.

The great advantage of building Australian ships in Australia will be apparent to all. It is *the* step to wide prosperity. The question is "Is it worth while?" and the answer is emphatically "Yes." But it will require modifications in the views of many and a broader outlook on the part of the producer and worker. It will require honest work in return for a wage and conditions that will compare favourably with any country in the world engaged in shipbuilding.

ENGLAND TO AUSTRALIA IN ONE-FIFTEENTH OF A SECOND

HOW WIRELESS MESSAGES ARE SENT

Written for "Sea, Land and Air" By ERNEST T. FISK,*

Member Institute of Radio-Engineers.

"No familiarity with the subject removes the feeling of vague wonder with which one sees a telegraphic instrument, merely connected with a length of 150 feet of copper wire run up the side of a flag-staff, begin to draw its message out of space and print down in dot and dash on the paper tape the intelligence ferried across 30 miles of water by the mysterious ether."

Dr. J. A. Fleming, the inventor of the remarkable Fleming valve, which was described in the last number of this magazine, spoke the words quoted above in 1897, when Mr. Marconi had succeeded in establishing communication across a distance of thirty miles.

It may be said with certainty that the eminent doctor of science, in his most enthusiastic moment, never dreamed that, in little more than 20 years, a wonderful combination of his own inventive faculty with that of Marconi would enable "a length of 200 feet of wire . . . . to draw from space a message which had been ferried across twelve thousand miles of land and water."

* Managing Director, Amalgamated Wireless (Australasia), Limited.

Mr. E. T. Fisk Receiving the First Direct Wireless Messages from England.

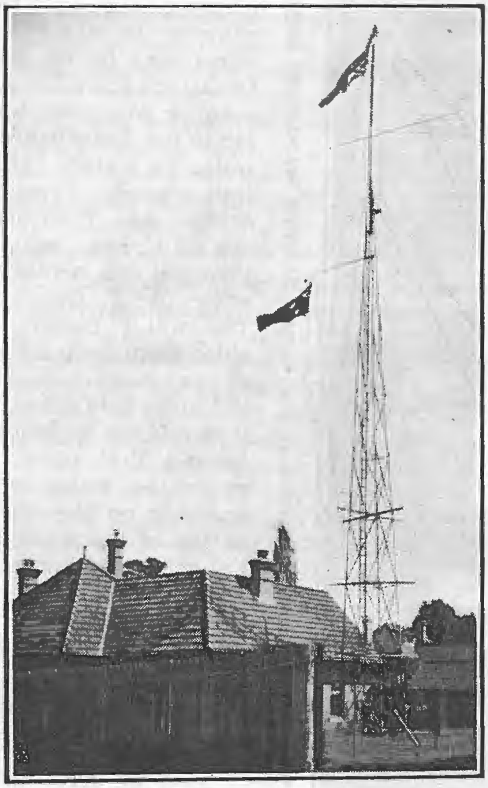
With such a record of achievement in the short space of twenty years, who can doubt the wonderful possibilities of future years, when our knowledge of the science and possibilities of wireless communication is growing wider every day. Just as the achievements in aviation are rapidly annihilating space in the transport of mails, passengers and merchandise, so is "wireless" destroying space, time and cost in the communication of intelligence.

An authoritative endorsement of this fact has just reached Australia in a report of the speech of the Managing Director of the Marconi Company at a recent general meeting held in London.

Such a wide interest has been created throughout Australasia by the successful receipt in Australia of the first direct wireless message from England that a clear description of the station from which those messages were sent and of how the wonderful electrical radiations are produced will undoubtedly interest all readers of *Sea, Land and Air.*

The apparatus with which the messages were received was described by the writer in the last number. In that article we gave an easily acquired mental-picture of the actual ether connection between any two wireless stations, no matter what their distance apart, by likening the all-pervading ether to an enormous jelly, in which vibrations are created by the sending apparatus. These vibrations spread in all directions through and across the jelly and cause the antenna (or feeler) at the receiving station to vibrate in sympathy with the sending antenna, provided, of course, that both antennæ (or aerials) are adjusted to the same rate of vibration or to the same tune.

Coiled Spring and Weight, for Producing Mechanical Oscillations.



Wireless Tower and Aerials at Wahroonga, New South Wales.

A question frequently asked is: "Are the receiving instruments very powerful?" The answer is that, although a small amount of electric power is used to reinforce the energy received, the power, or, better said, the energy, for the received messages comes from the sending station. For the layman this is a surprising statement, but it is quite true that energy, in the form of electric and magnetic impulses, actually travels from England to Australia and it covers the distance in the astonishing time of *one-fifteenth of a second.*

Our human faculties cannot easily appreciate such a short period of time, therefore it may be said that when the operator in England touches his key a signal is received in Australia almost instantaneously.

To describe in non-technical language how this energy is produced and imparted to the ether is no easy task, yet is possible, and the writer hopes to succeed, so that all readers may understand, as everyone should in these days, how wireless messages are sent.

Still looking on the ether as an enormous jelly, in which vibrations are created by the aerial wires at the sending station, we now wish to know the nature of the vibrations and the method of producing them.

Electricity, of course, is the agent or source of wireless waves. That electricity is first generated in the ordinary way by dynamos or batteries, but the kind of electricity obtained from generators such as are used for electric lighting and power will not produce the vibrations required for wireless telegraphy.

To create vibrations in the ether the wireless aerials must be charged with electric currents which flow first in one direction and then in the opposite direction. They must alternately flow up and down the aerial and change their direction with great rapidity. The number of times these currents flow up and down in one second is termed the frequency of the current.

Mr. E. T. Fisk's Experimental Station at Wahroonga, Showing Instruments on which the First Direct Wireless Messages from England were Received.

This frequency differs according to the "tune" or wave-length we wish to make. In low power sending stations, such as are used on board ship the frequency is often as high as one million; that means that the current changes its direction at the almost incredible rate of two million times per second.

In high power stations the frequency is lower, sometimes only 20,000, yet with that the currents change direction forty thousand times in one second.

These very rapidly changing electrical charges in the aerial wires may be imagined to disturb the ether in a manner somewhat similar to the disturbance of water by a stone falling into a pond. From the centre of disturbance waves are radiated through and across the ether in all directions. The water picture enables us to form an idea of waves spreading or radiating into space, but it should not be followed beyond that point, because the water waves are only on the surface or top of the water and the ether, so far as we know, has no top.

The wireless aerials are *in* the ether rather more like a short rod stuck in the ground at the bottom of a deep pool.

Now we have to see how these extremely rapidly alternating currents are produced, and here again it is possible to describe analogies with every-day objects, so that we can form a mental picture of how the electricity does its work.

Anything which is capable of vibrating must possess two well-known physical qualities; these are elasticity and inertia. Elasticity is the property which causes a thing such as a thin piece of steel to return to its normal condition after being bent or stretched. Inertia does not mean laziness, as many who are not accustomed to the every-day practical use of the term might think. It is a natural quality of all bodies, by reason of which they cannot change from rest to motion or from motion to rest, or from one form of motion to another, unless they are compelled to do so by some external force.

That is why the earth, planets, sun and stars move on for ever, they were started and are unable to stop themselves; their direction of movement is partly due to the direction in which they first started and partly to the external force of gravity.

Having a brief but sufficient outline of these two important laws of nature, we can now follow examples which will enable the mind to form a picture of what goes on in the wireless sending station.

Imagine a coiled steel spring with a weight at one end, as shewn by the accompanying illustration. Without thinking of laws, everyone will realise that if we hang the spring from a hook with the weight downward, then push the weight up with the hand, so that the spring is compressed, and afterwards let go, the weight will bob up and down many times before it comes to rest. That happens because of the laws of elasticity and inertia. The elasticity of the spring causes it to spring back to its normal position when the hand lets go of the weight. When the weight moves with the rebound of the spring its inertia makes it continue moving past the normal position of rest. Once that point is passed the spring is stretched and tries to pull the weight back again, and after a certain distance the spring wins and pulls the weight back. But the weight again overshoots the mark and compresses the spring once more. That is why the weight bobs up and down. It would go on for ever if there were no external forces, such as gravity and friction.

It is quite easy to carry the picture in the mind, and therefore it will be easy to remember that the rapidly changing (or oscillating) electrical currents for wireless act in a similar manner.

In the case of the spring and weight we do some work in pushing up the weight and compressing the spring. The energy we expend is then stored in the spring. When we let go the spring gives up its energy to the weight, and when the weight overshoots the proper point it commences to give its energy to the spring. When the weight has gone as far as possible past the mark all the energy is in the spring, which then starts giving it back and moving the weight once more.

For wireless we deal with electrical energy in a similar manner. Ordinary electrical energy, such as is used for lighting and power purposes is used to charge an electrical condenser, which is now like the spring, ready to rebound or discharge.

When it is sufficiently charged the condenser commences to discharge through something which we call "inductance," and which is analogous to the weight. The inductance causes the electrical energy to overshoot the mark, just as the weight does, and so the condenser is charged in the opposite direction, like the spring being stretched, until the condenser has taken all the energy, when it commences to discharge again. Just as the spring and weight would bob up and down for ever if there were no external forces to steal some of the energy each time, so the electrical energy would oscillate for ever if no energy were lost.

One very interesting fact about the spring and weight, which anyone can try, but which is perhaps not widely realised, is that the actual time taken by the weight, when released, to make a complete swing up and down is fixed and unalterable. No matter how much or little we push the weight up to start, it will always make a complete oscillation in the same time, so long as the stiffness of the spring and the mass of the weight are unaltered. If a stiffer spring is used with the same weight the oscillations will be quicker; if a lighter weight is used with the same spring the oscillations will be quicker. If the spring is not so stiff, or if the weight is made heavier, the oscillations will be slower. It would be quite possible to make the spring very stiff and the weight very light, so that the thing would oscillate fast enough to produce a musical note. The production of musical tones and the action of tuning

THE FIRST DIRECT WIRELESS MESSAGES FROM ENGLAND TO AUSTRALIA

Form No 6A—100—19/4/16 Deld. Date

AMALGAMATED WIRELESS (Australasia) LIMITED

WIRELESS HOUSE, 97 CLARENCE STREET, SYDNEY, N.S.W.

No. 1. Wahroonga OFFICE Sept 22nd 1918

Handed in at London

Office Rec'd from	Time Rec'd.	By whom rec'd.
Carnarvon (direct)	1.15 pm	G. T. Fisk

This message has been transmitted subject to the conditions printed on the back hereof, which have been agreed to by the Sender. If the accuracy of this message be doubted, the Receiver, on paying the necessary charges may have it repeated whenever possible, from Office to Office over the Company's system, and should any error be shown to exist, all charges for such repetition will be refunded. This Form must accompany any enquiry respecting this Telegram

CHARGES TO PAY. £ s. d

To Sydney for Publication

I have just returned from a visit to the battlefields where the glorious valour and dash of the Australian troops saved Amiens and forced back the legions of the enemy, filled with greater admiration than ever for these glorious men and more convinced than ever that it is the duty of their fellow-citizens to keep these magnificent battalions up to their full strength

W. M. Hughes. Prime Minister

Form No. 6A—100—19/4/16 Deld. Date

AMALGAMATED WIRELESS (Australasia) LIMITED

WIRELESS HOUSE, 97 CLARENCE STREET, SYDNEY, N.S.W.

No 2. Wahroonga OFFICE Sept 22nd 1918

Handed in at London

Office Rec'd from	Time Rec'd	By whom rec'd.
Carnarvon (direct)	1.25 pm	G. T. Fisk

This message has been transmitted subject to the conditions printed on the back hereof, which have been agreed to by the Sender. If the accuracy of this message be doubted, the Receiver, on paying the necessary charges may have it repeated whenever possible, from Office to Office over the Company's system, and should any error be shown to exist, all charges for such repetition will be refunded. This Form must accompany any enquiry respecting this Telegram

CHARGES TO PAY.

To Sydney for Publication

Royal Australian Navy is magnificently bearing its part in the great struggle. Spirit of sailors and soldiers alike is beyond praise. Recent hard fighting brilliantly successful but makes reinforcements imperative. Australia hardly realises the wonderful reputation which our men have won. Every effort being constantly made here to dispose of Australia's surplus products

Joseph Cook Minister for Navy

Received at the Experimental Wireless Station at Wahroonga, near Sydney.

forks was clearly explained by Mrs. Selwyn Lewis, B.Sc., in the July and August numbers of this journal.

This brings us to a clear understanding of that wireless "mystery" which is often spoken of as "tuning." The electrical currents in our wireless circuit change their direction (swing to and fro) a definite number of times per second.

As in the case of material bodies, we must have elasticity and inertia before we can make vibrations, so in the electrical case we must have similar qualities.

Our electrical "elasticity" is supplied by the condenser and our electrical "inertia" is supplied by the inductance. Instead of speaking of the stiffness of a condenser we speak of its "capacity," and instead of inertia we use the term inductance. Whenever we have capacity and inductance in an electrical circuit we can produce natural electrical oscillations, and the frequency of those oscillations is fixed by the amount of capacity and inductance.

In the next article we shall explain how the electrical vibrations are radiated and how the wireless instruments are "tuned" for different frequencies, so that a number of stations can work at the same time without interference. We shall then describe, in simple language, the apparatus used at Carnarvon for sending the first direct wireless messages from England to Australia.

ELECTRIFICATION OF MELBOURNE RAILWAYS

(From Our Own Correspondent.)

MELBOURNE.

The electrification of the suburban railway system in Melbourne has been greatly delayed owing to war conditions, but finality now would appear to be in view. During the closing days of September preliminary trials on the short section of the line between Newmarket and the Showground took place, with results declared to be entirely satisfactory. These trials would have taken place earlier, but as it was found that the voltage from the Newport Power Station was too high for use on the portion of the line over which the trials were to take place and also on the City-Newmarket line, a breaking-down station was erected, whereby the pressure was reduced to 1,500 volts, with the results already indicated.

Over the City-Newmarket line comprehensive trials are being arranged, to take place about the middle of October. Whether electric trains on this and other lines will be running by the middle or end of January is a moot point, but in the engineering department of the railway such a hope has been tentatively held out.

SECOND-CLASS SLEEPING CARS

MELBOURNE.

Second-class sleeping cars are not likely to be introduced on the Victorian State Railways, at least just yet. A deputation waited the other day on the authorities, urging this reform, but the reply was the reverse of hopeful. Speaking to Mr. Commissioner Jones on the subject, that gentleman said that the authorities of New South Wales, South Australia and Victoria were in absolute agreement on the question and that agreement was absolutely against the innovation. The expense would be prohibitive, for there would be little or no difference between the haulage weight of a first and a second class sleeping vehicle. The Commissioners would seem to regard sleeping cars as luxuries, which if people wanted they must be prepared to pay for.

Seven years have elapsed since the West Australia Government introduced second-class sleeping cars on the expresses between Perth and the Goldfields and until the outbreak of the war they received a large amount of patronage. The experiment in the Western State was unique in the Empire, save in Canada, where on trans-continental trains over the Canadian Pacific Railway colonist sleeping cars were attached and they were what we should term second-class sleepers. But the conditions in Canada were and are greatly different from any existing in Australia. It may be that when Germany shall have been put in her place and a strong tide of immigration sets in Australia-ward the desirability may be found of providing newcomers proceeding to distant settlements necessitating journeys covering one or two nights' travelling with sleeping accommodation of the type Canada employed.

By no manner of means is the question of a second-class sleeping car novel. So far back as November, 1897, a writer in *The Railway Magazine* (London), dealing with "The Evolution of the Third-Class Carriage" (the third-class in the United Kingdom being equivalent to our second) wrote: "When the third-class passenger gets his sleeping car he may regard his emancipation as complete."

AUSTRALIA'S PRICELESS HERITAGE—IRON

ITS CONVERSION INTO STEEL

Did you ever hear of a steel mine?

A Sydney man, prominent in business circles, recently mentioned, in our hearing, "the wonderful steel mines of South Australia!" That day, during lunch, we quoted this phenomenon to another acquaintance. The latter, scenting some hidden joke, pondered for a while and finally, with the air of one not quite sure of himself, ventured: "I suppose he must have meant *Queensland!*"

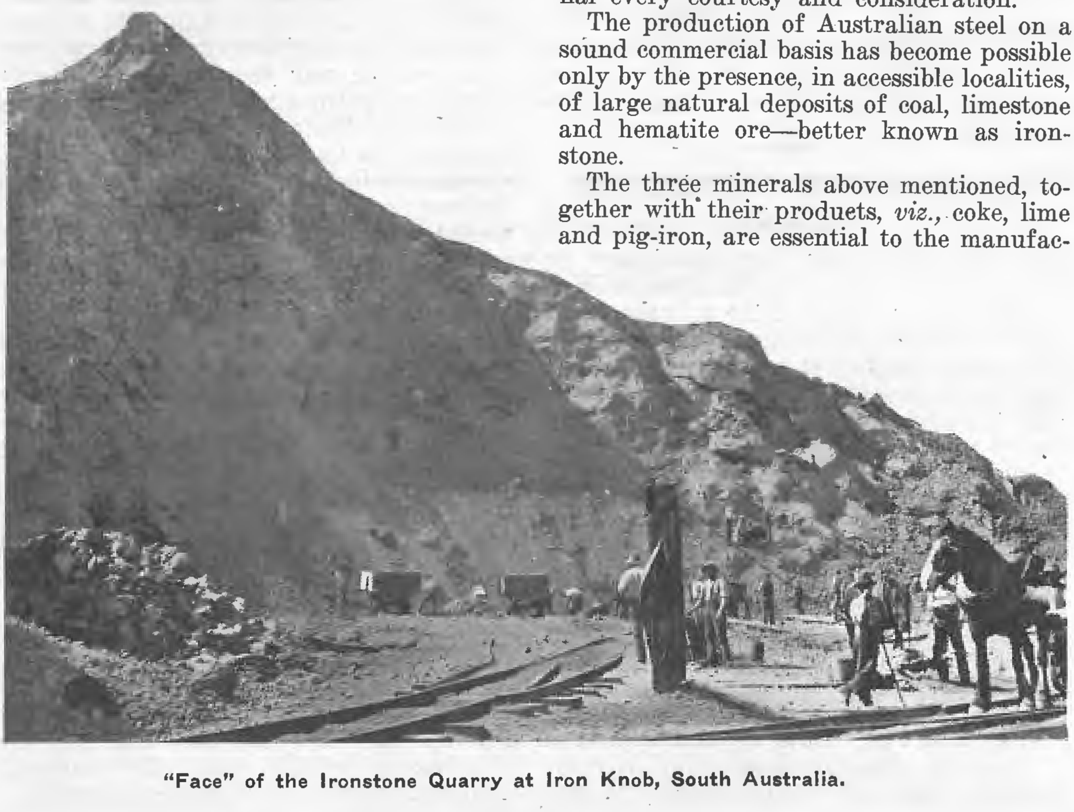
We then began to realise that, even among apparently well-informed sections of the community, the idea still exists that steel is a natural product of the earth, and that it is found in a raw, mineral state, like copper.

With the object of dispelling this fallacy, we shall attempt to describe, in the simplest possible terms, the various technical processes through which the raw materials pass during their conversion, first into pig-iron, and later into the tempered metal from which our needles, bayonets and battleships are made.

In publishing the first of this series of industrial articles we would acknowledge our indebtedness to the Directorate and Management of The Broken Hill Proprietary Company, Limited, who, both in Melbourne and in Newcastle, have facilitated our task by arranging for *Sea, Land and Air* a personally-conducted tour of their vast Steel Works and by placing at our disposal the excellent photographs from which the accompanying illustrations are made. In this connection were are especially grateful to the Company's Secretary, Mr. F. M. Dickenson, and to the Works-Manager, Mr. David Baker, who, with Mr. F. M. Mitchell, have extended to this journal every courtesy and consideration.

The production of Australian steel on a sound commercial basis has become possible only by the presence, in accessible localities, of large natural deposits of coal, limestone and hematite ore—better known as ironstone.

The three minerals above mentioned, together with their products, *viz.*, coke, lime and pig-iron, are essential to the manufac-



"Face" of the Ironstone Quarry at Iron Knob, South Australia.

ture of industrial steel. The raw material is found and quarried in various parts of the Commonwealth and brought by rail and steamer to the Steel Works at Port Waratah, New South Wales. Here, in one huge blast furnace—which we shall presently describe—all three ingredients are finally united, to emerge from the smelting process in a stream of molten fluid called pig-iron. This, after being subjected to further treatment—which we shall also endeavour to explain—is later converted into ingots of steel. These ingots, in turn, are rolled and moulded into various shapes and sizes and from them can be manufactured almost every conceivable object, from the delicate mainspring of a watch to the framework of a modern sky-scraper.

The Source of Supply.

To South Australia Nature has bequeathed the legacy of a particularly valuable mineral property—ironstone. These deposits are in the form of lofty mountains, and are of singular richness. They yield a very much higher percentage of metallic iron than has yet been found in any other part of the world, as proved by the following comparisons:—

Great Britain's record output of metallic iron per ton of ore is thirty per cent.

The ores of Belgium, France and Germany produce thirty-six per cent.

American ores produce from fifty to fifty-five per cent., the latter figure representing high-water mark.

The South Australian hematite ores (or ironstone), of which the mountains of Iron Knob and Iron Monach are composed, yield an all-round average of sixty-eight per cent. metallic iron to the ton, or thirteen per cent. higher than America's record output.

Let us make a further comparison.

To produce a ton of pig-iron in either America, Sweden or Russia almost exactly two tons of ore are required; in Germany, 2.4 tons; in France or Belgium, 2.7 tons; while native British ores yield pig-iron at the costly rate of three tons of ore for a single ton of "pig."

Nature's Legacy to South Australia—A Mountain of Metal.

In Australia the same quantity is produced by 1.5 tons of Iron Knob ore, thus effecting a remarkable economy in the consumption of coal and flux, besides enabling Australia to compete in the world's markets, despite the great distance which separates her from her biggest and nearest rival.

The extent of the Iron Knob deposits is altogether beyond computation, for, in addition to the wide, steep quarry "face" illustrated on the preceding page, the ironstone has been followed down several hundreds of feet without the slightest sign of diminishing supply. Experts estimate that here alone is sufficient ore to meet the whole of Australia's requirements during the next three generations.

From this quarry, which is connected by tramway with the South Australian coast, the ore is conveyed to Port Pirie and thence by steamer transported at very low cost direct to the Broken Hill unloading wharf at Port Waratah, New South Wales.

Taking this wharf as the starting-point

of our tour, we will now follow the movements of the raw materials on their arrival at Newcastle.

At Port Waratah.

The Newcastle Steel Works are situated at Port Waratah, within easy reach of the city, both by tramway and by direct ferry service across the harbour. Owned by The Broken Hill Proprietary Company, Limited, they cover an area of some 450 acres and provide employment for 3,500 men.

The work upon which these men are engaged proceeds without interruption year in, year out, from sunrise to sunrise. For it is work of international importance, whether it be the manufacture of shell-steel for British guns in Flanders, of steel plates for the construction of our own merchant fleet, or structural girders for some new building enterprise, or of rails for a future railway system across some remote outpost of the Commonwealth or through the arid *veldt* of South Africa. To-morrow may witness the manufacture of steel rods and ribs for the aerial fleet which Australia will soon command, or of the sectional parts of wireless towers, in anticipation of the day when private individuals will erect their own wireless stations throughout the Commonwealth.

Meanwhile, day and night, the work of manufacturing steel continues. That ferry-steamer now setting out from the wharf carries a load of homeward-bound toilers, representing a small section of the outgoing shift. A few minutes earlier that some boat has brought across from Newcastle a corresponding number of artisans to replace those who have just "knocked off"; for as one batch of men "downs tools" the relieving batch takes them up again, the work continuing, in eight-hour shifts, all day and every day, the whole year round.

At the Wharf.—Discharging Raw Material.

Unloading Raw Material.

To return to the Company's wharf.

This extends along a harbour frontage of 1,300 feet, and furnishes berthing accommodation for three 5,000-ton cargo boats simultaneously.

To this wharf come vessels carrying iron-ore from South Australia, limestone from Tasmania and coke from the neighbourhoods of Newcastle, West Maitland, Wallsend and elsewhere.

Two large vessels are berthed alongside. One, outward-bound, is loading munition-steel for the British Government; the second is discharging South Australian ore into the stockyard.

A double railway-track connects the wharf with every portion of the Works, the Company's traction system covering some 15 miles of railage and employing 11 locomotive engines.

One of these engines now appears upon the scene, puffing, snorting and hauling in its wake a string of trucks, heavily freighted with the finished steel product. The train draws up alongside the waiting cargo vessel. Powerful electric capstans hoist the trucks to the ship's hatches, and here, as in every other branch of the Works, the operation of loading for overseas proceeds smoothly, expeditiously, with the maximum of mechanical precision and the minimum expenditure of manual effort.

Meanwhile, our attention is claimed by the activities of an immense overhead ore-bridge, engaged in unloading the second vessel. Our photograph shows the bridge in operation. Running, noiselessly and automatically, along the entire length of the wharf, it carries, suspended in mid-air, a giant "grab," manipulating it electrically from overhead and controlling its every movement by the merest pressure of a lever.

A "Grab" at Work.
Emerging from the Ship's Hold.

The ore-bridge, gliding from hold to hold, lowers the grab into the innermost depths and remotest corners of the ship's hatches or bunkers. The grab, after one hasty bite at the contents, reappears almost instantaneously, bearing aloft in its steel jaws a dainty morsel weighing about six tons. On the overhead bridge the mechanic touches a lever. Swiftly, yet in complete silence, the load swings clear of the wharf and resumes its aerial flight towards the stockyard. Another touch of the lever brings the grab to a standstill, poised above the particular corner at which its prey is to be ejected. Yet another touch of the lever. With a monstrous yawn the jaws swing wide apart, releasing the six-ton avalanche in a clattering shower and depositing it exactly where it is required.

The stockyard has a storage capacity of 120,000 tons of raw product, the material itself being sorted automatically into huge pyramids, as shown in the illustration.

The combined operation of plunging the grab into the hold, piloting it to some specific section of the stockyard, discharging the material on to its allotted pyramid and returning the grab to the hold for another load is performed in far less time than it takes to describe.

From the stockyard, with all the raw materials now at hand, the next step is to the blast-furnace, where they are smelted into pig-iron.

The Blast-Furnace.

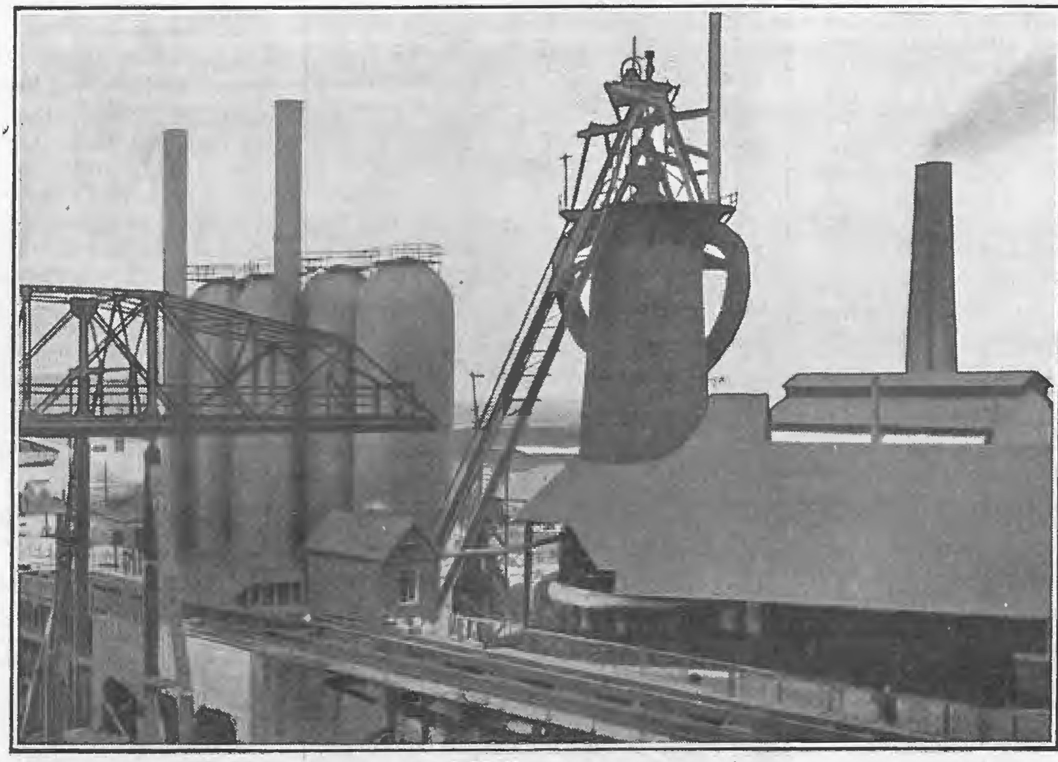
The blast-furnace may be described as a cylindrical stack, standing 98 feet high and lined with refractory brick.

Drawn up at the base of the furnace is a row of ore-bins or trolleys, electrically propelled. These have been loaded from the stockyard by one of the grabs, and contain alternate charges of iron-ore, limestone and coke.

The material is now discharged from the bins, and, by means of an endless chain of "skips," is carried and fed into the furnace head after an upward journey of about 100 feet. The entire operation is conducted automatically on a labour-saving system, said to represent the latest development in American iron manufacture.

The lower portion of the furnace consists of the hearth, or crucible, containing molten metal and slag, to a depth of about eight feet. Above the crucible is the melting-zone, or "bosh," the outer diameter of which is 26 feet 6 inches. Higher still is the stack, slightly tapering in form and enclosing, to within five feet of its apex, the raw materials. By the intense heat generated below and driven upward through the stack, these are now gradually being smelted into cast-iron and slag.

The average daily quantity of material fed into the blast-furnace is between 900 and 1,000 tons. Not only is the feeding accomplished without manual assistance, but the charge is so directed as to prevent any possible access of outer air to the interior.



The Blast-Furnace.
The Raw Materials are Carried Upward Along the Track and Fed Into the Furnace Head.

The charging must continue every day of the year, at intervals never exceeding a very few minutes; for the interior, were it ever permitted to cool, would at once collapse, and, for this reason, air-currents, heated to 1,200° Fahrenheit, must constantly be forced through the cylinder, even if the furnace, by some unforeseen mischance, be rendered temporarily idle.

The hot blasts pass through a series of pipes, or *tuyères*, and are driven by triple sets of huge blower-engines, 80 feet in height, developing 3,000 horse-power per pair and having a compressing capacity of 30,000 cubic feet of free air per minute, on a pressure of 15 pounds to the square inch. The fly-wheel has a diameter of 20 feet and attains 50 revolutions per minute.

From four to five tons of air are required to produce a single ton of iron.

After leaving the blower-engines and before reaching the furnace, the air is heated to upwards of 1,500° Fahrenheit by passing through hot blast-stoves. This are duplicate sets of cinder-notches, or channels, let into the raised platform. One set leads away to the left and directs the flow of slag; the second controls the stream of molten iron. In employing the term "set" it should be explained that each system of channels is divided into three distinct avenues, which, being wide and deep, serve to guide the seething, rushing torrents of white-hot metal into their appointed "runners," or outlets, and thence into the waiting ladles.

Front View of the Blast Furnace.
Showing Platform from which the Molten Metal is Shunted to the Pig Mill.

blast consumes the coke and thus smelts the ore.

"Taking a Cast."

Every four hours the blast-furnace is tapped to run off the molten metal from the crucible or hearth.

This process is known as "casting," or "taking a cast"; hence the term cast-iron.

To provide an outlet for the metallic fluid an aperture is pierced, by means of powerful rock-drills, into the sealed-up mouth of the furnace.

Radiating from this aperture, or "tap-hole," and diverging in opposite directions,

The platform is erected at the base of the blast-furnace, at a height some fifteen or twenty feet above the ground. Beneath it, mounted on wheeled trolleys and attached to locomotive-engines, are the ladles. These immense steel-lined chalices, each with a capacity of from thirty-four to thirty-six tons, are drawn up on the railway track in a position immediately beneath the outer end of a corresponding "runner."

On the eastern side of the platform three ladles receive the slag, which, passing through water, emerges in granulated form and is shunted away to another section of the Works. Here it is subjected to various mechanical processes, and subsequently utilised in the manufacture of concrete, for at Port Waratah the word "waste-product" has no significance.

Simultaneously, on the opposite side of the platform, the molten "pig," swirling, in an incandescent stream, along its own particular channels, is received into three more ladles, which, when filled, are at once transferred by rail to the pig mill, a few yards distant.

The progress of the liquid iron, from furnace to ladle, occupies approximately ten minutes, the daily run-off averaging some 500 tons.

The tap-hole of the furnace is now re-sealed. The method by which this is accomplished is distinctly picturesque, the aperture being closed with large masses of fire-clay, which are shot into the furnace mouth from a four-inch mud-gun, operated by compressed steam. Baked by the intense heat of the furnace, this mass speedily becomes a solid wall of clay, which remains airtight until the next cast is taken.

Moulding the Iron.

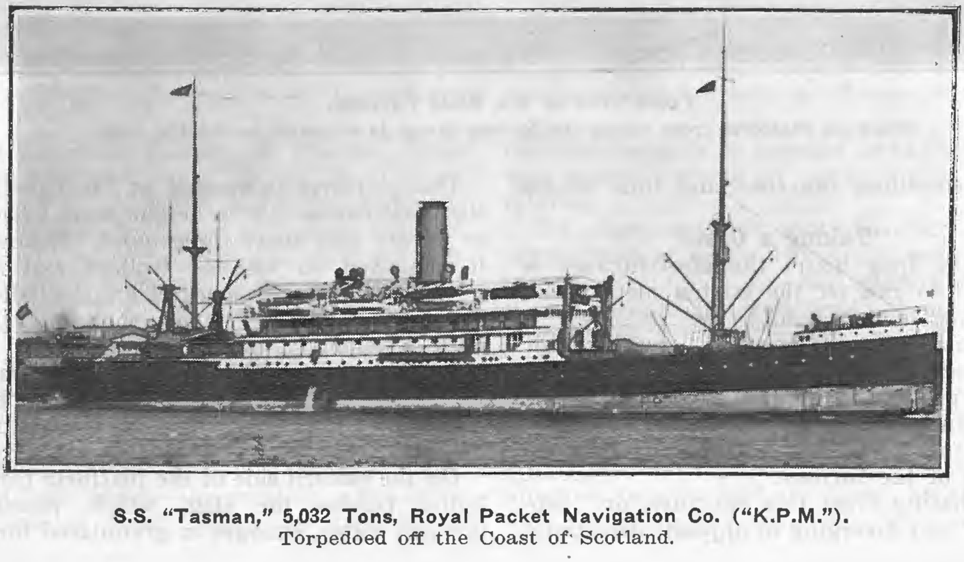
On reaching the pig-mill the ladles are electrically manipulated by a travelling crane of giant proportions. Hooking each receptacle at rim and base, the leviathan raises it aloft and tilts the contents into moulds with, apparently, no greater effort than an adult would put forth in lifting a very small boy by the back of his collar and the seat of his pants. In deploring our inability to suggest a better illustration of the process, we would respectfully ask our readers to accept the foregoing simile, which we have ventured to set down in popular, non-technical language.

The metal next goes to the casting-machine, and thence, passing along an endless-chain conveyor and being water-chilled in transit, the ingots are carried to a chute and ejected upon the ground.

A few seconds later along comes a Gantry crane, to which is attached an enormous, flat-surface, electric magnet; the latter, lifting the heavy "pigs"—like so many discarded match-stalks — removes them, in batches of 40 or 50 at a time, to the pig-stacking yard and automatically deposits them as and where required.

[In our next issue we shall endeavour to describe the conversion of pig-iron into structural steel.]

THE TOLL OF THE U-BOAT



S.S. "Tasman," 5,032 Tons, Royal Packet Navigation Co. ("K.P.M.").
Torpedoed off the Coast of Scotland.

LOWER DECK HANDS

TRAINING ON H.M.A.S. "TINGIRA"

AN IDEAL LIFE FOR LADS

Especially Written for "Sea, Land and Air" By E. J. HILL

"Go to your work and be strong, halting not in your ways,
Baulking the end half-won for an instant dole of praise.
Stand to your work and be wise—certain of sword and pen,
Who are neither children nor gods but men in a world of men!"
—England's Answer.

Securely moored in Rose Bay, Sydney, lies H.M.A.S. *Tingira,* the training vessel of the Royal Australian Navy for lower deck hands, and no sooner has one stepped aboard than one realises what a change a few years has made in the old vessel. Originally she was the *Sobraon,* one of the crack fliers bringing cargo and passengers out to Sydney and taking Home our wheat and wool, but was subsequently purchased by the New South Wales Government and converted into a reformatory ship for bad boys. In those days a boy had to be pretty bad to be sent on board her. To-day exactly the opposite is the case. When the Federal Government secured the vessel and had it fitted up as a training ship for the lower ratings of the Australian Navy it was with the idea of getting nothing but the best, as far as youths were concerned, to make up the ship's company, and a boy has to produce the highest references to be included in those on board to-day, in fact, a boy with a black mark in civil life against his name has no hope of ever getting on board.

The *Tingira* has accommmodation for between 250 and 300 youngsters, who range in age from 14½ to 17 years. They are the future gunnery and torpedo ratings of our Navy and are taught to become highly qualified; they may be said to represent the eye looking through the telescope of the gun-sight, the finger pressing the trigger

H.M.A.S. "Tingira" in Rose Bay, Sydney Harbour.

A Signalling Class on the Fo'c'sle Deck of H.M.A.S. "Tingira."

of the gun firing at an enemy ship, signallers, wireless operators, writers and stewards.

The training ship, like the Royal Australian Naval College at Jervis Bay—where officers for the Australian Navy are made —is non-sectarian and free to boys whose parents are in all stations of life throughout the Commonwealth. A boy has only to have an unblemished character and the desire for a sea life to obtain entry on board. There are recruiting officers in each State of the Commonwealth for this branch of the Navy, but the boys already on board provide the best recruiting agents and constantly return from week-end leave or the

A Gunnery Class on the Four-Inch Gun.

long vacation at Christmas with other boys only too anxious to participate in the fine life which the Navy offers to a boy with backbone.

Anything more different to the ordinary school one could hardly imagine. When new boys arrive on the *Tingira* they are not led to a desk and started on study right away. They are handed over to a Petty Officer and under his guidance practically have the run of the ship for a week to accustom them to their new surroundings. During this week they are issued with an entire kit including rigs for all seasons, and most particular attention is paid to the comfort and fit of the new clothes. They are taught to sling and stow hammocks; how to brush and fold up their kit so that it will fit exactly into the kit bag. Neatness and cleanliness are absolutely drilled into them, for the Navy has no time for a sloven in any shape or form. The Petty Officer acts as their guide and friend. He explains the ship to them and impresses upon them the due amount of respect to be accorded each and all of the staff from the Captain downwards and represses any desire on their part to address the Skipper as "Gov'nor" or the Chief Writer as "Matey." When a number of new boys arrive together on board they are formed into a mess of their own

Physical Drill on the Main Deck of H.M.A.S. "Tingira."

Sailing Cutter Drill in Sydney Harbour.

with an old boy in charge to show them the ropes and put them wise to the difference between life in the bush or city and life aboard one of His Majesty's ships of war. Particular care too is taken to ensure that no new boy comes on the vessel as a germ carrier. Prior to setting his foot on her decks he is kept under close medical supervision ashore until it is certain the he has no taint of any disease whatever in his system.

Once the new chum has become a full member of the ship's company he rises at a quarter to six and has a cup of cocoa, falling in at 6.30 to clean ship. At 8 o'clock he breakfasts which is followed by divisions and prayers. The afternoon is then devoted to study—ocean currents, anchor work, signalling, derrick or boat work, etc., but no boy is kept at one class of work for more than half a day. If the forenoon has been spent at study the afternoon will be taken up with boat pulling or sailing; he will be out in one or other of launches or in the sea-going tender *Sleuth* learning practical gunnery, steering, stoke hole work or heaving the lead. Instructional work is continued till a quarter to 12, when dinner is served, and from 1 to 3 further instructional work is carried out. Tea comes at 3.30 and that meal concluded half the boys wash clothes, the other half going ashore for cricket or football or some other class of sport. In the evenings boxing, fencing and similar sports are indulged in, one evening every week being given up to entertainment of some kind or other. Swimming is a feature of the training on the *Tingira*. Every boy is taught to swim, in fact it is one of the first things taught him, and during the summer months the boys have use of the Rose Bay baths close to the vessel for a certain period each evening. Adjoining the baths is a large playing ground with two fully rigged masts for signalling work, with gunnery drill and ammunition sheds near by.

There are always a number of boys on board whether in training for seamen, signalmen, writers or stewards, who can be turned out at a moment's notice fully armed and equipped for taking part in a procession, and every boy does a four weeks' mechanical course during each year to accustom him to the use of ordinary tools. Before leaving the vessel every lad has to undergo a week's musketry course on the Randwick Rifle Range some six miles distant from Rose Bay. It speaks well for the physical training of the boys that though carrying rifle and full kit not one so far has ever fallen out in the march to the range.

The usual course of training on board is a year, but certain boys who have come on well in signalling are selected for an advanced course covering an extended period on board, and are then sent over to Williamstown in Victoria for a final polish before being drafted to one or other of the vessels of the Imperial Fleet "somewhere at sea." The boys are divided into an upper and lower school according to their educational standard and those who pass well are allowed to qualify for higher grade work at sea than that which an ordinary seaman would be called upon to do. By so doing they also earn an accordingly higher rate of pay.

From the day a boy joins the *Tingira* the Commonwealth Government acts *in loco parentis*. It provides everything for him free; it feeds and clothes him and allows him pocket money; it attends to his ailments, having fixed up a sick bay on board and an isolation ward ashore, and should he meet with an accident or go down with a serious illness he is immediately removed to some hospital in the city. All that the parent is asked to do is to allow the boy to remain if necessary in training until he is 18 and to serve for a further period of seven years in the Australian Navy. A boy commences to count his seven years' service from the age of 18; at the age of 17 he is rated Ordinary Seaman (2nd class), and at the age of 18 is usually advanced to the rating of Ordinary Seaman, Signalman or Telegraphist, as the case may be. They are rated Able Seaman, Signalman, Telegraphist, Writer, or Ship's Steward Assistant as soon as found qualified. Promotion may be gained in special cases to Warrant Officer (Gunner, Boatswain, Signal Boatswain, Warrant Telegraphist, Warrant Writer or Warrant Steward), and in a limited number of cases promotion to commissioned rank is granted.

When the Angel of Peace once again spreads her wings o'er sea, land and air it is considered that the *Tingira* will be able to supply the whole personnel of the lower deck in the Australian Navy, and until that happy time arrives drafts of boys are constantly leaving to join units of the Grand Fleet at sea, and in every instance have proved themselves to be worthy sons of Australia. This is hardly to be wondered at, for the whole of the staff on board from the Captain down to the barber are men who have seen active service afloat or ashore.

It used to be said that the Australian boy had no liking for a sea life. The *Tingira* has proved that statement to be without foundation, for lads from every State in the Commonwealth are to be found on board—from the hot and steamy North to the rain-lashed, fog-enshrouded cliffs of Tasmania. They are all keen on becoming fighting men of the sea—that is their sole ambition—to be drafted to the Fleet in being in time for that great scrap which all are assured is toward at no very distant date.

THE LIGHTS OF EVENING

Written for "Sea, Land and Air" by STANLEY O. BATT

Sunlight.

Cool and sweet the close of day,
As the poop I pace:
Watching whilst the sun's last ray,
Plays on block and brace.
All the spars in golden sheening:
To the breeze our ship is leaning:
Far astern our wake is gleaming:
White and emerald grace.

Twilight.

Slowly 'neath the clear-cut skyline,
In the golden west,
As though weary, homeward hieing,
Dipped the sun to rest.
Every sail, and every shroud,
Every softly tinted cloud,
Every wave of ocean proud,
Fading beams caressed.

Lamplight.

Forward 'mid the deepening gloom,
On the fo'c'sle head,
Friendly warning pierce and loom,
Through the dusk ahead.
Ruby beams and emerald bright,
From the port and starboard light,
Guardians of the sailors' night:
Day at last is dead!

Starlight.

To the tropics' warm embrace
Swiftly night doth come;
And, like glow-worms, in the space
Starry lamps are hung.
Little specks of tend'rest beam,
Each a splendid sun, doth gleam
O'er stupendous depths unseen,
In great orbits swung.

Moonlight.

O'er the land of all our dreams,
Soft shall fall the light
Of the pale moon's tender beams,
In a pure delight.
On the homes where children play,
And where wives and mothers pray
To their God, at closing day:
"Guard our lad to-night!"

T.S.S. *Moeraki*, 1918.

Hero of Ostend and Zeebrugge.
Admiral Sir Roger Keyes.

TWO TEST-FLIGHTS

Written for "Sea, Land & Air" by "PROP BOSS"* (Australian Flying Corps)

Day broke under ideal conditions, but when a little later I drove on to the 'drome it was clouding up fast and threatened to be an impossible afternoon. There was only one machine for test. That meant two flights, and if the mechanics got busy I knew the "'bus" could be done easily before the weather broke, so (to misquote Omar) "why fret about the afternoon if the morn be fair?" One or two letters in the office needed attention and some of yesterday's test logs required entering up. During this operation I heard the big shed doors being pushed open and knew the "'bus" would be ready in a minute, so donning my flying cap and gloves—it was not cold enough for a leather coat—I went outside.

The machine was being pushed out and her nose pointed into the wind, to prevent it being blown over.

Beneath the wheels were two chocks or pieces of wood, placed so as to prevent the machine running forward when the engine started. An almost unnecessary cursory glance around the controls assured me they were O.K. I had trained and knew I could trust the inspections of my mechanics, as there were far too many machines for me to do in detail, so left the detailed inspection to them.

I turned to one of them and issued instructions for the barograph and other sealed instruments to be got ready for the speed and climb tests. These were done during the second ascent, on which I carried a passenger.

Now no two machines are exactly similar in their behaviour in the air, so I wondered if this one, which was brand new and had never been off the ground before, would do.

The First Ascent.

For the first ascent I went alone, so clambered into my seat and strapped myself in. This strapping in is to keep the pilot with the machine, because in "bumpy" weather aeroplanes do funny things, *viz.*, changing height suddenly, in sympathy with the variations of the vertical air currents.

Permit me to stop a minute and explain exactly what a "bump" is. For example, take an ordinary household plate and warm it before a fire. When warm place it in the centre of the floor. Now the air immediately over it becomes warm, consequently this air rises and more air closes in, to be warmed in its turn. As a result, there is a shaft of warm air rising off the plate in the centre of the room. Similarly the sun, striking the earth, warms different objects to different temperatures, *viz.*, hard, dry, caked mud will become hotter than water. Grassland, trees, ploughed fields, roofs of houses, all get different temperatures, consequently there are different vertical shafts of air arising from them. This is effected also when clouds cast a shadow. As the shadow becomes cooler and the rising air changes, so the machine is continually passing from one column of air to another, and these columns are called bumps.

Most bumps vanish as one rises higher, but very few go above 4,000 or 5,000 feet. Sometimes, if there are clouds, they go right up high. Electrical disturbances, such as the electricity in thunderstorms, all cause bumps.

But let us return to the job, as this is not a technical explanation of the oddities of the atmosphere around this world we live in.

Starting Her Up.

Sitting in the machine, I tried my controls by moving them to their extremes. They were O.K.

"Petrol on, switch off!" I yelled, to hear it repeated by my mechanic, who then proceeded to rotate the propeller with his hands. As the connection between the magneto and the sparking plugs is broken, or "earthed," by "switch off," there is not much danger of the engine kicking, unless it is hot. After a few sharp pulls round

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* "Prop Boss" is the *nom-de-plume* adopted by a returned A.F.C. airman, who still retains his high military rank and whose identity for that reason must remain anonymous.—ED.

to fill the cylinders with explosive gas or petrol, the mechanic stood clear.

"Contact!" he yelled.

"Contact!" I yelled back and turned the switch on.

The mechanic seized the propeller with both hands and gave it a swing. With a mighty heave and a roar the engine started. Thus this type of aero-engine started just like a car.

The next part of the programme was to wait two or three minutes while the engine warmed itself up, prior to opening my throttle wide and letting the engine "all out," to see that the required number of revolutions was produced. Had I opened my engine up when she was cold I should have damaged her, for though nearly 100 horse-power she was a delicate piece of workmanship and needed every care and attention.

I watched my instruments, saw that the oil gauge registered a certain pressure and that my petrol gauges read "Tanks full."

Satisfied at last that the engine was warm enough, I slowly opened my throttle. One thousand revolutions, eleven hundred, slowly the revolution indicator moved up and came to rest at one thousand, four hundred and seventy revolutions per minute.

As one thousand, four hundred and fifty was normal I knew I had a good engine, so throttling down again I waved my arms and the chocks were pulled away. There was nothing now to prevent the machine moving forward. One glance to see that nobody was in my way and I pushed the throttle wide open.

The machine rapidly gathered speed and in about seventy yards left the ground.

Flying around the aerodrome I reached 1,500 feet and started to see what the machine would do.

First I tried my fore and aft controls, pushing them to extremes, with the result that the machine proceeded to switchback in a very violent fashion. Then the lateral control, which made the machine roll and tilt up first one side and then the other, and lastly the rudder, which wagged my tail sideways and made the machine skid or side-slip.

All working very satisfactorily, I throttled my engine down a couple of hundred revolutions. I did not wish to use all my power, as I was high enough and three-quarters power was plenty.

One or two banks or turns followed, all of which were quite satisfactory.

Some ten minutes of this and I throttled down, gliding to some 100 feet on the edge of the aerodrome. Once again the engine roared out, this time full, and diving steeply to within a few feet of the ground the machine careered madly from one end of the aerodrome to the other.

On arriving there a "zoom" or steep climb, made possible by excessive speed, put us beyond the reach of houses, trees or chimneys. Back and across again, and yet a third time, all three times across the aerodrome against the wind.

Finally a dash back with the wind made it possible to get an average speed. As this was 93, and only 90 was required for tests I was satisfied. The three extra miles per hour were undoubtedly produced by a very good engine.

I looked at my watch and was surprised to see I had been up nearly half an hour. Time flies when one is happy and pilots certainly do enjoy themselves in a really good machine and, what is far more important, a good engine.

Time to come down and get ready for a test climb, which, if satisfactory, would release the machine for duty either against our enemies or for teaching new pilots.

I was confident of being able to pass this "'bus" O.K., the engine was so good and from long experience I could safely predict what sort of a climb test the machine would do when she was on her first flight.

The Descent.

My *altimètre* read 1,200 feet. Just high enough for a couple of "loops" before landing. Here goes!

The engine going as hard as it could and running like a sewing machine, I let her gather speed and by flying slightly downhill my speed indicator soon registered 100 miles an hour.

Now for it! Slowly and steadily, so as not to strain the machine, I raised the nose, still more and more. Now she is quite vertical and slowly begins to turn on her back.

When absolutely upside-down and beginning to drop out naturally in a headlong dive I closed my throttle and the engine stopped.

At the apex of the loop my forward speed had dropped from about 100 miles per hour to 40, then as I dropped out the speed increased again to nearly 100.

Once on the level I opened out full and for the second time up went her nose and the dive was repeated.

These two loops brought me to 800 feet, so I glided quickly down, touching the ground at about 38 miles an hour and was soon at a standstill.

Taxi-ing back to the shed occupied another few minutes and some 45 minutes after I had started I was back.

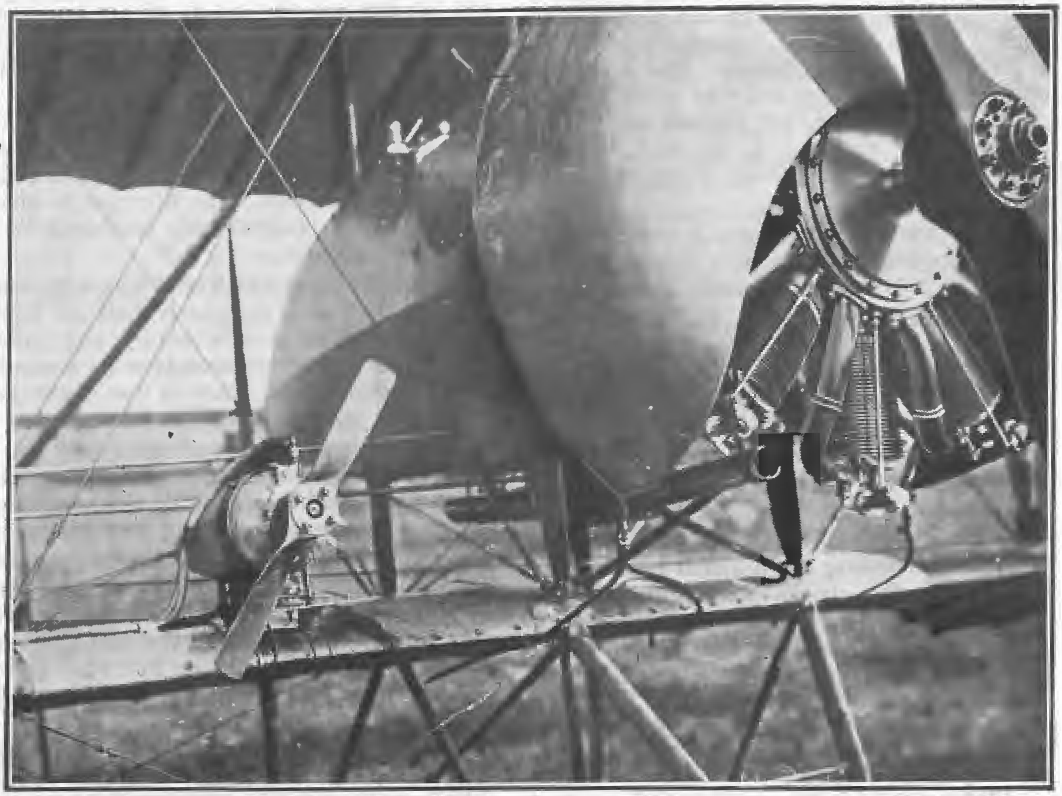
Another aeroplane had passed through her first test flight.

Being up without a coat I was none too warm and was quite pleased to stamp some warmth back. After a first flight the aeroplane is examined by trained men, who quickly detect any part of the machine that has not stood the strain as well as it ought. Of course, all new machines give slightly and the wires stretch, so some half an hour was needed for tightening up before the really important test.

The Climb With Full Load.

This time I took a passenger and certain automatic instruments, which were kept among the records for the machines.

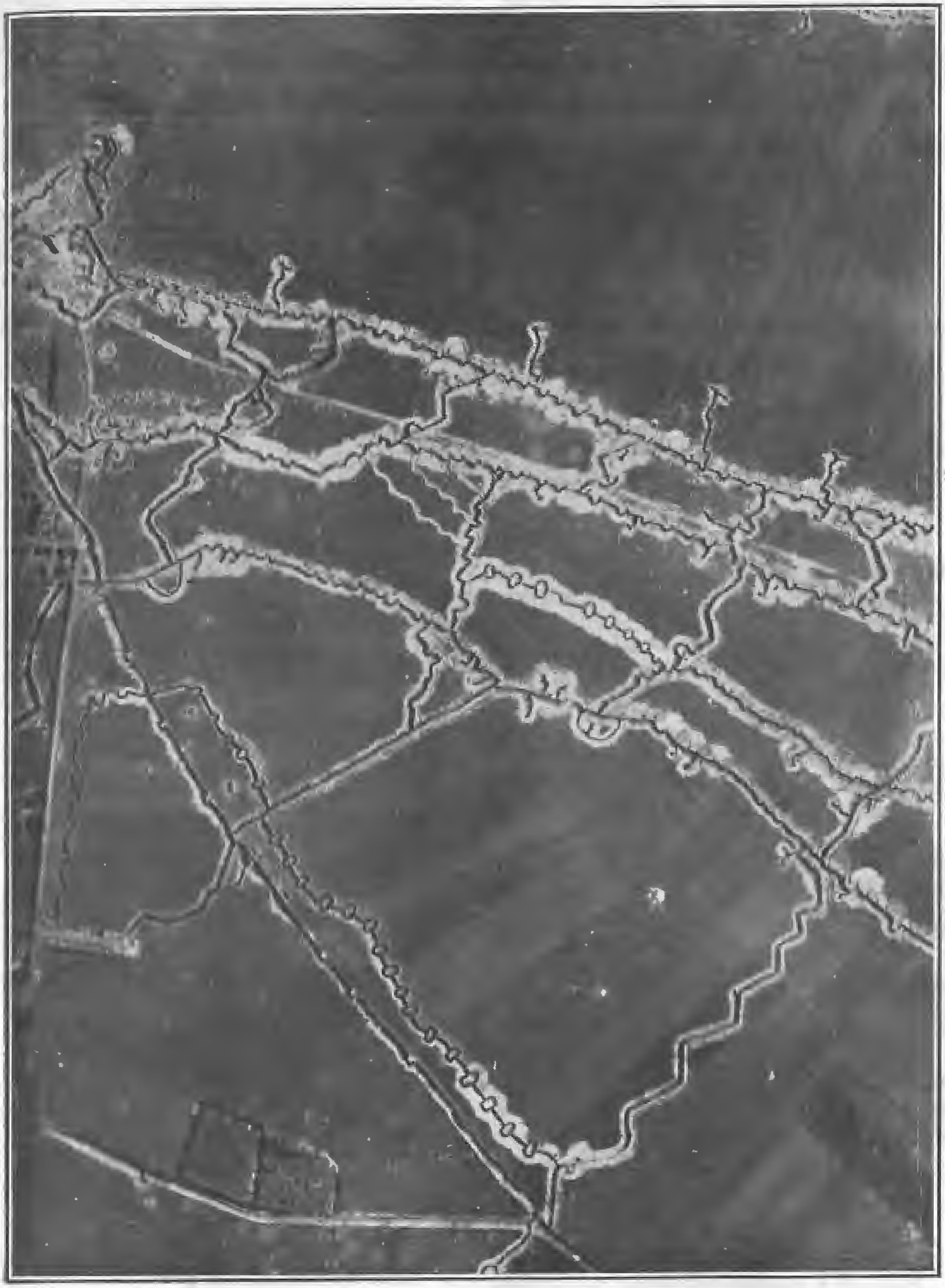
My passenger for this climb was a small chap and a great friend of mine. Born in Holland, his name was "Van ———," which, being rather a mouthful, was modified to "Van" for short.



Latest Type of Engine for High-speed Aeroplanes.
The Smaller Apparatus Seen on the Left is a Wireless Generator.

Although quite young, he was an extremely clever aeronautical engineer and was in charge of the manufacture of the particular type of aeroplane which I was testing at the time. He had been up on some half-a-dozen previous occasions and since he appeared very keen to come this trip I told him to get ready.

Passengers are nothing if they don't look the part and presently "Van" appeared in full rig-out: big fur-lined boots, a fur-lined leather coat, cap, goggles and my pair of



A RELIC OF THE PAST.

The Once-Famous Hindenburg Line.

Australian Aerial Photograph Taken from Behind the German Lines at an Altitude of Twelve Thousand Feet.

winter gloves. Everything was far too big for him and, in my opinion, quite superfluous, but as it pleased him, why worry?

After a while "Van" grew extremely hot and was in the act of removing his outfit when my senior mechanic reported the machine O.K. for climb test.

Seeing "Van" safely strapped in and the automatic instruments in place, I clambered for the second time into the pilot's seat. This trip there was to be no "stunting," just a direct climb to five thousand feet as quickly as I could get there.

The sky had meantime clouded over and become a trifle musty, but I knew, or thought I knew, every bit of the country and if I lost sight of the ground I anticipated little or no trouble in finding my way back to the aerodrome.

A Second Ascent.

Off we went! In one long straight flight, engine all out and the machine climbing up and up at her very highest speed.

At about 2,500 feet I entered the clouds and so lost sight of the ground. The light within the clouds may be described as a very bright twilight and a pilot loses all sense of direction and thus in a very few minutes I did not know which way I was heading and the compass swinging all over the place did not help me much.

Three thousand, three thousand five hundred. A sudden lightening of the gloom denoted that I was near the top. Then with a rush we came out into bright sunlight above the clouds.

Some of you may have been above the clouds when climbing mountains and beautiful as that is it is nothing compared to above the clouds in an aeroplane.

They looked hard and solid, like cotton wool, roll upon roll of it stretching as far as the eye could reach. Above the aeroplane only the sun in a cloudless sky!

I will not attempt to describe the sensation of being there. One feels oneself but a pigmy among the great forces of Nature.

The Loneliness of it.

When in a machine without a companion a great loneliness overcomes one. But this is lost when one has a passenger. Sometimes on long *solo* flights I would take my dog for company; anything to get away from the desolate feeling and the mighty power of God.

If you sing you cannot hear your own voice, as the rush of wind and the engine drown that. Only with an aerial telephone or by shouting when the engine is shut off and the machine gliding can the pilot and passenger communicate.

"Van" had never been either as high up or above the clouds before, and I could see that he was enjoying the experience to the fullest extent. He turned, smiled and waved to me a sort of "cheer-ho."

Four thousand five hundred, read the *altimètre*; only another 500 feet to go. It was certainly cold up here, and I half envied "Van" and all his toggery.

At Five Thousand Feet.

Five thousand feet at last! My watch showed that I was within the time laid down for the official test, but I could not tell to the second until I saw my automatic instrument.

Then closing the throttle I began to quietly glide down to the cloud level, which I would have to pass through.

"Van!" I yelled, "I wonder where we'll come out," because, being unable to see the earth, I did not know where I had wandered to.

"Don't know," he replied, "but isn't this glorious?"

"Yes, if it wasn't getting on for lunch time I'd stay here; but I think we'd better go down, don't you?"

He nodded in reply.

"And besides," I added, "we've got to find our way back and pick up our bearings."

We were now only a few hundred feet above the clouds, when suddenly I espied a thinness and a hole and the ground visible beneath. Without thinking of poor "Van's" inside I proceeded to drop through this hole in a vertical spiral, which means putting your wings at right angles to the earth and going round and round in a small circle, at the same time dropping considerably.

In circling down through the hole in the clouds I quite forgot poor old "Van's" breakfast. Although I did not know it at the time, he was having great difficulty in keeping it in its proper place.

At about 1,000 feet we passed the lower level of clouds and were below them. Since we had been "up," however, we had been drifting towards some mist and were now in the thick of it, with the result that, at about 700 feet, I could only see a very small portion of the ground beneath me.

Lost in the Air.

I knew I was safe from running into any hills or trees, etc., because the country for miles around was flat and I was sure we were only a few miles from the aerodrome.

For ten minutes or so I circled round, trying to pick up some familiar landmark. I was rather annoyed at not being able to do so, because I thought I knew every field for miles around.

Soon we passed over some golf links, and even then I failed to recognise the locality, so the only course left was to land and inquire my way.

Lower and lower we dropped, and soon there appeared a small piece of the course which looked safe to land on.

An Awkward Landing.

It was more by the grace of God than anything else that we got down safely and without overturning, because the ground, which, from a very few feet up appeared quite flat, was in reality ridge and furrow and we had landed across them, pulling up a very few feet short of a bunker. Had we rolled into it the machine would have stood on its nose and broken the propeller.

The few golfers and people who had seen us land soon crowded round the machine.

"Air-Sickness."

Meantime, where was "Van"? I had lost him. Immediately on landing he had jumped out and disappeared behind some trees, where he parted company with his breakfast. I'm afraid the spiral through the clouds was too much for him.

Soon he emerged from his retreat and greeted me with a sickly smile. Inquiry elicited the facts of the case and a stiff brandy and soda in the golf club house soon pulled him together—more or less.

The people told us we were on W——— golf course and I then realised what an ass I had been. We were only three miles from the aerodrome! I knew the main road at the western end of the golf course ran by the aerodrome and had I followed it we would eventually get home safely.

The next step was to get the engine started.

I had no "chocks," nor was there anybody to start the engine.

One or two of the golfers offered to assist and something had to be done quickly or we should be unable to get back owing to the fog, which was rapidly increasing in density.

The one course left was to start the engine myself, so I put "Van" (still looking green) in the pilot's seat, instructing him in the use of the throttle, which I set as near as I could gauge, at the same time making him keep his hand on the switch and thus immediately stop the engine should anything unforeseen occur.

Two of the golfers held on to the outside struts and helped to hold the machine back when the engine started.

Up Again.

After one or two attempts I managed to start the engine myself, then, after "Van" had scrambled into the observer's seat, I got into the pilot's.

In the absence of chocks I could not fully open out my engine to ascertain whether it was O.K. before starting, as the men on the wings were unable to hold her. Accordingly I had to trust to luck that she would open out fully when I started to get away.

Owing to the ridge and furrow it was impossible to get off as I had landed, so we had to run parallel to the furrows. This meant going down-hill, which would have been very satisfactory but for the presence of a big clump of trees at the bottom. To clear these required a good clean open out of the engine and getting off the the ground as quickly as possible.

After heading the machine in the direction of these trees I opened out full and made straight for them at top speed. The wind, having dropped, neither helped nor hindered me.

A Close Shave.

The trees rushed to meet us, and when I judged I was near enough I climbed the machine as steeply as I dared.

The wheels cleared the trees by inches only, but I knew that as long as the engine kept on jogging all would be well. There was no need to worry, as the engine went beautifully all the way home.

On nearing the aerodrome I had to descend to just above the trees and the road, as the fog was very thick, but there being no high obstructions, excepting a chimney near the 'drome, I was quite happy. At last this chimney loomed out of the mist.

some 40 yards or so to my right, and I was then over the 'drome and could see the aeroplane hangars.

The Return.

Two minutes later I was on the ground, one hour and twenty minutes after ascending for the climb test.

My mechanics were quite sure I had landed, and assuming that I should stay down until the fog cleared, they were surprised to hear the machine return. It was long past lunch-time and I wasted no more time than necessary.

A glance at the automatic instruments showed the test satisfactory, so there was no need to grumble at anything.

"Van" came home with me for lunch (he didn't eat much), but promised to come up again when the weather was fine and get accustomed to spirals.

I might add here that 'Van" was a constant passenger with me on other days, but I have never stopped ragging him about that famous (to him) spiral and I don't think he will ever forget it, as it was his first and last experience of air-sickness.

The following day another pilot took the old machine away to her destination and a month later she departed to *strafe* the Germans.

A considerable time after that the news came through that she had ended a glorious career in an aerial fight, but luckily the pilot and observer escaped with their lives, although the latter was injured.

However, it was a worthy end to an especially good machine.

Her last flight took place almost exactly eight months after her first and during the interval her career was, to say the least of it, exciting.

[A second article by this writer will appear in our next issue, under the title "Two Landings."]

German "Albatross" Brought Down Intact by Australian Airman.

Illustration shows Australian soldiers surveying the prize

AERIAL MAIL SERVICES (SYDNEY-LONDON), LTD.

AN INTERVIEW WITH MR. REGINALD LLOYD

Mr. Reginald Lloyd, whose portrait appears on this page, is an opportunist. Returning to Sydney a few weeks ago from England, he has already done much to arouse public interest in the important subject of aerial mail services. He is confident that the Old World is separated from the New by not more than a week's journey through space. Further, he has undertaken to prove it.

That Mr. Lloyd's opinion is favoured by many of our most astute business men is evident by the alacrity with which these latter have supported the new enterprise.

At a private meeting convened recently (at 24 hour's notice) by H. M. Mackenzie, F.I.I.A., at his offices at Australasian Chambers, Sydney, and attended by a representative group of men prominent in the world of commerce and finance, Mr. Lloyd outlined his project in the following terms:—

"We are here to-day, gentlemen, to do something concrete. We are here to decide definitely whether or not, Australia is to be brought within 150 flying hours of London; and if we decide that that is to be done, I am here to consummate and to put into immediate effect that decision, aerial science having rendered possible such an achievement.

Mr. Reginald Lloyd.
Who has Undertaken to Bring Australia Within 150 Hours' Flight from England.

"Before you are asked to decide anything, however, I will briefly outline the *modus operandi* to be pursued in establishing a long-distance aerial mail service.

"As things are to-day it is not possible to cross with safety from London to Australia by air. Not because the machines cannot perform the work—they can—but because it is not known definitely where landing places are, although it is known that suitable landing places exist; nor does anyone definitely know which is the most suitable route to fly.

"It is obvious, therefore, that the initial thing to do in establishing any air service is to survey the route, and to locate the landing places.

"No one machine could fly with safety from London to Australia. That task can be accomplished only in relays; and, when it is a matter of maintaining a mail service, the pilots also will have to be worked in relays.

"While I have already suggested that each landing station and each relay station should be distant 300 miles, it does not follow that each machine and each pilot is going to travel only that distance.

"The fuel-carrying capacity of a machine may be taken, perhaps, as the determining factor in establishing the distance between landing stations.

"Experts only, however, can decide this point with accuracy.

"The only business-like method, in my opinion, to adopt in selecting a route is to attempt no such task until after consultation with Geographical Authorities at the University, a Meteorological Authority from the Observatory, and in conference with experts who know and who have traversed the country.

"In deciding the question of route the following points must be borne in mind: The shortest route compatible with suitable geographical and meteorological conditions should be selected, having in mind also road accessibility for the convenient transport of petrol, spare parts and general equipment accessories, and with adequate water supply near each locality likely to be selected for a relay or for a landing station.

"The route first to be dealt with should be, I think, to the farthest point in Australia from Sydney, and which point would be the nearest point to the Malay Archipelago.

"The route having been decided upon, the next step would be to traverse it.

"My suggestion, therefore, is to engage the services of four men, a motor-cycle expert, a flying expert, a surveyor and a propagandist respectively, each skilled in motor-cycle riding, and equip each for the trip across the Australian continent from Sydney to Cape York Peninsula, if that point be the point decided upon, having arranged previously for a supply of petrol to be available in those parts of the country where in the ordinary way petrol would not be procurable.

"These men, accompanied by myself, would survey and lay out the entire route, their respective duties being: motor expert to keep machines in order, flying expert to select the relay and landing places, the surveyor to measure off under instructions from the flying expert, and to procure in each case the option of a lease or the option of purchase, or both, while the propagandist would study the situation and equip himself for work later.

"Photographs must be taken of each relay and each landing station, and also of any essential features, or points, in route, such as mountains, waterways, and heavily timbered country. The distance between each landing station must be recorded, using the speedometer of the motor cycle to gauge the distance, and its latitude and longitude noted. Similarly, any obstacles opposed to easy flying must be recorded, as must also their latitude and longitude.

"On finishing the Australian survey, the route party would proceed to Siam or Burmah, *via* new Guinea, Celebes, Borneo and Penang; either by pearling lugger or a small motor-propelled boat; taking their motor cycles with them.

"They would survey and lay out the routes as they passed across the Malay Archipelago, and would decide upon landing and relay stations until they reached the continent of Asia; where similar operations would be repeated throughout India, Arabia and Egypt.

"On arrival at Port Said (Egypt), the mapping out of the route would be temporarily finished, because the territory between Port Said and London need not be surveyed until a date much later. Only recently the following cables appeared in the Press:—

TWO BRITONS FLY 2,000 MILES, FROM ENGLAND TO EGYPT IN BATTLEPLANE.

LONDON, Saturday.—Two Royal Air Force Officers, with two mechanics, have completed a flight from England to Egypt, a distance of 2,000 miles, in a type of aeroplane that has seen considerable service on the Front.

"The official report, in announcing this feat, says:—

One or two halts were made for petrol, but the flight was merely a bit of routine work.

"The exploration staff, however, must not be disbanded on arrival at Port Said.

"Arrangements would be made to carry by air a letter from His Majesty the King in London to his Deputy the Governor-General of Australia in Sydney thus demonstrating the practicability of the undertaking.

"As no country now is without its air service, and as at this stage we have no aeroplanes, arrangements would have to be made with each of the nations over whose territory these letters would have to be carried for relays of airmen to pick the letters up at a point to be nominated. For instance, at the commencement of the journey, a British airman would make the flight to Paris. From Paris a French aviator would carry on to Italy, whence the flight would be continued in relays by the flyers in other countries, including India, until the letters arrive in the North of Australia, where they would be taken charge of by an Australian airman, and in relays brought on for delivery to their Sydney addresses.

"In conclusion, permit me, gentlemen, to point out—and I cannot emphasise too strongly the point—that to fly from London to Sydney is a simple matter, provided always that landing stations and relay stations are accessible, while to maintain a regular mail service, either weekly or daily, over the same area is by no means a difficult task. The flight of 2,000 miles, from England to Egypt, referred to earlier, is a practical demonstration of my contentions."

* * * *

At the conclusion of this address practically the whole of the money to finance the expedition was subscribed in the room, a large proportion being contributed personally by Mr. Lloyd.

In his office in Culwulla Chambers. Sydney, Mr. Lloyd informed *Sea, Land and Air* that the expedition will leave Sydney on November 14, and that the preliminary survey will probably occupy six months. Arrangements have been concluded whereby our readers will be kept informed from month to month as to progress of the expedition.

Mr. Lloyd expresses the fullest confidence in the success of his project, which, in his opinion, is entirely a matter for private enterprise. The Government, he points out, does not own the mail steamers, seldom the mail trains and never the coaches which carry its mails. For this reason he anticipates no Governmental obstacle which would prevent a similar service being performed by aircraft.

Mr. Lloyd informs us that it is the intention of Mr. Webster, P.M.G., to submit these plans in detail to the Federal Crown Solicitor and later, if necessary, to the Secretary of the International Postal Union.

The new company contemplates the establishment of headquarters in Sydney and in London, with probably a third branch at Port Said. It will be registered, we are informed, under the title "Aerial Services, Limited," with a capital of £500,000, shares to be held partly in England and partly in Australia. From other sources we understand that Mr. Reginald Lloyd George will be invited to act as Managing Director.

The initiator in furnishing certain details, which under the existing War Precautions Act we are not at liberty to publish, stated that some forty relay stations will be erected along the proposed routes. Each of these will carry large stocks of spare aeroplane-parts, petrol and other requirements for effecting minor repairs. In addition there will, at stated intervals, be Central Repairing Depôts.

Mr. Reginald Lloyd is the youngest son of the late Hon. G. A. Lloyd, M.L.C., who for many years was a member of the New South Wales Upper House. He estimates that, to successfully conduct the proposed services, not less than one hundred aeroplanes will be required. These are to be purchased entirely at the new syndicate's discretion, and Mr. Lloyd would strongly urge that aerial mails from Australia be carried by 'planes of our own construction.

In view of the statements made by Major-General Legge, Chief of the Commonwealth General Staff, and printed in another portion of this journal, there would be no cogent reason why Australian aerial mail services should not be Australian in every sense of the word.

Mr. Lloyd is confident that this project will be in operation within four months of completing the preliminary survey. In other words that before the end of 1919 direct aerial postal services will be operating at weekly intervals between Australia and England.

SHIPS THAT HAVE PASSED

Especially Written for "Sea, Land and Air"

BY CAPTAIN J. H. WATSON, J.P., F.R.A.H.S.

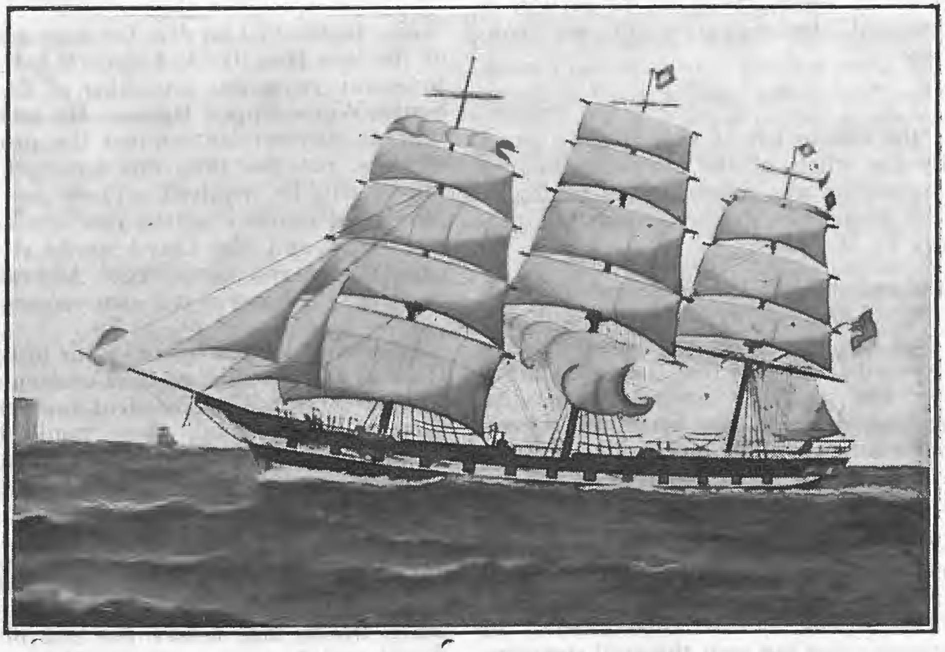
"FORTUNA" TO BE REFITTED.

Owing to the scarcity of tonnage the *Fortuna,* which has been doing duty as a coal hulk for some time past in Port Jackson, is likely to be refitted as a sailer and commissioned for the oversea trade. The vessel is at present moored below Garden Island, and her hull has been found to be in excellent order.

The above, which appeared during the last few weeks in a local paper, perhaps attracted little attention, or caused any comment. For how many readers would see behind it the history of a great shipping firm, linked up in the far distant past comparatively speaking, with a still greater firm, and yet another, which, back in the early years of the past century, did much, both to create and develop Australia's trade.

The dirt-begrimed old hulk, as she is towed about the harbour, causes little notice, yet the day was when people flocked down to the waterfront to welcome back to Sydney the stately ship *Macquarie* and her commander, whether it were Garvosso, Goddard or Corner—all popular men of their day.

The old hulk *Fortuna* has an interesting story; launched in 1875, she was the last of the Blackwall Line, built at Blackwall by R. & H. Green, builders and owners with a world-wide reputation.



THE "FORTUNA."
Launched in 1875 as the "Melbourne," Re-Christened "Macquarie" in '76 and Later "Fortuna."

She was an iron ship of 1,975 tons, built on the lines of the old East Indiamen, and it is said that the plates used in her construction were originally intended for a warship, and, as such, would be thicker and of a superior quality to those used in merchant ships, which will account for her hull being found in excellent order, as stated in the excerpted paragraph. The builders' price is said to have been £42,500. When launched, she was named *Melbourne* and was put into the trade for that port, in which at that time and for many years previously the firm had a fleet of splendid vessels. Included therein were the *Alfred, Agamemnon, Agincourt, Alnwick Castle, Carlisle Castle, Roxburgh Castle, Walmer Castle, Blackwall, Highflyer, Result, Superb* and *Anglesey.* They had many others, some of which had come to Sydney before the port of Melbourne existed. The *Waterloo,* with Captain Cow in command, was here in 1835, and the *Matilda* was in these waters earlier than that, with Captain Robert Pockley in command. This gentleman was the commodore of Green's whaling fleet, and on a voyage in 1833 had with him his eldest son, then only ten years of age. This son was Robert Francis Pockley, who in after years commanded vessels on this coast for many years, brought the brig *Tobago* out from England in 1842, when he was 19 years of age.

In 1857, at the time the *Dunbar* was wrecked at the South Head, he was Port Master of Port Jackson, and Superintendent of Pilots and Lights. He was later a prominent shipowner. He died in 1892 at his residence "Lorne," Killara, where his widow still resides. Dr. F. Antill Pockley is his son; and two grandsons, sons of the doctor, Captains Brian Pockley and I. G. Pockley, A.I.F., lost their lives during the war, the former at Rabaul and the latter in France.

Captain R. F. Pockley used to tell a story of the father of Richard and Henry Green, who was the founder of the firm. His whaler, the *Matilda,* had sailed for the South Sea fishing ground, with Captain Robert Pockley in command, on what was usually about a three years' voyage.

In eleven months she was at anchor again in the Thames, and shortly after Mr. Green's yacht luffed up under her stern, and the reception Captain Pockley got was, "What the hell brings you back?" His reply was "Full ship, sir." "Full of what?" "Full of oil, sir, water casks and all."

Green's were a notable firm, for when the East India Company lost its monopoly of the Indian trade, Green was one of the shipowners who went into it, and his Blackwall-built ships soon made a name, which on the commencement of an Australian trade, first with Sydney and later with Melbourne, he extended to those ports.

The firm has been variously known as Green & Sons, Richard Green, R. & H. Green and Henry Green, but it was under the management of Richard Green that it reached the acme of its fame, which was in the fifties and early sixties.

Not only were Green's a great shipping firm, but as shipbuilders were second to none, and their yard at Blackwall on the Thames, close to the East India Docks, was a scene of great activity. When wooden ships and canvas had to acknowledge themselves defeated, iron, steel and steam took their place, and in later days a limited company carried on the turning out of steamships, both warships and mercantile.

Richard Green, in 1850, recognised that unless British builders woke up, the United States would both build and sail them off the sea. The clippers were already taking our China trade, and at a city dinner he said that the British shipowners had at last sat down to play a fair and open game with the Americans, "and by Jove we'll trump them!" And they did.

Richard Green died in January, 1863, in his 59th year, and after his death the lustre of the firm began to fade, and their ships were confined to the Melbourne trade. Newer people were competing for Australia's growing commerce, and by degrees Green's ships were sold. The last ship they built, the *Melbourne,* passed, in 1887, into the hands of Messrs. Devitt & Moore, a firm who had for some time been coming rapidly to the front. They were not new people, having been connected with shipping since 1836, when Mr. T. H. Devitt and Mr. Joseph Moore founded a ship-broking business, which gradually developed into a ship-owning one, and some of the most up-to-date and finest vessels that ever came into Sydney Harbour sailed under this firm's flag.

It was, however, when Mr. (now Sir) Thomas Lane Devitt came into the active management that the firm's business began to bound forward. The ships once owned by another great shipowner passed by degrees into the hands of Devitt and Moore. These were those of Duncan Dunbar, the largest shipowner of his day, who eighty years ago had twenty vessels in the Sydney trade, one of which the *Bombay*, a vessel of 1,280 tons, was a teak ship, built at Bombay, in 1809, for the India trade, for Dunbar, like Green, was in that before he took on Australia. The *Bussorah Merchant, Camperdown, Collingwood, Earl Grey, Morayshire, Sarah Scott* and *Trafalgar*, were familiar to Sydney people in the 'forties. Of these, six were built at Sunderland, and when the British builders set themselves out to eclipse the Americans all Dunbar's ships were built there by Laing.

The first to be built under the new conditions, that is the clipper instead of the bluff bow, was the *Vimeira* in 1851, followed by the *Dunbar* in 1853, *La Hogue* in 1855, *Cospatrick* in 1856, *Duncan Dunbar* in 1857, and *Dunbar Castle* in 1864 All these vessels in succession were described at the time as the finest ever built, and this could safely be said, for each one in succession was an improvement on the others; but the Dunbars were unlucky ships. The *Dunbar* was lost at the South Head in 1857, the *Phœbe Dunbar,* built in 1850, was burned at Newcastle in 1864, the *Duncan Dunbar* was lost on the La Rocas Shoal in 1865, and the *Cospatrick* was burned at sea in 1874, when 475 people lost their lives, including Captain Elmslie, brother of the captain of *Sobraon.* The three last, however, had passed out of Dunbar's fleet when they were lost. Other Dunbar vessels which came to an untimely end were the *Blervie Castle* and the *Trafalgar.* The former left London, under charter, for Adelaide in December, 1859, under command of Captain W. Hardy; she was a new ship and it was thought she would make a good passage, but she was caught in a violent gale in the Channel, and became a total wreck on the French Coast, the Captain and crew, and the passengers (21) being lost. The *Trafalgar* was an older ship, having been built at Sunderland in 1845. She was on a voyage from Manila to London, and when in the latitude of the Cape Verde Islands, in March, 1860, she sprang a leak and foundered. Two boats containing the crew left her, the captain's was found five days later empty, it having capsized; the chief officer's was picked up, and those it had on board were landed.

It was in the mid-sixties that Duncan Dunbar as a shipping firm ceased to exist, and Devitt and Moore acquired some of the ships just mentioned.

In those old sailing-ship days there was an element of romance in a voyage, and the passengers saw more of the inner working of the ship, as they became acquainted with the officers. People in those days selected the vessel to go by as much on account of the man who commanded her as for the vessel herself. The men who have had charge of Devitt & Moore's ships made hosts of friends, and though, like the old skippers themselves, most of them are dead, still there must be many among us who have pleasant memories of Captains Williams, Elmslie, Carvosso, Goddard, Swanson, Andrews, Barrett, Corner and Forbes. It matters not which ship they commanded, for they passed from one to the other as new vessels were added to the fleet.

The vessel which will be best remembered is the *La Hogue,* which made her first appearance in Sydney harbour on January 6, 1856, a new ship, just off the stocks of James Laing's yard, at Sunderland.

She commenced her career in the unusual way of being launched stern on, and when ready for sea was put under the command of Captain Henry Neatby, a now forgotten man, but then the most popular master mariner coming to Sydney. For twenty years he had commanded ships coming here under the Dunbar house-flag. In the 'thirties he had the *Susan,* in 1844 the *Agincourt,* in 1848 the *Waterloo,* in 1855 the *La Hogue,* and he afterwards had the *Duncan Dunbar,* until Captain Swanson took charge in 1863, but who had not the command when that vessel was lost.

The *Duncan Dunbar,* whilst under Captain Swanson's command, flew the blue ensign, and was the first vessel to do so in Sydney Harbour, the captain, the officers, and most of the crew being of the Royal Naval Reserve.

In 1864, the *La Hogue* passed to Captain Williams, but he only had her for one voyage, as Captain Goddard took the command in 1865. It was in the *La Hogue* that Captain Goddard made his name, for he had charge of her for many years.

Another noted ship of her day and the first built for Devitt and Moore was the *Parramatta,* she also was built by Laing in 1866, and her captain was Williams, who had command for three years, and was followed by Swanson in 1869.

Then came the *Sobraon,* a vessel when on the stocks in Hall's yard at Aberdeen, the first place in the United Kingdom that turned out a clipper-built ship, was being built for a steamer, but Devitt and Moore bought her, and had her finished as a sailing ship. She made her first voyage to Sydney, arriving on February 4, 1867, commanded by Captain Kyle, a gentleman who had frequently been to the port in the barques *Bright Planet* and *Nestor* at various times during the previous twenty years. On this voyage, during the passage home, Captain Kyle became mentally affected, and nearly lost the ship on the Orkland Islands, and finished up by taking her up the Bristol Channel. Eventually she reached London, where Captain Kyle was replaced by Captain James Aberdour Elmslie, who retained the command until the ship was sold to the New South Wales Government, in 1891, for £12,500, and by them to the Commonwealth Navy for £15,000, in 1911. Under the name of *Tingira,* she is now the training ship for boys for the Royal Australian Navy.

Other noted ships of this line were the *Hawkesbury,* 1868; *Collingwood,* 1872; *Hesperus,* 1873; *Harbinger,* 1876; *Illawarra,* 1881; and *Derwent,* 1884.

Space will not permit details of the career of these splendid ships, several of which were used for training ships for the mercantile marine, to which service this firm were enthusiasts.

The *Illawarra* on a trip to Adelaide, with 100 *Warspite* boys on board, and under command of Captain Maitland, was in collision on Christmas Eve, 1904, and cut to the water's edge. She was off Gravesend at the time, so was towed back, the damage repaired, and she reached her destination. At different times she was commanded by Captains Carvosso and Barrett. In 1907 she was sold to a Norwegian house and carried their flag to the bottom in the North Atlantic, in February, 1912.

It was, however, in 1887 that Devitt and Moore bought and brought into their trade a ship that may yet have a great future before her if sentiment is not dead, and the brief press notice, which more than hints at this, heads this article.

This ship, then the *Melbourne,* a year later was renamed *Macquarie,* withdrawn from the Melbourne trade and put in that of Sydney. There was an appropriateness in changing her name, no doubt meant as a compliment to Sydney. But as years passed it was evident the day of the sailer had gone by, and the *Macquarie* was passed on to the Norwegians, who in turn disposed of her to a colliery company as a hulk. The Norwegians had renamed her *Fortuna,* and who in looking at her would recognise the once favourite passenger ship, whose destiny for the time being had been presided over by men like David Banks, Carvosso, or William Goddard?

There are men at the present day, some occupying good positions in the business life of the State, who look back to the time when as boys they served under one or other of those two men, and thank God it was their privilege to have had their lines cast in such a servitude. Fatherly, godly men who feared God, honoured the King, and taught them their duty; and instilled into them such principles as not only made them respect themselves, but to love their teacher and to hold his memory dear.

[A further contribution from Captain Watson will appear in our next issue.—Ed.]

JACK'S DAY

Speaking to a representative of *Sea, Land and Air,* Mr. Percy Hunter, one of the Honorary Organisers of Jack's Day, gave the following particulars of the work done up to the present.

This is the first movement set on foot in New South Wales for the benefit of the sailor men. The idea originated with The Navy League, and that little band of enthusiasts is working heart and soul to make the "Day" a success.

As a preliminary the interest and patronage of the Governor-General and the State Governor were secured and the Chief Justice of New South Wales, Sir William Cullen, who has accepted the Presidency of the General Committee, was found to be an ardent advocate of the movement.

Included in the General Committee are the names of some of Sydney's most influential citizens, and brigaded under their leadership is an extensive band of capable and tireless women patriotic workers.

Having elected the Committee and Officers and set forth the objects of the "Day" and adopted a schedule of division of the profits, the Controllers set to work to lay down a plan of campaign. It was first resolved to appeal to the public upon lines which, while following more or less the stereotyped methods now familiar to the public, were designed with the object of maintaining the strictest supervision over the offerings of the generous givers, and at the same time putting the public to as little inconvenience as possible.

It was determined to organise the country through the local Governing Authorities and each Mayor and Shire President has been approached and asked to set on foot a local committee. This request has been followed up by an active canvass of the country centres, and the prominent citizens in each district have been approached and asked to lend their aid to the Mayor or the Shire President in their efforts to set on foot a capable local organisation. In addition, through the good offices of Mr. Shannon, the General Manager of the Bank of Commerce, the banking interests in the country centres have been asked to lend their valuable influence to the movement. These measures should result in a complete and comprehensive organisation of the country districts.

Within the metropolitan area a vast deal of valuable organisation work has been already completed.

In the Shipping Community alone an effort has been put forth comparable with the complete organisation of some movements which have preceded this one, but this effort is only a section of the work. The shipping interests, with their separate Committee and Directors, under the Presidency of Sir Owen Cox, have a definite section of the city allotted to them, and, while their plans are to some extent secret, one is safe in saying that some novelties are projected which will greatly enhance the interest of the "Day," and doubtless add very materially to the profit of the undertaking. This effort of the Shipping Community embraces large sectional movements, such as Art Unions, Sports Meetings, Galas of various kinds, preliminary to the main demonstration and, of course, the usual direct action in the way of direct collection.

The portion of the city set apart for the shipping demonstration in the streets is roughly Circular Quay, Pitt Street, Macquarie Place, Bridge Street, Royal Exchange, Gresham Street and Spring Street, and it would be admitted that here the inventive faculty and ingenious contriving spirit of the Mercantile Marine will find full scope for its activities.

Amongst the subsidiary of the features of the "Day" perhaps pride of place should be given to the Rose Fête, organised by the ladies of the Red Cross, which took place in the Centennial Park, on October 19.

On the following Saturday, October 26, a Regatta, under the auspices of the Anniversary Regatta Committee and an Aquatic and Continental Carnival on the grounds of the Royal Sydney Yacht Squadron, at Kirribilli, was conducted, and here again a mammoth programme of a most attractive nature was carried out with very profitable results.

On the day following "Jack's Day," November 2, the Trustees of the Taronga Park Zoo have very generously offered the whole of the takings of the Zoo to the fund. In order to popularise the Park on that day a Fête will be conducted there, and in addition an Art Union, with a first prize of one hundred guineas and a number of other valuable prizes, will be held. Every purchaser of a ticket, in addition to securing a chance in the prizes, will be entitled to a free return trip on the Sydney Ferries and admission to the Zoo. The first prize for the Art Union of one hundred guineas is given by the Sydney Ferries Limited.

Another interesting function will be the "Jack's Night," which will take the form of a naval demonstration in the Town Hall. This interesting feature has been listed for Friday, October 25.

The "Lucky Packet" scheme is on a scale of very considerable dimensions, and will contain prizes of a range hitherto unknown in this class of distribution. The prize first in importance will be £100 open order on Marcus Clark, Ltd., generously given by that firm, and other prizes will include a trip to the Fijian and other South Sea Islands, trip to the Jenolan Caves, or trip to New Zealand and back by the *Riverina,* fifty trips to Newcastle, trip to Melbourne and back, season tickets on the Sydney ferries, one hundred trips to Manly, several war savings certificates for £5 and £1, orders on tradespeople, to a value of from 5s. and others. Every enevlope will contain a prize representing very solid value for money.

A local "Christie's" is being projected by Lady MacCormick, Miss Janet Knox and an influential committee of ladies, who have for some time been collecting objects of art, furniture and valuable household requisites of various kinds, with the idea of at some favourable moment during the campaign holding a week's sale of these articles. This promises to be a very valuable adjunct to the movement.

One of the most interesting money getting schemes is the sale of an insurance certificate in the streets for 1s., which will cover the purchaser for the day for one hundred pounds. These certificates are the gift of the Sydney Insurances Offices, and there is no doubt that there will be a tremendous run on them.

The Public Schools Amateur Athletic Association has very generously offered to give half the takings of their annual demonstration, which is to take place on the Sydney Cricket Ground, on November 2, to "Jack's Day." It is a well-known fact that these sports invariably attract a huge attendance, and a substantial cheque will no doubt result from this source. This project has an advantage besides the direct contribution, of interesting the school children throughout the State, in the endeavour to assist our gallant sailor men.

A motor car has been given by one of the firms as a prize for an Art Union, which will be a special feature connected with the "Day."

Mrs. Kelso King has given a cupboard, specially contructed and valued at twenty guineas, which she has filled with household linen, the total value being over £125, which cupboard will be the subject of a special Art Union.

There are a host of other functions and matters of interest connected with the "Day," too numerous to particularise. Prominent among the number, however, may be mentioned the fact that Dame Melba has promised to give a concert at a date to be fixed. The *Tingira* Naval Variety Show will perform at some suitable opportunity. A special dance will be held at the Wentworth Hotel, and the remnants of the flag, flown by the gallant little *Calliope* on her famous departure in the teeth of the hurricane at Apia, which wrecked the German and American fleets in these waters, will be sold by auction.

There are a number of other entertainments listed, including a great many individual efforts by stall holders.

The buttons selected have now been manufactured, and they range in value from £5 to 6d. They are a very handsome set and should provoke a very keen demand.

Judging by the programme mapped out, patrons of "Jack's Day" should secure very good value for money.

In addition to the activities enumerated above Mr. Hunter said a very complete scheme for the exploitation of the citizens by a street collection had been prepared by Mr. A. L. Blythe, the second Honorary Organiser. Mr. Blythe, said Mr. Hunter, has perhaps the widest experience of the intricacies of street collection among all the patriotic workers, and it is confidently hoped by the Jack's Day Controllers that his knowledge and administrative capacity will render the "Day" a model in respect of management, and also result in a record collection.

COMMERCIAL AVIATION

ITS IMPORTANCE TO QUEENSLAND AND THE NORTHERN BELT

Written for "Sea, Land and Air by C. A. JEFFRIES

The greatest hindrances to Australian development, especially in the northern and richest parts of it, have been the difficulties and cost of transportation. There is no richer realm in the world then Queensland, the Northern Territory and the northern portion of the State of Westralia, known on the map as the Kimberley District. It is a land of gigantic potentialities, many parts of it have a greater rainfall than England, and here everything necessary for the welfare and happiness of mankind can be produced in profusion.

Gold is the least valuable of its products, though there may be concealed within its recesses half a dozen "golden miles." Tin, copper, tungsten, wolfram and molybdenite are known to exist in many, many parts, but they cannot be worked profitably, owing to the vast distances and the cost (in time and money) of transportation.

Cotton grown in the Northern Territory some years ago and sent to Manchester proved to be of better quality than the best Egyptian, which is the highest grade on the market. Tea was successfully grown by way of an experiment in Queensland, but was not persevered with because somebody said it could never compete with the Indian and Singalese in price. Coffee and cocoa can also be produced, and there are enormous tracts suitable for the production of rubber.

The gems of Queensland are sought after the wide world over. The golden sapphires of Anakie are as famous as the diamonds of Golconda; while Queensland tourmalines, olivines, hyacinths and sapphires of every colour are sold under many names and at prices that would give the actual producers cold shivers. The wonderful opals of Lightning Ridge, ranging from the white (made of the morning light on the sea, or the gleam of the sunset on many waters) to the black (composed of the baleful glare of the sunlight through a dust storm), were the world's craze when the war arrived, and will be again when the minds of men and women revert to precious stones.

Upland rice, from the coastal tracts of Arnheim Land, is equal to the best Japanese. There are distinct traces of liquid petroleum from the Victoria Downs in the Territory to the uttermost parts of Queensland and Papua.

But the development and production of all this wealth has been impossible, owing to the vast distances. Railways over such huge territories have been impossible to the scrap of population. Consider the distances from the centres of population:

From Brisbane to Darwin (as the crow flies, mark you) is approximately 1,800 miles.

From Brisbane to Cooktown (round the coast) 960 miles.

From Brisbane to Rockhampton (by rail) 350 miles.

From Brisbane to Thursday Island 1,290 miles.

From Brisbane to Townsville 700 miles.

The northern portion of Westralia draws all its supplies from Fremantle, and it is 1,257 miles from Fremantle to Broome, the pearling port, and 1,457 to Derby, the port of the Kimberley District. To put it in another way, the area we are discussing is 2,400 miles from east to west at its widest, and 900 miles at its widest from the tropic of Capricorn northwards. The land surface is probably over 800,000 square miles. It has practically no population, except in Queensland. Railway development is beyond the financial resources of the whole population of the Commonwealth. Much of the railway development already carried out has proved unprofitable, owing to lack of population to develop the opened-up country.

Before railway development can prove profitable there must be either a considerable population on the ground, or else a large surplus population waiting at the railway base to overflow the opened-up country.

Queensland has no such population. The vast districts of this huge State that have already been opened up can absorb all the

population that Queensland can develop for many a decade to come. The Northern State has done wonders. Unlike the other States it has avoided centralisation. Its Brisbane railway system runs out to Cunnamulla, 604 miles in the interior, and to Rockhampton, 396 miles up the coast. Its Rockhampton system runs inland to Longreach, 427 miles away. Its Townsville system runs right away to Mount Elliot, 552 miles inland.

It is like a boy having accomplished the labours of Hercules. But the boy can do no more in that direction till he grows somewhat. Till the coastal population has grown enormously, the development of the interior of this vast area must wait under existing circumstances. There may be half a dozen Golden Miles awaiting at Arltunga, but if it costs £6 per ounce to produce, even gold is unprofitable. And for many years to come our railway development is going to be seriously handicapped by the load of war debt that will hang like a millstone round the Commonwealth's neck.

Enter the Aeroplane.

Existing circumstances are passing away under the fiery test of war. The thing that was imposible in 1914 is in 1918 an everyday occurrence. In those days it was a wonderful thing for two men to go aloft in an aeroplane. To-day British bombers with crews of eight men are devastating the valley of the Rhine. In 1914 it was a wonderful thing when an aeroplane carried a hundredweight of mails. To-day Handley-Page bombers make long flights into Germany and drop *tons* of high explosives, and return without alighting to replenish fuel supplies.

The great bombing machines that are to-day bringing home to German consciousness the horrors of war will do still more wonderful work in Australia's treasure house. The winged transport will make it possible to scatter small clusters of population throughout the wilderness to develop the wonderful mineral treasure that hitherto has been worthless, because the cost of transportation ate up the whole value of it and more. Already the Handley-Page has a working burden of ten tons, and it is increasing every week. In one short quarter the horse-power of these machines bounded from 1,500 h.p. to 3,000 h.p., and what a 3,000 h.p. aeroplane can carry has not yet been made public.

The wonderful performance of the motor lorry in relieving the congestion on the American railroads and supplying the bulk of the cities with food last winter was based on a fleet of lorries, the great majority of which did not exceed three tons burden, and practically none went beyond five. Lorries that carry over five tons are rare and are seldom used.

With a system of co-ordinated aerial routes, with smaller services from the general distribution centres, the whole of the tropical area of Australia can be served quickly and comparatively cheaply with mails and the necessaries of life.

The effect on the cattle raising and sheep industries will be enormous. Whereas it now takes several months to communicate between some of the inland Queensland stations and the cattle runs of Centralia and the Northern Territory, mails and passengers can be conveyed from any city in Australia in a period of time computed in hours and not days. At present there is no sign of the cattle-carrying aeroplane on the rim of approaching things; neither is there any indication that in the near future loads of frozen meat can be carried in sufficient quantities to load ships at the nearest part of the coast. Still, when the horse-power of aeroplanes jumps from 60 to 3,000 in four years, anything seems possible. He would be a daring man who would deny the possibility of great aeroplanes loading up with the produce of Centralia and flying with it direct to the nearest export depôt.

The aeroplane makes it possible to develop the mineral wealth of the great area under discussion. The rare metals and the rarer earths all seem to abound in Australia. These minerals when mined occupy little space, especially if they are partially refined on the field. The aeroplane that can carry ten tons can serve quite a nummer of little communities, each of which might be working at a considerable profit once the long, costly and tedious transportation problem is solved.

The aeroplane that will carry passengers abolishes the wilderness. The mere fact that in 24 hours or so one can be in the capitals does not make much material difference, but its moral effect is tremendous. No man will willingly take a wife and family even to a terrestrial paradise if it entails a horrible journey by primitive means for hundreds of miles every time he desires to bring his wife and children into contact with civilisation. But all that disappears the moment he knows that, when he desires it, a few hours in a comfortable, safe, almost fool-proof aeroplane will land his wife or any of his children where, if necessary, they can get the best medical attention, or enjoy the alleged delights of metropolitan life.

At present this vast area of country has not been properly explored, let alone prospected. It has not even been surface-scratched, but by the wonderful results that have accrued from what has been done, it is obvious that it teems with potential wealth. Also, if the handful of people who inhabit the land have done so well with the primitive means at their disposal in the past, what will they do with the aid of the weight-carrying aeroplane, which annihilates distance, which makes a trans-continental flight a matter of less than two days' flight; and which will enable the ardent searcher of wealth to cover hundreds of square miles where before he got over only a few acres?

[Mr. Jeffries will contribute to our next issue a further article on Australian Aviation. This will be entitled: "A Week's Excursion—by Aeroplane."—Ed.]

ENEMY USES VALVE RECEIVERS

All readers of *Sea, Land and Air* are now interested in the magnifying valve receiver, the origin of which we owe to Dr. Fleming, the well-known English scientist, and they will probably not be surprised to learn that the Germans are making good use of this wonderful instrument.

We have been fortunate in obtaining a photograph of a magnifying valve manufactured and used by the Germans and actually captured from a German Field Wireless Station. The construction of the instrument is clearly shown in the photograph, and wireless men particularly will be interested in the unique design. The illustration shows that the three elements—filament, grid and plate—are supported from a main glass column from which two stout wires formed into a "U" shape project upwards and support a single wire filament. below the filament is the grid, which consists of a flat wire spiral, and below the grid is the plate, which consists of a small, flat disc of approximately the same diameter as the grid. The plate and grid are both supported by a light glass bridge-piece, which is extended from a glass pillar drawn out of the main glass column. This bridge-piece supports plate and grid on opposite sides, but the two anodes are further supported at right angles from the bridge supports by glass beads, which are threaded over the filament support wires and over two similar wires running parallel with the filament supports.

One particular feature of this valve appears to be the exceptionally small separation between the filament and grid and between the grid and plate.

The wire supports for the filament, after passing through the glass pillar, are connected to two terminal plugs, the two other wire supports, which run parallel to the former, make connections from the grid and plate respectively to other plugs. The bulb is mounted on a heavy ebonite base, through the bottom of which the sockets protrude, and the sockets are so constructed that the valve can only be inserted into the adaptor in the proper manner.

On the whole, the instrument is very well constructed, and probably gives excellent results, although we fear that the Germans have not yet paid royalty to Dr. Fleming or the Marconi Company, who own the master patent.

[In our next issue will be shown and described a magnifying valve used by our French Ally.]

THE PHENOMENA OF LIGHT

BY MRS. SELWYN LEWIS, B.Sc.,

(Concluded from previous Issue)

The Marvellous X-Ray.

How many of us have at some time or the other trodden on a sharply pointed needle that we are afraid will be forever lost to sight. But nowadays the wonderful discovery by Röntgen has made it possible for a flat silhouette to be obtained by the X-rays as they travel through the human body.

For more than half a century a small band of men passed some of the best part of their lives in experimenting with a little glass tube through which they sent currents of electricity. The glass tube was a modification of the ordinary closed arc-lamp.

After being emptied as far as possible of air, two metal points were fixed inside it and connected with the wires of an electric spark coil. A spark was created by the electric discharge across the air space between the points. When, however, most of the air was pumped out of the tubes the passage of the sparks was facilitated and a luminous glow appeared. For the sake of clearness it must be explained that the metal point by which the electric current enters the tube is called the anode or upward path, while the point from which the current leaves the tube is called the cathode or downward path. Thus the cathode ray is created by the electrical charge at the cathode, it then shoots from the cathode to the sides of the vacuum tube and there produces a beautiful coloured glow.

Sir William Crookes, whose experiments have opened up all the new sciences that come out of the little tube of glass, found that when the cathode ray struck against a little vane placed inside the tube in the path of the ray, the vane rotated in the direction which it would take were it being bombarded by a stream of exceedingly small shining bullets.

Hertz, one of the discoverers of electric waves, essayed to prove by his experiments that the new ray consisted of waves of electricity. He fitted a very thin window of aluminium in the part of the vacuum against which the cathode ray shot from the cathode. And, strange to say, the marvellous ray passed through the sheet of aluminium and lighted the air for a short distance outside the tube. Since the letter X is used in mathematics to signify an unknown quantity and because he could ascertain little or nothing concerning the nature of the second new ray Röntgen called it the X-ray.

This new ray is capable of passing right through solid objects, so any surgeon can now say with truth to his patients what Hamlet in his frenzy said to his mother: "You go not till I set you up a glass where you may see the inmost parts of you."

In addition to being produced from electric spark discharges the X-ray and the cathode ray are emitted by radium and other radiant elements; as a matter of fact, this is the oldest discovery of the wonderful new ray. Nièpce, the inventor of modern photography, found that salts of uranium placed in utter darkness close to a photographic plate left an impression on it. The only difference between the X-ray created in a vacuum tube and the X-ray found in radium is one of speed.

The artificial X-ray has a velocity of about 60,000 miles a second; while the X-ray that shoots out of radium has about three times this extraordinary pace.

At first only flat silhouettes were obtained, but by using a ray which did not penetrate the bones, but showed them as dark shadows among the vaguer tints of the flesh, it became possible to make "perspective" pictures.

This method was useful in discovering fractures of bones and foreign bodies of metal, such as bullets and splinters of shell in wounded soldiers, also to detect the presence of needles and nails due to domestic accidents.

But now, by using soft rays on certain parts of the body and taking separate photographs and combining them into a composite whole for the purposes of examination, the surgeon can obtain a perspective view into the human body.

Then there is plastic X-ray photography, where the doctor can observe with his own eye the improvement that is taking place and he can give the patient certain bismuth preparations that will coat some of the interior parts of the body and make them stand out visibly.

Just recently a wonderful discovery has been made in which the human body is converted into a fluorescent screen.

Our nerves, muscles and brain contain a fluorescent material that resembles quinine. Now experiments are being made in dosing patients with quinine, then making the medicine shine in the body by applying X-rays to the diseased part.

Revelations of the Cinematograph.

An old adage, "the quickness of the hand deceives the eye," has a particular application to the marvels of cinematography.

Scientists tell us that the moving picture is produced by "persistence of vision."

Do you realise that it takes about one-twenty-fourth of a second for the ordinary human eye to get rid of a single image formed on its retina? Consider the eye as a photographic camera, attached to the brain by a kind of telegraph wire.

When the lens of the eye is adjusted to an object the rays of light form an object on the retina, which is a dark screen at the back of the eye. Behind the retina runs the optic nerve and along this nerve the image is transmitted to the brain by a kind of telegraphic code of nervous impulses. Out of these nervous sensations the brain reconstructs a conception of the actual image printed on the retina.

The brain is somewhat slow in its work of reconstruction and will retain the picture of its own making some time after the real object has disappeared from sight.

In the meantime other objects may flash into view, but they remain invisible, for the telegraph line is engaged.

It takes one-twenty-fourth of a second for the ordinary human eye to get rid of a single image formed on its retina; during that time it is possible to create in succession at a certain point nearly half a million electric sparks, but the eye can only see one steady, unbroken light; in other words, it is quite blind to 499,999 things taking place within a few feet of it.

What happens in cinematography is that numbers of scenes are photographed and printed on a long, transparent picture band.

This ribbon moves on rollers and between two reels.

As the ribbon passes from the first large reel to the second it comes between a magnifying lens and a large lantern. Each picture is thrown upon a screen.

Although there is a shutter opening and closing swiftly and continuously in front of the magnifying lens the enormous speed at which the ribbon passes along gives a smooth impression of the scenes to the interested spectators.

Important as the cinematograph is as a means of enjoyment, it is still more valuable as an instrument of scientific research.

A leader in military science recently secured moving pictures of a bullet striking a steel plate, which promised to revolutionise the science of ballistics.

Ballistics is a comprehensive term for the study of bullets, shells and other projectiles in actual flight.

The new kind of cinematograph camera for demonstrating this had a film moving before the lens at the great speed of 150 miles an hour. So more than 280 feet of the film passed before the lens in the space of one second. Light was obtained by a series of electric sparks, some of which lasted only one-ten-millionth part of a second. Yet the pictures obtained at this tremendous speed were quite clear.

The scientist took 500 consecutive pictures in one-tenth of a second and projected them on the screen at the slow speed of sixteen pictures a second. So the cinematograph enables us to magnify time in the same way that the microscope enables us to magnify space.

The wonder of it is that we can study the action of flight in the swiftest bullet more easily than, with the unaided eye, we can observe the movements of a tortoise.

No doubt quite soon the strange and hitherto hidden structure of matter will be made plain to children's eyes by means of moving pictures.

ACCUMULATORS

A PLEA FOR THE AUSTRALIAN-MADE ARTICLE

Written for "Sea, Land and Air"

By W. N. CATON,
Managing Director, Accumulators, Limited.

The writing of this article has been prompted by the bringing into being of a new Australian industry, namely that of the manufacture of accumulators or secondary batteries. The want of this industry has been manifest in Australia for a considerable time. The batteries now used in this country are mainly obtained from the United Kingdom and Germany and consequently there is a lack of personal supervision, due to the manufacturing works being 12,000 miles away, which causes endless trouble both in selecting suitable types of batteries and also in providing the necessary interest which tends to make the apparatus work to its maximum efficiency.

When selecting a battery for any particular requirement the user or consulting engineer has to decide upon the conditions under which it will have to work, for certain conditions require certain types. For instance, a light traction battery or a cell of the motor car lighting type would not do the work demanded by a hospital plant or a power house. It is generally conceded that the most suitable type of battery for power house or municipal work is one which combines the principles of Gaston Plante and Jaques Faure. These two men were responsible for the respective designs of accumulators which bear their names and to-day, after forty years of experience, the leading manufacturers of the world are using the same combination, namely the heavy cast Plante Positive Plate. This has a great surface area, with a fine adhesive coating of lead peroxide, which is formed electrolytically out of the solution, and a negative plate which has for its active material a lead oxide suitably mixed with a vehicle which allows of the right consistency before the grid is pasted.

Many devices have been invented to prevent the active material in the negative plate from falling out and shrinking and probably the most adopted plate to-day is that which was made by the Pflueger Co., of Germany, and introduced into the United Kingdom about the year 1903.

Having then selected the most suitable cell for power house requirements the next point for consideration is the country in which the battery has to operate. Experience proves that the excessively high temperature in Australia is not conducive to the life of the battery, and therefore this second point is an important one. The writer had occasion to visit a power house in Australia where the temperature of the battery room exceeded 100°. No provision had been made for keeping the battery room at a normal temperature and consequently the battery, although reasonably looked after, became liable to accelerated peroxidation and did not last more than forty per cent. of the time it should have done. From this it appears that when batteries are being selected the place of destination should be known and where excessively high temperatures are encountered the plates should be so formed that the rate of capacity can be given with the finest film of peroxide. In addition to this the writer would suggest that the battery room should be arranged with open ends so that two wire screens can be filled with coke, medium size, and arrangements made to allow water to percolate the coke and at one end of the building have an in-take fan and at the other an out-take fan. By this means the battery room would be kept at a temperature which could be adjusted from time to time and by this means prolong the life of the battery.

When comparing the batteries of the various manufacturers a good rule to decide their respective values is to take the weight of the plates in each battery and balance against their cost. This will be of interest when it is known that the life of a battery depends upon the amount of metallic lead in the positive plates when all other factors are equal. Thus the maker who can give the greatest amount of lead in the plates for a minimum cost represents the best battery proposition to the user. In addition to this the worth of a battery is in its backing and the manufacturer who is willing to supply a battery in which he has every confidence, and which he is willing to maintain for three, five or ten years and at the end of this period leave the battery with a definite percentage of its initial output, allows the user to accurately computate his battery maintenance costs exactly as he would in the case of prime movers or other mechanical plant. This, too, would be of great assistance when calculating the cost per unit. Generally speaking this practice has not been adopted by the manufacturers supplying batteries to Australia, chiefly because the inspection staff required for the work would entail too large an organisation and expenditure. The writer believes that the main plank in a new accumulator industry in Australia will be that which caters for the periodical inspection of the battery plates, the manufacturer accepting the responsibility for the battery by entering into a maintenance contract with the user.

In the United Kingdom, roughly from the year 1900, Broken Hill lead has largely superseded that supplied by other countries, and in every case that has come before the writer's notice the lead supplied by the Broken Hill Proprietary Co. has been considered eminently suitable for battery work, chiefly on account of its purity and ductility. The materials necessary in the manufacture of storage batteries are all obtainable in Australia, and in many cases, as previously shown, the batteries now supplied by the United Kingdom have been made entirely from materials obtained in Australia. When it is considered that this necessitated the transportation of approximately 80% of material for 12,000 miles as a raw product, and the return transportation as a finished article to Australia, it will be realised that the new industry of battery making is a much needed one from an economical standpoint.

Touching on the question of the national defence of Australia. It is a well-known fact that the whole of the battery makers in the United Kingdom at the present time are working mainly on the cells which are required for submarines. England, Scotland and Wales combine to form an island, and it is fair to assume that the protection of its coast is largely effected by the utilisation of submarines, and as in the case of the British Isles, so must it eventually be with Australia, who will have to rely upon her underwater craft for protection to an even greater extent than does the Mother country. When it becomes necessary for us to defend our shores in this way we should not have to rely upon any other country for the proper supply of accumulators necessary for propelling our underwater craft. It would be a national catastrophe if in our hour of stress we failed to adequately guard our shores by not being able to supply the country with the necessary apparatus for the efficient and skilful manipulation of our defence.

German Aerial Photograph of British Position in Palestine.

Airman and camera were captured by Australian Flying Corps. An automatic device attached to the apparatus numbers each exposed plate and simultaneously registers the vertical and horizontal tilt of the camera which, in this instance, is a 4.5. Zeiss, of German manufacture.

THE MERCANTILE MARINE

WRITTEN FOR "SEA, LAND AND AIR"

We boast of our boys in blue, our hats to our soldiers we raise,
We present them badges and medals, our voices ring loud in their praise;
And when days of strife are ended, we will do it all over again,
Entirely forgetting the *other* man, who sails the infested main;
In the mercantile marine.

He wears no special uniform (any old thing will do),
Never a thought to appearance; one of a motley crew;
No one knows much about him, the man who goes to sea,
He may be a grimy fireman, or just a common A.B.;
In the mercantile marine.

On a trooper from Australia, through the Panama to France,
Then back across the Westward, giving Uncle Sam a chance;
Running guns and ammunition, to the Persian Gulf's foul shore,
Grafting in the stokehold, in a crow's nest on the fore;
In the mercantile marine.

Butting Eastward, with racing screw, homeward bound with grain,
Groping, in a ten-knot convoy, through mist and driving rain;
From Barry Dock at break o' day, in a sailing ship forlorn,
The outward track for Callas, beating round the Horn;
In the mercantile marine.

Torpedoed in mid-Atlantic, mined in the bleak North Sea,
Shelled while adrift in a lifeboat, no wounded stripe wears he;
A few days ashore to recover, clothes to get, where he may,
It seems hard to believe, but it's done every day;
In the mercantile marine.

Our Navy still shall rule the waves, just as in days of yore,
Aye! ready there, if needs must be, to guard its native shore;
Our soldiers, too, at duty's call, rally line upon line,
And all prepared, these other men, beneath the red ensign;
Of the mercantile marine.

At country's call, in hour of need, they also lives have given,
When days were black, to do their job, unflinchingly they've striven;
These sailor men who sail the seas, and murmur not nor whine,
Who brave the perils of the deep, the submarine and mine;
In the mercantile marine.

We recognise his services, with no Flower or Button Days,
No clasping warmly by the hand, or toasting, 'ere he weighs;
Just an every-day occurrence, whether winds blow foul or free,
The eternal game of chance, and putting out to sea;
In the mercantile marine.

["STEAMBOAT"] *At Sea.*

WIRELESS WORKSHOPS

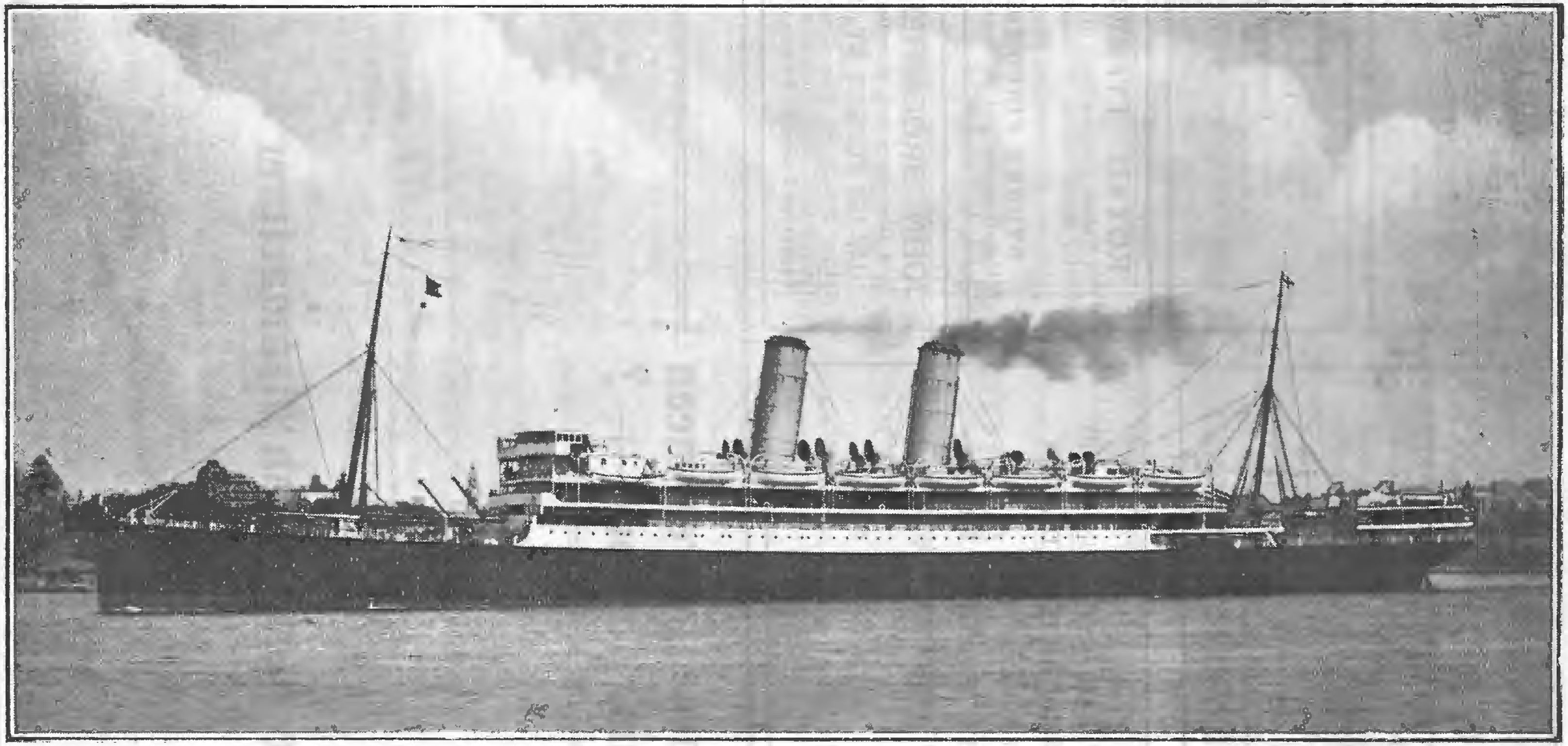
According to a statement made by the Treasurer and published recently in the *Commonwealth Gazette*, the Government Wireless Workshops show, for the year ended June 30, 1918, a financial loss of £4,831. * * * *

The expenditure on the Government Radio (Wireless) Service, apart from workshops, for the year ended June 30, 1918, amounted to £40,157 2s. 8d.

AUTOMATIC TELEPHONES IN AMERICA

Information has just been received to the effect that the manual telephone system in Washington, U.S.A., failed recently owing to the exceptional load thrown upon it by conditions arising out of the war. Automatic telephones are now being installed in Washington to deal with the exceptional amount of business which the old system was not able to cope with.

SUNK BY COLLISION



R.M.S. "Otranto," 12,124 Tons (Orient Steamship Company).

Built at Belfast in 1909 the *Otranto* was one of the best known steamers in the Australian Trade. On October 6, 1918, colliding with the P. & O. Company's steamer *Kashmir,* the *Otranto* drifted ashore off Islay Island (Scotland), and became a total wreck. A destroyer, summoned by wireless, took off 27 officers, 239 members of the crew, 300 United States military ratings and 30 French sailors. Officially reported missing are 335 United States military ranks and ratings, 11 officers and 85 members of the crew. Of the *Kashmir* no official news is obtainable. The *Otranto* was the first of the Orient fleet to be fitted with wireless. —*Exchange Studios.*