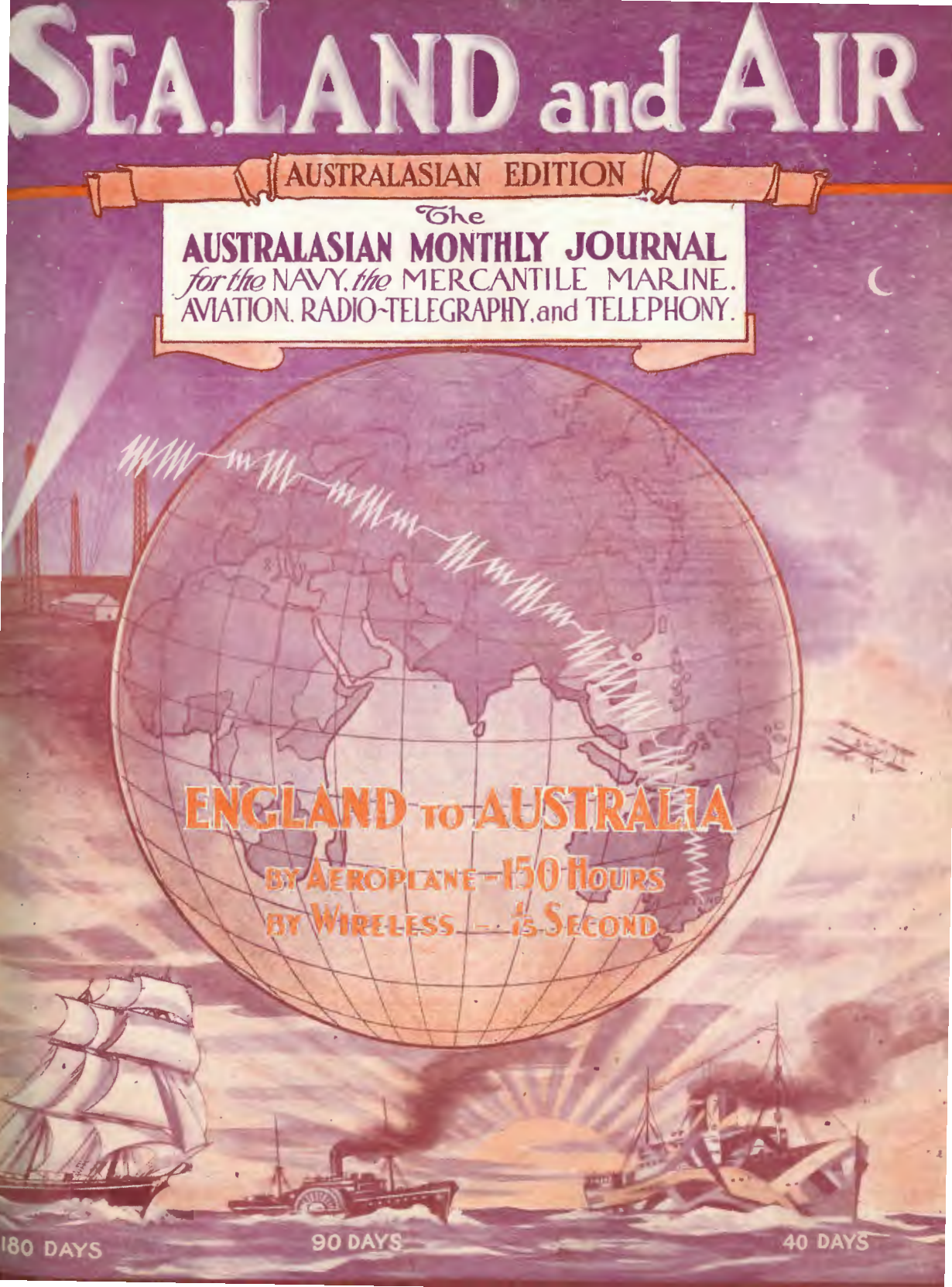
SEA, LAND and AIR

AUSTRALASIAN EDITION

The
AUSTRALASIAN MONTHLY JOURNAL
for the NAVY, *the* MERCANTILE MARINE,
AVIATION, RADIO-TELEGRAPHY, and TELEPHONY.



OFFICIAL JOURNAL OF THE AUSTRALIAN AERO CLUB
OFFICIAL JOURNAL OF THE WIRELESS INSTITUTE OF NEW SOUTH WALES

Vol. II.—No. 13 April, 1919 Price Ninepence

BY THEIR FRIENDS SHALL YE KNOW THEM

We are assured that when the curtain descends upon the first volume of any new publication it is customary for the editor to advance to the footlights and briefly acknowledge such tributes as may have come his way. Wherefore our second volume will open, in conventional manner, with a reference to our reception during the twelve months just ended, and with an indication as to editorial policy for the ensuing period.

These opening remarks are dedicated to our friends, by whom—we are old-fashioned enough to believe—some such introductory will not be resented.

That *Sea, Land and Air* lacks neither friends nor supporters is manifest in the following letters, which cover a wide range and represent every section of the community. To reprint all the letters of appreciation which readers have seen fit to write to us were to occupy several pages. Accordingly we quote but a few extracts, adding that, in the hackneyed phraseology of the patent medicine advertiser, "the originals of these testimonials may be inspected at our offices."

Vice-regal encouragement came early in our career from His Excellency the Governor-General, Sir Ronald Munro Ferguson, P.C., G.C.M.G., LL.D., who graciously informed as that he reads *Sea, Land and Air* with the deepest interest.

From Her Excellency Lady Helen Munro Ferguson we have the written assurance that she, too, derives great pleasure from reading the many interesting articles contained in its pages.

His Excellency Sir Walter Davidson, K.C.M.B., Governor of New South Wales, encloses his personal cheque for two yearly subscriptions, adding that he would very much like to have all subsequent issues sent to him at Government House, Sydney.

His Excellency Lieutenant-Colonel Sir Henry Lionel Galway, K.C.M.G., D.S.O., Governor of South Australia, writing from Government House, Adelaide, states that he has found the journal most interesting and encloses cheque for annual subscription to same.

Mr. W. Holman, Premier of New South Wales, writes that he finds the publication a distinctly interesting one, and that it has been decided to subscribe to it through the Department's regular newsagency.

From the Hon. R. T. Ball, M.L.A., New South Wales Minister for Public Works and Railways, we have an order for 150 copies of the monthly issue for Depart-

mental purposes, and from the Naval Secretary a telegram: "Please send one hundred and fifty copies your magazine with *Adelaide* launch."

The Hon. A. J. Poynton, M.H.R., Acting Minister for Navy and Minister for Shipping, who has favoured our readers with an occasional literary contribution, writes us the following:—

> "No doubt you have dealt extensively with the shipbuilding industry, and your articles will be read with great interest throughout the country."

Mr. J. J. King-Salter, R.C.N.C., M.I.N.A., General Manager of the Commonwealth Naval Dockyard, Cockatoo Island, writes:—

> "I congratulate you on the excellent manner in which you have dealt with the launch of H.M.A.S. *Adelaide*—editorially and pictorially."

The Right Hon. Sir Joseph Ward, Postmaster-General of New Zealand, has "noted the contents of this journal with very great interest," and prophesies that "the publication will undoubtedly prove very useful and instructive"; while Mr. W. R. Morris, Secretary to the New Zealand Post and Telegraph Department, writes:—"The magazine is in every respect a highly creditable production."

Touching on friendly comments by prominent directors of the Australasian Mercantile Marine, we have printed (on page 9) a particularly pleasing letter of encouragement received a day or two ago from Colonel the Hon. Sir James Burns, K.C.M.G., M.L.C., while Sir E. Owen Cox, K.B.E., Chairman of the Overseas Shipping Representatives' Association, writes:

> "Permit me to compliment you upon the production. The workmanship reflects great credit upon those responsible for same."

Mr. A. Gordon Wesché, of the Peninsular and Oriental Steam Navigation Company, in renewing his annual subscription, wishes *Sea, Land and Air* "all the success which the high-class manner in which it is produced thoroughly deserves."

Mr. D. A. Aiken, General Manager of the Union Steamship Company of New Zealand, has "perused the magazine with very much pleasure and offers congratulations on the quality of its contents." Messrs. Macdonald, Hamilton & Company, writing from Brisbane, congratulate us on the "general get-up of the journal and the choice of such readable articles," while Mr. W. E. M. Tremearne, manager of Charles Parbury & Company, Limited, writing also from the Northern capital, complains:—

> "I have lost all my numbers of *Sea, Land and Air*, because I have been foolish enough to lend them. Will you be good enough to send me all the numbers from No. 1."

Captain T. Langley Webb, Sydney director of Huddart, Parker, Limited, writes:—"*Sea, Land and Air* reflects great credit on the editor and publishers." Mr. W. Rigg, Chairman of the North Coast Steam Navigation Company:—

> "I consider your magazine most interesting, dealing as it does with almost everything under the sun in the most up-to-date fashion. I read it with considerable pleasure, and feel sure that if it be conducted in like manner in the future it will meet with the success which it undoubtedly merits"

Even as we pen these lines there comes to the editorial desk a letter from Cunnamulla (Q.), a district so remote from our offices that the letter has occupied six days in transit. It is dated March 18, and is from Mr. Samuel S. Pegg, solicitor and commissioner for affidavits. Says this gentleman:—

> "Enclosed I have pleasure in handing you renewal sub. for *Sea, Land and Air*, and in doing so I have to congratulate you on the splendid get-up of the magazine. I think the idea of publishing explanations of intricate scientific principles in everyday, common, readable and understandable language is a distinct step forward, and will be appreciated by all laymen."

Among our friends in the world of wireless are Radio-Commander Cresswell, R.A.N., Director of Royal Australian Naval Radio Service, who writes that the journal is both instructive and entertaining, "bidding fair to become the best semi-technical journal published in the Commonwealth"; Dr. Alfred N. Goldsmith, Fellow of the Institute of Radio Engineers, New York, who writes:—

> "*Sea, Land and Air* will go far towards establishing a widespread interest and consequent technical advance in the field of radio telegraphy and telephony. Both professionals and amateurs should derive benefit from a publication of this type, particularly as the scope of its articles and their technical character progressively evolve."

The late Mr. John Bottomley, Vice-President of the Marconi Wireless Telegraph Company of America, wrote us from New York shortly before his death:—

> "I have certainly nothing but praise to offer for such a very fine magazine. It is

extremely interesting, and my only remark would be that you have undertaken 'some job,' as we say out here, to keep up to the high standard of your early issues."

Mr. E. B. Pillsbury, General Superintendent of the Marconi Company (New York) wrote:—

"I have read it from cover to cover with much interest. You have produced a most readable magazine, which seems to me beyond criticism. I predict for it permanent popularity, and I wish you success in a large way."

Mr. Roy A. Weagant, Chief Engineer of the same Company (and recently prominent in the public eye by reason of an invention by which he is said to have overcome the difficulty of atmospheric disturbance, or static, in wireless transmission), writes us that he has read the journal with considerable interest.

Mr. J. C. H. Macbeth, a scientist whose popularity will widen with the completion of the Marconi International Code, of which our correspondent is originator and compiler, writes us from London:—

"You will be glad to hear that I sent a copy of *Sea, Land and Air* round to one of my friends in the Admiralty, and they liked your paper so well that they immediately became subscribers."

Mr. B. S. B. Cook, Commonwealth Publicity Officer (Prime Minister's Department), writes:—

"I have looked through your publication with a critical eye. I am sorry—or rather glad—to say that I can offer no suggestion for its improvement. The illustrations are excellent, while the letterpress is suitable and of the right length. Altogether it is a very bright publication."

Friendly support has been no less freely given by our contemporaries and by the daily Press.

The Australian Aero Club and The Wireless Institute of New South Wales have adopted us as their official journal, thus investing us with a responsibility which we shall at all times strive to discharge honourably and impartially, for our obligations, as we see them, do not cease with the mere collecting and disseminating of topical news and special articles.

Quite apart from these there is a certain amount of "outside" work to be done, and even though we are not always able to do the actual work ourselves, there are many matters which we feel called upon to bring to the notice of those who should.

We are now in communication with the Acting Prime Minister on the subject of aerial services, an issue rendered doubly obscure just at present by the attitude of certain powerful aeronautical bodies in Great Britain who, doubtless in ignorance of Australian activities in aviation, have apparently come to regard the oversea Dominions as their legitimate fields, to be exploited by special arrangement with the British authorities.

Our correspondence with *The Aerial League of the British Empire is a case in point. Still more important is the matter of The Civil Aerial Transport Committee (London), which, in a voluminous report to the Imperial Air Board, makes the following recommendations:—"The Dominion and Indian Governments would, we hope, also be willing, unless they were running STATE-OWNED aerial services of their own, *to allow the British authorities to tender to their Post Offices for the carriage of their mails, and generally to operate in their territories on the same terms as their own citizens.* . . . Such facilities would include the provision of aerodromes and landing places, or the grant to the authorities controlling British aerial services of *the right to acquire them for themselves.*"

We have brought these projects before the Commonwealth Prime Minister in London and the Acting Prime Minister in Melbourne, and in doing so have endeavoured to point out the immediate necessity for protecting Australian interests and for encouraging private enterprise. This can best be done by (1) expediting the registration of such *bonâ-fide* companies as have already lodged their applications, (2) by granting financial assistance in cases where such may be considered justifiable.

Correspondence will be published when some definite action has been taken by the authorities concerned. At present nobody appears to have progressed beyond preliminary reports and recommendations.

But that complications will arise can never be doubted, and by assisting, in our own small way, towards the solution of these and kindred problems, we shall, we feel, in some degree merit the handsome testimonials mentioned herein.

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* Page 4

THE AERIAL LEAGUE OF THE BRITISH EMPIRE
INFORMATION SOUGHT CONCERNING AUSTRALIA

Mr. Douglas G. H. Gordon, J.P., Secretary of * The Aerial League of the British Empire, has written the following letter to the Sydney Chamber of Commerce. Mr. C. E. D. Meares, President of the Sydney Chamber, invited the Editor of this journal to furnish the League with the information desired. This was duly done.

A copy of Mr. Gordon's letter appears below:—

AERIAL LEAGUE OF THE BRITISH EMPIRE.
Head Office—46 Dover Street,
Piccadilly, London, W.1.,
December 30, 1918.

To the Secretary,
The Chamber of Commerce,
Sydney, Australia.

Sir,—

The use of air transport for commercial purposes after the war is now generally foreseen, and the Aerial League of the British Empire desires to collect information which will be filed and made available for those who are proposing to engage in air transport.

We therefore apply to you, as the paramount body for commercial purposes, to give us such information as you may think fit with reference to the use of air transport in those parts which come within the scope of your committee's activities. We should be exceedingly obliged if you would provide us with detailed particulars and a marked map, if possible, in respect of the following questions:—

1. Over what routes is it likely that an air transport service could be successfully maintained in those districts which come within your province? Such a service could be profitably provided where, *owing to scarcity of population, sparse settlement* or geographical difficulties, the construction of a railway was not a profitable proposition. *Such an air service also gives exceptionally rapid and direct delivery for mails*, small parcels and certain valuable, perishable commodities.

2. In the course of each route, what towns would be served between the two termini and what are the populations, special characteristics and industries of these towns?

3. What would be the nature of the goods to be carried? Although those goods are most profitable which have the greatest value in proportion to weight and bulk, the weight-carrying capacity of the aeroplane has, of course, been greatly advanced of late. There is no doubt that aeroplanes are now being designed to carry several tons of merchandise and passengers.

4. Would an aeroplane passenger service be desirable on any of the routes indicated?

5. What are your local sources of supply or natural resources as regards oil fuel for aeroplanes and lubricating oils?

We may perhaps say that the Aerial League is not a trading body. It was established early in the century and is recognised as the paramount body of the British Empire for educational and propaganda purposes.

We trust that you will be kind enough to give us the information for which we ask, as well as other particulars which you think advisable for us to know, as it is intended for the benefit of your own commerce and the prevention of unwise and ill-formed enterprises which are so generally detrimental. We hope that it will stimulate those aerial progressive and Empire-developing activities which this League was formed to foster and support.

In this latter connection we should further be glad if you can see your way to taking the initiative in establishing a branch of our organisation which might possibly be affiliated to your body. We suggest that this would identify you more closely with aerial movement and would facilitate communications and help towards the continuity of our policy.

Yours faithfully,
DOUGLAS G. H. GORDON.
Secretary.

* The objects and activities of the above League were detailed in the September (1918) issue of *Sea, Land and Air*.—ED.

Our reply to this letter was necessarily long, and we do not propose to reproduce it *in extenso*. Readers of this journal are well aware that the question of aerial transport has been under consideration in Australia for at least six months past, and that active steps have been taken to commence practical operations in the near future.

We pointed out that the entire personnel of eight Australian flying squadrons would return to Australia during the next few weeks, and that they would bring back about 150 modern areoplanes; further, that sixty per cent. of the A.F.C. pilots are reported as having declined to join the Permanent Reserve, electing instead to engage in commercial aviation upon their return to Australia.

We mentioned that the Department of Defence had recently landed a large shipment of Avro and Sopwith aeroplanes, to be utilised for instructional purposes in the several flying schools.

A brief summary of recent developments in Australian aviation was given in their proper sequence, together with the copies of this journal from which our summary was extracted.

The five specific questions contained in Mr. Gordon's letter were answered as follow:—

(1) "Over what routes is it likely that an air transport service would be maintained?"

A.—"We would refer you to our report on All-Australian Aerial Services, pages 649-652, February, 1919."

(2) and (3) *A.*—"We have invited Major Lee Murray, initiator of the all-Australian aerial project to furnish us with replies to these two questions, and they shall be transmitted to you at the earliest possible moment."

(4) "Would an aeroplane passenger service be desirable on any of the routes indicated?"

A.—"In our opinion, emphatically yes."

(5). *Q.*—Local sources of supply of oil fuel and lubricating oils for aeroplanes?"

A.—"The following firms are represented in each of the capital cities of the Commonwealth, with branch offices in every important district: The British Imperial Oil Company, Limited; The Vacuum Oil Company Proprietary, Limited; The Neptune Oil Company, Limited; The National Oil Company, Limited. Further, we are assured by these and other firms, that adequate stocks of petrol, benzine, and other oils and lubricants are held to fully meet the estimated requirements of the immediate future."

With regard to Mr. Gordon's suggestion of local representation of the Aerial League of the British Empire, a copy of his letter was forwarded by us to the honorary secretary of the Australian Aero Club with a request that he take the matter up with Mr. Gordon.

We concluded our reply to Mr. Gordon's requests in the following words:—

"We note that yours is not a trading body and that such information as we may be able to supply, or may consider advisable for you to know, is to be filed by your League and made available to those who are proposing to engage in air transport in the countries concerned.

"We shall be pleased to keep you informed as to further developments in this country but in view of the headway already made here by Australian airmen and of the infinitely greater headway which will doubtless be made on the return of our eight flying squadrons, Australia, in our honest opinion, cannot truly be said to offer the slightest commercial inducement to airmen of other lands, except in close co-operation with all-Australian services which will be existing in the near future."

Copies of the above correspondence have been filed in the Sydney Chamber of Commerce.

The present writer, in our issue of December last (Vol. I., page 522), ventured the following opinion:—

> The time is now ripe for some definite plan of action in the construction of Australian aircraft. The eyes of English and American aircraft builders are already focussed upon our raw materials, and a "wait-and-see" policy on the part of Australian engineers will probably lead to the early establishment in this country of aircraft factories erected by nations more enterprising than our own. Further, these factories will be branches of the more important concerns already in operation overseas, and the profits derived by their exploitation of the Australian market will probably not be expended or invested in Australia.

Was this a mere platitude? Let the reader decide.

TRANS-OCEAN WIRELESS FOR AUSTRALIA

Especially Written for "Sea, Land and Air"

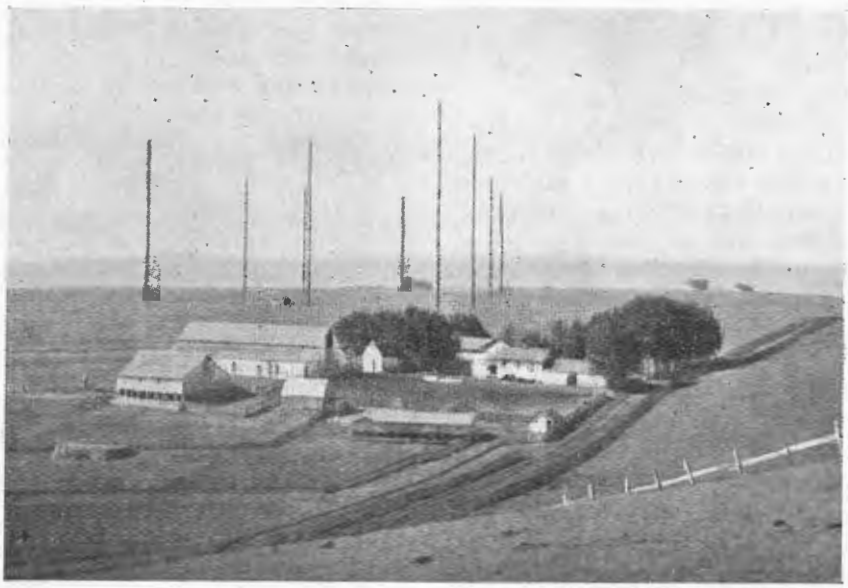
By ERNEST T. FISK, Member Institute of Radio-Engineers

Ever since Marconi produced the first practical system of wireless telegraphy (23 years ago), the great inventor's attention has been closely given to extending the range of communication. In spite of the ridicule of many scientific contemporaries who said it would never be possible to send a wireless message across the Atlantic, Marconi went straight ahead, and within five years of his first invention he achieved success in that supposedly impossible feat.

History is being repeated now that a wireless services are in operation in many parts of the world to-day. The oldest service is that across the Atlantic, from Clifden in Ireland to Glace Bay in Canada.

The Glace Bay-Clifden trans-Atlantic service was established twelve years ago, and it has successfully carried millions of wireless messages between the new world of America and the old world of Europe.

The first trans-Atlantic signals were sent from that famous Marconi station at Poldhu, in Cornwall, the huge wooden



Trans-Ocean Wireless Service.
Bolinas, California. Transmitting Station of the Marconi Trans-Pacific Link between America and Japan.

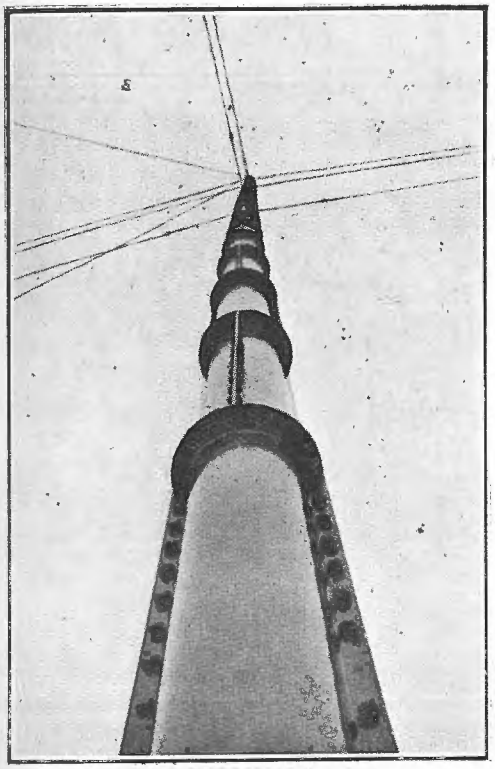
definite proposal has been made to establish direct wireless communication on a commercial basis between Australia and Great Britain. Eminent men in scientific and engineering fields are shouting "impossible" or "impracticable."

These bad prophets, however, are mostly men who are not actively associated with practical wireless work. It is safe to say that every practical wireless engineer knows that such a service can be provided and successfully maintained. Trans-ocean towers of which were for many years a landmark for ships entering the English Channel. Although Poldhu station was able to make itself heard in Newfoundland, it was not sufficiently powerful for conducting continuous communication with the assurance and speed required for a successful commercial service.

Poldhu station was kept for another important service: sending the long daily news messages to be printed and published on board the great trans-Atlantic liners,

all of which have had their daily newspaper for several years past.

Senatore Marconi and the other great pioneers who were associated with him in the Marconi Company, were so confident that a commercial wireless service could be successfully conducted across the Atlantic that they expended several years of untiring work and hundreds of thousands of pounds. They met with untold difficulties, many of which, to men of lesser courage, would have been unsurmountable, and their troubles were not lightened by the



Trans-Ocean Wireless Service.
450-ft. Steel Sectional Mast as seen from base.

sceptical opinions and even the ridicule of numerous influential people, and by the indifference or amused tolerance of the general public or "the man in the street."

This small band of men, however, had the courage of pioneers, coupled with unshaken faith, great genius, and practical ability. Their efforts were crowned with success when in 1907 the great stations were opened for commercial messages between any point in the United Kingdom and any address in Canada or the United States, "*via* Marconi," at two-thirds of the existing cable rates.

Naturally the public was timid and conservative at first, but in a very short time large volumes of commercial, social, and press messages were sent and received in both directions. The business grew to such dimensions that the company had to open a special London office in the Strand for collecting and delivering the messages. The "Marconi" service became so popular among the great commercial houses that a second office was opened in the heart of the city of London, also one in New York and one in Montreal.

The demands on the two stations had increased to such an extent that additional stations (at Carnarvon, Wales, and Belmar, New Jersey) were erected, and plans made for collection and delivery offices in all the principal cities of the United Kingdom. These new stations were completed just after the outbreak of war in 1914. Although they had been provided entirely at the Marconi Company's risk and expense, these new stations proved to be valuable assets for the Allies, and were used for war purposes exclusively.

They embodied all the knowledge and experience that Senatore Marconi and his assistants had gained in past years. Both stations were equipped with the latest apparatus to send and receive simultaneously and for automatic high speed work at 75 to 100 words per minute. Each station was connected by direct land telegraph with the capital city (London and New York respectively). At the city collecting office in London special apparatus was provided by mean of which a typist could send the message from a keyboard like an ordinary typewriter, and this wonderful machine actually "operated the wireless apparatus in Wales and sent the messages across the Atlantic at high speed, without the intervention of a wireless operator." By this means the wireless messages would be actually sent to America from the heart of London.

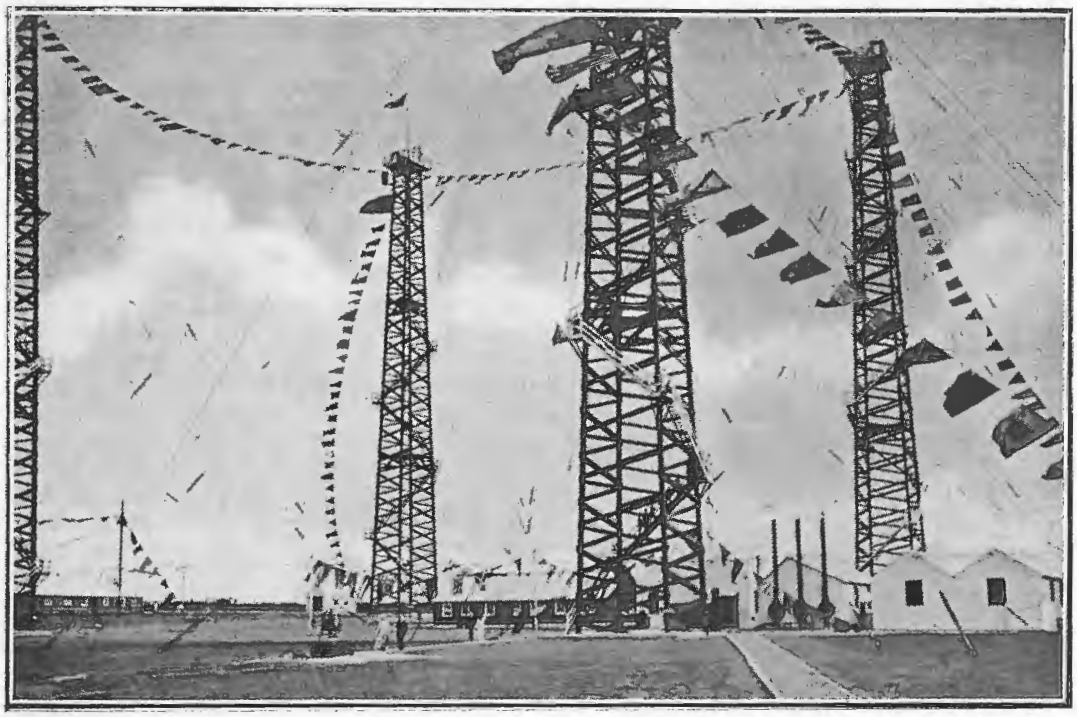
Since the armistice was signed the new stations have been released from war work, and the company is now carrying on its commercial service with the equivalent of six trans-Atlantic stations. The Marconi service has gained a high reputation for its speed and accuracy, and in addition to the thousands of commercial and social messages, thousands of words are sent and re-

ceived daily for the principal British and American newspapers. It will probably be news to many to know that much of the news published in Australian newspapers is sent "*via* Marconi" instead of through the Atlantic cables.

So great has been the success of the Marconi trans-Atlantic wireless service that many extensions have been planned, and some are already in operation. Recognising the great possibilities of wireless communication and its cheapness compared with submarine cables, the Norwegian Government invited the Marconi Company to provide a direct service to home station is situated at Coltano, near Rome, and the Somaliland station at Massaura.

A still greater achievement was the erection of Marconi stations and the successful inauguration in 1914 of a trans-Pacific service between California, Hawaii, and Japan.

Quite recently a new company, entitled "The Pan-American Wireless Telegraph Company," has been formed to use the experience, organisation, and patents of the Marconi Company in a great scheme for high-power Marconi stations throughout Central and South America to provide



Trans-Ocean Wireless Service.

Old Wooden Towers, Marconi Station at Poldhu (Cornwall).

North America. For this purpose a great Marconi station has been erected at Stavanger, in Norway, and a corresponding station at Chatham in Massachusetts. These stations are designed for simultaneous sending and receiving, and for automatic working at 100 words per minute.

Earlier than that arrangements were completed at the request of the Italian Government for direct communication between Italy and Italian Somaliland. The direct communication on a commercial scale between the United States and every Central and South American state or republic.

The great benefits of the Marconi Company's world-wide and unique experience, its organisation, and its numerous patented inventions, are now made available for the greatest scheme of all. That is, the immediate establishment of a *direct* service between Australia and England. An offer has been made to the Commonwealth Gov-

ernment which cannot be declined, for it involves no expense and no risk to the country, while no special concessions are sought.

The Marconi Company is prepared to erect the stations and conduct the service entirely at its own risk and expense, and to send and receive all classes of messages, commercial, social, government and press, at *two-thirds of the existing cable rates.* These great stations will probably cost £100,000 each, and the Marconi Company is prepared to find the money. Therefore, it is the company's money which would be lost if the scheme should not prove successful or remunerative. We can be sure, however, that the company, with its exclusive knowledge and experience, has no doubt of its success. In fact, it has conducted a long series of experiments for that purpose.

The only thing required at the present time is the necessary official sanction, and that will, no doubt, be forthcoming very soon. Preparations will then be made for the stations. A temporary service from England to Australia will be opened immediately, and the permanent service in both directions will probably be opened within eighteen months.

These stations will be the most powerful and modern in the world. They will incorporate all the past experience of other great trans-ocean services and every latest invention. The sending and receiving systems will include, among other patents, the Marconi continuous wave system, magnifying valve receivers, the Marconi duplex system, Weagant's startling invention, which destroys all atmospheric disturbances and jamming, and the new Marconi directive system. With that combination, speed, accuracy, reliability, and secrecy will be obtained. Wireless messages to England will be brought within the means of the smallest purse, because week-end messages will be sent at the rate of ten shillings for twenty words.

LETTERS TO THE EDITOR

The following letter, which we print with pardonable pride, has been received from Colonel the Hon. Sir James Burns, K.C.M.G., M.L.C., managing director of Burns, Philp & Company, Limited:—

To the Editor, *Sea, Land and Air.*

Dear Sir,—

I was much pleased to receive your last issue, and consider that no journal in Australia should be read with more interest.

Considering our gigantic land spaces, which can now be made quickly accessible by periodical air service, and the thousands of miles of sea coast Australia possesses, which should in future be used to better advantage, you have a wide field to operate in by drawing attention to these all-important matters.

Yours truly,

JAMES BURNS.

Gowan Brae, Parramatta, N.S.W.
March 16, 1919.

To the Editor, *Sea, Land and Air.*
Department of the Navy,
Navy Office, Melbourne.
R.A.N. Radio Service, Collins House,
March 3, 1919.

With reference to your letter of the 22nd ultimo, addressed to Commander Cresswell, asking whether you could be furnished with copy of the *order issued on April 26, 1917, prohibiting the sending of wireless messages in code, the Naval Board have acceded to your request. The order reads as follows:—

"I am desired to inform you that until further orders wheat ships and other merchant vessels are to make no W.T. signals except—

(*a*) In emergency;
(*b*) One signal, if necessary, within 24 hours of making a port to announce time of arrival. The name of the vessel should not be given, the name of the master or some similar indication being used."

GEO. J. WESTON,
Radio Lieut. Comm. R.A.N.,
Acting Director of Radio Service.

* The above order was referred to in an article dealing with the capture and loss of the *Matunga,* published in our March issue.—ED.

WOMAN'S SHARE IN VICTORY

AT SEA AND IN THE AIR

Especially Written for "Sea, Land and Air" by MISS KAE McDOWELL

When the iliad of the Great War comes to be written, some of its most gallant passages will be needed to describe the part Woman has taken in the almost superhuman effort after victory. Never had it been dreamed by civilised nations that her place in war would be other than that of weeping, waiting and nursing. Artists had portrayed her as a white-robed phantom, urging men to conquer; writers had described her as the white man's burden. No one had foreseen her "up in the trenches," garbed in sober uniform, wearing an identity disc, and working like himself.

Hers has indeed been no Penelope task, no light juggling with time, no mere anxious idling for her warrior's return. She has carried despatches on motor cycles and done "chores" in the dug-outs, such being but individual instances of her work. Her most prodigious efforts were in the munition and aeroplane factories, in foundries and shipbuilding yards. Her courage there proved of a high order and her adaptability in emergencies surprising.

In the munition factories she worked unconcernedly through air-raids, where the accurate fall of a bomb would have meant the death of hundreds.

That wizard of administration, Lloyd George, informed a large audience that: "It would have been utterly impossible for us to have waged a successful war had it not been for the skill and ardour, enthusiasm and industry, which the women of the country have thrown into the work of the war."

The building of ships and aeroplanes was work as completely new to the women of England as the addressing of an election meeting would be to a lady from an Eastern harem. Yet before the war ceased an entire ship had been constructed by their sole effort.

Work in engineering shops and munition factories—in fact in all the directions where labour was most urgently needed—requires expert knowledge. The problem which directors of labour were faced with in the early days of the war was therefore no light one. Women though overflowing with zeal were quite unfitted for almost every branch of work. The whole country was harassed by the extreme need for greater production, while every day the labour shortage was being more keenly felt.

Then a movement arose among institutions of university rank and various feminist organisations for the training of industrial recruits. In 1915 the training of factory workers was undertaken by the Ministry of Munitions.

The aptitude of the women students surprised their instructors. One onlooker writes: "I remember watching in this training ground the manufacture of small aero-engine parts, exact in dimensions to within the smallest limits of tolerance. I put a query as to the wastage of material in such an operation, when handled by comparative new-comers. 'Scrapping from this process,' replied the production manager, 'does not exceed a total average of one per cent.' The women at work at the time had come from the most varied occupations. A large proportion of them had never been outside of their own homes. Others were domestic and so on."

The construction of aircraft had not been undertaken in England upon any large scale before the war. As the work is light and clean it is not surprising, then, that the majority of it has fallen into the hands of women.

Some idea of the rapid growth in the production of "flying machines" may be had from the fact that in one London factory the output was trebled within three months. But great as the demands for labour for this work there has never been any shortage. It seems to make a direct appeal to people of all ages. Then again

the factories are chiefly in the open country, and they are to a great extent free from the noise and dirt of machinery. There are women in England to-day who are managers and even partners in aircraft factories. It appears as though it will not be long before lady "pilots" will be as usual as lady chauffeurs are to-day.

Women may be found proficient in almost every process of the manufacture, from the cutting of wings and the sewing of seams, to the welding of metal joints, with the aid of the oxy-acetylene process.

It is interesting to see women in dainty caps and overalls working on aero-engines with the sure, light touch of the expert, and even helping in the making of the magneto, which is the very soul, as it were, of the machine. They grind and mill, drill and bore, gauge and regauge, for extreme accuracy is essential. They even undertake some of the special processes which before the war were only given to the most trusted male experts.

The most bewildering of aeroplane processes, to the onlooker, is the assembling of the parts of aircraft after they have

Woman's Share in our Victory at Sea.
British women and girls doing heavy work in a Royal Naval Dockyard.

been tested first by overseers and then by Government inspectors.

Proof of the efficiency attained by women in this industry was given in a recent test, when a female operator was ordered to dismantle and re-assemble a machine. She went through the whole process, stripping the network of the stay and control wires and re-assembling them with perfect precision, and at the first attempt.

The advisability of introducing female labour into the ship-yards caused many an employer's brow to wrinkle with doubt when the idea was first mooted. It sounded very like the acme of hysterical folly. True the urgent call for more and more ships to combat the wastage of war was sounding clarion-like through the Empire. It was essential that every dock-yard in the country be working at its highest pressure, yet of the male labour required there was not a fraction available.

Then into the fount of trouble stepped Woman, with the lubricant of her eager enthusiasm. "Teach me," she said, and here and there a pioneer employer was found to try the experiment. Its success was unquestionable and the movement grew rapidly.

An eye-witness declares that it was an amazing sight to see the women working in a big yard crammed with shipping of every kind. A great battleship lay along the dock serene and stately. Men were on the conning tower busy with paint pots, and there was a tangle of ropes and pots on the upper deck, where the guns were biding their time. Down below the women were renewing electric wires and fittings; installing new cables, drilling holes; "sweating-in" a distributing box, and marking the positions for the wires.

Everywhere they were working in pairs. Behind a small iron door a couple were engaged on a fire control. Here the space was so small that the visitor caused "bad over-crowding."

Very strict discipline is maintained on board ship—far stricter than is known in any factory.

Besides working on board, women were employed in the various engineering shops where practically every description of ship's constructional and repair work is undertaken. In these shops extreme celerity and efficiency are needed. Daily consignments of damaged electrical apparatus came in. In the constructional department women made bulkhead pieces and various kinds of metal work, undertook oxy-acetylene welding and were even to be encountered in the foundry.

Before the war the furthest that women had been allowed to penetrate into shipbuilding had been the flag-making and upholstering for yachts. One ship-yard foreman expressed to L. K. Yates his astonishment at woman's success in this new work. "We can hardly believe our eyes," he said, "when we see the heavy stuff brought to and from the shops in motor lorries driven by girls. Before the war it was all carted by horses and men. The girls do the job all right though, and the only thing they ever complain about is that their toes get cold." Here a strapping youung woman driver interrupted him. "They don't do that now," she said, "because we've got hot-water tins."

Whether women will continue to hold their positions in the ship-yards after normal conditions have been restored is a question. The indication is that to a certain extent they will, but only to a certain extent. With peace many will be glad to relegate to stronger arms the arduous work that patriotism fired them to undertake for their country's need.

In the face of all this it is rather amusing to recollect the opinions voiced by even the most farseeing of employers, on the question of women's labour, at the outbreak of hostilities. Realising that recruiting would cause a shortage of labour they suggested that women would probably be employed upon many "simple kinds of repetition work" in the engineering workshops.

GAZING DOWN AND THINKING BACK

DEDICATED TO THE PIONEERS

Especially Written for "Sea, Land and Air" by ALBERT DEANE

I was flying over "Aussie" quite a mile up in the air,
Cutting out two miles a minute, and with more speed left to spare;
And beneath me, smoothly gliding, when my gaze would wander down,
Were trees and creeks and ridges; now and then we'd pass a town.
I was flying on to Darwin in the *Rocket*, swift and neat,
Though the first to start the running, she was fleetest of the fleet;
But my vision soon got misty and I saw not towns, but ghosts,
Of those steadfast, grim explorers who had gone before the hosts.

There was Leichhardt stalking westward with a few still faithful blacks,
And blazing trails for highways with a blunt and battered axe,
Striding on to conquest grimly and, unknowingly, his fate,
A fate not known to mankind, but to Him above, the Great.
And then I sighted Mitchell—yes, Sir Thomas was his name;
He too was seeking highways and he too was just as game,
But though misfortune dogged him and the road he did not find,
His memory goes marching with the heroes of his kind.

And I saw a form a-crawling, digging deeply in the dirt,
Seeking shelter from the sun-rays, and I knew that form was Sturt;
And I saw McDougall Stuart, in the centre of the land,
Shake out a silken emblem, and the sunlight kiss each strand.
And so, in long procession, went those grim and silent ghosts,
Some just exploding theories, and some redeeming boasts;
But behind each one was urging, though reward be gold or dross,
The desire to know the wonders of this Land of Southern Cross.

Then my vision somehow hastened and advanced full fifty years,
And I saw a party gathered, heard some oaths (I thought) and cheers;
And I somehow saw the faces and I somehow knew each man,
But I couldn't quite imagine how they'd gathered in a clan.
There were men whom gifted poets had immortalised in verse,
And others, wild bushrangers, men who couldn't have been worse;
But their ghosts were all assembled and they raised their glasses high,
As they seemed to drink to Progress—and the monster in the sky.

I straightway sighted "Clancy," who was on the "Overflow,"
The chap who went a-droving—just to where I do not know,
And "The Man from Snowy River" and "Jack Dunn from Nevertire."
Were telling poor "Joe Wilson" to gaze upward at the flier.
Faded then these visions swiftly as we settled to the ground—
We had hopped across Australia, as it seemed, in one great bound—
And I hoped these silent visions would rejoice in what they'd seen,
For to them is due much glory, else such sights might not have been.

AIRCRAFT CONSTRUCTION

MANUFACTURING POSSIBILITIES IN AUSTRALIA

Especially Written for "Sea, Land and Air" by "PROP BOSS"

In the February issue I touched on the growth of the aeroplane and the safety of flying; in this issue I am going to touch on the possibilities of manufacture within the Commonwealth of Australia. For the past six months this subject has interested me, and, in a word, Australia is almost in a position to commence the manufacture of aircraft to-morrow.

It is common knowledge that an *Aircraft Construction Committee, controlled by the Defence Department, has gone into the matter very thoroughly from a defence point of view. Exactly what decision they arrived at I am not in a position to state, but my own inquiries, taken for what they are worth, show that there is not one firm in the country which can start building a complete machine at once, but there are several firms which, with a slight alteration of their plant and one or two additions, could become aircraft manufacturers.

The chief materials required are:—(1) timber; (2) aluminium; (3) textiles; (4) steels.

Timber for the construction of spars, ribs, and longerons; aluminium for alloys for the light fittings on the aeroplanes and for the sumps and crank-cases of the engines; textiles for the fabric to cover the wings and bodies; steels for the fittings requiring strength, for cables, and for engine construction.

Ash and spruce are generally used in England. There is no spruce in this country, but there are excellent substitutes. On the whole the Australian woods are very much heavier than the English, but they are more than proportionately stronger, *i.e.*, hollow spars and ribs can be used in Australian woods, and can thus be lightened to correspond with ash and spruce weights, but hollow parts of local woods are as strong, if not stronger, than the English timber.

Any form of aluminium is lacking locally, and will have to be imported, probably in ingot form; but this is no great difficulty.

Textiles form a subject for experiment, but material is here, and given suitable mills an excellent fabric could be produced.

Steel in almost any form is produced here.

Aeroplane engines have already been produced in this country, and there is no reason why engine manufacture should not be made perfect. I know of several firms who, given the necessary encouragement, would start at once. In a very few months there will be inquiries from private individuals for aeroplanes and engines.

The greater part of the building of an aeroplane is hand-work done by the various tradesmen. Machine tools are, of course, necessary, but all the fitting and delicate parts are done by hand. This means a large wage bill every week, but it must be faced by those who are going to look upon aviation seriously. It will be many years before machines are reduced to a price much below £1,500 for a small two-seater, while big commercial machines will run into their tens of thousands of pounds.

War necessity compelled England to make use of female labour for many parts. For instance, all sewing, sandpapering, "doping," and, in some cases, rigging itself was done by women. The best acetylene welder I ever saw was a woman; she was doing man's work and getting woman's pay.

Aeroplane manufacture cannot be classed as heavy work; it is light, delicate work, and must all be done with care. It is the conscientious worker who scores at this class of work.

Throughout the factories in England the Australians number legion, many of whom, now the war is over, wish to return to their own country. Here is the personnel already trained for the enterprising firms to snatch up. Only one thing is need-

* The activities of the Aeroplane Construction Committee were described in the November (1918) issue of *Sea, Land and Air*, page 461.—Ed.

ed, encouragement. In spite of the higher wages, aeroplanes can be built here for less money than in the Old Country.

Australia can build better and cheaper propellers out of Queensland maple than can be built anywhere else in the whole world. This alone is an asset, for why should not Australia be the propeller-makers for the world?

In England a two-bladed propeller will cost over £20 to make, while a better article can be made here for less than £10. Big consignments to England would only cost a few shillings apiece to ship, and once there they could be sold at at least 33 per cent. profit, and still be below the English production cost.

Many firms here have members of their staff at home in the flying services; these men on their return could handle the technical side of the question.

Estimates of manufacturing costs are rather startling at first sight—big costs, big wages and salaries, big selling prices, *but* big profits.

When Australia awakens to the necessity and uses of aeroplanes, it will be impossible to import the quantity to satisfy the demands. *They must be made here,* and the sooner people realise it the better.

People here still look upon aeroplanes as dangerous. Rot! with a big capital "R." But I suppose time alone will tell, and when machines come into every-day commercial use the business houses will wonder how they managed before.

I met my business friend the other day, who talked a lot of nonsense about people being "dashed to pieces from thousands of feet." He looked quite angry—I suppose he had read the February issue of this paper. Anyway "if the cap fits," etc.

I am going to finish up by giving a diary of a trip from Melbourne to Sydney to-day (forgetting the quarantine) and a trip in 1920, *i.e.,* within one year from to-day. Now, do not snigger, but if you do not believe, just think of this paper in March, 1920.

"A Business Trip to Sydney"

MARCH, 1919.

Monday.

4 p.m.—"Hurry up with those letters, or I shall miss my train. D—— the train. Why does it leave in the busiest part of the afternoon?"

4.15—(On the phone) " . . Well, I must go now, as I have hours of work to do and I must catch the train."

4.30—"Where's the office boy? Hi, boy, go to the station and buy my ticket, and meet me when I get there."

4.31—"Boy, order me a taxi, to be here at ten to five sharp."

4.45—"No, I don't care who he is or what he wants; I have no time to see him now. Say I'll be back at the end of the week."

4.48—"Is the taxi there? Please keep all letters till I get back next week. Address Sydney office if you want me specially."

A rush to the taxi and a crowd at the station barrier, more fuss at the train, and finally a scramble into a full compartment among a heap of suit cases, etc.

5 to 11 p.m.—Bump, shake, bump, shake, reading impossible with any comfort; writing impossible in any circumstances; sleeping—well, it's a lucky man who can sleep in the average train.

11 p.m.—"Albury! Albury! Change for the Sydney train!"

As a result of this disturbance, the wretched passengers are thrown out on the platform with their baggage, and a scramble ensues to find the allotted sleeping berths.

After some delay the Sydney train departs, while the various passengers prepare to retire for the night. Some sleep, some don't. In most cases the noise and usual train jolting only permit of dozing.

Tuesday.

8.30 a.m.—Passengers begin to arouse themselves and endeavour to have a train shave and wash.

11 a.m.—Arrival at the station in Sydney and the usual rush to engage porters and cabs takes place.

Noon.—Our friend has at last managed to get free of the station, and proceeds to an adjacent hotel for, if possible, a bath and some food.

2.30 p.m.—Arrival at the Sydney office, where, because he has about six hours' work to do, it necessitates a night in Sydney.

Wednesday.

7.30 p.m.—Catches Melbourne express, by which, after innumerable discomforts at Albury the next morning, he arrives in Melbourne just in time for lunch.

Thursday.

4 p.m.—Returns to his own office for the last hour before the staff goes home.

Friday.

9 a.m.—Business begins again as usual, while the last three and a half days' correspondence has accumulated.

Expenses to cover a trip to Sydney from Melbourne on business to do six hours' work:—

Fares	£8	0	0
Hotel bill in Sydney and meals Tues.-Wed. ..	4	0	0
Incidentals	2	0	0
Loss from long absence from office	5	0	0
Total	£19	0	0

One year later there is the aeroplane mail service in operation. The particulars of a journey to encompass the above are as follows:—

AERO MAIL TIME-TABLE.

Leave Melbourne - Midnight
Arr. Sydney - - 6 a.m.

Daily.

Leave Sydney - - Midnight
Arr. Melbourne - 6 a.m.

Daily.

N.B.—Passengers travelling by this route need not vacate their berths before 8.30 a.m. Baths and breakfast can be obtained at the terminal aerodrome stations.

Monday.

4 p.m.—"Let me have the letters by half-past five, please, as I shall not be here all day to-morrow. Splendid service to Sydney; does not waste any time."

4.15—(On the phone) " . . . . Well, we will discuss it to-night at dinner if you will dine with me at seven. I am going on the midnight to Sydney and will be back early Wednesday morning."

4.30—(To the office boy): "Here's £10, go and book my passage to Sydney to-night by the midnight, and order an aero-mail taxi to call for me at 11.30."

4.45—"A gentleman to see me? Show him in, I'll see him at once."

Until closing time the regular office work goes on unimpeded.

Closing time—"Hold to-morrow's letters up, I will attend to them the following day."

During the evening our friend dines and packs his suit case in comfort. At 11.30 the taxi conveys him to the aerodrome, arriving about five minutes before the 'plane is due to start.

11.57—"Good evening, Captain Brown. What time will we leave?"

"The mails are five minutes late to-night from the P.M.G., but we can easily make that up and arrive on time."

Tuesday.

12.5 a.m.—Arrival of the mails.

12.15—Royal mail plane *Valkyrie* leaves on the seven-hour run to Sydney.

Owing to the lack of noise and any form of jolting our friend enjoys a good night's rest, lulled to sleep by the well-silenced engines' drone. At eight o'clock on Tuesday morning the attendant knocks at the cabin door.

8 a.m.—"Eight o'clock, sir; time to turn out."

"Are we in Sydney?"

Yes, sir; landed an hour ago, dead on time."

"Wonderful, it never disturbed me at all."

Donning his overcoat in lieu of a dressing gown, he join his thirty fellow-passengers on their way to the bath-rooms. Bath, shave, and dressing finished, breakfast is served.

9.30 a.m.—The taxi arrives and conveys him to the office, arriving there before ten o'clock.

11.55 p.m.—Return to the aerodrome station and back to Melbourne, arriving at the office by ten o'clock on Wednesday morning.

As there is only one day's correspondence, by the afternoon the work is regular again.

Expenses to cover trip to Sydney from Melbourne to do six hours' work:—

Fares	£10	0	0
Meals	1	0	0
Incidentals	0	10	0
Loss from absence	2	10	0
Total	£14	0	0

Time over whole journey, if by rail, 95 hours.

Time over whole journey, if by air, 35 hours.

Therefore, by going by air the business man saves £5 in cash and 60 hours in time, but can do the same amount of work in Sydney in both cases.

THE CITY OF SYDNEY, A.D. 1971

Especially Written for "Sea, Land and Air," by W. F. BAYAL

PART I.

The Awakening.

I awoke from endless dreams—strewn with faint, perplexing memories, and felt relief that the nightmare of darkness, stars, clouds, lightning flashes, rushing winds, drowning waters, vast, unreal scenery, and fabulous, menacing monsters—had been cut short at last. The sun was shining brightly, and I lay in my own bed, depressed, yet at peace.

I turned my head to take, through the lower slats of the venetians, my usual morning glimpse of the harbour and the South Head lighthouse. I was surprised to find I moved with weariness and great effort, and the venetians were tightly closed.

Had I been ill? I remembered once before having felt much like this, some years ago, when I learned that I had been asleep for nearly a week. And before that I recalled a time in boyhood when I was told I had slept for a night and a day, to my mother's great distress.

However, all was well. I dozed fitfully, and must have slept again, for on re-opening my eyes the sun was in the west, throwing the familiar room into soft shades. My eye travelled over all the little labour-saving devices, arranged to suit my own particular needs, which I had built into this, the topmost suite of the flats. I recalled the satisfaction which I had experienced three years previously on completing the building in 1915. Equipped with every modern convenience which I, an experienced civil engineer, could design, the flats were at once in great demand by people tired of the blank futility of the every-day house.

A bell-push hung at my side, and I now pressed it to summon the house-boy from below. My fingers and arms were very stiff, and I closed my eyes once more in weariness.

When I again looked out a strange face, bearded and spectacled, was regarding me keenly.

"Where is Robert?" I asked.

"You are all right," he replied; "all right and quite safe. You have been asleep for some time. Do you hear me? Permit me ——." He took from the dressing table a perfume bottle and played a cooling, fragrant spray over my face. "Better now?" he anxiously inquired.

I felt very much better indeed, and thanked him.

He was attired in a rich purple tunic, with gold clasps down the front, something like that which the wealthy Chinaman wears, and I wondered how such a figure had got into my room. To add to my surprise, the door opened and a young man, carrying a tray full of bottles and glasses, entered on tip-toe, an awed expression on his face. He was dressed even more eccentrically than the other, in a costume resembling that of the late Mr. Chidley, but of a bright orange colour.

Perhaps I was still dreaming? The young man deposited the tray on the dressing table, and the spectacled one proceeded to pour out green, and pink, and yellow liquids from the bottles into a long glass. I observed now that his costume was an extremely graceful one, terminating below in shorts, stockings, and purple shoes.

"Drink this," he commanded, approaching my bed, and assisting me. Immediately I had drunk I felt so very well that I tried to sit straight up—and failed. He replaced the glass on the tray.

"How long have I been asleep?" I asked.

"A considerable time," he replied, glancing quickly at the other man, now hovering near the table.

"How long?"

"A very long time."

"Yes, yes, but *how* long—some days, or a week?"

He appeared confused, yet there was something at once comforting, quizzical, and familiar in his countenance. Where

had I seen him before? A doctor? Could he be a doctor in that costume? These men looked like actors. No doubt practical jokers; some friends, perhaps, of young Stacey, mad medical students like himself. I determined to settle the matter offhand. I was slightly irritated.

"Will you please ring up Dr. Stacey, in Macquarie Street, and ask him to kindly call as soon as possible?" I asked. "You will find a telephone in the next room."

The purple one hesitated, and seemed to blush slightly. "As a matter of fact," he said, "my name is Stacey, and I am a duly qualified practitioner."

"Please do as I ask," I returned, annoyed at his keeping up the mystification.

"You may be sure everything will be done," he stammered. "It may be difficult to get your Dr. Stacey; in fact—in fact—he is not in Sydney at present."

"That will do," I cried; "he was here last night on important business which must be fixed up to-day. But perhaps this gentleman will call him?" I looked at the orange man, who did not move an inch.

"I implore you," said the purple one with some agitation, "do not excite yourself needlessly, it is unwise in your condition. If you will be perfectly calm—" He laid a professsional finger on my wrist —"you must prepare yourself for a slight shock." A long pause followed. "The Dr. Wilson Apperley Stacey of whom you speak"—another long pause, he fixed me with his eye—"was my grandfather."

"Was your grandfather?"

"Yes; he died in 1920."

Nineteen hundred and twenty! Then I had been asleep for over a year! I mused over this amazing fact for a second or two. Of course it might be the truth.

"And young Stacey—Seymour Stacey, where is he now?"

"Dr. Seymour Stacey was my father; he died in 1951."

Nineteen hundred and fifty-one! Heavens! *How* long had I slept? The Stacey before me was not less than thirty years of age. My brain whirled again as in the lighter stages of my old dreams. My last perception was that the purple Stacey was pouring something hot and volatile down my throat, then night fell again.

. . . . .

The Morning After.

"You will find great changes," said Stacey next morning. I was in bed, awaiting, with some anxiety, his inspection and opinion.

A Chidley hairdresser had called and operated on me with electric scissors and clippers, attached by a long cord to my lamp bracket. The shorn locks almost filled the little vacuum box which formed part of the gear. Within two minutes he had packed away his tools and departed, leaving me amazed at the speed and skill he had displayed. Never before had my hair and beard given me such satisfaction as I now drew from my reflection in a hand-mirror. Yet if Stacey had spoken truly last night, I was perhaps a hundred years old.

"Can't I get up to-day?" I asked him. "I feel quite fit."

"Really," said he, "I do not know yet, but you are wonderfully alive for a man who has been nearly dead for over fifty years." He proceeded to take my temperature, looked at my tongue, and played over my chest with a stethescope of a kind which I had never seen before.

"Hungry at all?" he inquired. I laughed. "Not very, but I can tell you what you are going to say next."

"What?" he asked, mildly surprised.

"Strong as an elephant?" I suggested.

"Yes, but how did you know?"

"Your grandfather always concluded the performance with those words."

We laughed aloud together. "I suppose we really do know each other very well. I have been coming to see you once a week for the past ten years, and you knew my grandfather longer than that. Now, drink this soup, and I will send a message to the tailor."

"That wardrobe is full of my clothes," I ventured.

He threw open the doors, exposing a row of dark-coloured, sad garments. Prominent on a hook was the white shirt with stiff-starched attachments which I had worn the night—that is a century—before. Then I realised that Stacey's soft purple costume was much more beautiful and becoming than anything to be found in that old recess.

"I really don't think you could go about in things like this," he said, thoughtfully fingering waistcoats and trousers and other articles which had taken on a ludicrous appearance; "we only see such garments

now in cinemas of the good old times. People might stare at you in the streets, you know."

"All right then! Send for your tailor. By the way, I suppose I can afford new clothes?"

"Don't worry, my dear fellow, I think you are fairly comfortably off. Your rents have been coming in regularly for fifty years, and the biggest expenditure has been our family retaining fee. When your catalepsy extended over a year, grandfather, as next of kin, put your estate in the hands of the Public Trustee. You would have become a multi-millionaire under the old laws, but the State looks after and checks the rich man nowadays. 'Mind if I use your 'phone? For the sake of convenience I have taken the liberty of putting in a wireless installation; hope you don't object; the cost was small, and I've debited it in my professional fees."

He went into my sitting-room, and I heard him giving some order through the wireless telephone.

I mused as I supped some soup, and began to realise I was going to be very hungry. So, private property had not yet ceased to exist, and the Bolshevik dream of complete appropriation was not yet an accomplished fact! I recalled the I.W.W., the war—ah, the war!

Stacey re-appeared in the doorway. "How did the war finish up?" I asked.

"What war?"

"*The* war, the war against the Germans; the last I remember was that America had sent a million men over to France."

"Oh! yes,—that was the war which brought the aero-bus and the taxi-plane into use. Germany was badly beaten, of course, but don't ask me for details, history is one of my weakest points. How's the soup?"

A dapper little fat man, in a pale-green bath-gown, bustled into the room and bowed—the tailor, no doubt. Under his arm he carried a tube like a plan-case. From this he extracted an array of telescopic rods, which he set up on the floor as a tripod, with a loose, swinging, elbow-arm dangling from it. "If you will kindly stand on this plate?" he murmured interrogatively. I managed it without a stagger. He then proceeded to feel me at selected joints of my anatomy, with the tip of the arm, and noted the figures, registered on three little dials at the top of the machine, in a tiny notebook. After a minute or so of this he suddenly shut the thing up in its case again, and produced a second small book. This contained strips of coloured cloth in fifty numbered shades, ranging from white, through red, yellow, and blue, to black. A pocket of the book held twenty transparent celluloid patterns, which he rapidly displayed over the coloured cloths, so that in this small compass a thousand combinations lurked.

"White, of course, for you," said Stacey.

"Why, 'of course,'?" I inquired.

"Well, there is no actual law, but it is customary for senators, retired officers, and men of independent means to wear white." The tailor corroborated with a murmur.

"But, I like your purple, Stacey."

"Just the colour you can't have. This particular shade is especially reserved for doctors and judges."

"I see I am in your hands. Make it white, and any pattern you like."

"Remember," said Stacey to the tailor, "we want the suit and the other things in an hour, without fail."

"You shall have them without fail," said green-robe, and vanished.

. . . . .

"While your clothes are being made," said Stacey, "we had better have a little talk. I suppose you feel strange yet?"

"Not at all, except that I keep on thinking yesterday was—well, yesterday, you know. I have neither wife nor child to remember, and except for your grandfather's family, I had few friends. It may sound heartless, but I do not feel hurt to think I shall never see any of those old people again. No time like the present for me! By the way, what *is* the present—the date, I mean?"

"Third Wednesday of January, 1971," he replied gravely.

So I had slept for nearly fifty-three years. Appalling lapse!

"But why the third Wednesday, Stacey?"

He looked puzzled, then smiled. "I forgot," he explained. "Of course you used the old style, we have an improved calendar now, much simpler than yours. Look at this," he drew a book from a pocket, "you will soon understand it." It

was the fly-leaf of some advertising diary, and this is what I saw:—

Try the Australectric Company for Your Electrical Repairs.

CALENDAR FOR 1971.

The 28 Days of the Month.					The 13 Months of the Year.	
S	1	8	15	22	January	July
M	2	9	16	23	February	August
T	3	10	17	24	March	September
W	4	11	18	25	April	October
Th	5	12	19	26	May	November
F	6	13	20	27	June	and
S	7	14	21	28	Jack	December

Quarter Days: 7th April, 14th Jack, 21st September, 28th December.

Holidays: Easter, 27th March; Six-Hour Day, 27th Jack; Christmas, 27th December; Anniversary Day, 27th January. The next Double New Year's Day will be in 1972.

"You see," he continued, "instead of the days jumping all over the months, we have them nailed down. The third Wednesday, for example, is always the eighteenth of the month. Sundays are always the first, eighth, fifteenth, or twenty-second of the month. There are thirteen months of four weeks each, and the odd day is called New Year's Day."

"What an enormous saving of clerical work!" I exclaimed, remembering the maze of weekly accounts, monthly bills, interest tables and other machinations of my early days. "Have you made any other improvements like that; the decimal system for example?"

"I don't know yet how antique you really are," said Stacey, "but we have altered that old clock-face." He pointed to my watch lying on its stand, with its hands run down at 10.30. "I never could understand those old-fashioned dials with so many queer marks on them. Look at this watch of mine." He produced one from his inner pocket. "You see, six o'clock is mid-day and mid-night, and sunrise, and sunset. We use letters M., A., E., and N., for morning, afternoon, evening, and night, so the time now is 4M.—let me see, that would be 10 o'clock in the forenoon, old style."

"Hum!" I compromised, "perhaps I do not see all the good points of it, but it doesn't seem so good as the calendar. Any more efficiency dodges handy?"

"Lots of them; but here come your clothes."

I drew up the blinds, and was surprised to find, instead of the view of the distant harbour, an elevation of a lofty building confronting me a short fifty feet away. Wondering if my property had been affected for better or worse by the flight of time, I proceeded to array myself, first in a one-piece suit of underwear, and then in the white silky garments, which transformed me into a very superior creature indeed. Never before had my clothes given me such pleasure; never, I am sure, had my appearance been so graceful and becoming. Stacey explained to me the location of the pockets, and how the canvas shoes (or were they sandals?) were to be laced up, and we strolled out to the automatic lift, my latest design. As we descended I noted that the interior of my building was unaltered except that the colours of some of the paint work had been changed. My new raiment gave me the feeling of intense comfort, it was so very light and free.

"Do I look all right, Stacey?" I asked anxiously.

"Uncommonly well," he replied.

"This stuff, tell me, it seems very thin, will it wear?"

"Wear?" Stacey was puzzled again. "Oh, I understand! No, of course it won't wear, as you are thinking. The tailor sends you a new one every week. There is a regulation of the Board of Health that no clothing shall be worn for longer than three weeks. So we mostly have a suit a week. The old stuff is just pulped up and spun again into cloth."

"And how much does this outfit cost?" I demanded, with visions of tailors' bills covering quires of paper.

"I forget the Board of Trade price just now," he replied, "it varies a little each month. About a pound, I think."

"A pound—for all this?"

"Yes, there is a standard price for all suits. You can have little extras such as gold buttons by paying more, if you like."

The New Sydney.

We emerged, as we talked, into Macleay Street, sunny Macleay Street. Heavens! could this be Macleay Street?

Towering buildings, Babylonish in style, ten to twenty storeys high, lined both sides of the street. Between each pile and the

THE CITY OF SYDNEY, A.D. 1971.
Could This be Macleay Street?

[See p. 21.

next was an open garden, or lawn, or fountain court, so each building was surrounded by air. My own house, once unique in that street, was the smallest and poorest of them all, disfigured, as I now perceived, with excrescences that I had once considered ornamental. The childish "decoration" was cruelly exposed by the beautiful simplicity and clean outline of those others.

The pavement on which we stood, as also the roadway, was of some kind of concrete, pale-green in colour, most soothing to the eye on this hot January morning. I scrutinised it with professional acuteness, for evidently some very clever engineer had carried out this strict but charming design. The kerbs of the footpaths, only three inches or so in height, were carried along in unbroken lines, and both sides of the street were quite obviously and truly at the same level—there was no weak humouring of surfaces to accommodate some ancient door-step. Old Sydney pavements, I well remembered, were undulating like a choppy sea. The roadway sloped downward very slightly from the kerb to the centre, which was occupied by a single line of tram rails, and a central slot, similar to those once in use on the old cable-tracks. Narrow strips of bronze, flush with the surface of the concrete, possibly expansion joints, ran athwart the street from kerb to rails, cutting the roadway into delightful squares of twenty feet, and for as far as I could scan on either hand, there was never a crack, even a hair-crack, in the beautiful clean surfaces.

Stacey, I found, was watching me sideways, as I took all this in. "Well?" he queried. "Marvellous!" was the only word I could find. Not a single wire, telephone pole or span pole marred the splendid effect of the vista. A luxurious electric car shot across at the Darlinghurst Road end, all else was a deep, holy peace.

"Come," said my guide, "let us catch this tram." I turned and saw, approaching from the Potts Point direction, not the hideous truck I expected, but a green and gold pavilion, gliding noiselessly along the tram track. If it had any wheels they were invisible from outside. In front, on the flat roof, which projected a yard all round the car, was a sign with letters a foot high—BRODWY.

"Where are we going, Stacey?"

"Broadway, of course," he replied. "Quick, they don't wait long."

The driver on the front platform was a slip of a girl in a khaki-coloured kilt costume; a thin red arrow, pointing forward, was embroidered on her sleeve. She was as graceful as the car. Stacey stepped on the platform, a scant nine inches above the ground, and I followed. He dropped a coin into a funnel slot in the front panel, the car started, without a quiver, while the coin rolled into the centre of the glass wind-screen. The girl casually glanced at it, and absently pressed a couple of keys beneath her left hand. Some coins fell from a slot into a little metal bowl. Stacey pocketed them, and walked through a revolving door into the car. I followed him again in cheerful amazement.

Within, some twenty passengers were seated on either side. There was plenty of room to walk down the centre without falling over protruding legs. Upholstered arms divided the seats, which were of leather. There were no advertisements, only a notice over another revolving door at the rear—PLESE ALIT HERE. Narrow vertical *louvres* of greenish glass, pivoted top and bottom, admitted light and air as required, the verandah roof kept off the glare, and the interior was light, bright, cool and airy.

"Well?" said Stacey again.

"Please don't talk just yet, I have so much to look at and absorb," I replied.

The passengers' costumes were a riot of colour like a sunset; my companion's purple and my white were the sedatest of them all. The Chidley rig was the most popular among the men, but one or two portly creatures were covered with their dust-cloaks. There were no old or fat women visible, yet as I shyly scanned the lady opposite, I deduced from the infallible lower eye the surprising fact that she was probably fifty years of age—with the figure of twenty-five. The women all wore knickerbockers, some with kilts, some without. A sweet-faced girl a little way off was smoking a long, thin, brownish cigarette (or could it be a cigar?) while reading a magazine, the title of which, I noted, was *Ocean, Earth and Sky.*

Everybody looked perfectly happy, healthy and wise; there was never a distorted "business" or "wowser" face in the whole of that fairy car.

At King's Cross we stopped for a mo-

ment to allow another gliding pavilion to cross into Victoria Street. I guessed its speed at twenty miles an hour, but there was neither noise, jolting, grinding, nor swaying on curves. Evidently some genius had been at work on street traction as well as on road-making. We started, again without a tremor, and swung round into William Street.

What a sight! Straight before me ran the concrete roadway, level from King's Cross to Hyde Park. On the left towered the gigantic buildings, but on the right the view over Woolloomooloo was unobstructed to the Bay. As we crossed Bourke Street, I estimated our height as some seventy or eighty feet above the ground.

"What is beneath us?" I asked Stacey.

"This roadway," he replied, "is the roof of one of the big stores of the Federal, and some other Departments, Postmaster-General's, I think; they take up all the southern side of Old William Street between them. "Over there," he pointed towards the Bay, where a viaduct emerged from a tunnel in the Domain, and vanished in another tunnel beneath Potts Point, "is our city goods railway, mostly underground, as you see."

Something in the distant sky, above the harbour, caught my eye. Aeroplanes! " That," he said, following my glance, "is the Ariel from Mosman to The Gap; they run an eight-minute service at present, but it is to be accelerated to five soon."

"Let us get out, Stacey, I feel quite dizzy," I gasped. We were now speeding across Hyde Park, and what a park! Chatsworth, Versailles and Babylon, all in one tremendous circle of my shrinking gaze. The car came to a stop at Elizabeth Street.

"We will go into the club and take a refresher," said Stacey, "you look rather *distrait.*" He hurried me through the wide portals of a palace, just where I had expected to find the old Synagogue, into a high lift, and out again into a luxurious lounge. A deft girl in a blue kilt placed a tray with long Venetian glasses of sparkling, golden liquid on the table. I drank deeply, and presently felt myself again.

My companion, I noticed, had been watching me out of the corner of his eye as usual. "Go slow," he said, "you know I am responsible for you; a man over ninety," he grinned, "cannot rush about like a boy of forty. Easy, or you may regret it later on. Care to see the paper?"

He handed me, as he spoke, a single sheet of yellow paper, printed on both sides, with blue ink. It was a smaller and handier size than the old-time daily. I saw:—

THE STRALIAN WIRELESS PRESS.
Official Organ of The Commonwelth.
Morning, 18th January, 1971.

At the foot of the page, in small type, appeared:—

Printed simultaneously in Sydney, Brisb'n, Rockhampton, Townsvil, Port Darwin, Perth, Adlaid and Melb'n, for the Commonwelth, by the Gov'nment Printers, Department of Publicity.

One side of the sheet was devoted to "News of the World." This morning's contents included reports from London, Paris, New York, San Francisco, Tokio, Hong Kong, Singapore, Simla, Baghdad, Damascus, Rome, Constantinople, Chicago, Panama, and Rio. A comprehensive list I thought. The language was highly phonetic. The reports had all come through by wireless and none of them was more than a few minutes old.

"How did this blessing of phonetic spelling come to pass, Stacey?" I asked. "There used to be a howl if anyone proposed to drop a redundant letter in my time."

"Very simply and quietly, I believe," he replied; "but it was before my school days. Some commercial firms in America, exasperated at the deliberate pitfalls and eccentricities of the old system, invented mostly by people who had not learned to spell, commenced to publish a small yearly edition of standard contractions for commercial use. They began by cutting out the more glaring idiocies, such as double letters, and so on. The idea caught on. In a few years the books enlarged themselves, and at last became dictionaries. The literary people kicked, but they were too late; the public had got it, and went on using it. So at last even the schools were compelled to adopt it. Now it has spread all over the world, and is the premier language; Russian and Chinese are its only serious rivals."

"Simple enough when you know how it is done." I replied. "And these wireless reports from all over the globe?"

"Quite an old institution," he returned, dates back several years before my time. I'm told that the Marconi people were ex-

changing direct wireless messages between England and Australia more than half a century ago. The newspapers, I believe, first adopted wireless services in 1920, or it may have been during the previous year; but, as I told you before, I've no head for dates or statistics."

I resumed my quest for news. "I see," said I, "there is a vast war raging now in Asia; the League has ordered a hundred Razers to patrol Siberia and destroy all hostile craft found aloft. What are 'Razers,' please, Stacey?"

"Razers," said he, "are the last thing in aerial warfare; they can go four hundred miles an hour, carry a crew of about three hundred men, and can project liquid fire over a path three hundred feet wide as they travel."

"How horrible!" I exclaimed; "do they burn people alive?"

"Of course not," said Stacey; "by the time they have made a fire-break around a village or town the people are ready to promise anything."

I turned to the other side of the sheet. It was filled with local and general Australasian news, and such news! I noticed an announcement by the Director of Politics that the next weekly referendum would be on a question submitted by the Roselle Circle: "That the retiring age for all parliamentary delegates be lowered from 50 to 45 years." Also a statement by the Public Statistics Department that the population of Australia for the year ending 1970 was as hereunder:—

State.	Capital.	Population.
New South Wales		7,542,321
	(Sydney	3,147,265)
Queensland		5,671,946
	(Brisb'n	1,527,893)
Capricorn		2,536,794
	(Gladstone	572,937)
Alexandria		931,080
	(Stralia	57,232)
Forrest		2,954,781
	(Albany	376,437)
Wakefield		2,897,473
	(Adlaid	896,028)
Vic. and Tasmania		6,760,036
	(Melb'n	2,676,715)
Total Population of Commonwelth		29,294,431

There followed a forecast of the weather, in quite unmistakable terms, for a week ahead, and a short list of current amusements in Sydney.

"Where are the advertisements?" I inquired; "they used to occupy more than half the old-style newspaper."

"Advertisements? You must get a private commercial paper for those; they print nothing else, and people usually buy them for business and office use only. The Publicity Department, of course, controls all the news."

"But, doesn't that put a tremendous power in the hands of the Government?" I asked.

"Why so?" interrogated Stacey.

"Censors," I suggested.

"Nonsense," he retorted, "any publicity officer found suppressing or altering news items would be torn to tatters. The Press belongs to the public."

"That is news to me indeed. Hullo!" I read aloud:—

> It is reported that Mr. Alfred Chatterton, a civil engineer well nown in Sydney in the early years of this century, who has been since June 30 (O.S.), 1918, in a cataleptic sleep at his residence in M'Klay Street, yesterday awok, and resumd his ordnary activities. Altho there are a number of similar cases on record, and at least five other persons are nown to be asleep now in dfffrent parts of the world, Mr. Chatterton holds the record, so far, with 53 years 204 days. The medical profession is much perplexed at this quite modern development, and Dr. Meredith Stacey, who is our authority on the subject, is, we understand, engaged in preparing a report for the Department of Health.

"But I don't want my case published, I——"

"No hope of suppressing it," was the genial reply; "this is not your old kind of nineteenth century, you know. Now, if you are quite sufficiently refreshed, I will show you our Broadway. We are rather proud of it in Sydney; said to be the finest travelling street in the world!"

"It used to be, 'Have you seen our harbour?'" I commented.

"Oh! the harbour is all right in its way, but Broadway is the bigger thing now; besides, we made it all by ourselves."

"Is it far?" I asked.

"Far? No, this club has an entrance on it; come along."

He led me down a long corridor in the direction of Pitt Street. Soon I noticed that we were crossing a narrow gutter of a street deep below us. "Bridge over X-ray Street," said Stacey briefly; "I mean Old Castlereagh Street," he translated for my benefit.

We gained at length a small reading-

room, its large windows opening out to balconies. We stepped outside, and I fell back into an hospitable chair, feeling somewhat awed, the scene was so unexpectedly and appallingly vast.

Our balcony hung, I estimated, a hundred feet above the street, and that street could not have been less than two hundred feet in width. Hundreds of motors were travelling at great speeds over its pale-green surface, up and down as far as the eye could reach. Down its centre ran a concrete viaduct raised some twenty feet above the street, carried on beautiful elliptic arches of a hundred feet span. I judged this elevated road to be about sixty feet wide; on it ran six travelling roads, three moving towards the Quay, and three in the opposite direction. A central strip of the viaduct remained stationary, and stairs led up from Broadway, with people ascending and descending, stepping first on the slow-moving ways, and then on to the faster ones on the outer sides of the viaduct. These outer ways were provided with seats and awnings, but few of the passengers were seated, most of them stood still and allowed the ways to carry them along. Some of them, the modern hustling city man, I supposed, were walking with the ways. Numbers of women appeared to be travelling merely to look at the shop windows. The buildings in this street were continuous, and of the same gigantic proportions as the others I had seen.

"Stacey," I exclaimed, "this is immense, magnificent! How long is this Broadway of yours?"

"Oh! about six or seven miles, I should think," he said; "it runs from the Quay to Portobello, which was called, in your time, Botany Bay. Portobello is where all the turbines come in for the wool and wheat. Only the smaller passenger motor-boats enter Port Jackson now; they berth in Rose Bay Docks. 'Our harbour,' as you call it, is reserved for ferry traffic, although a few tiny coasters still come in and out, and tie up at old wharves here and there."

A vast cloud loomed overhead and vanished behind. It travelled so quickly that I caught nothing but an impression of tremendous dark planes, and a row of pale faces peering down through slits. It seemed to skim within a few feet of the top of the opposite building, it hummed, and I found I had shrunk further back in my chair.

"Nothing, nothing," said the watchful Stacey; "you will soon get used to them. That was the Ariel from Central to Moore Park. There will be another of them along in five minutes. I have read that fifty years ago they used to make a great noise, and frighten timid people to death. I should think, if you feel steady enough, we might go round the Inner Circle this afternoon, and then you will see more of Sydney in a few hours than I could tell you in a month."

"Of course!" I replied; "it has been my ambition to fly ever since I saw Guilliaux whizzing over the harbour in 1915. Let us start now!"

"No," said my guide, shortly, "lunch first. Besides, you haven't any money, have you? We must hurry; the banks close at mid-day."

[A second instalment will appear in our next issue.—ED.]

WITH THE AUSTRALIAN FLYING CORPS

SOME REMINISCENCES OF TRAINING DAYS AND OF WORK OVER THE LINE

Especially Written for "Sea, Land and Air" by "WINGS," A.F.C.

Comparatively little has been heard in Australia of the work of the Australian Flying Corps. In fact, its existence as a specialist corps of the Australian Army, and therefore separate and distinct from the Royal Air Force, is not generally understood. The Australian Army is unique in possessing its own flying corps. All other Dominions and Crown Colonies have been content to contribute man-power to the Imperial Air Force, to be trained for pilots and observers and attached to that force for service. We have similarly contributed, but in logical sequence of the decision to make our army a complete one, capable of absolutely independent action, the release of men from the A.I.F. for transfer to the Royal Air Force was stopped, and our own flying corps proceeded with. It is a widow's mite in comparison with the gigantic organisation controlled by the British Air Ministry, which is probably why so little has been heard of it. But it has been a very effective force, and generous tribute has been paid it by the British Air Ministry on several occasions. At the cessation of hostilities it consisted of eight squadrons, of which four were on active service and four devoted to training work in England. Of the fighting squadrons, No. 1, consisting of a squadron of mixed machines for scouting, bombing, and artillery observation, was operating in Palestine. No. 2 and No. 4 were scouting squadrons in France, and No. 3 was doing contact patrol and artillery observation work on the same front. Of the training squadrons, which were collected in the West of England, three were devoted to the training of scout and one to artillery observation pilots.

The decision to establish a separate flying corps was subjected to a good deal of criticism, which grouped itself under the two main headings of cost and manpower. A flying corps is the most costly branch of any army. A single service machine, fully equipped for work over the line, costs an average of £2,500, and the wastage is enormous. I have no data on the point, but I should say that the average life of a service bus was considerably less than a month. The training of pilots is also very costly. It takes fully six months to convert a "Hun"—as the flying novice is ungraciously termed—into an accomplished pilot. Here also the wastage is very considerable. Service flying takes a big toll of manpower both in the training stages and in the battle-zone, and a large number of spare pilots and observers must always be at hand. Then, of course, riggers and mechanics have to be provided and trained, as well as a host of specialists —facetiously referred to as "ground larks" by the flying men—for wireless, gunnery, photography, aerial bombs, equipment, etc., and an administrative staff. But an army without a flying corps is an army without eyes, and it would have been a very short-sighted policy which neglected to furnish the Australian Army with a complete and battle-experienced flying corps from which could be formed the nucleus of its future aerial organisation.

The story of the Australian Flying Corps is the story of the Royal Air Force, because the work is identical and in the field our squadrons are attached to and work under a R.A.F. wing. It was only on rare occasions that they operated on the same section of the front as the main body of the Australian troops. Except in the case of contact patrol practically no direct connection existed between the work of the infantryman and the aeroplane. A flying squadron does not come out to "rest" as does the main body of troops, and as the nature of their work demands a sound knowledge of the ground over which they operate, a squadron usually moves but little, thus while they remain on the same part of the front different infantry divisions come and go.

With an artillery observation squadron the case is different, because their work is in direct contact with the men on the ground, two flights "spotting" for and directing the fire of the artillery, and one flight, known as the contact patrol flight, working with the infantry from as low an altitude as possible, and acting as the eyes of the staff in charge of operations.

Whenever possible No. 3 squadron operated with the Australian infantry. The moral effect of this combination was very marked. It is difficult for anyone dependent on secondhand information to appreciate the wonderful fighting qualities of the Australian infantryman without losing his sense of proportion. No one was in a better position to know his true value than the man in the aeroplane, less than a thousand feet overhead, whose duty it was to watch his progress and assist him materially by the direct method of using his guns or smoke-flares on the enemy, or by carrying back the story of his special difficulties to headquarters for treatment. And no one held him in higher regard than the Australian airman.

During the final advance on the Somme No. 3 squadron operated with the Australian infantry practically from Villers-Brettoneaux to the Hindenburg Line. It was a thrilling time, and the airmen returned to their drome day after day bubbling over with enthusiasm for the magnificent work "the digger" was doing. They took big risks to obtain every item of information which could be of value, and to emulate in the air the deeds of their compatriots on the ground, and their services earned a spontaneous and wholehearted tribute from General Monash. This was, I think, the first occasion on which Australia was represented by an independent army complete in all its branches.

This is not an attempt to write a history of the Australian Flying Corps. The record books of the squadrons hold that story, and even the curt official language of the recording officer cannot rob it of its thrills and romance. For flying is the romantic side of war—the game of individual adventure where man meets man in battle as did the knights of old, only with the clouds for a battle-ground and a racing, sensitive machine, capable of lightning-like manoeuvres, for a steed. It was an adventure which claimed a heavy price but which gave liberal compensations. It is gratifying to know that the youth of Australia took its share in this ultra-modern and picturesque warfare, and that the ambitious standards of the battle pioneers of British aviation were not too high for it, as the fighting history of the British nation was not too big for the rest of the men from Australia. To portray a little of the life of these Australian airmen and recount a few of their every-day experiences gained at first hand on the training ground and in the battle zone is all that is attempted here.

The Cadet's First "Flip"

The airman is the Bohemian of the army. For him there is very little of the cut-and-dried discipline of the soldier's life once he has passed the preliminary stages. His intense enthusiasm in his work is shared exclusively with his colleagues, for the *finesse* of flying cannot be appreciated by the uninitiated. He has a technical jargon of his own and is as clannish as the art student or the schoolboy. The freemasonry of the army is accentuated in the flying corps, and two strangers wearing wings need no mutual friend to make the introductions. This clannishness begins when the flying aspirant runs his trial course for the Physical Fitness Stakes. I have a very vivid recollection of that ordeal. The would-be service pilot needs to be a sound animal and has a lot of hurdles to take before he qualifies. Those of us who lasted the course left the Hotel Cecil (London) with the same feeling of brotherhood that Shadrach and Meshach must have experienced when they were removed from the fire. Before that we were infantrymen, artillerymen, sappers. We were now a little band of brothers with two fixed objects—to clamber into an aeroplane at the earliest moment, and to keep as far away from the Hotel Cecil as the size of London would permit.

This medical test is the first of several stages which become indelibly stamped on the memory of the pilot. Later he is able to recall every emotion experienced on his first *solo;* when he sat above and watched the barrage go down for the first time and thought the earth was heaving with the pandemonium, and when he saw the tracer bullets from a Hun machine fly past and

he set his teeth to engage in his first air-battle. But after his acceptance by the medical board comes a dull interim of seemingly endless courses and exams. He must first enter into the theories and technicalities of flying; study every detail of the internal combustion engine; the composition and construction of bombs; the arts of navigation and rigging; the mechanism of the machine guns; the intricacies of the codes of co-operation between the artillery and the aeroplane, and a whole stream of facts and theories which have to be crammed into an overburdened brain in a very limited time, and which become such a jumble of half-remembered things that the cadet shivers in a blue funk at the prospect of failure. But this dreary business of cramming does have an end, and, contrary to everything our instructors led us to believe, some of us, at any rate, have

A Group of Australian Cadets dismantling a crashed Avro. The two standing erect—Lieut. Roy Cummings and Lieut. Maxwell Edie—were killed in action.

passed. It is quite a tragedy for the fellows who have failed. For them there is another two months of the class-room or an ignominious return to their unit, while the rest of us are in sight of our goal.

Once at the squadron, life takes on a new and pleasanter aspect. We receive our flying kit—goggles, helmet, leather coat, otter-skin gloves, and thigh boots—put it on and off and on again on the pretext of seeing if it fits, and surreptitiously get our photographs taken. We cease to discuss the angle of glide and the causes of carburation failure—relics of the Oxford course. Instead our talk is of landings, loops, spins, rolls, and when we shall get our first "flip." We drink in the talk of the advanced pupils and assiduously pick up all their flying slang. The weather becomes a vital matter. Dull days bring forth gloomy faces, but on the sunny windless days we are all down at the hangars, replete with flying kit, chasing a harassed instructor for a "flip" with the same anxiety that is displayed by the little town boy coaxing the milkman to give him a ride. It is a great event when the instructor takes up the first man of our group. Everybody gathers on the tarmac—that stretch of macadamised pathway in front of the hangars which is the grandstand of the flying pupil—and watches the flight with the same enthusiasm as people watch a close finish at the races. These first days at the squadron are days of wonderful keenness. There is always something fresh to be learned, some new experience to be gained, and there is the ever-present element of risk which helps to make this early flying so very fascinating.

I have frequently been asked, "What did it feel like when you first went up?" It has been easier to explain what I felt like when I came down. I was horribly depressed. In imagination I had taken this trip many times. I had pictured myself leaning back in those comfortably padded seats one saw in the machines and absorbing every detail of this new sensation. But my instructor was very business-like. "Keep your hands and feet on the controls," was his command, "and feel every movement I make with the stick and the rudder." For half an hour I struggled frantically to carry out the curt orders which came back to me through the telephone. I saw nothing but the sky-line. It is the beginner's beacon. Let the nose of your machine stray from that and you court disaster, diving at what seems to be terrific speed, or getting it up so far that you will stall, which means that you will lose flying speed and topple over. I think I only had time to notice even the wings but once, and that was when the instructor

put me into what must have been a vertical bank, and I remember feeling very distinctly that we seemed to have no business to be where we were.

Just as I was beginning to think that perhaps after all it was possible to keep the machine level, the remark came through the telephone that we would proceed to do a few stunts. First of all we would do a loop. "Keep your hands and feet, etc," said the voice. I put them there and waited. We seemed to get into an endless dive. Then, suddenly, as the nose came up, I felt as if someone was trying to push my head between my knees and glue me to the seat. The next second was one of horror. I felt myself leaving the seat and falling upside down out of the bus. I released the joy-stick and grabbed the bottom of the seat and then the machine came over. "That," said the voice, "was a bad loop. We hung on the top. We will do another; only this time don't let go of the controls." Before we were half way over the second loop I had hold of the bottom of the seat once more.

"That was a better one," said the voice; "now we'll do a spin." We did. I saw the earth and then lost it, and saw it again and felt dizzy and hopeless, as the instructor, now fully enjoying himself, pulled out of a spin, did a roll and a few other things which so mixed me up that I didn't know when we were upside down and the right way up and—I didn't care. At last we landed and taxied to the hangars. "That's all right," said the instructor, "but, I say, why did you let go of the controls each time I looped?"

"Well, I couldn't find the belt to strap myself in," I explained, "and I seemed to be falling out."

"Oh, I see," he said; "it's just as well to hold on then, because chaps have been known to fall out!"

I walked over to the little knot of colleagues on the tarmac. "What was it like?" asked the chorus.

"Oh, all right," I said, "only I'll never be able to fly."

THE HISTORY OF THE ORIENT LINE

Especially Written for "Sea, Land and Air"

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

(PART II.)

As pointed out in the early part of the sketch, the Orient Line was initiated by Messrs. Anderson, Anderson & Co. in the year 1877 with steamers chartered from the Pacific Steam Navigation Company, after testing the Australian trade with the steamships *St. Osyth* and *Whampoa* in 1874-7. In the following year (1878) the firm of Messrs. F. Green & Co. joined the Andersons, and a monthly line, running five steamers, developed in 1880 into a fortnightly service, by the Pacific S.N. Company coming in as partners, when seven other of their vessels were put into the trade.

As all the steamers running on this line were built for the South American and Pacific trade, they were not suitable for what it was desired to make the Australian service. So the Orient Steam Navigation Company made a commencement of supplying this by building steamers with suitable accommodation for passengers and cargo, to meet the growing demand.

The first two, the s.s. *Orient* and s.s. *Austral*, were built, respectively in 1879 and 1881, to sail under the O.S.N. Co.'s flag, all the previous vessels flying that of the P.S.N. Co.; and as the combination was the Orient-Pacific Line, each company forming it flew its house-flag on its vessels.

The year 1886 saw three new vessels placed in commission, one by the Orient Company and two by the Pacific Company. The first was the *Ormuz*, from the yard of the Fairfield Shipbuilding & Engineering Company, who had taken over the works of John Elder & Company. This was the second steel vessel for the Orient Company, the first being the *Austral*.

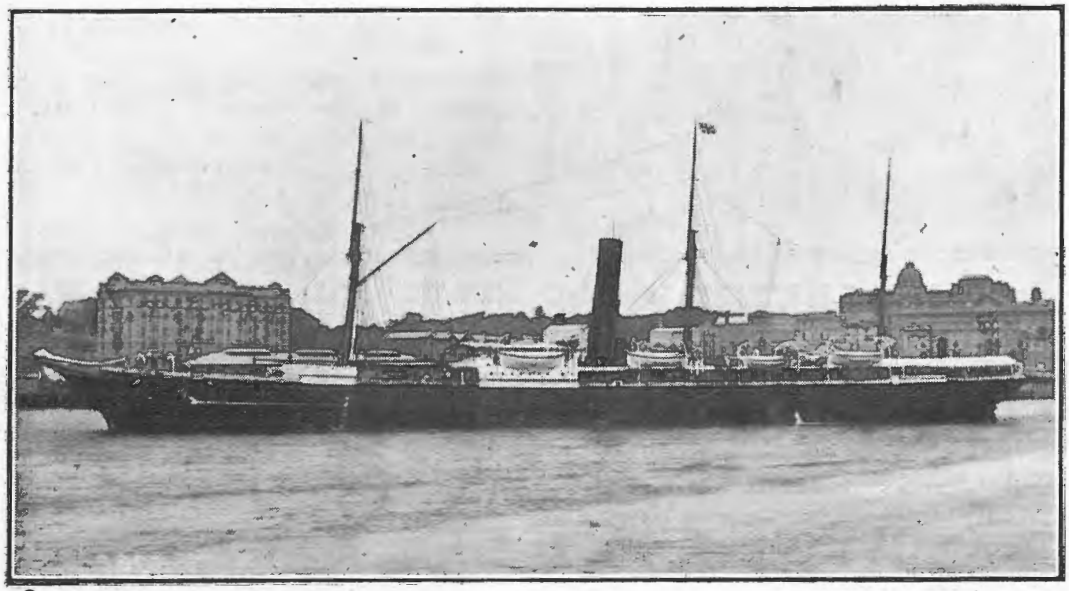
The *Ormuz* was 6,387 tons, larger than the *Austral* by 863 tons, and than the

Orient by 1,022 tons. In length she was 465 feet, or 20 feet longer than the *Orient,* and 9 feet longer than the *Austral.* So in construction there was little advance in five years.

The *Ormuz* became a favourite with the travelling public and maintained a high reputation up to the time of her withdrawal in 1912, when she was competing with the Company's up-to-date 12,000-ton vessels. Her first voyage to Australian ports was in 1887, and her last in 1912, when, on her return to England, she was sold to French buyers, and re-named *Divona.*

The two vessels built to carry for the P.S.N. Co. at the main were the *Orizaba* and the *Oroya,* both being launched by the Barrow Shipbuilding Company. They were both constructed of steel, and were within a ton burthen of each other, the former being 6,298 tons, the latter 6,297 tons, evidently measured up to a nicety, and both slightly less than the *Ormuz.*

The *Orizaba* made the usual voyages to and from Australia with varying success, but in November, 1904, met trouble on the homeward run from Sydney. While making Port Melbourne pier, in Hobson's Bay, she struck heavily the St. Kilda bank. The *Orizaba* was in charge of a pilot at the time, and it required the united power of her own engines and three tugs to get her off on a rising tide; fortunately she sustained no damage. On continuing her voyage and whilst off the coast of South Australia, a large steam-pipe burst, mortally injuring six of her Lascar firemen. On the next outward voyage she found herself in a dense fog on the morning of February 16, 1905, somewhere off the West Australian coast, which should have been near Fremantle, but she was 20 miles too far south, and brought up on a reef to the southward of Garden Island, where she remained hard and fast. All efforts to move her were fruitless. She was then put up to auction, the vessel fetching £3,750 and her cargo £500. The speculator who bought them made a handsome profit out of the deal, and she broke up and disappeared in August, 1907.



S.S. "Cuzco" at Circular Quay.
She reached Sydney on her maiden voyage November 14, 1877.

Like the *Orizaba,* the *Oroya* was not free from accidents, for in 1907, just after extensive alterations had been completed, and one of her masts removed to improve the passenger accommodation, her machinery broke down during the homeward passage, while off the Eddystone lighthouse, and after landing her passengers at Plymouth she was towed to London.

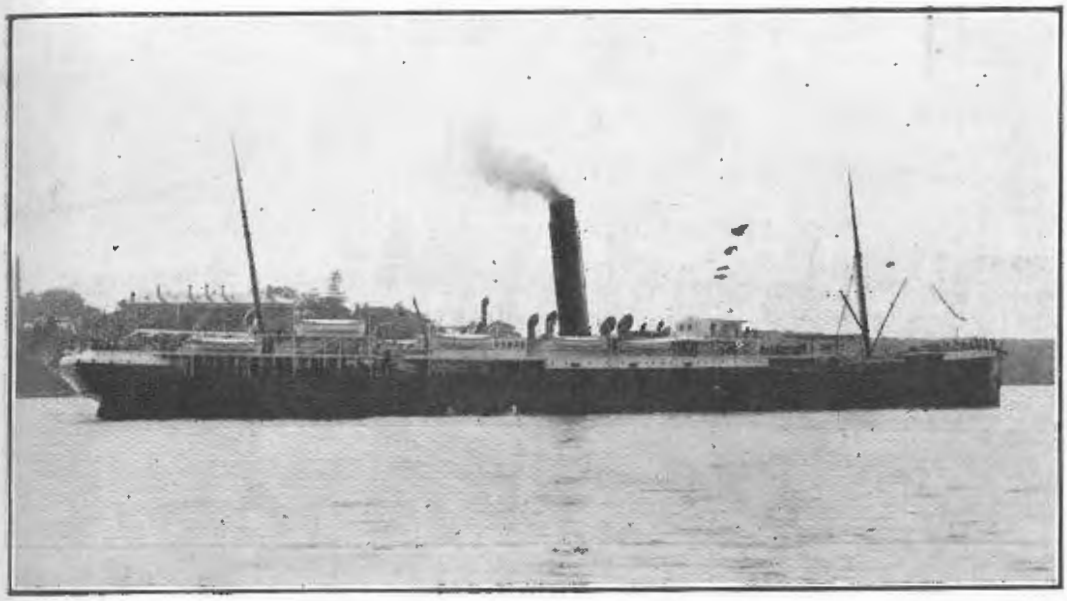
As a result of this she could not be got into sea-going condition to meet the time-table, and the Aberdeen liner *Miltiades*

was chartered to take her place, arriving at Sydney in August.

The *Oroya's* last voyage to Australia was a veritable chapter of accidents. She left Tilbury on Christmas Day, 1908, and when crossing the Bay of Biscay on December 27 a third-class steward was reported missing. On the following day a seaman was so severely injured by the heavy sea that he had to be landed at Marseilles. The next to be injured by the same cause was the ship's doctor, who was thrown down and had an arm broken. Then scarlet fever broke out on board, and the vessel was quarantined at Colombo. On the homeward voyage she went ashore in the Bay of Naples, and was

The *Orotava* on her first voyage was commanded by Captain W. Waddilove, who was mate of the steamer *Duco,* which left Wellington for the Chatham Islands on September 7, 1909, and was never again heard of. The *Orotava* had her little troubles, one of which was going below the surface at Tilbury on December 14, 1896, when five men working on board lost their lives. On her next outward voyage she ran aground on a shoal in the neighbourhood of Cape Guardafui, but was not seriously damaged.

The sister ship, *Oruba,* joined the service at the same time, and ran on the line for some years, nothing disturbing the even tenor of her way until July, 1905,



S.S. "Orient," 5,365 tons, the First of the "O" Steamers.

When delivered by her builders in 1879 she carried four masts and two funnels.

thought to become a total wreck; she was, however, refloated, but passed into possession of a Genoa firm, who paid £12,000 for her.

The next vessels to be added to the fleet were s.s. *Orotava* and the s.s. *Oruba,* which were built by the Naval Construction and Armaments Company, who had built also the *Orizaba* and *Oroya,* but under a new name. Both were steel vessels, sister ships, of 5,857 tons, 440 tons smaller than their two predecessors. They were launched in 1889 under the P.S.N. Co.'s flag.

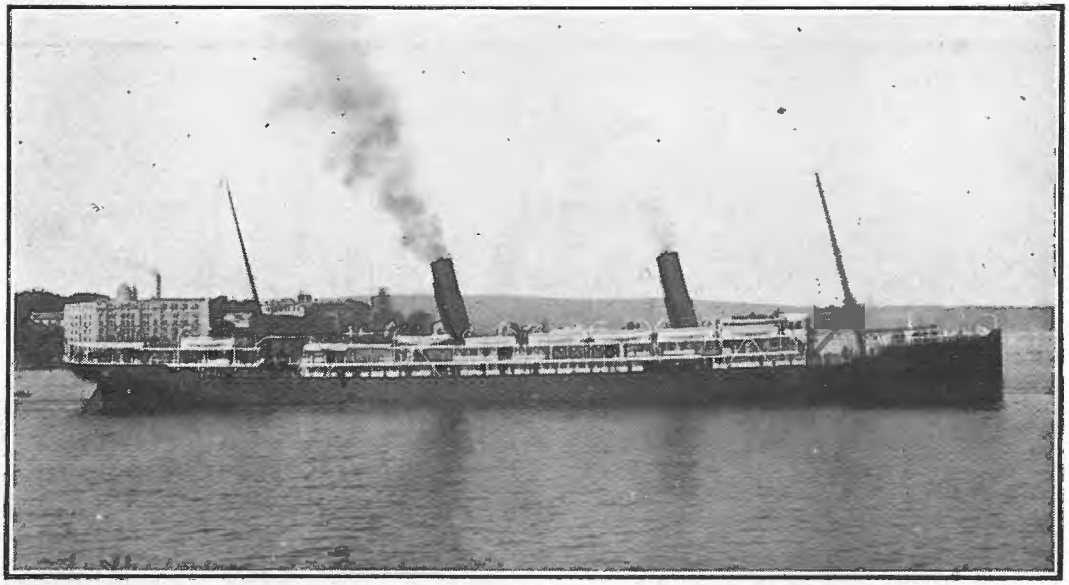
when on the first of the month a fire was discovered in the No. 4 hold, which was promptly got under; the only damage done to the ship was to the insulation, which caused the fire by fusing, but a great deal of the cargo in that hold lost its market value by fire and water. Occurrences of this nature are very unpleasant at the time, although affording opportunities for conviviality hereafter. On this occasion it was responsible for Captain Plunkett hearing some very nice things said about himself in the saloon of his

ship by the underwriters of Sydney, who no doubt had the assistance of the chief steward and his subordinates to make things go pleasantly.

Like others of the line the *Oruba* in 1907 underwent great changes, being sent to Belfast, where her interior accommodation was entirely altered and greatly improved. Externally two masts and a funnel were removed, bringing her into line with the principle the Company had adopted. On resuming her place she was unrecognisable as the *Oruba*. It may be assumed there was some work done, as the sum spent on it was £41,000.

Five years after the building of the others lay in her twin screws, an innovation since become the general thing with large passenger craft. Her light and graceful appearance caused her to be described as "the yacht-like *Ophir,*" "this floating palace," and "splendid triumph of the shipbuilder's art."

It is said that when she made her first voyage in 1892 she rolled to such a degree that the passengers became alarmed, but that this was corrected on her return home by the removal of the top hamper. Be that as it may, six years later, when on a visit to London, the writer was begged by friends who had travelled in her not to risk returning to Sydney by her, as she



S.S. "Ophir," 6,910 tons.

Steel, twin-screw steamship, built 1891 by Robert Napier & Sons, Glasgow, for the Orient Steam Navigation Company.

steamers that have just been dealt with the Company decided to build a vessel that was to be regarded as a model passenger liner, and placed an order with Messrs. R. Napier & Sons, of Govan, with the result that towards the end of 1891 the *Ophir* was launched from their yard.

The *Ophir* was a steel vessel of 6,910 tons, an advance only of 600 tons over any other of the Company's steamers; her length was 465 feet, the same as the *Ormuz,* built five years before her. She carried two masts and two funnels, which were erected some distance apart. The principal distinction between her and the would be sure some day to turn turtle. However, the writer did risk it, and twenty years after is recording the fact; but she could roll and ship seas, too, such as recalled the old sailing-ship days when the "old man" was carrying on.

Yet she was a beautiful vessel, and for that reason was selected as the "royal yacht" for the Duke and Duchess of York (now King George V. and Queen Mary) on their visit to Australia to open the Commonwealth Parliament, which ceremony took place on May 9, 1901. On her visit on this occasion she was officered and manned by the Royal Navy.

On her return to London she resumed her place in the trade for which she was built. A break was made in April, 1905, enabling her to take those who wished to attend the medical congress at Lisbon; in addition she visited many places of interest, including Cherbourg, Gibraltar, and Tangiers.

In September, 1912, she was again withdrawn, to become the excursion steamer to the land of the midnight sun, but once more made her appearance in Australian waters, coming to Sydney on July 31, 1913, it being her fiftieth voyage, and again, contrary to expectation, she arrived on December 9, 1914, under command of Captain Ruthven, who had some time previously retired, the war being responsible both for his and the ship's appearance. But this was her last voyage to Australia, at least as an Orient liner, for on her return to England she was purchased by the Admiralty for special service.

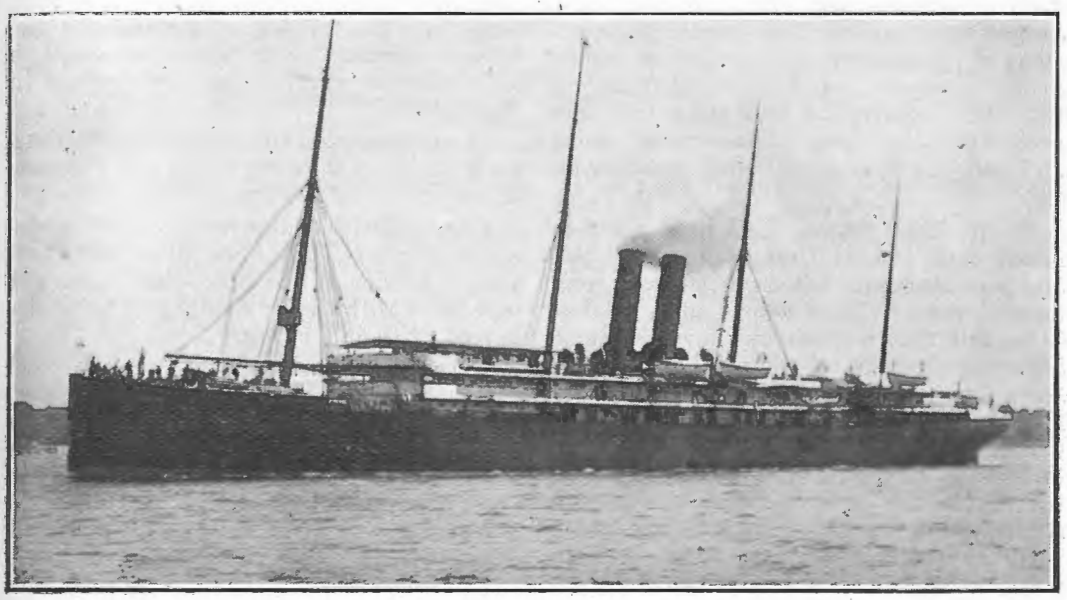
* * * *

So far the ships only of this Company have been dealt with, but there are other matters within the Company's economics which enter largely into its history.

At the initiation of the service in 1877 the steamers of the line made the outward voyage by the Cape of Good Hope, calling at St. Vincent, one of the small islands of the Cape Verde group, to coal. They did not then call at Cape Town, but came on direct to Australia. After a time this was changed, and Cape Town was a port of call. The homeward voyage has always been via Suez Canal, which became available for shipping from its opening date, November 16, 1869.

However, the managers of the Company made a change at the end of 1881, and the Suez Canal route was followed both outward and homeward.

The last Orient liner to make the voyage via the Cape of Good Hope was the *Cotopaxi*, which arrived in Sydney on December 1, 1881, under command of Captain Robert Studdert.



S.S. "Oruba," 5,857 tons.

Steel, screw steamship, built 1889 by Naval Construction and Armament Company for the Pacific Steam Navigation Company.

The first to open the Canal route was the *Orient*, which just two years previously had commenced her career via the Cape, under command of Captain W. F. Hewison, who took out the *Lusitania* on the introduction of the Orient line of steamers to Australia. Was this honour a coincidence, or did the managers purposely select their own first steamer and their senior commander? Whether accidental or premeditated it was most *apropos*, and

augured well for the success of the Company.

The *Orient* completed her voyage on December 12, 1881, having taken 44 days to make the run from Plymouth.

It is interesting to make a comparison of the time occupied on the two routes to see what advantage was gained by the change, if any:—

The *Lusitania* in 1877 via the Cape, from Plymouth to Sydney, took 46 days.

The *Cotopaxi* in 1881 via the Cape, from Plymouth to Sydney, calling at the Cape, took 47 days.

The *Lusitania* in 1882, following the *Orient,* via the Canal, from same port to Sydney, took 49 days.

So apparently the difference was little, and whether sufficient to justify the payment of the heavy canal fees is best known to the Company. It goes without saying that the Canal is far and away the most preferable one from a passengers' point of view, and that is the chief public concern.

Up to 1905 Sydney had been the terminal port, but as Queensland developed and Brisbane was becoming a great commercial centre, the business men of that State felt that they should have the same advantages as the other States, and representations made to the Federal Government and to the managers of the Orient line brought about the extension of the line to include Brisbane, the *Orotava* opening the service in 1905, leaving Sydney on August 29 and arriving there on the 31st.

On the following day a luncheon to inaugurate the event was given on board, Mr. David Reid, representing the management, presiding. The ship was dressed from stem to stern in gala style, and over one hundred of Brisbane's prominent men accepted the Company's invitation.

It is said that in seeking the history of a place and its people valuable information can be gained in the church and graveyard. It may be added that if you wish to write of ships read the shipping advertisements. Acting on this it is found that early in its career the line of steamers so familiar to all was "The Orient Line of Steamships," "The Orient Line of Steam Clippers," in 1882 it was "The Orient Line, under contract with the New South Wales Government for the conveyance of Mails and Immigrants," the following year the South Australian Government was added.

By this we see that the Orient Line had a contract to carry mails, but it was not till February 17, 1887, that the Company used the heading of "Orient Line of Royal Mail Steamers," since when its steamers have hoisted the Royal Mail flag at the fore. The vessels at this time so privileged were the *Potosi, Orient, Ormuz, Garonne, Oroya,* and *Orizaba.* Under the terms of the contract then made the Company continued the service for about 20 years, adding to their fleet an occasional new vessel.

The *Ortona* was built in 1899 to the order of the Pacific Steam Navigation Company, and at the time was the largest vessel on the line, being 8,000 tons. She was followed by the *Omrah,* of 8,130 tons, built by the Fairfield Company for the Orient Steam Navigation Company in 1901, and arriving on her first voyage in March, 1902.

Then came the *Orontes,* of 9,028 tons, each of these showing a gradual increase in size.

These, like the later vessels, were twin-screw steamers, and were all in the Company's service at the time when Australia was faced with the probability of being deprived of their services.

It came about in this wise: the mail contract in 1904 was drawing to a close, and the Commonwealth Government on July 7 invited tenders for a service on stringent specified conditions, and the Orient Company put in one providing for a fortnightly service between Naples and Sydney for £150,000, the contract to last for three years, and the time between the places named to be 696 hours (29 days). This did not meet with approval, and a fresh tender, with some modification, was sent in for £140,000. This also was rejected, the Government offering £100,000, which the General Manager in Sydney said he could not think of submitting to the London office. He was then invited to submit another price, but replied that this must come from the Government. Whilst negotiations were proceeding, or in abeyance, it was announced that the Company would have to strike out Adelaide as a port of call, probably revert to the Cape route, and substitute a different class of vessel to those which had been lately added to the fleet. This was the difficulty which might have brought about the state of affairs

indicated, but which was happily got over by personal conferences, after other tenderers had failed to satisfy the Government that they could guarantee a service such as was required. The subsidy was fixed at £120,000, for a term to be decided by two years' notice being given, and provision of employing white labour only in any branch of the service covered by the contract was included.

The first steamer to arrive under the new contract was the *Ormuz*, which reached Adelaide on April 16, 1905, with white firemen in the stokehole.

(To be continued.)

MERCHANTMEN

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

Sir Eric Geddes gave some indications of the part played during the war by the Merchant Service at a meeting called in support of a scheme to raise £100,000 for building a London hostel in memory of merchant seamen. During the war, he said:

2,475 merchant ships were sunk under their crews.
670 fishing vessels were sunk.
3,147 crews were left adrift.
15,000 merchant seamen had lost their lives.

For many a mile about us lie towers and temples fair,
That once knew the golden light of the sun and the breath of the upper air.
Above us, above the deep sea crags the dolphins plunge and glide,
But we lie on the floor of the deep, made safe from the swing of the lifting tide—
Safe from the mesh of the sea-fog pale,
From the inshore wind, or the deep sea gale—
We lie, cut off from the azure sky,
Gazing up through the water with drowsy eye.
And together for ever and ever shall we and our messmates lie,
As the eyeless fish of the undersea oft circle and pass us by;
For we rest in a vale of ocean land,
With a ruined temple on either hand,
That were built by magicians in days gone by,
Who ruled o'er the earth when the seas were dry.

We did not go in for murder, we did not go in for boast;
Our work eternal vigilance o'er all the restless seas.
But whether on deep water or patrolling round the coast
We never hauled our colours down before the savages—
Those scavengers of ocean's ways who shouted "Might is Right!"
Yet sank the merchantmen and tramp and called it merry fun,
But sneaked away from action whenever we showed fight.
The widows' and the orphans' curse rest on the shameless Hun.

Our bones lie in deep water or upon the shifting shoal,
But the spirit's still undaunted at the toll of thousands gone;
And still the packets come and go with corn and meat and coal,
And still the Empire's standing that the sun ne'er sets upon.
Our ensign's o'er their U-boats; it is floating o'er their fleet,
It is flying in the tropics and above the ice and snow;
It is blowing free at Harwich where the pirates came to meet
And surrender to our brothers. It's aloft at Scapa Flow.

Our lives we gave in service and we do not grudge the gift
If it has been of benefit to others of our kind;
Our packets strew the ocean's floors and swing to every drift
Of current as it ebbs and flows before the driving wind.
But snug we lie and deep we lie, and none may know the spot—
What matters it? Our work is done. We gave our little all;

We carried on in spite of odds and now our bodies rot
In slime upon the seabeds deep, awaiting Gabriel's call.

From history's dawn it's been our pride to tempt the driving main—
We rowed for Arthur's arméd knights, manned Alfred's ships of oak;
We challenged Caesar's legions (though our efforts were in vain
To stem the hordes of Roman force when ancient Britons broke).
When Norman William led his van once more we rushed to meet
The invader of our homeland shores, from dune and scarp and bay;
We formed the first line of defence to stay the conqueror's feet,
And played our part—we fisherfolk—till Harold lost the day.

As Phillip dared to look upon our shores with lustful eye
We flocked to Drake and Hawkins and in storm we set the sails;
We'd caught the warning flung aloft to light the midnight sky
From Plymouth Sound to Berwick, from Yarmouth into Wales.
We singed the Spaniard's beard for him, we raked him fore and aft,
We drove his mighty galleons on sand and rock and reef,
We swept the "Narrow Seas" of him and all his pirate craft,
And brought Queen Bess a tale of deeds almost beyond belief.

For years we manned the fighting ships, whene'er the call was made.
(The navy, as it is to-day, an unborn entity.)
'Twas ours to fit the merchantmen with pike and carronade,
And take them out to meet the foe in near or distant sea.
Sometimes we came back safely with rich spoils of jewels and gold,
And sometimes empty-handed with deep curses on our lips—
Our canvas torn, our cordage frayed and with an empty hold,
But how we signed and signed again on those old merchant ships!

Those craft wherein we worked and fought the rending squall or foe—
Those craft which bore us outward with the chance of fortunes great—
Those craft supplied by Bristol town, and Falmouth and Truro,
Each manned by clerks and 'prentices and sweepings of The Gate.
They served their purpose, those old ships—they schooled the haughty Don,
The Portuguese and Dutchmen and the Frenchies as they came—
Their crews in every kind of rig for eyes to gaze upon
But safe to obey orders and as one to play the game.

And now in Armageddon we have had our share and part,
All unafraid we swung her out or warped her in to dock,
Or took our trick at drifting from the Lizard to the Start,
Or snatched the big supply ships home after torpedo shock.
We have worked the old windjammers; found the crews for cargo tanks,
And manned the transports through it all, we common merchantmen.
We do not seek for monuments for those within our ranks,
But—had we fifty lives to give—we'd sign and sail again.

AEROPLANE FLIGHT FROM ENGLAND TO AUSTRALIA

The Aerial League of the British Empire announces that it is organising a flight to Australia via India. It is stated that certain offers of financial assistance have been received conditional upon the full amount being subscribed, and it is hoped this will be forthcoming before the preliminary work is completed. It has not yet been decided whether or not the flight will be competitive, but if so, the co-operation of the Royal Aero Club will be invited and suitable prizes offered, not only for the pilots, but also for the makers of the successful machines and engines. The route also is still under consideration, and it is proposed to ask the Government to lend its aid where necessary.

The above news item appeared in *Flight*, the official journal of the Royal Aero Club of the United Kingdom, in its issue of December 5, 1918.

Mr. Douglas Gordon, Secretary of the Aerial League of the British Empire, wrote to the Sydney Chamber of Commerce more than three weeks after that date, and his letter, which is reproduced on page 11, therefore becomes all the more interesting.

THE PAINT INDUSTRY

Especially Written for "Sea, Land and Air"

By MRS. SELWYN LEWIS, B.Sc.

Painting as an art, whether our interest in it be a fine art or an industrial art—and the technical principles of both are the same—is as old as civilisation itself. Its craftsmen show an unbroken descent from "the early dusk and dawn of time."

The oldest varnish in existence is that on the wooden mummy-cases of Egypt, probably 2,500 years of age.

The ancient Egyptians followed the same essential principles and manufactured practically the same glue as is produced at the present day. Most of the paintings executed by the Romans at Pompeii were made with size or glue solution. Pliny says that when it became the fashion to paint ships of war wax was melted with fire and a brush used. What foresight they must have had, for paint so applied to ships cannot be destroyed by the action of either sun, brine or wind.

Inferior resins, commonly termed frankincense, were also used with varnish and sprinkled over the paper on which drawings or writings had been made.

Grease-Paints.

The earliest pigments were those mixed with grease or fat. Such a paint adheres to the human skin with great persistence, yet may be removed by washing. Actors' grease-paints of the present day are of this nature.

In Xenophon's "Economist" one of the speakers relates that his wife was in the habit of rubbing white lead into her skin to make her face appear white, and then drying her cheeks with alkayet to redden them; even in Cennini's time one of the branches of the artist-painter's work was not only to paint pictures, but also to paint and varnish human faces.

Sir Humphrey Davy, who closely studied the subject of paints, states that the earlier Grecian masters used only four colours: attic ochre, for yellow; sinopis, for red; earth of Melos, for white; and black.

Pigments.

Those beautiful tints which embellish our dwellings and by means of which artists so cleverly interpret Nature's creations are obtained by mixing coloured pigments with oil or varnish.

Pigments are really coloured rocks, pulverised into very fine powder. The material is ground in a stream of water, which carries off the fine portions into a system of settling tanks.

The rougher grains are deposited in the first tanks and require regrinding, while the lighter parts remain longer in suspense in the water and flow along to the larger tanks, which are the last to be reached.

Some of these pigments are opaque, some semi-transparent and some entirely transparent; they are insoluble in water, but, when mixed with size, gums, oils or varnishes, form paints. The pigment does not actually dissolve in oil, but, mixing with it, converts the latter into a muddy, opaque coloured liquid, much thicker, of course, than pure oil or varnish.

When this mixture, which is called paint, is spread out in a thin film the oil hardens and acts as a cementing material or binder to hold the particles of pigment on the coated surface.

But oil and varnish are not the only cements; the coloured pigment may be mixed with a dilute solution of glue, as in the manufacture of kalsomine; it is used also in making water-colour or distemper paintings.

In former times there existed yet another form of painting, now abandoned; this was by means of wax, mixed with suitable pigments, applied in melted condition and sometimes covered with a varnish; but it was used only for mural decorations and could not be handled.

What gives pigments their colour? Quite erroneous is the popular idea that the colours red, yellow and blue are "primary" colours, simply because no human eye has been able to detect in them two different colours, while all others contain at least two primary colours. This disproved theory was based on visible results obtained in the mixture of pigments and by the transmission of light through coloured glasses.

When the retina of our eyes receives the impressions of white light it is due to the combination of the following pairs of colours: red and blue-green, yellow and violet-blue, green and pink. Thus it is seen that yellow and blue are complementary colours.

The term "secondary" is applied to the colour resulting from two "primary" colours, such as red and blue, which produce a violet or purple.

In bulk form powdered pigments are opaque, but almost every substance, when evamined in very thin layers, is found to be comparatively transparent, and upon their transparency their colour effect depends.

When white light falls on such a powder a small portion of it is reflected from the outside surface of the particle, the remainder penetrates the particles and undergoes reflection at some of their surfaces of separation. The small portion which is reflected from the outer surface is white, as no absorption has occurred, but what is reflected after absorption is that which determines its colour. The finer the particle the more white light is there reflected at the surface. That is why the froth of deeply coloured liquids and the spray of the breakers rolling in from the ceaseless blue sea appears white.

The White Lead of Commerce.

White lead, which is the chief constituent of white paint, was known even to the ancients. As far back as B.C. 400 a face-powder or cosmetic was found in its original pottery-box in the neighbourhood of Athens, and proved to be a mixture of white lead and whitening. Pliny, in his writings, described its manufacture from lead and vinegar.

But nowadays huge factories carry on the process of attacking metallic lead in the form of "crates," "grids" or "spirals" by acetic acid, carbonic acid, atmospheric oxygen and water-vapour.

In Australia we are fortunate in receiving the lead straight from Broken Hill in pigs or ingots; these are fed into a furnace, from which the boiling metal flows to a buckle-moulding machine. The buckles are carried away into big jars containing weak acetic acid in the bottom cup. A steady heat is applied and the fine blue lead buckles eventually become a corroded mass of lead carbonate.

This carbonate undergoes various processes of grinding and crushing, until it becomes a fine powder, so fine that in the end it passes through a silk screen of 157 mesh.

The water is then extracted and oil added, giving us a white paint, with its attendant drawbacks, a few being its highly poisonous character, its sickly and noxious odour when used with oil, and its liability to discolour when exposed to sulphuretted hydrogen; on the other hand, the quality of the whiteness of the best flake-white is second to none, the paint works so well and has great body.

Yellow ochre owes its colour to iron in a state of oxidation and chemically united to water. It is one of the most ancient of pigments and was used by the Egyptians, Greeks and Romans; pots of yellow ochre were even found at Pompeii.

Now the chief supplies come from India, France, Italy and Spain. Some excellent ochres are produced at Dubbo (N.S.W.).

Red ochre, like the yellow, contains iron, but in the anhydrous—that is, dry—state.

Vermilion derives its title from the Latin *vermes,* a word originally designating the "kermes" insect found on the ever-green oak and still employed in the preparation of a red dye.

The old name for vermilion was "vermiculus," and from "kermes," in its turn, the words crimson and carmine are derived.

The name cinnabar is believed to be of Indian origin, and was used sometimes to designate dragon's blood—a red resin.

A curious fact concerning vermilion is that it is identical in the nature and proportion of its two constituent elements with an artificial black substance, "Æthiop's Mineral."

The red substance may be transformed into the black and *vice versâ,* without any alteration of chemical composition, the change being purely physical.

The pigment "vermilion" may be made very simply, by grinding pieces of native cinnabar, or artificially, by combining the two elements, sulphur and mercury.

Cochineal is found in the dried, wingless female of a species of coccus which feeds upon several kinds of cactus. The best quality comes from Teneriffe and contains about half its weight of colouring matter. This colouring matter is a glucoside, to which the name of carminic acid has been given, for when treated with weak sulphuric acid the substance is re-

solved into a sugar and a second colouring-matter, known as carmine-red.

Emerald-green pigment is an aceto-arsenate of copper and is obtained by heating verdigris with some weak acetic acid and adding a little arseneous acid dissolved in water. The precipitate is a dirty green, but becomes more brilliant on reboiling with fresh acetic acid. This pigment is highly poisonous; it is chiefly used in paper staining and is very dangerous when the powder is not fastened with strong size.

Indigo has been used either as a pigment or a dye from very early times in India and Egypt; in the seventeenth century it was imported into Europe from India by the Dutch.

Indigo does not exist ready formed in the plants which yield it, but occurs as a colourless compound or glucoside, which, when combined with water, splits up into a sugar and indigo.

Indian ink, so valuable to mankind, has been prepared in China for at least 2,000 years. It consists of a very fine lamp-black associated with gelatin and scented with musk, camphor, cloves or rose-water. According to the treatise of Chem-ki-suen, which was written in A.D. 1398, these oils are burnt in small earthenware lamps in the presence of a limited supply of moist air. The smoke is collected in earthenware conical covers, from which the condensed soot is removed at short intervals, sifted and reduced to a very fine powder.

Size, made from a mixture of clean fish-glue, is then added, while warm, to the fine soot. The paste thus formed is kneaded into balls, which are heated and fashioned roughly into sticks. These are subjected to repeated blows from a hammer and re-heated to prevent hardening. The material is next pressed into wooden moulds, which give it its final form, then dried and the sticks of ink packed in the ash of rice-straw. After the removal of any adhering ash, these sticks are cleaned and polished with an oily brush.

Dyeing.

The art of dyeing has been practised for long ages; in fact, its origin is lost in antiquity, but there is evidence that operations of this nature were carried out in Persia, Egypt, the East Indies and Syria in early days. The Tyrians excelled in the production of the celebrated purple of Tyre and appear to have made its manufacture one of their chief occupations. This wonderfully rich colour is said to have been invented about 1,500 B.C., and the wool dyed by this process was sold in Rome at a price equivalent to £30 per pound.

The purple of Tyre seems to have varied in colour. Pliny mentioned that the shades ranged from a faint scarlet to the red of coagulated bullock's blood, but the origin of the shell fish from which the colour was developed appears to have determined the shade.

The Atlantic variety gave the darkest colours, while those obtained off the Phœnician shore yielded the scarlet shades. The dye prepared from these varieties of shell fish was probably developed by some process of oxidation, but the exact nature of the operation is unknown.

It was not until the fourteenth century that the art of dyeing flourished in Europe. Florence was the headquarters of this industry, and between the ninth and fourteenth centuries all rural serfs were compelled to deliver annually to the convents a specified quantity of the dye "kermes" for the manufacture of cochineal.

With the discovery of America a great advance was made in the dyeing industry, many very valuable dye woods being introduced to Europe; among these may be mentioned cochineal, logwood and annotto. Then Oricelli discovered the action of ammoniacal liquors on certain lichens with the production of coloured bodies, which might be used for dyeing organic fibres.

In 1667 a Fleming brought to England the art of dyeing wool. Up till then woad had been used, and the introduction of indigo, with its superior colours, created a scare among those engaged in the woad industry, so that its use was prohibited until the reign of Charles II. Then the value of Turkey red, as it was dyed in India, so impressed the Europeans that an introduction was made of that colour from the East.

And so have men laboured since the dusky ages, and they may feel like all who dignify an art by faithful and intelligent service that

"The gods hear men's hands before their lips,
And heed beyond all crying and sacrifice
Sight of things done and noise of labouring men."

[The Paint Industry as carried on in modern Australian factories will be described in a subsequent issue.—ED.]

THE STOKERS

LIFE IN THE BOILER-ROOM OF A BATTLESHIP

By LEWIS R. FREEMAN, Official Press Representative with the Grand Fleet

Except for the actual lift she receives from a wave, a battleship rolling in a beam sea moves a good deal like an inverted pendulum, so that one feels a minimum of motion when he is down against the skin of a lower hold and a maximum in the foretop. The transition had been a sudden one for me that morning, for the Gunnery Lieutenant, who had been initiating me into the secrets of "Director Firing" in the foretop, brought me back to the main deck and turned me over to the Senior Engineer, who had volunteered to show me what "rough weather" stoking was like.

The big ship was wallowing with that ever disconcerting "hang" at the end of a roll, such a pause as one never experiences in an ocean liner which (with no heavy guns and only light upper works) needs no great amount of time to make up its mind as to whether or not it is worth while going to the trouble of getting back on an even keel. As we put one reeling steel ladder after another above us in our descent, the roll decreased as the tumult of crashing waves was stilled to muffled jolts, and, with a flight or two still to go, we were steady enough on our feet to have both hands free to lift the heavy air-tight "flap" of the boiler-room.

As I ducked under the "flap" the chill, damp, clammily clinging air of the decks above was assailed by a sharp blast which, however hot and dry, was still (at least in comparison with the heavy atmosphere of the higher 'tween decks spaces) fresh and invigorating. Although far from an earthly paradise in a ship on an equatorial run, the stokehold of a battleship that is battened down against heavy winter weather is in some respects the most comfortable spot aboard her.

Certainly the half-dozen brawny fellows who sat or lounged against the steel bulkhead of the half of the boiler-room into which we had descended did not look to be having anything like so bad a time of it as an equal number of oil-skinned seamen I had seen but a few minutes before bracing themselves against the seas sweeping the icy forecastle deck, as they tried to repair a smashed ventilator. Grimy they were, to be sure, but otherwise there was little about them to suggest the sweating, stripped-to-the-waist, in-to-the-last-gasp stoker of romance and popular fancy.

To one who has pictured the stoker as a gaunt-eyed demon steadily shovelling coal under a boiler for four hours, the first glimpse of a stokehold of a warship that is in no great hurry to get somewhere will come as a good deal of a surprise. The place is neither especially dirty nor especially hot. Neither the letting the coal slide down by its own weight from the encompassing bunkers nor the cracking up of the occasional lumps which are too large for even combustion raises as much dust as the dumping of a single sack upon one of the upper decks.

The footing on the grilled steel plates of the deck is firm and sure, and, as I have said, there is less motion in the stokehold than in any other part of the ship. It might conceivably happen in destroyers, but the stories of men half-roasted from being thrown against the furnace doors in storms do not originate in battleships.

Actual Stoking.

But let us see how these comfortable, easy-moving chaps manage to handle the fuel sufficient to send twenty-five or thirty thousand tons of steel hurtling through the seas with so little apparent haste or effort. The running back of a sliding steel door brings a stream of coal running out of one of the bunkers, coal which, dumped from sacks into the entrance of a chute on one of the upper decks, has worked its way downward by gravity as that beneath it has been fed to the furnaces. This stream is caught in a "skip" of steel, shaped like the half of a cylinder and capable of holding

something like a couple of hundredweight. Sliding fairly easily over the grilled deck —pushed by one man and pulled by another—the "skip" loads are dumped evenly along in front of the twelve doors which open—four to each—to the three furnaces under the boilers occupying this half of the stokehold. Now we come to the actual stoking.

A bell suddenly clangs, echoing sharply from the steel walls, and instantly two of the lounging figures quicken to the alert. One scoops up a shovelful of coal and the other steps forward and rests a hand on the lever running to one of the furnace doors. A second or two later, as a number shows on a dial on the wall, the latter pushes the lever sharply, and the door is pressed upwards, revealing a glowing bed of fire running back out of sight under the boiler. The shovel is already swinging forward as the door rises, and, missing that steel plate by a fraction of an inch, its contents are discharged—with a quick "wristy" motion which scatters the coal evenly over the fire—into the furnace.

As the shovel is drawn back the lever is released, permitting the door to fall shut of its own weight. With all possible speed another coop is filled with coal and the operation repeated once or twice more according to the speed which it is desired to maintain. Then the two men relax and stand at ease until another clanging of the bell heralds the number of the next furnace to be fired. Then the door is lifted and the coal thrown in as before, the operation going on until each of the twelve has received its two, three of four shovelfuls, when—always subject to the indicator on the wall—it begins over again.

If a lump of coal is larger than a man's fist it is cracked up before being thrown into the furnace. As the stoker swings his filled shovel toward the opening door his trained eye is looking for two things—a pronounced hollow in the bed of coals, or a spot in which the duller glow tells him the combustion is considerably advanced If neither is visible he gives his shovel a very sharp side flirt and spreads its contents just as widely and evenly as he possibly can. If he observes a hollow he endeavours to even it up with fresh coal. A burnt-out spot also receives fresh fuel, and if there is evidence of the formation of a crust of "clinker," this may be marked for a subsequent cracking up with the "slice," a long steel bar which serves the purpose of a poker. Every effort is bent towards maintaining a smooth, evenly-burning bed of coals under all of the boiler.

Automatic Regulation.

Automatic regulation of stoking is no new thing on warships, and was even in use on the latest of the Atlantic liners running before the war. The machine most commonly in use by the British is the "Kilroy," and its object is to raise a given amount of steam with a minimum of coal and physical effort.

Thoroughly to understand its workings one should go first to the engine-room, from where it is regulated. The order for a certain speed is sent from the bridge to the engine-room, and the engineer sets his "Kilroy" so that the stoking shall proceed at a rate calculated to produce the necessary steam. The dial of the machine is numbered from "3" to "12," and the number he turns the indicator to —say "7"—rings up the numbers of the furnace doors in the boiler-room at a rate which will ensure that each shall be stoked every seven minutes.

The number of shovelfuls of coal to be thrown in at each stoking is determined by consulting first the telegraph from the bridge (which registers in both the engine-room and stokehold) and a table which each stoker knows by heart. The dial of the telegraph is marked as follows: "Keep Steam," "Stop," "Slow," "Half Speed," "Full Speed," "More Steam." The table referred to gives the number of shovelfuls to be thrown on at each stoking to fulfil the direction on the telegraph. Thus "Slow" calls for from two to three shovelfuls of coal, "Full" four to six, and "More Steam" from six to eight.

This plan, says the writer in *The World's Work,* gives perhaps the most perfect control of stoking possible without mechanical handling of the coal, and that is hardly practicable on shipboard. Practically all modern coal-burning ships carry a small supply of oil fuel, which is, however, generally used very sparingly and kept for raising steam pressure quickly in great emergency.

In a Roll.

It was while I was being initiated into the technique of stoking by shovelling coal under the boilers at the rate indicated to keep the steam at "Half" that a change of course brought the swinging seas dead abeam and set the ship rolling even more drunkenly than before. After failing to hit the "dark spots" and "hollows" two or three times as I staggered to the roll, and once even missing the furnace door itself, one of the stokers, taking compassion, relieved me of the scoop and put the trouble right with half a dozen quickly tossed shovelfuls.

I was frankly glad to work over to where I could take a "half Nelson" round a bar by the starboard bunker, for the way the open mouth of the furnace was suddenly jumping up at me in the lurches was something more than disconcerting, especially after one of my fellow stokers had told me that his scarred forearm was the result of having once been pitched forward against a red-hot door, under a destroyer's boilers.

It was easy to see that stoking the furnaces of a ship with a 25 to 30 per cent roll is no job for a novice. Keeping one's balance without holding on to something was difficult enough all of the time, and there were intervals when it was a sheer impossibility. Yet the inexorable gong rang out its warnings just the same, and when the number of the door to be stoked slipped into place on the dial, the particular stretch of glowing coals commanded by that aperture had to be fed willy-nilly.

With the coal "skip" doing a dervish dance from one end to the other of the narrow space, and with even lumps of the coal itself indulging in punitive expeditions on their own account, the waiting stoker needed all the quick-wittedness and shifty-footedness of a bull-fighter combined with the nicety of balance of a tight-rope walker to carry on at all. Yet carry on they did, and with only less clocklike a regularity than the imperturbable "Kilroy" itself.

The Skip Runs Amuck.

A heavy slam-banging from the opposite end of the boiler-room indicated that things were not going quite so smoothly there, and edging cautiously along I was presently able to get some hint of the cause from the words of a volubly cursing stoker who limped out to tell me that the "blinkin' skip 'as took charge." Rubbing a bruised shin and glowering balefully from a blackened eye, which appeared to have bumped against a boiler, he explained, in language more forceful than elegant, that some unpractical theorist had encouraged them to experiment with wheels on the side of the skip with the idea of making it easier to push about over the coal-cluttered deck. This had proved a very satisfactory "safe-in-harbour" expedient, but the increased mobility which had proved so useful in fair weather had proved its undoing in foul.

In the picturesque language of the sea, it had "taken charge," and so effectually that one swift, straight rush to starboard, followed by a "googly" progress back to port, put every man who, either by chance or intent, barred its way more or less *hors de combat*. When I peeped gingerly round a corner the sight I saw was vividly suggestive of those good old days of mass play American football, when a burly half-back was bucking the line of his demoralised opponents.

Shipping Seas.

The heavy three-quarters-full skip had slammed down against the port bunkers when the ship had rolled to that side, and in the second or two she hung there before swinging back again half a dozen men had thrown themselves upon it in an effort to "clip its wings" by removing the wheels. Either the time was too short, or else they had got in each other's way.

At any rate, the wheels were still in position to go round when the battleship, sliding down the reverse of the big wave that had thrown her over, tilted her decks back the other way. Straight down the one-in-three incline from the port to the starboard bunkers lolloped the Juggernaut, dashing the protesting anatomies of the stokers to left and right as it went. Spitting blood and oaths indiscriminately, one man clung to it all the way, however, and he it was who, taking advantage of the tilt, finally rendered it harmless by pushing it over on its side, where it was left wriggling impotently like an overturned turtle.

Meanwhile the "Kilroy" had been ringing up its numbers in vain, and it took several minutes of fast shovelling by al

hands to bring the fires up to where they would have been had the interruption not occurred.

It was about this time that the bridge called on the engine-room for an increase of speed, and it was that, with a change of course which sent the mounting seas crashing over the starboard bow, which brought my visit to the stokeholds to a sudden and unceremonious end. There came a shivering crash, followed by a momentary halt like that which throws one against his neighbour in a jerkily-braked tramcar.

The great ship staggered groggily for a second or two as a weight of solid water equal to her own was launched against her. Then the relentless urge of her spinning screws drove her forward, with the dish of her rigid hull skimming a few thousand tons off the top of the up-rearing wave that had assailed her. Most of the mighty cataclysm surged to lee and back into the sea again, but wherever there was an opening—by gunport, by ventilator, by unbattened hatch—it poured below in thunderous torrents. Deck by deck, where we had descended so laboriously by tilting ladders, we heard it bounding lower and lower, and then (just how and by where I never exactly understood) the flood was all about us.

"If we ship two or three more like that it'll be getting to the fires," shouted the warrant officer who had taken me over from the Senior Engineer; "we'll only be in the way here; we'd best get up while we can. I've stood all the watches I care to in flooded stokeholds in the years I was a stoker myself."

An Old Stoker's Tales.

Over steel plates that were rocking with the wash of the water that had penetrated beneath them, he led me to a little electric lift into which the two of us were just able to crowd and slide the door. "Never thought much of this thing," he said as the car began to ascend after two or three propitiatory prods at the button; "there's too much chance of getting stalled halfway and spending the night like a tinned herring. But even that would be better than getting caught by another waterfall on one of the ladders. Besides, she seems to be going all right, anyway."

Half a minute later the little lift came to a creaking standstill, and we squeezed out to a ladder which led up to the main deck. The wash swirled to our knees in an angle of the mess deck, but the warrant officers' mess, to which I was conducted by my guide, was warm and dry. Toasting bread for our tea in the genial glow of the electric heater, he told me yarns of the days when he himself had (to use his own picturesque expression) "stood at the small end of a shovel" before the furnace doors.

He had once been scalded with escaping steam in the hold of an old cruiser off the coast of South America, once imprisoned in the stokehold of a destroyer for forty-eight hours in a gale in the sub-Arctic, and once he had been "mentioned" for putting out a fire started by a German shell on some nondescript craft on which he found himself at the time the British Navy was trying to protect the retreat along the Flemish coast. The latter sounded like a "story," and I threw a "lead" or two to draw it out. This was about all I got.

"The old *Flighty* got in too close," he said, turning the slice on his toasting fork, "and the Huns opened up on us with bigger stuff than we reckoned they had there. There was a big crash, just like when a big lump of sea hits you, only worse, and all the stokers and me (I was a petty officer then) was knocked flat. We were under forced draught, and the fires needing all the coal we could pitch on to them. No one was much hurt, and I got them to shovelling again as soon as I could. Then I took a squint up the ventilator down which most of the shock seemed to come.

"There was a bit of a fire getting under way up there, and so I pitched up two or three buckets of water and put it out. Didn't notice till afterwards that a small fragment of shell had come down and hit me in the forehead—right here (touching a jagged cut just under the hair).

"Captain seemed rather pleased about it, as the men on fire station in that part of the ship had been knocked out, and he appeared to think I had kept the blaze from getting a big headway.

The Cook and "The Lobster."

"'Nother funny thing"—and he went on to tell of a stoker of a trawler who, after having his face slightly scalded by steam, had laid down and gone to sleep with his head pillowed among some of the steward's recent purchases, and of how the cook, foraging in the twilight and starting to pick up what he thought was a lobster, had nearly pulled off one of the unlucky chap's burned ears!

I sought the fo'c'sle deck for a breath of fresh air after that, and pushed my head out of the after superstructure just as a hulking cinder came winging aft before the snoring north-east gale. It was quite possible (I said to myself as I ducked inside and pulled down my eyelid in an endeavour to deposit the unwelcome fragment on my cheek) that this very cinder was one which I myself had dumped down one of the bunker chutes during our last coaling.

At any rate, I knew that, save for that last leg skywards by way of the furnaces, I had followed the path of the coal from the collier to the funnel-top, and even a bit further. I had, therefore, no legitimate cause for resentment over the fact that it had taken to following me.

With the Imperial Navy in War-Time.

Pay Day. Each man receives his money on his cap.

THE WHEATSTONE AUTOMATIC

Especially Written for "Sea, Land and Air" by ARTHUR RUSSELL

When a telegram is handed in for transmission at a telegraph office, the sender gives little, if any, thought to the processes through which the messages must pass before reaching the office of destination.

Between any of the capital cities of Australia and the country stations nearly all the business is done by hand, but between one city and another a system known as the Wheatstone automatic is adopted.

For moving a large mass of telegraphic traffic quickly from one centre to another this system is unexcelled and, so far, has given complete satisfaction throughout Australia.

The system is capable of transmitting, and recording in ink, signals at a rate of five or six hundred words per minute, the speed depending mainly on the electrical properties of the line. In Australia the highest speed obtained "duplex" (*i.e.*, sending and receiving simultaneously on the one wire) is one hundred and eighty each way, or a total of three hundred and sixty words per minute.

The main instruments in use are a perforator, which punches holes in a paper tape to represent dots and dashes; a transmitter, through which the paper tape is fed and by means of which electrical impulses are sent along the lines; and a receiver, which records, in ink, the electrical impulses as dots and dashes upon a paper tape drawn through the receiver, either by clockwork mechanism or by a small electric motor.

The chief drawback to this system is the number of processes through which the telegrams must pass, with a consequent multiple handling of them.

For instance, after a telegram has been handed in at the counter, checked, stamped and entered, it passes to the perforating telegraphist, who either punches out the holes manually on a hand-puncher, or on the more up-to-date Gell perforator, which has a keyboard similar to that of an ordinary typewriter. The perforated tape and the message now pass to the transmitter attendant, who feeds it into the machine and enters the time of transmission on the message. At the distant station the message is received in dots and dashes on a paper tape. Gummed on to a sheet of paper this tape is then passed on to the checking telegraphist, who records the number of the message and the address, enters the time of receipt on the tape, ascertains that the signals are readable, and hands it over to the copyist. The latter is usually a "touch" typist (not needing to watch the typewriter whilst typing), who transcribes it into plain English.

Another automatic system which may be worked in conjunction with the Wheatstone is the "Creed." The tape is perforated and put through the transmitter, as in the Wheatstone, but instead of being received at the distant station in dots and dashes, it comes out in perforated characters on a paper tape. This tape is rolled on spools and fed through the "printer," a machine which reproduces it in plain typed characters. These are then gummed on to the ordinary telegraph form and sent out, thus saving much copying.

In Australia the Creed system is only in an experimental stage, and has not yet justified its general adoption.

TO RENEW WORN-OUT DRY CELLS

Worn-out dry cells need not be thrown away but with a little trouble can be made nearly as good as new. Strip off the outer zinc covering, which, in the majority of cases, is corroded and full of holes, and stand the carbon element, with its surroundings, in a jar of dilute salammoniac solution. A small leclanche zinc (costing about two pence) is then stood in the same solution alongside the remains of the dry cell. The resulting battery will be found to be equal in strength to the original dry cell and its life will be very long. Indeed, with an occasional renewal of the zinc and solution, it can be used over and over again with good results.

THE WIRELESS INSTITUTE OF N. S. WALES

A largely attended general meeting of members of the above Institute and of others interested in radio work was held on March 14 at Wireless House, Sydney, the chair being taken at 8 p.m. by Mr. E. T. Fisk.

Minutes of the previous meeting (January 7) were read by the Honorary Secretary, Mr. Malcolm Perry, and unanimously adopted, as was the committee's report on action taken to obtain licences for amateurs and the co-operation of wireless institutes in other States. Letters on these subjects had been received from the Naval Secretary, stating that the matter would receive consideration; from Mr. J. S. Fitzmaurice, State Engineer, Adelaide; Mr. C. R. Dodson, Honorary Secretary of the Wireless Institute of Victoria; and from Mr. H. Coleville, Organising Secretary for Queensland, each of whom promised his local support to the proposed affiliation of State institutes. Other general correspondence was read and passed.

Mr. Perry, in recapitulating the work of the New South Wales Institute since its formation, said that they began with a membership of fifteen. A practice class, furnished with buzzer sets and library, was opened at Dominion Chambers, Sydney. The premises consisted of one room, which was made available to members at all times. Some interesting lectures were given here and each member received the Institute's badge. The original Secretary had been Mr. W. Hannam, who was present that evening in khaki, having recently returned from service overseas.

Mr. Perry next dealt with the revision of rules. These, he said, had been carefully reviewed by the Council during the past few weeks.

Mr. Basil Cooke moved that the present title, Wireless Institute of New South Wales, be altered in such a manner as to incorporate the other States. In its present form, the mover contended, the title was not sufficiently comprehensive.

Mr. Perry replied that nothing really definite had yet been achieved with regard to affiliation of the Institutes; if this were brought about, as he hoped and believed it would, the title would, of course, be amended accordingly.

Mr. Cooke now withdrew his motion.

Mr. Hannam moved that an amendment be made in respect of Rule 5, the words "British *nationality*" being substituted for the words "British or Allied *extraction.*" Carried unanimously.

A 17-year-old visitor urged that the age-limit for membership be lowered.

Mr. Perry, in reply, stated that the Council had carefully considered this question. In the past, he added, certain youthful experimenters had been in the habit of tapping wireless messages and then ringing up addressees to inform them of the contents. (Laughter.) This practice had very nearly led to a withdrawal by the authorities of all amateur licences, and one must run no risk of its repetition. Mr. Perry advised the mover to "come back in a year's time," meanwhile he regretted that the age-limit must remain at 18 years. There was no seconder to the motion.

The remainder of the rules were unanimously accepted without further discussion or amendment.

This concluded the preliminary business of the meeting.

Mr. Perry now announced the return of Mr. Hannam, and spoke of their earlier associations in pre-war days.

Mr. Fisk, in proposing a vote of hearty welcome, added that Mr. Hannam was a highly valued member; not only had he seen active service during the present war, but he had been also a member of the Antarctic Expedition.

Mr. Cooke spoke in support of the motion, which was carried with enthusiasm.

Mr. Hannam, in the course of a brief reply, said he was "mighty glad to get back."

Mr. Fisk, in an extremely interesting lecture, explained the historical development and rectifying action of the Flem-

ing valve and the electronic theory as applied to the valve with two and three electrodes, illustrating the various effects by means of blackboard diagrams.

At the conclusion of the lecture Mr. Hannam, in proposing a hearty vote of thanks to Mr. Fisk, stated that the valve was "the most interesting part of the whole business." "If any of you," he asserted, "have the opportunity at any time to get valves, you will never touch a spark wireless again." The speaker added that he had used the valve receiver both in France and Australia.

Seconded by Mr. Perry, the motion was carried amid loud acclamation.

Mr. Cooke suggested that Mr. Fisk be "definitely bound in some way or other" to continue these very interesting lectures; they would be to everybody's advantage.

Mr. Fisk, replying to the vote of thanks, agreed that there was a good deal in what Mr. Hannam had said regarding the possibilities of the valve. Touching on future lectures the speaker suggested that some of the other gentlemen present should be called upon. He might ask Mr. Cooke to assist him in the matter. It was difficult, he said, to definitely bind oneself, a fact which had been brought home to him only a few seconds previously by an interjection from the Editor of *Sea, Land and Air*, who had asked, "How about your article for April?" (Laughter.) This interjection, he explained, was bred of the speaker's promise, in an unguarded moment, to contribute a monthly article to the Institute's official journal; a promise of which he was being continually reminded. In conclusion, Mr. Fisk stated that he had much to attend to these days, but would endeavour to lecture at future meetings whenever circumstances permitted.

Mr. Perry now moved that the meeting be adjourned until April 4. The election of office-bearers for the ensuing twelve months would be held on that date. The Council, he concluded, had the matter of licences well in hand, and these would be pushed forward as quickly as possible.

A cordial vote of thanks to Mr. Perry, proposed by Mr. Stowe and seconded by Mr. Hart, brought the proceedings to a close at 9.55 p.m.

"INTERNED" WIRELESS APPARATUS RESTORED

The following official notification has been forwarded to all licensed owners of amateur wireless apparatus:—

COMMONWEALTH OF AUSTRALIA.
Postmaster-General's Department.

Mr..... General Post Office, March 3, 1919.

Sir,—With reference to apparatus belonging to you which is now stored at the ..... Post Office, I have to intimate that such may, on application at that office, be obtained.

The Naval authorities, however, point out that the restrictions on the use of wireless apparatus still remain in force and that a rigid continuance of the prohibition against all private experiments must be observed, in accordance with the War Precautions Regulations.

Yours faithfully,
E. J. YOUNG, Deputy Postmaster-General.

AERIAL SERVICES (SYDNEY-LONDON), LIMITED

PROGRESS OF SURVEY EXPEDITION

The above expedition, of which much has been printed in our earlier issues, is now well on its way, and, as we go to press, information reaches us from Mr. Lloyd that the party has arrived at Longreach, Queensland.

Progress, even in the earliest stages, has not been altogether devoid of incident.

The route which the expedition will follow on its journey from Sydney to Calcutta was detailed in our February issue and appeared in print on the day selected for the departure of the little band of pioneers.

On Friday, January 31, after breakfast at the residence of Mr. G. A. Lloyd, J.P., of Five Dock, the party mounted its motor-bicycles and pedalled off down the carriage drive.

The first to get away was Mr. J. C. Marduel, who was "snapped" by our official photographer at the moment of turning into the road; the remaining four machines followed hard on his heels and the much-discussed aerial expedition had now actually started.

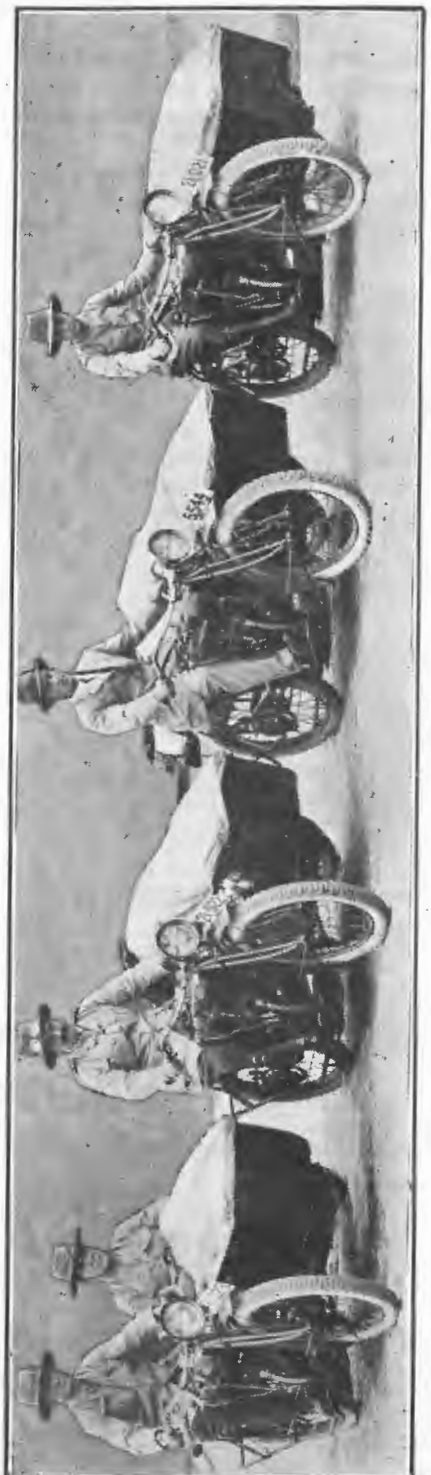
Wiseman's Ferry was reached the same evening, with Singleton as the next objective, but while some 18 miles from the latter town a snapped chassis-bar necessitated a halt for repairs, thus delaying the arrival at Singleton until the morning of February 2.

Four days later the party arrived at Moree and mapped out a landing ground some three miles from the town; this will be the first aerial stage between Sydney and Calcutta.

Tenterfield was reached on February 9, after a hazardous all-night run; here the expedition was detained by the quarantine authorities until the 16th.

Resuming their journey across the Queensland border the next halt was made at Yeulba. While approaching the last-named town Mr. Marduel's cycle overturned, causing a slight injury to his back and wrist and compelling him to lie up for a few days.

Roma was reached on February 19. Here the party halted to await the arrival of Mr. Waldron, who accompanies the expedition as surveyor. The first Queensland



Aerial Services (Sydney-London), Limited.—Lined up for the Start.
Seated in the side-car (left) is Mr. Reginald Lloyd, organiser and leader of the survey expedition.

landing ground was selected on the outskirts of Roma.

Mr. Marduel rejoined the party on February 28 at Charleville, where, in a corner of the Show Ground some forty acres were selected as a landing ground. After a stay of four days, during which they were entertained by the Charleville Chamber of Commerce, the expedition resumed its overland journey on March 4. Owing to the swollen condition of the River Ward the party camped on the bank at Oakwood until a crossing became possible.

OUR QUESTION BOX

G. B. Bowman, Quirindi—(1) Containers of the shape specified are not obtainable. Ordinary round, glass jars would serve equally well and are easily procured. Ebonite containers may be obtained from the Colonial Rubber Company. (2) Wall plugs and sockets may be purchased, at a cost of 3/9 each, from the Australectric Company.

C. E. Ames, Torrensville—(1) Magnifying valve type. (1a) Diagrams of circuits as used with above tests would be practically unintelligible to wireless amateurs. (2) The circuits shown in your letter would be satisfactory only on very long wave-lengths—say over 3,000 metres. For reception of shorter wave-lengths the standard loose-coupled, or auto-coupled, receiving systems are preferable; the former is able to cut down stray interference.

RAILWAY ELECTRIFICATION

Though some time has elapsed (writes our Melbourne correspondent) since the first electric train that, from Newmarket, entered Flinders Street station, it is believed that it will be June, at the earliest, before the Essendon-Sandringham line will be in operation. The delay in connection with this and other suburban lines is that British firms manufacturing gear were handicapped by war conditions and big private orders which had accumulated on their hands. Further, there are the industrial troubles, but whether these will result in a further delay is not known at this juncture. It was hoped to see electric trains running on all the suburban lines by January 1, 1920.

Worries of a Wireless Man.

Sparks (after a heavy roll): "Cripes! after all that adjusting, I've missed those blinkin' time-signals!"

Sketched (from life) for *Sea, Land and Air* by Donald Gunn.

THE NEW METALLURGY

Especially Written for "Sea, Land and Air" by C. W. NASH

One of the results of the great struggle from which we have just issued has been the production of a keener appreciation of the debt that the industries owe to the prosecution of pure science, to work undertaken in most cases with no thought of reward other than the feeling of satisfaction arising from the knowledge that an advance has been made. In the case of metallurgy, perhaps more than the other sciences, the general public has failed to grasp how greatly industry has benefited by purely scientific investigations into the structure and properties of metals. So often are we told of the advances made by other countries in chemical science and manufacture, and so little do we hear of our own progress in metallurgy, that few people realise that during the last forty years there has grown up, principally in England and France, an entirely new science of metallurgy. This science, originating in a disinterested study of the internal structure and constitution of metals, has in the last few years so extended our knowledge of the metals and alloys as to bring about a revolution both in their manufacture and industrial application.

At first sight a piece of metal must appear a most uninteresting subject for study. Of sombre colour and generally of indefinite outward form, there is nothing to indicate that it is anything but uniformly dull and uninteresting throughout. "As dull as lead" has, indeed, become an expression for all that is without interest or beauty. Yet we owe it to what we have here called the New Metallurgy to have shown us that all metals not only possess a highly complex and generally beautiful structure, but that this structure undergoes radical changes as the temperature, degree of purity and other factors are varied.

If any date is to be fixed for the birth of this new science it must be in the year 1861, when Henry Clifton Sorby, a mineralogist of Sheffield, turned from the study of the structure of rocks to that of metallic meteorites, and hence to the study of the metals themselves. Although living in the very centre of the metallurgical world, Sorby had no interest whatever in the production of metals; he approached their study from the purely scientific standpoint and was therefore free from the extensive lore that had grown up around the technology of metals. Sorby's principal contribution to the study of rocks had been the development of a complete technique for the microscopic examination of their inner structure. In attempting to apply the same methods to the examination of metals he was confronted by the difficulty that the very thinnest sections of a metal are practically opaque to light, and therefore could not be examined in the same manner as rock sections. This difficulty, which had hitherto prevented the microscopic examination of metals, he overcame in a brilliant manner. Having prepared a perfectly flat and polished surface on a piece of metal he directed a ray of light from inside the microscope vertically upon it. This ray, reflected again from the bright metallic surface and passing back through the microscope, gave a perfect, magnified image of the surface of the metal. When now any ordinary metal, such as copper or tin, after the surface has been suitably prepared, is examined by this method, a remarkable fact is disclosed. The whole surface of the metal is seen to be divided up into a number of minute polygonal areas, or sections of grains, separated from each other by thin, hair-like boundaries. In most cases it will be seen that the boundaries of the grains do not conform to any regular crystallographic shape, but form an irregular interlocking pattern. Nevertheless, Sorby was able to show that these grains were true crystals in all but outward form, and his recognition of the fact that metals are essentially crystalline constituted a fundamental advance and laid the foundations of the new science of metals.

The immediate practical benefits arising from this purely scientific discovery are

seen when we come to examine any of our industrial metals or alloys by these methods. It has long been known, for instance, that iron is a comparatively soft metal, but that when mixed or alloyed with an exceedingly small proportion of ordinary carbon it becomes hard and strong, and is then known as steel. To what are we to attribute the strengthening effect of this small amount of carbon upon a whole mass of iron? Beyond telling us that the carbon has combined chemically with a small portion of the iron to form an exceedingly hard compound the chemists have been able to offer no explanation. The methods of the New Metallurgy at once make the matter clear. On examining the prepared surface of a piece of the strongest steel a wonderful and beautiful structure is revealed. Each of the grains of which the metal is composed is seen to be built up of alternate light and dark bands, so narrow that 30,000 of them would scarcely occupy an inch and often rivalling mother-of-pearl in the beauty of their irridescence and play of colour. In the presence of these fine bands, consisting of alternate layers of the hard carbon compound and the comparatively soft iron, lies the secret of the strength of steel, for as the engineer makes his strongest structures by embedding fine filaments of metal within a mass of concrete, so has the metallurgist learned that the strength of his steel is almost entirely dependent upon the structural relations of these two constituents. When it is further considered that by varied thermal and mechanical treatment the same piece of steel may be made to take on many different structures, each corresponding to some desired combination of strength, ductility or hardness, we see of what immense practical advantage a knowledge of their internal architecture is to the manufacturer of steel and other metals.

One of the most useful properties possessed by metals is the facility with which they undergo plastic deformation when pressed, hammered or rolled, and it is naturally a matter of considerable scientific interest to inquire how the individual crystals of a metal behave when subjected to a deforming force. How, in fact, does it come about that a crystalline substance can be bent without fracture immediately taking place? Again the microscope enabled the question to be answered. It was found that when a metal is forced to take on a different form it does so, not by the sliding of one crystal past another, as had previously been supposed, but by a process of slip along the cleavage planes of each individual crystal. When, therefore, we bend a piece of metal beyond the point at which it will spring back (*i.e.*, beyond the elastic limit), instead of breaking as any ordinary crystalline substance would do, it adapts itself to the new form imposed upon it by the sliding of one crystal plane over another, much in the manner in which the leaves of a book slide upon one another when the book is bent. But it has been found that this sliding is accompanied by something further. The attrition along the planes is sufficiently severe to cause an actual molecular derangement of the particles, which retards the motion and soon renders further slipping impossible. When this point has been reached the metal can no longer accommodate itself to the applied force and fracture must result.

This knowledge of the mechanism of deformation has carried in its train a whole series of practical results of the first importance and has given the key to many hitherto unexplained failures of metals in daily engineering practice. An insight into the processes by which metals fail when subjected to stress is the first step towards discovering methods of preventing these failures, and this fact has been so well recognised by the manufacturer and engineer that the microscope has become an indispensable adjunct to every metallurgical works.

In even the shortest account of the debt which practical metallurgy owes to pure science mention must be made of a parallel line of research without which the microscopic study of metals could not have made such rapid progress. By means of an extremely sensitive pyrometer, which we owe to the genius of Le Chatelier, it has been found possible to follow the thermal changes taking place when a metal is heated and cooled. The study of the thermal history of metals has been of the greatest service in interpreting the meaning of the different structures resulting from the various heat treatments to which metals are subjected during their manufacture, while even in the means it has afforded for the scientific control of that most ancient of metallurgical operations, the hardening and tempering of steel, Le Chatelier's pyrometer is not the least of the numerous gifts of science to industry.

DEFECTS IN AEROPLANE WOODS

JUDGING THE QUALITY OF THE TIMBER

By SAMUEL J. RECORD

The wooden components of an aeroplane represent the "survival of the fittest." The process of elimination begins with the species and follows through all the various stages of manufacture and assembly. One kind of wood may be rejected because it has a bad reputation, while another is passed by because its properties are unknown. Thanks to the long series of laboratory tests made by the Forest Service, war did not find the United States unprepared so far as a working knowledge of its own woods is concerned.

Merely to enumerate the species used is to tell only a part of the story of wood selection. While every species tends to preserve certain racial characteristics, and to produce woods of a certain sameness, yet each tree within that species possesses a distinct individuality. Wood is a natural product, a structure designed to meet the needs of the tree, not of man; a structure which, in detail, is as infinitely variable as the conditions which combine to produce it.

Accordingly, wood is not amenable to refinements of standardisation. In this it differs from many other structural materials such as metals and concrete. There are, to be sure, tables giving unit strength values for woods; but these are merely averages of many tests and are not directly applicable to any given piece of material. They serve many useful purposes, however, not the least of which is to provide a basis for comparison.

In selecting wood for a particular purpose one of the fundamentals is to be able to correlate strength values with features which are readily discernible; to know the signs of strength and the signs of weakness. The best criterion of strength is the weight of the dry wood. The substance composing the cells weighs about one and a half times as much as water and is practically uniform for all species. The more wood substance per unit of volume or the greater the density of the material, the harder and stronger it will be.

Since lightness is a desirable property in aeroplane construction it might be assumed that the less weight a given specimen of wood has the better. There is, however, for every wood a certain minimum limit beyond which reduction in weight is attended by brashiness and brittleness. The wood produced late in the life of an old tree is almost invariably light and brash, with little reserve strength beyond the limit of elasticity. Wood immediately surrounding pith, sometimes erroneously called the heart, is invariably weaker than that further out. Sometimes ash, normally one of the strongest and toughest woods, is so punky and brash as to be absolutely useless for any purpose requiring strength. Kiln drying at too high temperatures will induce permanent brittleness in wood. There are various methods for detecting brash or brittle material. Abnormally light weight is an almost certain indicator. The nature of the fracture when a specimen is broken in bending is another. A tough wood will give way gradually, with a fibrous or splintery fracture, while a brittle one will snap off short without warning. The same effect can be approximated by gouging the surface of the wood with the point of a knife and noting whether it splinters or "picks out" punky.

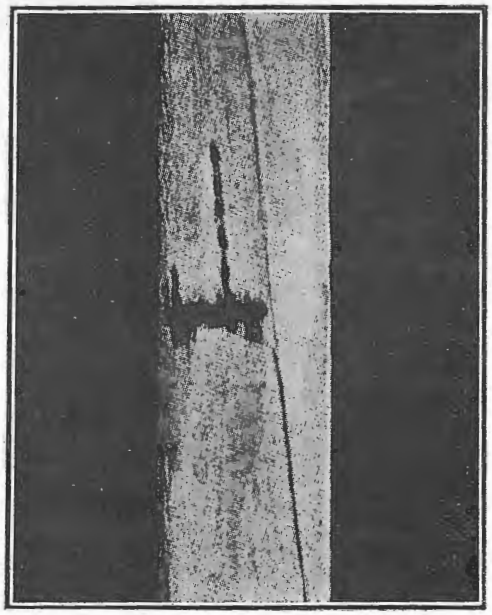
Wood is at its best for most purposes when the grain is straight, that is, when the fibres lie parallel to the long dimensions of a stick. In such material the shrinkage is more uniform throughout, and the tendency to warp out of shape in response to fluctuations in the moisture contents is at a minimum. Whenever a wooden part is deformed by an external force, as in bending, a portion of the material is stretched, and the resistance offered when this tensile stress is *along* the fibre may be more than fifty times greater than when the pull comes *across* the grain. This ratio is increased enormously if the lateral continuity of the fibres is interrupted by splits due to seasoning and other causes.

There are many factors which interfere with straightness of grain. Some trees have their fibres arranged in a spiral direction, and produce what is sometimes termed "torse" wood. Spiral grain is the source of much trouble in the use of spruce. The direction and pitch of this spiral are subject to change, sometimes at such regular intervals that a so-called "ribbon" or "feather" grain is produced. This is very common in mahogany, prima vera and tanguile, but owing to the fact that these woods are used in laminated construction the ill effect of the irregular grain is largely overcome.

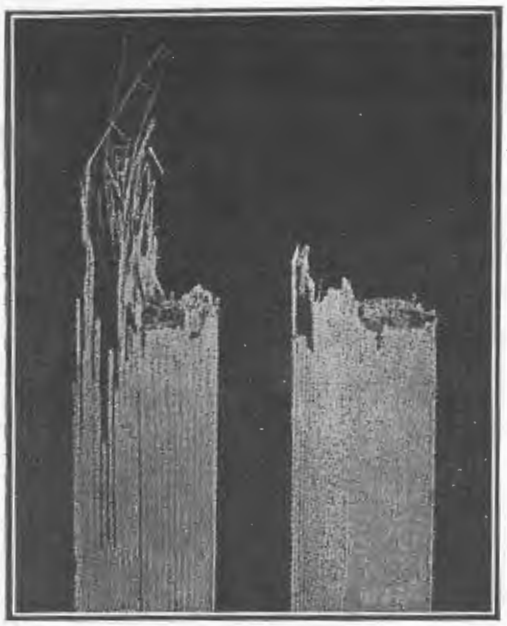
Another form of cross-grain is produced in timber by the method of sawing and has no reference to the natural arrangement of the wood elements. If a log is approximately the same diameter at each end the plane of the saw must be parallel to the axis of growth, while in logs with decided taper, the plane of the saw, for the outer planks at least, must follow the outer edge and not the middle of the log. Otherwise the growth rings will be cut across diagonally and the timber weakened accordingly.

Another source of local cross-grain is knots. The bigger the knot the greater the range of the disturbance. It is largely on this account that knots are such serious defects, though they also interfere with the cabinet qualities and are always disturbing factors. There are also various local irregularities which cannot readily be accounted for, though due in some cases to unevenness in the surface of the tree and to injuries. The "blister mottle," which occurs in yellow poplar, is believed to be due to injuries caused by sap-sucking birds. These also produce "bird-peck" and "rust streaks" in hickory. Some spruce logs show on the outside beneath the bark long narrow furrows of unknown origin, sometimes called "bear-scratches." The wood shows undulations in the growth rings on the ends and peculiar vermiform markings on the surface. They have been mistakenly ascribed to mistletoe.

The surest way to detect any kind of cross-grain is to split a piece of the wood and note how the cleft runs. It must be remembered, however, that normally there are two planes of cleavage in wood, one following the rays, the other following the growth rings. A stick may be straight-grained so far as one plane of cleavage is concerned and diagonal with respect to the other. When the rays and vessels are



Testing for direction of grain by observing the course of the ink as it runs into the pores of the wood.



Brashiness is indicated by the square break at the right, toughness by the splintered one. (Both specimens Sitka spruce.)

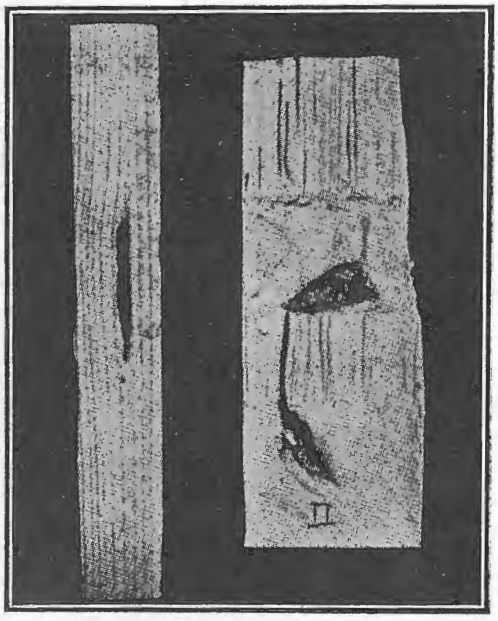
large enough to show prominently, as in oak, the direction of the grain is easily noted. In some woods it is shown by the roughing of the fibres under the planer, and by the way in which the light is reflected, an effect very noticeable in mahogany.

In conifers, such as spruce, and in fine-textured hardwoods, like yellow poplar, the rays and wood fibres are so small that it is often difficult to determine their direction, even with a hand magnifier. This is particularly the case when the specimen is cut quartering, that is, with the growth rings running diagonally across the ends. Splitting, of course, would spoil the specimen. In such cases, the ink test is fairly satisfactory. A pen is drawn across the wood and the ink spreads along the fibres. The pen is then touched to the end of one of these spreading lines, causing it to run further. By repeating this process a few times a line is formed long enough to permit measuring the angle the grain makes with the axis of the piece. If this line deviates more than one inch in fifteen, twenty or thirty inches, depending on the class of material inspected, the specimen is not acceptable. In a wood with resin ducts, as in spruce, pine and Douglas fir, the longitudinal course of the ducts on the tangential surface is usually distinct enough to show the direction of the grain.

Section of spruce wing beam cut from wood which was broken in the tree, probably when felled.

It is not generally known that wood is often broken in the tree without any outward indication of the fact. Areas of compression failures result, usually in connection with some weak place such as a knot or other defect. Just what causes these compression failures, sometimes designated "heart breaks," is not definitely known, but they may result from severe wind storms or more likely from the severe shock when the tree is cut down. They constitute a very serious defect and are fairly common in spruce and mahogany and may appear in any wood that is somewhat brittle. In mahogany there is usually enough discolouration to make the break conspicuous, but in the case of spruce very careful inspection is necessary. In a soft wood, too, the matter is sometimes complicated by superficial fibre breaks made by the planer knives, but these can usually be recognised by their regularity.

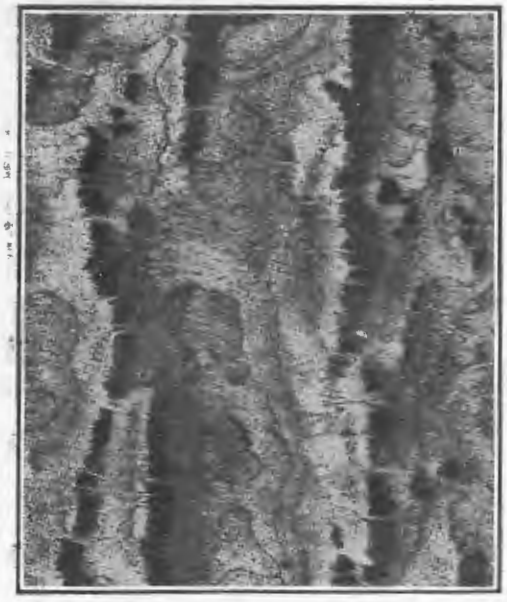
Splits or shakes of any nature in wood are elements of weakness. Sometimes these occur in the living tree, but more frequently result from irregular shrinkage in drying. If drying proceeds too rapidly on the outside the outer layers of wood contract and stretch about an unyielding core, and many of the fibres are torn



Pitch pockets, a very common defect in spruce, are difficult to detect unless of some size or located near the surface.

apart. Wood also dries very fast from the ends and if these are unprotected, numerous splits will open up. Later, when drying is complete, many or all of these checks may close up and become invisible, but the lateral continuity of the wood fibres is broken and the strength materially reduced. The effect is most serious when a cross-grained member is subjected to a bending stress. The best cure for season checks is careful attention to all stages of the drying process, from the living tree to the kiln-dried lumber. The modern methods of kiln-drying give better results with green timber than the air-seasoning methods until recently considered the best.

If drying is not properly done wood will case-harden and be full of unrelieved strains, which are likely to cause a manufactured article to get out of shape. Before the wood leaves the dry kiln tests are made to detect case-hardening. Sections of sample boards are ripped through the middle and their behaviour noted. If the boards remain flat the material is in good condition, but if case-hardening exists the thin board will cup or bow from or toward the saw, depending upon whether case-hardening is in the first or the final stage. Case-hardening is overcome by a sort of annealing process in which the wood is rendered plastic by steaming for a short time and then re-drying.



Blister mottle in yellow poplar, believed to be due to the pecking of holes in the live tree by sap-sucking birds.

Smooth end of Philippine mahogany, under the glass, shows characteristic rows of white dots which distinguish it from true mahogany.

Pitch pockets in coniferous woods are local cavities between growth rings which become filled more or less completely with hardened resin. They are difficult to detect until opened up in manufacture, unless large enough or near enough to the surface to distort the grain. They are elements of weakness, but their seriousness in any particular case depends upon their size, number and location.

There are various other defects in wood, some of them the result of growth, others due to external agencies. In mahogany it is not uncommon to find large reddish streaks composed of short, brittle cells with little strength. Such portions should always be eliminated. "Black dote" is frequently met with in yellow poplar and may be merely a stain which does not affect the strength, or incipient decay which does. Sapstain does not weaken unless it is in advanced stages. Holes made by worms, borers, teredo, etc., reduce strength in proportion to their number and size. They are often accompanied by decay.

Where various kinds of woods are being used on the same operation the question of identification becomes important. Sometimes it is a question of excluding a certain species entirely, again merely in measure of precaution against indiscriminate mixing. Philippine mahogany, for

instance, is not permitted in the combat type of propellers, and the inspectors and manufacturers frequently are at a loss to separate this material from genuine mahogany. While the general appearance and feel of the wood are usually enough for a person familiar with them, need is often felt for some definite characters which can always be relied upon in cases of doubt. It exists in the form of resin ducts which are distinct on a smooth end of a specimen individually if a hand-magnifier is used, collectively without it. To the naked eye the end section appears marked with narrow white lines, some long, some very short, and mostly without any regularity of spacing. With the lens these lines resolve themselves into rows of white beads, each bead corresponding to the cross-section of a resin duct. With very little practice anyone can "spot" Philippine mahogany as quickly as he can smooth the end with a sharp knife and apply the lens.

Philippine mahogany is not the name of a tree, but a trade term for a group of closely related woods. It corresponds exactly to the American use of the term "southern pine" to designate the wood of any one or all of five different species of pine which grow together in the South. And just as these southern woods intergrade and are separated commercially on a basis of quality, so in the case of Philippine mahogany. The writer has attempted, so far in vain, to find some specific characters which are constant, but the individual variations seem to cover as wide a range as those of different species. Hence it seems safe to follow the present practice of classing the softer and lighter grades as red lauan and the harder, stronger material as tanguile.

Another problem, says *The Scientific American,* is the separation of the African and the tropical American mahoganies. Although these woods are both acceptable, it is not considered good practice to mix them in a propeller. Here again the ends of the boards tell the story, this time so the casual observer may read. Narrow white lines, which appear as though marking rings of growth, sometimes close together, sometimes widely spaced, will be found in every piece of true mahogany from tropical America, but not in that from Africa. At least the writer knows no exception to this statement. If these lines are examined with a lens they will not show the beaded or dotted nature previously described for the Philippine substitute. Some of the harder grades of genuine mahogany have some of the pores filled with lime deposits, but they are irregularly scattered instead of collected in tangential rows or concentric rings. More commonly the pores are plugged with reddish gum masses and as these are absent in the Philippine material they furnish additional aids in identification.

The so-called "practical" man is inclined to look upon these methods as needless refinement, but the large number of cases of mistaken identity of woods used in propellers which have come to the writer's notice emphasises the need of some refined methods. The fact that wood is variable should serve, not as an excuse for careless selection, but as an incentive for more thorough analysis of its properties. Only those who know woods intimately can use them with discrimination.