



**The Right Hon. S. M. Bruce, M.C., P.C., M.P.,
Prime Minister of Australia**

Foreword

By the Right Hon. S. M. Bruce, M.C., P.C., M.P.,
Prime Minister of the Commonwealth of Australia.

As Chairman of the Parliamentary Committee which recommended the adoption of the original agreement providing for direct wireless communication between Australia and England, and as Head of the Government which introduced proposals for the Beam Stations which are now being erected, I am naturally watching with great interest the progress of wireless development.

The practical application of this marvellous invention to every-day affairs and its constant development in numerous directions increases its importance to a country like Australia, with its vast territory, sparse population and great distance from the main centres of the world's commerce. As a civilising agent, and in promoting education in the widest sense and international trade and goodwill, its possibilities are immense. As a cementing force within the British Empire it is calculated to play a vital part, for it will secure promptly to both the Governments and people of the Dominions that fuller information on questions of Foreign Policy and other important matters which is essential in view of the developments in Imperial relations which have taken place in recent years.

The Commissioner for Australia in the United States of America has projected his voice through the ether from Pittsburgh to Sydney and Melbourne. In a few months, when the Beam system has been installed, England will be exchanging wireless messages with Australia, and Melbourne will be in instantaneous touch with Whitehall. Speech has already been transmitted between the two countries, and there is every probability that regular wireless telephonic communication will be possible in the near future. What that will mean to closer Imperial Unity, to a clearer understanding and sympathy between all parts of the Empire, to social convenience and to efficient business is obvious.

The Commonwealth Government has always been in favour of cheapening and expediting communication within the Empire, and the holding of the Imperial Press Conference in Australia is a reminder of the advantages which wireless will bring to the newspapers of the Empire in cheaper rates and more rapid transmission.

This volume outlines the history of wireless in Australia and the Empire generally, and, in making available for permanent reference the facts relating to a vital phase in the development of the Commonwealth, Mr. Myers has rendered a useful service.

S. M. BRUCE,
Prime Minister.

Melbourne,
July 18, 1925.



The Right Hon. Wm. M. Hughes, P.C., K.C., M.P.

Foreword

By the Right Hon. W. M. Hughes, P.C., K.C., M.P.

Early next year direct wireless communication will be established between Britain and Australia. In a little while it will be as easy for a man in London to speak with one in Sydney or Melbourne as it now is for one in Birmingham to speak to one in Manchester.

The realisation of an Empire wireless scheme marks a new era. It comes at the very hour when the political and commercial circumstances of Britain and the Dominions most need it. When the problems of a world Empire had become so difficult that many despaired of any solution that reconciled unity of the whole with complete autonomy of the parts, science has placed in our hands a ready means for smoothing out our difficulties.

Most of the problems of Empire arise out of its vastness, its widely scattered parts, and its political circumstances. Improved communications are essential if the Empire is to survive. Communications condition the progress of nations. Roads sufficed for Rome, but for the wider Empire of Britain even steam and the electric telegraph have proved inadequate. But where these have failed wireless will succeed. By its magic the vast globe shrinks to compassable dimensions, distance is annihilated, isolation banished. Upon the ear of the dweller in the silent desert falls the roar of the busy world; the sailor in the most distant seas is in touch with those in his far-off home.

Wireless is the Spirit of Civilisation made manifest. It carries knowledge on the wings of light. It will help all men to know one another, to understand each other's point of view, and as wars come very often from misunderstanding, wireless is the great messenger of peace and goodwill amongst men.

When Downing Street can talk to Melbourne and Montreal, when it can hear the views of Pretoria and Wellington, half the difficulties in the way of a united foreign policy for the Empire will disappear.

Wireless will help British trade in the Dominions and Dominion trade in Britain. We know one another pretty well as it is, but we shall know one another far better when, in place of the tiny trickle of news that comes through the cables, we are able to dip our cups in the broad river of wireless.

We live in an age in which miracles happen daily although many heed them not. Wireless is a miracle, but its full glories are not yet fully revealed to us. Every day sees some new development. That which was impossible yesterday becomes the commonplace of to-morrow. Now we hear, in a little while we shall see, men and events half a world away.

Many ties bind this great Empire, this Commonwealth of Free Nations, together. They are strong ties. How strong the world saw during the late war. But wireless will make them still stronger, dispelling misunderstanding, drawing us all closer together, our mingled voices proclaiming our united destiny.

I am glad that in this great scheme of Empire Wireless, Australia has taken a leading part.

W. M. HUGHES.

Lindfield, Sydney, July 20, 1925.



**E. T. Fisk, M.Inst.R.E., A.M.I.E., (Aust.)
Managing Director, Amalgamated Wireless
(A/sia) Ltd.**

Introduction

In these pages a record is given of the development of wireless in Australia and of the proposals for a British Empire wireless organisation in which the Commonwealth has been vitally interested.

The meeting in Australia of an Imperial Press Conference has been chosen as an appropriate occasion for the publication of this record, for the Empire Press Union, under whose auspices the Conference is held, has done more than any other body to educate public opinion as to the need of cheap, speedy, communication within the Empire. The forthcoming initiation of direct wireless communication between Australia and the Mother Country also marks an epoch in inter-Empire union which it is desirable to commemorate.

No country in the world—certainly no part of the Empire—has more to gain than Australia from the fruition of that comprehensive scheme for linking the component parts of the British Commonwealth by a wireless girdle for which the Empire Press Union has striven so consistently.

The dissemination of inter-Empire news at cheap rates, the greater facilities for consultation between the Imperial and Dominion Governments, the stimulus to commerce and particularly to trade within the Empire which will result from the new system will be of incalculable advantage to Australia and every part of the Empire.

The value of wireless in diminishing the handicaps of Australia's isolation in the Pacific was fully recognised in the Commonwealth as soon as the merits of the science were established. For nearly twenty years Australian statesmen have formulated plans for overseas wireless communication. But unfortunately their efforts have been frustrated year after year. From the Pacific Conference in Melbourne in 1909 to the Imperial Economic Conference in 1923 the same obstacles to progress were experienced.

Now, however, Australia is about to initiate the greatest advance in regular long-distance wireless communication on commercial lines which has yet been attempted, and it may be fairly stated that the progressive and determined policy of the Commonwealth has done much to stimulate similar action in other parts of the Empire. The Australian Government showed its confidence in the progress of the science by supporting direct communication (when that was proved possible) rather than an unnecessary and costly relay system, and again by adopting the "Beam" system in preference to the high-power stations, which now appear to be obsolete.

The Commonwealth already possesses the second largest wireless organisation in the British Empire, and this will be enormously increased in importance and extent when the new overseas stations are in working order. A great British wireless centre in the Pacific in direct touch with America,

the Far East and England, as well as the whole of the British possessions in the Pacific Ocean, will become a great Imperial asset.

The Amalgamated Wireless Company and its Managing Director, Mr. E. T. Fisk, are to be congratulated on the valuable work that has already been achieved, and on the far-reaching plans that have been made for the future. With the same prescience, determination and enthusiasm which inspired the founders of the Suez Canal over half a century ago to open a gateway providing more speedy and economical transport between Europe and the Pacific, the supporters of direct wireless communication between Europe and Australia have performed an even more valuable task. The British Empire has had reason to be grateful for the services rendered by the Earl of Beaconsfield in purchasing shares in the Suez Canal Company on behalf of the British Government. It may be predicted that the part taken by two Prime Ministers in another part of His Majesty's Dominions in finalising the purchase by their Government of shares in a Company promoting an even more important undertaking will also not be overlooked.

The joint arrangement between the Government and the Amalgamated Wireless Company has worked smoothly and efficiently. It has given the Government the power, through its financial holding and representation on the Directorate, at any time to control the affairs of the Company, if it so desires in the public interest. But it also leaves in normal circumstances the business and technical organisation in the hands of experts. Elasticity in management, adaptability to the ever-changing results of scientific research and freedom from bureaucratic interference will be some of the advantages of the arrangement without diminishing the full safeguarding of national interests.

The particulars which are given in this booklet justify the assertion that Australia has kept abreast of all the modern developments of wireless, and it will now have an opportunity of putting these to the best and wisest use. The first successful broadcasting experiment took place in Australia within a few weeks after the first public demonstration in England. The remarkable experiments in transmission with low power and short waves between England and Australia were largely the determining factor in the adoption of the Beam system, and the results of these tests have been amply confirmed by the enterprise and ingenuity of a number of Australian amateur experimenters in different parts of the Commonwealth who have succeeded in effecting two-way communication with America and England with simple apparatus.

Direct telephonic wireless communication with the most distant countries and the transmission of photographs and relaying of broadcasting programmes from them have been rendered possibilities of the near future by the most recent discoveries. The manufacture in Australia of every type of wireless equipment and the training of an expert Australian staff in research, operation, and other branches of wireless work will tend to make the Australian wireless organisation self-contained for all practical purposes. On the other hand, the close liaison which has been established with the best brains in the science of wireless in all parts of the world will assist to keep the undertaking progressive and responsive to the rapid developments which are being announced with bewildering frequency.

Early in 1926—thirty years after wireless telegraphy became a commercial proposition—it will be possible for business firms in Great Britain, North

America, and Australia to exchange messages with great speed and at a considerable reduction on existing cable charges. British newspapers in all parts of the world will find removed two obstacles which now hinder that comprehensive publication of the news of the Empire which is an essential stimulus to a healthy, well-informed public opinion on matters of Imperial interest. Prompt—almost instantaneous—transmission will replace the heavy delays that now frequently occur except with traffic for which special payment is made. And the cost of the messages will certainly be substantially below the existing high cable rates.

If direct telegraphic communication proves to be as reliable and speedy as has been guaranteed, direct telephonic communication on commercial lines will undoubtedly follow. The Editor of a London newspaper will be able to consult his Australian correspondent; the President of the Empire Press Union will be able to confer with his colleagues in the Commonwealth; the Prime Minister of Great Britain will be able to exchange views with the Prime Minister of Australia.

If this prediction is justified by the results, the Empire Press Union and a few enthusiasts in public life, in journalism, and in the wireless world in Australia may claim some credit for assisting to make available for the welfare of the whole Empire the fruits of the genius of the men who are primarily responsible.

Sydney, July, 1925.

J.M.M.

How Wireless Developed in Australia

THE EARLY DAYS

Soon after the advantages of wireless telegraphy had been clearly established, interest was taken in its future possibilities in Australia. Tasmania was particularly anxious to establish wireless communication with the mainland, and the Commonwealth Government was approached in October, 1901, with the view of a wireless service between Tasmania and Victoria being undertaken by the Marconi Company, via King Island in the Bass Straits.

In October, 1902, a proposal was submitted by the Marconi Company for the establishment of a wireless service between Australia and New Zealand, but the P.M.G.'s Department opposed the scheme on the grounds that the business was provided for by the Eastern Extension and Pacific cables, and the cable rates were lower than those proposed by the Marconi Company.

In February, 1903, a joint memorandum by the Departmental Electrical Engineers in New South Wales, Victoria, and Queensland regarding the practicability of establishing wireless telegraphy between Victoria and Tasmania, reported:—"There is no doubt that telegraphic communication can be established by the Marconi system between Victoria and Tasmania." No action was, however, taken by the Government at that stage.

THE FIRST OFFICIAL TESTS.

On June 1, 1903, the Electrical Engineer of the P.M.G.'s Department, Queensland, made the following report, which is particularly interesting, as it relates to the first official tests with wireless telegraphy in Australia:—

"I have to report that trials of the Marconi Apparatus for Wireless Telegraphy have been carried out from time to time in conjunction with the Naval Authorities as opportunity has offered. Communication, satisfactory in every way, has been maintained between Tangaluma (Moreton Island) and the Naval Stores, South Brisbane. Preliminary experiments were not satisfactory owing to the fact that the requisite height of vertical wire was not available. When, however, the vertical wire was increased to the requisite length no difficulty was experienced. The two sets of apparatus used were from the 52 obtained by the Imperial Naval Authorities from the Marconi Company for marine use."

In July, 1903, the Marconi Company offered a Tasmanian service, to do the same work as the cable, at a cost of £5,000.

In April, 1904, the Marconi Company quoted for stations on islands in Torres Straits, but the Government was still undecided what to do in the matter.

Early in 1905 the Admiral commanding the Australian Naval Station recommended the establishment of wireless stations on certain points of the Australian coast, and these recommendations were referred to a conference of electrical engineers of the P.M.G.'s Department which sat in Melbourne. They were also considered by the Defence Department, which requested information regarding the arrangements between the Admiralty and the Marconi Company.

On May 30th, 1905, the Telefunken Company offered to establish a wireless communication between Victoria and New Zealand, and between Sydney and Lord Howe and Norfolk Islands. Proposals were also received by the Government between 1902 and 1905 with regard to the Slabys, Lodge-Muirhead, T. E. Clark, Heinicke, De Forest, and Shoemaker Wireless Systems.

PARLIAMENTARY ACTION.

The first parliamentary action with regard to wireless in Australia was taken in October, 1905, when, following similar legislation in Great Britain in 1904, the Federal Parliament passed the Wireless Telegraphy Act, which gave the Commonwealth complete control of wireless activities, with wide powers. The Act remains in force, an amendment having been passed in 1919 embracing wireless telephony as well as telegraphy. Numerous regulations dealing with the licensing of stations, broadcasting, and other phases of wireless have been issued under this Act.

The first land stations in Australia were erected in 1905 at Devonport (Tasmania) and Point Lonsdale (Victoria) by Messrs. Dowsett and Densham, on behalf of the Marconi Company. They carried on communication over a distance of 180 miles. No further steps were taken to develop wireless in Australia until 1907, when a conference comprising representatives of the Commonwealth Defence and Postmaster-General's Departments, together with a representative of the Royal Navy, recommended the immediate establishment of stations at Sydney, Cape York, Port Moresby, and in Torres Straits, with the erection later of stations at Wilson's Promontory (Victoria), Fremantle, Cape Leeuwin (W.A.), Geraldton (W.A.), and on the north coast of Tasmania. In March, 1908, tenders were invited for the installation of stations at Cape York, Thursday Island, Goode Island, Port Moresby, and Fremantle. Five tenders were received, but none were accepted.

In the following year (September 9, 1909) the House of Representatives passed the following resolution, moved by Mr. W. H. Kelly, M.P.:—"That this House is of opinion that wireless telegraphic stations should be immediately established as found desirable round the coasts of Australia, and that our merchant marine should be equipped with wireless installations as an up-to-date means (1) of gaining intelligence of the appearance in Australian waters of a hostile force, and (2) of saving life and property imperilled by accidents upon the sea." Sir John Quick (Postmaster-General) accepted the motion on behalf of the Government, and announced that £10,000 would be placed on the Estimates for wireless telegraphy installations.

THE FIRST TWO EFFICIENT STATIONS.

With this mandate, the Postmaster-General's Department in October, 1909, took the first step towards the installation of efficient, up-to-date stations. The tender of the Australasian Wireless Company (which owned the rights of the Telefunken Company) was accepted for £4,150 for a station at Perth, and £6,150 for a station at Sydney, the site in the latter city being Pennant Hills, which is still used for the purpose, and is destined to become a large wireless centre in the near future—a powerful broadcasting station, a feeder station for the long-distance beam stations, and a coastal station being concentrated in this area.

The Sydney station was opened on August 19, 1912, and the Perth station on September 30, 1912. Both stations were of the "quenched spark" type.

Small experimental stations had previously been erected under licence at Randwick (Sydney) and King Island (Bass Strait) by Father Shaw, who conducted research work and manufactured wireless equipment under the name of the Maritime Wireless Company, afterwards called the Shaw Wireless Company. The King Island station was closed on the introduction of the Government's own commercial system. There was also a station handling commercial traffic at the Hotel Australia, Sydney, operated by the Australasian Wireless Company, under license during 1911 and 1912.

A conference to consider the development of wireless in the Pacific (to which reference is made elsewhere) took place in Melbourne on December 15, 1909, and this had directed additional attention to the subject.

NAVAL WIRELESS SCHEME.

In August, 1910, Admiral Sir Reginald G. Henderson had been asked by the Commonwealth Government to report on Australian Naval Defence, and he included wireless in his report, dated March 1, 1911. He recommended a complete scheme of wireless stations as necessary for Australia from a naval point of view, comprising (a) a system of high-power stations for transmission from the central authority to the fleets at sea; (b) a system of medium-power stations for normal ship to shore communication, and also for commercial purposes.

There were to be three high-power stations capable of transmission day or night over 1,250 miles, to be erected at Sydney, Port Darwin, and Perth. Thirteen medium-power stations were recommended at Thursday Island, Port Moresby, Townsville, Brisbane, Port Stephens, Sydney, Westernport, Port Lincoln, Hobart, Beauty Point, Fremantle, Cone Bay (or other port on the New South Wales coast), and Port Darwin. These stations were to be used for commercial work, and be capable of communication over 500 miles on wave-lengths ranging from 600 to 2,200 metres.

Admiral Henderson recommended that the Commonwealth Government should take control of wireless in Australia into its own hands from the first, and erect and operate all the stations required for public and private purposes, being completely independent, including manufacture and training, the control being invested in a special branch of the Post Office.

FIRST VESSELS EQUIPPED.

The Government had been stimulated to take action by the arrival of steamers from overseas which were equipped with wireless, but were unable to communicate with the mainland because there were no coastal stations. The first merchant ships equipped with wireless to arrive in Australia were the s.s. "Malwa," of the P. and O. Line, the s.s. "Otranto," of the Orient Line, and the s.s. "Bremen," of the Norddeutscher Lloyd. The s.s. "Otranto," in 1911, was able to exchange wireless messages with H.M.S. "Powerful," which was lying in Sydney Harbour, the "Otranto" being 200 miles north-west of Fremantle—a total distance of more than 2,000 miles. This was regarded as a notable achievement at that time. The first Australasian-owned merchant ships equipped with wireless were the s.s. "Riverina," s.s. "Ulimaroa," and s.s. "Zealandia," of the Huddart Parker Line, in 1910. Other Australian inter-State companies, followed, some being equipped by the Australasian Wireless Company, and some by the Marconi Company.

GOVERNMENT ORGANISATION.

In 1911 Mr. E. T. Fisk (now Managing Director of the Amalgamated Wireless Company) came to Australia to represent the Marconi Company's interests in advancing the science of wireless throughout Australasia, and on behalf of the Marconi Company he submitted a proposal for erecting stations in the Commonwealth. Arrangements had in the meantime been made by the Government to commence its own controlling organisation. The late Mr. J. G. Balsillie was brought from England by the Fisher Government and was appointed Engineer for Radiotelegraphy in 1911. Mr. Balsillie advised against the Marconi Company's proposal, and undertook to produce a system which would not infringe the Marconi patents. In collaboration with Father Shaw, he designed apparatus which was manufactured at the Randwick works, employing a spark system with air blast gaps. Action was taken subsequently by the Marconi Company against the Government for infringement of patents, and the matter was compromised by a payment by the Government. A number of stations were erected round the Australian coast, and in Papua, between 1912 and 1914.

THE AMALGAMATED WIRELESS COMPANY.

In 1913 Amalgamated Wireless (Australasia), Limited, was formed, absorbing the Australasian Wireless Company and its rights, and possessing the Australasian rights to the patents of the Marconi Company, England, and associated companies in the United States, France, Germany, and elsewhere. The Company was thus in the fortunate position of possessing the exclusive rights in Australasia to the world's principal wireless devices, and was assured in particular of the close co-operation of the Marconi Company and the benefit of its research and business organisation, without any form of financial or other control. The shareholders were drawn mainly from prominent Australian shipping and commercial firms and individuals, and the Directors were leading Australian business and professional men. The Australian share-

holders have, since the inception of the Company, held a considerable majority of the shares.

Mr. E. T. Fisk was appointed general manager of the company, with a seat on the Board of Directors, and three years later was appointed managing director, a position he still holds.

The company immediately took over the whole of the Australasian marine services, which it rapidly extended, and gradually built up a comprehensive wireless organisation in Australia covering all developments, including manufacture. Since the company was formed, in 1913, it has been the only commercial undertaking in Australia to conduct wireless services of any kind. Its various activities are described elsewhere.

WAR ORGANISATION.

German medium power stations were captured by the Australian Expeditionary Force at Bita Paka (near Rabaul), and at Nauru, in 1914, and are still in operation.

The Wireless Section of the Expeditionary Force was led by Radio-Commander F. G. Cresswell, and the men and equipment were supplied by the Amalgamated Wireless Company. The demand for these men and equipment was made at 8 p.m. on August 8, 1914, and the entire organisation was completed and shipped by 3 a.m.—seven hours later. Two members of the expedition established a station at Noumea, New Caledonia, and maintained a wireless service with Australia, communication having been interrupted owing to the breakdown of the New Caledonian cable. The work done in capturing the German stations and in operating them and others in various parts of the Pacific during the critical early days of the war was of first-class importance.

Additional stations in the mandated territory were built in 1915.

In 1916 the Navy Department assumed control of wireless in Australia from the Postmaster-General's Department, and continued in charge until October, 1920. During the war much valuable work was done by the wireless branch of the Australian Navy. Apart from the work of ensuring efficient communication between warships and intercepting enemy signals, the Department had to arrange for wireless stations on transports, and trained more than 200 operators for this purpose. The ordinary commercial services, through the coastal and ship stations, were continued, with necessary limitations imposed by the war, with the co-operation of the Postmaster-General's Department.

In 1916 the Commonwealth Government purchased the Shaw Wireless works at Randwick, and the Navy Department, which controlled the works, undertook the manufacture of wireless equipment and also electrical apparatus for the Post Office and other Departments.

It may be here mentioned that during the war a large number of wireless operators and considerable quantities of materials were supplied from Australia by the Amalgamated Wireless Company. Ships were equipped, stations were erected in the Pacific, military pack sets were manufactured,

men were recruited from the commercial services and from the ranks of the experimenters and trained for service in the navy, army, air force and transport services. Equipment, manufactured in the Company's Radio-Electro Works, was supplied to India, Japan and other countries which could not be conveniently reached from Great Britain.

A valuable contribution was thus made to the war resources, not only of Australia but of the whole Empire by the Amalgamated Wireless Company which organised most of this work in conjunction with the Naval and Military Authorities. In this and other ways there was provided support for the prediction that Australia would before long become the most important wireless centre in the Pacific.

Although the Amalgamated Wireless Company was restricted in its development on account of the War and the delays which took place with the completion of the Imperial wireless scheme, every effort was made to build up an organisation which would be prepared to deal with the larger problems of world-wide communication when this was made practicable. It gathered round it an efficient staff, kept in close touch with modern inventions, engaged in research and experiment, which included reception from the high-power stations in different parts of the world, and perfected the commercial side of the work. When the time came in 1921 for real progress the Government found at hand an efficient Australian undertaking well-equipped to present practical schemes.

AGREEMENT WITH AMALGAMATED WIRELESS COMPANY.

Co-operation with Government.

As the result of the discussions at the Imperial Conference, 1921, and the information which the Government had obtained with regard to the possibilities and advantages of direct long-distance wireless communication, including the results of successful reception tests in Australia, the Commonwealth Ministry decided to endeavour to arrange for a direct service between Australia and England independently of plans for a complete Empire chain.

Between 1917 and 1921 the Amalgamated Company had made successful tests in reception of daily messages direct from England and other countries, and in 1919 the Commonwealth Government called for expert reports with regard to a high-power Station in Australia for direct communication with England. Among the sites then suggested for a high-power station was Lake Eyre in Central Australia, the location being selected in order to render the station immune from attack.

From its inception the Directors and Staff of the Amalgamated Wireless Company had adopted a progressive, courageous policy, believing that Australia was destined to be the pivot of the Wireless Systems of the Pacific and Indian Oceans. The Company immediately recognised both the possibilities and the importance of direct communication, and it was fortified in its confidence by the remarkable results attained by its own Staff in long-distance reception, and by the technical support of the Marconi and other companies, whose patents it operated.

Undeterred by opposition from many quarters, the Company concentrated

its energies on preparing proposals for a long-distance scheme. So-called "experts" ridiculed the Company's plans, and the pressure against them was almost overwhelming. The Company, however, ultimately had the satisfaction of seeing the opposition withdrawn, and the cogent arguments and practical proposals submitted by Mr. E. T. Fisk on behalf of the Company, which had been challenged so strongly, were subsequently, in the main, accepted.

Without the foresight, initiative, enterprise, bold advocacy and technical progressiveness of the Amalgamated Wireless Company, it is doubtful if the subsequent course of events would have been shaped so satisfactorily.

The Amalgamated Wireless Company, which had been able to secure guarantees from the Marconi Company, submitted proposals to the Government for the erection of high-power stations in England and Australia, the Government to join the company in the enterprise. A proposal on similar lines had been submitted to the Government prior to the Imperial Conference of 1921 and no doubt influenced Mr. Hughes' action at that gathering. The new proposals were subjected to various modifications, and ultimately took the form of a draft agreement which Mr. Hughes submitted to Parliament. He accepted a proposal of Mr. Charlton, Leader of the Opposition, that the details should be referred to a committee, and the House of Representatives and the Senate passed the following resolution on December 9, 1921:—

"That this House approves of the execution by the Prime Minister of the agreement proposed to be made between the Commonwealth and Amalgamated Wireless (Australasia) Ltd., a draft of which has been laid upon the table of the House, subject to investigation and approval, with such alterations as they may deem necessary by a Committee consisting of six members of this House (two nominated by the Prime Minister, two by the Leader of the Opposition, and two by the Leader of the Country Party) and three members of the Senate."

In the course of the debate, all the Party Leaders condemned the Norman Imperial chain scheme, and the general opinion was that, subject to adequate safeguards, the scheme embodied in the agreement presented a far superior alternative.

AGREEMENT SUPPORTED.

In a speech in the House of Representatives on October 5, 1921, in which he discussed the proceedings of the Imperial Conference in a comprehensive review, Mr. Hughes strongly condemned the Norman Scheme, and announced particulars of the scheme submitted by the Amalgamated Wireless Company.

In his speech on December 7, 1921, moving approval of the proposed agreement between the Commonwealth and the Amalgamated Wireless Company, Mr. Hughes provided convincing support for the policy of the Government. He said that it was essential for propaganda purposes that Australia should be able to communicate direct with other countries. He again condemned the Norman Scheme on the grounds of delay and financial loss, and strongly advocated approval of the agreement with the Amalgamated Wireless Company.

Summarising the position, Mr. Hughes stated: "The questions for the

House to consider are these: Are we to accept the Norman Scheme, with its system of relay, and its annual loss of £20,000, on top of which would be the annual loss of £60,000, which the Commonwealth is now incurring and in return get a scheme which will not put us in direct communication with Great Britain, Canada, the United States of America, South Africa and the East. On the other hand, we may secure a scheme in which the Commonwealth will be the principal shareholder, and in which practically all the rest of the shareholders will be Australians domiciled in this country; a scheme which has rights over the Marconi patents, has at its command trained experts, and is managing a profitable business here, in glaring contrast to that which the Commonwealth is managing."

Mr. Charlton, Leader of the Opposition, said: "I agree with the Prime Minister in regard to the discarding of what is known as the Norman Scheme. That scheme was not at all satisfactory, and cannot be compared with that embodied in the agreement before us."

Dr. Earle Page (Leader of the Country Party) said: "I agree with the Prime Minister that the Post Office should not be called upon to handle this matter of dealing with wireless, because we are already showing a loss of about £57,000 per annum on our radio activities, and wireless development is controlled to a large extent by patent rights without which no company could carry on. Of the three proposals before us, the Norman proposition is not worth considering, alongside that which has been submitted by Amalgamated Wireless (Australasia) Limited."

PARLIAMENTARY COMMITTEE'S REPORT.

In accordance with the resolutions passed by both Houses of the Federal Parliament, a representative Select Committee was appointed, comprising Mr. S. M. Bruce (now Prime Minister) as Chairman, Mr. W. G. Gibson (now Postmaster-General), Senator R. V. Wilson (now Minister for Markets and Migration), Brigadier-General Senator E. Drake-Brockman, Senator J. D. Millen, and Messrs. J. A. J. Hunter, G. A. Maxwell, J. H. Catts, and F. Brennan.

The Committee reported on March 17, 1922, that separate proposals were submitted by the Amalgamated Wireless (Australasia) Ltd. and the Radio Communication Company, London. The Committee was unable to recommend the adoption of either of these agreements in the form presented, but recommended the Government to execute an agreement with the Amalgamated Wireless Company in an amended form. This agreement was signed on March 28, 1922.

The Committee had log books containing signals intercepted by operators employed by the Amalgamated Wireless Company at its experimental station at Koo-wee-rup, Victoria, placed before it. These showed the receipt of signals of varying intensity over a period of years during certain hours of the day direct from New York Radio Central, Long Island; Koko Head, Honolulu; San Paolo, Rome; Leafield, England; Carnarvon, Wales; Eiffel Tower, Paris; Bordeaux, France; Nauen, Germany; and other stations.

The first long-distance signals intercepted in Australia by a commercial station were messages exchanged between New York and German stations in August, 1916, which were heard at the Pennant Hills Station, Sydney. These

were verified subsequently by the officer in charge of the New York station. This constituted a record at the time for long-distance reception. The Australian naval wireless service also regularly intercepted messages from the German high-power station at Nauen and other distant stations during the later period of the war. The reception from Nauen reached 2,000 words a day.

Mr. W. M. Hughes, Prime Minister, informed the Committee that the British Press was opposed to the Norman Scheme mainly because it would be controlled by the Post Office, and the Imperial Conference held in June, 1921, was divided on that point. He (Mr. Hughes) was not in favour of the Post Office in England or Australia controlling wireless. The position was quite clear to the British Government, and if Australia insisted on a direct service and erected a station, no obstacles would be placed in the way of the Company erecting and working a similar station in England. If such assurances had not been received it is doubtful if the Committee would have approved the agreement.

PROVISIONS OF AGREEMENT.

The principal provisions of the agreement were as follows:—

(1) The Company to increase its capital to £1,000,000 divided into 1,000,000 shares of £1 each, of which the Commonwealth was to be allotted 500,001.

(2) Seven Directors, three to represent the Commonwealth and three other shareholders, the seventh Director to be selected by a majority vote of the other six.

(3) No action affecting defence or external affairs or the sale of the Company's business or changes in the status, powers, objects or constitution of the Company to be taken without the consent of the Commonwealth expressed through its representatives on the Board of Directors.

(4) The Company not to be a party to any commercial trust or combine but always to remain an independent British business.

(5) Company to construct, maintain, and operate in Australia the necessary stations and equipment for a direct commercial wireless service between Australia and the United Kingdom, including feeder stations.

(6) Rates not to exceed: Full rate 2/- per word, deferred 1/-, week-end 6d. (minimum 10/- per message), Government 1/-, Press 5d., deferred Press 3d.

(7) The Company to arrange for the operation of suitable corresponding stations in the United Kingdom.

(8) Main trunk stations in Australia and the United Kingdom to be provided within two years from the date of the agreement.

(9) Similar station to be provided in Canada within two years.

(10) Company to take over and operate Commonwealth radio stations on certain terms.

(11) Company to enter into an agreement within six months for erection of Canadian and United Kingdom stations. Agreement to contain guarantees approved by the Commonwealth Directors.

(12) Service to comprise a minimum basis of 20 words per minute each way for 12 hours per day for 300 days a year.

(13) In time of war or public danger Company, if required, to hand over control of stations, etc., to Commonwealth.

The agreement was much improved from the point of view of the Government as the result of the scrutiny by the Committee, as more stringent guarantees and safeguards and a closer control by the Government were thereby ensured.

A contract was subsequently made with the Marconi Company for the erection of high-power stations in England and Canada and for the erection of a similar station in Australia at a cost of £487,000. All progress with this work was, however, suspended owing to the refusal of the Imperial Government to grant a licence to the Marconi Company for the erection of a high-power station in England in accordance with its contract with the Amalgamated Company. There was no satisfactory response to the representations by the Commonwealth Government that the Imperial Government should honour its acquiescence in July, 1922, of a contract with the Marconi Company and the announcement by Mr. Bonar Law on March 5, 1923, that the Government would issue licences for communication with the Dominions. A proposal that the Australian Government should itself be licensed was also declined.

THE BEAM AGREEMENT.

As in England, the development of the beam system completely changed the outlook. The Government and the Company were so satisfied with the prospects of the new system and so impatient with the delay that had taken place, that it was resolved to erect a beam station in Australia and trust to events being shaped sufficiently satisfactorily in England to permit of a reciprocal station being erected in that country. The advantages assigned to the new system seemed so overwhelming that the Government had no hesitation in proposing a fresh agreement with the Amalgamated Wireless Company relieving it of such of its obligations under the first agreement as had been rendered impossible by the circumstances in England or unnecessary by the new system.

The view was taken that it was folly to spend £500,000 on a high-power station when far better results could be obtained with an expenditure of one-fourth that amount, with corresponding savings in maintenance and operating charges, resulting from lower power and simpler construction of the station and equipment. The facts that at least double the speed would be obtained with the new system; that the short waves, aided by a choice of direction, would enable communication to be maintained throughout the 24 hours; and that the directed "beam" would permit a far greater element of secrecy in transmission than would be possible with the broadcasted high-power transmission all strongly appealed to the practical minds of Ministers and Directors. The following technical points also impressed them: (1) the utilisation by stations in different parts of the world of the same wave-length without interference; (2) the utilisation of a valuable band of low wave-lengths which could not be used by the high-power station; (3) greater freedom from atmospheric disturbance; (4) greater facility for wireless telephony which is much more difficult with high-power stations; (5) less fluctuation in signal strength.

The only doubt was whether the system had passed the experimental stage. But the high-power scheme was in no better position so far as Aus-

tralia was concerned—indeed, the low power, short wave tests gave far superior results in strength, continuity and period of reception than the high-power long wave tests had done.

Any system must remain experimental until it has been established on a commercial basis with full equipment. The Government preferred to experiment with an expenditure of £150,000 than with an expenditure of £500,000.

On July 24, 1924, Mr. Bruce explained in the House of Representatives the changed position that had arisen, and stated that the British Government advised the Commonwealth to proceed with both high-power and Beam Stations, but it was decided to proceed only with a Beam Station, in view of the advantages above summarised.

A fresh agreement was accordingly concluded between the Company and the Government dated August 20, 1924, subject to ratification by Parliament, which was granted on September 11, 1924. The main terms were that the Company should be relieved from its obligations to arrange for the provision of stations in the United Kingdom and Canada and to arrange the rates, and from its guarantee to provide a wireless service between Australia and the United Kingdom and Canada. The conditions attaching to this relief were that the Company should enter into an agreement for the erection of a main trunk station capable of providing a commercial wireless service with the United Kingdom and Canada when corresponding stations were erected in those countries with a minimum traffic capacity of 21,600 words per day each way for 300 days per year at an estimated capital cost not exceeding £120,000. Such agreement was to contain guarantees similar to those provided in the original agreement.

The Company was given power to charge not more than one-half of the charges specified in the original agreement for its part in the transmitting to and receiving of messages from the United Kingdom.

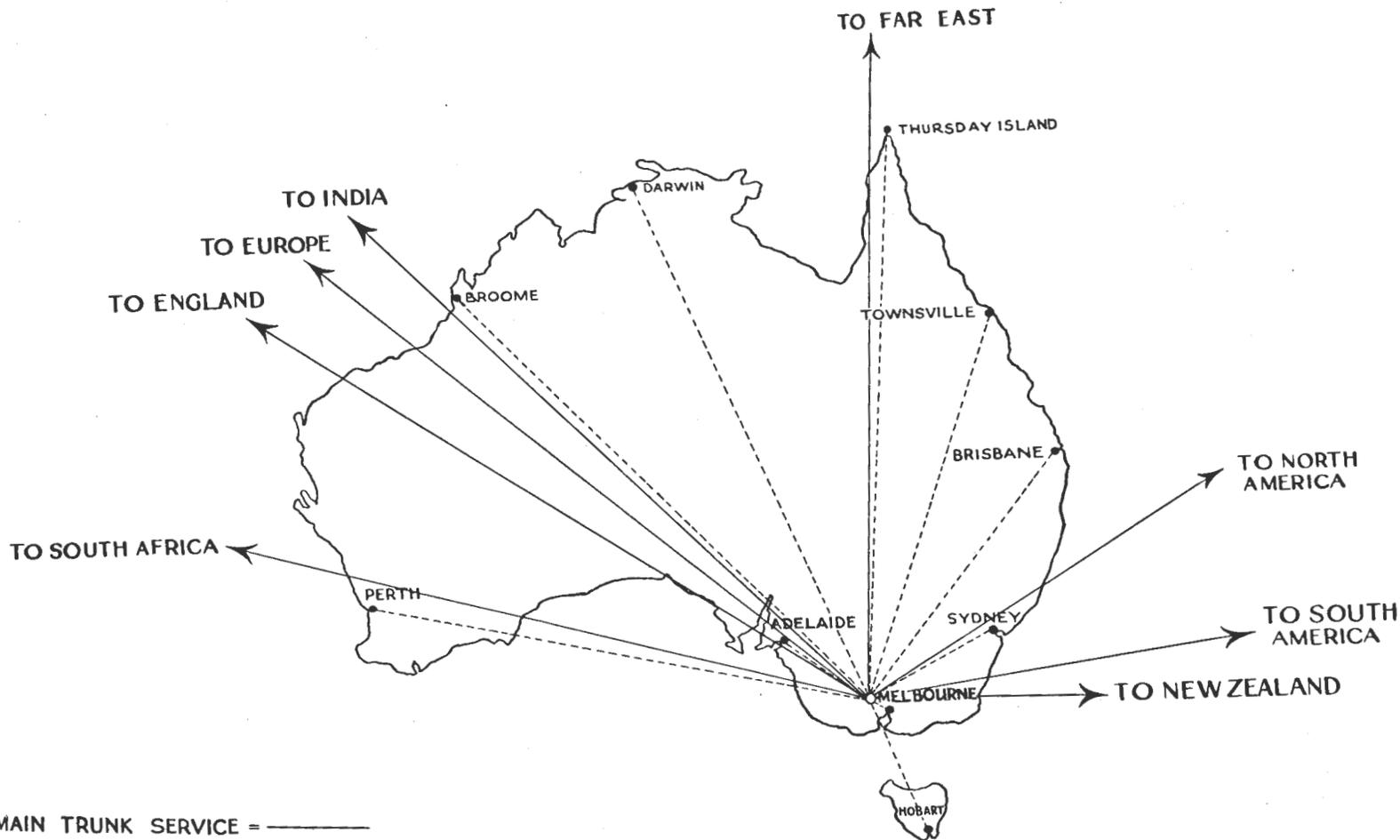
The obligations and powers of the Company were thus confined to the Australian end of the system, leaving arrangements for the reciprocal stations to be completed at a later date. The erection of the Canadian station is now far advanced, and work on the English station has been commenced. Traffic agreements are now being negotiated.

In moving the second reading of the Bill ratifying the revised agreement on August 22, 1924, Mr. Bruce reviewed the position on the lines above indicated in a closely reasoned speech. He referred to the undertaking given at the Imperial Conference, 1921, that no obstacle would be placed in the way of Australia making arrangements for a direct service to Great Britain, and the erection of a reciprocal station there. Reference was also made to the statement made by Mr. Bonar Law in March, 1923, which Mr. Bruce stated "has always been interpreted to mean that the British Government was prepared to alter its policy in regard to the issue of licences to private companies or individuals for the erection of stations for communication with the Dominions."

Opposing the high-power station, Mr. Bruce said: "Such amazing developments have occurred in wireless during the past two or three years that by the time a high-powered station had been erected at a cost of nearly £500,000, it

(23)

would probably be obsolete and useless. The Government is confident that it would be a grave mistake in all the circumstances to involve the country in an expenditure of nearly £500,000, to erect a high-powered station when a beam station will provide an equally satisfactory service at a greatly reduced cost."



MAIN TRUNK SERVICE = —————

FEEDER SERVICE = - - - - -

GENERAL ARRANGEMENT OF
 A COMPLETE WIRELESS SERVICE
 FOR AUSTRALIA

Four Beam Stations in Australia

CONTRACT WITH MARCONI COMPANY.

The Amalgamated Wireless Company on November 28, 1924, accepted the tender of the Marconi Company for the erection of two receiving and two transmitting Beam stations in Australia capable of communicating with England and Canada respectively. On January 13 a contract between the two companies was signed, the purchase price being £119,000, the amount allocated to the stations communicating with England being £75,000, and the amount allocated to the stations communicating with Canada being £44,000. The reason for the difference is that the English stations will be capable of working in two directions, and overhead costs necessary for either one or two stations have been charged against the English station only.

The sites for the stations were provisionally selected in March, 1925, but, owing to legal and other difficulties, possession was not given to the Marconi Company as contractors until the end of April, 1925. The Company, under its contract, undertook to complete the stations within nine months after the sites were made available. The contract date of completion is, therefore, January, 1926, and there is every reason to believe that the contractors will be able to adhere to that date. Material for the masts has already arrived (July, 1925), foundations have been prepared and all the work is proceeding smoothly and well up to schedule.

THE STATION SITES.

The selection of suitable sites required a good deal of careful investigation and experiment. Topography is of greater importance for the Beam stations than for the high-power stations and considerable attention had to be given to the contour of country, climate and other matters, as well as defence considerations. From the points of view of management and volume of traffic, it was decided to choose sites within reasonable distance of either Sydney or Melbourne. Technical and other considerations ultimately favoured the latter city. One factor which had to be considered was the avoidance of unnecessary interference with the system by proximity to mountains or cities. The country contiguous to both the transmitting and receiving stations had to be studied carefully from the standpoint of unimpeded radiations in the direction of both Canada and England. Tests in transmission and reception were made at various possible districts in order to examine the local atmospheric and other conditions.

The Transmitting site was chosen in the parish of Yaloak, county of Grant, Victoria, about six miles South from the town of Ballan and about 50 miles north-west of Melbourne, on the main road between Melbourne and Ballarat and on the main Melbourne-Adelaide railway line. This site comprises about

450 acres and is 1,450 feet above sea-level, well clear of neighbouring hills. Two Transmitting stations are being constructed here for communication with reciprocal stations in England and Canada.

The receiving site chosen is at Rockbank, County of Bourke, Victoria, 15 miles North-West of Melbourne on the Ballarat railway line; and comprises about 450 acres with about 1,500 acres in reserve, 400 feet above the sea-level. Two receiving stations are being erected on this site for reception from England and Canada.

The two sites are 25 miles apart, sufficiently distant for technical purposes, e.g., to permit duplex working, but easily accessible for management.

Both sites satisfied the requirements that they should be flat with a good, clear view, with easy access to main roads and railway systems, and the Commonwealth Government approved the sites from the defence point of view. The areas are sufficiently large to permit expansion in the form of stations capable of communication with the Far East or other parts of the world. The estimated cost of each additional system, comprising a transmitting and receiving station is between £40,000 and £50,000.

WORKING IN TWO DIRECTIONS.

The stations communicating with England will be capable of transmission and reception in two directions across the globe, completing the Great Circle—north-west by way of Malaya, India, Russia and Northern Europe, a distance of 9,381 miles; and south-east (the longer route) by way of Tasmania, the Southern Pacific, the Northern part of South America, and across the Atlantic Ocean, a distance of 12,219 miles. The facility with which this change can be made will greatly extend the possibilities of continuous communication, one direction rather than the other being more suitable during certain hours of the day or night. The aerials and reflectors in each case are being constructed at right angles to the direction of transmission or reception. Both transmitters and receivers have been constructed so that they can work in either direction with a very simple change-over.

MASTS AND AERIALS.

The masts which support and link the aerials and reflectors, though not so numerous or high as the masts used for a high-power station, account for about 10 per cent. of the cost. Each transmitting and receiving station will have three masts 650 feet apart and 250 feet high. They have been constructed of lattice steel and each weighs 50 tons. In all 12 masts will be used for the four stations, the total weight being 600 tons.

Each mast supports at the head a cross-arm of 90 feet in length, and is of square section, consisting of four legs braced together by horizontal and diagonal cross bracings. The masts are designed to carry loads due to the transmitting aerial and reflector system and to withstand a wind pressure of 30 lbs. per square foot. Each mast will be stayed in four directions at right angles. The lower ends of the stays will be connected to anchors buried in

concrete blocks situated at a distance of approximately 110 feet from the base of the mast.

The power generating plant at the transmitting station will comprise three 150 horse-power Diesel engines, one available for the running load, one as a stand-by ready for running, and one in reserve. The size of the transmitting building will be 135,000 cubic feet. The two transmitters will be served by the same plant.

The aerial and reflector for each station will consist of two separate identical systems of insulated vertical wires supported from other wires known as "Triatics" which are stretched between the horizontal cross arms of one mast to another at definite distances apart, depending upon the length of the wave to be transmitted.

The network of wires will be constructed so as to provide the minimum of free movement due to windage. The height of each aerial and reflector will be 200 feet, and 50 wires will be attached to each. The network length will be 1,300 feet. Each aerial and reflector will be parallel throughout the entire length. As they are identical in construction, it will be possible to interchange them easily to permit of a different direction of transmission or reception being used. The aerial will then become the reflector, or vice versa. The direction used will be determined by the aerial which is energised.

If necessary, the system can be altered to broadcasting by putting the reflectors out of operation.

The aerial wires are made of silicon bronze, of very high tensile strength, practically equal to steel, but with similar conductivity to copper.

SOME TECHNICAL POINTS.

The Transmitter comprises a bank of rectifying valves, with 1st and 2nd stage magnifiers and an independent drive unit. Each aerial system is energised from the transmitter by a distributory feeder system with suitable coupling arrangements ensuring correct phasing of the current in each aerial wire being obtained. Each of the 50 wires for each aerial and reflector is separately energised.

An open type of construction is used throughout, glass or porcelain only being used where insulation is required. The magnifiers consist of a number of oscillatory valves coupled to high frequency circuits tuned to the transmitting wave-length. These circuits are arranged to cover a band of wave-lengths up to 100 metres. The independent drive circuit consists of a separate low-power valve oscillator of the desired frequency separately exciting the common grid circuit of the intermediate bank of oscillation valves.

The filament heating of the magnifier and drive is obtained from a battery of cells whose output is regulated within very close limits. The heating of the rectifiers is affected by alternating current transformed to the correct voltage and regulated by means of chokes. The control of the transmitter is effected from a central point at which all the necessary switches for starting and stopping the plant are situated.

The control lines from the central office will run to the control table where the relays for operating the signalling switches will be located. The signalling switches will be electro-magnetically operated close to the oscillatory circuit of the independent drive. The control table will also carry filament voltage rheostats and other controls which permit of adjustment of the transmitter at a distance from the oscillatory circuits.

FIFTY MILLION WORDS A YEAR.

The revised agreement between the Commonwealth Government and the Amalgamated Wireless Company provides for stations each with a duplex traffic capacity of 21,600 words a day compared with 14,400 words a day under the high-power station agreement. Despite this large increase (50 per cent.) the Company succeeded in securing a guarantee from the Marconi Company as contractors of double that capacity in respect of each Beam station (i.e., three times the capacity originally guaranteed for the high-power station). This, for the two stations will total 86,400 words a day in each direction—a daily total of 172,800, or, for the 300 days a year for which transmission is guaranteed, a grand total for the year of 51,840,000 words. This is more than three times the total international traffic carried by the Pacific and Eastern Extension Cables in both directions between Australia and other countries in one year, and six times the guaranteed capacity for the high-power station.

The speed attainable under the Beam system is an important safeguard against any restriction of the hours of working. The guaranteed number of hours per day with the high-power station was 12. The Beam station can send in four hours the number of words that the high-power station was estimated to send in 12. It is, however, not expected that there will be any restriction of the hours of working. With the choice of transmission in one of two directions, a continuous 24 hours' service is practically assured.

So high is the speed attainable under the new system that it is believed even the large figures mentioned above could be exceeded, and that the capacity of the transmission and reception is limited only by the mechanical means employed in handling the traffic. The speed of transmission will, however, be assisted by the utilisation as far as possible of modern automatic appliances such as are used for the most efficiently conducted cable and inland telegraphic traffic. Wireless is not subject to the disabilities of cable transmission whereby the speed is limited according to the length of the cable.

FOUR HUNDRED WORDS A MINUTE.

The actual time of transmission between England and Australia of a wireless signal under the Beam system is estimated at one-fifteenth of a second. The operating speed between the two countries will reach at least 100 words a minute for each station, or 400 words a minute with four messages being handled simultaneously by two stations receiving and two transmitting.

With improvements that are now being tested there is every prospect that this speed will reach as high as 200 words a minute, which would provide an annual capacity of over 100,000,000 words.

FEEDER STATIONS.

"Feeder" stations will be established in each of the other capital cities communicating direct with the main trunk station, and, as the relay will be automatic, there should be little delay compared with the handling of messages originating in Melbourne itself. As the system develops, there will probably be additional feeder stations linking up other parts of the Continent more efficiently and speedily.

DISTANT CONTROL.

As in other countries the transmission and reception will actually be operated from central city offices by distant control. The Company has acquired a capacious building in a central position in the city of Melbourne where high-speed automatic telegraph equipment will be installed, and there the operators will work over the Beam System direct to London and Montreal, and also to the feeder stations in the other capital cities of Australia. The actual transmission and reception will take place in the city office; the work at the transmitting and receiving stations will be automatic only. All that the station staff need do is to keep the plant in working order. The Beam stations will be connected with the city office by ordinary telegraph transmission lines.

Similar conditions will apply in other capital cities. An office in Sydney will receive and deliver messages; and operators in that office will transmit to and receive from the feeder station at Pennant Hills messages for or from overseas handled by the main trunk stations near Melbourne. Each State in this way will have virtually direct connection with England and Canada.

ONE-FOURTH THE COST OF HIGH-POWER STATION.

Comparison between Beam and High-Power Stations in Australia

The following interesting comparisons show some of the advantages of the Beam Station over the high-power station:—

Item.	High-Power.	Beam.
Cost	£487,000	£119,000
Masts: No.	20	3
„ Height, feet	800	250
„ Distance apart, feet	1,600	650
Aerial, Height, feet	750	200
„ Length	6½ miles	1,300 feet
Power: Kilowatts	750	35
Wave-length, metres	24,000	30-40
Speed: Words per minute	20	100
Guaranteed Capacity: Words per annum	8,640,000	51,840,000

Empire Wireless in the Pacific

AUSTRALIAN SCHEMES.

Australia has always been interested, since the discovery of wireless, in developing a chain of stations in the Pacific, in the interests of commerce and the defence of British interests throughout that vast ocean. The preliminary steps taken to provide a network of communication between the island possessions of Germany opened the eyes of Australian statesmen to the dangers as well as the advantages of such facilities.

A CHAIN OF PACIFIC STATIONS.

A Conference to discuss Wireless Telegraphy in the Pacific was held in Melbourne from December 15 to December 21, 1909. Sir John Quick, Postmaster-General of the Commonwealth, presided and there were also present representatives of the Admiralty, New Zealand, Fiji, the Pacific Cable Board and the Commonwealth Naval, Military, Telegraph and External Affairs Departments.

The Conference recommended:—

(1) That high-power wireless stations be provided at or near Sydney; Doubtless Bay, New Zealand; Suva, Fiji; Ocean Island.

(2) That medium-power stations be erected at Tulagi (Solomon Islands), and Vila (New Hebrides).

(Note: All these stations were subsequently erected, although not as part of a concerted scheme.)

(3) That the service be under direct State control.

(4) The cost of the stations at Vila and Tulagi to be borne as to two-thirds by the Imperial Government and one-third by the Commonwealth; the station at Suva: Imperial Government one-third, Australia one-fourth, New Zealand one-sixth, Fiji one-fourth; and the station at Ocean Island: Imperial Government two-thirds, Australia one-third.

The Conference in its report stated that the question of the defence of the British Dominions in the Pacific was of paramount importance. One of the objects sought was the improvement of the means of communication for administrative purposes between the British Protectorates and the Administrations. The advantages to be gained to commerce, distressed shipping and tourist traffic were also mentioned. Communication with French and German possessions in the Pacific was regarded as a desirable outcome of the proposed chain of stations.

The estimated cost of the high-power stations was £12,000 and the medium-power stations £6,000, exclusive of buildings; the total estimate for the four

stations at Fiji, Ocean Island, Solomons and New Hebrides being £42,000 of which it was suggested the Imperial Government should pay £23,334, Australia £12,833, Fiji £3,500 and New Zealand £2,333.

IMPERIAL CONFERENCE, 1911.

The Pacific aspect of Empire wireless was raised at the Imperial Conference in 1911, but the Imperial authorities did not offer much encouragement in this direction. Mr. Samuel, Postmaster-General, depreciated the value of Pacific stations, and said that their commercial value was negligible, and the Admiralty was of opinion that there was little strategic value.

The Australian representatives of the Conference, however, did not allow these statements to pass without comment, and both Mr. Fisher (Prime Minister) and Senator Pearce (Minister of Defence) spoke on the matter. Senator Pearce said: "We trust the Pacific will not be lost sight of in this matter, because it is to be remembered that there are other European countries that possess Colonies in the Pacific, and if the Pacific is to be put out of consideration, it is just possible that those other countries will not throw away their opportunity." Subsequently, after referring to the 1909 Conference, Senator Pearce said: "The point we want to press is that the Pacific should certainly not be overlooked, and we are rather doubtful whether it should be held over pending the completion of the main line of communications."

In later years the Amalgamated Wireless Company elaborated schemes for a comprehensive network of wireless communication throughout the Pacific, linking up all British possessions with central points, having their pivot in Australia. The proposals were laid before the Imperial Communications Committee, but, beyond general approval, little has been done to bring the scheme to maturity, although it is expected that substantial progress will be made when the long distance Australian service is in operation.

IMPERIAL GOVERNMENT'S SUPPORT.

At the Imperial Economic Conference on October 16, 1923, Mr. Bruce said: "It does not appear that wireless in the Pacific is in a particularly satisfactory condition from the point of view of Britain and the Empire generally. If Australia is going forward with this big wireless scheme, it is very possible that we shall be in the position where we may more or less ensure the pre-dominance of the Empire in the Pacific with regard to wireless. I am sure the Conference would desire that we should advance our wireless interests in the Pacific as much as possible, because it would be very valuable from the defence standpoint in time of trouble."

Mr. Amery: "The whole question of the Amalgamated Wireless Company erecting a chain of stations in the Pacific for the use of the Islands has been up before the Imperial Communications Committee. As far as we were concerned, we have blessed it. I think there remains an outstanding question as to how far Fiji can come within the scheme. I may say that generally we are entirely of the same view as Mr. Bruce, and I think the thing is fully in train."

ISLAND RADIO SERVICES.

The system of Island radio services already operated by the Amalgamated Wireless Company indicates the possibilities for the future on a more extensive basis.

Its efficient operation has proved vital to both the administrative system and business interests of the Pacific Islands which are now being served.

The main station near Rabaul, the seat of Government of the Mandated Territory of New Guinea, is now the central Radio Station for all the North-west Pacific Islands. The original German apparatus has been replaced with modern Valve Transmitters and Receivers, with the result that constant and efficient communication is now maintained with Australia and with the outlying islands during the abnormal atmospheric season prevalent in New Guinea during the summer months.

In addition to handling a heavy inter-Island service, the Rabaul Station receives and distributes traffic between Australia and the North and West Pacific Islands, including those of the British Solomons and the Japanese Mandated Territory, the main station of which is at Truk in the Caroline Islands.

In addition to these services the Stations also maintain a Marine Service to and from ships at sea.

The main Island Stations in the North and Western Pacific in July, 1925, were:—

AUSTRALIAN MANDATED TERRITORY OF NEW GUINEA: Bita Paka, near Rabaul, Morobe, Madang, Aitape, Manus, Kaevieng and Kieta (operated by Amalgamated Wireless Company).

BRITISH SOLOMON ISLANDS: Tulagi and Ocean Island (controlled and operated by British High Commissioner for the Western Pacific at Suva).

NAURU: (Controlled and operated by Administrator, Nauru).

JAPANESE MANDATED TERRITORY (CAROLINE ISLANDS): Truk, Ponape, Jaluit, Saipan, Yap, Palao and Angaur Island (controlled and operated by Japanese Government).

FIJI: Suva, Taveuni, Labasa, Savu Savu (all controlled and operated by the High Commissioner).

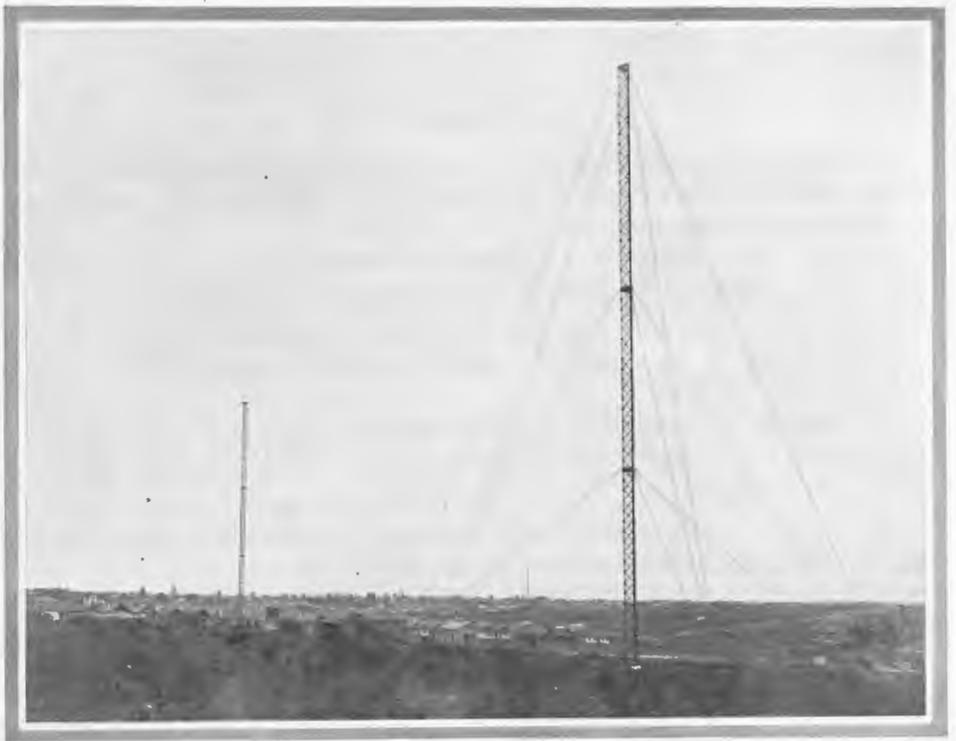
NEW CALEDONIA: Noumea (controlled by the French Government).

NEW HEBRIDES: Port Vila (controlled and operated by the Anglo-French Condominium).

PRIVATE STATIONS: Roviana (Solomon Islands), controlled by High Commissioner, Suva. Operated by Rev. Goldie, Solomon Islands Methodist Mission. Nauru: (telephonic station communicating with Ocean Island, operated by British Phosphate Commission. Tarawa (Gilbert Islands) (controlled by High Commissioner, Suva, operated by Messrs. Burns Philp & Co. Ltd.). Vanikoro (Solomon Islands) (controlled by High Commissioner, Suva, operated by San Cristoval Estates, Tulagi).

The successful results that have been achieved by the Solomon Islands Mission Station at Roviana, and by the Phosphate Commission Station at Nauru have resulted in many planters and traders residing in outlying islands to which there is no regular mail service considering the installation of a wireless telephone set.

Regular telephonic communication has been established between Nauru and Ocean Island (160 miles); between Rabaul and Roviana (360 miles); and communication can be effected between Rabaul and Nauru (1,000 miles).



**200 ft. Steel Lattice Masts at Broadcasting Station 2.FC., Sydney
Erected by A.W.A.**



**5 KW. Transmitter at Broadcasting Station 3.LO., Melbourne
Manufactured by A.W.A.**

Broadcasting in Australia

COVERING A CONTINENT.

Australia is taking full advantage of the benefits to be derived from wireless broadcasting, and can claim to take a place among the pioneers of this spectacular development of the science.

In June, 1920, the Marconi Company gave the first actual broadcast concert from its experimental valve station at Chelmsford, England, and among the artists was the great Australian prima donna, Dame Nellie Melba, whose voice was heard a considerable distance across the Atlantic and in many parts of Europe. The second important broadcasting demonstration was given at the Imperial Press Conference at Ottawa in August, 1920.

In the same month, August, 1920, Mr. E. T. Fisk, Managing Director of the Amalgamated Wireless Company, gave a public demonstration of wireless broadcasting in Sydney to an audience of more than 100 at a meeting of the Royal Society of N.S.W. In October of the same year, he arranged a complete public broadcast concert in the Queen's Hall, Federal Parliament House, Melbourne, to an audience of some hundreds of people. This was the third large public demonstration of broadcasting that had taken place in any part of the world. In January, 1921, a weekly broadcast programme was transmitted from Melbourne by A.W.A., and was heard by experimenters and others at distances up to 1,000 miles.

Discussions subsequently took place with the view of devising a scheme which would be suitable to Australian conditions and be adaptable to the vast territory and sparse and scattered population of the Commonwealth. It was desired that any such scheme should avoid the monopoly which had been granted in Great Britain and the confusion and uncertainty of continuity resulting from free broadcasting in the United States.

THE FIRST BROADCASTING STATIONS.

Regulations on these lines were issued by the Postmaster-General on August 1 1923, and two licences were issued to Broadcasters (Sydney) Limited on October 18, 1923; and to Farmer & Co. Ltd., Sydney, on October 26, 1923. The two stations (2BL and 2FC) were opened for service respectively on November 13 and December 5, 1923. The former company comprised mainly a number of radio dealers, and there was no subscription in cases where receiving sets were purchased from affiliated dealers. The latter company owns a large retail store and charged a subscription of £3 3s. Receiving sets were sealed so as to permit of reception from one broadcasting station only.

A limited number of receiving licences was issued in New South Wales, but, although the broadcasting attained a high standard and insufficient time

had elapsed to enable the system to be tested thoroughly, pressure was brought to bear on the Government, and the regulations were amended.

THE NEW SCHEME.

Finally new regulations were issued on July 17, 1924, which, with minor amendments, form the basis of the scheme now in force. The regulations involved the abolition of the sealed set, and the limitation of broadcasting stations in each State and the principal provisions were as follows:—

- (1) Owners of receiving sets, radio dealers and experimenters to be licensed by the Government;
- (2) Fees to be paid by obtaining licences at post offices based on a zoning system, persons operating receivers near the broadcasting station paying fees higher than those paid by listeners at a greater distance, where the reception might be expected to be less satisfactory;
- (3) Territory in each State placed in three zones at distances round each capital city approximately as follows: Zone 1, up to 250 miles; Zone 2, up to 400 miles; Zone 3, beyond 400 miles;
- (4) Annual fees (as amended in August, 1925) as follows:—

	Zone 1			Zone 2			Zone 3		
	£	s.	d.	£	s.	d.	£	s.	d.
Experimental Licence	1	0	0	0	17	6	0	15	0
Broadcast Listeners' Licences:									
Full year	1	7	6	1	2	6	0	17	6
Half year	0	17	6	0	15	0	0	12	6
Special Licence (hotels, etc.) ..	10	0	0	9	0	0	7	10	0
Temporary Licence (per week)	1	0	0	0	17	6	0	15	0
Dealers	5	0	0	3	0	0	2	0	0

The licence fees for broadcasting stations are £15 for Class "A" and £5 for Class "B."

- (5) Of the revenue obtained from the licence fees the Post Office to retain 5/- for each special and 2/6 for each ordinary broadcast licence, 25% for temporary and dealer's licences, and 10/- for experimental licence. The remainder of the revenue to be available for distribution to the broadcasting companies in the State in which the revenue is collected, subject to a satisfactory programme being given, the authorised power being utilised, and the transmission being efficient.
- (6) Two classes of broadcasting stations to operate, viz.: Class "A" stations in respect of which fees are payable, and Class "B" stations in respect of which no revenue is payable. The Class "A" stations were limited to two in New South Wales and Victoria, one on a power of 5,000 watts and the other on a power of 1,500 watts in each State. The licencees to receive 70% and 30% respectively of the licence fees available for distribution. In the other States only one Class "A" station to be licensed and the whole of the available revenue to be payable to such station.

- (7) Wave-length to be selected from bands available for broadcasting between 250 and 2,000 metres;
- (8) Licencee to guarantee reliable service by £1,000 surety;
- (9) Broadcasting of advertisements from Class "A" stations to be limited to five minutes in duration, 30 minutes in the aggregate in any regular programme and 60 minutes in any 12 consecutive hours.

A NETWORK OF STATIONS.

Up to July, 1925, seven Class "A" stations had been opened; and an eighth was being planned for Hobart. The following is a complete list:—

Station.	Call sign.	Wave-length. Metres.	Date of opening.	Authorised power. Watts.
SYDNEY:				
Farmer & Co. Ltd.	2FC	1100	5/12/'23	5000
Broadcasters (Sydney) Limited . .	2BL	353	13/11/'23	1500
MELBOURNE:				
Broadcasting Co. of Australia . .	3LO	371	13/10/'24	5000
Associated Radio Co.	3AR	484	27/1/'24	1600
ADELAIDE:				
Central Broadcasters Ltd.	5CL	395	14/1/'25	5000
PERTH:				
Westralian Farmers Ltd.	6WF	1250	4/6/'24	5000
BRISBANE:				
Queensland Government	4QG	385	27/7/'25	5000
HOBART:				
Associated Radio Co.	7ZL	417	(projected)	3000

The Amalgamated Wireless Company has manufactured and erected the 5-kilowatt stations at Sydney, Melbourne, and Perth, and is completing a 5-kilowatt station at Adelaide to replace the existing station, while a station is in course of construction for Brisbane. The station equipment, much of which is of a highly technical and specialised character, was made in the Company's works in Sydney, and the excellent workmanship affords a tribute to the skill and efficiency of the Company's staff. The nominal range of these stations is approximately 300 miles by day and 1,000 miles by night. This range has, however, frequently been greatly exceeded, and the programmes of the Sydney and Melbourne stations are heard almost every night in all parts of Australia, New Zealand, and the Pacific Islands, and authentic reports have been obtained of reception in Canada, the United States, and Hong Kong. An operator on board a cargo steamer heard an actress singing at Her Majesty's Theatre, Sydney, when his ship was at Honolulu, about 4,000 miles distant.

The power available in these stations is much higher than that generally used in other countries, the objects being to ensure ample strength at considerable distances from the transmitting centres, thus making it possible for the people "out-back" to listen-in, and also to secure reasonable reception during periods when atmospherics might be troublesome.

The benefits derived by residents in the country districts, especially in remote centres, from the broadcasting programmes have been very great. The entertainment provided has done much to make more pleasant life in the "back-

blocks," and the information with regard to stock and produce markets, weather reports, and other news is invaluable to the men and women on the land. It is expected the number of licences outside the capital cities will grow rapidly as the advantages of broadcasting become more widely known, and relay stations in country districts facilitate wider transmission. The Commonwealth Post Office has offered to make available telephone lines for this purpose during certain hours of the day.

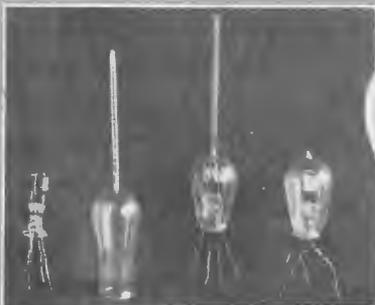
In addition to a high-class musical programme transmitted from special studios, arrangements have been made to broadcast theatrical performances, concerts, public meetings, and church services. In a number of these cases the cordial co-operation of the Postmaster-General's Department in making available suitable telephone lines and in other ways has contributed materially to the success of the transmission. The high quality of the transmission, the excellence of the programmes provided, and the range of reception, place the Australian high-power broadcasting stations on a plane equal to any in the world. The work accomplished is specially noteworthy in view of the special difficulties to be overcome.

Licenses for 12 Class "B" Stations (which are devoted to commercial or propagandist purposes) have already been granted, although they are not all conducting a regular service on the full authorised power, which ranges from 100 to 1,000 watts. Five of these stations are in New South Wales, four in Victoria, two in Queensland, and one in South Australia.

The following show the number of licences issued under the new regulations as at June 30, 1925:—

- (1) Broadcast Listeners' Licences: 61,357 (of which 33,785 are in N.S.W., 19,360 in Victoria, 3,454 in W.A., 3,167 in S.A., 1,076 in Queensland, and 515 in Tasmania).
- (2) Dealers' Licences, 2,044.
- (3) Experimental Licences, 1,085. Grand total, 64,486.

The revenue received from these licences for the year ended 30/6/'25 amounted to £118,308, of which the proportion retained by the Postmaster-General's Department was £18,373.



Valves in Course of Manufacture at the A.W.A. Valve Works, Sydney



Electronic Valve Manufacture at the Valve Works of A.W.A., Sydney

Marine and Coastal Services

CHAIN OF STATIONS ROUND AUSTRALIA.

Reference has already been made to the extensive system of wireless telegraph stations which link up every part of the Australian sea-board with ships at sea, and form the only telegraphic route to many important Pacific territories.

This service comprises 27 stations, all of which are operated by the Amalgamated Wireless Company. In addition to a station in each of the capital cities of Australia, there are four stations on the coast of Western Australia (Broome, Wyndham, Esperance, and Geraldton), three on the Queensland coast (Cooktown, Rockhampton, Townsville), and one at Darwin, Northern Territory. Papua has two stations, one at Port Moresby and the other at Samarai, while there is a station at Thursday Island, off the extreme northern coast of Australia; King Island and Flinders Island, in the Bass Straits; and Willis Islets, off the Queensland coast. There are seven stations in the mandated territory of New Guinea—Rabaul, Aitape, Madang, Morobe, Kieta, Kaeveing, Manus.

All these stations were maintained by the Commonwealth Government until 1922, when under the terms of the agreement with the Amalgamated Wireless Company, they were transferred to that Company.

The primary function of the service is to maintain communication between the mainland and merchant ships going to and from the ports of Australia. The stations are so situated and organised that at any time of the day or night a message from any vessel within 500 miles of the coast receives immediate attention.

Besides the transmission and reception of radiograms, the stations also send out to ships at sea a press news service, navigation reports and warnings, weather forecasts, and time signals.

The Coastal Radio Service gives direct employment to 130 trained Australians, absorbing in salaries and wages £42,000 per annum.

Radiograms can be lodged at any Telegraph Office throughout the Commonwealth.

TWO HUNDRED VESSELS EQUIPPED.

The Marine Wireless Service conducted by the Amalgamated Wireless Company comprises the equipment of modern wireless apparatus, manufactured in its own works, the services of operators, the benefits of its research organisation, the employment of inspectors, who supervise the efficiency of the installation on the ships and the work of the operators, with reciprocal services in other parts of the world.

The inauguration of the Navigation Act on October 1, 1921, introduced additional wireless regulations framed under that Act and in pursuance of the International Convention of 1914, which demand that all ships registered in Australia of 1,600 tons or more registered tonnage, or carrying more than 12 passengers, shall be fitted with an efficient wireless installation. These regulations resulted in a considerable increase in the number of ships fitted with wireless, and nearly 200 ships in the Australian and New Zealand Mercantile Marine are now so equipped.

COMMUNICATION OVER 7,000 MILES.

During 1924 the Company's engineers carried out many experiments in connection with the utilisation of short waves on low power for marine communication. In order to test the effectiveness of this system, a special transmitting set was installed at the Coastal Radio Station, Pennant Hills, near Sydney, and specially designed apparatus installed in the R.M.S. "Niagara." This apparatus incorporated some of the principles of the new short-wave system, but without reflectors.

So successful were the results that the R.M.S. "Niagara" was in touch with Sydney Radio Station regularly throughout the voyage to Vancouver. The advantages accruing by the use of this method are apparent when it is stated that passengers on the R.M.S. "Niagara" were able to communicate with their friends in Australia all the way across the Pacific, at no greater cost than when the vessel was only one day out from Sydney.

The apparatus employed was designed, manufactured, and operated by the engineers of the Amalgamated Wireless Company. The effectiveness and facility of operation of this system were fully demonstrated when one evening Mr. C. H. Hughes, manager of the Union Steamship Company, telephoned a message from his house at Bellevue Hill, Sydney, to the Sydney Radio Station; this message was for the captain of the R.M.S. "Niagara" (which was near Vancouver), and was immediately despatched. The captain's reply came across the Pacific by wireless to Sydney Radio, and then by telephone to Mr. Hughes at his home.

As the distance between Sydney and Vancouver is 7,000 miles, the feat of maintaining communication regularly between Sydney and the R.M.S. "Niagara" until she reached Vancouver constitutes a record in marine wireless communication.

The Canadian wireless station at Estevan Point, Vancouver Island, last year established two-way communication with the s.s. "Tahiti" (fitted with standard equipment) when that vessel was 6,000 miles from San Francisco, en route to Australia. Two-way communication was also established between Estevan and the steamer "Makura," when that vessel was over 6,000 miles from Victoria.

A regular wireless telephone service connecting with ships across the Pacific has been rendered easier of accomplishment by the success attained by these low-power, short-wave experiments.

THE WORLD'S NEWS AT SEA.

"The Wireless News" is published by the Wireless Press, Sydney, an affiliated firm of the Amalgamated Wireless Company, on board several trans-Pacific and inter-colonial steamers.

Special arrangements have been made with the leading press agencies and newspapers in Australia, Fiji, and Canada for the collection and transmission of world-wide news, which is transmitted across the Pacific to ships at sea from the wireless stations at Pennant Hills, Sydney; Suva, Fiji; and Estevan, Vancouver Island. Local ship news and advertisements are also published.

A special budget of Australian news (free of any charge to the shipowners) is also prepared by the Publicity Branch of the Prime Minister's Department, and transmitted nightly by the Coast Stations at Sydney, Perth, and Darwin to ships at sea. This service (which was commenced in June, 1925) is known as the Commonwealth Government News Bulletin, and has been undertaken by co-operation with the Amalgamated Wireless Company.

WIRELESS ON TRAWLERS.

One of the latest developments in wireless in Australia is its application to the trawling industry.

A Sydney trawling company has wireless telephone sets, made by Amalgamated Wireless (Asia), Ltd. installed on two of its trawlers, and the manager of the company can telephone from his office in Sydney to the trawlers.

As a result of being in constant communication with the captains of the trawlers, the manager is able not only to know the location of the ships, but on receipt of advice as to the "catch" is in a position to market a haul of fish almost as soon as it is received on board. This enables him to a large extent to avoid a glut on the market. Besides communication being maintained between the trawler and the head office, speech is made possible between the captains of both vessels, which in case of trawling is invaluable.

The route of the trawlers is generally between Sydney and as far south as Eden, over 225 miles away. The method of operation between headquarters and the trawlers is that the telephone conversation is relayed via the Willoughby Wireless Station of the Amalgamated Wireless Company, where there is a modern transmitting and receiving set.

A demonstration was given recently at the offices of the Company before a number of press representatives. Conversations were held with one of the trawlers, which was about 60 miles down the coast from Sydney. The operator on the trawler was asked a number of questions, and he answered in a voice of amazing clarity. It was a strange sensation to be speaking by telephone to a man miles out at sea.



**5 KW. Broadcasting Transmitting Set in Course of Construction
at Radio-Electric Works of A.W.A.**



**1/2 KW. Broadcasting Transmitters in Course of Manufacture
at Radio-Electric Works of A.W.A.**

Australian Manufacture

WIRELESS EQUIPMENT OF ALL KINDS.

The advantage arising from the establishment in Australia of works for the production of modern wireless apparatus of every type was immediately recognised by the Company. Local manufacture ensured not only direct control over design, quality, cost and deliveries, but permitted the production of apparatus specially designed to suit Australian conditions. Moreover, the experience of the war, when Australia was partially isolated and the importation of wireless equipment was difficult, if not impossible, pointed to national reasons for Australia to become self-contained in this direction.

The utilisation of Australian capital and employment of Australians has served to build up a stable industry which will be invaluable in any emergency in the future.

For many years all the wireless equipment used in the Australasian Mercantile Marine and a large proportion of that needed for wireless stations in the Pacific, has been manufactured in the Company's workshops. During the war a large number of the Company's Australian manufactured wireless sets were installed on vessels built in Japan to the order of the British Government.

During the last two years the demands made on the Company's factory have necessitated large additions, and in order to cope with this, much modern equipment has been installed for the large scale production of wireless apparatus. In order that the factory should be up-to-date, several of the Company's works staff investigated the largest and best plants in England, America, and the Continent, and as a result many improvements of a valuable nature have been effected.

Housed in premises in Knox Street, Sydney, the works are replete with the latest types of automatic turret lathes, screw-cutting machines, power presses, milling and multiple drilling machines, besides a multiplicity of special purpose machines, including coil winding and die-casting machines. Electroplating work is also carried out. The finished products are generally recognised as of unsurpassed workmanship.

The works are now in full operation, and every type of wireless apparatus is manufactured; broadcasting transmitting sets, radio receivers for listening-in, wireless apparatus for use on ship stations, wireless equipment for coast stations, and radio telephone sets for use by settlers in the outlying parts of Australia. Radio receivers are made in several types, from the small crystal set, suitable for use within about twelve miles of the broadcasting station, to the highly finished Sheraton cabinet type, operating without aerial or earth. Direction finders, lifeboat equipment, and almost every modern wireless device is or can be manufactured in the Company's factory.

The Company has pioneered the manufacture in Australia of Electronic Valves. In order that the Company's valve plant should be of the latest type the Company sent abroad a number of its expert staff to study valve manufacture in England and America; as a result of this, of agreements made, and of new plant installed, the Company will not only be able to produce sufficient valves to meet the Australian demand, but in quality its valve products will bear favourable comparison with any.

AUSTRALIAN-TRAINED STAFF.

Few industries with technique so complex and requiring so high a grade of ability have been built up in Australia without the importation of experts from abroad. In this the Company has followed a policy which is probably unique. With the exception of the Managing Director, every member of the Company's staff of 800 employees has been recruited in Australia.

To find men with the necessary technical or commercial training, give them the advantage of specialised experience in the various branches of wireless work, and, wherever possible, follow this up by sending them abroad for overseas experience, is a policy which the Company has found to be entirely successful.

During the last three years a number of the Company's expert staff have visited England, the Continent, and the United States, investigating the latest practice in regard to long-distance wireless stations and broadcasting stations, visiting the large wireless and valve works, and reporting on every phase of modern wireless development. It can, therefore, be truly stated that the Company's staff is thoroughly conversant with the very latest practice and development in regard to all phases of wireless, and that this knowledge is being applied to the expansion of the industry in Australia.

The early opening of the new Beam Station, together with feeder stations in each of the capital cities, will necessitate a staff of expert operators and technical engineers, and in view of this, steps have been taken by the Company to train experienced members of its Australian staff to carry out the necessary functions. A number of these are now abroad gaining experience of the most modern methods in the handling and operation of high-speed international telegraphic traffic.

RESEARCH.

In few industries is the maintenance of an experienced research staff such a necessity as in wireless. The Company's Technical and Research staff is in touch with the latest wireless developments throughout the world, and is thereby in a position to experiment and devise improved methods and to test and adapt to Australian conditions the very latest inventions. A feature of the Technical Department is a well-equipped laboratory.

Some of the most noteworthy and historical events in Australian Wireless have been carried out by Mr. Fisk, with the assistance of the Research staff, and they are responsible for the efficient co-operation given to Senatore Marconi and his assistants, which made possible the epoch-making experiments of telegraphic and telephonic communication between England and Australia. Successful broadcasting demonstrations were given in Australia within a few weeks of the first public tests in England.



Section of A.W.A. Technical and Research Laboratory



Section of Machine Shop, Radio Electric Works of A.W.A.

Inland Wireless

IMPROVED CONDITIONS OUTBACK.

There is an appreciable section of the Australian population living under comparatively isolated conditions, having no telegraph or telephone lines, while postal facilities are meagre.

The difficulties are particularly great in such parts of the Commonwealth as Northern and Central Australia and large areas in Northern Queensland and Western Australia, and the far-west of New South Wales.

The wireless telephone and the wireless telegraph are already proving a wonderful boon to settlers in these remote centres.

Modern apparatus and special research are being applied to the production of equipment designed especially for Australian inland conditions. Several stations of this kind are already in operation, or are being planned, a typical case being Brunette Downs, Northern Territory. An isolated island, Maria Island, off Tasmania, is also greatly benefited in this way. Other stations are in course of construction by Amalgamated Wireless (A/sia), Ltd., for the Commonwealth Post Office at Wave Hill, Northern Territory (400 miles from Darwin, and 1,900 miles from Sydney), and at Camooweal, on the border of Queensland and Northern Territory—550 miles from Darwin, and 1,400 miles from Sydney. The station at Wave Hill will collect messages from private radio stations outback and will communicate with Camooweal, a terminal point of the ordinary telegraph system. Camooweal station will exchange traffic with local private stations and transfer messages for other parts of Australia to the land telegraph system, relaying similar messages locally when received from the land system.

When it is stated that some of the big cattle stations in Northern Australia are one or two weeks' journey from a telegraphic centre by horse or camel, and that as a result it is often a month before a reply can be received even to a telegram, it will be realised how beneficial wireless will be in this Territory.

The proposed wireless system will prove of particular advantage to the producers of cattle and farmers and graziers generally. An example may be cited in the case of the various meat works in operation in Northern Australia. During the killing season the works must be ensured a regular flow of cattle, up to several hundred head per day, depending upon the capacity of the works. At present some of the cattle take weeks to reach their destination, with few opportunities for communication en route. The owner may be entirely ignorant of altered conditions at the meat works which would demand a greater or

smaller supply, or unable to regulate the movements of his stock to the best advantage. Prompt information by wireless will be of incalculable benefit in such cases or in times of drought, when advice regarding shifting of stock and sheep and other particulars, e.g., as to fodder being available, will be invaluable. The men on the land, especially in remote districts, need the most efficient possible intelligence system. Wireless will give them that.

The inland stations will thus act as distributing centres for all points within a radius of 200 miles, and be capable in turn of communicating with the main chain of wireless stations round the coast of Australia.

By this means all isolated points will be brought into communication with one another, and with their nearest towns, through those with the capital cities, and through the capital cities with every part of Australia, with ships at sea, and with the whole world. The advantages to commerce and production are obvious. Australia depends so much on the production of wool, wheat, meat, butter, and fruits that the fullest information regarding state of crops and weather and stock reports, etc., is essential. This will be greatly facilitated by a network of wireless posts in all parts of the continent. The bearing on social life generally and on the provision of medical and nursing assistance and advice, especially in maternity cases, is more important in Australia than in most countries.

By improving the conditions of life in the country districts settlement will be encouraged and a stimulus will be given to migration. The dreaded loneliness of the bush will be no longer a terror.

The erection of feeder stations to the main trunk overseas stations in the various capital cities, and possibly sub-stations in some centres inland, should assist this work of communication through the length and breadth of the Commonwealth.

ADVANTAGES TO THE PRESS.

From the newspaper point of view, the development of an inland wireless service would be very welcome, apart from the question of rates. But the greatest gain to the Press will come from speedy transmission. A wireless service will permit simultaneous transmission of syndicated matter to the recipients in the various States, whereas now separate transmissions are necessary.

Amateur Experiments

The experimental work done by Australian amateur wireless operators ranks with the most successful efforts made by non-professional experimenters in any other part of the world. This work has been encouraged and assisted by the Amalgamated Wireless Company with the view of arousing greater interest in wireless throughout the Commonwealth.

The most interesting examples of the work done by Australian amateurs have been:—

- (1) A series of trans-Pacific tests in 1923, when a large number of American stations were logged.
- (2) Two-way tests with New Zealand in May, 1923.
- (3) Duplex telephone tests in June, 1923.
- (4) Dictaphone reception from America in October, 1923.
- (5) Transmission to America in November, 1923.
- (6) Two-way communication with America and England on low power and short wave lengths in November, 1924.
- (7) Two-way communication with England on a 20-metre wave-length in April and May, 1925.

An interesting experiment was conducted in 1924 with short waves and low power across the Pacific. The Amalgamated Wireless Company constructed and supplied special equipment operated by two amateurs on the steamer "Tahiti," travelling from Sydney to San Francisco. Communication was established up to 5,900 miles.

Police Wireless

As in other parts of the world, Australia is utilising wireless for police purposes, and it has been found very useful by the Police Cars patrolling the city and suburbs of Sydney and Melbourne.

The first installation of this type in Australia was carried out by the A.W. Company in October, 1922, when a Receiving Set was erected on a Patrol Car of the Victorian Police Department. A telephone transmitter was installed at the A.W.A. Company's Radio Station, Melbourne, and the excellent reception results obtained on the car and the success of the installation as an aid to the police in the prevention of crime and in capturing criminals was such that twelve months later the Department purchased two fast cars and had both of these fitted with wireless.

The Victorian Department of Police now propose to instal a transmitting set on the cars in addition to the receiving set, in order that the members of the Patrol Force can telephone Headquarters from the car instead of having to leave the car and use the ordinary telephone for speaking to Headquarters, as was the previous practice. Records show that the average time taken to arrive at the scene of a crime after the receipt of a message is 4.4 minutes. It is hoped, however, with improved apparatus and methods, to halve this period in the near future. The highest motor speed attained for a continuous run was 74 miles per hour in an early morning chase after a suspected car, which was overtaken.

In Sydney the Police Department has one of its Patrol Cars equipped with a receiving set, while transmission is effected from the Company's station at Willoughby. The service has not been in operation long, but the results so far have been a signal success, and it is anticipated that the system will be extended in the near future.

Empire Wireless Chain

DELAY OF FIFTEEN YEARS.

The proposals for linking the various parts of the Empire by wireless have passed through so many vicissitudes that it is almost impossible to trace every phase of the disastrous delays, controversies, inconsistent policies and lack of vision which have prevented this great scheme from attaining fruition since it was first put forward in practical form 15 years ago.

The following record, however, sets out the principal steps in chronological order in the process of evolving the plans now in operation for direct wireless communication within the Empire.

THE FIRST PROPOSAL.

1910.—The construction of an Imperial chain of wireless telegraphy was declared by the Imperial Defence Committee to be a matter of extreme urgency. The Admiralty and War Office concurred in this view.

MARCH 10, 1910.—The Marconi Company submitted proposals to the Colonial Office for the establishment of a network of 18 high-power wireless stations throughout the British Empire. The Government deemed it undesirable that an Imperial chain of this magnitude should be in the hands of a private company, and declined to issue the proposed licences.

APRIL 13, 1911.—The Marconi Company wrote to the Post Office stating the terms on which it would provide a system of State-owned long-distance wireless stations, with the use of the Company's patents.

AUGUST 9, 1911.—The Imperial Wireless Telegraphy Committee appointed by the Government, with the Postmaster-General as Chairman, and including Sir George Reid, as High Commissioner of Australia, met and decided that a chain of stations connecting the United Kingdom with certain portions of the Empire should be established.

JUNE 15, 1911.—Imperial Conference passed resolution (moved by Sir Joseph Ward): "That the great importance of wireless telegraphy for social, commercial and defensive purposes renders it desirable that a chain of British State-owned wireless stations should be established within the Empire."

Mr. (now Sir) Herbert Samuel, Postmaster-General, discussing this motion, said: "In the opinion of the Government of the United Kingdom it is very desirable that a chain of wireless stations should be established within the Empire, partly for strategical and partly for commercial reasons. . . . On general grounds of Imperial defence we consider it very desirable to have such a chain of stations. For commercial reasons also such stations might be

of value. . . . The system of wireless telegraphy may be an effective means of securing or assisting to secure reasonable cable rates, and probably its influence in that direction will grow as years go on. We consider it, therefore, very desirable that such a system should be established. We also think it should be a State-owned system."

Mr. Samuel stated that the suggested first route was, United Kingdom, India, Straits Settlements to Australia and New Zealand. The proposed six stations would be erected in England, Cyprus, Aden, Bombay, Straits Settlements, and Western Australia. Later, South Africa would be connected, via East Africa or West Africa.

The resolution was supported by Mr. Fisher (Prime Minister) and Senator Pearce (Minister of Defence) representing the Commonwealth. Both Ministers indicated that Australia would proceed with its own scheme in any case. Mr. Fisher said: "We are going on, and we cannot stop because of anything being done elsewhere." Senator Pearce strongly urged proceeding with a chain of stations in the Pacific, which had been considered at a conference in Melbourne in 1909.

MARCONI CONTRACT SIGNED.

FEBRUARY 13, 1912.—After long negotiations the Marconi Company submitted a tender for the establishment of six high-power long-distance wireless stations.

Subject to agreed modifications, this was accepted by the Postmaster-General on March 7, and a formal contract was signed on July 19, subject to ratification by Parliament. On October 11, as the result of severe criticism in Parliament and allegations regarding the circumstances in which the agreement was concluded, a Select Committee was appointed to investigate.

JANUARY 14, 1913.—The Select Committee, Sir Albert Spicer, Chairman, reported: "It is a matter of urgency that a chain of Imperial wireless stations should be established." It recommended that the Government should be free to adopt or reject any system, and asked that a technical committee should be appointed to examine the merits of the various systems.

JANUARY 15, 1913.—The Marconi Company wrote to the Government asking to be relieved of the contract of July 19, 1912. The Select Committee reported that as the P.M.G. did not propose to seek to enforce the agreement, it was unnecessary to pursue the inquiry.

JANUARY 23, 1913.—Advisory Committee appointed (Lord Parker, Chairman).

APRIL 30, 1913.—The Advisory Committee reported that it had considered various systems from the point of view of continuous communication day and night over 2,000 or 2,500 miles. The Committee arranged with the Marconi Company for special tests between Clifden (Ireland) and Glace Bay (Canada), a distance of 2,300 miles, and stated: "According to our investigation, the Marconi system is at present the only system of which it can be said with any certainty that it is capable of fulfilling the requirements of the Imperial chain." The Committee favoured the Government undertaking the construction and equipment of the stations with the technical assistance of private enterprise, but recommended that the Government should not be pledged to any one system.

A SECOND AGREEMENT.

JULY 24, 1913.—Negotiations having been reopened with the Marconi Company and a new agreement discussed, Sir (then Mr.) Herbert Samuel, Postmaster-General, stated in the House of Commons that the Government was of opinion that the proposed stations of the Imperial chain should be State-owned and not in the hands of private companies. The erection of such stations would not necessarily preclude the grant of licences to private companies to carry on a competing business along the same routes. He added: "There will be no monopoly. The State will own its own stations, and the State will be able at any time in the future, if it wishes, to license private companies to compete with itself."

JULY 30, 1913.—An agreement was concluded between the Marconi Company and the Post Office for the installation of six stations in England, Egypt, East Africa, South Africa, India, and Singapore, the last-named station being capable of communicating with Australia as well as with India. An Australian station was not specifically provided by the agreement, but a clause stipulated that the chain should be extended to other parts of the Empire if desired. The stations after completion were to be handed over to the Post Office, subject to royalties amounting to 10 per cent. on the gross receipts. The term of the agreement was 28 years, terminable after 18 years, the royalties to cease if the Government used another system not subject to the Marconi patents. Each station was to cost £60,000, a speed of 75 words a minute was guaranteed, and the agreement was not to be binding unless approved by the House of Commons, on or before August 31, 1913.

DECEMBER, 1914.—The Cabinet considered the position of the Imperial stations as affected by the war, decided not to proceed with the Imperial Wireless Chain, and instructed the Postmaster-General (Mr. Hobhouse) to terminate the contract with the Marconi Company. This was done.

MARCH 1, 1915.—Mr. Hobhouse announced in the House of Commons that a considerable amount of work had been carried out in connection with the English and Egyptian stations. The question of proceeding further with the construction of the wireless chain was under consideration.

JULY, 1919.—The Marconi Company, having taken proceedings against the Government for cancelling the contract signed in July, 1913, Mr. Justice Lawrence awarded the Company £590,000 in respect of royalties that would have been earned under the contract.

MARCH, 1915, TO NOVEMBER, 1919.—Apart from the completion of stations in England and Egypt, no progress was made during this period in developing the Empire Wireless scheme.

THE NORMAN REPORT.

Six Relay Stations.

NOVEMBER 24, 1919.—The Imperial Wireless Telegraphy Committee, with Sir Henry Norman as Chairman, appointed "to prepare a complete scheme of Imperial wireless communications in the light of modern science and Imperial needs.

MAY 28, 1920.—The Committee in its report recommended "that a scheme of Imperial wireless communications be established connecting the communities of the Empire by geographical steps of about 2,000 miles." Six valve stations were proposed for a wireless chain connecting England, the Far East, and Australia in England and at Cairo, Poona (India), Singapore, Hong Kong, and Australia. Darwin and Perth were suggested as alternative stations, the distance from Singapore being 2,081 and 2,430 miles respectively. Additional stations were also proposed for East and South Africa. The total capital cost was estimated at £1,243,000, and the annual charges at £425,000. The Australian proportion was estimated at £185,000 and £60,000 respectively. The annual revenue was estimated at £325,000, the Australian share being £40,000. Of the estimated annual loss of £100,000, Australia would be responsible for £20,000. A separate service between England and Canada was also proposed.

The Committee found that no satisfactory commercial wireless service was in operation anywhere over a distance of 2,000 miles, and the report added: "We are convinced that consideration for commercial purposes of lines like those from England to India, from India to Australia, and from Australia to Canada involves far-reaching speculation beyond existing experience."

The Australian Government having requested information regarding the type and power of a station to be situated south of latitude 30° S. for communication with any station south of latitude 30° N., the Committee reported that, taking 6,000 miles as the required radius of such a station, the capital cost would be £356,000, apart from site and residences, and the annual charges £91,000. The Committee added: "The Australian Government would be well-advised, in our opinion, to be content for the next few years, which may well bring striking developments in long-range wireless telegraphy, with the communication from Northern Australia to Singapore by the employment of the valve station we recommend." The same conditions, remarked the Committee, would apply to the construction of a Pacific super-station by the Canadian authorities for communication with Australia. "A satisfactory commercial service between Western Canada and Australia we regard as of such extreme difficulty at the present stage of development as to be beyond practical consideration."

The Committee proposed that the Empire stations should be State-owned, and controlled by a Wireless Commission of four, but that communication with foreign countries should be left to private enterprise.

No representative of Australia or any other Dominion was a member of the Committee, nor was any such representative called as a witness.

OPPOSITION TO RELAY STATIONS.

Opposition to the Norman Committee's report was at once expressed in Australia, mainly on the following grounds: (1) Direct communication had been proved possible, therefore, relays were unnecessary; (2) Australia would be at the end of the chain, and if a breakdown occurred at Singapore or one of the other intermediate stations, Australia would be isolated. (3) In any case there would be delay in communication. (4) There would be objections from the strategic point of view. (5) Australia would be burdened with a heavy annual loss, whereas the direct scheme promised a substantial profit. (6) Other countries had already erected, or planned to erect, high-power stations, with

twice, and even four times, the proposed range of the relay stations, thus showing that the limitation was unnecessary.

AUGUST, 1920.—Imperial Press Conference, Ottawa, Canada. Resolution: "This Conference is strongly of opinion that steps should at once be taken to provide the British Empire and the world with the advantages of wireless telegraphic and telephonic communications, and it urgently requests the Governments of the Empire to secure by public or by full facilities for private enterprise at an early date adequate wireless services throughout the Empire."

DECEMBER 23, 1920.—Wireless Telegraphy Commission appointed with Viscount Milner as Chairman, and Professor W. H. Eccles as Vice-chairman, to decide upon the wireless plant most suitable for carrying out the scheme recommended by the Imperial Wireless Telegraphy Committee, sites, specifications for machinery, and other details.

JANUARY 19, 1921.—The report of the Norman Committee, which was warmly supported by the Post Office, having been adopted by the Government, Mr. Illingworth (Postmaster-General), in reply to a deputation from the Empire Press Union, stated: "The private companies will not be operating in the Dominions and Colonies; that will be a Government service." Lord Riddell remarked: "In the last sentence you have uttered you have said a very momentous thing; you have made a very momentous, if I may say so, historical, statement. You have said within the Dominions the Government is to control the wireless service. Well, that is a fact of the very greatest importance and interest, not only to us but to the whole of the British Empire."

AUSTRALIA'S RESERVATION.

JULY, 1921.—The Conference of Prime Ministers and representatives of the United Kingdom, the Dominions and India passed the following resolution:—

"It is agreed that His Majesty's Government should take steps for the erection of the remaining stations for which they are responsible, as soon as the stations are designed; that the Governments of Australia, the Union of South Africa, and India should take similar action so far as necessary, and that the Governments of Canada and New Zealand should also co-operate."

"The above scheme was accepted by the Prime Minister of the Commonwealth, subject to giving full freedom of action to Australia to decide the method in which Australia will co-operate."

Mr. W. M. Hughes, Prime Minister of Australia, strongly emphasised the importance of wireless communication from the broad Imperial standpoint. He said: "If we are going to have a real voice in foreign policy, then we must have improved communication—means whereby you will be able to communicate quickly with your colleagues overseas and they with you and with each other. That is absolutely essential." Mr. Hughes stated the Australian objections to the Norman relay scheme, and the advantages of direct communication, and made it clear that the Commonwealth Government reserved to itself the right to proceed with its own plans.

JULY 12, 1921.—The Council of the Empire Press Union passed the following resolution: "That this Council is deeply convinced of the necessity of combining Government support with private enterprise and competitive business administration in any world-wide British wireless system, and urges all Govern-

ments within the Empire to co-operate on concerted lines, without further loss of time, to secure improved business and political advantages that will otherwise be obtained by other enterprises."

A memorandum from the Empire Press Union and the Newspaper Proprietors' Association submitted to the Imperial Conference stated that an adequate Empire wireless service from the point of view of the Press "is recognised as an imperative necessity to relieve congested cables and to provide a cheaper channel for news."

A TECHNICAL COMMISSION.

DECEMBER 9, 1921.—Report of Wireless Telegraphy Commission recommended that the transmitting stations in England, Canada, Australia, South Africa, India, and Egypt be equipped with thermionic valve plant, the stations in East Africa, Singapore, and Hong Kong being equipped for combined arc-valve transmission, the thermionic valve plant being added later. Each transmitting station to be capable of working with either of two wave-lengths, it having been found that the best signals at night were obtained by relatively short waves, and the best day signals with long waves. Four masts, each 250 metres high, were recommended for each transmitting station.

For Australia it was recommended that the receiving station should have two aerial systems and three sets of receiving apparatus, with accommodation for a third outfit for direct communication with South Africa. When a station was built at Vancouver additional receiving equipment would be required, and this would also be necessary if the chain station was required to work across the continent of Australia. The Commission was informed that the Australian Government preferred to have the chain station at Perth rather than at Port Darwin.

The Commission referred to the tests from the Marconi Company's station at Carnarvon on November 19 and 20, 1921, with the largest thermionic valve set constructed up to that time. Successful transmission was made to Australia, and Professor Eccles remarked in an explanatory foreword that the fact that the Carnarvon station had succeeded in communicating direct at certain hours of the day showed that it was certain that the chain station in England, which would be of three or four times the signalling strength of the Carnarvon station, could communicate with Australia throughout a longer diurnal period.

MARCH 27, 1922.—The Assistant Postmaster-General (Mr. Pike Pease) stated in the House of Commons that the report of the Commission was sent to the Dominions, and they were invited to consider co-operating in the scheme in accordance with the resolutions of the Imperial Conference, but they had not yet replied. Preparations were, however, proceeding for the construction of the stations for which the Imperial Government was responsible (i.e. relay stations under the Norman scheme).

AUSTRALIAN CONTRACT APPROVED.

JULY, 1922.—The feeling in the Dominions in favour of direct communication rather than the relay system recommended by the Norman Committee had been gradually growing, and recognising that the original scheme would not be

practicable—at all events would not be accepted—the Imperial Government decided:—

(a) The decision of Australia and South Africa to contract with the Marconi Company for the erection of stations to be acquiesced in.

(b) The station in England to communicate with the Dominions to be erected by the Government in accordance with the original scheme, but the size of the station to be approximately doubled.

(c) The station in India to be erected by the Imperial Government and to be transferred to the Indian Government when completed. The Indian Government to repay the cost at some later date.

(d) The station in East Africa and the second station in Egypt to be definitely deferred, and the stations at Singapore and Hong Kong to be reconsidered.

Although the Australian contract with the Marconi Company was specifically approved, no steps were taken to grant the Marconi Company a licence for the erection of the proposed stations.

JULY 13, 1922.—The Postmaster-General (Mr. Kellaway), in the House of Commons, announced the reversal of policy from relay stations over a distance of about 2,000 miles to direct communication over all distances. Control by the Government was, however, to be maintained. He stated:—

“The Government have further considered the question of the Imperial Wireless Chain, and have decided to erect in England a station of the ultimate power contemplated by the Expert Commission, instead of the smaller power which they proposed should be used in the first instance. The Government are advised that this station will provide especially direct commercial communication with India, South Africa, and Australia. In India, the Imperial Government will erect and the Indian Government will work a station also capable of direct communication with England, South Africa, and Australia. As a corollary of this decision, the proposed second station in Egypt, and the station in East Africa will be deferred, and the question of erecting stations at Singapore and Hong Kong will be reconsidered.

“Communication is proceeding with the Union Government as to the station in South Africa, and the experts of the Canadian Government are expected to reach England very shortly in order to discuss the participation of Canada in the scheme.”

LICENCES TO PRIVATE ENTERPRISE

MARCH 5, 1923.—The Prime Minister (Mr. Bonar Law) announced the abandonment of Government monopoly and the issue of licences to private enterprise for communication with the Dominions. He stated:—

“The policy to be adopted with regard to Imperial Wireless communications has recently been under review by the Imperial Communications Committee, under the chairmanship of the First Lord of the Admiralty, and the recommendations of that Committee have now been approved by the Government.

“In view of developments in the science of wireless telegraphy and other circumstances which have arisen since the late Government decided upon the policy of a State-operated

wireless chain, it is not considered necessary any longer to exclude private enterprise from participation in wireless telegraphy within the Empire.

"The Government has, therefore, decided to issue licences for the erection of wireless stations in this country for communication with the Dominions, Colonies, and foreign countries, subject to the conditions necessary to secure British control and suitable arrangements for the working of the traffic.

"At the same time, the Government has decided that it is necessary in the interests of national security that there should be a wireless station in this country capable of communicating with the Dominions, and owned and operated by the State. A station of this kind will, therefore, be erected as early as possible, and it will be available for commercial traffic as well as for service messages."

No licence was granted to the Marconi Company.

JUNE, 1923.—First public announcements regarding Senatore Marconi's tests with small power over great distances.

IMPERIAL ECONOMIC CONFERENCE.

British Government's Plans.

OCTOBER 16, 1923.—Imperial Economic Conference. Sir L. Worthington-Evans, Postmaster-General, confirmed the decision of the British Government (1) to provide a station owned and operated by the Government; (2) to license private companies to provide other stations and conduct services subject to traffic agreements between the Government and the private stations. The Postmaster-General referred to the negotiations with the Marconi Company, and said there were three means of dealing with traffic: (1) unrestricted competition; (2) pooling revenue; (3) regional distribution. Negotiations for pooling having proved abortive, the Government had offered to divide the services on a regional basis, the Marconi Company being granted licences for all foreign countries outside the Continent, and all Dominions and Colonies except Canada and South Africa.

The Hon. G. P. Graham (Canadian Minister of Railways and Canals), referring to the grant of licences to the Marconi Company in Canada, said: "If you were to ask to-day what the policy (i.e., of the Canadian Government) would be, I would say that for the Empire chain it prefers private ownership."

THE RECIPROCAL STATION.

Mr. Bruce, referring to the need for a reciprocal station, said: "We are faced with this difficulty, with regard to the station that we are erecting in Australia, that it was quite useless to put up a high-power station capable of communicating directly with Britain if there was nothing in Britain that could communicate directly with us. We stood out and opposed what is known as the Norman scheme; the chain system of 2,000-mile steps did not appeal to us at all, probably because we were at the end of the chain, and we knew what would happen to our messages when they tried to get through the accumulation"

After referring to the fact that Australia had to make its own arrangements, which necessitated a licence being issued by the British Government, Mr. Bruce added: "The Australian Government never had very serious doubts about the licence being issued, for the reason that at the time when we took exception to the Norman scheme and did not vote in favour of it, the then Prime Minister of Australia specifically asked the question whether Britain would offer us all facilities for establishing our own service, and it was readily said that they would do so. Subsequently to that, and subsequently to our entering into these arrangements, Mr. Bonar Law made a statement in the House which we interpreted to mean that there would be no further trouble with regard to our reciprocal stations being erected here by private enterprise."

OCTOBER 16, 1923.—In reply to a statement by Mr. Bruce to the effect that it was necessary for Australia to make reciprocal arrangements in England, otherwise it was useless to complete the Australian station, Sir L. Worthington-Evans, Postmaster-General, said: "I quite agree, and you can rely on us, as far as we are concerned, not to stand in your way in the very least in the world—on the contrary, we will help you in any way we can."

THE PRESS AND WIRELESS.

OCTOBER 23, 1923.—A representative deputation from the Empire Press Union, introduced by Viscount Burnham, was received by the Imperial Economic Conference. Sir Robert Donald, Chairman of the Council of the Empire Press Union, the principal spokesman, said:—

"If the latest proposal of the Post Office to divide the Empire into two wireless spheres is carried out, the comprehensive world scheme adopted by Australia will be destroyed. The Australian scheme provided for the erection of a station at Vancouver, and another was to be built at Montreal. If the Post Office takes over Canada as part of this division of the Empire the Australian plan falls through, and who will build the necessary stations at Vancouver and Montreal? No doubt the estimates of the Australian Wireless Company were based on the assumption that it would have greater freedom of operation, not only in the Dominions but in foreign countries, so as to take full advantage of the alliances into which the Marconi Company has entered. It is not presumed that the one British high-power station proposed to be erected by the Post Office would adequately serve the Dominions, particularly in regard to news. A group of stations is necessary in order to provide for interruptions and to relieve pressure in one direction.

"The nationalisation of a business still in a state of evolution is not likely to be successful. A Government department will always play for safety. It will not take risks. In this case it will be unable to get the use of the world's latest inventions, and its administration will sterilise the whole business. . . . The cables are entirely inadequate to meet the needs of the Empire. . . . What is wanted, therefore, is not only cheaper rates, but speedy and adequate service. For these means we must look to wireless, to which the future belongs, and find some means of infusing a new spirit into the British Post Office, which has been mainly responsible for stopping progress."

MR. BRUCE'S REVIEW.

NOVEMBER 9, 1921.—Imperial Economic Conference. Mr. Bruce stressed the importance of wireless communication in regard to (1) trade, (2) improved news service, (3) migration, (4) defence, (5) closer consultation on foreign affairs, (6) supplement to cables, (7) dissemination of British news throughout the world. He referred to the fact that the United States of America, France and Germany were ahead of Great Britain in long-distance wireless communication.

On the subject of news, Mr. Bruce said: "If we can provide a greatly increased service of well-selected and interesting news we shall do a great deal towards getting a great unity of thought throughout the Empire. . . . The case made out by the Empire Press Union was a good case, and an unanswerable one. At the present moment the cable service is inadequate, and consequently there must be a very serious limitation of the news that will flow between the different parts of the Empire, unless some action is taken."

With regard to the Australian station, Mr. Bruce stated: "We are committed to this great undertaking, but, owing to differences of opinion with which I have no concern at all, we are faced with the very serious possibility that we shall not have a reciprocal station in Great Britain that will satisfy our requirements. Naturally, therefore, we have to press very very seriously that some settlement of the difficulty must be arrived at to prevent our arrangements with regard to wireless being rendered inoperative, and the whole scheme of Empire wireless development being held up indefinitely."

AN ALARMING POSITION.

Mr. Bruce said he saw the "gravest dangers" with regard to the proposed regional arrangement with the Marconi Company so far as it affected Canada, in view of the Australian scheme including Canada in its range. If only one station was provided for serving Canada and South Africa, a most embarrassing situation might arise. He added:—

"I think the present position is a most alarming one, and it is one for which we have to find some solution. Otherwise the whole of the wireless position of the Empire is going to remain in its present unfortunate state, which is handicapping us as against all the other countries of the world. . . . We went forward with our scheme of direct wireless communications, having been told that as we could not agree to the proposed indirect method, we could find our own method of getting Empire communication. If, after we have gone ahead and involved ourselves in very serious liabilities, we are to be faced with the situation that all we have done has been perfectly useless, I think we have very legitimate grounds of complaint, and we cannot be accused of interference if we press our case strongly. . . . The British Government have decided that they are going to build a station. That is entirely their business, and we have nothing to do with it at all. But, since they have decided to build a station, but have limited themselves to one station, I think, on behalf of Australia, I am entitled to say that there should certainly be licenses issued for other stations to be erected in Great Britain."

Mr. Bruce suggested that a pooling arrangement with the Marconi Company should be possible, failing which the position would be serious. The fullest publicity should be given to the facts, or some impartial authority should be appointed to investigate.

"AN EFFICIENT IMPERIAL SERVICE."

NOVEMBER 9, 1923.—The following resolution (moved by Mr. Bruce) was passed unanimously by the Imperial Economic Conference: "That this Imperial Economic Conference affirms the importance of establishing as quickly as possible an efficient Imperial service of wireless communication, and is of opinion that the several Governments of the Empire should take immediate action to remove any difficulties which are now delaying the accomplishment of this, while providing adequate safeguards against the subordination of public to private interests."

NOVEMBER 15, 1923.—The Postmaster-General (Sir L. Worthington-Evans) confirmed in the House of Commons his statements at the Imperial Economic Conference, and mentioned that he had informed the Marconi Company that he would be ready to grant it a licence, on terms to be agreed, for conducting all Imperial services other than those with Canada and South Africa, which would be conducted through the Government station in England.

MARCH, 1923-JANUARY, 1924.—Negotiations between the Marconi Company and the Postmaster-General for joint control of stations, pooling of profits, and other schemes all abortive.

FEBRUARY, 1924.—First authoritative announcement regarding "Beam" system.

THE DONALD COMMITTEE.

State Control for Dominions.

FEBRUARY 22, 1924.—Report of Imperial Wireless Telegraphy Committee—the sixth special Committee or Commission appointed to consider the subject of the Imperial wireless communication in 12 years. The Chairman was Sir Robert Donald, Chairman of the Council of the Empire Press Union, the other members being Professor W. H. Eccles, Sir Henry H. Slessor (Solicitor-General), Sir D. Drummond Fraser, and Mr. F. J. Brown (Assistant Secretary of the General Post Office). Professor Eccles and Mr. Brown were both members of the Norman Committee. No representative of the Dominions was given a seat on the Committee, and no Dominion was asked to give evidence, nor was the Marconi Company invited to give evidence.

The Committee recommended, *inter alia* :—

(1) The State, through the Post Office, should own and operate all wireless stations in Great Britain for communication with the overseas Dominions, Colonies, Protectorates, and Territories.

(2) An exception was made in the case of Canada, the existing competition to continue.

(3) The Leafeld station should be enlarged, and the new high-power station at Rugby extended to a 16-mast station, a second new station of similar capacity to be erected, a total expenditure of £875,000 being involved.

(4) Each high-power station to be of world range.

(5) Improved business organisation in the Post Office.

(6) Cairo station to be removed from the Empire system when the requirements of the Admiralty were met by other stations, and the proposed new high-power stations in India, South Africa, and Australia were in operation.

(7) Private enterprise to have facilities to develop wireless communication with Continental Europe and the rest of the world outside the British Empire, competition in foreign wireless to be free.

The Committee saw no prospect of success on the lines of the negotiations with the Marconi Company, and, therefore, favoured the only alternative—State ownership. The Committee, however, stated: "The public ownership of all wireless stations in Great Britain on the principle of the telegraphs would be an ideal scheme, which we have not, however, considered. Practice has been in another direction. The pioneer work has been done by private enterprise, and the Marconi Company participates in long distance and in Continental wireless services under conditions which safeguard public interests."

OPPOSITION TO REPORT.

The report of the Donald Committee was not received with favour in Australia. The Commonwealth Government saw no reason to depart from its declared policy of undertaking direct wireless communication between Australia and England in co-operation with the most expert and experienced private enterprise available, and still demanded that the pledges of the Imperial Government that licences would be granted for this purpose should be honoured. The following points also were raised:—

(1) There was no reason to discriminate between one Dominion and another. If Canada was to be permitted to continue wireless communication with England by private enterprise, why not also Australia? If, as the Committee admitted, the Canadian service was satisfactory, the presumption was that a service to Australia would be similarly successful.

(2) The Committee proposed to permit communication with foreign countries by private enterprise. A privilege granted to foreign countries should not be denied to the Dominions. If State ownership had any justification, it was certainly far more necessary, from a national point of view, in communication with foreign countries than in an inter-Empire service.

(3) No financial or technical guarantees of efficiency and continuous service such as had been rigorously stipulated in the Australian agreement with the Marconi Company were announced.

(4) The English station at Rugby was to be used for communication with all the Dominions. The Marconi agreement provided for a station in England operating exclusively, or at all events, in priority with Australia. No other arrangement would be satisfactory to Australia. The speed of messages despatched to Australia would depend, as with the relay scheme, on traffic to other stations, and Australian traffic would have to take its turn with other Empire messages.

(5) Different control and systems would not be conducive to smooth, efficient working. This was regarded as specially important in view of the fact that the Australian scheme included a service to Canada. Under the original proposals there would have been complete harmony, financially and technically, between the three stations. A common plan of operation, in which

the latest devices could be adopted promptly throughout the system was regarded as the most desirable.

(6) Australia preferred to deal with a Company whose technical qualifications and practical experience were unrivalled rather than with a Government Department whose stations the Committee reported to be inefficient and unprofitable, and whose business management was such that the Committee recommended a complete reorganisation. The view was widely held that it was safer to trust the undertaking which had proved its efficiency, powers of organisation and technical excellence. It would be dangerous, it was contended, to risk relations with a Government Department that had demonstrated its unprogressive policy, commercial incapacity and technical inefficiency, and would be subject to Parliamentary control, criticism, and interference in a manner which might seriously prejudice efficient conduct of the service.

(7) The view was taken that Australia was not concerned with the controversies between the British Post Office and the Marconi Company, many of which had no direct connection with Empire Wireless communication at all. The Commonwealth Government had suggested the grant of a licence to itself as a means of overcoming the difficulties, and it was argued that the Imperial authorities could not properly refuse to a Dominion Government what they granted for both wireless and cable communication with foreign countries. The Committee's report, if adopted, would have made this impossible.

APRIL, 1924.—The MacDonald Government adopted the Donald report and appointed a special Committee to recommend a scheme for the business reorganisation of the wireless work of the Post Office which had been proposed by the Donald Committee. The Committee included Viscount Burnham, Sir Robert Donald, and Sir Alfred Mond, all of whom strongly protested against the opposition within the Post Office Department to reforms being effected, and an adequate, independent business organisation being created. The Committee was not reappointed on the advent to power of the present Baldwin Government.

AGREEMENT FOR "BEAM" STATIONS.

MAY, 1924.—The announcement of the success attained by Senatore Marconi's epoch-making experiments with what is now known as the "beam" system altered the whole position. The revolutionary character of the new system—the immense reduction in capital cost of the stations, the lower maintenance charges, the low power, short wave-lengths, comparative secrecy and higher speed of transmission associated with the invention—made it impossible for the Government to proceed with the plans of the Donald Committee, which were immediately abandoned. Whatever claims the Post Office might have had to knowledge of the operation of high-power stations, it certainly had none with regard to the proposed new beam stations. Very wisely, the Government adopted the view that the only practical method was to secure that co-operation with the Marconi Company which it had previously failed to obtain. Negotiations were rapidly conducted, and resulted in a successful issue. Particulars of the system itself and the steps taken to adopt it are given elsewhere.

JULY 28, 1924.—An agreement was signed by the Postmaster-General and the Marconi Company for the erection by the Marconi Company as contrac-

tors for the Post Office of a Beam station (composed of sending and receiving sections) for communication, with a corresponding station in Canada, with provision for extension of similar communication with corresponding stations to South Africa, India, and Australia. Each station was to be completed within 26 weeks from notice to the company that the sites were available. The speed of transmission was to be 100 five-letter words a minute duplex for a daily average of 18 hours. On completion and satisfactory demonstration to the Engineer-in-chief of the Post Office for seven consecutive days, half the cost was to be paid to the company, which would then hand over the station to the Postmaster-General. After satisfactory tests over a period of six months an additional 25% was to be paid, and the final payment was to be made after a second satisfactory testing period of six months. The payments were to comprise the actual cost plus 5% establishment charges and 10% contractors' profit. The maximum cost was fixed at £44,920, or £50,420 if a public electrical supply was not available. Each additional unit was to cost £29,106, or £31,406, according to electrical supply.

The guarantees with regard to the Canadian station are to apply to additional units except that the minimum average daily hours of communication were fixed at: England to Australia, 7 hours; England to South Africa, 11; England to India, 12.

The Post Office is to pay the company a royalty of 6¼% on the gross receipts of the stations so long as Marconi patents essential for the working of the station are employed. The rates to Canada are not to exceed the existing wireless rates, and the rates to other parts of the Empire are not to exceed two-thirds of the cable rates in force at the date of the agreement. Section 19 (1) reads: "The Postmaster-General shall after consultation with the company fix such rates of charge to the public for the sending and receiving of telegrams by means of the Beam station as shall in his opinion be calculated to attract the largest possible volume of traffic with due regard to economic considerations."

Another agreement dealing with technical points was subsequently concluded between the parties.

The English stations for communication with Canada and South Africa are being erected at Bodmin, Cornwall (transmitting site), and Bridgwater, Somerset (receiving site). These sites were handed over to the Marconi Company on April 6, 1925, and according to the contract with the Marconi Company, the stations are to be completed and ready for commercial service by October 7, 1925. The English stations for communication with Australia and India will be erected at Grimsby (transmitting site), and Skegness (receiving site), on the East Coast. These sites were finally selected in July, 1925.

APRIL 9, 1925.—The Postmaster-General (Sir W. Mitchell-Thomson), announced in the House of Commons the establishment of a permanent Imperial Wireless Services Committee, presided over by the Assistant Postmaster-General (Viscount Wolmer), to consider practical details in the working of the service, including, for example, the routing of messages, and tariffs. Sir Joseph Cook (High Commissioner) and Mr. G. Mason Allard (Chairman of Directors of the Amalgamated Wireless Company) were appointed the Australian representatives on the Committee, which held its first meeting on June 21, 1925.

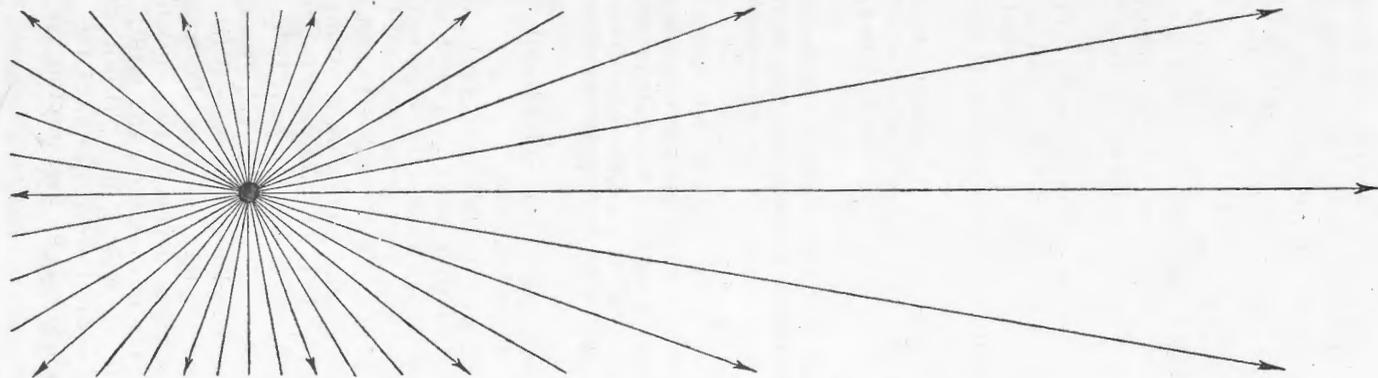


Fig. 1.—Transmitter radiating broadcast.

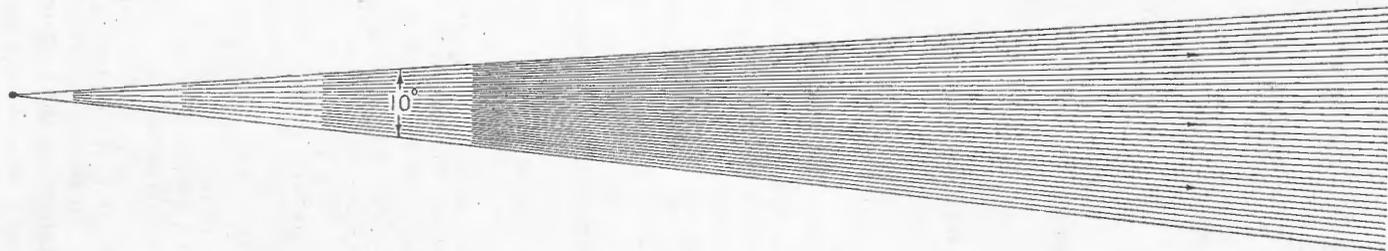


Fig. 1a.—The same transmitter radiating in a beam of 10° . The closeness of the lines in the two diagrams indicates the relative intensity of the wave front.

BEAM SYSTEM

The Beam System:

SENATORE MARCONI'S EXPERIMENTS

Tests With Australia.

The decision of the Commonwealth Government to abandon the proposed high-power station and erect beam stations was almost entirely based on the very emphatic advice of Senatore Marconi as the result of his experiments, supported by the Government's advisers in Australia. This also applies to other Dominions. Senatore Marconi's own account of the tests which led him to the conclusions he ultimately formed are, therefore, of historic interest, for they have been responsible for that development of Imperial wireless communication which is now at last proceeding throughout the Empire.

The first direct wireless telegraph messages transmitted from England to Australia were received by Mr. E. T. Fisk, Managing Director of the Amalgamated Wireless Company, at his experimental station at Wahroonga, Sydney, at 1.15 p.m. and 1.25 p.m. (Sydney time), on September 22, 1918, with apparatus designed and manufactured in Sydney by Mr. Fisk and the staff of the Amalgamated Wireless Company. The messages were transmitted from the Marconi Transatlantic Station at Carnarvon, Wales, and were from Mr. W. M. Hughes, Prime Minister of Australia, and Sir Joseph Cook, High Commissioner.

The first Press message received direct by wireless in Australia from England was received at the Amalgamated Wireless Company's experimental station at Koo-wee-rup, Victoria, in December, 1921, also from Carnarvon.

Wireless Telephonic communication was established between Melbourne and Hobart by officers of the Commonwealth Radio Service in 1921.

The first successful transmission of low power short wave signals from England to Australia took place in January, 1924, from the Marconi station at Poldhu, Cornwall, to Mr. Fisk's experimental station at Vaucluse, Sydney. Wireless telephonic communication was established in May, 1924, between the same stations, and the first transmission of wireless telegraphic signals from Australia to England took place on November 10, 1924.

The signals were first received at the Marconi Company's station at Hendon, near London, and were reported to be clear, steady and strong. They were also received by Messrs. W. J. Martin and F. A. Hunter, and by Mr. F.

Walker, of Walton-on-Thames. Successful reception was reported on subsequent days.

The later experiments are described in the following summaries of Senatore Marconi's two lectures, in which he made public the results of his work:—

SHORT WAVES—LOWER POWER.

In a paper read before the Royal Society of Arts on the 2nd July, 1924, Senatore Marconi, G.C.V.O., L.L.D., D.Sc., a vice-president of the society, gave an account of the experiments undertaken by him over long distances by short-wave directional wireless telegraphy, otherwise known as the beam system. He pointed out that the study of short electrical waves dates from the time of the discovery of electric waves themselves, that is, from the time of the classical experiments of Hertz and his contemporaries, over 30 years ago.

When Senatore Marconi first went to England in 1896, he employed a beam system, with short waves and reflectors. The progress subsequently made with the long wave system was, however, so rapid, comparatively easy, and spectacular, that it diverted research from the short waves. During the War Marconi renewed his experiments with the short waves, and in 1916, in Italy, he conducted a number of tests with the view of minimising interception by the enemy. Between that year and 1922 successful investigations with the beam system were conducted by Marconi and his assistant, Mr. C. S. Franklin. The results were communicated to the scientific world in a paper read by Mr. Franklin before the Institution of Electrical Engineers on the 3rd April, 1922, and in a lecture by Senatore Marconi before a joint meeting of the American Institute of Electrical Engineers and the Institute of Radio Engineers in New York on the 20th June, 1922.

In his paper before the Society of Arts, Senatore Marconi described his more recent experiments with the new system. In April, May, and June, 1923, he carried out a series of long-distance tests between a small experimental transmitting station at Poldhu, in Cornwall, and a receiver installed on his yacht, "Elettra." Marconi and his assistant, Mr. G. A. Mathieu, were on the yacht, and Mr. Franklin was in charge at Poldhu. These tests were conducted under unsatisfactory conditions and with incomplete apparatus, especially at the receiving end. The wave-length used at Poldhu was 97 metres, and the transmitting power was approximately 12 kilowatts, as compared with 24,000 metres and 800 kilowatts in the case of a high-power station. Marconi was able to record the most satisfactory results up to 2,230 nautical miles from Poldhu, the farthest distance the yacht sailed. He pointed out that no receiving reflector could be employed on the yacht, and it was obvious that the strength of the received signals, and the ranges covered must have been considerably less than could have been obtained had it been possible to use a fixed receiving station equipped with a suitable reflector.

FALSE IMPRESSIONS REMOVED.

Marconi pointed out that the following false impressions regarding the behaviour of short waves prevailed amongst most technical experts:—

The FIRST DIRECT
WIRELESS MESSAGES
from
ENGLAND to AUSTRALIA.



The Right Hon.
W.M. Hughes
P.C., K.C., L.D.



The Right Hon.
Sir Joseph Cook
G.C.M.G., P.C.

Form No. 10-100-12/15 Date, Date

AMALGAMATED WIRELESS (Australasia) LIMITED
WIRELESS HOUSE, 97 CLARENCE STREET, SYDNEY, N.S.W.

No. 1. *Wahroonga* OFFICE *Self send 101*
Handed in at *London* *1/15/18*

CHARGES TO PAY

To *Sydney for Publication*

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

W.M. Hughes, Prime Minister

Form No. 10-100-12/15 Date, Date

AMALGAMATED WIRELESS (Australasia) LIMITED
WIRELESS HOUSE, 97 CLARENCE STREET, SYDNEY, N.S.W.

No. 2. *Wahroonga* OFFICE *Self send 101*
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CHARGES TO PAY

To *Sydney for Publication*

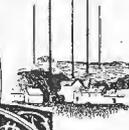
Royal Australian Navy is significantly blaring its part in the great struggle! Spirit of sailors and soldiers alike is beyond praise. Recent hard fighting brilliantly successful but makes reinforcements imperative. Australia badly realizes the wonderful reputation which our men have won. Every effort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

Joseph Cook, Minister for Navy.



Senatore
G. Marconi
G.C.V.O., D.Sc.

Trans-Oceanic Wireless
Transmitting Station



These messages were transmitted by arrangement with Senatore G. Marconi, G.C.V.O., D.Sc. & Godfrey C. Isaacs Esq. Managing Director, Marconi Wireless Telegraph Company, Limited, from the Marconi Transatlantic Station, at Carnarvon, Wales, at 3.15 a.m. & 3.25 a.m. (Greenwich mean time), September 22nd, 1918.

Received instantaneously at 1.15 p.m. & 1.25 p.m. (Sydney time) by Mr. E.T. Fisk, Member Institute of Radio Engineers & Managing Director, Amalgamated Wireless (Australasia) Limited, at his Experimental Wireless Station, Wahroonga, New South Wales, with apparatus designed and manufactured in Sydney by Mr. Fisk and the Staff of Amalgamated Wireless (Australasia) Limited.



Experimental Station
Wahroonga, Sydney



E.T. Fisk Esq.
Receiving the
message shown
above.

- (1) That their range during day-time is variable and short;
- (2) That the night ranges are exceedingly variable and freaky, and altogether too unreliable to allow of the carrying out of commercial work;
- (3) That any considerable area of intervening land or mountains very seriously reduces the distance at which it is possible to communicate.

Marconi disposed of these objections in the following very emphatic and convincing terms:—

“The tests carried out between Poldhu and the ‘Elettra’ proved by the definite results obtained, that the above-mentioned impressions or conclusions must be erroneous, at least in so far as they may concern waves of about 100 metres long, for we observed:—

- “(1) That the day ranges proved to be reliable and not inconsiderable.
- “(2) That the night ranges were much greater than any one, myself included, had anticipated, and no doubt very considerably exceeded the maximum distance to which I was able to proceed with the ‘Elettra.’

“(3) That intervening land and large portions of continents do not present any serious obstacle to the propagation of these waves.”

The transmitting power at Poldhu was gradually reduced from 12 kilowatts to 1 kilowatt, but, according to Marconi, the signals received at St. Vincent, 2,230 miles distant, were still stronger than would have been necessary for the carrying out of commercial work over that distance. Mr. Mathieu calculated that the signals would still have been readable at St. Vincent if the power at Poldhu had been reduced to one-tenth of a kilowatt. Marconi added that the night signals from Poldhu with only 1 kilowatt were much stronger than those received from the Marconi Company's own station at Carnarvon, or from other European or American high-power stations. Marconi summarised his conclusions of this series of tests by stating:—

“The results of these tests were sufficient to convince me that it would be possible to carry out reliable commercial services for a large portion of hours out of the 24 over distances of at least 2,300 nautical miles by utilising only about 1 kilowatt of energy at the transmitting stations, and that the practical range of the system, when using 12 kilowatts, had not even been approached.”

REMARKABLE AUSTRALIAN TESTS.

Marconi, encouraged by this success, proceeded to make tests over greater distances in 1924. Regular transmission was received in America, and in Canada reception was found to be possible for sixteen hours out of the 24. Marconi referred to the successful tests with Australia in the following terms:

“Rather to my surprise, I must admit, Mr. Ernest T. Fisk, the managing director of the Amalgamated Wireless (Australia) Ltd., reported to me that he could receive the Poldhu transmission at his house in Sydney every day perfectly well from 5 to 9 p.m., Greenwich time, and also that he had received them between 6.30 and 8.30 a.m., informing me also that for most of the time the signals were clear, steady, and strong on an improvised receiver con-

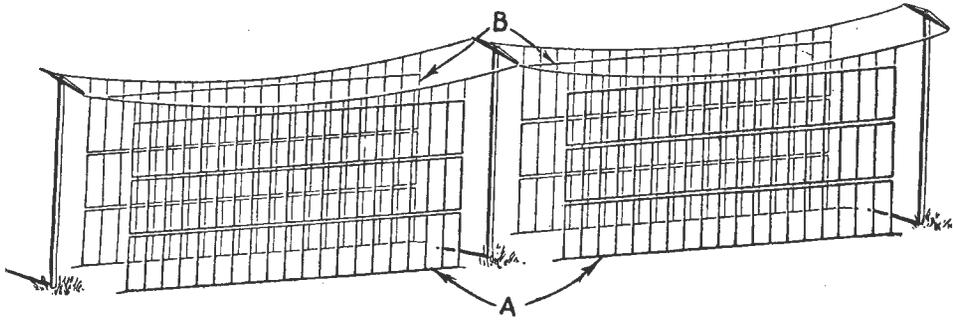
sisting of a two-stage high-frequency tuned plate and grid with one rectification. He also added that he had read every word that was sent, and that the signals were better than those he had yet received from the high-power station at Carnarvon. These experiments with Australia were continued during the month of May, consistently good results being obtained at two receiving stations situated in the vicinity of Sydney. It seems obvious, if we consider the position and altitude of the sun, that during the morning period the waves travelled from England to Australia starting in a westerly direction, across the Atlantic and Pacific Oceans, along the longest route, which is, approximately, 12,219 nautical miles, whilst during the evening period they travelled in an easterly direction over Europe and Asia along the shortest route, which is about 9,381 nautical miles."

SPEAKING TO SYDNEY.

"These results were so encouraging that I was tempted to try a wireless telephony test to Australia. With rather experimental arrangements at Poldhu, intelligible speech was transmitted for the first time in history from England to Sydney, on Friday, the 30th day of May, 1924. For the telephone test to Australia, oil-cooled valves were employed for the main valve and for modulating valves. The wave-length was 92 metres, and an independent drive was employed for controlling the main valves. The total power supplied to the valves was approximately 28 k.w. divided up as follows: 18 to the main valves, 8 to the modulating valves and 2 to the drive valves. No reflector was employed. It was gratifying to all concerned that the experiment succeeded the very first time it was tried, Mr. C. S. Franklin being in charge of the transmitting apparatus at Poldhu, and Mr. Ernest T. Fisk, of the receivers at Sydney. It is also interesting to observe that these extreme distances were obtained without the use of any reflector at either end. The results obtained between England and Australia easily constitute a record for ratio of distance to wave-length for Sydney, by the shortest route, is approximately 189,000 wave-lengths from Poldhu."

Marconi emphasised that, although two features of the new system were employed in the Australian tests—the short wave and low power—another important factor—the reflectors—was not employed, thus making the success of the tests all the more remarkable. He expressed the opinion in his paper that adequately designed reflectors, even if of comparatively moderate size, would enormously increase the effective strength of the signals. This would augment the efficiency of communication, increase the number of hours during which it would be possible to work with very distant countries, and reduce interference. Marconi added that there was no theoretical reason why the speed attained with the short wave should not be a hundred times as great as is possible with the long wave employed by the high-power stations.

In June, 1924, further tests were conducted between Poldhu and Buenos Aires, in the Argentine, a distance of 5,820 nautical miles. At the conclusion of the tests the international committee controlling wireless in the Argentine, stated that the signals from Poldhu, transmitted by the new system, were received at Buenos Aires with such regularity and extraordinary strength as to permit a service being conducted at any speed. The committee also expressed



Beam System Directional Transmitting Aerial
 A—Aerial B—Reflectors

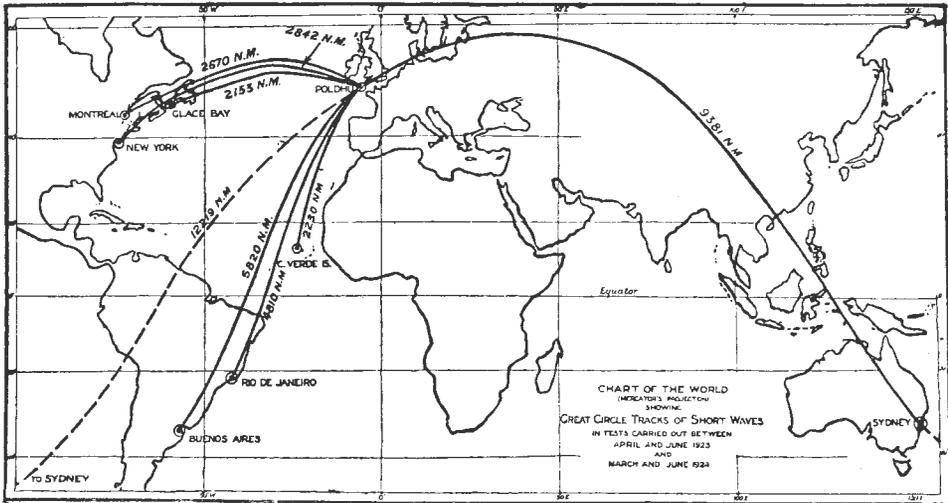


Chart showing Great Circle Tracks of Short Waves.
 Tests carried out between Australia and England

the opinion that the Argentine station should be immediately equipped with the new system, which the committee was confident would handle in six hours more than double the traffic that was handled in 20 hours with the super-power station.

Excellent results were also obtained at Rio, in Brazil.

SPEED, SECRECY, ECONOMY.

In view of these tests, Senatore Marconi concluded as follows:—

“All these results, many of which have greatly exceeded my expectations, convince me that by means of this system, economical and efficient low-power stations can be established, which will maintain direct high-speed services with the most distant parts of the globe during a considerable number of fixed hours per day. I am further of the opinion that by means of these comparatively small stations, a far greater number of words per 24 hours could be transmitted between England, India, and her distant Dominions than would be possible by means of the previously planned powerful and expensive stations. Another particular advantage of this system should not be overlooked. As distant stations situated only within a certain angle or sector of the beam are enabled to receive, this condition brings about a comparative privacy or secrecy of communication unobtainable with any other system of radio communication, and this may prove to be of the greatest importance in war time, besides considerably increasing the number of stations it will be possible to work, by reducing the possibilities of mutual interference between them. The comparative economy in capital cost of these stations, the small amount of electrical power which need be employed, together with the capability of working at very high speeds, should make it possible to bring about a substantial reduction in telegraphic rates. The importance of this to the Empire must be obvious.”

DAYLIGHT EXPERIMENTS.

In a lecture before the Royal Society of Arts on December 11, 1924, Senatore Marconi stated that commencing in August, 1924, he conducted a further series of investigations between Poldhu and the yacht “Elettra,” the object being to endeavour to find means of overcoming the limitation of working hours brought about by daylight, and also to test whether the effect of the reflectors would give the expected increase of signal strength over long distances. Comparative tests on different wave-lengths were carried out for a period of over two months in a variety of places, and all observations went to confirm the fact that for waves between 100 metres and 32 metres the daylight absorption decreased very rapidly with the shortening of wave-length.

Deciding to try further tests over much greater distances, Senatore Marconi in October, 1924, arranged for transmission experiments on a 32-metre wave from Poldhu to specially installed receivers at Montreal, New York, Rio, Buenos Ayres and Sydney. Although the available power utilised at Poldhu was only 12 kilowatts, it was found possible to transmit signals and messages to New York, Rio and Buenos Ayres when the whole of the great circle track separating these places from Poldhu was exposed to daylight.

SUCCESSFUL AUSTRALIAN TESTS.

Senatore Marconi added with regard to the Australian experiments:

"During a complete day transmission at fixed intervals carried out last October with Sydney, New South Wales, that station received the Poldhu signals for 23½ hours out of the 24, and a 48-hour test, which was only completed yesterday (December 10, 1924), fully confirmed this result. The tests from England to places situated south of the equator, such as Sydney, Buenos Ayres, Rio de Janeiro and Cape Town, are particularly interesting for the reason that the waves have always in these cases to traverse what may be called a summer zone, and are, therefore, subjected to an averaging effect of conditions, which can never possibly exist when the transmissions take place only between stations situated in the northern and southern hemispheres.

"During November some successful receiving tests were carried out in England, from a low-power transmitting station in Australia utilising waves of 87 metres. During the present month of December trials have been continued with Canada, the United States, Brazil, the Argentine and Australia and also, for the first time, with Bombay and Karachi in India and Capetown in South Africa. The power utilised at the Poldhu station during all these tests was 15 kilowatts.

"The results have fully confirmed my expectations in regard to the behaviour of the various wave-lengths over such great distances, and I have no doubt that the information gained will render possible the installation of comparatively low-power stations capable of establishing and maintaining commercial services by day and by night between England and the most distant parts of the globe."

REDUCTION OF RATES.

"The low cost of this system both in capital and running expenses, compared with that of the existing type of stations, must prove to be very great, and should bring about the possibility of a reduction in telegraph rates for all long-distance communications, besides making direct communication with some of the smaller outposts of the Empire commercially remunerative."

Contrasting the beam with the high-power stations, Senatore Marconi stated that he was firmly convinced that the Beam stations employing only a small fraction of the power used by the larger station and much lower and fewer masts "will be able to communicate at practically any time with any part of the Empire, and I cannot refrain from expressing my strong personal opinion that these powerful long wave stations will soon be found to be uneconomical and comparatively inefficient in so far as long distance commercial communications are concerned. . . . According to our experience the use of reflectors diminishes fading, and also tends to overcome its effects by enormously increasing the strength, and, therefore, the margin of readability of the received signals."

Amalgamated Wireless (Australasia) Limited

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