WIRELESS INSTITUTE OF AUSTRALIA

NEW SOUTH WALES DIVISION

The 46th General Meeting was held on January 18, at "Wireless House," 97 Clarence Street, Sydney, Mr. E. T. Fisk presiding.

The Minutes of the last General Meeting were read and confirmed.

Mr. H. R. S. Callan was elected a member of the Division.

The next business was a notice of motion which had previously been given by Mr. Wilson:—

"That it is desirable to register this Division of the Wireless Institute of Australia under Section 52 of the Company's Act, 1899 (N.S.W.), with a membership up to 500."

Mr. Wilson, in speaking on his motion, pointed out that registration as proposed would give the Institute a proper status, and although it was only possible to register the N.S.W. Division in this State, there being separate Company's Acts in the other States, it was felt that the other Divisions would appreciate this action and avail themselves of the opportunity of following the example of the New South Wales Division, which they would find much simplified thereby. Furthermore, this Division would be able to hold property such as wireless apparatus, etc., defend the rights of its members and members would only be liable up to the full amount of their subscription should the Division be involved in any litigation and finally the Institute's title would be protected.

Mr. Perry seconded the motion, pointing out several advantages, and mentioned that according to mutual arrangement the several Divisions of the Institute were at liberty to act independently in matters such as this, but that now this matter was before the New South Wales Division the other Divisions were being informed, and it was hoped that they would also act on similar lines.

Mr. Fisk, in supporting the motion, emphasised the importance of the step at the present juncture, as the Institute would at once become a recognised body, and not merely a group of persons without status. He also mentioned that the Aero Club had recently adopted a similar course.

The motion was then put to the meeting and carried unanimously.

Mr. Fisk, in outlining this Division's comprehensive scheme, drew attention to the fact that the whole scheme was again coming before the Council with a view to appointing a committee to carry out all the preliminary work and place the scheme in operation, and now that the control of wireless matters had reverted to the P.M.G.'s Department, it would be submitted to them as a basis of this Division's future operations. All members have already received a copy of the comprehensive scheme showing the proposed zones.

A special cinematograph demonstration on "Direction Finding" was then given by Mr. J. F. Wilson. The film depicted an aeroplane trip from London to Brussels, the three direction finding stations illustrated being situated at Chelmsford, Lowestoft and Pevensey.

During the particular trip indicated by the film, bearings were taken at regular intervals over the entire journey of several hundred miles.

A comprehensive description of the direction finder appears in this issue of our official journal.

At the close of the meeting a hearty vote of thanks was tendered to Mr. Wilson and also to Messrs. Tatham and McIntosh for their very valuable assistance in loaning and preparing the apparatus for the cinematograph demonstration.

The next general meeting of the Division will be held at "Wireless House" on February 8.

"SEA, LAND and AIR"

VOL. III. MARCH 1, 1921. No. 36.

ISLES OF PEARL AND GOLD

BY

FRANK REID.

Islands and reefs and palms—how we all loved them in our school days! How devotedly all the boys, and many of the girls, hoped some day to wander away in a long, low raking ship with many sails, discover pirate hoards, purchase handfuls of pearls for a few yards of gay-coloured cloth, see sharks and flying fish, pick up coral and cocoanuts, and have adventures like we read in the never-to-be-forgotten books by Robert Louis Stevenson and others!

I well remember the day I first met the late Louis Becke in Sydney. I had just returned from my first trip to Fiji, and we spent the best part of an afternoon discussing the early trading days amongst the isles of the South Seas, the notorious trading of firearms and black-birding, and the adventures of that most modern of pirates, "Bully" Hayes. I have visited many islands since those days, but alas, they have changed greatly since, full of boyhood stories, I wandered over coral seas to the climes of "reef and palm." Nowadays no natives flock in canoes to the ship the moment she nears land, to offer pigs, fowls, yams, and all kinds of island produce, in exchange for any trumpery we may give them. A ship is no novelty to them now; even steamers have, in a great measure, lost their charms, and the natives know a great deal better than we do what their property is worth, as we soon find out when we come on shore to deal with them. It is much nearer home, within the Barrier Reef, and amongst the islands in Torres Strait, that we can still find islands where adventure lurks, and where riches lie below the rippling waters. Even at the present time gold is being found on these coral specks, and pearls of great price are still dragged from the waters which wash the shell-strewn beaches.

A few months ago I visited Murray Island, in Torres Strait. Few places in the far north are so strewn with ancient wrecks, and so full of mystery and romance. It was here that the late Frank Jardine, in 1892, driven in from the open seas by a cyclone, came upon a chest of Spanish dollars buried near the beach. From an old Murray Island native Jardine learnt a tradition about the treasure, as handed down from his ancestors.

It was that a ship was wrecked on the reef fringing the island, and that some very dark men came ashore on a raft with a chest of money. They were all murdered by the natives. During the years that passed the chest was forgotten and crumbled with age a few inches below the surface until it was unearthed by Jardine. Later, Captain Dabelle, of the Torres Strait pilot service, found several ancient relics on the island. These included an ancient cannon, old coins, and an old-fashioned hour-glass. The natives of the island tell stories of other ancient Spanish ships which lie in shallow water on the reefs, a few miles from land. However, there is no evidence that these wrecks date from a period earlier than the settlement of Sydney.

About the beginning of the 19th century several Spanish prizes were brought to Sydney, and on the journey one or more of them may have been wrecked in the then unchartered waters of Torres Strait. On the other hand it is quite possible that unknown Spanish navigators may have attempted to sail through the straits with-ships, important developments are likely to occur as soon as the market is favourable.

The maritime strikes have also been held up as a bogey against manufacturers setting up industries in Tasmania because of the supposed difficulty of getting supplies across, but the ability of Tasmanian owners to maintain a service has shattered that contention.

A very important point that seems to be overlooked is that not once during any maritime strike has Tasmania had to close down industries for the want of power; cut off gas or electric light supplies, or to cut out tram, train, or steamboat services as has had to be done in the mainland States. The main reason is that the Tasmanian Government's hydro-electric scheme makes most of the enterprises independent of coal; it supplies the power for the tram services; it lights thousands of houses and business places, and in many cases supplies the heat for cooking and other domestic purposes. If the trains or other concerns run short of Newcastle coal Tasmanian coal and firewood are in superabundance to take its place. During the strike, apart from an ample cargo service, several small passenger steamers have been kept busily employed in the 215 to 277 miles trip between Victoria and Tasmanian northern ports; the Union Company has kept the large passenger steamers *Manuka* and *Moeraki* running between Sydney and Hobart, and the Eastern and Australian S.S. Company has sent two large passenger steamers across from Melbourne to Hobart and thence on to Sydney.

Although Tasmania's losses during a maritime strike are inconsiderable in comparison with mainland losses occasioned by the throwing of so many thousands of people out of work, these industrial upheavals are likely to lead to important developments. They might encourage the State Government to place at least one fast passenger steamer in the trade between Melbourne and a northern Tasmanian port. Possibly, they will hasten also the building of 30 odd miles of railway from Launceston to Beauty Point or Bell Bay, some six miles inside the River Tamar, to connect with the steamer services. Very great pressure by press and public is being brought upon the State Government to launch out in this direction, and some important development is bound to come, if not immediately in the near future.

There is also some hope of inducing the Commonwealth Government to enlarge the provision in the Orient Mail contract, now under review, regarding the calling of the Company's steamers at Hobart. Under the contract entered into in 1910, which was to have a currency of ten years, it was provided that six Orient liners should call at Hobart from February to May unless it could be shown that a loss would result. These steamers called ostensibly to load apples for the United Kingdom, and came from Sydney en route to Melbourne. The proposal now is that they should commence calling in November instead of February, coinciding with the opening of the tourist season; that they should call both en route from Melbourne to Sydney and Sydney to Melbourne. This would enable the Company to issue round tour tickets for the whole of the Commonwealth, as every State would be linked up. As Tasmania, through taxation, is paying its share of all Commonwealth expenditure this is considered a fair proposition. Such a service would not, of course, be to the advantage of Tasmania only. The number of passengers who travel between the Australian States and Tasmania in the course of a year is 50,000; the Orient steamers would also find considerable cargo to bring from the United Kingdom to Hobart, and also to load for London before the apple season. The Tasmanian dairying industry, for instance, is making rapid progress, and at the present time there are 600 tons of butter waiting shipment to the United Kingdom. This development in the export of butter is of recent growth, and bids fair to become an important industry. If the Orient Company cannot see its way to send its steamers to Hobart earlier in the tourist season desired efforts will be made to induce some other Company to do so. The traffic is there and only wants catering for. If the private shipping companies do not rise to the occasion the public will force the hands of the Tasmanian Government, as there is determination that the tourist traffic shall be developed to its highest pitch.

THE PRACTICAL APPLICATION OF THE TRIODE VALVE IN RADIO COMMUNICATION

[Paper read before Section A, Australasian Association for the Advancement of Science, University of Melbourne, on the 12th January, 1921.]

BY

E. T. FISK

Member of the Institute of Radio Engineers.

Prior to the war very little or no use was made of the Triode Valve in radio communication, but the demands to meet special conditions which arose during the war have brought this wonderful instrument out of the seclusion of the laboratory into practical application. The great possibilities of the valve for wireless reception were immediately recognised, with the result that many of our foremost wireless engineers and experimenters applied themselves strenuously to its development.

This technical work, together with the experience gained in practice, in a very short time brought the valve to a foremost position and far ahead of any other instrument used in wireless communication. I think it is quite safe and true to say that no other instrument devised or used at any stage in the development of this art has produced such astonishing efficiency, and no other has offered or does offer anything approaching the possibilities of this wonderful instrument.

Since Professor Laby has given a very complete description of the fundamental principles of the operation of the Electronic Valve, I will at once proceed to describe those aspects of the valve with which I am able to gain a closer acquaintance in the course of my work; that is its practical use in radio communication.

The earliest application of the Electronic Valve in radio communication was with the two-electrode valve properly known as the "Fleming Valve." This instrument, with its valuable rectifying properties, enabled it to be used in the ordinary way to operate an integrating detector for wireless signals, and in this form the original Fleming Valve had a degree of sensitiveness equal to, if not slightly better than, the best crystal detector.

It fell to my lot to use and exhibit the first commercial Fleming Valve receiving installation seen in Australia. That was in July, 1910, when I came here on a special mission for the Marconi Company to demonstrate the extreme range possibilities of their standard ship installation as applied on the voyage between London and Australia. On this the standard equipment was supplemented by a Marconi Fleming Valve Receiver, with which I am pleased to say record distances were established throughout the voyage.

The first extensive use of the three-electrode valve was its application in England and elsewhere in 1915 for the tapping of enemy wireless communications. In the early stages this valve was used more as a detector than an amplifier, although its amplifying properties were taken advantage of, but not of course to the extent in which they are used to-day. Following this, developments were so rapid that it would be difficult and probably unprofitable to undertake the labour of tracing the actual sequence of events. One of the greatest advances was the development, in conjunction with the valve, of its relay or amplifying qualities, a development which, like many other valve affairs, has become involved in a number of conflicting names particularly applied to the circuits devised for producing amplifications.

These circuits have been variously known as Retroactive, Reactive, Negative Resistance, Regenerative, etc. The general principle of this was foreshadowed as far back as 1913 in two German specifications, one of which described re-amplification of ships, important developments are likely to occur as soon as the market is favourable.

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These circuits have been variously known as Retroactive, Reactive, Negative Resistance, Regenerative, etc. The general principle of this was foreshadowed as far back as 1913 in two German specifications, one of which described re-amplification of rectified currents at audible frequency, and the other described re-amplification of oscillatory currents. There was also a method of circuits patented by Franklin in 1913 for "means of obtaining any desired decrement down to practically Zero." Franklin's invention differed from the others from the fact that he used the properties of the valve as a generator of oscillations and he arranged his circuits so that the oscillations generated locally by the valve could be superimposed in correct phase on the incoming oscillations. In other words, Franklin's invention, which appears to be of considerable importance, enabled the incoming oscillations to release the energy from the local battery in such quantity, frequency and phase as to

Two Watt Valve Transmitter, Manufactured by Amalgamated Wireless (Australasia) Ltd.

reinforce themselves, and the coupling between the primary oscillating circuit and the reinforcing circuit was brought to an optimum value where the reinforcing exactly counteracted the decrement caused by resistance and reradiation.

Another important practical application of the valve in receiving circuits is the facility which it offers for use in cascade. For some time cascade amplification was limited to its employment for current at audible frequencies because of the cumbersome arrangement of tuned oscillatory circuits for each valve which were necessary for amplification at radio frequencies and the extreme difficulty of maintaining such an arrangement in correct adjustment. Cascade amplification at audible frequencies suffered from no such limitations because it could be arranged quite easily with small iron-cored transformers of quite convenient dimensions. Cascade amplification at audible frequency, however, was usually limited to two extra valves, that is to a three-valve receiver, because of the tendency of the valves and their associated circuits to establish undesirable self-generated currents at varying frequencies, and thus to set up a phenomenon usually known as "howling." This howling was very difficult to prevent, but with care in the arrangement of circuits, the selection of transformers and the location or distribution of apparatus, I have found it possible to operate as many as ten valves in cascade at audible frequencies. In this particular direction I and my experimental staff in Sydney did a great amount of more or less original work in 1918, when we were experimenting for the reception of test signals from the Marconi Trans-Atlantic station at Carnarvon, in Wales. It was at this period that our receiver, known as the "Expanse Type 103," which is now widely used in Australasian ships and coast stations, was developed.

The difficulty with cascade amplification at radio frequencies has been effectively overcome by the recent work of some of the best experimenters, among the foremost of whom I might mention H. J. Round. The solution, broadly speaking, lay in devising a method of coupling the cascaded valves which would permit the transfer of potentials from the plate circuit of one valve to the grid circuit of the next, preferably at a higher value, in such a way that the oscillation frequency was faithfully reproduced and that for the frequency employed the coupling circuits offered a practical minimum of impedence.

An early solution was the insertion of a high resistance in the plate circuit across which the grid and filament of the next valve were connected so that the considerable potential drop across the resistance was effective for the next grid. Although this was a partial solution it was far from ideal because of its unsuitability for short wave lengths.

The next stage was the construction of transformers, wound with high resistance wire, but in such a manner that they had a more or less pronounced natural frequency in themselves, and the selection of such transformers to suit wave lengths or frequencies to be received. The resonance point of these transformers is fairly well defined, but the curve falls away steadily on either side so that they have a useful range of elasticity.

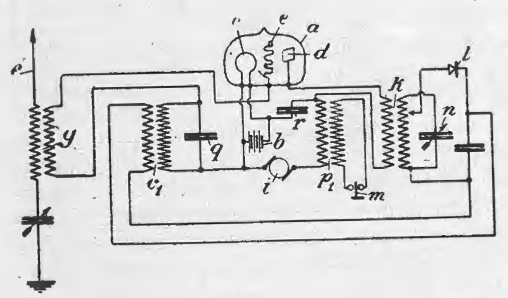
So far the references in this paper have been confined to the use of the valve in connection with the reception, translation and amplification of radio impulses, and before leaving this phase of the subject reference should be made to the possibilities of using the valve as a current-limiting device. In this particular application the valve is useful for the limitation of atmospheric disturbances and for the limitation of the strength of signals from interfering stations. The broad principle applied for this limitation is the variable nature of the filament-plate current characteristic and its control by grid potentials.

It is well known, of course, that this characteristic varies in sympathy with any condition which affects the quantity or quality of the electronic stream from the filament. The most important conditions of this variation are filament temperature, potential gradient between plate and filament, and potential gradient between grid and filament, while in addition to these the characteristic is subject to a variation which depends upon the degree of exhaustion or the nature of the gas contained within the valve.

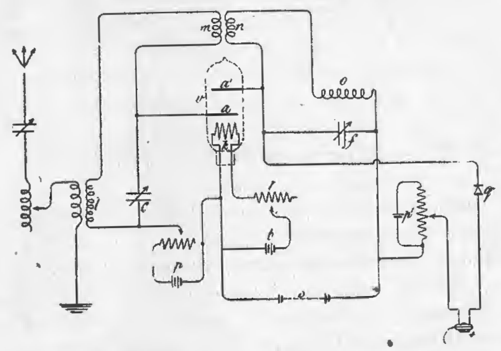
Several methods of employing this limiting quality have been devised and used, and one or two of the more prominent will be described later. The limiting principle was employed very successfully by me and my assistants in our series of experiments at Wahroonga, N.S.W., when working for the reception of signals from the Marconi Trans-Atlantic station at Carnarvon. In this case we had neither time nor suitable opportunity to thoroughly investigate the subject, but we found that when using a number of valves in cascade for audio frequency amplification, very effective limitation could be obtained empirically by simply adjusting the brilliance of each individual filament. This was so effective when using 7, 8 and 10 valves, that test messages from Carnarvon, which were otherwise quite undecipherable when atmospheric conditions were bad, could be copied with comparatively small difficulty.

The use of the Triode Valve for wireless transmission is due, as everyone here will realise, to its self-generating properties and its practical application to the transmitting circuit of the same methods and circuits as are used for regenerative reception. Any Triode Valve which can be employed for receiving and amplifying dealing here with the purely physical properties of the Triode Valves, this is a suitable point at which to emphasise its remarkable elasticity in oscillation frequency and consequently in wave length. There is no other generator of any type, even including the alternator, which can so readily adapt itself to such a wide range of frequencies. Another unique and important point is the facility with which the Triode Valve can be employed in radio telephony, and, apart from the combination of Alexanderson's alternator and magnetic amplifier, no other form of generator can be said to be so readily applicable to radio telephony.

It is authoritatively claimed that to obtain a given current in any aerial the ratio of power put into a valve to that put into an arc is approximately as 2 is to 5, and it is generally agreed that the valve provides much greater freedom than any other generator, with the exception of the Alexanderson alternator, from the genera-



Circuit Device by Wilhelm Schlomlich and Otto Von Bronk, for Regeneration of Audio Frequencies.



C. S. Franklin's Circuit for Reducing Decrement.

can be used with equal facility as a generator of oscillations for transmission.

Apart from the high frequency alternator, the great possibilities of which are only beginning to be appreciated, the valve is the nearest approach yet made in the art to a perfect generator of radio frequency oscillations. It is a long way in advance of any of the other forms of generator both in efficiency and utility. It lends itself more readily than any other form of generator to low and medium power work, and it is being rapidly developed for use on high powers. It is safe to say that the time is not far distant when signals from a valve generator in Europe will be received in Australia. Although I am not tion of harmonics, and in this direction it lends itself particularly to highly selective working both in radio-telegraphy and radio-telephony.

Other practical advantages of the valve for radio transmission are its adaptability for parallel operation so that large aggregate powers can be readily controlled through small power units; this provides particularly for facility in high speed telegraph transmission as well as microphonic control for telephony, while it is particularly adaptable for interruption of the signalling load, thus avoiding the difficulty of the arc system which operates necessarily with two wave lengths, one for signalling and one for spacing.

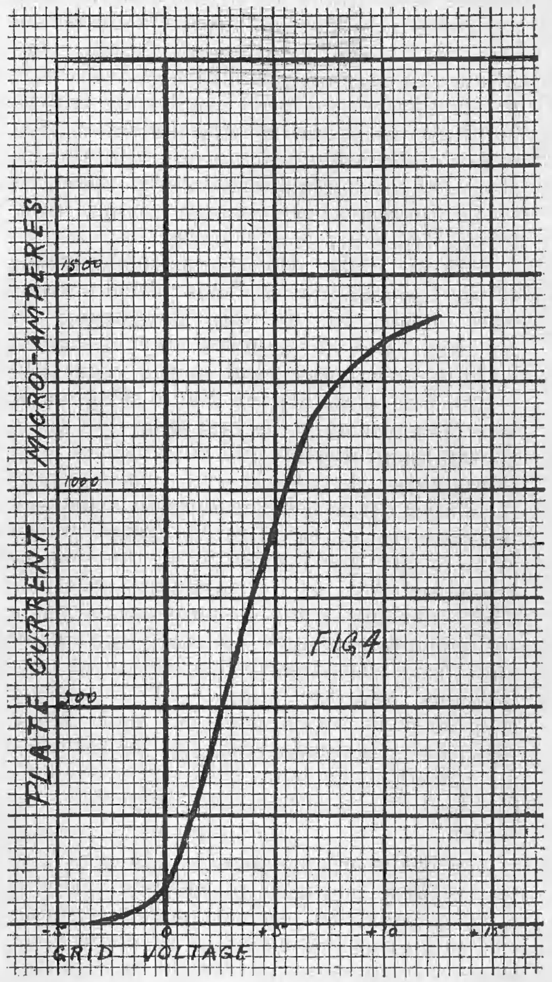
Some time ago we designed and constructed in Sydney a valve transmitter which gave excellent speech and music transmission over a distance of 20 miles and good telegraphic communication over a distance of 70 miles in broad daylight, using a maximum power at the transmitter of two watts. A larger type of transmitter made at our works in Sydney, using a maximum power, including the filament energy, of 50 watts, gave speech communication in daylight over 100 miles at sea and telegraphic communication in daylight up to a distance of 600 miles. In the case of the telephonic communication the reception was by means of a Marconi 7-valve amplifier and in the case of the telegraphic communication the reception was by means of the "Expense Type 103" Magnifying Receiver.

More recently we have made a series of tests for the Marconi ½-K.W. Radio Telephone Equipment. With these very loud speech communication has been obtained by my assistants in daylight between Bendigo and Melbourne. In this case the communication was 100 miles overland with a high land elevation of 2,000 feet between the stations.

Having covered the broad principles of practical application in radio communication, I now propose to deal more specifically with some of the more important and better known circuits and arrangements.

The earliest practical circuit employed in conjunction with an electronic valve was that patented in 1907 by Marconi, in which he shows the use of a transformer, coupling the plate circuit of the Fleming 2-electrode valve to the circuit of an indicating instrument. It is interesting to gather from this specification that the transformer originally used in this manner consisted of a 10 in. spark coal with its secondary proper used as the valve transformer primary and the coil primary being connected to the recording instrument. This arrangement had some importance at the time of its introduction, because it made the valve practically useful with an ordinary galvanometer or low resistance telephone receiver.

In the earlier applications of the Triode Valve it was employed as an amplifier for damped wave signals, and the best known arrangement for that purpose in the earlier stages was the use of a single valve to amplify the incoming oscillations with the



Characteristic Grid Voltage, Plate Current Curve of a Valve Showing Bend With Zero Potential on the Grid.

plate circuit coupled to a circuit containing a crystal detector for rectification.

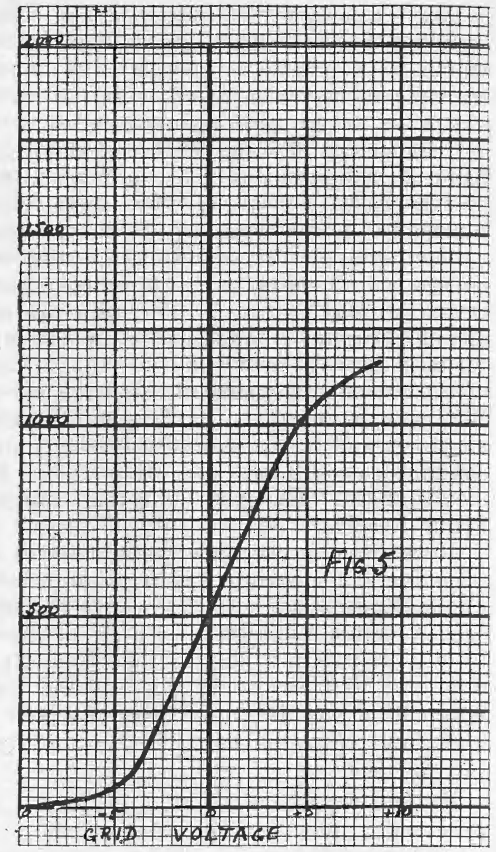
The arrangements patented in 1913 by Von Bronk and Arco, in Germany, consisted in the one case of valve amplification and crystal rectification with the rectified audible frequency impulses relayed back on to the grid circuit of the valve and there used for re-amplification, and in the other case the important reactive and regenerative principles of the valve were described.

The circuit devised by Franklin, of England, for reducing the decrement consisted substantially of a means whereby the amplified impulses in the plate circuit were impressed on the aerial circuit with a degree of coupling so adjusted as to keep the valve approaching, but not actually on, the point of self oscillation. In this condition a degree of instability existed which in its effects produced results equivalent be those suggested by the inventor, *viz.*, negative decrement, or, to put it more concisely, the incoming oscillations appeared to be incremented through being reinforced from the local battery.

Several elaborations and combinations of the fundamental methods just described were made by E. H. Armstrong in America, and these were ably described by him in a paper read in the year 1915 before the Institute of Radio Engineers. This was probably the first time that these particular properties and circuits had been thoroughly described, and consequently the paper attracted considerable attention, particularly in the United States, where even to-day many circuits of this nature are referred to as "Armstrong Circuits." There are numerous elaborations of these fundamental circuits in use, and many more have been described in technical publications, and the number of interesting combinations which can be made along these lines is very great, but so far they all appear to be more the products of individual choice rather than progressive research.

The early arrangement in which a crystal rectifier was used in conjunction with a valve amplifier was at once recognised in practice as something of a compromise, because it appeared at least to be imposing the limitations of an earlier and less efficient type of detector upon something far superior to itself. It is not possible without careful searching, and it is probably inessential for the purpose of this paper to state which of the two methods now well known and widely used was first in overcoming the above-mentioned limitation.

One of these methods is to choose a valve having such a characteristic that the bend in its grid voltage plate current curve appears with zero potential on the grid or the more usual and convenient method of impressing a small auxiliary potential on the grid so as to operate the valve at the lower bend of its characteristic curve. It will be quite evident that when this is done a positive charge on the grid will produce a large increase of plate-current, while the negative charge on the grid would produce substantially no effect. By



Characteristic Grid Voltage, Plate Current Curve of a Valve Requiring a Negative Grid Potential so as to Operate the Valve as a Detector at a Lower Point on the Curve.

this means we get a cumulative increase in the plate-current existing for the duration of the wave train.

The other well-known method is by the use of what is termed "a grid condenser," the commonly accepted theory of which is as follows:—

A small capacity condenser placed in series with the grid will accumulate a negative charge on its grid side from the Cathode stream and consequently the grid produces a sort of valve action by reason of this accumulated charge. Upon the arrival of an incoming oscillation that half of the cycle which would impose a positive charge on the grid produces no effect in the valve since it is neutralised by the Cathode stream, while the other half-cycle which increases the negative charge on the grid immediately reduces the flow

in the plate-circuit. It is possible, however, that the locally collected negative charge of the grid may be sufficiently great to apparently stop the action of the valve altogether; this occurs to a greater or lesser degree in various types of valves. In the case of a soft or gaseous valve this charge usually does not grow to a high value as a result of ionisation through the agency of the positive charges of the gaseous molecules, but this favourable condition does not exist, or if it exists at all its degree is inappreciable in a hard valve. Since modern practice principally favours the use of hard valves, it is necessary to employ a method of overcoming this minor difficulty. This is achieved by what is generally known as the "grid leak," consisting merely of a high resistance non-inductive shunt having a value in megohms around the grid condenser, and it will be obvious that this shunt permits a steady leakage of the accumulated negative charge.

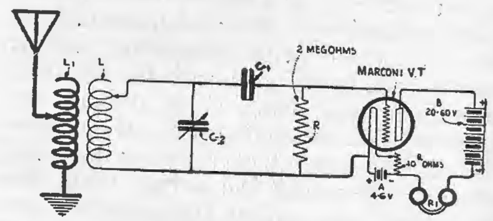


Diagram Illustrating Application of Grid Condenser "C" and Grid Leak "R" to Three Electrode Valve to Obtain Maximum Rectification.

In the application of limiting devices the more general method consists in adjusting one or more of the conditions which govern the valve characteristic. The method used empirically at Wahroonga, N.S.W., and briefly referred to in an earlier portion of this paper, consisted in adjusting the brilliance of the filaments of the valves; by this means the saturation point for the particular applied plate voltage was roughly brought down to correspond with the maximum effect of the signals which it was desired to receive. Theoretically this should reduce all other signals or disturbances, which in themselves were stronger than the desired signals, to an equal strength with those required, and in practice it appeared to work out fairly successfully because it enabled us to read messages which otherwise were indecipherable through the severe atmospheric disturbances. The practical result, however, did not correspond exactly with what might be theoretically expected, because on the few occasions when considerably more powerful signals were received on the same wave length the desired signals were interfered with. Another limiting method applying essentially the same principle is one well known on the later types of Marconi Cascade Amplifiers. This consists of applying a variable static potential to the grid of the last valve. Theoretically this should produce the same result as the foregoing and in practice the two appear to be equal.

A very interesting method of limiting, described in an English patent by F. P. Swann, consists in so adjusting and connecting the valve that it has what the inventor calls "a rising and falling characteristic." In other words, there is a point on the characteristic curve beyond which, instead of having no amplification as in the ordinary curve, it begins to fall away again towards zero. Theoretically this should be a perfect limiting device, because if such an arrangement were adjusted so that the desired signals operated the valve up to the peak of its characteristic, any impulses or signals of greater strength would be rendered weaker in effect than those with which they might otherwise interfere.

Another interesting method described by Pupin and Armstrong in America, consists in the introduction of very high resistance in the receiving aerial circuit and a correspondingly high resistance in the secondary, or valve, circuit. The valve is caused to generate oscillations at a frequency equal to that of the signals to be received and to superimpose these oscillations on the antennae with sufficient strength to practically overcome the loss produced by the auxiliary resistance. The effect of this resistance, therefore, theoretically disappears at that frequency, but the effect continues for all impulses at different frequencies. This, of course, is more in the nature of a selective rather than of a limiting device.

Although many different designs have appeared from time to time for valves, the practice in radio communication to-day is principally confined to a few well-known types. In England the valve most largely used now is known as the "Marconi V.24," which is particularly efficient and reliable for cascade amplification. Another well-known type of valve in England is the Marconi Q. Valve, which is a remarkably good amplifier and a good rectifier. All the work which we have done in New South Wales in long distance reception from Europe was done with Q. valves until quite recently, when we have made more use of the V.24 type. Both of these valves are hard valves, being highly exhausted and thoroughly treated for the removal of occluded gases. The essential constructional difference between the two is in the separation of the electrodes; the distance between filament and plate is ¼ in. in the case of the Q. valve and ⅛ in. in the case of the V.24 valve. The Q. valve amplifies with an applied plate potential of something in the neighbourhood of 160 volts, while the V.24 valve amplifies with a plate potential of approximately 24 volts, this difference being due to the difference between the separation of the electrodes in the two types. Both of these valves are of tubular shape and small external dimensions, making them convenient for use. It can be seen upon examination that the filament is brought out at either end of the valve where it is connected to a small metal cap, the grid and plate leads are made as short as possible and brought out on opposite sides of the glass tube. This general arrangement produces facility in mounting and also tends to keep the internal capacity at a minimum. The grid in each of these valves consists of a fine wire mesh mounted in a cylindrical form.

In France the valve more largely used has been of the type commonly known as the "French Valve," consisting of a pear-shaped container almost as large as an average 16 candle-power lamp, and having a horizontally supported filament surrounded by spiral grid and cylindrical plate. Very little has been done with this valve in Australia, although it has an excellent reputation as a detector and amplifier.

In America a standard type known as the V. T. Valve has been very largely used. It is somewhat similar to the French Valve, although its elements are mounted vertically instead of horizontally. The V.T. valve is usually made in two types, one apparently highly exhausted for use as a cascade and reactive amplifier, and the other not so highly exhausted for use as a simple detector and amplifier.

For some time past I and my technical staff have been experimenting for the manufacture of valves in Australia, and we are now turning out successfully an instrument which is known as the "Expanse B. Valve." This is a soft valve intended principally for use as a single detector and amplifier, and by all reports available from private and commercial users it is giving very high efficiency. The Expanse B. Valve has some novel points in its design and construction which have been the subject of recent patent applications.

The Triode Valve is remarkable in the fact that it serves with equal readiness as a detector, rectifier, amplifier and a transmitter, while later we shall find its two electrode ancestor filling another highly important function in modern applications.

There is no essential difference between the circuits of a valve used as a transmitter and one used as a retroactive amplifier or self hetrodyne. The fundamental circuits are those with the plate circuit coupled back to the grid with the coupling maintained at a point which permits the self-generation of oscillations. If we take this circuit as applied in receiving, and instead of coupling the aerial with the grid circuit we connect the aerial to one end of the plate circuit and the earth to the other end of the plate circuit, we have the modern valve transmitter through which the aerial oscillations are generated and maintained.

After this the function of importance in transmitting is the control of the radiated waves. As everyone knows, in the case of telegraphy this control must consist of cutting the waves into long and short trains or otherwise modifying them in sympathy with the Morse signals, and in the case of telephony it consists in modulating the amplitude of an uninterrupted wave in sympathy with the air vibrations produced by speech or other sounds.

The most obvious method of doing this, of course, is to operate direct in the antennae by inserting a Morse key in series with the aerial and earth for telegraphy, or by inserting a microphone in the same circuit for telephony. This method, however, has its limitations because it would not be possible to control any appreciable amount of power, and it tends to affect the

stability of the oscillations generated by the valve.

The most effective method of control is to imitate the action of the receiving valve, that is by controlling the Cathode stream through varying potentials on the grid. For telegraphy this method usually consists in imposing a negative potential on the grid for spacing and thus cutting off or appreciably reducing the plate current and by imposing positive potential on the grid for signalling, thus increasing the plate current and passing as much energy as possible for the duration of a signal. In practice, however, it has been found necessary with any appreciable amount of power to simultaneously break the plate

will in turn increase the amplitude of the carrier wave to the same degrees in quantity and duration as might be represented by the strength and duration of the compression. Conversely an expansion cycle of the air wave will impose a negative charge on the grid, thus reducing the amplitude of the carrier wave proportionately. Thus the sound vibrations are reproduced as modulations of the carrier wave.

It has been found in practice, however, that more perfect speech reproduction can be obtained if the control is exercised outside of the power valve, and an ingenious method of doing this has been devised by William Comings White, of the General

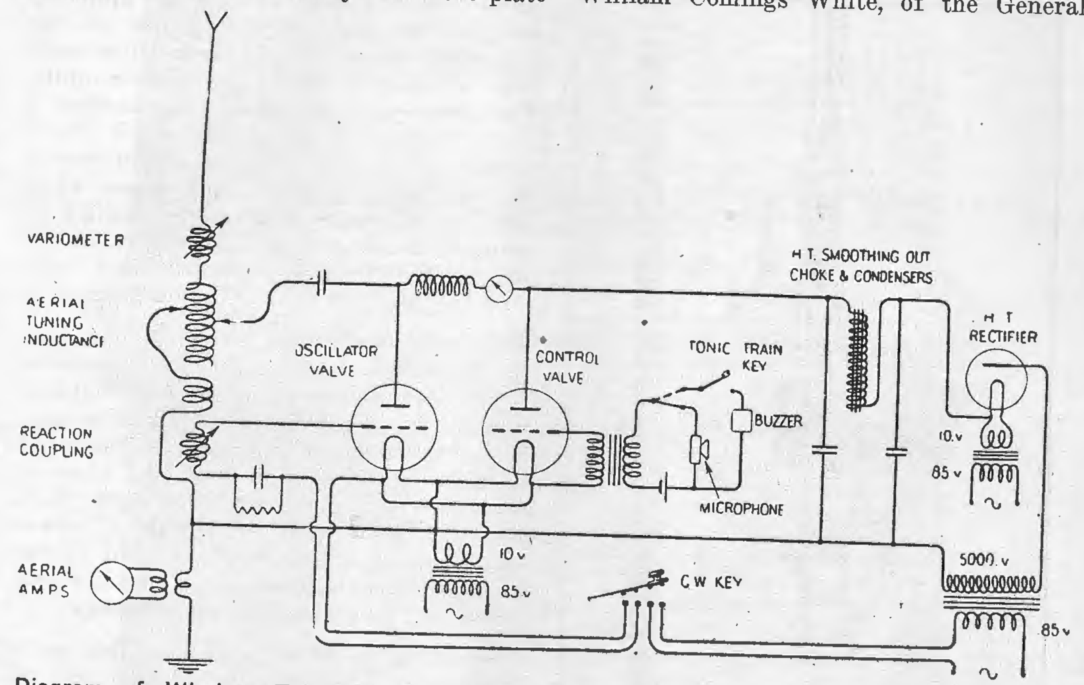


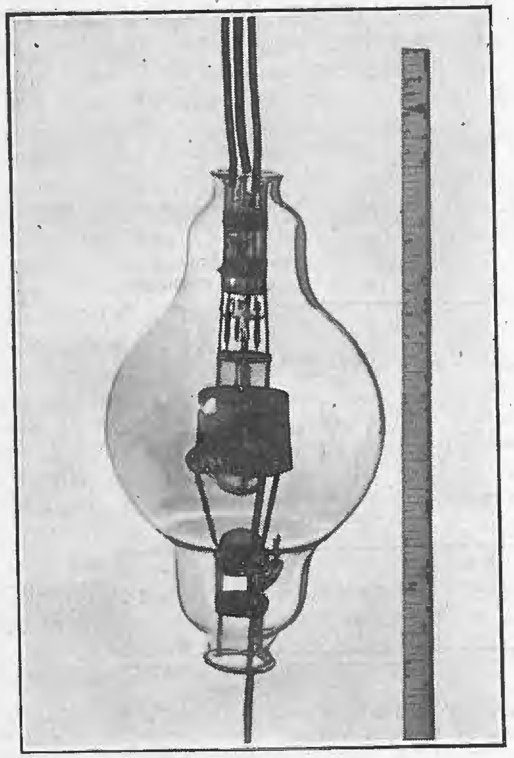
Diagram of Wireless Telephone Apparatus showing William Comings White's Principle of Modulating Carrier Wave by Control Valve.

circuit in order to avoid a discharge across the valve arising from the electrical inertia of the oscillating circuits.

For telephony the best method of control is to impose the speech variations on the grid from the secondary of a step-up transformer in the primary of which a microphone is connected. It will be readily appreciated that by this means the air wave variations can be faithfully reproduced electrically. If we assume that a compression wave affecting the diaphragm induces a positive charge on the grid, this

Electric Company, in the U.S.A. This method, which is described in the Commonwealth Patent No. 17742, of 1915, consists essentially in applying the microphonic control to the grid circuit of a second valve and connecting the plate circuit of the second valve in parallel with the plate circuit of the power valve so that the second valve, which is usually spoken of as the "Control valve," absorbs more or less energy from the power valve. The absorption, of course, is very small when the microphone is inoperative, but it follows the action of the microphone and consequently modifies the amplitude of the radiated wave. It might be said of this method that it tends to slightly reduce range, and this does appear to a small extent in practice, but the greater simplicity of operation and perfection in reproduction easily compensates for any slight modification of range.

The question of the supply of power for transmitting valves has opened up some rather interesting developments, which I will endeavour to describe as briefly as possible.



Marconi Type ½-K.W. Transmitting Valve, Plate Potential 7,000 Volts.

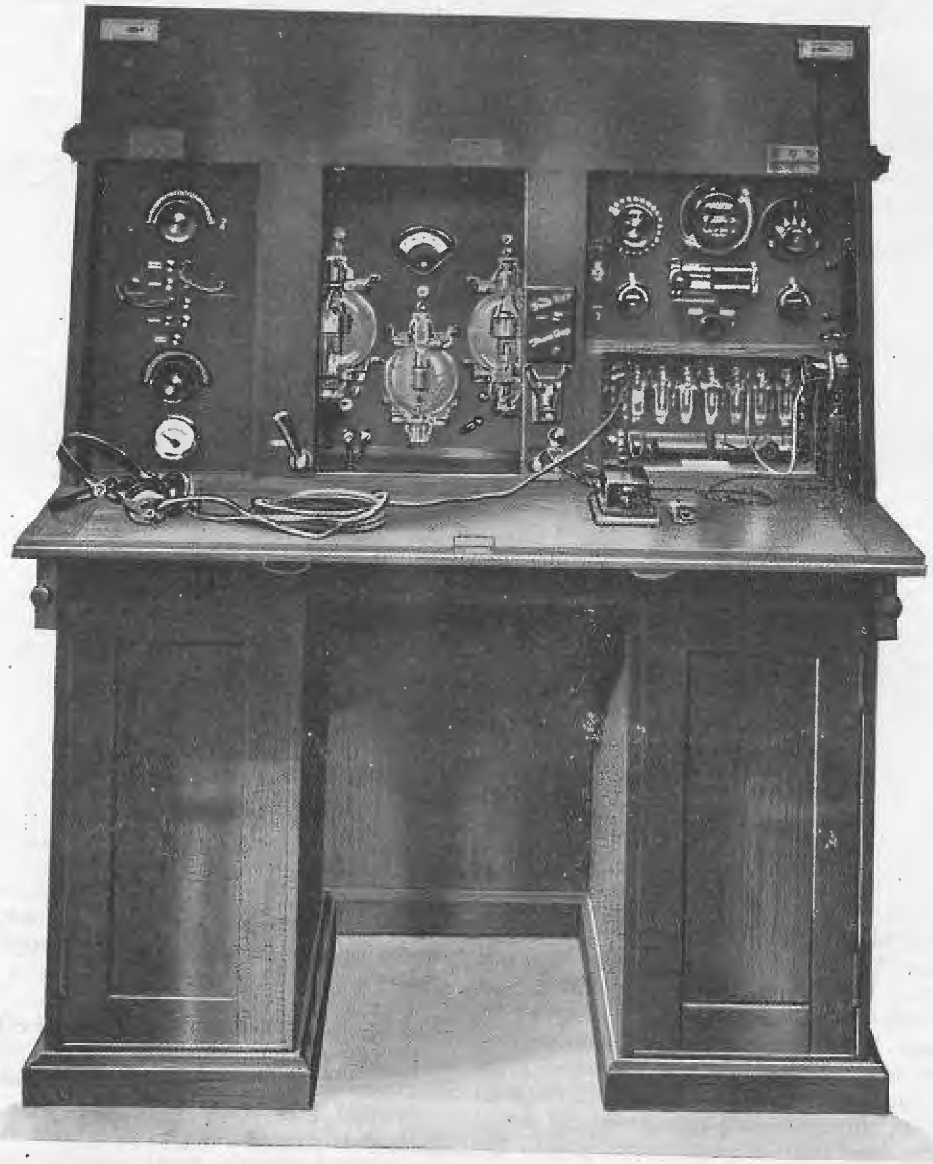
Reference has already been made to very small power valve transmitters which we have constructed and used in Sydney. In fact, ordinary receiving valves were employed for this purpose, but with a higher plate potential than is usually used in receiving. In the case of small valves of this type we have found it quite convenient to use a small ignition accumulator for the filament and to use the city supply direct current voltage of 240 or 480 for the plate circuit. In small independent transmitters, and particularly those used in aircraft, it has been fairly general practice to employ valves requiring a plate potential ranging from 700 to 2,000 volts, and this has been generated by means of specially constructed D.C. dynamos or magnetos.

The best solution, however, of the question of valve power supply is to use alternating current at commercial voltages and frequencies, to step this up through a transformer, rectify it through a two-electrode Fleming Valve, and to smooth out the rectified impulses by means of condensers and choke coils before applying the high potential to the plates of the operating valves. This system lends itself both to small and to higher power units. For instance, it is possible to construct a small power unit using only a few Watts which can be connected to a lamp socket on any ordinary A.C. supply mains, while for larger powers it gives the facility of using commercial type A.C. generators instead of specially designed and constructed high tension D.C. machines.

Another factor of value and importance in the employment of alternating current is the elimination of a separate lighting battery for the filament. From the same source and from a separate transformer it is quite practicable to light the filament with alternating current. For very small self-contained units employing a power measured in a few Watts it is of course quite practicable to use small primary batteries for supplying the plate energy.

Speaking generally of the valve as a wireless transmitter we find that one of its many advantages is its freedom from the inherent possibilities of variation of wave length and amplitude, which exist to some extent in the high frequency alternator and to a greater extent in the arc generator, and it gives a much greater freedom than the arc from the production of harmonics.

The transmitting valve being a somewhat later development than the receiving and amplifying valve is in consequence not developed so markedly into distinct types, but one of the most modern types of transmitting valve, capable of handling an energy of half kilowatt at a plate potential of 7,000 volts, is exhibited here. The development of the transmitting valve is proceeding very rapidly in England and America, but the latest available information indicates that the largest single valve yet produced and satisfactorily used handles a power of 2½ kilowatts, but since many of these can be operated in parallel they lend themselves readily to higher power working while at the same time giving a useful elasticity in the power employed at a transmitting station for varying circumstances.



Half-K.W. Wireless Telephone Telegraph Transmitter and Receiver, Manufactured by Marconi's Wireless Telegraph Co., Ltd., London, and Amalgamated Wireless (Australasia) Ltd., Sydney.

A novel feature of the Perdriau exhibit was their daylight cinema, featuring the collection of rubber on the plantations and its subsequent treatment in the big Perdriau manufacturing plant in Sydney, from the time it enters the plant to the turning out of the finished articles. These pictures were remarkably clear and distinct and provided an exceptionally interesting and instructive display.

The British Imperial Oil Co., Ltd., exhibited the world-famous "Shell," known by motorists and airmen in all parts of the universe. In addition to "Shell" motor spirit, they exhibited lubricating oils which uphold their slogan "For ease of motion."

"The oil that circulates everywhere"—"Castrol," was displayed by Messrs. C. C. Wakefield & Co., Ltd. This lubricant in addition to being used extensively throughout the motor world is used by the majority of aviators.

Colo Pneumatic Tyres and rubber goods of all kinds were in great prominence at the Colonial Rubber Company's stand. This firm manufacture all their goods in Australia and are well to the front in upholding our national slogan—"Australian goods first."

The motor show drew to a very successful conclusion after many thousands of people had passed through the gates to view the various exhibits and without a doubt it is expected to see many new things and great strides in this sphere of industry at next year's Motor Show.

A MIRACLE OF WIRELESS

BATTLE OF JUTLAND

HOW THE ADMIRALTY KNEW

I read with great interest Mr. Archibald Hurd's account in this morning's *Daily Telegraph* of the Battle of Jutland, especially the point dealing with the day before the battle, said Mr. W. Eccles in a letter to the Editor of *The Daily Telegrah,* London.

As Chairman of the Wireless Section of the Institution of Electrical Engineers, I think I might call your attention to the remarks of Admiral of the Fleet Sir H. B. Jackson after the reading of a paper by Captain H. J. Round, R.N., "On Direction and Position Finding," on January 14 last. I repeat them word for word from pages 247 and 248 of the journal of the I.E.E. in the issue of March last:—

The difficulties experienced in classifying errors in direction and the means of eliminating them and correcting the observed hearing are not the least interesting items in this paper. A remark on page 237 personally appeals to me. The author states that "the extent to which direction finding was trusted by the authorities was really remarkable," and he instances a most important event in the history of the British Navy brought about by an observed motion of less than 1½ deg. in the daytime. I think I may say we trusted him and his methods because we soon found them to be reliable. The trouble and intelligence of his staff reduced the errors to a minimum, and where strategical methods were under consideration a few miles of error in the North Sea was of secondary importance. I think it may be of interest if I give a few particulars about the case quoted in his paper, as it is really known to very few.

We have heard much about the use of direction finding for minor tactical movements of all arms, but this is a case of a major strategical operation which brought about the historical meeting of the British and German Fleets at the Battle of Jutland on May 31, 1916. I was First Sea Lord at the time, and so was responsible for the disposition of the Grand Fleet. I may incidentally mention that, in spite of other statements of which I have heard, its Commander-in-Chief (Lord Jellicoe) and I lived, so to speak, with the object of bringing off such a meeting. Our wireless direction finding stations, under Captain Round, kept careful and very intelligent watch on the positions of German ships using wireless, and on May 30, 1916, heard an unusual amount of wireless signals from one of the enemy ships which they located at Wilhelmshaven.

This was reported to me; the time was a critical and anxious one in the war, and I had also some reasons for expecting that the German Fleet might put out to sea during the week. Our fleet was ready at short notice, and had arranged, unless otherwise prevented, to put to sea on the following day for a sweep of the North Sea. But if the German Fleet got to sea first, the chances of a meeting in waters not unfavourable to us was remote; our object was to try to get to sea before or shortly after the Germans, and hitherto we had not succeeded in doing so.

Later on in the afternoon it was reported to me that the German ship conducting the wireless had changed her position a few miles to the northward. Evidently she and her consorts had left the basins at Wilhelmshaven and had taken up a position in the Jade River ready to put to sea. This movement decided me to send our Grand Fleet to sea and move towards the German Bight at once, and try to meet the German Fleet and bring it to action.

This they did, with their usual promptitude, and the result was the famous Battle of Jutland, and it was indirectly brought about by the careful and accurate work of Captain Round and his staff, for which I hope they will now accept my belated thanks and appreciation. Their work is not ended. Direction finding has come to stay for more general use in peace. Errors are being eliminated, and there should be a great future before it, especially on the lines indicated in the Press to-day by the Admiralty for assisting navigation at sea as well as in the air.

I might point out that in this instance the directional wireless proved itself competent to detect a movement of about seven miles at a distance of between 200 and 300 miles, a feat the Germans, perhaps, thought impossible.

As regards its utilisation by the Admiralty, if a layman may make the comment, the incident indicates how very much alive Sir Henry Jackson and his staff were to the possible significance of apparently trifling portents.

[NOTE.—Captain Round is a prominent member of the research staff of the Marconi Company.—*Ed.*]

COMMONWEALTH GOVERNMENT LINE

ATTITUDE OF TASMANIAN IMPORTERS

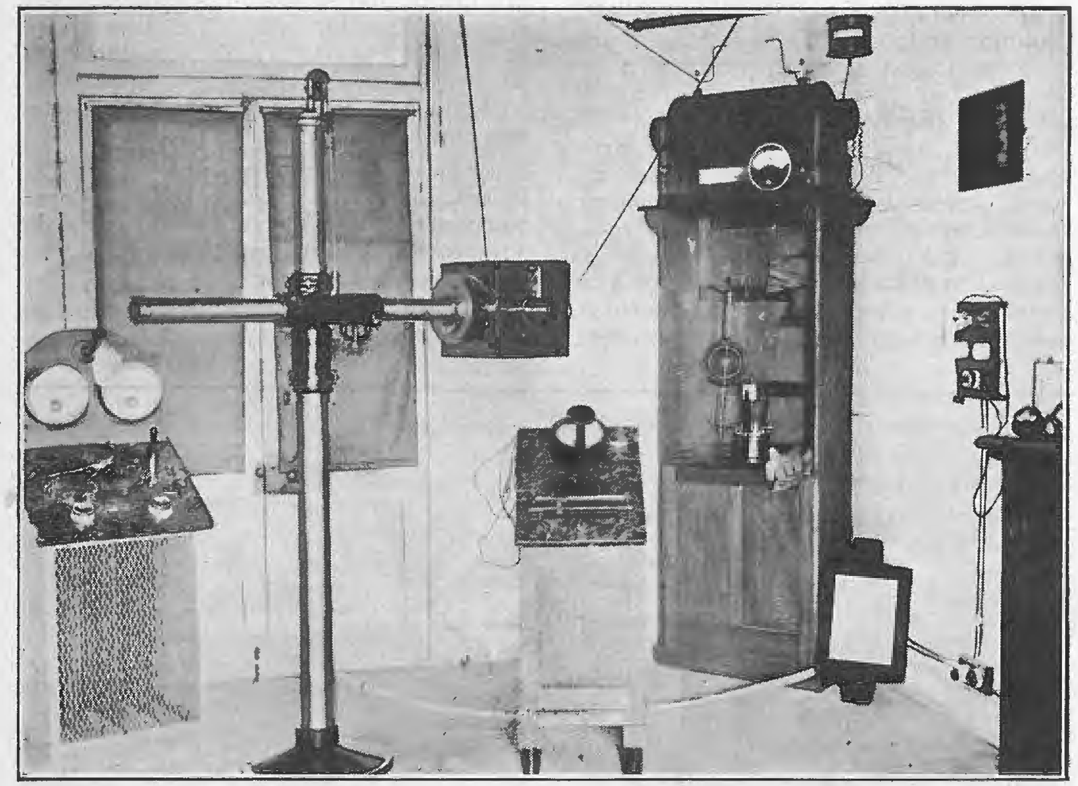
(Special to "Sea, Land and Air.")

Although the Commonwealth Government Line is finding no difficulty in getting the support of Tasmanian exporters for its ships, it is experiencing obstacles in getting a footing in the trade from United Kingdom ports to Tasmania. At first sight this may seem a somewhat strange contradiction, and an inexplicable position. The explanation, however, is really very simple.

Since the days of the trusty "wind jammer," Tasmania has had no regular and permanent line of ships to carry its products to United Kingdom ports, apart from the fleet of steamers that call at Hobart in the months of February, March, and April to load apples, and occasional steamers for wool. After the close of the English fruit shipping season it has been customary, with odd exceptions, for Tasmanian products for oversea destinations to be sent to Melbourne or Sydney for transhipment. The opportunity to ship direct by the steamers of the Commonwealth Government Line which is now afforded, is, therefore, welcomed. Another apparatus there is, outside the State capitals. The whole set is entirely of Australian manufacture, designed and manufactured throughout by The Australectric Co., of Sydney. By means of its specially designed controls it can be adapted to function at high efficiency with almost any voltage. The writer, who installed the apparatus, demonstrated how, with the small input of 25 V. and 3 amps., this powerful apparatus could excite a modern Coolidge X-Ray tube to deliver rays sufficiently penetrative to show clearly on the screen all details of limbs interposed in the path of the rays. At 110 volts, and drawing 6 amps. the sceptics were shown the heart beating, and the internal details of the stoutest man in the audience. When Jerilderie grows and a high powered electric light plant is installed of, say, 240 volts, this set will still function correctly without a single alteration. At the close of the demonstration the interest taken by pastoralists, in fact everybody, in all the technical details of modern electronics, the subject soon veered round to wireless telephony.

The writer predicts that, in the near future, this up-to-date community will be linked by wireless telephony. The station owners cover great distances in their high powered cars, the boundary rider on a motor bike is an accomplished fact. Every station runs its own electric light plant and effects its own running repairs. I saw at various places "hitching posts," but no horses. High powered cars were there instead.

The station owner now enjoys the hospitality of "Mine Host," staying till closing time, and covers his 76 miles, more or less, to home in no time. His only bug-bear is "gates," but he is thinking hard. His next purchases will be an aeroplane and a wireless telephone set. Why not?



Roentgen Apparatus Installed at Jerilderie Hospital.

The tablet on wall (right hand side of photograph) reads:—"This X-Ray plant was installed in memory of the late Sir Samuel McCaughey, March 1920."

WIRELESS EXPERIMENTAL STATIONS IN AUSTRALASIA

[Under this heading we propose to publish, month by month, photographs and descriptions of Experimental Wireless Stations in Australasia. All experimenters are invited to submit particulars and photographs of their stations, which will be published if suitable.—*Ed.*]

Mr. C. Maclurcan's Station at Strathfield, New South Wales.

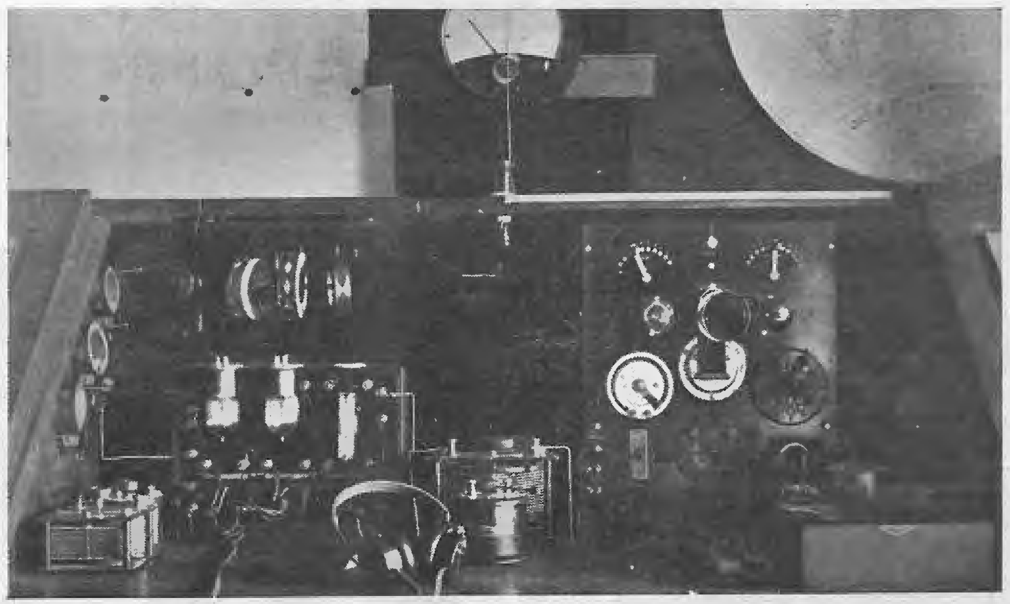


Fig. 1.

Showing the general layout of the station. Receiving instruments on left and Wireless Telephone transmitter on right.

The receiving set consists of a three coil honeycomb type tuner, employing one coil each as primary, secondary and reactance, variable series or parallel primary condenser, secondary condenser, grid and bridging condensers. A 3-valve transformer coupled detector-amplifier, Baldwin head phones and loud speaker. Figure 2 shows the detector-amplifier in detail. Although primarily designed for tubular valves, it will be seen that, although a Roome valve is used as a detector, two Marconi V.T. 11 Valves are used as amplifiers. The intervalve transformers are wound with No. 46 gauge wire, 5,000 turns on Primary, and 20,000 turns on Secondary. By simply plugging in a telephone Jack any valve may be used as desired. The filament rheostats may be of special interest, as apart from their compactness they also act as switches for their respective valve filaments. Once adjusted they may be left, for the aerial switch opens the "A" and "B" battery circuits of both receiver and transmitter.

The transmitting set (Figures 3 and 4) is designed for either speech, continuous wave, or tonic train (buzzer modulation) transmission.

Although it has not yet been tried out it is expected to cover 50 miles for speech and 100 miles C.W. telegraphy. The source of oscillations is either 3 Marconi V.T. 11 tubes with plates and grids connected in parallel, or a De Forest Singer oscillation tube of 25 watts output, 750

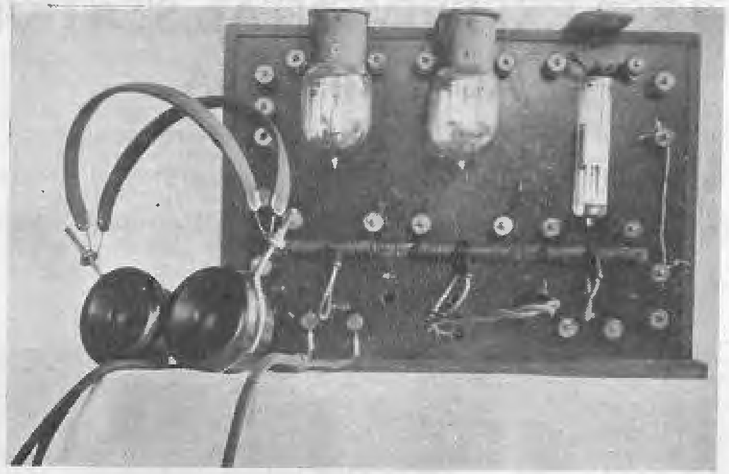


Fig. 2.
Part of receiving apparatus, showing detector amplifiers in detail.

volts plate circuit. This voltage is obtained from a transformer which, in addition, supplies the filament current from a special winding.

The aerial consists of two wires 350 ft. long by an average height of 60 ft. This aerial has a natural wave length of 450

Fig. 3.
Front view of Wireless Telephone transmitting set.

Fig. 4.
Back view of Wireless Telephone transmitting set.

metres and its capacity is 0.0013 M.F. At right angles to this aerial is a lower and smaller one, 1 ft. above the fence surrounding the house. With the former, using one valve, no difficulty is experienced in reading Lyons, Nauen, San Francisco, Annapolis, Darien, Cavite, Funabashi, Cairo, etc., but with the latter it is necessary to use two and sometimes three valves to get these stations.

AVIATION IN AUSTRALIA

BY
S. E. TATHAM

CIVIL AVIATION.

Under the Controller of Civil Aviation (Lieutenant-Colonel Brinsmead) the following appointments have been announced: Superintendent of Aircraft, Captain F. W. Follett; Superintendent of Aerodromes, Captain E. C. Johnson, D.F.C.; Superintendent of Civil Flying Operations, Captain E. M. Jones, M.C.

New Regulations Framed.

The first set of regulations for the control of civil aviation in Australia was approved by the Federal Executive Council last month. The Regulations are based on those adopted by the International Convention at Paris in April, 1919.

In detail the regulations are framed with Australian conditions in view. They will come into force forthwith, but while a fine not exceeding £200, or up to six months' imprisonment, or both, is provided for contravention of the regulations, no penalties will be sought or exacted until three months after the gazettal. This will give aeronauts and others an opportunity to become fully acquainted with the provisions before liability. No fees for licensing, certification, or other official services will be payable for twelve months.

Mails may be carried in the air only with the consent of the Postmaster-General. Certain prohibited areas will be agreed upon by the naval and military authorities. Trick flying over any city or populous district is prohibited, but official sanction may be obtained for exhibition stunts. Nothing may be dropped from an aeroplane without a special permit. If an aeroplane fly over a city it must be at such an altitude as to enable it to land outside if the means of propulsion fail.

Without the consent of the Minister for Defence no flying machine, except a seaplane or amphibian, carrying passengers, shall fly over the sea for a longer distance than 50 miles in a direct line from coastline to coastline. Naval and military machines may make the trip across Bass Strait if necessary, but no passenger flights will be sanctioned unless machines have such accessories as to provide for reasonable safety of the passengers in case of mishap.

The distinctive national mark to be borne by all machines of the British Dominions, under the terms of the Paris Convention, is the letter G.

* * *

'Planes Carrying Sixteen Passengers.

The Diggers Co-operative Aviation Company have imported aeroplanes, which were to have taken part in big aerial attacks on Berlin, for use in a continuous aerial service between Dubbo and Sydney. The aeroplanes are *De Haviland's*, capable of carrying sixteen passengers each, and are fitted with two 500 h.p. *Rolls Royce* engines, and, when fully loaded, have a maximum speed of 135 miles per hour.

* * *

Aerial Taxis.

The Shaw-Ross Aviation Company, of Melbourne, is filling a long-felt want in instituting a service of aerial "taxis." A telephone ring brings a car to the office of the "fare" to take him to the aerodrome at Port Melbourne, who, without delay, enters the 'plane, which immediately takes off *en route* to his destination, somewhere in Victoria. The Shaw-Ross organisation has provided landing grounds, supply *depôts*, etc., all over Victoria, and their daily operations cover every form of activity in commercial aviation, which they may be said to have demonstrated to be thoroughly practicable and economical.

* * *

Business by Air.

Captain Roy King, piloting a Sopwith *Gnu* aeroplane, with Mr. Howard Jolley, of the Life Assurance Company of Australasia, and Dr. L. J. Hardnett, left the aerodrome at Glenhuntley (Victoria) early last month on a three weeks' tour, to cover 2,000 miles throughout the Wimmera and Mallee districts. Mr. Jolley intends in future to use the aeroplane to a great extent for business, and will shortly travel to Queensland.

* * *

Many hours were saved in a fast flight to Ballarat by Mr. E. Lee Neill, Managing

Zealand aviation when greater progress and enterprise is shown, and the value and need of aviation more fully realised by the Government.

The Aerodrome at Auckland.

During the Christmas holidays I paid a visit to the New Zealand Flying School's aerodrome at Kohimarama, on the Auckland Harbour, and spent a most interesting day with the two Walsh Brothers, who must be regarded as the pioneer pilots of New Zealand aviation. Many years ago these two enthusiastic aviators built a flying-boat of their own design under great difficulties. They had no elaborate plant or tools to assist them, and their only weapons were a few odd tools and a good knowledge of the principles of flight and plenty of good common sense. After innumerable trials the machine was made to fly, and in this early flying-boat many flights were made by the two brothers. All that remains of the pioneer 'plane is the hull, which now hangs on the wall of the hangar at Kohimarama.

Although the hangar at Auckland is not a large one it houses several machines, including an *Avro*, Walsh Brothers' Flying-boat and a seaplane. The school possesses several *Avros*, a few seaplanes and flying-boats. The aerodrome is not built for aeroplanes but for water craft. There is no extensive landing-ground for the former type of aerial transport, while the beautiful Auckland harbour is an ideal landing-ground for the seaplanes and flying-boats. Mr. V. C. Walsh has ordered a large flying-boat of the supermarine type from England and this should arrive in New Zealand shortly.

LETTER TO THE EDITOR.

To the Editor,
Sea, Land and Air,

Dear Sir,—With reference to our recent conversation, it is obvious that the wireless experimenters of Australia do not make sufficient use of their official journal *Sea, Land Air*, and I quite agree with you that descriptions and photographs of the various experimental stations and isolated pieces of apparatus would be of considerable interest to many experimenters.

With this object in view I am sending you photographs of my experimental station at Strathfield, and append a brief description of same. With the exception of the Honeycomb Tuning Coils, the Milliammeter, and two of the Condensers, I have made the whole station myself with the valuable assistance of Mr. J. Reed.

I will be very pleased to show the station to anyone interested, and hope that other experimenters will follow my example and send photographs and descriptions of their stations to *Sea, Land and Air.*

Yours faithfully,

C. MACLURCAN,

Agnes Street, Strathfield.

[NOTE.—Photographs and descriptions of Mr. Maclurcan's station appear on another page.—*Ed.*]

A WIRELESS ALPHABET.

A is the Anode glowing bright red,
B is the Battery, sure to be dead;
C the Condenser that always leaks,
D the Detector that only squeaks.
E the Electron that hateth man,
F is the Filament "also ran."
G is the Grid that is touching the plate,
H the High Tension that won't actuate.
I The Inductance, much too long.
J is the Jigger, always wrong.
K is the Konstant, whose value we sigh for,
L is the Licence we didn't apply for.
M is the Mutual wound the wrong way,
N is the Novice who worries all day.
O is the Office where cockroaches crawl,
P is the Patent that's no use at all.
Q for the Questions, which rise thick and fast,
R the Resistance which beats us at last.
S is the Starter that never will act,
T the Transformer whose casing is cracked.
U the Unknown that ruins the test,
V is the Vacuum, doubtful at best.
W the Worries which chase us all night,
X's will never let signals come right.
Y the Young Helper who gets in the way,
Z is the end of this rhyme—hurray!

—J.A.S., in *The Aerial.*

THE HISTORY OF ENGLAND

BY

ERNEST A. S. WATT

PART IV.

CHAPTER V.—(Continued from January issue.)

Richard II. (1377-1399).

Richard, son of the Black Prince, was a boy of eleven years when, upon the death of his grandfather, Edward III., he became King of England.

There is—superficially at least—a marked similarity between Richard's reign and that of the equally unfortunate Edward II.; for both came to the throne at a comparatively early age; both relied upon the assistance and advice of unpopular foreign favourites, whom the barons eventually ejected; both were fated to see the royal authority usurped by a committee selected from amongst the more overbearing of their subjects; and finally both were compelled to abdicate, and were then quietly put out of the way. Nothing could, however, supply a more striking contrast than a comparison drawn between the respective characters of the two kings, for whereas Edward's misfortunes were fundamentally the result of his incompetence, his weakness and his indolence, it was the very strength, vitality and energy of Richard's nature, coupled with his ill-concealed desire to concentrate all power and all authority in his own hands, that were chiefly responsible for his ultimate failure and downfall.

On Richard's accession to the throne the war with France was still allowed to drag on, and for some years longer it continued to be a heavy drain upon England's resources. Being feebly and half-heartedly conducted, the brilliant successes of Edward III.'s opening campaigns were far from being repeated, but taxation became, of necessity, increasingly onerous. A new impost indeed—the Poll Tax, levied at first at 4d. per head on rich and poor alike—proved so intensely unpopular as to culminate in open revolution.

The Poll Tax was not, however, the only cause of the so-called Peasants' Revolt. The Statute of Labourers, as we have seen, was also largely instrumental in this direction, whilst the teaching of the Lollards must also bear its share—a large one—of responsibility for what might easily have been a most disastrous social upheaval.

The leader of the insurgents was a noisy—and apparently worthless—demagogue known as Wat the Tyler.

Discontent being widespread the situation became at once an intensely alarming one, and Richard—a boy of 15—displayed remarkable courage in riding out to meet the poor wretches, whom sheer poverty and the pangs of hunger had temporarily transformed into rebels and rioters. The young King having imbibed deeply of the doctrines of the Lollards, his own sympathies were largely with the down-trodden masses, and it was only his prompt assurance that their demands would be granted that saved the situation and put an end to what threatened to be a widespread revolution. In an unfortunate skirmish the rebel leader was killed, but despite this *contretemps,* the peasants, relying on the King's promises of reform, departed quietly to their homes, satisfied that better times were in store for themselves and their like. Unfortunately, however, Parliament refused to ratify the promises Richard had made and, despite the King's solemn assurances to the contrary, the ringleaders were severely dealt with, a fact which, of course, had the effect of still further intensifying and extending the already widespread feeling of discontent and exasperation.

In governing the country Richard chiefly relied upon the services of two foreigners, de la Pole and de Vere, who in consequence soon came to incur the barons' antipathy and disfavour. De la Pole and de Vere became respectively Earl of Suffolk and Duke of Ireland, but so intense were the feelings of jealousy and animosity which their rapid promotion had aroused that in 1386 the barons, urged on by the King's uncle, the Duke of Gloucester, forcibly intervened, re-

Ere he became King of England the truth had evidently been forced upon him that the only chance of preventing a further continuation of that long succession of rebellions which had so seriously disturbed the quiet of his father's reign, lay in a renewal of the war with France. For such a venture circumstances were astonishingly favourable, that country being rent asunder by the enactment of that grim duel between Burgundians and Armagnacs, which was playing such havoc with the national resources. Edward III.'s claim to the French crown was accordingly revived, but even this did not lead at once to war, the French King being so eager to maintain peaceable relations with England as actually to offer the restoration of Gascony and Guienne as the price of Henry's abstention from hostilities. The King of England had, however, set his heart upon war, and accordingly, the tempting offer being rejected, hostilities commenced with the invasion of France by a large army under the command of Henry himself.

The Duke of Burgundy at first stood altogether aside, but after Henry's brilliant victory at Agincourt (1415) he decided to participate in the struggle as England's ally.

The battle of Agincourt is still regarded as one of the most glorious achievements of British arms. Henry had landed at the mouth of the Seine early in 1415 and had sacked Harfleur, but, pestilence setting in amongst his army, his losses had soon reached such proportions as to compel him either to return home or force his way through to Calais. Despite the advice of the more prudent of his counsellors to embark for England, Henry decided to make his way through to Calais, despite the fact that a large French army blocked his path. The rival forces met at Agincourt, and the English were considerably outnumbered. The French commander, however, discounted this advantage by drawing up his line of battle on a narrow plain between two thickly timbered woods.

Henry at once attacked, and crowded together in this narrow space the French bowmen found themselves unable to use their weapons to advantage.

The archers who composed the English front line fired volley after volley, with dire results to their unfortunate opponents, and when their supply of arrows was exhausted they rushed forward with axes and pikes to complete the carnage. In like manner was the second French line forced back and when, with barely a struggle, the third line also gave way, Henry was left with a momentous and hard-fought victory, gained against fearful odds. Thus was Henry enabled to make his way through to Calais and to return in triumph to London, laden with honours and rich with the spoils of victory.

Two years later Henry again invaded France, and after many notable successes in Normandy he signed the Treaty of Troyes (1420) with the Duke of Burgundy and the Queen of France, by which it was agreed that Charles VI., now a hopeless imbecile, should remain King until his death, and that Henry of England should be his successor.

The Queen of France had long been on bad terms with her son, afterwards Charles VII., whose cause, however, this iniquitous treaty did much to assist by rallying the nation to resist the shameful surrender of its beloved France into the hands of a foreign conqueror.

To bind the Treaty of Troyes it was arranged that Henry should take to wife Katherine, the daughter of Charles VI., and it was to this union of course that Henry's successor owed those occasional fits of insanity that eventually cost him the throne.

Henry, in 1421, invaded France for the third time. Once again he proved brilliantly successful, but unfortunately, at Vincennes, he suddenly fell ill and died at the early age of thirty-two.

Only one rebellion had sullied the records of his reign, the Earl of Cambridge, son of Edward III.'s youngest son, the Duke of York, and father of Richard Duke of York, the early hero of the Wars of the Roses, being discovered, just prior to Henry's first invasion of France, plotting to replace the Lancastrian King with his brother-in-law, Edmund Earl of March, the great-grandson of the Duke of Clarence, Edward III.'s second son. The fact that Edmund's claim to the throne was a better one than Henry's did not, of course, mitigate Cambridge's offence, and he and his associates, being convicted of high treason, were promptly put to death.

The reign of Henry V. had witnessed a revival of the glories of Edward III.'s earlier years, and the war proving highly highly remunerative was immensely popular with all classes of the community; the King, on whom had fallen the mantle of the Black Prince, being of course the hero and the idol of his people. Under the circumstances the relations between Henry and his Parliaments could not well be other than amicable. Of the King's military genius and of his rare gift of arousing in the minds of others an enthusiasm comparable even with his own there can be no question. Nor can it be denied that Henry was the master of the art of statecraft to no inconsiderable extent, or that he was whole-hearted in his love of England and in his desire to see her power made paramount.

God-fearing and high-minded, of a generous and happy disposition, good-looking and possessed of the charm of youth to an abundant degree, an heroic soldier, without one single failure to his record, it is small wonder that his people loved him almost to the point of idolatry. Shakespeare's great play will preclude all possibility of the glories of Agincourt being forgotten. Henry's great victory will abide for ever in the annals of English history as a monumental instance of the triumph of fortitude, endurance and strategical genius over the force of mere weight of numbers, of mind over matter.

Henry died at the height of his fame, in enviable contrast to the Black Prince, who lived to see the loss of all that he had fought to win.

It remains to point out two distinct blemishes upon Henry's escutcheon, to which we must not allow the glories and triumphs of his reign altogether to blind us. In the first place he continued his father's persecution of the Lollards, a policy which posterity has found it impossible to condone. In the second place he plunged two great nations into war in order to serve the interests of his dynasty, his "loosening of the dogs of war" being from every other point of view utterly and entirely unjustifiable.

(To be continued.)

AUSTRALIA'S PROSPERITY

The following interesting figures were quoted by the Prime Minister of the Commonwealth, Mr. W. M. Hughes, at the annual luncheon of the Australian Natives' Association in Melbourne on January 31:

Australia, judged by national standards, is the most prosperous and best country in the world.

To-day Australia is reaping the most abundant harvest which the country has ever known.

In 1913 the value of Australian exported wheat was £8,000,000. In 1920 Australia received £32,000,000 for exported wheat.

In 1921 Australia will receive about £40,000,000 for exported wheat.

In five years the value of the wheat harvest has increased more than five times.

In 1913 the wool exported was valued at £26,000,000. In 1920 the wool exported was valued at £50,000,000.

In 1913 there were 2,160,000 Savings Bank depositors, making an average of £37 for each depositor. At the end of September, 1920, the deposits numbered 3,178,000 and the average was £44 each.

The total amount of deposits in the Associated Banks in 1913 was £149,000,000. In 1920 the total was £265,000,000.

The total value of manufactures in Australia was £161,000,000 in 1913, and £249,000,000 in 1919.

In the past four years £111,000,000 has been invested in Australian industries. Of this £59,000,000 was invested in existing industries and £52,000,000 in new enterprises.

Taxation in Great Britain in 1920 was £21 per head of the population. Taxation in France in 1920 was £16/10 per head of the population. Taxation in Australia in 1920 was £10/9/6 per head of the population.

Mr. Hughes remarked that this is the greatest story of progress ever told.

The Leader of the Federal Opposition, Mr. Tudor, stated that "the Australian workman is as good as any in the world, and Australians can make this the best country in the world by believing in it and not by decrying it at every opportunity.

LIST OF WIRELESS OFFICERS ATTACHED TO VESSELS OF THE AUSTRALASIAN MERCANTILE MARINE

Revised to February 25, 1921.

SHIP.	OPERATOR.
Aldinga	———
Apolda	J. W. McKay
Arahura	W. C. Brown
Araluen	H. H. Black
Aramac	C. Williamson
Arawatta	D. W. Higgins
Atua	———
Australbrook	J. F. McGinley
Australcrag	V. E. Stanley
Australford	T. W. Bearup
Australglen	W. H. Richardson
Australmead	S. V. Blight
Australmount	A. R. Catford
Australpeak	J. B. Ponsonby
Australplain	A. Stuart
Australpool	E. J. Glaisher
Australport	J. H. Pullan
Australrange	V. P. Nevins
Bakara	C. W. Donne
Baldina	———
Bambra	R. C. Williams
Barambah	M. L. Robertson
Bellata	G. Soilleux
Berringa	L. E. Ternes
Bethanga	F. G. Forrest
Bingera	J. H. Hawkins
Birriwa	F. G. Lewis
Bombala	A. H. Jeremy
Boonah	F. A. Cook
Booral	T. V. Tressler
Boorara	T. Alexander
Bulla	R. T. Stephen
Bundarra	N. W. G. Scott
Calulu	F. Exon
Canberra	H. W. Barnfield
Carina	W. Hill
Changsha	B. Boni
Charon	J. E. Cleary
Cooee	P. D. Hodges
Cooma	V. M. Brooker
Delungra	I. B. Gibson
Dilga	R. Jordon
Dimboola	———
Dinoga	K. J. Dines
Dongarra	H. J. Byrne
Dromana	F. Stevens
Dumosa	H. Beckett
Dundula	P. C. Gillon
Eastern	C. H. A. Kidman
Emita	———
Enoggera	———
Eudunda	———
Eurelia	J. A. Guy
Gilgai	A. S. Dening
Gorgon	———
Hwah Ping	H. F. Hartley
Kaiapoi	E. A. Miller
Kaikorai	J. Elmore
Kaitangata	H. F. Harman
Kaitoke	A. W. Watt
Kaituna	F. E. Duggan
Kaiwarra	F. Marsden
Kanna	K. McSwann
Kanowna	W. J. Washbourne
Karoola	R. R. Pilmore
Karori	W. C. Lucas
Katoa	A. E. Lawrence
Katoomba	T. A. Jones
Kauri	H. S. Chown
Kawatiri	E. H. Heather
Kekerangu	R. P. Ginders
Koromiko	J. G. Henderson
Kowarra	H. Fullerton
Kurow	A. D. R. Davis
Levuka	A. S. Smith
Loongana	H. A. de Dassel
Macedon	H. E. Young
Mackarra	———
Macumba	S. G. Jones
Maheno	G. H. Hugman
Makambo	C. F. Griffiths
Makura	———
Malayan	H. F. Giles
Manuka	J. A. Heavey
Maori	R. S. Taylor
Mapourika	C. F. G. Taylor
Marama	J. H. Bennett (s) F. Ouvrier (j)
Mararoa	W. A. Hawkins
Marella	W. H. Harris
Marsina	J. H. Gilligan
Mataram	J. F. Hutton
Maunganui	———
Melusia	S. F. Stafford
Minderoo	M. A. Prudence
Mindini	E. F. Hayes
Moana	S. R. Dixon
Moeraki	L. G. Devenport
Mokoia	———
Monowai	———
Montoro	A. L. Dixon
Morinda	F. C. Davies
Nairana	———
Navua	L. V. B. Sutton
Ngakuta	S. G. Bargrove
Niagara	W. J. Martin (s) F. A. Hunter (j)
Ooma	A. E. Sheppherd
Oonah	R. M. Firminger
Paloona	———
Parattah	K. L. Simpson
Rakanoa	———
Riverina	G. Illingworth
Rotomahana	R. J. Webb
Shandon	G. Vincent
South Africa	E. J. Giles
St. Albans	T. Bannister
St. George	A. J. Sawyer
Suva	L. S. Lane
Tahiti	E. M. Bain (s) W. S. Ringrose (j)
Taiyuan	F. A. Woodall
Talawa	D. Hairs
Talune	R. W. Barnes
Tarawera	T. H. McWilliams

(Continued on page 817.)

(Continued from page 816.)

SHIP.	OPERATOR.
Tofua	L. R. Dickson
Toromeo	M. Sedgers
Ulimaroa	H. Tuson
Victoria	H. M. Lamb
Waihemo	G. Maxwell
Wahine	J. O. Taylor
Waihora	E. A. Hunter
Waikawa	N. W. Marshall
Waimarino	F. L. Dawes
Waipori	G. Donnelly
Wairuna	F. N. Davidson
Waitemata	G. Poole
Waitomo	S. J. McVeigh
Wanaka	———
Wandilla	D. N. Quinn
Westralia	M. A. Ryan
Whangape	A. O. Sutherland
Wodonga	A. W. Hooper
Wyandra	J. Doggett
Wyreema	T. Chalmers
Zealandia	A. G. Ross

Amalgamated Wireless (A'sia.) Operators Temporarily Attached to M.L.M.C. Co.'s Ships.

SHIP.	OPERATOR.
Kumara	H. C. Kirk
Raranga	R. R. Robinson
Rupara	G. Cook

Radio Holland Station.

SHIP.	OPERATOR.
Rotti	R. H. Alexander

New Guinea Expedition.

SHIP.	OPERATOR.
Wattle	L. N. Callaghan

PERSONALITIES.

Mr. J. O. Taylor, late Wireless Officer of the s.s. *Wahine*, has resigned from the operating staff of Amalgamated Wireless (Australasia) Ltd. We understand Mr. Taylor is considering the matter of opening up a wireless training school in Wellington, New Zealand.

Messrs. V. M. Simpson and L. V. Sutton, Wireless Officers, of Amalgamated Wireless (Australasia) Ltd., have also resigned to take up business ashore in the Dominion.

WIRELESS INSTITUTE OF AUSTRALIA

NEW SOUTH WALES DIVISION

The Forty-seventh General Meeting of the New South Wales Division was held on Tuesday, February 8, 1921, at "Wireless House," 97 Clarence Street, Sydney, Mr. E. T. Fisk presiding over a very satisfactory attendance of members.

The Minutes of the previous Meeting were read and confirmed. Messrs. H. E. Grey and F. Latham-Arnott were elected member and associate-member respectively.

Mr. Fisk informed the Meeting that in view of certain developments in regard to the question of licenses, collective application had already been made to the Postmaster-General on behalf of all those members whose applications had previously been lodged through the Institution with the Navy Office.

Mr. J. G. Reed delivered a most interesting demonstration on "Amplification," using a Loop Aerial for convenience. Circuit diagrams were shown for the benefit of the members. Full particulars of Mr. Reed's lecture will appear in our next issue.

A hearty vote of thanks was tendered to Mr. Reed, and in proposing same, the Chairman pointed out that the preparation of the apparatus for the demonstration had incurred considerable time and effort.

The Annual General Meeting will take place in April next and an election of officers for the ensuing year will be conducted.

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Mr. C. P. Bartholomew, Vice-president of the New South Wales Division, left Sydney by the R.M.S. *Ormonde* on Saturday, February 12, 1921, on a business visit to the United Kingdom and America. He expects to be away about seven months, and hopes to obtain some valuable information appertaining to experimental wireless in the countries mentioned.

South Australian Division.

The Monthly Meeting of the above Division was held in Adelaide on Wednesday, February 2. The chair being occupied by the President, Mr. Hambly Clark.

Amongst other business two applications for membership were received.

The following resolution was carried: "That a Sale and Exchange Department be established for the benefit of members who have apparatus which they may wish to dispose of."

Mr. Waite, ex-operator of s.s. *Quiloa,* then gave a very interesting lecture on the Marconi 1½ K.W. ship's set. Diagrams of the various circuits were shown together with explanations of the working of the various instruments.

The Meeting closed by hearty acclamation being tendered to Mr. Waite, who promised another lecture at a future date.

(*End of Volume Three.*)