CHAPTER IV

The Development of Radiotelegraphy

WITH a Branly's filings-tube I made many more experiments, developing the subject mainly on quasi-optical lines. And on the untimely death of Hertz I determined to raise a monument to his memory by a lecture at the Royal Institution on these experiments (Friday, June 1, 1894), which I styled "The Work of Hertz"—meaning that it was a direct outcome and development inspired by that work. I soon found that the title was misleading, so that in the next edition I changed it into 'The Work of Hertz and Some of his Successors," and afterwards changed it still further into "Signalling Across Space Without Wires"; for that, of course, is what was being done all the time. The depression of a key in one place produced a perceptible signal in another—usually the deflexion of a spot of light—and, as I showed at Oxford, also in 1894 (employing a Thomson marine speaking galvanometer lent me by Alexander Muirhead), a momentary depression of the key would produce a short signal, a continued depression a long signal—

thus giving an equivalent for the dots and dashes of the Morse code—if the filings-tube were associated with an automatic tapper-back. One form of such tapper-back was then and there exhibited, a trembler or vibrator being mounted on the stand of a receiving filings-tube. This was afterwards improved, with Mr. E. E. Robinson's help, into a rotating steel wheel dipping into oiled mercury. Our aim was to get signals on tape, with a siphon recorder, and not be satisfied with mere telephonic detection. We succeeded; but more rapid progress would have been made had we stuck to the telephone, as wiser people did.

My Royal Institution (1894) lecture was heard by Dr. Muirhead, who immediately conceived the desire to apply it to practical telegraphy. And when my lecture was published —as it was in the *Electrician*, with diagrams roughly depicting the apparatus shown, drawn (some of them) skilfully but not always quite correctly, by the then editor of the *Electrician*, Mr. W. H. Snell—it excited a good deal of interest, stimulating, to the best of my belief, Capt. (now Admiral Sir Henry) Jackson, Prof. Righi, and Admiral Popoff to their various experimental successes.

It was now possible to use them for roughly

and imperfectly transmitting signals in the Morse code, either by the direct use of a Thomson marine speaking galvanometer or through a relay by operating an ordinary Morse tape instrument or a siphon recorder, which same instrument, besides recording the signal, could operate the "tapper-back." In August 1894, I exhibited this method of signalling at the British Association in Oxford. None of us ever, so far as I know—unless it was Sir Henry Jackson—actually applied these waves to anything that could be called practical telegraphy. Nothing was as yet done outside the laboratory and grounds, although Alexander Muirhead was preparing to take the matter up from the telegraphic point of view, clearly anticipating the coming of practical wireless telegraphy along these lines.

The first strenuous effort at actual telegraphy, though certainly the appliances were then in an infantile stage, was made by Senatore Marconi, who, having heard of the Hertz and other experiments on waves from Prof. Righi, of Bologna, worked away in his father's garden in Italy, secured an introduction to Sir William Preece, and came over in 1896 to England.

Preece knew nothing of the experiments that had been shown two years before in this

country : he was doubtless fully occupied with his official duties. But he was interested in the idea of wireless transmission, as he had made several attempts by means of electro-magnetic induction, and, indeed, this method, and the corresponding one by earth-tapping, can really be used, and, if there were no better method, might have been developed into something considerable. Preece realized, however, after a few demonstrations, that Marconi had in his possession a better method than ordinary induction between circuits. He regarded it as a complete novelty, and enthusiastically introduced Marconi and his device to the British public. The Post Office gave Government facilities, the attention of financiers was attracted, Prof. Fleming became scientific adviser and thereafter the matter became not only scientifically but also otherwise complicated. Progress was continually being made, distances were constantly being increased, and the transmission of Morse signals satisfactorily improved.

This long series of advances began in 1896. A most important early step onward was the achievement of accurate tuning by the introduction and utilization of adjustable inductance, with possible transformer reception, as recorded in my patent No. 11,875, of 1897, which was subsequently extended to twenty-

one years by Lord Parker, and was then acquired by the Marconi Company from the Lodge-Muirhead Syndicate. This formed the necessary basis of all radio tuning. The validity of the patent was fully upheld by a long arbitration trial, under Lord Moulton, some years later.

A still further step in tuned telegraphy was made by Mr. Marconi in his famous Patent 7,777, of 1900, by combining tuned closed with tuned open circuits. He also devised a magnetic detector, somewhat on the lines of experiments made at Cambridge by Sir Ernest Rutherford. And then Fleming discovered his rectifying valve, and applied it to wireless, thus inaugurating more modern methods of detection. In the hands of Lee de Forest this became a triode, a magnifying or amplifying device of the utmost importance. By the use of valves, as everyone knows, detection is not limited to the discontinuities of Morse signalling, but we can detect all the continuous fluctuations which are employed in human speech. Consequently, not wireless telegraphy alone, but wireless telephony was born, after a short interval for further improvements. And gradually, in the hands of many experimenters—some of them military and naval, and some associated in one

way or another with the Marconi Company—the apparatus became the singularly perfect and efficient arrangement which is attracting not only scientific but widespread popular attention.

The introduction of the vacuum valve as rectifying detector by Prof. Fleming, and its subsequent improvements, mark a great step in the achievement of wireless telephony, and has stimulated many amateurs to experimental work of high value. It is needless to emphasize the world-wide character of Mr. Marconi's subsequent developments, his discovery of the power of ether waves to curve round the earth to immense distances, his discovery also of the adverse effect of sunshine, and the more recent discovery that short waves can travel efficiently to the Antipodes: the theory of which travel by reason of peculiarities in the atmosphere has been given both by Dr. Eccles and Sir Joseph Larmor.

Looking back now at our old difficulties, ever since the seventies of last century, the ease and perfection of wireless telephony to-day seems little short of miraculous. It just shows what can be done by the combination of a great number of workers all intent on securing improved results. It is probable that many who began as amateurs have contributed in

one form or another to this success. One hears of skilled amateurs who are able to talk to each other, when conditions are favourable and sunlight is absent, not only between America and England but between Britain and New Zealand.

I have also been told by correspondents in or near South Africa that they have been occasionally able to pick up wireless broadcast talks intended only for the British Isles. The rapidity of progress is wonderful, but it is quite unlikely that perfection has been reached. There is evidently no finality; and we are probably still far below the summit of achievement.