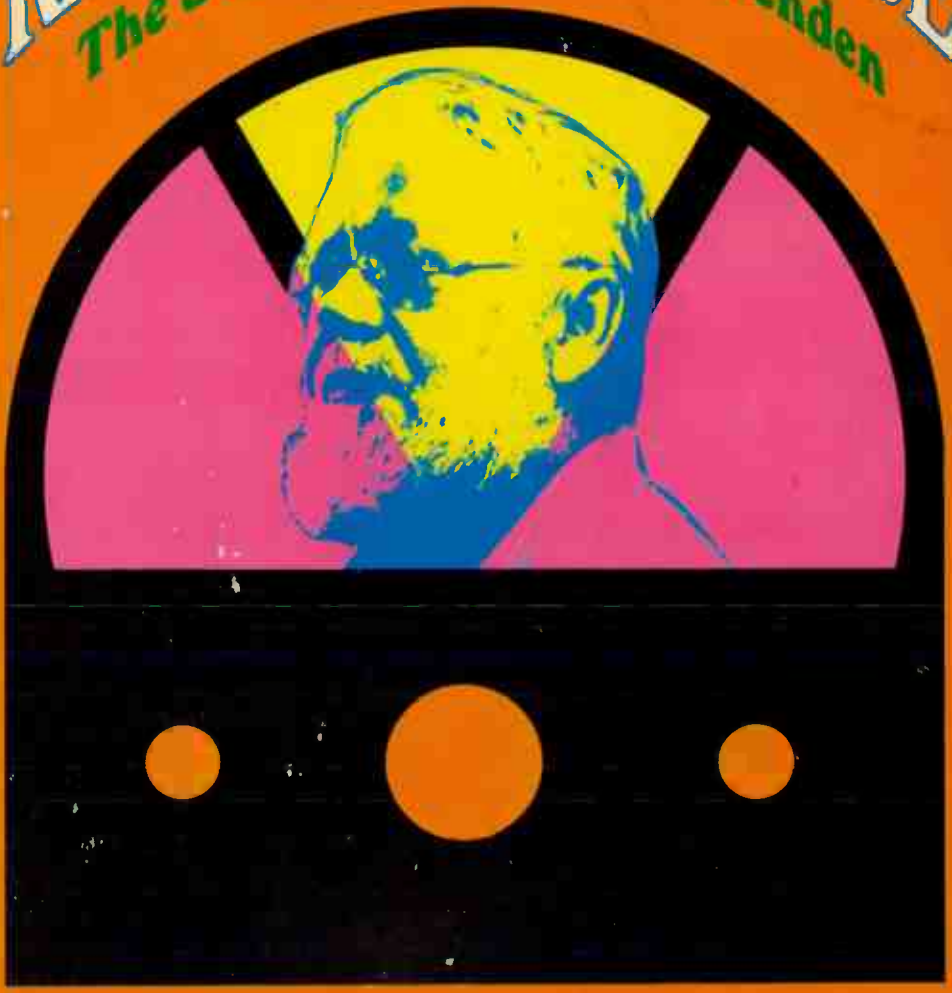
RADIO'S FIRST VOICE

The Story of Reginald Fessenden



Ormond Raby

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Macmillan of Canada / Toronto

Printed in Canada
for The Macmillan Company of Canada Limited
70 Bond Street, Toronto

To my mother and father

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Acknowledgments

Tracking down the facts of Reginald Fessenden's life required the better part of three years. Of the nearly one hundred persons interviewed, I wish to thank particularly Sir Hereward Watlington and Sir William Zuill, both of Hamilton, Bermuda.

Numerous Fessendens and Trenholmes in the United States and Canada replied to my many queries and to them, especially to Peter Fessenden, son of Cortez, I owe a singular debt of gratitude.

Helping, more than anyone, to interpret the technical aspects of Fessenden's genius was Ernest Welling of Montreal, editor of *Electron* magazine. His assistance was indispensable.

The State Archives of North Carolina in Raleigh has the honour of caring for Reginald Fessenden's papers. Other important data are contained in the Clark Collection at the Smithsonian Institution in Washington and the Douglas Library of Queen's University, Kingston, Ontario.

Still more material can be found in the public libraries of Hamilton, Ontario, Hamilton, Bermuda, and Toronto.

To the many persons in these places who aided me and to others in Canada, the United States, and Bermuda, too numerous to list individually, go my warmest thanks.

Ormond Raby

'By his genius distant lands converse
and men sail unafraid upon the deep.'

Reginald Kennelly Fessenden

Part One
Boyhood in Canada

1.
The First Experiment

The little town of Fergus, Ontario, had never seen a June day as hot as this scorcher of the year 1876. Even the grasshoppers had clacked into the shade at mid-morning and now, only a few minutes past noon, hardly a thing moved in the streets save the odd dawdling cluster of school children.

Behind the scraggy trunk of a plum tree in the Anglican Rectory's front yard, ten-year-old Reggie Fessenden tried to breathe in more than out, hunching his shoulders up toward his ears in a struggle to stay hidden from his approaching schoolmates. This was the day he had picked to give them a 'shocker' and at his feet, beneath a cedar bough, lay a number of well-packed snowballs, the result of his first experiment.

When the boys were only a few feet away he let fly. Thoughts of fishing and swimming holes disappeared in a flash as the big wet pellets plunked home and dribbled down open shirt fronts. They rushed to get the sandy-haired thrower and then, when they saw him laughing and making no effort to follow up his first barrage, they stopped and stared, open mouthed.

'Snow in June?' they gasped. 'Reggie, where did you get it?'

'Fooled you, eh,' he retorted. 'I've got a whole lot of the stuff out back near the river. Come on down and I'll show you.'

Reg led the way to a cool spot where the bank overhung the Grand, 'my river' as he called it. 'See, right there,' he pointed out triumphantly. 'Last year there was ice under a bunch of old, fallen branches past Easter. This spring I wondered how long it would really last so I filled that box with snow and piled boughs on top to keep out the sun. Bet I have some around all summer.'

But the lads barely heard him. In an instant the lot of them were out and running along the main street, snow chunks clutched in their fists, hollering, 'Look, Dr. Orton! Look, Mr. Graham! See what Reggie Fessenden's done! Snow in June and it ain't from the ice house, either.'

By the time school let out for the day, at four o'clock, Reggie Fessenden and his snowballs had become the main topic of conversation in Fergus. About the middle of the afternoon an angry Mr. Graham had called round to see the principal. 'One of young Fessenden's snowballs cuffed my hat onto the roadway and a horse and cart ran over it. It is ruined, as you can plainly see,' he sputtered. 'The school board will pay for this, make no mistake about it.' The principal had taken the hat in to show Reg and it was quickly agreed that a note addressed to his parents would accompany the guilty one home when school was out.

Then, a while later, the Reverend Elisha Joseph Fessenden himself, jogging along the main street in his buggy, came across Dr. Orton. Noticing that the good doctor's hat sat on his head flat as a flapjack, he stopped to ask the reason.

'Why, why Reverend, it has been slightly damaged by a snowball, that's all,' stammered the doctor, 'but it is not beyond repair.' He twirled the hat in his hand, turning the crumpled part toward himself so that it could not be readily seen. He and Reg were 'fishing friends' and it would be a black day, indeed, when he would inform on the boy. But there was no keeping the truth away from the Reverend.

'I suppose my boy Reginald has had a hand in this,' said Mr. Fessenden a little wearily.

'But boys will be boys,' laughed Dr. Orton. 'I don't want a cent for it,' he said, shaking his head. Then his eyes twinkled, 'But if Reggie has any snowballs left would you be so kind as

to tell him to fetch them along when we go fishing at the dam tomorrow. Perhaps we can stun a few bass with the odd good throw.'

'That's the trouble with Dr. Orton,' Elisha brooded as he drove off. 'No matter what mischief the boy is up to the doctor can be counted on to make light of it.' And the doctor's disgraceful work habits were another annoying thing. It was well known in town how he neglected his obligations to the community, closing his office at a second's notice whenever he heard Reg hollering from the dam, 'They're biting, they're biting!' Then the doctor would scurry to the dam himself, taking along his fishing pole and stethoscope and blood pressure machine. If anyone needed medical help of a Saturday afternoon, that is where they got it.

'The doctor's influence can do nothing but have a bad effect on Reginald,' his wife Clementina had said and Elisha had confessed that he must agree.

Wherever he went that afternoon the snowballs had been there before him, not only flattening hats but cracking window panes as well. 'It all happened during the noon mealtime, Reverend,' they told him. 'No, we never saw your boy Reggie throw any, but then he made them, didn't he?'

By the time he had finished his calls the Reverend Mr. Fessenden was convinced that drastic measures must be taken to put a stop to such 'deviltry'. A licking was out of the question; kind man that he was, Elisha could never lay a hand on any of his four boys no matter what the wrongdoing. And a 'talking to' would do no good; there had been plenty of those in the last month since Reg, having passed all the subjects on his year's work, had taken to playing hooky from school to roam in a seemingly aimless way about the countryside.

'It's not so much that the boy is disobedient,' Reg's teacher had told Elisha and Clementina, 'but he could have written his year-end examinations at Christmas and passed with top honours. We are much too slow for him here, I'm afraid.'

Well, there was a solution. Elisha had some letters in his pocket which, if he chose to act on them, promised to take care of just such problems, but he and Clementina had put off reaching a decision on their contents. 'A charge at Niagara

Falls will be coming vacant in the summer,' the headquarters of the Anglican Church had written him a while back. 'Would you be interested?'

Elisha had gone and looked at it and liked much of what he saw. The rectory was old and dismal but plenty of grounds surrounded the grey frame buildings. Besides, his salary would be a few dollars more than the pittance he received at Fergus and he would not be so dependent on the occasional five dollars from a funeral to help make ends meet. Then, too, with Reg's truancy in mind, he had crossed the river to the American side and found out that the military school there had vacancies for day students.

'But how can we tear Reg, not to mention Ken and Tren and little Vic, away from their chums and surroundings here in Fergus?' Elisha had lamented to Clementina on his return. 'Why, it would break their hearts.' And there the matter had rested, until now.

Though the drive back to the rectory took only a few minutes it seemed much longer to Elisha. A boy of his in a military school, jumping like some dumb animal to the mean-mouthed barks of teachers only a few short years removed from their commands in the Civil War! Just the thoughts of it alone made him sick at heart. But the happenings of the afternoon, lumped on top of everything else, made him feel even worse.

By the time he reached the yard at the rectory those little creases of humour which usually warmed Elisha's thin, parched face had sagged into deep lines of care. But he had decided what had to be done. He would take the new charge at Niagara Falls, and, if his wife agreed, they would get a letter off right away to the De Veaux Military School about Reg's enrolment for the fall term.

As it turned out, gaining Clementina's consent was no problem. 'The young scamp came home with this from the principal,' she blurted out before Elisha could even alight from the buggy. 'Here, read it! And don't think for a minute that this is all; the worst is to come.'

'Tina' Fessenden, in spite of her temper, which at times got the better of her, loved her children as if they were all that really counted in her life. For this reason she expected them to

be perfect, and when her eldest boy, Reg, especially, was guilty of some misdoing she was horrified. It was like the end of the world.

In March she had caught him carrying the kitchen scales toward the back of the yard and he would not tell her why. 'Reggie is the one we must keep an eye on,' she had told Elisha. 'He is up to something and if it is another one of his experiments then I'll see to it that it is the last. He'll not end up like his Grandfather Trenholme if I can help it.'

Edward Trenholme was Reg's grandfather on his mother's side. Years ago in Lower Canada he had taken to inventing and had built a grain elevator and a railway snowplough which were away ahead of the time. But that was the trouble; people were blind to their advantages and Edward had died a pauper, leaving his widow and ten children without a dollar to their name. Tina had never forgotten: 'Woe to a single one of my boys who shows more than the slightest interest in tinkering around,' she continually reminded her husband.

'So, I see that Mr. Graham's hat is ruined as well as Dr. Orton's,' said Elisha when he finished reading the principal's note. Then he told Tina about the broken windows and the decisions he had come to on the way home. 'Where is the boy now?' he suddenly asked.

'I sent him to his room the minute he finished feeding his kittens,' answered Clementina. 'If you are going upstairs ask him to show you his scribbler,' she moaned, half burying her head in her hands. 'At the back you will find a maze of figures about the snow business and, heaven forbid, the other pages are pasted full of clippings from the Toronto *Globe* and the Brantford paper about that Bell fellow's telephone goings-on. And to think I wanted him to become a minister or a teacher!'

The coal-oil lamps burned late that night in the old stone rectory by the river. Clementina busied herself in the pantry checking her preserves and deciding what could be put on the table over the summer and what to store away in boxes for the move to Niagara Falls in late August.

When he had had it out with Reg upstairs, Elisha retired to his study and sat up till the small hours putting together his sermon for the following Sunday in which he would tell his little flock that he was resigning the charge in Fergus. Then he

wrote the letters to the military school and the Church headquarters. For a few seconds, when he noted that classes at the school ran to Saturday noon, the sadness and worry melted away from Elisha's face. 'That will help keep him out of trouble,' he chuckled to himself.

In the bedroom over the back kitchen Reg lay sprawled on the covers of his bed staring at the ceiling, gloom all around him. The pale yellow light from the lamp, which his father had turned down when he left, barely flickered into the dark corners. About the only sound came from the tick, tick of a moth's wings as it struggled to get through the hot glass of the shade and into the flame. There it would die, and it seemed to Reg, as he watched, that he might as well be dead too.

His old white cat, the mother of all the kittens, had slunk upstairs to join him, crouching beside a pile of nuts gathered along the corduroy road to Orangeville. There would be no play tonight, no sending the nuts spinning around the floor while her master laughed and egged her on. Instead Reg stroked her back and aimlessly thumbed through the pages of his scribbler. When he came to the day-to-day entries for his snow experiment the gloom lifted a little. He was sure that even Aleck Bell, down in Brantford, would think well of the way he had gone about it. Every day he had recorded the snow's depth and how warm the weather was so that he would know how fast it melted. And he would have weighed it too if his mother had not caught him with the scales. Then he had looked up a list he had made as best he could of the previous year's temperatures so that he could estimate how long his snow would last. But when the spring had turned unexpectedly hot his calculations had gone astray. Then and there he had put together this little golden rule of research: 'In any experiment the less you leave to chance the more successful you will be.'

But on this mournful night Reg Fessenden was certain that the snow experiment would be his last. 'You had better hide that scribbler where your mother will not find it,' Elisha had advised before he had gone downstairs. 'If she catches you with it again she'll burn it. Those Bell clippings have her all upset.'

Burn it? Burn his scribbler before he had a chance to show it to Uncle Cortez? Never! Not while it could be safely hidden in a pasteboard box under a pile of butternuts. There he would

keep it until Cortez came over to visit from Brampton in August.

How he looked forward to the time each summer holidays when Cortez would swing into the yard in his buggy, take his pipe from his mouth, and whoop loud enough for everyone to hear, 'Put the pot on, Clementina, I've come to stay for a couple of days.'

'This will be the last summer that I will ever see him,' groaned Reg. 'It must be a thousand miles to Niagara Falls, well, a hundred anyway, and the old horse could never take him that far.'

Still, just thinking about his uncle made Reg feel better. Of all his relatives Cortez was the favourite by far. For one thing Cortez, though only in his twenties, taught mathematics and physics at the Brampton high school and he didn't mind showing off his learning in the slightest. When Reg had been only five he had asked: 'Uncle, why do the winds blow? Why is there lightning? Where does the thunder come from?' Cortez, responding to a curiosity such as he had never before seen in one so young, had been only too glad to explain in the greatest detail. And the questioning and answering had continued over each succeeding summer, fostering such a high regard between the two that they had become the most steadfast of friends.

Now, as he thumbed through his clippings, dozens of posers about the telephone welled up in Reg's mind as they had been doing for months. By the time the scribbler slid from his sleeping grasp the questions had shoved aside the last of the wretched day's broodings and every single one had been carefully noted in anticipation of the arrival of Cortez.

2. Listening for Sounds

Back on the 10th of March, in an attic room in Boston, Alexander Graham Bell had spilled sulphuric acid on his clothes. Suddenly dismayed, he had yelled to his assistant, 'Watson, come here, I want you!' And, in a room close by, the astonished Watson heard the fateful words – over the telephone line which he and Dr. Bell had been testing but which up till then had refused to transmit a single syllable.

Without having the faintest idea of what all this meant, the newspapers reported the happening in quite some detail and since young Bell was in the habit of spending his summers at Brantford, the local paper and the Toronto *Globe* copied the item. When the Emperor of Brazil spoke through the telephone in July at Philadelphia, everyone in the Grand River Valley who followed the news was all agog because, in addition, it was rumoured that "crazy" Bell himself would be coming home to spend the holidays with his mother and father.

In the rectory of the Anglican Church in Fergus, Clementina and Elisha decided that the less Reginald knew about such things the better, so they removed the offending portions before the boy was allowed to see the papers. But their scheming was undone without their knowing. Whenever a letter arrived from Cortez, inside there was as usual a private note for Reg, and inside this again, the latest clipping on the telephone.

'I have been invited to see a demonstration of the telephone at the Bell homestead on the 4th of August,' Cortez wrote Reg, 'and I will tell you all about it when I see you the following day.' Then he added, 'Has your snow all melted away?' And Reg laughed at the big teardrops of water which Cortez drew running down to the bottom of the page.

In truth the last of the snow had long since vanished in the summer heat, the exact time being duly entered in his notebook. If anything, he had been glad to see it go and he wished the ill-luck it had brought could have disappeared as readily. But as the blissful July days raced by even this came to cause him only faint concern, for his thoughts centred on little else but Aleck Bell's telephone. He counted the hours until he could see Uncle Cortez and find out how it worked.

In the meantime with his brother Tren's help, he had been listening for sounds. Many a time one of the boys had ducked his head in the Grand while the other banged rocks together. They could hear the noise all the way from the dam to the old iron bridge – a good hundred yards or more. Then with a hammer and nail Reg had punched holes in the bottoms of some of his mother's pots. When they strung them together with wet binder twine and hollered, they thought that they could hear one another. 'But that's not how Aleck Bell sends words over a telephone wire,' said Reg with great authority. 'He uses a current of electricity to help them along but darned if I can figure out how. Uncle Cortez will know though.'

The day before Cortez was due to arrive Reg and Tren raced down to the railway yards and the two of them crept into a low open culvert beneath the tracks. 'Now listen,' whispered Reg, his voice trembling with excitement, 'though the train is still miles away you can hear the hum it makes.'

'You're right,' answered Tren, bending an ear as close as he could to the bottom of the rail.

By the time the train bore down on the tiny crawl hole the singing from the rails had swelled into an ear-piercing roar. 'I'm getting out of here,' yelled Tren. 'I don't want those wheels whizzing by within a foot of my head.'

But though the wooden culvert top sagged and heaved under the weight of the thundering boxcars Reg stayed put. To him the danger was something to be relished. He would not dream

of scrambling to safety unless it was to grab hold, as he often did, of the last car and swing aboard the train, then minutes later jump off onto the high bank where the engine slowed a little before puffing into town.

'That oldest Fessenden boy isn't scared of anything under the sun,' the townspeople would exclaim, not always in admiration.

3.
Uncle Cortez

'Now look here, young fellow, if I've told you once I've told you a dozen times, the train bringing your Uncle Cortez from Brantford is due in at five in the afternoon and not a blessed minute before.' Old Tom, the station agent, shrugged his shoulders and turned away in make-believe disgust. 'Hear that telegraph key? Know what it means? It means I've got work to do; so run along, pick berries, go fishing, do anything! Oh, one thing more.' This time Tom looked Reg square in the eye. 'Don't let me catch you jumping off that train while it's still moving or . . .' and he peered about for some favour he could deny the strapping lad staring through the glass of the wicket counter, 'or I'll never show you a blame thing more about how that telegraph key works.'

'Is that a message coming in from London, England, or New York or some other faraway place?' asked Reg.

'Well, it's important, that's all I know. Now, be off. Saturday is too busy a day for me to be explaining things.' With this old Tom shut the ticket window, saying as he did so, 'I'll bet you another lesson on the telegraph key that you can't walk the rail to the high bank. And don't bother coming back to tell me; I'll take your word for it.'

To put in the hours, Reg walked the rails in both directions more times than he could remember and in the afternoon he cleaned off the raspberries along both banks beside the tracks.

Though he had hardly slept a wink all the night before and had run down to the station before the sun had barely begun to lift the morning mists from the Grand, he wasn't the slightest bit tired. Not every day did someone like Uncle Cortez come to town!

Suddenly, a little after five, the whistle blew and when the coach was opposite the high bank Reg dropped onto the rear platform. Then as the train struggled up the long grade into the station and later during the buggy ride to the rectory he showed Cortez his scribbler and listened, hardly daring to breathe, while his uncle described the events of the evening before at the Bell homestead.

During supper Cortez was still so carried away with the telephone that he repeated his experience for the benefit of everyone, completely forgetting that it was the last thing in the world that Tina, especially, wished to hear about.

'You should have been there, you should have been there!' he exploded. 'Young Bell strung a stovepipe wire from the farmhouse to connect with the telegraph wire to Brantford and by golly it carried his words all the way there and back. And Reggie,' Cortez said, partly turning to take in the flush of excitement which covered the lad's face, 'you will be glad to know that your dear uncle spoke into the thing and listened too. Mark my words, all of you, this telephone will be every bit as important as the telegraph.'

As much as he enjoyed eating, nothing in the world appealed to Cortez more than anything having to do with his beloved mathematics. Soon, even though the frown on Tina's face kept getting darker and darker, he had his end of the table covered with old envelopes and the envelopes covered with calculations on the telephone. Then he lit his pipe, as he always did after mealtime, and blowing out a few test puffs he added expansively, 'I'm a bit of an inventor myself, you know. I'm making mighty good headway with the new arc light and Mr. Cartwright down in Kingston has shown quite an interest in it.'

'Making! Why, the only thing you will be making is a fool of yourself,' burst out Clementina. 'And with all this talk about that gimcrack of Bell's and snowballs and arc lights, I wouldn't wonder if you make one of Reginald also!'

Clementina's long, thick brown hair, which she usually kept

tightly pinned behind her ears, loosened and flew out in wide circles as her gaze shifted between Cortez and Reg. 'If we aren't careful,' she continued, 'the boy will end up like his Grandfather Trenholme and it is about time that you knew this as well,' and suddenly her eyes rested on Cortez. 'With Ken and Tren there isn't a worry, they give every sign of taking after their father, and little Vic is going to be a mother's boy. But with Reg, I simply don't know what to think. But I'll tell you both this: the way this inventing business takes over a man's mind and makes him forget his responsibilities, it is worse than alcohol!'

That evening Reg and Cortez took a ride through the town and onto the high ground toward the west. Elisha's horse, which they had borrowed for the occasion, was in a trotting mood, his hoofs clopping evenly and hollowly on the hard clay. Now and then he tossed his head and snorted in disgust at not being able to outdistance the squeak of the buggy wheels.

'It has been a long time since I have seen Tina as snappish as she was tonight at the supper table,' declared Cortez. 'She is a fine mother to you, make no mistake about it, but I am sure she will see to it that a classical education is rammed down your throat.'

'And we both know that that means being a teacher, or even worse, a preacher,' broke in Reg. 'I want to be something different, Uncle Cortez, do something that has never been done before, something like Aleck Bell.'

'Oh, you do, eh,' answered Cortez. 'Now that is the way to talk. As sure as blazes that fellow is headed for fame and fortune. "Rise, Sir Aleck," the Queen will say and he will have to stand to catch all the honours coming his way. Or will he?' Cortez suddenly looked doubtful. 'A while back,' he continued, 'I was telling my physics class about the trouble that poor Cyrus Field had with the Atlantic cable. That fellow's heart was broken before he finished.'

'But Field kept at it, he didn't quit, did he!' interrupted Reg. 'That is the way I would be. The Queen could crochet for all I care just so long as the people could use what I made. Wonder if I could fashion something anyone would really want. There isn't much need for snow in the summertime, you know.' Then Reg suddenly remembered the lump in his cape and he reached

inside and hauled out a small model of his Grandfather Trenholme's snowplough. 'I can whittle pretty well, Uncle Cortez,' he said, 'all sorts of things out of cedar sticks. When Mum isn't watching I take the snowplough that Grandfather made for the patent office from the mantel, and using it to go by I whittle on mine in bed late at night. Tren helps clean up the shavings and we stuff them in the attic.'

Reg grinned and his boyish deceit tickled his Uncle's fancy so that he laughed all the way to the Armitage place. This was the regular turn-around spot, chosen with great care on Cortez's first visit years before. Old plum and apple trees in the abandoned fields looked like bent scarecrows, yet somehow when the right time came they could yield the best-tasting fruit that Reg had ever poached. On this night plums were in season.

All evening long the thunder had been playing tag among the black clouds along the sky's northern rim and scarcely had they turned about for the return trip when it suddenly crashed like a dozen Niagaras, directly overhead. Cortez leaned into the lines, straining to hold the horse from leaping clear out of the shafts. He snatched a hurried glance at Reg, whose head had turned in the direction of the receding blasts. 'Well, nephew,' he shouted, 'here I am struggling to stop the horse from running away with us while you don't bat an eyelash and gaze off into the distance.'

'Uncle,' said Reg excitedly, 'how far do you think that roar of thunder could be heard?'

'All the way from the clouds to the ground, of course,' replied Cortez, losing some of his anger. 'Why do you ask? What has that got to do with this jumping horse?'

'Not a thing, not a thing!' exclaimed Reg. 'But have you noticed that it comes booming down without a single wire to help it?'

'Yes, not being blind, I have noticed that,' retorted Cortez sarcastically. 'The thunder doesn't need a wire because it travels down to us on a sound wave; with lightning it is an electric wave.'

'Then why doesn't Bell shout on a wave?'

'He does, he does,' returned Cortez, a little impatiently, as he looped the reins around the buggy's whip holder and lit up

his pipe again. The thunder had rolled away into the west and south and the horse was once more plodding evenly along. Like most creatures homeward bound, he needed no one to show him the way. Cortez peered over at his questioner. 'I have never seen a boy so determined to pry into everything,' he thought to himself, then he continued aloud, 'Bell gets his electric waves from storage batteries and those waves shuttle back and forth on the wire, thus carrying his voice.'

'But why is the wave on a wire?' persisted Reg. 'It strikes me that those wires are a crazy nuisance. The thunder bounces along without a wire to carry the sound, so why does Bell need one?'

'Heaven knows what direction his words would take without something to guide them,' cried Cortez with mock harshness. 'Is it not plain to you, my lad, that the thunder is only a sound wave? Why, it wouldn't travel any great distance at all unless you loaded the whack on a wave of electricity.'

A heavy rain had started to fall and a few drops had splashed onto Cortez's fuzzy chin whiskers. He leaned back in the buggy seat and wiped them away with his sleeve. Out of the corner of his eye he noticed that Reg was still staring straight ahead, paying not the slightest attention to the downpour. Look how erect the boy sits, he thought, his shoulders back, his chin up. Why, already he holds himself better than a soldier. What a shame to send him to a military school and bury him in Virgil and Homer and waste his time with a flock of useless dates from history and such tripe. But Cortez had promised Tina and Elisha not to bring up the matter of the school and he was as good as his word.

The remainder of the drive home was taken mostly in silence, the two of them seemingly wanting to be alone with their thoughts. On Cortez's part he was not entirely satisfied with his answers to 'why a wire'. Being a good physics teacher he was up on his mathematics, and it appeared that there should be some way of using them to explain the working of electricity and words and wires, but he had to admit to himself that it was simply beyond his ken.

As is the case with all good things the time spent enjoying them seems to pass on lightened wings. Before Reg knew it, it was Sunday afternoon and Cortez's stay had ended for another

summer. From the room over the back kitchen he watched the buggy from the livery stable, carrying his dear uncle, swing out the gate and turn down the road to Brampton.

'Words without wires,' Cortez had muttered in a little private chat just before leaving. 'I have never heard of such a nonsensical thing.' Then he seemed to think better of it for he placed a hand under Reg's chin and tilted his face up till their eyes met. 'What is the main thing to remember about Cyrus Field?' he asked out of the blue.

'Field stuck to his ideas!' replied Reg.

'Right. Even though all the great scientists of the day called him a lunatic. And they said the same of Samuel Morse and Michael Faraday. So look what's happened! Why already we have made more headway in this century than in the thousand years before.'

Then Cortez was gone from sight, puffing like mad on his pipe, and where the buggy rounded the corner a wisp of sand from the wheels curled into the hot, sleepy air. For Reg, the day suddenly stood still.

4.
Year of Years

As Cortez had said, the nineteenth century had indeed become a 'let's find out what makes things tick' kind of century. And about time, too, for, especially where 'getting in touch' was concerned, yoo-hooing from a hilltop was nearly the best that man could do. Then, all at once it seemed, the dreamers, the inventors, the scientists, and the just plain tinkerers from little nooks and crannies the world over declared, 'Enough of this nonsense,' and they started out to change the world.

'Samuel Morse, you are a painter, yet you have the nerve to tell me that if I bang away at this small key your what-shall-we-call-it – electric telegraph – will carry my words, say all the way to the other side of Washington?'

'It will, sir,' replied the confident Morse, 'and even farther, easily as far as Baltimore if you desire. You see, the key breaks the current and these little pauses come out as dots and dashes at the receiving end. Then an operator changes them back into the very words you left at the sending end.'

'How interesting,' mused the questioner, a senator from the state of Maryland. 'What you want Congress to do then, young fellow, is to give you the money to stretch a wire from Washington to Baltimore so that you can whisk these dots and dashes along it.' The senator stroked his chin, then his face brightened. 'Perhaps the device has possibilities; after all, what congressman is not interested in letting his voters know what

he is doing and as fast as possible? Mind you, presuming that it works in both directions, I can predict some disadvantages. However, I will see what can be done.'

In 1844 Morse sent his dit-dit, dah-dahs over the wire from Washington to Baltimore and convinced Congress and the whole world that his ideas were practical. For the first time in history man could send a message between places far apart in less time than it took him to travel the same distance himself.

But it was one thing to string a telegraph wire between points on land and an entirely different undertaking to stretch a cable across the Atlantic and join Europe to the Americas. By the middle of the century you could telegraph anywhere you wanted to within a country or a continent, but the great ships, now reefing in their canvas to the thump of steam engines far down in the holds, were still the only way of keeping in touch across the ocean.

Then, not far into the 1850s, Samuel Morse chanced to meet a certain young man who had already made his fortune and was seeking some new challenge. To Cyrus Field it was absurd that the telegraph lines must end at the seashore, and soon, with his spirits aflame from the enthusiasm of Morse, he set about the task of laying the Atlantic cable.

Four times the churning sand and jagged rocks tore the cable apart. Then in 1866, Field chartered the huge steamship *Great Eastern*, and by late summer he had his wire rope safely across. In no time Morse's dots and dashes chattered under the ocean just as easily as they did above the ground.

About the time that Field finally struggled to the coast of Newfoundland with his cable, a baby boy, plump as a pumpkin, was born in a certain Anglican rectory near Sherbrooke, Lower Canada. The room in which Reginald Aubrey Fessenden was born was as sparsely furnished as a monk's cell and in this way differed hardly at all from the rest of the house. But with their first child taking up so many of their waking hours and much of their sleeping time as well, neither Clementina nor the Reverend Elisha Joseph Fessenden had the chance to dwell on their hardships. Not that they otherwise would have, for they both came from that pioneer Canadian stock whose rule was 'Make do and thank God for His blessings.'

'I have never seen a child quite like him,' Clementina told admiring neighbours. 'One minute he is trying to scramble off in every direction at once and the next he is so sound asleep that we fear it is his last.'

When spring came they trundled Reg's basket into the sunshine on the south porch from where he could see the maple-clad hills rising away toward the Vermont border. As soon as he was old enough to move about on his own he would wander to the edge of the clearing and lose himself amid the cathedral-like towers of the great hardwoods.

Once, in his twenties, when he had already become a thoroughly respected professor of electrical engineering at the University of Pittsburgh and a member of a stuffy club made up of many of the great scientific men of the day, Reg was called on in his turn to talk about the earliest thing he could remember. The other speakers, thinking only of their high scholarly standings, had merely gone back to events which hinted at the greatness to come.

'But I gave them a jolt,' Reg later noted. 'I called to mind something good to eat. In the centre of a clearing, with snow lying several feet deep around, were big kettles in which the maple sap was being boiled to sugar. There were married couples about the fires and me, only three or four and bundled so I could hardly move. Big ladlefuls of hot taffy were poured into buckets filled with snow; then the taffy was pulled. If I were a painter I think I could paint it now, for I can still taste the maple sugar and it is beyond description.

'Needless to say there were many noses in the air at such a "common" remembrance and they discussed for five minutes whether I ought to be permitted in the club.'

Without fail the day came when the little fellow escaped his mother's watchful eye and meandered farther into the forest than usual. No one missed him until a wild thunderstorm burst over the countryside. Then there was a great to-do. In a short time he was found on a hill slope among the swooping trees, clapping his hands and leaping for joy and hollering, 'Wind-a-blowing, wind-a-blowing.'

The spring lilies, the tree toads squeaking in the high maples on a summer afternoon – all these simple trappings of nature cast a spell on Reg. But the crash of thunder, the yellow streak

of lightning flicking out from the black clouds like a snake's tongue, and the St. Francis River, its spring freshet thrashing through the valleys to the St. Lawrence, these things were the real workings of the gods and they took his breath away.

'Sometimes I think that river is cursed,' his mother exclaimed to him one day. 'Three mills your Grandfather Trenholme struggled to build on its banks and three times they burned to the water's edge. If he had been looking after things instead of traipsing off to Sherbrooke wasting time on his inventions none of this might have happened.'

However, once the last snow and ice had melted from the hillsides, the St. Francis settled back to being its normal friendly self, and Reg had great fun picking his way among the pilings which had supported the mills. Wherever he looked the beams stuck up from the river bottom like a giant's toothpicks, and on a few, where the wood had rotted into soft moss, rested the nests of water birds.

'I bet I would have liked Grandfather Trenholme better than any of my grandparents,' he thought. 'Mother says I'm the spitting image of him and that's all right with me. Gosh, what a stubborn old man he must have been!'

Reg fancied he could see his grandfather inching the logs out into the river to shape the dams and sluiceways, and the big square timbers being swung into place to hold the machinery. Suddenly his mind was full of the whirr of spinning shafts and wheels, and right there before his very eyes the big circular saw bit into the maple logs, and the great millstone, brought over all the way from France, began to grind the wheat into flour.

In the beginning Clementina never minded the time the boy spent with his imaginings at the old mill site because she thought the place might help teach him a lesson on the evils of inventing. But one day when he said, 'Mother, I want to grow up to be like Grandfather,' she was horrified, and from then on she did her best to interest him in other things.

As it turned out, one item the Fessenden home had in abundance, like most church residences, was books, all kinds of them, for Elisha Joseph was an educated man and liked to read. With his mother's help young Reginald was reading before other boys his age could recite the alphabet. Fat Ali Baba and Sinbad the Sailor welcomed him into the *Arabian*

Nights and before long he had followed poor Scheherazade through every single onionskin page, fine print and all.

Most childhood tales did not interest him in the slightest and he rated them a 'bunch of hokum'. And one, the story of Jenny Wren and Cock Robin, so upset his sense of fair play that it made him downright furious: 'Shame on you, shame on you, you faithless Jenny Wren!' he shouted. 'Cock Robin fed you when you were sick and then you up and flew away. Shame on you, I say.'

The book of nursery rhymes hurtled across the room and five-year-old Reggie sprinted after it ready for another heave. His tousled hair bobbed around as he ran, flapping his arms in scornful mockery of fickle Jenny. He was broken-hearted for days, unable to understand how Miss Wren could have done such a thing. In time Jenny would be gone from his memory, but the gesture of jerking his arms up and down like a bird's wings whenever he was ruffled would remain forever. As the years sped by he would shorten and polish it to a couple of flops.

One day in the late summer of 1871 Elisha received word that the Church wished to send him to Fergus, Ontario, to carry on his ministry. Accordingly the family, now larger by two more boys, Ken and Tren, set off for their new home and to a land that seemed to Reg as far away as China. They travelled by bits and pieces, taking the stagecoach where necessary and at other times relishing the ride over the newly opened railway line to Toronto.

Reg at first could not believe that there could be rivers like the St. Francis in Ontario, or hills and trees and even thunderstorms half as good as the ones he had come to love so well. But now, with his nose pressed flat against the coach's window so that he could better take in the countryside bobbing by, he was not so certain. His eyes fastened on a hundred rivers, and nearly everywhere he looked he saw trees and hills reaching away toward the clouds, just like the ones he had left behind. Soon his doubts were forgotten and he was dreaming of new adventures.

5.
A Piece of a Boy's Heart

Before long the Fessendens were comfortably settled at the new rectory, and in Reg's case the blissful haunts in Quebec soon began to fade from memory. As good luck would have it, a friendly old river, much like the St. Francis, flowed by at the foot of the lot. It was called the Grand – majestic, important, handsome – and it was all these and more.

'Wow! Look at that high bank!' he shouted on first reckoning. 'In winter the snow will drift in there and I can scoop out a house. Swipe a candle and I've got a dandy place to read.'

A few miles down the Grand, near Brantford, another family from much farther away had taken up residence at about the same time. And the only remaining boy, Aleck Bell, looked on the river as being his friend as well. Aleck had in mind the idea of improving on Samuel Morse's telegraph, and he would sit on the high bank and when he wasn't actually meditating he would work at testing tuning forks for vibrations.

In this same fall of 1871 Reggie Fessenden had thoughts mostly of sour apples and fishing and river diving. But when at last the Grand froze solid, shore to shore, and the snow house had been hollowed from a huge drift, it was time for reading, time to learn and ponder about Ben Franklin and his discovery that lightning was like electricity, and about Samuel Morse

and Cyrus Field, too. And all the while in some mysterious fashion the old river worked its magic on the minds of both the dreamers.

As it turned out books and Fessenden got on too well together; he spent too much time in their company for the good of his eyes. Often in the daytime he would be obliged to find a quiet place, some seldom-used cranny of the rectory, and rest them in sleep. At night, after hours of reading by the feeble glow of the oil lamp, he would cover them with a cold, wet towel to ease the burning. Both Elisha and Clementina were dismayed at the possibility of future suffering this foreshadowed.

Clementina had early taken a dislike to the public school and as a result Reg had studied at home, writing the same examinations as the regular students. But during the final year at Fergus, to ease the burden on his eyes a little, they sent the lad back to school where less of the learning would come from books than at home.

In addition, to cut down even more on his reading, the door to Elisha's study was locked each night at bedtime and Clementina kept the key under her pillow. But the temptations inside proved more than Reg could stand. He made a duplicate key and, without his mother or father being any the wiser, he quietly busied himself till the small hours poring over the treasures that lined the walls.

Directly in front of his father's desk hung a painting done mostly in black and a half-dozen shades of brown. The oval frame suited the long, narrow face which glowered down at him, and so heavy were the chin whiskers that at any minute Reg half expected to see them come alive and flop over the edge. With a mouth as thin as a razor blade, a sharp, bony nose, and deep-set eyes the man in the picture looked a lot like his father but less friendly, Reg decided.

Those fiery eyes fairly dared the lad to shift his gaze, until he imagined he could hear the old man shout; 'Well, young fellow, what do you think of me? I'm John, the first Fessenden to settle in the New World. That black building in the background was my glove factory. A hundred years ago they built Harvard University right on top of my tanning yards. And William Pitt Fessenden; now there was a good one! Lincoln's

Secretary of the Treasury, he was, and a finer man never lived. You will find it all in the album up there on the top shelf.'

Some nights Reg took the album to the bedroom he shared with Tren and together they leafed through the pages, chuckling at the 'funny faces' but lingering over Grandfather Edward's photos in the Trenholme section. 'Look Tren, there's a picture of the snowplough being shoved along the railway tracks near Sherbrooke. Mine could go by itself too, if only I had an engine of some sort. I wonder if there is anything in the house that would do the trick?'

A number of weeks passed before Elisha even so much as missed the works from his study clock. They were always in their proper place whenever he would be timing the length of a sermon, but at other times, especially late at night, they propelled a small wooden snowplough across a blanket laid on the bedroom linoleum to lessen the noise. However, mothers are nosier than fathers and there came a time when the jig was up.

'He is becoming more like his grandfather every day,' said Tina to Elisha soon after finding the clock works inside the plough. 'His imagination runs away with his common sense. If it is curiosity that is driving him to tamper with everything that he can lay his hands on, then a little more time with Latin verbs is in order.'

In the last week of August in 1876, not long after Uncle Cortez's visit, the Fessendens caught the train for Niagara Falls, or more exactly, for Suspension Bridge. The new rectory was more citified than the homey old place beside the Grand; thus there would be no room for the horse and certainly not for all of Reg's cats, which by now swarmed underfoot from the attic to the root cellar. They stayed behind in Dr. Orton's care, along with Tina's berry bushes, a certain wooden box used in a snow-keeping experiment, and a piece of a boy's heart.

6. Soldier Boy

'Hup, two three, hup, two three; Fessenden, keep your chin up, your chin up, boy! up, up, up! That's better; lift your knees to your belt buckle. You're the picture of a soldier today, boy.' Reginald high-stepped along the footwalk at the edge of the suspension bridge over the Niagara River, having a great time mocking the commands of his drill teacher. School was out for the year and he was feeling in good spirits for the first time in months.

When he reached the Canadian end he abruptly sagged against the railing, looping his arms over the top. 'There had better be no fall term for me back at that place,' he grimaced. 'I have had enough of getting my own breakfast before dawn and tramping over there every day and Saturdays too.'

In some ways the military school had been a little more than Reg could handle. True, he had walked off with about every prize the school had to offer, but there had been no intermissions or times out for the slightest bit of play. It was a case of 'class fall in for drill', lessons hour after hour, then more hup, hupping on the parade ground before leaving for home. And how those ex-army officers boomed out the orders! The excitement of the Civil War still flowed in their veins and to a man their manner was 'Come or we'll fetch you.'

However, the morning trips to school just about made the nightmare tolerable. In the spring and fall the sun would be

coming up as he scurried along the pathway at the rim of the gorge toward the school near the Whirlpool Rapids. As the air warmed, a long tunnel of mist would slowly rise and hang in the sky, twisting the outline of the river far below. But in winter it was another story. On many a dark morning the icy winds tore down the canyon, swaying and rattling the big iron bridge until he was sure the bolts holding it together would pop or his grip on the railing would be loosened and he would be tossed into the water. 'That old river will come in handy in the summertime,' he figured, 'but I will have to come to terms with it first.'

In the seven years that the Fessendens were to live almost within a stone's throw of the Niagara, Reg would learn what to do and what not to do in tempting his mighty 'friend'. For instance, trying to swim across the whirlpool was out of the question, but he found that if he floated on his back he could somehow venture out near the eye of the monster and be certain of being tossed like a piece of driftwood back to the slower swirl at the edge. In the long run the boy and the river came to have a kind of respect or understanding of one another. In a way he came to look on any body of water as a living thing and by some odd quirk of fate hardly a day would pass in his life when he would be out of sight of a river, a lake, or an ocean. And even from his grave site it is possible, by climbing a little hill, to look down and see the Atlantic breaking over the coral reefs below.

During the summer holidays, it was arranged that in the fall Reg would go to Trinity College School at Port Hope, Ontario. First of all, though, the family had to move again. but this time only a few miles up the river to Chippawa. Here the rectory was more like the one at Fergus with a good amount of ground and trees around it.

Gradually a whole new collection of ducks, cows, cats, and a horse accumulated, and, as well, Clementina found herself with a garden full of vegetables and berry bushes.

'We will have to grow everything we need for the table,' she said to Elisha one day, 'and what is left over will be put up for sale. With Reggie going off to boarding school there will be a place for every dollar we can find.'

Elisha agreed. 'Marriages and funerals can be depended on for the odd five dollars,' he said. 'God forbid that I should hope for an increase in the number of deaths in the parish but I cannot see anything wrong with pushing the advantages of wedlock. After all, look what it has done for us. Now that Reggie is straightened away I could not be more proud of our little family. Why only this morning he came to me and said, "Father, I can sell some of our milk to the neighbours. Will that help?" ' Then Elisha added, his face brightening with the thought, 'If I know the masters at Trinity they will see to it that he gets a good grounding in the Queen's English and literature at least.' And Tina nodded happily because for a whole year, as far as she could determine, not a single thought of experimenting had poisoned her boy's mind.

Reg found his new school easy to settle into. Everything – books, spots to play, and help from the teachers – could be claimed to be exactly as he wanted. And for the first time he struck up firm friendships with other lads. Oh, at the beginning, some fun was made of a boy who walked erect as a grenadier, who donned a black cape at the first sign of a cloud in the sky, and who was so poor that he wore the trousers and jacket from his cadet uniform. But such comments were made behind his back because something about this new fellow, Fessenden, suggested that a clout on the nose would be the reward of anyone caught smirking about his clothes, or anything else, for that matter, to his face.

Before long word got about that where lessons were concerned this new boy had the answers. 'Now suppose, Fessenden, that you give me a hand with my maths and I'll do the same for you in English.' The speaker was Archie Lampman, who, perhaps because he sensed in Reg another as penniless as himself, had singled him out as a likely friend from the first day. Already Lampman bore the nickname 'Archie the Rhymester'.

'Who needs help in English?' retorted Reg scornfully. 'My Easter marks were as good as yours! Watch out or you'll be called Archie the Moocher.'

'Call me anything as long as you like my poetry,' laughed Archie. 'What do you think of this? "Be strong therefore;

resume thy load and forward stone by stone go singing, though the glorious road thou travellest alone." You're a loner, Fessenden, it shows all over.'

'You write better than you paint,' replied Reg in mock anger. 'That valentine you pinned on the wall showing me being kicked out the college back door is a mess.'

'Let them catch you again reading the *Scientific American* in Latin class and that's the way you'll be going,' rejoined Archie.

Reg was at Trinity four years and during the first few terms he was the happiest he had ever been. Books and learning and play were there for the taking. As for the *Scientific American*, it fitted inside his scribbler well out of the masters' sight. Lake Ontario lay only a few hundred yards off, and while most of the boys found it too chilly for swimming, even in summer, the water turned out to be exactly to Reg's liking, even in winter. At that, it was little frostier than the school buildings, which came alive in the early mornings to the banging of hairbrush handles breaking the ice in the water pitchers. On Saturday afternoons Archie Lampman would stand on shore guarding Reg's clothes, while their red-hued owner chased through the freezing shore spray or dived into the mass of floating ice crystals farther out. 'Only fit for seals and Fessenden,' Archie would holler.

As had been the case at the military school Reg never once tried any kind of experiment which amounted to anything all during his years at Trinity. A couple of times he fooled around taking storage batteries apart but he quickly realized that he must first learn a great deal more before he could do anything worth while with electric currents. Besides, he was much too busy simply growing up and storing away all the facts he could on a wide range of subjects.

But his curiosity was as boundless as ever, especially with things having to do with science, and he could hardly wait for Cortez to send him the *Scientific American* each month. Nearly every issue held a story on Bell and the wire telephone. In his haste to find out the important things first Reg would scan the opening paragraph of an article, then go to the last one where the results would be summarized, afterwards reading gradually back to the beginning.

A great river of letters flowed between Reg and Cortez, as well as to his parents and brothers at the rectory. 'My nickname is "Soldier Boy" because of the uniform I still have to wear,' he grumbled to his mother and father. 'All the boys are getting express parcels from home and you know how miserable it is to have other people giving you something when you can't give them anything in return. Would you mind sending me some apples and cookies in the summer?' Another time he asked about his old white cat, and, as he had done well in his examinations a short while before and was feeling pleased with himself, he added, 'I think as God has made me beat boys of 18 in my studies he means me to be of use in the way of learning.'

But by the time summer arrived in that year, 1881, the blissful days suddenly ended. Reg's eyes were on fire again, burning even worse than at Fergus, till he could barely read or write. At the rectory it was feared that he might be losing his sight, so arrangements were made to have an operation in Toronto as soon as possible.

In the weeks before the operation Reg was more disheartened than he had ever been. He would squat on the cliff by the Niagara feeling so oppressed by fate that hardly a single thing mattered to him. Not even the river seemed to take any notice of his troubles as it scudded along toward the falls, and he was very lonely. What a change from other Julys and Augusts, he thought, when with Ken and Tren or Archie Lampman he had scrambled among the rocks like a mountain goat.

The operation came just in time to rescue him from something worse than merely feeling sorry for himself. 'We have not cured all the difficulty by any means,' said the doctor to Elisha and Tina. 'Your son must wear glasses all the rest of his life, for I am afraid that a good deal of the eye strain will remain.'

Reg needed only one more year to graduate from Trinity but he wasn't up to it, and Tina and Elisha decided that, with the boy's age in mind, it could be put off. As a result they started him at the near-by high school to be certain that he 'kept his nose in the books'. But it was not long before they heard from the teachers that this idea was not quite working out. Reg would leave for school in the mornings and return at night, all

at the proper times, but in truth the school only saw him during the coldest fall and winter months. In the spring he played hooky every single day, to wander aimlessly it seemed among the Clarke Hill and other islands above the falls.

Despair filled the rectory. 'The boy has lost himself,' Elisha grieved one night. 'He is back to his old bad habits and if this keeps up he won't amount to anything.'

But those bad habits! As it turned out they need not have worried any more than at Fergus. Uncle Cortez had dropped off a copy of James Fenimore Cooper's *The Deerslayer* as an Easter present for Reg, and while a little twig fire warmed his lunch and the Niagara thundered by only a few yards away, the object of their gloom was doing nothing worse than losing himself in its pages. After only a few seconds' excited pondering, Hawkeye and his Delawares were shifted from Otsego Lake to the grey cliffs beside Niagara. Reg could see the men of the wilderness slide their canoes into the water farther upriver where the current was quiet and slow, then glide across to disappear into the endless forests of the Huron country.

'Hawkeye, don't let them kill you, you're too good a fellow to die,' he would groan, half aloud. Then his fingers would whip through the pages to the last one and there, thank God, was Hawkeye, still alive.

This new truancy proved to be more than Tina and Elisha could bear and when the next term began they shipped Reg back to Trinity. He took the year's work in six months and passed the honour examinations, though only coming second, much to his distress.

On his way home Reg stopped off to see Archie Lampman, who was nearly through a course at the University of Toronto. Archie carefully wrote out his 'Thou Travellest Alone' poem and gravely handed it to 'Soldier Boy'. 'I'm afraid, Fessenden,' he said, 'that I will be graduating right into a depression. Just my luck. But I will have my name in for a postie job at Ottawa and maybe that will keep some meat on my old bones while I versify.'

The usual promises of undying friendship followed, such as schoolmates deal out on a final day, but the boys' ways were parting and they would never meet again. Still they would keep in touch by letter and many of the poems that Lampman wrote

in his poor short life would be sent to Reg for his consideration. But this first one, 'Thou Travellest Alone', would always stay in Reg's heart.

That summer of 1884 saw less money at the rectory than at a pauper's prison. Few couples were getting married, and as Elisha observed to Tina, 'For some odd reason even fewer people than usual are dying.'

While there was never a shortage of good things to eat and always a comfortable place to sleep as well as neat clothes of one sort or another to wear, rarely was a cent left over for anything out of the ordinary. As the months passed it seemed that more schooling for Reg would be a luxury far beyond the family's reach. Then, as sometimes happens when things are at their lowest ebb, a stroke of good fortune came out of the blue, and suddenly everything was right again.

When Elisha had been a young man, studying for the ministry, he had attended Bishop's College at Lennoxville, a small town not far from where Reg was afterwards born. In late August a letter arrived from the college saying: 'We have a mathematical mastership vacant which should give your boy the chance of teaching some high school subjects and at the same time being credited with his year's work in the college. He will, of course, have to pass the regular examinations at the end of the year.' This windfall was answered by a hasty overnight mustering of every last cent for travel and spending money, and the very next morning Reg was off to accept the offer personally.

7.
A Leave-taking

At Bishop's, Reg was on pins and needles as he awaited the arrival of the next issue of the *Scientific American*. Would the magazine feature an account he had written of his first real invention, a kind of tractor which walked ahead by moving big feet-like supports up and down? An editorial in the magazine had said that such a way of advancing was impossible, that 'some sort of straight line motion was required'.

'You could not be more wrong,' Reg had advised, perfectly sure of his ground. 'If a circle rolls round on the inside circumference of another twice its diameter, every point on the outside of the smaller circle will describe a straight line. You will see that this is a feature of my model.' And he had sent the tractor and the comments off to prove his point.

There will hardly be a picture of the model on the cover, guessed Reg, with the explanation 'Canadian schoolboy proves us wrong'. But a well rounded description somewhere inside of how it worked would make him pretty happy, he decided.

While he waited he took over the librarian's chore of unwrapping and placing the new magazines on the tables so as to get a peek before anyone else. 'Well done, Fessenden, you certainly showed them,' he fancied he could hear Lobley, the school president, say. 'We are proud of you, you are the first Bishop's boy to be published in a magazine of that importance.' Say, maybe Lobley will even stop me in the hall and shake hands, he thought.

But exactly nothing happened. When he unfolded the magazine it was found not to contain a single mention of the tractor. Reg hid his disappointment from his chums as best he could, the saddest part of all being that he had let them in on the project from the very beginning.

While he was not a braggart, Reg could not keep a secret either. In later years this habit would cause him no end of trouble because word of his discoveries would often fall into the wrong hands. Even as a grown man he was so trusting that he saw others as they should be and not as they were.

On a warm afternoon in early spring, two figures could be seen making their way slowly down the gentle incline that lay between Bishop's and the St. Francis River. Warm weather had settled in ahead of time and the snow had been gone for two or three weeks. Already, at the edge of the field near the river, some blades of green grass had sprouted up to join the brown of the previous year, and automatically both young men bent down at the same time to pluck a few shoots.

Of the two, the one whose face had turned pallid-thin from worry appeared to be doing most of what little talking was taking place. A black cape had been thrown loosely about his shoulders, as its owner was uncertain whether the sun could pierce the morning mists which still squatted on the water and the low patches. Not that the chance of a wetting troubled him; only a few days earlier he had run clean across the river, jumping from ice block to ice block. But this was a different kind of day and somehow he felt that he needed all the comfort he could get.

When they reached the water's edge, the other man, whose fuzzy brown chin and side whiskers made him appear older than he really was, sat down on a pine log. From here he intently watched his young nephew, who stood in front of him idly staring out into the haze over the river.

'So, Reginald, you have decided to leave Canada,' Cortez repeated at length. 'It's too bad I ever told you about that teaching position in Bermuda. Now it's causing you to make a fool of yourself with only a few short months to go before your degree. For the last time, why won't you let me pay at least the balance of your tuition? Consider it a loan if you prefer.'

'There's the trouble, Uncle,' replied Reg, his voice rising. 'You lend me money, Dad and Mother borrow to keep me

here, and now Ken and Tren must leave school so that I can finish. Everybody sacrificing but me. It's not fair.'

'May I pay your way to Bermuda then; how else will you get there?'

'I have been teaching Greek and French besides mathematics ever since Christmas,' answered Reg, coming to sit on the log beside Cortez. 'I have put away the exact amount of my train ticket to New York and the boat fare as well.'

'I see. I can neither stop you from going nor help you then,' sighed Cortez with some annoyance. 'You know, I wonder if there is not more to this than meets the eye.' And Cortez switched his gaze toward the river. 'Does Tom Edison have anything to do with your decision?'

A long pause followed. Cortez knew that he had asked a question which answered itself. After all, he reflected, the scientific magazines had been jammed recently with stories of Edison's experiments on the wire telegraph and in electricity. Indeed he and Reg had often discussed them in their letters. But he never dreamed that it would come to this.

'I intend working for Mr. Edison just as soon as I can manage it,' said Reg firmly. 'Looking into Greek participles day after day makes me sick. Bermuda will only see me long enough to get my hands on some money for Ken and Tren; then I'll be off to New York.'

'Edison is the most successful inventor in the world,' continued Cortez, still keeping his face turned away so that Reg could not see the doubts that clouded it. 'I'll bet there's a line-up of job seekers a block long after him every day. You'll have to beat out some mighty smart men, walking encyclopedias who know laboratory work inside out.'

'Don't you realize, Uncle, that might be their trouble,' retorted Reg, a little vexed at Cortez for seeing only the obstacles ahead. 'I mean, they've got in a rut from doing the same thing over and over again always based on the same old book learning.

'Edison must be an idea man. When the time comes I'll show him some fresh ones he's never heard of before. He'll hire me all right.'

And Cortez, now seeing the sudden determination on his nephew's face, was certain that Edison would.

Part Two
The Learning Years

8.
Flour Doin's and Chicken Fixin's

The whistle of the Bermuda boat added its final shriek to the babble of the New York docks as it edged out of its berth. Reg stood at the rail, staring at the high buildings. As in a dream, he felt as if he had entered a whole new world. Only a few days before, his mother, back in Chippawa, had tearfully handed him a wicker basket crammed with sandwiches and maple sugar lumps, and Ken and Tren had stayed aboard the train till the last second before tossing him a bag of apples: all this now seemed suddenly so long ago.

He had relished the early morning ride down the Hudson shores to New York, the towns speeding by on the landward side reminding him of Canada before they gradually ballooned bigger and bigger as the train neared the vast city. In the few hours prior to boat time he had found Edison's big Pearl Street generating works, but a timid inquiry at the gate had told him that the great man was in his laboratory miles away.

As a result he had stood on the opposite side of the street, watching the coal smoke heave up from the high stacks and cringing a little while the great engines which spun the generators panted, wheezed, gasped, and caught their breath. The day was warm, the windows were open, and the din flooded out into the street in such bursts that when he stood on his suitcase and peered in he half expected to see some enormous giant who had somehow been geared to run the machines.

It had been a frightening sight to a lad not yet quite eighteen and Reg remained glued to his perch on the upended suitcase, his knees trembling while people on the sidewalk turned out to pass round him. Then in the uproar he caught the sound of the steamer whistle and he lit out for the dock, his cape streaming back from his shoulders.

For a short while he stayed at the stern, seeing the city fade away into the distance. But dreams that build a future are made at the bow of a ship and as the vessel ploughed east into the open ocean toward the Bermuda islands he strolled forward and clung to the rail at the very front.

In the straits and sounds of Bermuda the water is so clear that it is possible to observe the scallops thirty feet down on the bottom. And where they are flanked by high coral walls, the still waters mirror from dawn to dusk and from day to day a sky of the deepest blue.

No sooner had Reg arranged matters at his new school, Whitney Institute, as the little one-teacher building was called, than he found a place for himself both close by the school and, as it happily would turn out, not far from the estate of a well-to-do planter named Thaddeus Trott. His personal 'think and swim' spot would be the equivalent of Niagara, the old Grand River, and Lake Ontario all rolled into one and plopped down in the warm sun.

Here, on weekend afternoons, Reg attempted to add a pinch of electricity to a head full of mathematics, but try as he might he could not get them to mix. Though he had the understanding to see through the most difficult mathematical problem, when it came to knowing anything about electricity his cupboard was as bare as ever. Still, something told him that the two would have to be combined before he could have even a hope of getting real words off and winging through space, let alone any kind of job with Edison. By now Reg, for the first time, had laid out his life a little in advance. He had decided that, even when hired, he would only stay with Edison long enough to find out everything he possibly could about electricity and signalling. He was on the way to making it his life's work.

'Look at Reg down there in the sound, floating on his back with his hands under his head and that old hat over his eyes!

Every Saturday he simply wafts about on the tide, dead asleep, I guess. I know that Dad sometimes wonders if I should dream of marrying such a man.' But the friendly faced girl of medium height who was sitting on a coral outcropping high above the water had no such doubts herself, no matter how 'odd' her young suitor might be.

Reg had met Helen May Trott on his first day in Bermuda when she had been chosen to show him his new boarding house. She had been educated abroad and such were her winning ways that Reg, who had never had a girl friend before, was very taken with her. He promptly fell in love for the first and only time in his life.

Love means plans and plans take money and in 1886 money meant New York. And, of course, in Reg's mind New York stood for one thing, the research laboratories of Thomas Edison.

Accordingly, he carried his books and periodicals on electricity every place he went. And that was all over the island, for he often hiked as much as twenty-five miles in a day. The boarding house saw little of him and so did the school once classes were over, save for the odd climb into the white clock tower which rose above the entrance. Here, sometimes at dusk, he would read for a short time, then use the books for a seat while he peered out through the Moorish-style arches in the direction of the Atlantic and home.

In other ways Reg's life became one continuous round of 'flour doin's and chicken fixin's' usually centred on the Trott plantation. As Elisha and Tina and the children had done at Fergus in the good weather the Trotts took their meals outdoors, and Reg would find himself sitting next to Helen, with the long rows of onions, tomatoes, and potatoes stretching up through the valleys and along the hillsides in front and behind them.

Save for a little loneliness at the beginning, being in Bermuda was such fun, so good for him, that he had to pinch himself to be sure it was real. Why, he thought, my whole stay has been exactly like some heavenly play with all the characters fitted in perfectly.

Reg had gotten to know Thaddeus Trott rather well and had found that a sure way of getting along with the old planter was

to bend his back and pitch in whenever the pickers got behind or some sudden emergency caused all hands to come on the run to ward off disaster.

After one such Saturday, when a huge order of tomatoes had been quickly crated for the New York market and they had earned a rest, Mr. Trott asked him point blank: 'Have you made up your mind yet, young fellow, how you intend supporting my daugher? I understand from Helen that your father has entered your name at Oxford for a scholarship. How can you take on a wife and raise a family on this?' He looked intently at Reg, expecting an answer. And when Thaddeus Trott expected an answer you gave him one, fast and honest.

'I can't, sir,' declared Reg, 'though I know that Mother and Dad will be cross with me for not going to Oxford. I intend working with Mr. Edison while I learn all I can about electricity. Edison pays a good wage, twenty or thirty dollars a month, enough to live on.'

'Electricity? You mean there's a future in that?'

'Well not exactly, sir,' fumbled Reg. He had never spoken to Mr. Trott about his ideas on wireless but now he decided it might as well be gotten over with no matter what the consequences. He bit his lip. 'You see I must know a lot about electricity before I can get anywhere at sending voice without wires.'

'Will it work like this new plaything of Bell's which I have been persuaded to put in the house? Why, that contrivance is a dead loss, can't be depended on. And you are interested in talking without wires? No poles? No nothing?' gasped Mr. Trott. Then he calmed down, for he was essentially an even-tempered man. 'Supposing this notion of yours has some sense in it,' he continued, 'what on earth could such a thing do for me that the telephone doesn't, or shouldn't!' He looked away, disgusted.

'You could talk from Bermuda to New York—'

'Yes?'

Reg looked hastily about, trying to think of an example that would help drive his idea across. Then he spied the huge pile of crated vegetables waiting shipment. 'It is six hundred miles to New York, and, as you know, the steamer runs only every few

days,' he began again, speaking with a great deal more conviction than courage although he sensed that his earnestness appealed to the old man. 'Now here you are with hundreds of pounds of tomatoes, the best that Fulton Market could ever want. So the commission agent writes and tells you to ship but it takes so long for his letter to arrive that it is a month or more before your tomatoes reach New York. And when they do, for one reason or another, they face a market that has plunged to the bottom in the meantime. Now, if you were to know the prices from hour to hour –'

Thaddeus Trott was startled. 'Why, it is not too long ago that that very thing happened. A bad market held up selling a whole shipment and I had to pay dock charges while we waited around for the prices to go up and they never did. The tomatoes would have been better staying on the vine. But come now, the very thought of using the air to get those prices over to me before I ship, why I have never heard of anything so ridiculous. If there is anything to your scheme why isn't it already in use?' Thaddeus Trott took on the self-satisfied air of a man who had asked a question impossible to answer.

'Because no one knows enough about electricity yet,' rejoined Reg.

'And likely never will,' broke in Mr. Trott. 'Besides, think of the money needed to build such a thing and keep it in repair. According to the newspapers that's why we haven't got the cable, too costly to keep up, they say.'

'But don't you see, sir,' replied Reg, becoming a little exasperated, 'with my way of signalling no cables or wires are needed; it would be a lot less expensive.'

'So it might, so it might,' growled Mr. Trott. Then he abruptly changed the topic to something with which he was more familiar, the pros and cons of placing his favourite daughter in the care of such a harebrained young man in a city like New York.

Finally it was decided, mostly by Mr. Trott, that Helen would remain in Bermuda until Reg had good prospects in New York. 'Why, Edison wouldn't employ a lad barely twenty unless it was to carry water,' he complained when announcing his verdict. 'As smart as that young man is, with times as hard

as they are he will do well to get an interview.' But he did give Reg letters of introduction to important people he knew in the great city, and, as it turned out, they were needed.

The two years in Bermuda had come to an end. There remained a final evening when Reg took Helen for a drive along the shores of Harrington Sound. Moonlight glistened on the coral rocks and on the waters below, and the air hung heavy with the scent of jasmine flowers. They pulled up at the Trott gate and then, because she could handle the horses, Helen suggested, 'I will drive you back to the boarding house, Reg.' She did and, when he made the same suggestion at the other end, they both laughed. Then he was gone.

9. "Get Out and Hustle"

'Rooms to rent' signs flooded the side streets that swarmed off New York's wide main avenues and Reg had little trouble finding space that suited him, though he had to be careful to take one within walking distance of where he would be making his calls. Squandering money on trams was unthinkable and even the odd restaurant meal was far beyond his means. Though his stomach ached for a plate of oysters or a nibble of a bass such as Dr. Orton used to catch, morning, noon, and night his fare was the same: some fresh vegetables and sausage and more sausage and still more sausage, taken in his room or in a quiet square near by where he shared crumbs with a number of homeless cats.

As soon as he was settled Reg struck out after Edison, but finding the inventor's whereabouts, let alone getting in to see him, proved no easy task. Though his main office was in New York, Edison at this time was toiling at the lamp works over in New Jersey, the very place where he had created the incandescent light. And the light was giving him no end of trouble. First, the filaments would burn out after only a few hours of use; then, with the bulbs being made one at a time by glass blowers, his lights were becoming so expensive that few could afford to buy them.

These were bad days for Thomas Edison and the fact that he was being continually interrupted by applications from a host

of job seekers overflowing the waiting room did not improve his temper.

It was Reg's misfortune to proposition the great man at just such a time. When his turn came he sent in his card along with a slip stating his business, and back came the slip reading: 'Am very busy, what do you know about electricity?' This was a 'facer' for, truth to tell, though he now understood the theories of electricity forwards and backwards, Reg realized that he did not know the first thing about wiring a dynamo or improving an incandescent light. So he wrote on the slip, 'Do not know anything about electricity but can learn pretty quick.' Back it fired again and he sadly read: 'Have enough men now who do not know anything about electricity.' And Fessenden trudged back to New York.

That night in the rooming house he put together one of his earliest bits of wisdom: 'Getting a job is mainly a question of mathematical probabilities. No matter how far away the target is or how badly you aim, if you shoot often enough you are bound to hit it. So the sooner one shoots that number of times or applies for that number of openings the sooner one hits the target or gets the job. In other words, get out and hustle.' When he had it written Reg pinned it to the wall at the foot of his bed so that he could see it first thing in the morning and last thing at night.

With the help of his letters of introduction he tried the large newspapers but they wanted no part of a 'journalist' whose only other attempt at writing had been a turndown by the *Scientific American*. Then, spurred on by the fact that his rent was overdue to the point where he was having to slink into his rooming house after dark and leave before daylight to avoid the landlord, he hastily wrote some articles on scientific subjects and left them with the editors on the chance that one or two would sell. When Whitelaw Reid, managing editor of the *Tribune*, bought a couple, Reg sprinted down to the newspaper offices excited by an idea which he knew had never been tried before.

'So, Mr. Fessenden,' Reid rasped out, peering over his glasses at the strapping young man perched on the edge of a chair across from him who had the boldness to suggest some-

thing new to one of the top editors of the day, 'you propose a daily section of my newspaper devoted to scientific news and you believe that this will help sell newspapers?'

'I believe that it would interest your readers, sir,' answered Reg. A withering look darkened Reid's face and he turned back to his desk without a single comment. Some years later the same Mr. Reid, by then American ambassador to London, would find himself facing Fessenden again, only the circumstances would be vastly different.

Now nothing remained but to send a sad note off to Helen, 'My articles have paid me five dollars each and I have sent some of the money to Chippawa. Though I call on Mr. Edison every few days I seem to get exactly nowhere. But as long as the price of sausages doesn't go up I should be able to see it through.

'Don't let on to Mr. Trott how things are going or he will can me for sure. Every day I go down to the Fulton Market to make my purchases and I wonder if the tomatoes I see have come from Bermuda, maybe even if you have picked them yourself.'

Without fail the day arrived when Reg could no longer afford to travel out to New Jersey to see Mr. Edison. The only thing left was to hang about Madison and Fifth avenues where one of the Edison companies was installing new electric lines and hope the foreman, a kind soul named Mr. Kreusí, would take notice of a hungry but pig-headed young man. As it happened, a friendship blossomed between the two and one morning when a tester walked off the job Reg was hired on the spot to replace him.

No company ever engaged a more honest workman. Soon Reg had been promoted to chief tester and when they noticed how handy he was at reading the galvanometer, an instrument used to determine the strength of an electric current, he was made inspecting engineer for a whole section of the work.

Often Mr. Edison would happen by but he would be much too busy to take heed of 'the lad with the galvanometer'. And the lad with the galvanometer would be too occupied to pay much attention to Mr. Edison, unless it was out of the corner of his eye, for not a minute was being frittered away in his rush

to learn the practical points of electricity. Even during the half-hour lunch period he read up on this new 'wonder of wonders' as well as studying mechanics.

On late afternoons the wealthy who lived in the big brown-stone mansions would pass by on their way home, the ladies in frilly hats and wide-sweeping skirts and the men in tight-fitting suits, twirling their walking sticks and striding full out as if they owned the world. To the boy from Canada it seemed they did. When work was finishing for the day he would keep an eye open hoping for a few words with them.

Many of the rich had their own private lighting systems, and as the strong currents these generated interfered with his galvanometer readings Reg would send an assistant ahead to shut them down. One of these plants, a huge affair rivalling some of Edison's, was possessed by the great financier Mr. J. P. Morgan. When the switch was thrown his lights went out, right in the middle of his reading.

'Young man,' bellowed Morgan, striding to the front door, 'what in the devil are you up to and how long will my place be in darkness?'

'I'll be finished in a very short time,' explained Fessenden.

Morgan's anger lessened. 'Well, when you are I want you to come in and look at my wiring. I am continually having fires all over the place.'

Before long Reg found the trouble and he suggested that rubber-covered wires be placed inside galvanized pipes, and, as an extra job, he helped install them. This method proved far superior to setting the wires directly in the walls and in time it would become standard practice the world over. In return Morgan gave him a handsome payment and noted, 'This young fellow is someone to keep an eye on.'

For his part Reg wrote out another little saying and pinned it on the wall beside the first: 'Young men should, while always taking particular care not to foist themselves on others, make as many acquaintances as possible for they will come in useful when doing business later.' Years after he would add: 'I have often met men who, to protect themselves from strangers, would take on the winter plumage of a cake of ice but who thawed out in the most astonishing way on being casually reminded of some trivial meeting with me a score of years before.'

The windfall from Mr. Morgan was divided three ways, some going to Ken and Tren, another bit to Tiffany's, the exclusive jewellers, no less, as down payment on an engagement ring which was bound to make Helen's eyes pop, and the balance toward a better rooming house. And his meals improved, with the odd one being enjoyed in a restaurant on Saturday evenings where he would tarry by the hour, his books piled high around him and his cape pulled tightly under his chin no matter how stifling the heat, ordering just enough buttered oysters so that the management would let him remain till closing time.

You would think that someone who barely had an extra penny to his name in his youth would value his money more than the Merchant of Venice. But with Reg Fessenden just the opposite was true and always would be. At times the tip he left in the restaurant totalled more than the cost of his carefully ordered food. Perhaps that 'Thank you very much, sir,' which the waiters gratefully lavished on him was, even then, getting to be a needful part of his well-being.

On the day before Christmas Reg finished his section of the cable laying and reported to Mr. Kreusi that it was all tested and ready to go. 'I have told Mr. Edison how happy we are with your work, Fessenden,' said the foreman, 'and the "old man" wants you to see him at his laboratory right after the holiday. Seems he needs an assistant to carry out experiments on dynamos.' Mr. Kreusi winked knowingly. 'Would you be interested?'

Interested? A dazed Fessenden stumbled back to the rooming house so carried away that he passed by it twice before remembering to go in. When he collected his thoughts he sent a wire to Chippawa and another to Helen directing her to 'show this to Mr. Trott'. Then for the first time he recalled that it was Christmas Eve and he bundled his books under his arm and headed for the restaurant and a double plate of oysters, feeling very pleased with himself.

10. His Own Original Thinking

'Fezzy,' Edison called out, 'leave the wire insulation for a few hours and catch a little sleep. Come in here and try the table for size.'

'I have already, Mr. Edison,' answered Reg laughing, 'and I hang over about a foot at each end.'

None of the laboratory tables suited Reg's six feet two inches and whenever experiments ran through the night he would take a nap on the floor, Watt's thick chemical dictionary under his head. He had plenty of opportunity to get used to the experience because the attempt to find a new kind of insulation kept him in the laboratory for days without a letup.

Some weeks earlier Edison had taken his new assistant off dynamos and placed him on more urgent work. 'Our electric wires are causing too many fires,' he had said to Reg. 'We must have a covering that will not get too hot from the current or be affected by oils or acids, and at the same time it must be as elastic as India rubber. Now I don't want to see hide nor hair of you until you come up with the answers.' Then out of the blue he had asked, 'By the way, Fezzy, do you know anything about chemistry?'

'No, Mr. Edison.'

'Well, then, I want you to be a chemist. You will have to

year-old lad at that, must have been difficult for the celebrated Kelvin to bear.

No one enjoyed Kelvin's displeasure more than Edison himself. 'So, Fessenden, already you are making fools of the big shots, eh,' he chortled. 'And it serves them right. You have no idea how these holy men of learning get riled when one of us fellows who never attended their pet schools steals a march on them. What will we show them next?'

The gyroscope is a device with a wheel which moves on a vertical axis, the whole in turn revolving on a horizontal axis. It had been invented about the middle of the century and, as Reg read in a book from Edison's library, it was being used to show only the earth's rotation. But the oversized, clumsy affair was run by steam engines and belts and these hindered its movements.

Suddenly Reg asked himself, Why not place an electric motor right on the gyroscope in such a manner that it will be free to turn every which way. Then look at the uses!

Other experimenters had laboured for years over this problem but it is a fact that Fessenden, working only in his spare time, arrived at the answers in a matter of weeks. Soon after, he published his results in the magazine *Electrical World*, but because he waited much too long before patenting the discovery only a dribble of money ever found its way into his bare pockets.

But money was not everything that mattered. Each year of his life, right to the end, Reg would be amazed and gladdened and sometimes deeply hurt at the ways others found to profit from the electrically driven gyroscope. It came to be used as a compass because it was not affected by magnetism, and when coupled to the steering gear it held a ship or an airplane exactly on course without a hand so much as being laid upon it. Many years later its more gifted offshoots would be employed to help guide huge rockets from earth into outer space. Their magic would direct the rocket's flight, based on the same principles Fessenden had built into his first machine in the laboratory of Thomas Edison.

But in times to come the gyroscope would also be employed for more deadly purposes. 'This new instrument will allow us to sight our guns automatically,' boasted the world's arma-

understand a good deal of chemistry to find your way a this riddle.'

And Edison had been right. Reg found that he must from scratch, learning about the composition of matte why it changed as it did from one form to another. Meeti 'elastic as India rubber' requirement turned out to be tl poser but in the end he succeeded. Hundreds of comj were tested and for days both Reg and the laborator shrouded in a yellow fog given off by chlorine. Even his to Helen in Bermuda reeked of the smell.

'What has this got to do with talking in air?' Mr grumpily wanted to know. The old gentleman wonder more when another letter arrived containing a sketch f *New York Herald* showing Reg being introduced by E 'The man with the platinum lungs'.

In truth, if only Thaddeus Trott had realized, what up to had a lot to do with 'talking in air'. He was learr to develop his work habits and methods based only on original thinking, just as he had set out to do at Fergus snow-keeping experiment. He would never be an What was equally important, he would come to b himself to the point where he would never back d when his conclusions were the very opposite from th greatest scientists in the world.

About this time, in England, Lord Kelvin, pe world's best-known authority on electricity and mat had formed a conclusion as to why rubber was ela viously,' said he, 'the fact that rubber particles stic cannot possibly be due to electricity. Every physic that it is because of gravitation.' Fessenden did not though, and just as well because while making the r tion he proved that Kelvin had his theory backward was, indeed, electricity and not gravitation.

A while later Reg published his findings in a scie azine and included were additional theories he hac the course of his research. They concerned the stru atom, and afterwards Lord Rutherford and ot menters used them in their own work. Being made a nincompoop on such a basic principle, and by a

ment makers, and they hastened to mount it on their warships. When information such as the speed of the ship and its drift was fed into the machine the wheels whirred and the gyroscope turned in its mazy patterns until, as if guided by some unseen hand, the gun barrel took on the right aim and off crashed a shell, on its way to kill with an accuracy never before known.

11.
Lightning Bugs and Crickets

Edison's main laboratory nestled in a sea of green called Llewellyn Park, New Jersey, not far from New York City. Clustered around this long, low brick building were a number of smaller 'think and do' structures, some of brick and others of timber, where things electrical were fashioned, chemical compounds tested, and pieces of metal for a thousand uses shaped and honed. Rising two full storeys up the middle of the laboratory building was the library, bulging with technical books and substances gathered from every corner of the globe. And here, each day after his regular work was finished, Reg came to feast.

Nothing like this huge experimental laboratory existed anywhere else in the world. It was not a place where great truths of science were born only to fall by the wayside because no one knew or cared enough to put them to use. Instead no sooner did the most outlandish ideas come to mind than they were squeezed, stretched, and strained to see if they held anything which might be beneficial to mankind.

The tale about the invention of the talking machine was old hat by the time Reg had been hired; still he read about it from Mr. Edison's notebook. 'Batchelor,' the inventor had exclaimed to his foreman, 'I bet if I run a smooth piece of paper underneath that diaphragm and talk into it that it will

record what I say and we can play it back and hear each single word.'

'Twenty-five dollars says you can't,' had retorted Batchelor. Edison had talked, the paper had been wound round a cylinder, and when the handle was turned out came his words, 'Mary had a little lamb', and the phonograph was born.

Later, when Reg pored over books in the library, he noted that every material needed to make the phonograph had been available to man since the time of the Pharaohs yet the actual invention had to wait around until Edison 'stumbled' onto it. 'Will someone, just like this, hit on a way to send speech through the air before I do,' he worried, 'or will it bide its time until I come along loaded with every fact and theory I can find?'

One day Reg asked the great inventor, 'What do you think, Mr. Edison, are the chances of sending speech without wires?'

'Fezzy,' Edison replied wearily in his best fatherly manner, toying with a grey forelock as had become his custom, 'what do you say are man's chances of jumping over the moon? I figure that one is about as likely as the other.'

And there the matter had rested.

Almost two full years had now sped by since the day Reg had begun working for Edison on the streets of New York. In the meantime he had been promoted to chief chemist. So expert had he become in the preparation of such things as varnish gums that once a Mr. Pratt of the Pratt and Lambert Paint Company offered him the unheard-of sum of ten thousand dollars a year to take a job as supervisor. But he had turned Mr. Pratt down. He had decided once and for all that his future lay with wireless, no matter what.

The decision was a hard one to make because always the Edison companies were trying such a vast number of undertakings that salaries were skimpy and payment uncertain. Reg would have liked to experiment on his own with wireless but his money drained off in so many vital ways that none was ever left over to buy equipment.

One drain was eating. The pork sausages of his early days in New York had given way to huge plates of oysters and fruit such as he had not tasted since he and Cortez had last sampled the plums at the Armitage place. Accordingly his big frame

had filled out and this, combined with his great height, gave him a figure of the most majestic bearing. When he strode to his place in the restaurant the other diners promptly stopped eating to whisper in awe: 'Why, that man looks just like a Viking,' and their gaze never left him.

It was a time when men grew luxuriant beards and Reg sported his own, a sandy red one of average length which thinned out to fuzzy whiskers on his cheeks where it blended with long, bushy sideburns. Often at trimming time he would stare at his 'plumage' in the mirror and chuckle at his resemblance to old John Fessenden.

He wondered if the old fellow's picture still hung in his father's study. He had no way of knowing for in all the years since leaving Bishop's College it seemed that never once was he able to save enough to make the trip to Chippawa. But he was so swallowed up by his work that he hadn't time to feel lonely, and then there were letters home which he sent off at least once each week. The notes to Tren and Ken held a little money to help them through school and Vic rated a shinplaster now and then in addition to what Reg could spare for his mother and father.

Tina was loath to accept any help and once she answered him, 'We are proud that you are making a name for yourself but neither your father nor I have changed our opinions of this inventing business one whit. In the long run it can only harm you.' Another time she questioned, 'Cortez tells us that you wrote him saying that you have given up your rooms and sleep in the laboratory. What about your health, your eyes? Do they still burn? Have you given a thought to them or are you too busy?'

And Reg found time for letters to Helen. Though his heart ached to have her near him so that he often trudged down to the dock just to watch the Bermuda boat unload, he knew their marriage was out of the question for the time being. He would have to travel a lot farther along the rocky road to radio before that could happen, especially with Thaddeus Trott doing the deciding. Instead he held to mentioning only workaday things.

'Many are the nights,' he wrote Helen, 'when I have finished my regular duties and before plunking my head down on Watt's Dictionary, I climb to the roof of the lab to lie there

staring up into the black sky trying to at least guess at the secrets behind electric waves. There is nothing else I can do until Mr. Edison lets me experiment on my own.'

But without Reg's knowing it, at this very time as he wrestled with the whys and wherefores in theory, a young German physicist was actually producing and studying the waves in his laboratory at the Polytechnic Institute in Karlsruhe. Because they were made up of both magnetic and electrical energy Heinrich Hertz properly called them electromagnetic waves. Though he had found out a lot about them – that they flew at a speed of 186,000 miles a second, as fast as light, could be made to change direction or pierce a wall, and chattered like crickets and lit up like lightning bugs when they hopped a gap in his wires – just what use could be made of them baffled Hertz. But for three years he had laboured to ascertain their properties and now at the beginning of 1890 he determined to publish the results and leave this end of things to other experimenters.

At no place were Hertz's papers more eagerly awaited than at the laboratories of Thomas Edison. Dr. Kennelly, who was in charge of Edison's electrical work, had promised Reg a look at his copy when it arrived. Half a dozen times a day he would find Fessenden gazing across at him with inquiring eyes.

Reg was fortunate that Dr. Kennelly had taken a liking to him, for if anyone could be rightly called an authority on electricity it was Kennelly. For some time he had been after a theory that concerned the sun's effect on tiny particles known as ions, which swim about in the earth's atmosphere, and he looked forward to the day when he could send balloons into the upper air for first-hand information. At this time, while he and Reg ate their meals together and read mathematics to one another, neither of them even guessed what a decisive part these hungry electric sharks would play in signalling through the air. And from Reg's standpoint, it was just as well, for he might have been persuaded to drop his notions about wireless then and there.

To Fessenden, Kennelly's electrical building was the home of the gods and, but for the library, commanded every spare moment he could find. Here, along the centre of the workshop floor, crouched the big black dynamos, purring as softly as kit-

tens. And looping every which way from them to the steam engines outside were a great number of rubber belts, spanking themselves with a slap, slap, clatter as they wound round and round. Often, to suit his friend, Kennelly left the machinery running over the supper period and at other times when he was away, knowing that when he returned Fessenden would still be standing, spellbound, not having moved an inch the whole time.

Then one day Kennelly received his copy of Hertz's papers and Reg went to see him in the little nook at the back of the building where, surrounded by Leyden jars – small glass vessels used to store and condense electric charges – Kennelly had his desk. 'Look,' cried Reg. 'Hertz says that the waves will go through solids and that they move back and forth or oscillate and also that he can vary their length from a few inches to twelve feet or more. I tell you there is no reason why they cannot be made to carry sound!' And suddenly, realizing what all this meant, he was off prancing around the desk, waving his arms up and down.

'Perhaps, perhaps,' mused Kennelly when Reg stopped long enough to listen to him. Then all at once, seeing things in their proper sense, he exclaimed: 'Now see here, Fessenden, why are you getting so worked up? Good grief, man, there are a hundred problems to lick first, and I'm afraid to even think of where you should begin.' Then he added, searching deliberately for the right words: 'You will talk into a microphone, say one like Bell's, then turn your voice over to some sort of modulator . . . '

'Suppose we call the modulator a kind of sculptor,' broke in Reg excitedly, 'a sculptor which can carve the voice sounds onto these electromagnetic waves; let's call them carrier waves because they will carry the sounds.'

'All right,' continued Kennelly, 'but that word "carve", there is the first difficulty. Sure, it is easy for Bell because he uses a wire which sits up there like a paved road; he starts the signal down it and he knows exactly where it is going and the amount of power needed to get it to the end. And another thing: it's easy to reckon the resistance speech meets when it goes along a wire – the thing is fairly constant; but how can you tell what spoken words, riding the back of a carrier wave, will run into out in space? Furthermore, I haven't the faintest

idea how you would go about carving voice onto anything as shifty as a wave of electricity.'

'Or finding and unloading it again at the receiving end, or separating it from all the other sounds of the atmosphere, or this or that?' finally exploded Reg in exasperation. He sprang from his chair, paced over to a small window, and stood glaring out into the grey sky. 'You are right, Kennelly,' he declared finally. 'Sending end, receiving end, all the miles in between! It's "how?" every way you look at it, isn't it?'

Then he turned back to his friend. 'Have you got anywhere lately with your sun radiation theories?' he asked.

'I've made a little headway, Fessenden,' answered Kennelly. 'I'm convinced that each day, once the sun has warmed the atmosphere sufficiently, those electric particles multiply like rabbits until after a few hours they surround the earth in huge layers. But don't ask me about all their habits because I don't know as yet.' Kennelly spread his hands apart, palms up, and looked hopeless. 'This much I can tell you,' he resumed, 'they'll do something to your signals: absorb them, drain them of energy, blunt them, or bounce them back to earth. And for your sake, Fessenden, if you're bound to keep on with this wireless bit, let us pray they are bounced back to earth; either of the others and you haven't a chance.

In the spring of 1890 Edison set out for Paris to see the great exposition there, and before he left he promised to let Reg do wireless work along the lines of Hertz's experiments. But Reg's high hopes of at last being able to put his own theories to the test soon plummeted. Times were hard and during the summer months the Edison companies came close to going on the rocks. When the inventor returned in August he laid off all but a few of the help and Fessenden was let go with the rest.

In the first stages, soon after the loss of his job with Thomas Edison, Reg was lonelier for Helen than ever and finally the two of them persuaded Thaddeus Trott to let her come to New York. Shortly after her arrival in the last week of September, 1890, they were married at a little meeting house with a name more fit for funerals, the Church of the Heavenly Rest.

After the ceremony they took a stroll in Central Park, for it suddenly occurred to Reg that there was little else they could do. Carried away as he always was when things were happening to suit him, he had not only paid the balance owing on

the engagement ring at Tiffany's but had bought a diamond brooch to go with it. For a time Helen allowed him to pace back and forth while he scolded himself unmercifully for his thoughtlessness in not keeping a cent for a meal to celebrate, let alone money to stake them to the meanest kind of honeymoon. Then, when she thought that he might have learned his lesson, she came to their rescue and handed over part of the rainy-day money which she had brought from Bermuda. After dinner they set out for Canada and a couple of weeks at the rectory at Chippawa. But for a short stay at Christmas time during his second year with Edison this was Reg's only journey home since he had left to strike out on his own.

They spent much of their time by the Niagara, picking their way along the thread-thin paths that as a boy Reg had scooped from the high bluffs beside the river. 'There's the spot above the Whirlpool where I learned to float on my back,' he pointed out. Then he took her to the Clarke Hill and other islands just above the falls and they sat where he had burned his twig fires. 'Deerslayer Country,' he reminded her and she was properly impressed.

The holiday at Chippawa passed all too quickly. On the last weekend before they left Uncle Cortez came over from Peterborough where he was now principal of the collegiate, and he and Reg had many a fine chat. Out of Tina's and Elisha's hearing they talked of wireless and Hertz's waves, but no matter how hard Reg tried to persuade him, Cortez wouldn't budge from his old opinions. 'It's a waste of time, my boy,' he said. 'I'm beginning to agree with your mother and father that you might be better off teaching. Look what happened with me and the arc light,' he lamented. 'Mr. Cartwright paid me a thousand dollars for an interest but it has come to nothing; nobody seems to want to buy it.'

Mother and Father Fessenden took to Helen right away and they could not fuss enough over her. But when Reg told them that his plans for the future still meant working in the laboratory, they were crestfallen. They had hoped that with a wife to support he would give up such frivolous ideas. But Reg was, if anything, even more set in his ways. When he bid them goodbye he knew there would be no turning back, ever, if he could help it.

12.
Hither and Yon

George Westinghouse, the inventor of the air brake for trains, had set up a plant in Newark to manufacture his devices and there Fessenden went in the fall to take a job. 'Yes, we have heard of you,' said Mr. Westinghouse. 'You can take charge of the work on generators and if you have some spare time I would like you to look into problems we are having with our light bulbs. Edison holds the patents and we must figure a way around them.'

Reg went to work in what had been the inventor Weston's laboratory. He marvelled at the new instruments such as the voltmeter which the great scientist had perfected and which could gauge the amount of electricity flowing in a wire or circuit. He learned to use them and, what was vastly more important, to understand the whys and wherefores of those complicated mechanisms which lay behind the tiny measuring hands and determined their movements. And the more he found out the more curious he became.

Though he still had no time for experimenting on his own Reg was certain that day was drawing closer and closer. He had found out most things there were to know about sending dots and dashes over wires. This had been necessary so that he could get on with his theories about casting aside the wires themselves. In the process he had hit on a way of sending the Morse code faster than ever before and at the same time using

less electrical energy. As a result the Pennsylvania Railroad asked him to give a talk to its engineers. The lecture was so well received that, full of confidence, Reg approached the big companies which owned the cables under the Atlantic to see if they would listen to his scheme. He even dared to hope that a deal could be made whereby he could leave Westinghouse and set up his own laboratory.

Reg soon discovered that he was a babe in the woods where the methods of big business were concerned. 'Mr. Fessenden, we think your system would work,' they told him, 'but we do not want it. Why, young man, every one of our cables has cost us three million dollars and we would lose much of our investment if we were to make the changes you suggest. For the greater part of the day they are hardly worked at all. Now if you can invent something that will prevent all cables from sending more than four words a minute we will pay you well for it.'

What a jolt! Just what did they mean? In truth, Reg had run up against one of the basic laws of inventing: It is not enough to discover new and better ways of doing something if this means discarding the old at a loss.

'All right then,' he thought, as he trudged back to report to Helen, 'when the time comes for wireless I'll form my own company.' But one upsetting conclusion lurked in his mind and that was that inventing would be a much tougher business than he had ever dreamed.

Reg solved Mr. Westinghouse's troubles with the light bulbs by designing new lead-in wires. While they were not of any use right away, they would later save the company's contract to light the giant Columbian Exposition in Chicago and please Westinghouse no little bit.

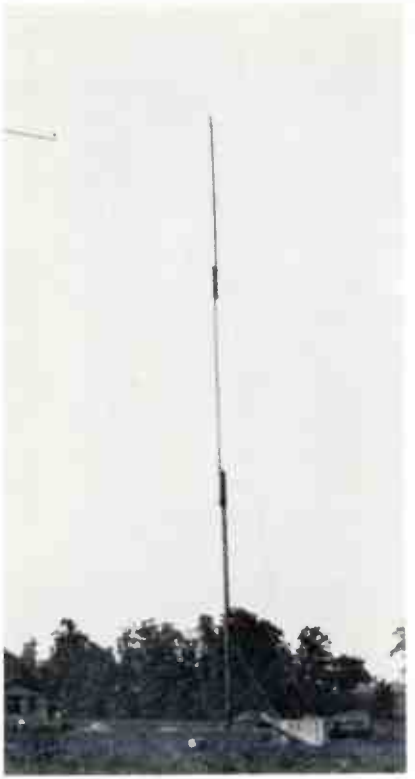
But right now he had come face to face with a difficulty of his own. Most of the company's research was being done in Pittsburgh and, as a result, at Newark he felt that he was at a dead end. He had come to know a Mr. Stanley who made lighting apparatus and Stanley, noting the unsettled nature of his new acquaintance, had come forward with a proposition: 'Fessenden,' he said, 'I would like to know what means Ferranti is using to send power into London. The pay will be small but would you like a trip to England?'

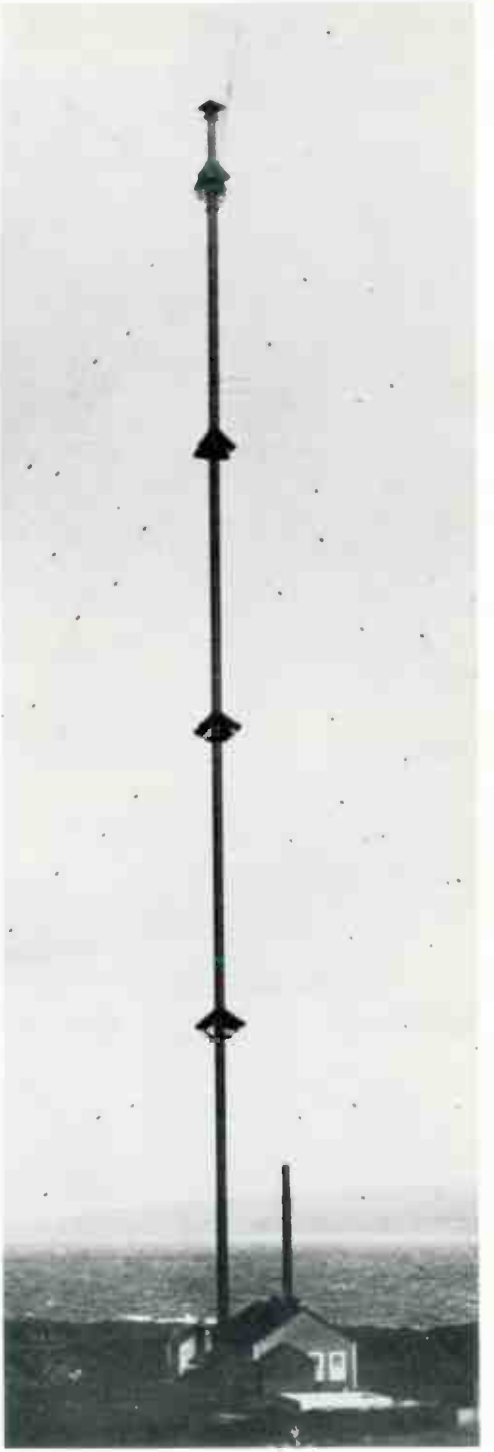
The Rectory at Fergus, Ontario, taken in 1967

Reginald Fessenden, 1905

Twin radio towers at Cobb Island

View from the top of the Brant Rock tower





The Brant Rock tower, with the radio shack at the bottom

The Brant Rock operators. Fessenden is seated in the middle and to his right is his son Ken, holding Mikums. Mr. Pannill is at the far left standing next to Jessie Bent, the secretary. Mr. Stein is on the far right.

The interior of the radio shack at Brant Rock with the operators in transmitting position

The chance of a visit to the land that had nourished two of his boyhood heroes, Farraday and Newton, proved to be a bigger temptation than Reg could resist, even though the letter hiring him left much to be desired. 'You will receive a salary of $100.00 monthly, $125.00 if this is not sufficient,' it read. 'There will be no particular hours of work but when necessary you will work evenings, but not necessarily every evening.' After pointing out to Helen that their nest egg had now reached the lofty pinnacle of five hundred dollars he quit Westinghouse, with the inventor's approval, and in the spring of 1892 boarded the steamer for Southampton.

The visit to see Ferranti's big generators belting current into the city from safe points outside proved to be no disappointment, though he wondered at the location. 'The people fear that electric plants might blow up and cover the countryside with sheets of flame,' he was told. 'That is why we have built them in the quiet meadows at Deptford.'

Reg shook his head at such ignorance. But he could not guess that many of his own creations-to-come would be looked on with the same misgivings, and often by people who should have known better. He would find it another bitter truth of invention that 'being too far in advance of the crowd can sometimes be no better than being too far behind it'.

Before he left England for home Reg made a side trip to Newcastle-on-Tyne and there he saw a demonstration of Charles Parsons' steam turbine. 'In this engine,' he wrote in his notebook, 'a shaft is made to run at a great speed by jets of steam striking the fins of a wheel attached to it.' Reg was thunderstruck with the possibilities of this great new source of power. When he left, his notebooks bulged with facts and figures and during the long days and nights homeward bound on the liner, his head was also spinning as he contemplated the turbine whirling huge generators at unheard-of-rates.

When he landed back in New York, instead of being met by a happy Stanley, Reg came face to face with a notice of bankruptcy posted on the company's main gate. While he had been away another money panic had struck. Everywhere companies were going broke and depositors were in line at the banks to withdraw their savings. He and Helen, however, had none to withdraw. At the last minute before sailing Mr. Stanley had

asked Reg to cover the expenses of the trip himself, promising to repay him on his return. Now that was out of the question. Once again the topsy-turvy business world had upset his plans and in the general gloom he did not know what to do next.

'Teach, Reginald, by all means go back to teaching,' he could hear his mother plead, and he could see his father nod his head and say wisely, 'Whoever, my boy, heard of a college going broke?' Reg's mind was in a turmoil, and for some nights he swore he saw the ghost of old Edward Trenholme standing beside the misty St. Francis, and heard it whisper into the wind: 'Stick with your inventing, lad. Stick with your inventing, no matter what the cost.'

Suddenly he saw the answer to his grief and he wondered why it had taken him so long. He had simply been aiming too low, he decided. If he had to teach, it needn't be in some obscure school where they had never heard of electricity. Why not try the big universities? A professor, say in McGill or in one of the large American colleges, should have plenty of time to both lecture and experiment on the side. In addition the apparatus he needed would be right at his elbow.

Then he recalled a letter from his uncle, Norman Trenholme, who was about to become a Judge of the Appeal Court in Montreal. 'When you feel that you are ready, Reginald, come to Montreal,' the letter had read. 'McGill has established a chair of electrical engineering and we might be able to get it for you. Needless to say we follow your career with great interest and when you come back to us, I am sure that your uncle can find some spare money to help finance your inventions.'

But he was not 'ready' for McGill, Reg decided. Too many links were still missing in his plans for wireless signalling and he must not use Uncle Norman's money until he was on the right track. No, McGill and Montreal would have to wait awhile.

13.
Pittsburgh

Over in Indiana, on the banks of the storied Wabash River, not far below where it meets the Tippecanoe, is the small city of Lafayette and Purdue University. To this place came Reg and Helen in late August of 1892.

'Tippecanoe!' What a strange-sounding name, he thought, repeating it over and over, and right away he knew that he would be at home in this wild land. It was his kind of country: endless forests in which to ramble and picnic on Sunday afternoons after a hard week in the classrooms, and crystal clear rivers in which to swim. And besides, there was the connection with Canada which was so meaningful to him. It was in the dense woodlands along the Tippecanoe in 1811 that Tecumseh's brother, the Shawnee Prophet, had fought the Americans in one of the bloodiest of frontier battles.

At Purdue Reg set out to dovetail mathematics with electricity. From the beginning he realized that he could not have chosen a better place for the attempt. 'You have a free hand in purchasing equipment,' stressed Dr. Smart, the university's president, and Reg took him at his word. In addition to the regular apparatus he filled the laboratory with all kinds of instruments, many of the very latest manufacture and capable of giving the most precise measurements.

But even with every aid he could lay his hands on, plotting a course in teaching was like sailing a ship on some dim,

uncharted sea. Little was known of electricity in those early days and textbooks were few and often so poorly written that Reg decided their authors were not nearly as 'up' on the subject as he. Fortunately, President Smart had faith in him or the attempt to mount a study of Hertz's sphynx-like waves on such a shaky base would have been doomed.

Although he noticed that sometimes his students held a finger to their foreheads when he approached and murmured, he was sure, something like 'Here comes Professor Fessenden, like everyone else in his class he doesn't know where he's been, where he is, or where he's going,' still Reg got on well with them. When he lectured the halls were filled to overflowing because he had developed a way of explaining the most complex things in simple everyday terms. And the plainness of his speech often brought a titter, such as when he would fill a blackboard with equations and then stand back and refer to them as 'that bunch of stuff'.

There was plenty of time for his own experimenting and at all hours of the night Reg had willing recruits hard at work in every nook and cranny of the laboratory. But his digging for the truths of wireless could not have been more frustrating. He would round a corner in his research only to find, like an explorer of Egyptian tombs, a dozen more side paths branching off in new directions. And, as with the archaeologist, every path would have to be closely examined. One of these byways was marked 'resonance' and it took him a long time, just as it had Bell and Samuel Morse, to estimate how this fitted into the picture.

It was well know to experimenters that if different sets of sound vibrations could be put in motion and intermingled in some way, the resulting tones would be much stronger than otherwise. Reg established to his own satisfaction that in wireless a means would have to be found of vibrating or resonating the sounds of the human voice before carving them onto the carrier waves. And likewise, at the receiving end, vibrations of the same frequency or number must be set in motion so that they would be 'sympathetic to' or in agreement with the others. It was very complicated, and knowing what had to be done was the simplest part; the actual doing would be a far different story.

At this time Reg began to grope along still another path of research even more knotty than resonance. 'Electric waves swing back and forth, or oscillate,' Hertz had said, but no one had the faintest idea of how often in a given period they would have to do this to support the transmitting of sound.

By the end of the school year, when he was getting ready to leave Purdue, about all Reg had decided was that sending dots and dashes would be a much simpler proposition than real words; therefore he must master this first. What a paltry result for so many months of hard work! Uncle Cortez and Edison and everybody else, for that matter, could have sat back and smiled at this meagre accomplishment.

But in the spring Reg had something else on his mind, a happy event, and for a while, at least, investigating electric waves had to move over and take second place. This new interest would soon have his own way of shuttling back and forth and there would certainly be no question about resonance. Reg and Helen named their son Reginald Kennelly, and Kennelly himself travelled over from Boston to give his approval. Before long it was found that one Reginald around the place was enough and the little fellow came to be known as Ken.

During his childhood about the only complaint Ken had against his loving parent concerned his cat. No experiment in the world was so sacred to Reg that it could not be shared by a playful kitten, and Ken simply got tired of searching out his busy father and climbing up to haul his tabby out of a shirt pocket. Two or more cats became the order of the day and Helen made sure that each master would always have at least one within meowing distance.

About June Reg received a letter from Mr. Westinghouse. The Columbian Exposition was on in Chicago and the lamp filaments were working perfectly. Westinghouse was overjoyed. 'I've enclosed a cheque for a thousand dollars,' he wrote, 'on condition you come to Pittsburgh where I can keep an eye on you. The university here is creating a new chair of electrical engineering and Dr. Holland, the Chancellor, is quite agreeable to having you accept it.'

Though the trustees and students at Purdue begged Reg to stay on, he knew the day had come for another move, this time

of his own making. Pittsburgh was a much larger university and, in addition, working with Westinghouse would have many benefits. Seven years had sped by since Hertz's experiments and Reg was convinced that any number of European scientists must be ahead of him. The opportunity of readily making parts for his apparatus in Westinghouse's factories, and saving time and money as well, was too good to miss.

In July Reg, Helen, Ken, and the cats arrived in smoky Pittsburgh. It was as if they suddenly had been dropped into the middle of an immense ant colony. Reg and Helen had never before seen so much going on in one place at one time in their lives.

It was here that the Allegheny and the Monongahela rivers flooded down from the hills and swirled together to give birth to the mighty Ohio. On all three rivers tiny tugs puffed back and forth, pulling and pushing endless rows of barges loaded low into the water with iron and coal and timber.

Along the shores, hard by the newly laid railway tracks, open coke ovens heaved their great clouds of soot and ash up among the treetops where it hung all day long, only slightly muffling the clang from the rolling mills and Westinghouse's sprawling works. On the campus, even though summer had barely come, the leaves had already turned brown and crisp.

On one side of the university sprouted the mushroom-shaped dome of the Allegheny Observatory where a short time before Professor Langley had laboured to determine the lift of little curved pieces of wood. The 'experts' had laughed when Langley contended that in time man would learn to fly, and just as surely they were ready to pour scorn on Fessenden. 'Professor Simpleton,' they would joke, 'you are as crazy as Langley. Flying like a bird. Talking without wires. Whoever head of such humbug!'

The Fessendens and the cats went to live in a large brick house in a pleasant part of town. For the first time since their marriage Reg had a 'think room' all to himself. Except for the doors and windows, bookshelves lined all four walls clear to the ceiling and end to end. Elisha sent him Grandfather Trenholme's roll-top desk and swivel chair from his study, and these Reg placed at one side of the room, keeping just enough open floor space for nap-taking. Near by rested the same old

Watt's chemical dictionary he had had at Edison's, the covers worn smooth from being used as a headrest.

Through the years, and especially while he was at Purdue, Reg had gathered together a huge pile of drawings having to do with his apparatus designs. About this time, too, he had begun taking an interest in photography and now, as he sat eying the space the drawings took up on his desk and shelves, an idea occurred to him: 'Why can't I photograph these papers in miniature and instead of needing all this space to store them, merely retain the films themselves?'

He screwed a wooden arm to the edge of his desk and at the other end mounted a tiny camera. When the pictures were taken he joined the plates in their proper sequence and ran them back through disks of quartz, projecting them onto a large screen he invented for the purpose. 'See,' he explained to Helen, with relish, 'I can keep them in a space no larger than a matchbox. Think what this will mean to big companies or museums. Why their permanent records can be kept forever in a few sealed tins!' Before the end of the year the American government had issued him his patent for 'microphotography'.

Though the Department of Electrical Engineering at Pittsburgh had already been under way for two years, it had languished. As at Purdue, Reg was allowed to purchase the finest equipment money could buy. Classes were running smoothly and what's more the arrangement with Mr. Westinghouse could not be better. 'As long as I can come to you for advice, that is all I ask,' Westinghouse had said. 'When you require anything from the machine shop just say so and I'll see that the boys get on it right away.'

All this, along with the best salary he had ever earned, combined to make him the happiest he could remember being. It was too good to last – and it didn't. In the short period of a few months Reg was struck two crushing blows, all the more numbing because they came from Canada where he least expected them.

In 1892 his father and mother had moved to a new charge at Ancaster, Ontario, near Hamilton, and from the first nothing seemed to go right for them. Though Reg had never missed a month sending them whatever money he could spare, Elisha's salary from the church was such a pittance that the family

could not make ends meet. And they had kept the real state of affairs to themselves. Ken had gone west to work on the Winnipeg *Tribune* and Tren, too, was far away. As the years went by the debts increased until finally Elisha was beside himself with shame from owing the bank, the storekeepers, and even the coal merchant.

Then late in 1895 Vic gave up his job and returned home, all mixed up in his own mind, only to find his father worse off than himself. One fall day when he was travelling by train from Hamilton his remorse became more than he could handle and he flung himself to his death beside the rails.

Reg came up from Pittsburgh and they buried Vic in the maple-rimmed cemetery next to the church. Then a few weeks later he returned, and in the midst of a howling January blizzard Elisha's body was placed beside that of his youngest son.

Little Vic, who had always been the first to run and take his hand when he had returned for holidays from Trinity. And Father Fessenden, good man that he was, giving his all for the church and never looking out for himself, and whom Reg had never quite got to know. Both now dead by their own hands.

> Be strong, therefore; resume thy load,
> And forward stone by stone
> Go singing, though the glorious road
> Thou travellest alone.

These words of Archie Lampman's, written out for him long ago, these he would remember. But 'singing'? Would that be possible ever again? For he did feel alone, suddenly so very much alone.

14.
"Continuous Waves"

About this time, in Italy, another young man who also had been experimenting with Hertz's waves was meeting with a different kind of fortune. From the beginning fate had smiled on Guglielmo Marconi, giving him parents of wealth and understanding who saw to it that their son wanted for nothing. When they noticed that he had a bent toward science, they bought him everything needed to equip a small laboratory at home. Then when the family journeyed to Leghorn for the winter a special tutor was engaged to teach the boy electricity and, as it turned out, all about the electromagnetic waves of Heinrich Hertz. How far removed from the young Fessenden having to experiment on the sly, then later make his own way in the world and help support his family as well.

One day while tinkering in his little upstairs laboratory at the Villa Grifone, the family estate, the twenty-two-year-old Guglielmo caused an electric impulse to spring through the air and tinkle a tiny bell. His curiosity aroused, he took his apparatus outside and before long was banging out a kind of mechanical signal which he loaded on his Hertzian waves and sent crashing from the villa's garden over or around or through to the far side of hills a mile away.

His insight immediately told him that he had hit on something of great consequence, something that, if handled correctly, would some day make him a great deal of money. And

to Guglielmo nothing in the world was more important than success in business.

By the spring of 1896 Marconi had landed in England. He was nearly breathless with anticipation and even during the customs inspection he refused to move so much as a foot away from the big black suitcase holding his precious instruments. In only a few days his mother had him comfortably settled in a flat in London and then, because her family's wealth had already made her well known to important people in the government, she persuaded the post office to give Guglielmo the chance to demonstrate his apparatus.

This was all Marconi needed. By July he had erected small antenna masts on Salisbury Plain, near Stonehenge, a prehistoric ritual monument. Now another kind of mystic function took place. Marconi's dots and dashes fired through the air for a distance of two miles. Then, as the months passed, he continued to work day and night readying his equipment for what he knew would be the hardest feat of all, signalling across the Atlantic.

For Fessenden the year 1896 was a trying one. He had been working on a device to use at the receiving end of his apparatus, something to help him detect or find the telegraph signals and unload them from the carrier waves. But little progress had been made. He and his assistant, Mr. Kintner, had been doomed to using a gadget called the coherer, sent over from Europe, but to Reg the less he had to do with the 'vile little cylinder filled with metal filings' the better. 'It is so sensitive,' he emphasized one day to Kintner, 'that it is bound to pick up all the sounds in the atmosphere; then try finding our signals among all that garbage.' He chuckled, though, as he added, 'Perhaps I should be thankful. If I can devise a new kind of detector that will screen out this unwanted stuff and the other experimenters stick with the coherer, I might have a chance of beating them.'

Then came the day in July when the newspapers broke the story of Marconi's good fortune on the Salisbury Plain. Fessenden and Kintner took stock of their own scanty progress and felt like crying on one another's shoulders. But they both bucked up when they learned that the Italian was using the coherer. 'That thing will lead him down the wrong road sooner

or later,' Reg said encouragingly to his assistant. And they attacked their problems with new gusto. However, when spring came they were still little further ahead.

Though he did not know it at the time, Reg was aiming for a much higher goal than Marconi. Young Guglielmo had never once thought of tackling the far more difficult task of sending voice, being content with his mechanical signals. But Fessenden, when he designed a piece of equipment, did his utmost to see that it suited both methods. To him the sending of speech in the very form it left the mouth was grander, no matter what the added complications, than the actual sending of dots and dashes a hundred times around the earth. And herein lay part of his trouble.

At times he and Kintner were lucky to get any kind of sound from their moody apparatus. One day their hopes would soar when a handful of faint click-clacks trickled the few feet across the laboratory. Then the signals would give up the ghost and die out, and the two of them would begin all over again, taking some new approach. Beginning all over again, to Reg, meant mathematics and more mathematics, page after page of them far into the night and sometimes right through until morning when students' footsteps in the hallways would remind him that it was class time once more. And, as ever, no matter how well he worked things out, the fickle coherer stood willing and able to make a mess of his best-laid schemes.

Plainly, he was getting nowhere; at some stage his theories were all wrong and once he complained bitterly to Kintner, 'I wouldn't be surprised if Marconi gets across the ocean before we can signal out of the laboratory!' Something had to be done and it set him thinking along a different line. Perhaps a change was needed, a few days away from the dirty brown hills and never-ending clang of Pittsburgh, a chance to roam about in the clean air again and reason things out. It was June and back in Canada, he remembered, the countryside would be green, the lakes shimmering in the summer sun; a fishing pole, that is what he needed, a fishing pole and a quiet place and someone to talk with who understood him, someone like his favourite uncle, for instance.

At first Cortez barely recognized the stoop-shouldered giant who shuffled toward him from the train at Peterborough. Gone

was the long-striding soldier's way of walking and when he saw the whiskered face at close hand he winced because he had never seen his nephew this down at the mouth before. Helen had come along too, and just as well, because it would take the combined efforts of both of them to put the starch back into the big body. But Cortez had planned for precisely such an emergency: the canoe was painted a spirit-lifting red for tripping on the Otonabee, his two bicycles had been overhauled, and he had staked out a hideaway for chatting within 'wheeling' distance of their cottage, only a few miles away on the shores of Chemung Lake.

Gradually, over the weeks of July, the Viking look returned and with it all the ginger of old. Soon Reg was tackling each new day's activities with a zest that should have gladdened their hearts. 'But that is part of his trouble,' confided a resigned Cortez to Helen. 'Why can't he simply take things easy like anyone else under such circumstances? But no, he has to seize on even the poor knack of relaxing as if it were holding something from him.'

Toward the end of the month they visited Reg's old school, Trinity, and he presented the prize for mathematics. It was a happy event for he had donated the prize himself, one he had been giving the school each year since he had gone to the university at Pittsburgh. 'I want you to make an award to the student getting the highest marks for the full term,' he had written Dr. Bethune, the principal. 'Find the best book available on mathematics and I will gladly pay for it.'

As a matter of course Professor Fessenden was called on to make a speech. By this time he was in his glory when talking to 'his' students and usually he spiced his delivery with tidbits of personal wisdom. 'Of the hundred things we shall be remembered for, most of all we shall be remembered for our inventions,' he told them at Trinity. 'All our civilization is based on invention. Before that man lived on pine cones and roots and slept in caves.'

And the odd part was that, though Reg had dedicated very nearly the whole of his own life to improving man's lot on earth, in this summer of 1897 he preferred not to practise what he preached. After the others were asleep he would steal from the cottage and bed down on a pile of leaves in the bush near

by. There he would lie in the quiet night, hands under his head, imaginings lost up among the layered stars. At the first light of morning he would spring up and be off to the lakeshore where he kept his fishing pole, lingering only long enough to strip the occasional handful of raspberries from the mass of branches thatching the narrow pathway. At first Helen was for putting a stop to such 'roughing it', fearing the dampness might sharpen the trace of rheumatism which lurked in his back. But Cortez persuaded her against the idea. He had noticed that 'some special sort of thinking' seemed to be going on and the last thing they should do would be to interfere. So they left him alone.

The British Association was an ageless, stuffy society which met once a year to discuss things scientific, and on August 18, Reg went to Toronto and sat in on the annual meeting. Though already the electric gyroscope and many of his other inventions were in use throughout the world, save for one old gentleman, not a soul recognized him. 'I understand you teach, Mr. Fessenden,' the gentleman said. 'Oh, and you have worked for Mr. Edison, you say. A most fascinating man! Of course, you realize that it is Mr. Marconi's name which is on everyone's lips these days. I see where he has formed a wireless company in England and they have given him £76,000 for his patents. It does seem a shame, doesn't it, that Canada can never produce men of that calibre.'

Reg took little notice of the dull, endless speeches which followed except to note that the speakers agreed with Marconi that 'to carry sound, the electromagnetic waves must snap out into space like a whiplash and be repeated over and over again at intervals.' Of all the reasoning behind wireless, that concerned with the generation of the waves and how they should proceed through the air was probably the most basic. Yet the more he heard this whiplash theory put forth, the less he was convinced that it was the correct one, for either mechanical signals or voice.

During the summer bits and pieces of a totally different idea had begun to unfold in his mind but he had hardly dared believe that it could hold any great promise. Suddenly, during the speeches, the remaining parts seemed to fall into place and he escaped from the meeting to a quiet seat in the smoker of

the Peterborough train. Soon his notebook was on his knee and he was writing like a man possessed, something having to do with endless streams of electromagnetic waves. While the train clicked off the miles, conclusions so startling and original flooded his brain that he felt as if he were in a trance. Dared he be right? Had all the other experimenters since Hertz missed what was now becoming crystal clear to him? He must try his new reasoning on Cortez as soon as possible, pin it down before it flew off and disappeared like some will-o'-the-wisp, because suddenly it seemed too simple, too obvious, too easily come by.

Chemung Lake is a long, windless water sheet, spread as flat as glass among the low hills near Peterborough. Reg and Cortez's hideaway was located a short distance along the shore from the cottage and the next day they wheeled out to it to be alone. During the early hours, while the soft sun sponged the mist from the water, they fished for bass and about noon lighted a twig fire to cook their catch. Then, when they were finished, Reg asked Cortez to watch while he tossed a small rock a few feet out onto the still face of the water.

'Look, Uncle,' he explained, 'see how the ripples circle out from where the rock hit? If they are going to carry the whole range of voice sounds, the Hertzian waves must radiate just like that from the antenna at the transmitting end and they must keep going in a steady stream until they encircle the antenna at the receiving station, then never let up, even for a split second.'

'I see. In Marconi's scheme they stop and go, stop and go,' exclaimed Cortez, tapping fresh tobacco into the bowl of his curved briar pipe and feeling quite satisfied with his own reasoning. Though he had written a textbook on physics, which was being used in Ontario's high schools, still he had often confessed to Reg during the summer that wireless had him 'baffled'. But Reg's new wave idea – this he could follow.

For a short while they were both lost in thought, Cortez puffing out little clouds of smoke at deliberate intervals so that they hung in the air looking like Indian signals and Reg now and then skipping small pieces of shale far out into the lake and eying the ripples at each touch-down place.

He realized it would take ages to make this new theory

work: to find a way of generating the waves, then to alter or modulate them to carry voice sounds, and finally to separate the two at the receiving end. And he knew that much of his past experimenting would be scuttled. Still, deep inside, he felt strangely elated. Marconi's whiplash theory was doomed, his discovery of continuous waves would see to that.

Suddenly, Reg whirled toward Cortez, his eyes brightening. 'Continuous!' he blurted out. 'That's the word that describes them.'

'Continuous waves!' He kept rapping out the expression over and over again while he grabbed the loose rocks around and flung them one after the other out into the glassy water until the wave circles intertwined every which way and the surface looked as if a huge school of bass was all at once jumping for flies.

15. The Interrupter's Wail

Back in Pittsburgh, Reg pushed his experiments as never before. The stay in Canada had made him a new man; the 'few days' had stretched into three months and he did not return until early September. Lost time must be made up; classes needed organizing; a start must be made on a means of producing continuous waves. And in the part of the laboratory he reserved for his own research, the tools of his trade – the batteries and generators, telegraph keys and headphones – all practically shouted for him to take them up and get on with the job. Everything save the coherer, and this he felt like kicking into the Ohio.

Each day when he returned from the university, Helen and little Ken saw him for only the few short seconds it took him to stride from the front door into his study. Now and then during the long night hours he would snatch a few minutes from his drawing and figuring to sprawl full length on the floor, head on Watt's Dictionary of Chemistry, or to make a fast trip to the kitchen for oysters and milk. He was a man possessed, and at the laboratory too he drove himself and Kintner without mercy.

As before, whenever possible, they worked on apparatus which would be suitable for both wireless telegraphy and telephony. 'Think, Kintner,' Reg shouted one day, pounding his fist on the workbench as if the significance of what they were

attempting had suddenly dawned on him, 'think what it will mean to be able to transmit either Morse or voice at a second's notice and merely by flicking a switch!'

Over the winter their experimenting advanced at a fast clip and when spring came they moved some of the tests outside the laboratory. Dots and dashes went winging for a mile or more, not nearly as far as Marconi was now signalling but still good enough to show that much longer distances awaited only a few additional adjustments in the apparatus. The clearness of the signals and the performance of each piece of equipment meant more to Reg than anything else at this stage. As yet he had not even tried to transmit real words; in fact, even in his thinking there were still a number of blank spaces as to how this could come about, but he reckoned he was headed in the right direction and that mattered most.

He had heard that the chair of electrical engineering at McGill University was coming vacant with the end of the term and he decided that now, at last, the time had come to return to Canada and carry on his work. In June he sent off his application, enclosing copies of printed articles, and he began to count the days until he would receive an answer. July passed and no reply, then, on August 8, they gave him their answer: 'Professor Owens of the University of Nebraska has been given the appointment,' the letter read. 'Would you kindly advise us where to return your application?'

Short! Brutal! To the point! They might as well have said: 'You aren't good enough, Fessenden.'

'And they chose an American,' he despaired over and over again to Helen. 'Isn't that just like them? To think that they did not even deem me worthy of an interview!' For a time his spirits were crushed. He even considered giving up his work, but such was its hold on him that he could more easily have quit eating. In the end he plunged back into his research more determined than ever to win out.

About the beginning of the third week in November he and Kintner were in the laboratory testing the telegraph, using a device called the interrupter, which broke or 'interrupted' the flow of the electric current. So far it had been a day no different from countless others, with only a pitifully few things here and there seeming to work out better than usual. But in

truth Reg was progressing more than he realized. All the small improvements, when lumped together, had carried him forward further in a few months than in all the years before. During the afternoon he had often paused among his machines and instruments, stooping to check their connections or to give a friendly pat to a particular piece of equipment for a job well done. And they were returning the affection by chattering and singing in their working like a flock of merry magpies.

And then it happened. Kintner had been keeping the sending key down for a long dash in the Morse code and Reg was sitting at the far end of the room, both hands holding the headphones tight to his ears. Suddenly he leaped to his feet and raced back to Kintner. 'You run over to the receiver and listen,' he shouted. 'What I heard is impossible, utterly impossible!'

'Why it's the wailing sound of the interrupter, that's all,' Kintner looked up questioningly, the phones dangling loosely in his hands.

'Then you heard it too? You heard the interrupter in the headphones?'

'Yes, I heard the interrupter in the headphones. What's so important about that? Why are you flapping your arms?'

'Because, you jackass, if we can transmit that high-pitched wail I'm certain we can send voice, music, you name it!' babbled Reg. Then he apologized for calling Mr. Kintner anything but Mr. Kintner, and went on to explain his reasoning to his amazed assistant.

'I'll send out waves of such high frequency that they won't disturb the operator's ear,' he said hurriedly. 'He'll only hear the variations due to the human voice.'

'Frequency above audibility.' That is the grand phrase the technical people would come to apply to Fessenden's simple conclusion. But how in turn to produce the continuous waves and to reach the desired frequency, that application was to be left to Reg himself.

'I'll make an alternating current generator more powerful than any in the world,' he later said to Kintner. And over the winter he worked out the design and ordered a large electrical company to construct his dynamo. But conclusions and ordering don't make a thing so and it would be many months

before this special machine would be anything like the way Reg wanted it. In the meantime he would have to improve the apparatus on hand and hope he could make the progress needed to change the wail into words, 'words of a sort', at least. But the minute he had those continuous waves, in that glorious instant he knew he would leap a good half way toward his goal. And the goal never changed: he must 'talk' over great distances. Let Aleck Bell string wires between the houses and the towns; he, Reginald Fessenden, would try to join the continents.

He spent most of the time on the telegraph side of his 'system', for dots and dashes could be sent with only a fraction of the power needed for speech, and at the receiving end, bearing in mind the awful coherer which he still had to use, they were much easier to detect. And he had to toil like mad to invent devices which would prevent the unwanted prattle in the atmosphere from drowning his feeble signals. Fail here and the headphones would re-echo and sound like a room full of crickets. As with a hundred other things, his 'interference preventers' must be the very best he could possibly devise.

Toward Christmas Reg gave a demonstration of the telegraph to agents of the United States Weather Bureau and they were impressed. 'We must find a speedier way,' they told him, 'of transmitting our weather forecasts from the remote stations along the Atlantic coast. Would you put your plans and ideas in writing?'

This Reg did, as fast as he knew how, because here, he sensed, lay an opportunity too good to be missed. On the fourth of January, the first January in the brand new century, he heard from Willis Moore, chief of the bureau.

'You will be employed for a year at a salary of $3,000 per annum and Mr. Thiessen of the Bureau will assist you,' the letter read. 'Your headquarters and laboratory will be in Washington where there are plenty of blacksmiths and instrument makers but the actual testing will be done at Cobb Island in the Potomac. Though the Bureau reserves the right to use the devices which you may invent, you will be allowed to keep their ownership in your own name.'

This last was very important to Reg for he had worried that the bureau, in accepting him, would also insist on taking his

precious patents. These were about all he had to show for his years of hard work. The savings from his university salaries had always been eaten up by the costs of his experimenting.

No longer would he have to pay such costs from his own pocket and, besides, he could spend all his time on research. Teaching had only been a means to an end and now that it was no longer needed he felt like a prisoner at the moment when the shackles are removed. His spirits soared. He would be working where he had longed to be from the beginning – outside, where he could feel free as the wind, could build his wireless masts and fire his signals over the endless miles of water and forests. And about time, too, for he had heard that Marconi already had sent dots and dashes over the English Channel to France.

The Weather Bureau had asked Reg to be on Cobb Island no later than March. Again, though he had everything in his favour, the decision did not come easily. But the whole world was rounding a corner; the turn of a hundred years was at hand. Everyone was looking ahead and in the end he, too, got caught up in the excitement. The classroom would know him no more.

Part Three
Words without Wires

16.
December 23, 1900

It was about four o'clock on a squally December afternoon and circles of snow curled round the corners of the unpainted radio shack, making it appear like a grey island in a sea of white. The wind, gusting up from the Potomac, puffed in under the shack's slat door and beneath the linoleum floor covering, slapping it up and down wherever it was not weighted by clusters of batteries and preventers and other trappings of the wireless experimenter.

Save for the scratching of Fessenden's pen nib as he struggled to make sense from a mass of symbols and equations, there was no sound. For the moment his chirper, as he called the telegraph, was quiet. It had not clicked since the last Morse message had come an hour ago from Thiessen, a mile away at the other mast.

This was to have been a day of miracles, a day when man first spoke real words that were heard at a point beyond his shouting range, but this had not occurred and time was running short. In another couple of hours darkness would begin to cover the island and he and Thiessen would get ready to trudge back through the snow to the main buildings. Already the opening blasts of an earlier and harsher winter than was usual in this climate showed signs of crippling their experiments.

Spring and summer had passed with more headway being made in a few months than would have been likely at the uni-

versity laboratory in years. Every daylight hour had been drained of its work possibilities. Reg had to get to know his electric waves and he sent them down the river, across the wet swamps, and over the dry hills and rocks to see exactly how they would behave. How fast would their strength trickle away? What direction would they take? He had little confidence in these weak, jumpy, jerky waves for they were only improvements of the same kind that Marconi was using. His own big generator was not yet ready and, at the other end, his instruments for receiving the signals were still centred on the coherer. But dozens and dozens of different items went to make up a wireless apparatus and these he had continually refined.

In the fall he had fired dots and dashes the fifty miles to Arlington, Virginia, where the Weather Bureau had erected another tower. Moore and his agents were astonished when the signals swept over the evergreen forests between Cobb Island and Washington, somehow pierced or bounced around the high buildings and monuments of the capital, and were hauled in on the other side by the Arlington operators.

But it was speech and not mechanical click-clacking which gnawed away at Reg. However, to suit his employers he had to bide his time and tend to the telegraph first. Moore would have fired him on the spot if he had caught him so much as daring to talk into the microphones. 'We want nothing to do with that sort of quackery,' he had warned Reg. 'My superiors would laugh me out of the bureau, yes, right out of the country, if they found me wasting the taxpayers' money on such tomfoolery.' But like the little boy with eyes only for the cookie jar, Reg waited for his chances and each day when telegraph work had been taken care of he would scrape together an extra hour or two to lavish on the wireless telephone.

Many a long night he had spent cutting grooves lengthwise in a phonograph cylinder, little incisions of such fineness that they could barely be seen with the naked eye. These grooves had indicated to him, when he had spun the record, how many times his interrupter must break the current in order that speech clear enough to be understood could be transmitted. And the magic number was 10,000 each second. Not per min-

ute, even, but per second! Mr. Brashear, the optical manufacturer in Pittsburgh who had agreed to make up the interrupter, was aghast when he came face to face with the problem. But it had been built and during September and October Reg tenderly eased it into place in his sending circuits. It gave every sign of being a willing worker but now that the do-or-die day had come it was acting like a *prima donna*.

Try as he might Reg could coax no more than two thousand breaks out of the interrupter. When he talked into the transmitter, Thiessen telegraphed back from the other tower, 'Professor, your voice comes through sounding like the flapping wings of a flock of birds; I can make no sense from it.' Reg, disgusted, tramped to a lean-to on the shack's north side and shut down the steam engine which ran his generator. Then in the stillness he returned to his notebooks.

An hour passed, then two, and the first shades of dusk darkened the corners of the shack. Shaking his head he pulled himself up from the table and in an angry instant hurled the pen down, where it stuck, quivering, in the soft pine boards. 'The figures all check out. There is not a thing wrong with them,' he growled.

As an afterthought he restarted the steam engine. His heart beat faster when he noticed that the engine seemed to run smoother and speedier than before. Then he tried all the wire connections for the tenth time. They were tight and in order. He pressed the telegraph key and the dots and dashes told Thiessen, 'There is still time for one last try at voice. I will begin sending in a few seconds.'

Then, 'One, two, three, four,' he carefully spoke. 'Is it snowing where you are, Mr. Thiessen? If it is, telegraph back and let me know.'

Barely had he finished and put on the headphones than he heard the crackle of the return message. After the first couple of clicks he fumbled wildly for a new pen and, hand shaking, he scrawled, 'This afternoon, here at Cobb Island, intelligible speech by electromagnetic waves has for the first time in the world's history been transmitted.'

Thus, on December 23, 1900, Reginald Aubrey Fessenden recorded the very beginnings of what we now call radio.

True, it was at best a sickly birth, the roar and hissing of the sender's spark nearly drowning the feeble voice sounds, but a sure start none the less. Where would it lead?

Reg got caught up in the wonders of it all. He had heard that Professor Langley was close to launching a man-carrying airplane from a catapult near Washington and a little news item on a back page of the *Post* had mentioned that two bicycle mechanics, Orville and Wilbur Wright, were moving their glider experiments to Roanoke Island off the coast of North Carolina. The thought struck him that if man could some day fly, would he not want to keep in touch with his earth-bound fellows? And ships at sea; certainly they would wish to talk to one another and to shore. If man could hear voices through the air would he not want to listen to music also? The more he considered it the more Reg realized there would be no limit to the uses of his new invention. And Cortez, what would he think? Why, his dear uncle had been excited right out of his mind the day he came to Fergus so long ago after talking over Bell's stovepipe wire. Reg wished he could pick up the microphone and yell 'Hello!' But that time would have to wait. Meanwhile he could drop him a line, which he did, sending off a letter to Thaddeus Trott in Bermuda as well.

Early in the New Year Willis Moore called Reg to Washington. 'I needn't tell you, Fessenden,' he remarked, 'how satisfied the bureau is with your progress. The range of your telegraph opens up great possibilities in our work.' If he had heard of the voice-sending, Moore did not let on, and for once in his life Reg gladly kept his triumph to himself. Endless hours needed to be spent on patent drawings and descriptions, so the less talk at this stage the better.

Moore studied a wall map of the Atlantic coast, then continued: 'What do you say to a move down to North Carolina where there will be plenty of room for long-distance testing over water?'

Say? Why he would say, 'Yes, of course!' After all, the one-year contract with the Weather Bureau had expired and he would go anywhere that wireless experimenting chanced to take him.

'All right then,' exclaimed Moore, 'we will continue under the same terms as before. The masts will be taken down and

you will arrange for their shipment to Roanoke Island. Report to me regularly as you have been doing, but remember that the fewer people who know about your work the better.'

This last unsettled Reg, for it seemed to show a certain slyness in Moore which he had never noticed before. Was there a glint of greed in those steel-cold eyes? 'You will keep the rights to your inventions in your own name.' Yes, that is what the letter hiring him had stated. But suppose, he worried, the letter is not a real part of the contract? What then? When Reg left Moore's office he wrote to a lawyer friend in Pittsburgh, Mr. Darwin Wolcott. 'Lose no time in seeing that my patents are looked after,' it directed. 'They are all that Helen and I have in the world.'

17. The End and the Beginning

Roanoke turned out to be an island in the wilderness, swarming with mosquitoes and crawling with ticks and huge water snakes. Around its margin oozed endless miles of marshland with an occasional gravel spit on the seaward side, while behind stretched the sand dunes where even to walk took care. In times past, as the onshore winds had piled the sand ever deeper, the pine trees had choked to death and withered away, and long, empty air tubes now remained where the great trunks had once flourished.

At the north end of the island, in one of Sir Walter Raleigh's early colonies, Virginia Dare had been born, the first white child of English parents to begin life in the Americas. Then the whole settlement had disappeared, wiped from the face of the land, leaving only the faded letters C R O A T O A N blazed in tree bark. The island was a place of mystery, somehow the ideal spot for an experimenter to come seeking more of the secrets of wireless.

For Reg the schooner ride down from the Potomac would take some getting over. More often than not the Atlantic had come within inches of hurling him, as well as Thiessen and Captain Chiseltine, into the sea. The masts had been chained aboard an old water-soaked scow and all down the wild sweep of the Albemarle Sound they ducked and lurched at the end of the tow rope, playing snap-the-whip with the little schooner at

the other end. Once Chiseltine, thinking to save his ship, had tried to cut them loose, but Reg had wrestled him to the deck. His precious equipment meant more to him than life itself. And Thiessen had even threatened to jump overboard, if only to escape the foul smell of an immense chunk of Limburger cheese which Reg had included as part of the stores. In the end they hung it over the side, though according to Thiessen this did little but madden the ocean even more. Eventually another schooner came to their rescue and they drifted into the bay at Manteo, a little fishing village on the island's east side.

Reg set up his headquarters in an old frame hotel near the wharf and he built his laboratory and a high tower on the Croatan Sound side directly across from the Carolina mainland. Away to the south lay Cape Hatteras and the great reaches of Pamlico Sound. Here, for nearly two years, he would find a perfect firing range for his electric signals.

In time two more towers were built, making a giant triangle nearly a hundred miles around, and the Weather Bureau sent such a number of workmen down from Washington that he could afford to place the best of assistants at all three stations. Now he could devote the whole of his energy to improving his instruments and in a matter of months he was able to say good-bye forever to the coherer.

'One of my jewels of great worth,' Reg called the new device, showing not the slightest bit of modesty. 'It cleaves the sound wave from the carrier wave as slick as a scalpel with less than 1/500 of the electricity needed to work the coherer. I can now wireless voice or dots and dashes as far as Hatteras village, sixty miles away, and given a little more power I am convinced I can send speech right across the Atlantic.'

Unknown to Reg, as this Christmas of 1901 drew near, Marconi was not just talking about signalling across the Atlantic, he was getting ready to do it. And on December 12, he stood on Signal Hill atop the city of Saint John's in Newfoundland and pulled in the letter 'S' transmitted all the way from England.

Although this signal was the first across the ocean, the letter 'S' in Morse is not the letter 'S' spoken and, as Marconi would find to his sorrow, neither was it a whole word.

None the less Reg could not hide his disappointment, for

Marconi's success did mean that in some ways his rival was still ahead. If only the continuous-wave generator could be made to work, then it would be a different story. Or would it? Supposing the generator was in readiness, where would he find the thousands of dollars needed for such an attempt? Nowhere, he sadly concluded, unless the government of Canada could be interested. And this idea he at once discarded because he doubted if anyone of importance in his native land either cared about or even knew of his existence.

Then, without warning, early in the new year his hopes were further dashed. Professor Moore summoned him to Washington. The Weather Bureau chief was brief and to the point as he rocked back and forth in his swivel chair and shuffled a sheaf of Reg's patent applications. 'I cannot find my name as a beneficiary on a single one of these,' he said sharply. 'But for me you'd have no job with the bureau and without the bureau's money you'd have no apparatus worthy of the name. Don't you realize that?' He flung the papers across the desk.

Reg didn't answer. He hesitated, not sure what to make of Moore's conduct.

'Haven't you ever thought,' continued Moore, his voice rising as his chair teetered abruptly forward until he leaned over the desk, his head only a foot or two from Reg's, 'that I might be entitled to some consideration?'

'If it is money you have in mind, forget it,' replied Reg, fighting to keep an even voice. 'The $250 the bureau pays me monthly barely meets my own expenses.'

'You're pretending not to understand me, Fessenden,' scoffed Moore. 'You want me to put it in plain English?' Reg watched the bureau chief as he rose and strutted to a window, turned, and said in knife-edged words which cut through the stillness of the office: 'I demand a half interest in every invention you have made since joining the bureau. A half interest, do you hear? Either that or you let me go to the patent office and swear out some of them in my own name.'

'You have no right to a single one of my inventions.' Reg's voice shook as he angrily persisted, 'Our agreement states . . .'

'Curse the agreement,' Moore spat out. 'I don't care what it says. Either you take care of me or you're fired and the bureau uses Marconi's apparatus.'

Reg got up slowly. He had suspected for some time that here might be a trickster, someone who could not be trusted, but he never imagined that a man could be this bold, this greedy. His thoughts raced madly. He must delay; do anything to hold Moore off, for he suddenly realized that the chief could seize all his equipment at Roanoke and at a moment's notice. 'The patent oath says that an applicant must have helped in making the invention,' he countered. 'How do you get around that?'

'I suggest you find a way,' retorted Moore, his voice calming somewhat as he sensed that Reg might do business. He jerked his arm toward the door. 'Good day, Mr. Fessenden,' he said, 'I will expect an answer from you shortly.'

Small wonder the chief of the Weather Bureau hungered for a share of the Fessenden patents! Gradually, since going to work for the bureau, Reg had perfected such an immense number of wireless devices that he was close to having the control of the whole field of radio signalling in the palm of his hand. Not that he wished it that way; such an accomplishment for its own sake meant nothing to him. He would have been content just to live comfortably, in the manner he wanted, as long as he could edge ever closer to his goal. Though it was still giving him no end of trouble, the new generator, or 'High-Frequency Alternator' as he called it, would some day be in working order and when this machine was added to the others he was convinced that voice and music, as well as the lowly dots and dashes, could be sent every which way over the vast surface of the earth. But Willis Moore knew this too, as did dozens of other pillagers. Even as Reg headed sadly back to Roanoke he realized he would have to fight with all his strength to defend every single one of his inventions, spending endless days in court and nights without count preparing his evidence. Away would drain more of his time and money just when he could least afford it.

His days with the Weather Bureau were numbered. He even wrote the President of the United States, Mr. Theodore Roosevelt, telling him of Moore's treachery and asking him to intervene. Poor, plain Fessenden! Capable of thinking through the most complex of scientific problems but as simple as a child in the ways of men. The President passed the letter to the Vice President, who shunted it along to the Secretary of Agricul-

ture, whose department looked after the Weather Bureau, who in turn showed it to Mr. Moore, who thought the matter a grand joke and over the summer plucked away, one at a time, each of Reg's assistants.

In the end Reg had no choice but to leave Roanoke, for he refused to give in to Moore's blackmail. In August 1902, he hitched his team of horses to the old lumber wagon with the overturned washtub for a seat that had been his means of getting around on the island, and he paid a final visit to the wireless stations and to Orville and Wilbur Wright. Success was coming the way of the two bicycle mechanics where they had pitched their tent among the sand dunes at Kill Devil Hills a few miles distant on Hatteras. Facing into the onshore winds they had managed to jump their frail man-carrying gliders into the air. In a few months they would go aloft in a real airplane. Reg wished them well, then with Helen and Ken and his priceless apparatus and Yellow Maria, a homeless cat he had found by the wharf, he struck out for the boat landing and the road north.

The next few months would be bittersweet. Only a small amount of their savings remained, enough for Helen and Ken to reach Bermuda where, as it turned out, they borrowed a little money from Thaddeus Trott on the security of the inventions. With the few dollars still left Reg skittered between New York and Montreal and Pittsburgh attempting in every possible way to raise sufficient capital to carry on his work. He stayed in the cheapest of rooming houses, doing his best to travel overnight and thus save on accommodation. But more than once he bedded down with Yellow Maria on hard benches in chilly railway stations, thankful for the warmth from his long black cape. Yet never did he lose faith in himself or in his wireless apparatus. He had come to term it the 'Fessenden System' and he was ready and willing to demonstrate it to anyone anywhere his scanty resources could take him.

'If I weren't so poor I'd gladly give you a hand, Reginald,' said Norman Trenholme miserably, 'but the kind of money you need is far beyond my means.' Then he added with a wry face, 'But I see where the Canadian government has advanced Marconi £16,000 to build his wireless station at Glace Bay. Would there be any point in approaching them?'

'I might better talk to totem poles,' retorted Reg, shrugging his shoulders.

He had written the government at Ottawa before leaving Roanoke but they had never answered his letters. He had told them how his apparatus could send dots and dashes much faster and with a clearer signal than Marconi's and that it could send real speech as well. But, in truth, he should have understood that at this stage Canada was little more than a colony of Britain, though it sported the lofty title of Dominion. The British government had invested its money in Mr. Marconi's system and the decisions were being made in London. Under no circumstances would some upstart colonial be allowed to upset the apple cart.

From Montreal Reg travelled to Pittsburgh and here, with hope ebbing as fast as his pennies, he at last met with good fortune or, as it would turn out, good fortune of a kind. His friend Wolcott, in return for a part of the proceeds, had interested two millionaires in forming a company. Mr. Given and Mr. Walker were among the wealthiest men of Pittsburgh and they knew a good thing when they saw it. But they were also sharp businessmen and on the lookout for a good profit on their investment. 'We will advance the money for you to erect your wireless stations, Fessenden,' they said, 'and also pay you a salary of $300 a month, but you must place your inventions in the name of the company.'

Reg noticed that the company for the most part would be in the names of Mr. Given and Mr. Walker but he agreed to go along because he had no place else to turn. The National Electric Signalling Company – what a fateful decision its formation would be! Both the good and the bad of it would affect the progress of the world for decades to come.

In a few weeks the Fessendens went to live in a cottage on the ocean's shore at Chesapeake Bay. Yellow Maria had died and a new cat, the scraggiest yet, turned up to make the family complete. 'Mikums', Reg called him, after Michael Farraday. In years to come Mikums would endear himself to his master more than any animal Reg would ever know. Soggy, stuccoed with mud, of unknown parents, the little fellow staggered up from the moat at the Fortress Monroe testing station looking for all the world like a survivor from some prehistoric civili-

zation. Reg rubbed him dry, filled him with milk, then coated him with butter, figuring that by the time it was licked off Mikums would feel at home. This would be his cat, he decided; no sharing of this one with Ken.

And that was the way it worked out. For many years whenever Reg travelled to Pittsburgh on the train or to Washington or Canada or wherever, Mikums journeyed with him, drinking milk from a thermos cup and at other times curling up and snoozing on the black inverness cape. He attended the most important conferences, sat in on far-reaching court decisions, and at Brant Rock, in his last days, he watched the screaming generators hurl Reg's electric carrier waves across the Atlantic. Then he died and his master, with tears streaming down his cheeks, placed him tenderly in a little satin-lined cheese box near the base of the tower.

After the family got settled in their new living quarters two wireless stations were built on either side of the neck of Chesapeake Bay. Then, because these performed so well, three more went up at New York, Philadelphia, and Washington. Reg now became the first to send dots and dashes regularly overland. As a result he was called on to give papers to learned societies and to write magazine articles by the dozen explaining this modern miracle. Even in Canada his work was attracting some notice. But only now and then did he touch on the sending of true speech and when he did, the scientists snickered behind their bushy beards. 'He's merely jesting with us,' they knowingly nudged one another.

Both Mr. Given and Mr. Walker thought there might be something in actually talking from one place to another but they let Fessenden understand in no uncertain terms that dots and dashes interested them more. By this time a simple little pen-and-paper gadget called an 'inker' had come into use along with the telegraph and without a hand being laid on it, it recorded a message as it was received. 'Suppose you can send voice from one place to another, Fessenden,' they asked him, 'how would you keep track of it? That's why the wire telephone will never get anywhere and the same applies to your idea. No, keep your mind on the telegraph. That's what we're paying you for.'

18. Canada– A Faith Restored

On August 12, 1903, an important meeting took place at the City Hall in Toronto and by late afternoon four far-sighted men had been appointed to form a commission. Chosen were P.W. Ellis from Toronto; W. F. Cockshutt, the implement maker from Brantford; E. W. B. Snider, the chairman, whose mills at St. Jacobs turned out the best flour in the province; and Adam Beck, whose flinty eyes already sparkled with a politician's ambition.

Even Mr. Snider's face, usually cool and composed, mirrored the excitement of the undertaking which loomed ahead. 'Well, gentlemen,' he exclaimed, dabbing a forefinger at a chart showing scale drawings of Niagara Falls, 'one further appointment remains to be filled and I believe that we are agreed as to who is the most capable man in electrics today. I move that we instruct our secretary to write Reginald Fessenden, offering him the position of technical adviser.' Words of approval sprang from every lip; then the chairman concluded: 'Our work will lead to the largest public power project in the world. Nothing like it has ever been attempted before and when I think of the engineering problems I certainly don't envy Fessenden his task.'

Though he had already taken on twice the work he should have been attempting, Reg sent a wire back to Toronto the same day, accepting the position. There need be no second

thoughts about this job, no debating the pros and cons of whether or not to accept. 'At last my native land realizes that I exist,' he kept repeating to himself, to Helen, and to anyone else who would listen.

Thoughout the following months and into 1905 he corresponded with the commission, and gradually the big brick house in which he lived in Washington took on the appearance of a drafting workshop. Scale drawings relating to every feature of the project littered the floors and walls. He was the Fessenden of Cobb Island and Roanoke all over again; not a single source of information went untapped; not a single detail escaped the closest scrutiny. By the time, early in April, when his train trundled across the old iron bridge at Niagara Falls and on into Canada, Reg felt sure that he had the answers to most of the engineering problems.

However, it would not be long before his mind was in a turmoil and he was at odds with himself. Standing deep down in the gorge, his eyes feasting up through the mist to where the water seemed to thunder straight out of the clouds, he beheld exactly what his conclusions in Washington had told him he would see. And that was more energy by far than was brought together at any single place on earth. James Watt had said that a cubic yard of water falling with the force of gravity for one thousand feet gives one horsepower. At Niagara the scientific part of Fessenden's mind saw six million horsepower, more than could be produced by all the boilers and steam engines in Great Britain and Ireland. But when he stood on the lip of Goat Island or stopped to eat his lunch on the Clarke Hill as he had as a boy so long before, he had second thoughts. He knew how much water the power commission would need for its generators and, as gigantic a gulp as this would be, it would still take only a trickle from the great surge above the falls. But man's greed was another matter and of this he had had first-hand experience. What of tomorrow and the tomorrows after that? In time, would the yawning mouths and churning insides of generators grow hungry beyond even his imaginings and swallow water to the point where the flow would be only a mere dribble? Would the falls be destroyed? By Fessenden?

Through the following days he tramped and drove his buggy over the countryside between Lake Erie and Lake Ontario,

desperately seeking some other way or method which would still allow the power to be generated but not interfere with the beauty of the falls. At last, in the summer, he found it and he advised Adam Beck: 'I see no engineering reason why the water cannot be brought through large pipes from Lake Erie to the shores of Lake Ontario and the generators set to work there. As the difference in height between the two lakes is 320 feet, while the drop at Niagara is only half that, double the power could be obtained in this way.' But like so much of Fessenden's reasoning this proved to be too far ahead of the times. He had still to learn that you can push the world along the road of progress just a little at a time.

'Your scheme is much too daring, Mr. Fessenden,' lamented Adam Beck as they stood poring over maps in his office. 'At another time, maybe; under other circumstances.'

'But,' interrupted Reg, 'as I have said, if we place the powerhouse at Niagara we lose half the electricity which otherwise could be obtained. The waste of energy in terms of getting horsepower from steam and coal is equal to fifty thousand men mining six hundred tons of coal each per year. The figures are staggering.'

'I know, I know,' groaned Beck, nodding his head, 'but we will be lucky to get approval from Parliament for even our more moderate ideas. As you know there are influential men dead against the people owning anything of this kind. Building these flumes hundreds of feet in the air right across the peninsula as you propose! Why they would scalp us if we even hinted at anything so bold. However, I can promise you one thing,' and Beck's voice was firm, 'you can bet that nothing will be done to mar the beauty of your beloved falls.' Then his eyes twinkled, 'I'm sure that even Hawkeye would approve of what we have in mind.' They stood looking at one another; then suddenly both laughed as Beck concluded, 'You see I have read Fenimore Cooper too.'

Though on occasion his heart ached when he thought of the power being lost by building directly at the falls, Reg could look back on the summer days of 1905 as being the most pleasurable of his life. He brimmed with enthusiasm, built castles in the air, and felt that all was right with the world.

He went to spend a while with his mother and Tren in Ham-

ilton, and the old lady, now nearly seventy, gave her blessing to what he was doing. 'I'm as proud of you as Grandfather Trenholme would have been,' she said. 'At least you are making something of your life, not just scratching a little niche and staying there like I'm afraid happened with your dear father. It's an old Trenholme saying,' she went on, taking his hands in hers as he stooped to kiss her good-bye, 'that the only difference between a rut and a grave is that the rut is longer. Fat chance of that fitting you!' Her eyes sparkled.

Wherever Reg went, to Toronto to attend the commission meetings or to Peterborough to visit Cortez, people had heard of him and they called him Mr. Fessenden on sight. And these little touches of remembering meant more to him than anything. He had never forgotten the poor times of his boyhood when he was a nobody: his first year at Trinity when he wore the De Veaux military uniform because his parents could not afford to buy him new clothes, and the morning at Bishop's when he stood by the river with Cortez, knowing he must leave Canada, his pockets near-empty and his soul lost in doubt and disappointment. Now, as he tarried by the Niagara and in his fancy saw the giant powerhouse take form at the foot of the falls and the transmission lines untwine toward Toronto, all of it shaped and approved by himself, he felt more than a little pleased. He sensed he could do anything he set his mind to.

When the time came for Reg to give his report to the commission at the offices of John MacKay on King Street in Toronto the pessimists were ready and in full cry. One newspaper declared: 'This is too big an undertaking, it will surely bankrupt the province.' But Mr. Snider and Adam Beck and the others who made up the commission were determined men. And backing them up, waving his arms and rattling his papers as he read, was Fessenden. 'The gold fields of South Africa are of small value when compared to the wealth of Niagara Falls,' he exclaimed. 'I can see this part of Canada becoming the foremost manufacturing centre in the world, providing we use this great asset in the proper way.'

Then he laid the report on the table and his gaze took in Beck and Snider and, in turn, Ellis and Cockshutt. 'Gentlemen,' he continued, now speaking in a firm, even voice, 'I have noted some thoughts which came to mind over the summer. I

hope that you will agree with them as I think they express the feelings of all of us.' Later, when the final report was published, the following paragraph, ascribed to all the commissioners, was found on page 23: 'Your Commissioners do not hold the opinion that there is some deep-seated defect in Canadians as compared with others that will foredoom to failure a civic enterprise such as that under consideration.'

Reg's faith in Canada had been restored. 'Is there something else we could do together,' he puzzled, 'something that in the long run would be of even more value than bringing cheap electric power to the cities of southern Ontario?'

'Telegraph across the Atlantic and we will ride down Pennsylvania Avenue with our feet hanging out the car windows,' Given and Walker had boasted to him late in the year 1904. This had been like asking a captain to sail before the wind. As fast as his work with the power commission allowed, he had switched over to this new challenge. Soon maps with different-sounding names such as Brant Rock and Machrihanish had begun to take the place of drawings of Niagara. Instead of tracings of generating stations and transmission lines, his specifications told of steel towers three times as high as the mighty cataract.

Already the great pencil-like tubes reached far into the sky above both places. Brant Rock was nearly complete, while the other clawed upward ten more feet each day from the wind-whipped rocks on the west coast of Scotland. Reg's spirits soared as high as the towers for he knew that rarely had the world witnessed the miracle of such an undertaking. It would be the laying of Field's cable and Bell's sending of voice along a wire all rolled into one. And it would be fraught with danger and uncertainty. These great towers would bend and lurch in the storms like no structures ever built before. Even the mighty currents of electricity surging from the generators would do his bidding only so long as he kept his wits about him.

But he dwelled more on the blessings that would come to people in Europe and America if only his signals could make it across the ocean, day in and day out, not just hit and miss as Marconi's were doing. 'And what of Canada?' he asked aloud. 'Why should Canadians twiddle their thumbs waiting for Marconi to transmit readable messages?' In 1902 the Italian

had sent greetings from America to King Edward and the King of Italy, but the few weeks in a year when he could signal in the one direction he could not turn round and send in the opposite. Now, three years later, things were going little better for him. Marconi was an inch from total failure.

'There is something Canada and I can do together,' Reg suddenly enthused, pounding his fist on the roll-top desk. 'If I can make wireless work between Brant Rock and Scotland, then why not between Canada and Europe too? And what's more, keep it in Canadian hands where it ought to be. Given and Walker will have nothing to do with this venture, I'll see to that!'

Accordingly, with only a few days to go in June of this year, 1906, Reg and Mikums caught the train for Montreal. By this time Norman Trenholme had become a judge of the Superior Court and with his help Reg set about forming a company. His uncle had all sorts of connections with important people in government and business, and in a short time Sir Frederick Borden and a half-dozen other prominent men consented to serve on the board of directors. Even Lord Strathcona, an important figure in the building of the Canadian Pacific Railway and now High Commissioner to London, promised to interest himself there on the company's behalf. Thus it came about that on July 20, a special act of Parliament created the Fessenden Wireless Telegraph Company of Canada. In the naming no reference was made to the wireless telephone, since not even the term itself was as yet quite 'respectable', let alone the actual sending of words without wires.

Before returning to Brant Rock he paid a final call on Minden Cole, the company's secretary, at his offices on St. James Street. 'As soon as I can prove that good working is possible between Brant Rock and Machrihanish,' he began, 'I will want you to apply to the government for a permit to build a station on Sable Island or in Newfoundland, if that's best.' A box of long thick cigars lay open on Mr. Cole's desk and, helping himself, Reg lit up. 'Furthermore,' he continued, pacing back and forth the length of the office and puffing out a cloud of blue smoke, 'you must make clear that we ask for no exclusive right or privilege, and tell them too that our station

will be at the government's disposal for the sending of public messages and weather reports.'

'Don't give away every advantage the company has,' interrupted Cole, his eyes narrowing.

'We owe it to the country,' answered Reg gratefully. 'They have been very liberal with us in section seven of our charter.'

What if this section seven would turn out to be like an Indian treaty of bygone days, taking away in one paragraph what it had promised in another? This was not the time to be spying out hidden meanings and double talk, not when his thoughts centred on electromagnetic waves and hungry ions and on his wireless machines, which he knew even now were being swung into place at both stations. In his excited state Reg could hardly wait to finish the company business before setting out for Brant Rock and the Atlantic shores.

19. At Bay

Brant Rock was only a couple of hours by train from Boston and, taking most things into account, a better place for a wireless station couldn't be found along the whole eastern seaboard of the United States. It took less electric power to signal over the water, and except for the wilds of Newfoundland Reg had a clear stretch of three thousand miles to Scotland. However, this was still not the good fortune which smiled on Marconi. With one station on the tip of Nova Scotia and the other in the south of England, the Italian had a full third less distance to cover. And as Reg would find out before long, he meant to keep it that way.

As usual, with such a vast amount of testing to tend to, Reg did not spare himself in the slightest, nor would he allow his assistants to let up for even an instant. Restless, prodding, always a busybody, notebook and pencil never far from his reach, screwdrivers and wrenches stuffed into his pockets, he pampered his instruments one minute and bullied them the next. And woe to any worker whose efforts were not up to the mark. 'How many words had to be repeated today, Mr. Stein?' he would ask. 'Too many, I fear. Then I must insist that you practise until you can do it in your sleep without a single mistake. And Mr. Pannill,' he would say over and over again impatiently, 'don't try to think. Leave that to me. You

haven't the brain for it.' Sometimes his assistants could not stand the everlasting asking for 'just a little more' or 'a little better' and they left his employ. But more often they stayed, working their hearts out, caught up in the spell of his genius.

But in these last months of 1905 Reg himself had begun to doubt his abilities. Everywhere he looked he came face to face with either a new problem or else an old one blown up elephant-size by the great distance which separated his two towers. The amplifiers for increasing the signal strength must be redesigned, the tuners improved, the interference preventers brought to a higher level of perfection. And when he had them in order he must get exact duplicates off on the long sea voyage to Scotland, for both stations must have the same equipment. The feeble spark gap worried him the most because it appeared to be the only device he would have to get the electric waves under way, and he had no business asking it to do a job for which it had not been designed. Still, what choice did he have? For two long years both Mr. Steinmetz and Mr. Alexanderson at the General Electric Company had laboured to build his high-frequency alternator and now, with the stations all but completed, they had sent him a totally useless machine, saying 'We are sorry, Fessenden, but this is the best that we can do.'

The best, indeed! He should have done the work himself. Well then, he would do it himself. He tore the alternator apart over and over again trying to improve it, but to no avail. The shafts must spin at such unheard-of speeds that the bearings got red-hot and melted into chunks of solid steel. Or the wheels, one second a grey blur as they purred soft and sweet, like a contented tiger, would in the next instant shatter into a shower of flying metal. Then he would pick up the pieces and start over. He stuck with it, for that was the only way he knew how to work, but progress had been so slow that he despaired of having it ready in time. Sometimes, to ease his disappointment, he would walk to the water's edge, across the sandy shoals that lay in front of the tower, and shake his fist in the direction of Machrihanish. After all these years during which he had perfected his apparatus to the degree where it could take care of every situation imaginable, here he was, on the very eve of the most momentous experiment of his life,

condemned to sending out his waves with only a fraction of the energy they should have. He, Fessenden, the man who never left a stone unturned in his search for perfection.

Then, as if this state of affairs was not disheartening enough, Professor Kennelly came down from Harvard bearing more bad news. With a long face, he declared, 'From my experiments, Reginald, I can tell you that less than a tenth of the energy you transmit will make it through the ionosphere. The ions start breeding at dawn and as the day gets hotter they increase in number; likewise with the seasons. Here's hoping you make it across the ocean before the warm weather comes in the spring.'

Suddenly it seemed to Reg that so many things were against him that he had better get on with his attempt before he lost heart altogether. Already the newspapers were calling his towers 'Fessenden's follies', and only a while before, a report had come in of slipshod methods used to connect the guy wires at Machrinhanish. Though Reg did not know it, a few sockets filled with cold, crumbly solder were racing the pesky ions to see which would be the first to defeat him. Much against his better judgment, for the Scottish station was not yet complete, he started the steam engine which ran the Brant Rock generators. And on into the cold, crisp darkness of the long December nights he continued to pour his electric waves from the high tower, all of them loaded with dots and dashes, for these must be sent first.

Mr. Pannill was in charge of sending at Brant Rock and time after time Reg would stop to grip the back of his chair, his knuckles showing white, while he watched the operator's fingers flicking the telegraph key so fast that he could barely see them move. Then he would go to the cottage near by, have his supper, and before returning, change into his best suit and white shirt with a high wing collar and his favourite inverness cape. It was a brave front, calculated to prove to his assistants that nothing worried Fessenden, but the one part he could not hide, his face, betrayed his anxiety.

At midnight he would tell Pannill and the others to go to bed, and then he would move over to be near the telephone because the reports from Machrihanish would have to come back along the undersea cable, then over the regular wire lines.

The Scottish tower was supposed to be able to receive, but it could not signal westward, as many devices were still missing from its sending apparatus. Then as the nights grew colder he would stride furiously back and forth, now and then stopping to run his fingers along Mikums' back as the cat played in the heat of the green glass lamp shade. Finally he would fall into a deep sleep, his great mind still groping for the answers to his problems as it had always done. He once told Helen, 'Even when I'm sleeping my subconscious mind is busy. It's just as if there were a lot of little workers tugging out one fact after another in my brain and holding it up for inspection. "Is that it? Is that it?" they say an endless number of times till suddenly the right one is hauled out and click, there's the solution.' But now it seemed his helpers were sleeping as soundly as their master, for each day the cables repeated the same sad story: 'We are not getting you, Brant Rock.'

Reg was at his wits' end. What more could he do? New pieces of equipment had been built and rebuilt until he sickened of the repetition. And still he could expect no help from the latest alternator, for though he saw some improvement whenever he speeded it up, it shook and rattled like a can full of bolts. Meanwhile the days of December continued to whirl by in a mad rush of shouted orders and commands: 'Check the voltage, Mr. Armor; get busy in the machine shop on new condensers, Mr. Bennett; cable Machrihanish, Miss Bent, so that they will know exactly what we are attempting.' And always the same reply back, 'We are not getting you, Brant Rock.'

Then, suddenly, he thought of the operators. Were they up to the mark? Of Mr. Pannill he had not the slightest doubt, but what of those at Machrihanish? He had drilled them in the 'Fessenden way' but had their work habits become sloppy? A man had to be a near-magician to tune up a station and get everything acting in harmony. After all, those letter D's he was carving on the carrier waves would not sit forever in the Scottish sky waiting to be plucked. There was a split second to grab them; miss them and they were gone.

Scarcely a week before Christmas Reg called Mr. Armor, his best engineer, into the office. 'I'm sending you to Scotland on the first steamer,' he exclaimed. 'In spite of my instructions

the operators over there must be passing too quickly through the instrument settings.' Frown furrows filled the high sweep of his forehead, and his eyes, even deeper set than usual due to weariness and worry, squinted hard as he added: 'I don't envy you an ocean crossing at this time of the year but the winter is nearly half over and we haven't many days of good sending weather left.'

He jabbed a forefinger at a map of the North Atlantic lying worn and wrinkled on his desk. Armor watched as the finger traced the 'great circle' route the signals should be taking on their flight between the continents. 'Either we message both ways in the next few weeks, Mr. Armor, or we might as well forget it.' He rose from behind the roll-top desk and, taking Armor's outstretched hand in a firm grip, concluded, 'I'm assuming that with luck and a good crossing you should arrive at Machrihanish on the second of January. Put on the headphones yourself and tend to the settings. I'll be throwing every ounce of energy I can into those signals.'

20. "Getting You Brant Rock, Loud and Clear"

For thirteen long days Fessenden waited at Brant Rock while Armor's ship steamed eastward across the Atlantic. He put in the time bringing his patent applications up to date – they now numbered more than three hundred – and in doing a host of little tasks calculated to help him keep his feet on the ground. For some reason, deep inside, he was stirred by a sense of expectancy such as he had not had since the triumphs at Cobb Island and Roanoke. 'I feel the same as a prisoner on death-row,' he told Helen. 'Like a man who has asked for another chance at the eleventh hour and who stalls out the final seconds, hardly daring to trust that fate will grant him one.'

Christmas and New Year's came and went but he took little notice of them other than to long for a simple holiday. Things were not so simple any more, he reflected. Each milestone in his life had been a little more advanced, a little more difficult to reach, and when he had attained it, always there seemed a dozen others to tax his skill. Already he was forty years old; still, as he sat writing at the desk, the boy in him reminded Reg that the early goals had been important too.

His notebook, the one where he kept his daily entries, was open at this day, January 3. He finished dictating the final letter to Miss Bent, his secretary, and made a record of it in the book; then, turning his swivel chair so as to face out the window, he idly thumbed through the back pages. It was about

mid-afternoon. The few inches of fluffy snow which had feathered down in the early morning had settled on the roofs of the radio shacks and cottages and thinly blanketed the gentle slope leading to the water's edge. The guy wires barely budged in the quiet of the afternoon, and in spite of the sun, shining for the first time in weeks, some flakes still clung to the wires making them look like white ribbons hanging from a Maypole.

In the gathering darkness of the previous night and only a few hours before sending had begun, Reg gave the tower a last once-over, climbing hand over hand up the black inside to a small platform at the top. Here one of his latest inventions, a new kind of aerial, had been hoisted into position and he eyed it closely. At transmitting time, long thin staves of steel would spray up and out from the device, ready to direct the pulsing carrier waves away into space. He expected a lot from his 'umbrella' and impulsively he leaned over and gave it a friendly pat.

The night had turned crackling cold but clear, and throwing on an old, threadbare cape which had been left at the top he lingered to watch the lights of the aurora wink across the northern sky. A good sign, he told himself, and inside he felt better about his prospects than he had for a long while. It had been hard to keep his hopes alive, what with the failures of the past weeks, the ill-spoken remarks of his fellow scientists, and the criticisms of the newspapers ringing in his ears. 'Fessenden,' they had said, 'you will be lucky to signal past Nantucket Point.' And there had even been a cartoon showing his dots and dashes dropping off the ends of the aerial like some dead things. 'Look at Marconi,' they had reminded him, 'six years and he still can't get a complete message from Europe to America.'

But he had said nothing, though he remembered how the prophets of a different time had sneered at another explorer, Columbus. 'Sail too far westward and you will fall off the edge of the earth,' they had said. Suddenly, Reg felt a deep compassion for the navigator because it seemed that they had a lot in common: he with his feeble dots and dashes and some day soon the sounds of the human voice clinging to the backs of the puny carrier waves, Columbus with his poor frightened sailors

and frail wooden ships. Both of them probing into the unknown. Both of them laughed at. Both of them having to beat that same terrifying ocean, for in reality the Atlantic was not only the water below but the air above as well. It was lightning and thunder and wind and rain, sunrise and sunset, and always the hot sun in between spawning those starving ions.

Then he had scrambled back down with just enough time left to begin charging the antenna. Before dawn the tower's entire four hundred feet would be flashing and humming as the electric waves surged from the generator and sped upward. As a final act he had ordered the umbrella aerial to be opened.

The transmitting had gone off without a hitch and now, as he sat waiting and wondering, he prayed that Armor had reached the Scottish station in time to make his adjustments. Looking out the window he watched his assistants struggling along the narrow paths in the snow between the outbuildings. They shuffled by noiselessly and no more often than necessary. None ventured near the office for word had gone around that the 'old man' had posted his familiar 'do not disturb' sign on the door and they were all aware that this meant exactly what it said.

Reg knew that he could depend on Mr. Armor to give him the results, good or bad, the very instant he could get time on the cable. That cable! The more he dwelled on it, even though he needed it today, the more certain he was that in the long run it would be the mortal enemy of wireless across the Atlantic. Wealthy men in England and Canada and the United States had staked their fortunes on its success and they would not stand idly by and see themselves ruined by some upstart inventor and his manner of messaging without wires. But at this moment he despised the cable for another reason. It was a wire, little different from Aleck Bell's telephone wire, and whether these 'pieces of string' ran under the ocean or over the land, Mother Nature could slice them in two without a by-your-leave. And here he was, Fessenden, the inventor of wireless, having to depend on such things.

He leaned forward in his chair, impatiently tapping his fingers on the desk top. He glared at the telephone hanging from the wall above his head. 'Will the worthless thing never

ring,' he growled. Then all at once in the middle of his crossness, clang! the bells in the black box pounded their first piercing note and he grabbed the receiver.

There was a second's pause, he listened. Then, 'It's the cable from Machrihanish coming through,' he cried in the direction of Miss Bent.

'It's the cable from Machrihanish,' Miss Bent shouted to Helen in the doorway of the cottage near by. And Helen ran out into the snow. 'We are hearing from Scotland,' she yelled, waving to the men in the radio shacks. And they all raced to the office and pressed against the window and filled the doorway.

Reg, trying to listen and talk and write at the same time, was suddenly all fingers and thumbs, and to hold the notebook in place, he jammed it under the edge of Watt's Dictionary. The words poured out of the telephone and he jotted them down, dotting the i's and striking the periods as if he was pounding nails.

A grin slowly spread across his face and he copied, 'We are getting you Brant Rock, loud and clear.' He waited for no more. He tossed the pen and notebook to Miss Bent and sprinted outside where he thumped each of his assistants on the back.

At Brant Rock, late that afternoon and on into the evening, Mikums had never had it so good. The oyster kettles boiled as never before and he sat on his master's knee, listening to the cheers of the men and getting morsel for morsel with them.

21. The Grey-black Bear

For a while, during the cold, clear months of January and February and on into March, Reg continued to fire his beep-beeps across the ocean, and once the station had been completed, Mr. Armor answered him directly from Scotland. No need for the wire telephone and the cable now. They exchanged messages about the working of the machines and each day improvements were made here and there until it appeared that nothing could go wrong. They had beaten Marconi at transmitting the Morse code in both directions and the day when they could step to the microphones and speak real words to one another seemed near at hand. Only a little more power was needed and at long last the alternator was nearing the point where it could take care of that problem.

In Pittsburgh his backers, Mr. Given and Mr. Walker, sat pleased as Punch because their investment had now assumed a greatly increased value. They even agreed to raise Reg's salary from the paltry three hundred a month he had been earning to the unheard-of sum of six hundred dollars, though still taking care to see that all new inventions became the property of the company.

These were indeed days of champagne and cheerfulness at Brant Rock. There were the usual bickerings, of course: 'We are losing money by not selling the devices separately,' repeated Reg.

'No! We must find a buyer for the whole system,' answered Given and Walker. And the matter of the Canadian company was causing some trouble. 'We cannot let you away with this venture on your own,' the backers had told Reg, but he felt certain they would change their minds. For the moment he was more interested in the sudden increase in money to spend, and he did some foolish things. One day he returned from New York City with an expensive evening gown for Helen.

'Where among these bleak rocks and in this wilderness do you expect me to wear such a thing?' she admonished him, and he confessed he hadn't considered that angle. On another occasion the Russian Embassy in Washington wished to witness a demonstration of his apparatus and without a second thought he chartered a special train to bring them to Brant Rock, fêting them with caviar and the best of wines *en route*. It seemed the good times would go on forever, but out over the Atlantic the ocean and the sun were readying a surprise. Spring would burst forth early this year and an unsuspecting Fessenden would not be ready for it.

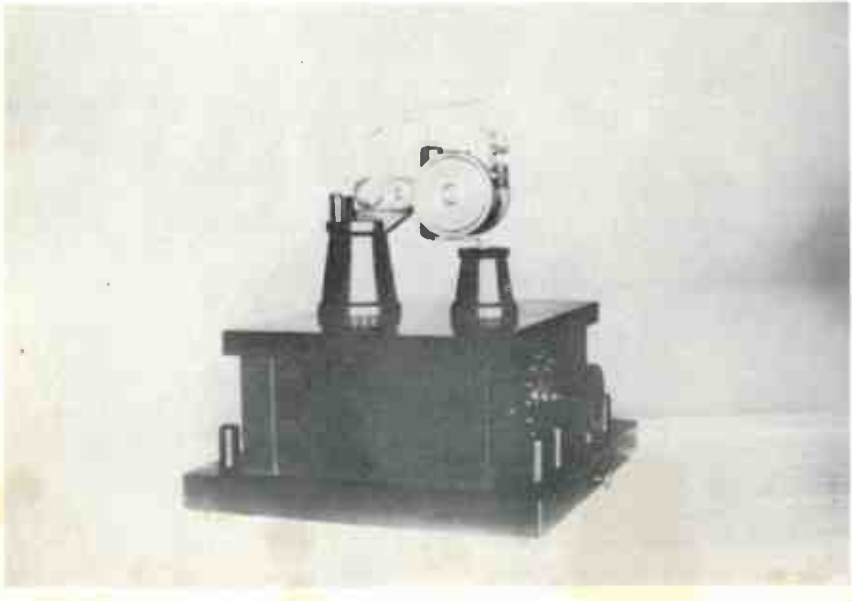
Reg first noticed that some signals had to be repeated, then more of them, until finally on certain days not a solitary sound could be picked up at either station. It was as if a big, black blanket had suddenly fallen over everything and he was working in some sort of nether world. Whatever the reasons, he realized that this state of affairs would never do if his wireless were to have any commercial value. You could not tell a customer, 'No, we cannot transmit your message today, perhaps tomorrow.' This untrustworthiness was the very difficulty with the cable and he must avoid it at all costs. But his careful calculations had gone astray. Somewhere, for the first time in his scientific life, he had made a monstrous blunder. But where? And how? As it would turn out, it would take the whole of spring and summer to answer both conundrums.

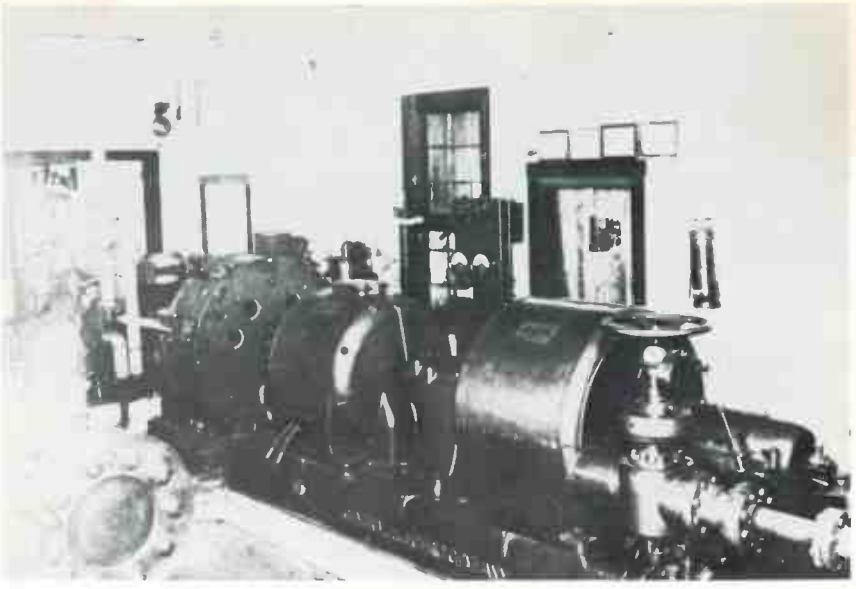
For a time Reg's hopes were crushed. He could not believe that Fessenden, the true scientist, the mastermind, could have fallen into error. But once he made tests near the towers and checked the strength of his signals from boats 1,500 miles out in the ocean, his worst fears were realized. Not only had the ions swarmed down from their lair seventy to a hundred miles up in the atmosphere weeks earlier than he thought they would,

Fessenden (on right) at work with Mr. Pannill and Mr. Stein

Mr. Pannill at Brant Rock

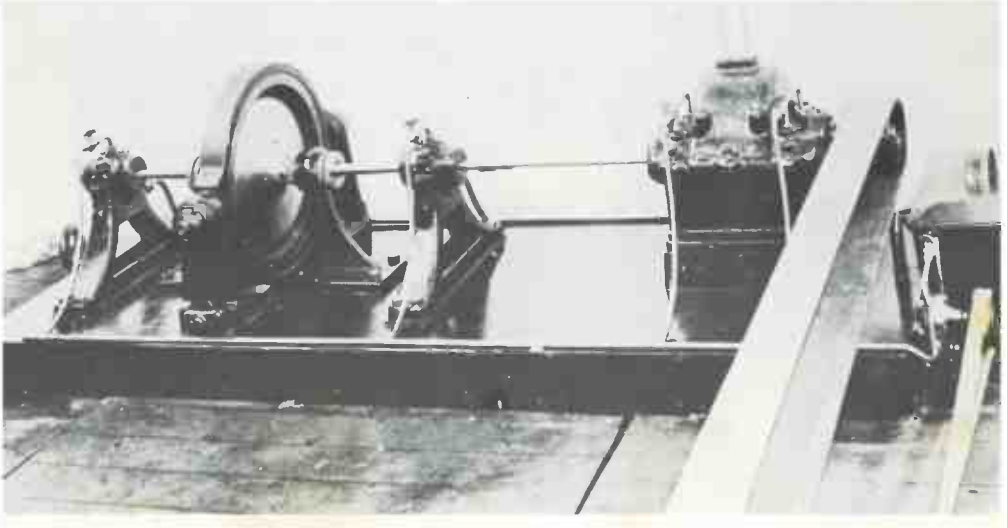
Fessenden's liquid barretter





Steam-turbine-driven high-frequency alternator

High-frequency alternator built for Fessenden



Reginald Aubrey Fessenden

but they had come so low that their whole vast, squirming mass nearly scraped the whitecaps on the ocean's surface. And instead of bleeding his electric carrier waves of ninety per cent of their energy as he had anticipated, they had devoured all but one per cent. No wonder his signals had disappeared! Clearly, Kennelly's ionosphere had made a fool of him! How could he ever hope to speak across the ocean when he could not even generate enough electricity to carry over dots and dashes?

Reg knew the answer, though he dreaded having to face up to it so suddenly. It lay in the machine shop and was as high as his waist and as long as his body, sullen and grey-black, stretched out and dozing, like a hibernating bear. On good days he called it his high-frequency alternator and at other times his 'six years of heartbreak'. When he had last prodded the thing to life, back in the fall, it had snorted, then run like a charm, but when he had measured the power output he found it to be only a tenth of that needed. Still, what could he do now but give it a final try? With the failure in sending across the Atlantic in the warm weather, both Mr. Given and Mr. Walker had threatened to shut the work down. If that happened he would have neither a job nor possession of his inventions, nor would he have got anywhere in proving that sending speech through the air without wires was anything but a mere trifle, good for a few miles on a few days of the year.

Once again it was time to take stock, to go back to the beginning in his thinking or to first principles, as he called it. Hence for days on end he locked himself and his ablest engineers in the machine shop, only leaving the shop the odd time to steal up among the trees on the slopes behind the tower. Here the tree toads sang in the high elms just as they had when he was a boy in Lower Canada, and the lilac-laden breezes of springtime soothed him. It was the very kind of peaceful place his genius needed to work its magic. On more than one occasion his assistants stopped in their tasks to watch him on the hillside and lament the way the 'old man' was wasting his time with such dilly-dallying. But they needn't have despaired. At certain times the notebook would fly open, there would be a furious scrawling of words and figures and lines, followed by a chuckle as a particular problem was solved, then a fast soldier-strutting back to the shop and the barking of orders to his

machinists to get busy, on the double, at fashioning fresh parts.

First the old engine had been torn down to the barest skeleton, and now, gradually, they built it back up, blending new bearings and shafts and wheels together so that it ticked like a fine watch, no matter at what speed they ran it. At long last Reg had his power, great swooping arcs of it, enough electric radiation to sweep his signals halfway round the world.

About this time, in England, a certain manuscript was published, one for which scientists and inventors the world over had long been waiting. It bore the frightening title *The Principles of Electric Wave Telegraphy and Telephony*, and had been written by the man many considered to be the greatest expert in the field of communications. The author's name was John (later Sir John) Ambrose Fleming, recently of the University of London and at the time of the publication of his book an adviser to Guglielmo Marconi.

In Reg's mind this made his opinions suspect from the beginning and he was not at all surprised to discover that references to his own work rated only a few lukewarm sentences. Neither was he startled by Mr. Fleming's estimation of the alternator: 'There is no such machine suitable for wireless,' declared the scientist, 'and even if there were it is doubtful if any appreciable radiation would be obtained if it was used as Fessenden proposes.'

'Well, at least he has heard of me,' grinned Reg, 'and that's something.' The jealousy and one-sidedness among scientists was a tendency Reg had long noted, especially when it had to do with those in Europe as opposed to their fellows in North America. Some day he hoped to lecture in England and Germany and tell them a few things, but this would have to wait until his work had eased and he had time.

Or would it? Was there another way? He thought of his apparatus and the mighty carrier waves he could now generate. Adjustments must take place before he could begin transmitting across the Atlantic again, but suddenly he remembered a demonstration of the wireless telephone which was to occur in a few days. He had advised some Boston fishermen that a commercial use for the telephone might be in sending them the prices on the market while they were still at sea. If the prices were low they could remain on the ocean increasing their catch

and only haul up their nets when it was worth while to return to port. Now he knew what he would do. He would call in the newspaper and magazine reporters to witness the test; Fleming would find out soon enough that the alternator worked exactly as Fessenden proposed.

'Mikums,' he said, tickling the cat under the chin, 'we'll teach Mr. Fleming a lesson. And while we are at it Tom Edison can learn a thing or two as well!' Reg had been astonished to read an interview with his old employer in the newspapers of a few weeks before. 'What is the outlook for wireless telephony?' the inventor had been asked. He had replied scornfully, 'It does not exist.'

What a silly reply, Reg thought. 'They have belittled me long enough,' he exploded to Mikums, and the cat jumped behind the green glass lamp, shocked by his master's sudden show of temper.

On the appointed day, Mr. Pannill boarded the fishing schooner with his receivers and senders and presently he talked to Brant Rock. Reg, using the wire telephone, got in touch with the Boston market and in just a few minutes he had radioed the prices by voice back to Mr. Pannill and the fishermen. And the amazed reporters duly gave an account of the triumph. In London, Mr. Fleming swallowed his pride and set about making certain that his misstatement would not be repeated in succeeding issues of his book. And it wasn't. Reg was never to know what Edison thought, for only on rare occasions would he again hear from the great inventor, and then the subject of wireless never came up.

By now, the critics and the 'experts' could no longer pretend that there was no such thing as the wireless telephone. Though a few still believed it to be nothing but hocus-pocus, a trick of some sort, Reg had held his accomplishment aloft for all to see and the majority figured the demonstration proof enough.

But to the plain folk it was simply too much, every way they looked at it. 'You mean to say,' people would ask one another when told that real words could be heard, 'that I can take these instruments of Fessenden's and by twisting a few dials hear actual talk, just like I'm hearing from you now? And from a long ways away, with no poles or wires or anything like that in between? You mean to tell me these words are right up there in

the air, this same air I'm breathing? What tomfoolery! Why, they can't be, there's nothing in this air but air and don't you try telling me different!'

In the long run it is the 'little people' who decide whether or not something new is to be accepted, they and those higher up who gauge the opinions and are in a position to pull the strings. For decades to come radio would have a fight on its hands. To and fro, hither and thither, its destiny would spatter about like a lump of mercury when shaken, little different from the ups and downs of the mastermind still managing its birth.

Now, at Brant Rock, the short, mellowing days of autumn had returned and to the east a mass of Arctic air streamed south from Greenland making for the wide Atlantic. Good sending weather! Time again to fire the boilers on the steam engines, to set the high-frequency alternator quivering, whining, roaring. Once more the umbrella aerial opened up and out from the top of the giant tower, ready to radiate a rush of continuous waves hundreds of times stronger than those of the fall before. And anew Reg peered eastward in the direction of Machrihanish, more confident than ever that at last he could transmit real speech across the ocean.

22.
Disaster

During this summer of 1906 a tiny testing station had been built at Plymouth, about eleven miles down the coast from Brant Rock, and for some time Reg had been sending voice between the two places. His apparatus had to be modified to take the fresh surge of power from the alternator and this involved a great deal of extra work. In addition he was trying out a brand new discovery in the receiving circuits, hoping that before long it could take over many of the duties of the liquid barretter. 'The liquid barretter', tried and true, barely larger than an alarm clock, with its thin wire and platinum point where the incoming signals bubbled the surrounding acid before gurgling on into the operator's headphones; this magical little box which picked up the connected sounds of the human voice; no fault of its that the signalling had broken down in the spring.

But good as the liquid barretter was, the mind that created it was never truly satisfied with anything, so now this new intruder. As he did so often, Reg gave it a curious name, 'heterodyne', from the Greek words meaning 'a different force'. The heterodyne concerned a whole fresh mode of thinking, a different concept of circuitry and use of the radio waves. It would let him transmit and receive messages on the same aerial without them interfering with one another and it would put a stop to noises from the atmosphere and other stations

drowning out the signals. The day would come when it would be hailed as one of the greatest inventions of all radio. And so it would remain as long as people desired to keep in touch by words without wires.

Many other contrivances, too, were included in the apparatus for the first time. For a long while Reg had believed that his wireless could be used to take the place of the wire telephone in talking between cities and he had invented small relay mechanisms which, without a hand being laid on them, could receive voice from the wire line then give it over to be radioed to the destination where the operation was reversed. A demonstration had been given to the Bell Telephone Company, and music from one of Mr. Edison's phonographs had even been included for good measure. The transmission had been perfect, the telephone people impressed, and along with Mr. Given and Mr. Walker, he was sure that an offer would be made some day for all the wireless inventions.

For Reg's part it could not come too soon. Though his salary had risen a substantial amount, he was still continually broke, mostly because of the expenses of keeping the patents up to date though they belonged more to the company than to him.

And the hours available for experimenting disappeared as fast as his money. By now the apparatus was so complicated and made up of such a vast number of components that even the smallest change in one place caused dozens more on down the line. In his experimental transmissions to Plymouth he was helped by one of his assistants, Mr. Stein, and after each long sending period they had to travel back and forth to compare notes and plan the next step. Time wasted away and though dots and dashes flew in both directions between Brant Rock and Machrihanish, they talked real words only to Plymouth. Or so they thought!

One day about the middle of November a registered letter marked 'personal' came for Reg from Mr. Armor at Machrihanish. As he read it a look of utter disbelief crept over his face and when he finished, the letter slid from his hands onto the floor beside his swivel chair. For a minute or two his mind was a blank and he was too overcome to say a single word or think one clear thought. He sat dumbfounded, staring straight out

the office window. Then he grabbed the letter and, still unbelieving, searched through parts of it again.

'At about 4 o'clock in the morning,' he read haltingly, quoting Mr. Armor, 'I was listening in for the telegraph signals from Brant Rock when to my astonishment I heard instead of dots and dashes the voice of Mr. Stein telling the operators at Plymouth how to run the dynamo. At first I thought I must be losing my senses but I am sure it was Stein's voice for it came in as clearly as if he were in the next room.'

When the first shock had disappeared Reg asked Mr. Stein to come to the office and bring the logbook with him. The book held a record of every word sent out over the air and without doubt it would show the impossibility of Mr. Amor's account.

'He must be mistaken or else it is a joke,' Reg exlaimed half-aloud. But then he quickly reconsidered. Mr. Armor was not the kind of man who would trifle with him and he was too good an operator to make an error. Still Reg could barely contain his irritation. After all, it was ridiculous to think that Stein's words had somehow gone clear across the Atlantic when they were only sending the eleven miles to Plymouth.

Hardly was Mr. Stein seated before Fessenden seized the log and began flipping furiously through the pages to the date indicated in Mr. Armor's letter. Then he read, his glance darting sideways every few seconds as he compared the two reports. When he finished he slowly handed both to Mr. Stein, not quite certain what he was doing, for they were exactly alike down to the last 'and' and 'but'.

He did not know whether to be overjoyed or upset at his 'accomplishment'. He wondered how he could announce to the world that by a lucky break he had sent voice across the ocean when he had never been meaning to. Why, it was something like hitting a bull's eye while aiming in the opposite direction! But then, as he dwelled on it more, he realized that it was not really the chance happening it had appeared to be at first. The apparatus had been working perfectly lately and the strength of the new alternator, for example, was beyond words to describe. With equipment like this almost anything could happen. He remembered one cold morning about 3 a.m. a week before when, dressed in his bathrobe and puffing a cigar, he had gone

into the receiving room where Mr. Pannill was listening for signals from Machrihanish. 'When you hear the next sound of the telegraph key,' he had explained, 'listen intently for an echo one-fifth of a second later. That echo will be the signal coming round the world.' And sure enough he had been right.

Still he must look at the other side too. The whole affair had been so utterly unscientific that no one would believe him. Well, one way remained of settling that. He looked at Mr. Stein sitting at the other end of the roll-top desk. 'We will speed up our testing,' he said; 'then when we are certain that we can send speech across the Atlantic, no matter what the conditions, we will put on a public demonstration. In two or three weeks we should be ready.'

Reg shook Mr. Stein's hand and as he watched his assistant leave a great rush of happiness welled up inside him. Finally after all these years his goal was within reach, and since it was only a few weeks to Christmas he was doubly excited. What a present to the world transatlantic sending of the human voice would be! 'Step right up, Mr. Prime Minister. You wish to speak to the President? We will have him for you in a minute. And Mr. Rothschild, Mr. Morgan is ready to talk to you from New York.' In his mind's eye he saw the merchants, too, and the fishermen and the sea captains and the ordinary folk; people in business as well as private individuals, from just over the horizon or halfway round the world, each of them clamouring to use his wireless telephone and wanting only one thing: 'to find out'.

Over in Scotland, during the early part of December 1906, gale winds swept along the western coast, tearing up trees and rocking the great Forth Bridge to its foundations. On the night of December 6, they roared and shrieked in past the lighthouse at the headland of the Mull of Kintyre and, leaving it a shambles, stormed straight for Fessenden's tower of dreams. The secure guy wires held, but those whose sockets were filled with powdery solder were ripped away, and the giant tube staggered apart at the joints. Then the pieces rattled down onto the rocks, where they lay in a twisted line looking like the spine and round ribs of some ancient creature that had slithered up from the sea to die.

When he heard the news Reg shut down his machines, and

they sat, silent, in the receiving and sending shacks, resembling rows of tombstones. All around Brant Rock it seemed as if the black hand of death had choked the last ounce of life from that which only minutes earlier had glittered with such promise. In the stillness of his bedroom Reg collapsed into a deep slumber, neither knowing nor caring when he would waken.

23. The First Broadcast

It is a fact, of course, that though a man may, to all intents and purposes, remove himself from the land of the living, still the world will go on in its doings, its ups and its downs, and during the couple of days, while Reg remained deep in sleep at Brant Rock, events having to do with his future took place as before. For instance, Mr. Cole wrote him a letter from Montreal saying that the government had granted Guglielmo Marconi the sole right to build wireless stations in Canada. Luckily, he was dead to the world when that one came! Then a wire arrived from Mr. Given and Mr. Walker in Pittsburgh urging him to keep his chin up. 'The company will rebuild the tower at Machrihanish,' it advised. 'Let us get on with the work.' And near to the end of the second day he returned to his senses enough to feel Mikums' furry back rubbing against his cheek. Who could resist that?

For a while longer he stayed in bed, feeling more than a little ashamed of himself for giving up, but gradually he began to think ahead again. About Marconi, well, he, Fessenden, knew plenty of influential people and he would see to it that that battle was fought to the end. As to 'get on with the work', never before had it been necessary for anyone to tell him that. However, he was not at all sure which way to turn. Some months back the huge United Fruit Company had purchased his wireless sets for its ships carrying bananas from Central

America. He supposed he could keep on experimenting to them with dots and dashes or to a little receiving station which had been built on the far-off island of Puerto Rico. But this all seemed so simple, so lacklustre, compared with sending speech across the Atlantic. With only two weeks to go before Christmas he searched his mind desperately for some 'big' task to perform. Already, with the disaster in Scotland a thing of the past, the men had begun to take on a holiday mood and Helen had put up some pine branches about the cottages. In spite of what he had been through he found himself feeling in the same spirit. Suddenly he sat up in bed and called for his secretary. 'Miss Bent,' he exclaimed, 'would you have Mr. Stein sent in to me?'

When Stein arrived they talked of this and that at first, then Reg reminded his assistant that the old year was nearly over. 'However, there's plenty of time for a demonstration I have in mind,' he added. 'Mr. Stein,' he continued, with a wink at Miss Bent, for it was common knowledge about the station that Mr. Stein rather fancied his voice, 'can you sing?'

'After a fashion, sir,' replied Stein, startled. 'I've been told I carry a note quite well.'

'Fine, fine,' grinned Reg, patting his assistant on the back. 'You'll come in handy on Christmas and New Year's Eve, so keep in practice.'

As he left, no matter how high an opinion he had of Fessenden's abilities, Mr. Stein must have felt more than a little uneasy, for he knew that the 'old man' never asked any such question as 'Can you sing, Mr. Stein?' without there being more to it than met the eye.

On different occasions over the past year or two Reg had whistled into his transmitters and the sounds had been received perfectly both at Plymouth and at a tiny station in Brooklyn. And a number of times the scratchy music from an Edison phonograph had also been sent, arriving in no worse shape than when it left. By degrees he came to conclude that perhaps some day the wireless telephone could be used to entertain and amuse a vast number of people and need not be reserved just for personal or business calls. Of course it was difficult to see how the bulky apparatus could be tidied up to where it would fit into a neat little box like Aleck Bell's wire

telephone. Perhaps, he decided, the future would take care of that as it had taken care of so many other seemingly impossible problems. Be that as it may, of one thing he was certain: the idea had stuck with him and now it seemed time to do something about it.

With little more than a week to go before Christmas, Reg called everyone on the station into the office and told them of his 'outlandish' scheme.

'I have notified the fruit company's wireless operators by telegraph to be on the alert Christmas Eve for something different,' he said. 'And if we fail to reach them the "program" will be repeated New Year's Eve.'

Then he proceeded to tell them what he had in mind and a loud cheer went up. This was the kind of work they needed for a change, something light-hearted and free from the tension of trying to signal over the ocean. Though it would be a demanding undertaking, something that never before had been attempted, they were all certain that the 'old man' could pull it off, and none was more so than Mr. Stein. Far into the cold nights to Christmas he could be heard exercising his voice in one of the radio shacks. And late in the same evenings, when the machinery had been shut down for the day, Reg himself would steal into the hut at the foot of the tower and, with only Mikums to listen in, would practise as quietly as possible on his fiddle.

Meanwhile the usual flood of preparations threatened to overwhelm the station. Changes were needed at a number of places in the apparatus, the sound waves of music being somewhat different from those of voice.

One day a new time-saving gadget appeared on the scene, straight from an all-night work session Reg had put in in the laboratory. It was about the size of a small matchbox and fitted underneath the workmen's hats. When he required a particular assistant he sent out an electric signal and the resultant buzz in the little hat 'beeper' brought the man on the run.

On one such occasion, during the hurly-burly of the final week, he needed nearly all his helpers at the same time. He had crawled to the top of the tower to check the umbrella aerial and on the way down, when he was leaving through the access hole at the bottom, he became stuck. Summoned by the beeper, his

assistants raced to the spot. What to do? They pulled and pried but good eating had swelled Reg's girth little by little over the preceding months and, though they realized that 'what goes in must come out', they still could not budge him. Finally they removed his vest, his shirt, his trousers, and even his pride until he was left with only his humiliation; then they greased him with butter and slid him out. Yet he took it in good part, never minding a joke on himself so long as it didn't concern his powers of intellect. But the problem of getting up and down the tower still remained. Under no circumstances would he give up oysters, but an easier solution suggested itself. He rigged a kind of bosun's chair with a long cable and from then on had himself pulled up the outside. Many a time his assistants would stand glued to their places on the ground, almost too frightened to look, but the speck at the top, four hundred feet up and nonchalantly inspecting his aerial, was no more alarmed than the boy in the thunderstorms of long ago.

At last the momentous evening before Christmas arrived. At Brant Rock all was in readiness, while south in the Caribbean a dozen or more ships of the fruit company ploughed through the placid waters. In their drab, darkened little wireless rooms the operators counted the hours and wondered what mysterious sounds the night air would carry into their headphones.

In the sending shack Reg gathered Mr. Stein, Miss Bent, and Helen around the asbestos-covered microphone, while toward the back the others stood, some smiling, some tense, all alive to the importance of the moment. At exactly nine o'clock 'CQ, CQ, CQ', meaning 'General call to all stations within range', was sent out in dots and dashes, and then Reg himself stepped to the microphone. He gave a short speech as to the program to follow and the second he finished one of the operators switched on the Edison phonograph and a solo voice singing Handel's Largo squealed out over the air waves.

Now it was Mr. Stein's turn. He cleared his throat, stepped forward, turned pale, then backed away from the fearful little device, unable to utter even so much as a squeak. Quickly Reg grabbed his violin and fiddled through 'O, Holy Night', managing as well to sing the last verse at the same time as he played. Helen and Miss Bent had promised to read parts of the Bible text, 'Glory to God in the highest and on earth peace to

men of good will', but when their time came they looked at poor Stein, opened their mouths and not a sound came out.

Reg took over their share as well. In truth he could speak much better than he could sing or fiddle and he minded this bit not at all. Finally he wished his listeners a Merry Christmas and advised that the program would be repeated on New Year's Eve. It was, and even Mr. Stein, his stage fright gone, held forth in excellent voice.

That he had reached the operators on board the ships was proven in the weeks ahead when reports poured in not only from the fruit company but also from vessels all over the south and north Atlantic, wherever Fessenden's radio receivers had performed their magic. Though Reg had no idea that this miracle of the first broadcast foretold a change in the habits of people greater than almost any single event in history, he was overjoyed to have shown the world what his wireless telephone could do, and this on the very night which celebrated another wonder, that which had taken place so long before in a manger in Bethlehem.

Surely, now, people the world over, even those in Canada, would be impressed with the number of uses to which his apparatus could be put; surely they would recognize its great worth!

As he set about enjoying himself over the holiday season at Brant Rock, Reg took time to get a note off to Minden Cole in Montreal, describing the fine points of his latest triumph. He had a plan in mind, both for himself and for the Canadian company. If it worked out it would change the whole course of his life.

24.
Cast Adrift

As it turned out in the months to follow, the world did not beat a path to Fessenden's door in order to avail itself of the wireless telephone, either for broadcasting or for any other purpose. 'A somewhat interesting contrivance, to be sure,' certain persons muttered, but in the main most folk did not consider it anything nearly as important as the celluloid collar then coming into style. On one occasion, though, there seemed to be a chance of a sale. The giant American Telephone and Telegraph Company, which had witnessed a demonstration the year before, asked Reg and his backers to come to New York City to talk business, but while they waited in an outer office a change of management was taking place in an inner one, and even this opportunity was lost.

As a result Mr. Given and Mr. Walker began to lose much of their enthusiasm and they talked of selling their interests with the hope of getting as much of their investment back as possible. For his part this turn of events did not disappoint Reg in the slightest; in fact, it made what he had in mind easier. In his letter to Mr. Cole he asked if the directors of the Canadian company could be persuaded to buy out the two millionaires from Pittsburgh, for he had a great urge to return and carry on his work in Canada. 'I do hope they look favourably on my proposition,' he had enthused. 'Remember,

no one else has the wireless telephone, and even with dots and dashes I can signal five times as far as Marconi.'

Some progress had been made. The directors had come down to Brant Rock and satisfied themselves on the working of the apparatus, but such decisions take time and they were in no hurry to give him a yes or a no. In the meantime he had to get along with Mr. Given and Mr. Walker as best he could and honour his obligations to them.

These were not easy times for Fessenden. He was completely unhappy about the use being made of his apparatus. Mr. Given and Mr. Walker behaved like dogs in a manger, still refusing to make and market the devices themselves and at the same time not being the slightest bit interested in selling rights to the inventions to others. This was an invitation to thievery, and soon the United States Navy and a number of companies started to make millions of dollars' worth of liquid barretters on their own without paying a cent to the Signalling Company. To Reg fell the task of taking these people to court and thus more of his precious time was frittered away. Still, each day his radio continued to perform better and better, the strength of the signals amazing him. Voice and dots and dashes were reaching Puerto Rico without the slightest difficulty, and on occasion all the way to Alexandria in Egypt, a quarter of the way around the world.

Reg lost no chance to keep his fellow scientists informed of his progress. On Monday, June 29, 1908, he addressed the annual convention of the Institute of Electrical Engineers in Atlantic City. His subject: 'The invention of the wireless telephone'. As usual, once he warmed to the occasion, he was in his glory and he talked of his beloved apparatus as if he had a mission to perform. Speaking clearly, his big grizzled head held high, he led his listeners from the experiments of Hertz to the time when the idea of the continuous waves first flowered in his mind at Toronto, then past the meaning of the interrupter's wail, and on to Cobb Island and Roanoke and Brant Rock. And finally the future.

'In the days to come,' he declared, 'all the oceans and continents of the world will be bridged by radio and ships and airplanes will use it to keep in touch with one another and with

their bases.' He could have told them about a host of other applications which he was certain radio would come to have, but he had boggled their minds enough for one time. And he dared not refer to 'broadcasting', because even men as learned as these would have ridiculed the suggestion that some day right in their own living rooms they would hear, for instance, great concert artists at the very moment the performance was taking place, miles away. About other 'far-fetched' uses, such as bouncing signals off the planets to determine their distances from earth and the joining up of radio with his gyrocompass to automatically guide ships of air and sea, such practices he would have questioned himself if they had come to mind.

These were great days in the history of invention and the benefits could be seen at every hand. Even now enough automobiles to fill an acre or two spilled out around the convention centre, and Reg himself had driven over from New York in one fresh from the assembly line. 'Only for a tryout, of course,' he ruefully admitted to friends, remembering for once the limitations of the Fessenden budget. But he had wanted to observe the working of the engine under the hood and see for himself how the whole thing performed. A big improvement on his father's and Cortez's buggies, he must have concluded.

And there was the airplane. In a few weeks he would be going to Fort Myer in Virginia to watch his friend Orville Wright demonstrate a new model. And he had heard how, back in May, Casey Baldwin, a daredevil from Toronto, had made the first public flight of an airplane anywhere in the world. He wished he had seen that because he felt a deep kinship with anyone from his native land. Though the pace had lately been a little less hectic than usual, at Brant Rock there was always some rush of new ideas to fill the time available and to curtail his travelling.

At this time Reg probably knew more about electricity than any man alive; hence as a matter of course his thinking wandered far and wide as to how it could be put to use in ways other than radio. When he had seen Parsons' steam turbine at Newcastle in England so many years before, he had told himself that here was a machine that would come in handy in a dozen different ways. One day when he was considering using

it to power his generators, the thought struck him that the ship builders, who had hooked it directly to the propellers, were all wrong.

'Use the turbine to generate power for electric motors and run the propellers in this way,' he suggested to the big electric companies and the United States Navy. However, they wouldn't listen to him. After all, they had their own laboratories, huge affairs employing hundreds of scientists, and they reasoned that in this field they had little to learn from some 'upstart'.

In the weeks following the convention at Atlantic City Reg completed the design of a monster engine such as the one he had proposed. 'I call it a turbo-electric drive,' he advised the Secretary of the Navy. 'It will develop 2,800 horsepower and drive any of your battleships.' To show his gratitude to the land that was giving him the opportunity of advancing his radio work, he never patented his invention and as a result it never earned him a penny. Still, in later years he was more than satisfied to see the turbo-electric drive become a prime means for propelling all kinds of ships, from huge battle cruisers to the smallest merchantman.

In the months that followed, Reg came to believe that satisfaction would be about the only reward stemming from any of his work. Mr. Given and Mr. Walker still held that selling the Fessenden system in one fell swoop was the only way out of their difficulties, but each passing day seemed to bring a sale no closer. In the meantime the two millionaires lived well on the income from their banking and other enterprises, but Reg's eggs were all in one basket. Every waking minute he lived with the torment that the two backers would get fed up and place the company in bankruptcy. Then the patents would go to pay off the debts and he would be left with nothing. In addition it also appeared that the directors of his company in Canada were no nearer to making an offer than they had been a couple of years earlier. Everything hung fire; it was like the lull before the storm.

Suddenly, late in the year 1909, his worst fears were realized. In England the Postmaster General, whose department looked after the various means of communication, announced that wireless transmitting across the ocean would

become the special possession of the government and no private companies would be allowed to engage in it. Reg was horrified, as were Mr. Given and Mr. Walker, and even the snoozing directors of his company in Canada.

Something had to be done, and soon. But what? How do you go about persuading the most powerful government of the day to change its mind? Worried sick lest his whole future should be crashing down about him, Reg hurried to Pittsburgh. Now he sat directly across the desk from Mr. Given and Mr. Walker, and they as much as said that very thing to him.

'No, you wouldn't have a ghost of a chance, Fessenden,' echoed Mr. Given.

'Lord Strathcona must have the ear of the Prime Minister,' answered Reg. 'He should be of considerable help. And then there's the American ambassador; he's bound to be against such a thing.'

'True, true,' considered Given, staring first at the ceiling then at Mr. Walker for inspiration. He knew that if the worst came to the worst, they could sell the patents for more money than they had invested. Still, if the company could in the future signal across the Atlantic and show a profit, their interests would be far more valuable. His gaze riveted on Fessenden, a plan swiftly taking shape in his mind. 'Suppose you could somehow secure a permit from the British allowing us to work across the Atlantic, what then? What would you want?' he asked, his voice sounding suddenly rough.

'Permission to use my inventions in Canada,' Reg retorted.

'Who would pay the cost of your trip to England? You might be there the better part of a year.'

Reg was surprised at the directness and smallness of Given's question. He had only the shirt on his back and some sort of interest, he wasn't sure how much, left in his patents. All he could do was shrug his shoulders and await the next query.

'About this Canadian company of yours,' continued Mr. Given. 'If you get a permit you will be able to transmit between Canada and England, I presume, and will this not add greatly to the company's worth?' He asked the question sharply, his eyes squinting at Reg; then he glanced knowingly at Mr. Walker and back at Reg again. 'We will advance the funds, Fessenden, on condition that you give us in return a controlling

interest in your company, otherwise . . . ' Given sat back in his chair, waiting.

However, Reg was not without some points in his favour. The whole business of his patents, now numbering more than three hundred, was so complex that Given, the banker, and Walker, the soapmaker, had not the slightest understanding of them. When suddenly he took a chance and burst out, 'Sending between Canada and England must remain in Canadian hands; I will quit before I give up an ounce of control!' he had turned the tables. For the moment they needed him and the licence too as much as he needed them and, as this was a state of affairs which businessmen well understood, he had won his point. But time and events have a way of changing need, like everything else, and for Reg this would be his last victory over Mr. Given and Mr. Walker for a long time to come.

On March 12, 1910, Reg and Helen boarded a steamer at New York and sailed for England. Mikums stayed behind, now too frail in his old age to travel. His days, like those of his master at Brant Rock, were numbered, and when they left he seemed to sense it, for he put up a pitiful wail.

As Reg raced around London, seeing in turn Lord Strathcona, the Postmaster General, the Secretary of State for the Colonies, and dozens of others in officialdom, he had not the slightest knowledge of the plot under way against him at Brant Rock. But Mr. Given had put his plan into operation. Every little while he saw to it that new 'technicians' were hired, but in fact these men were private detectives, and their duty, when the time came, would be to seize the station and bar it to the man who had created it.

Though he should have known that the task he had set himself in London was a well nigh impossible one, Reg never once considered failure. In fact, he couldn't see the officials possibly turning him down once they had heard his arguments. But there was such a vast number to interview, such a multitude of decisions to be made, that the summer doldrums descended before he was half way through and hardly a single one of the King's ministers could be found in the city. None the less, a little at a time, he was bringing matters to a head. As good luck would have it, the Canadian Postmaster General

was also in London at this time, and Reg got his promise of permission to build a station in Canada – as long as the British agreed, of course.

During the summer he visited Darwin's home and sat under the same tree where the famous naturalist had thought out many of his theories on evolution decades before. Then he went south to Canterbury and spent a few days seeking information on the Fessendens of long ago. But not a solitary one remained there now and he was glad to leave the old cathedral town.

Numerous invitations to address all kinds of meetings flooded in on him since by this time he was well known in England. 'A doughty champion of lower trans-Atlantic wireless rates,' had cried a London newspaper the day he landed, and Reg made certain that people in government saw the report.

But the get-together that gladdened his heart the most was assembled on the occasion of Lord Strathcona's Dominion Day dinner. This he would not have missed for the world. Here, before the greatest lords and ladies of all England, Reg gave one of his most telling speeches. Ranging far and wide on the subject of invention, he concluded with a paragraph that brought gasps of surprise and no little admiration from his listeners. 'The only thing that really matters, materially as well as spiritually, on this earth, are its men,' he contended. 'It is not the so-called "Natural Resources" which should be conserved, but rather the Administrators, the Discoverers, the Organizers, in short the men who give these resources their value. Given the men, they will create all the natural resources needed out of whatever may be at hand.'

In spite of Reg's hard work, it was November before the licence approval came through. But then, wonder of wonders, it turned out to be for a twenty-year period, longer than even he had dared hope.

On the steamer back to America it seemed to him that he had more reason to eye the future with confidence than ever before. In a short while a brand new tower, six hundred feet high, would begin sprouting into the Scottish sky at Machrihanish, Given and Walker had told him as much before he had left. This time the sending of voice across the ocean would be no accident, whether from Brant Rock or the east coast of

Canada. The more he thought out the possibilities the more elated he became because, in addition, he as good as had a permit to build a station on Sable Island off Nova Scotia. Wait until Minden Cole and his directors in Montreal heard this! Though he had cabled the other good news to Mr. Given and Mr. Walker, this tidbit he would deliver personally.

Before long he had things humming again at Brant Rock. Though Reg noticed that the men hired during his absence seemed to have no special duties to perform and his mentioning of it to Mr. Given brought only a stony silence, he put it down to his having been off the job too long. New tasks awaited and soon the matter was forgotten.

His old friends, the people at the United Fruit Company, had just erected a station at New Orleans to wireless to their ships and to the plantations in Guatemala and he was called to Louisiana to put it in order. After a few days he had it working perfectly and for good measure he transmitted dots and dashes 1,600 miles back to Brant Rock. 'By far the longest sending ever over land,' noted the newspapers. 'An impossible feat,' they added.

One day shortly after Christmas, Mr. Given and Mr. Walker telephoned him at Brant Rock, asking him to come to Pittsburgh for a conference. While they engaged him in conversation, all day long their men at Brant Rock changed into their real roles. Helen and Miss Bent were flung aside and the station records seized.

At Pittsburgh they began by demanding that they be included in his plan to wireless between Canada and Britain. Reg refused.

'But we have the licence; we don't need you any more,' exclaimed Mr. Given, gleefully. 'We can get someone else to run the station, your old helper Mr. Kintner, for instance.'

And when Helen tried to telephone him from Brant Rock they told her that he was nowhere to be found.

At the station the regular workmen remained loyal. They had themselves sworn in as special police and by late afternoon they were patrolling the site, armed with shotguns and rifles and shouting, 'We only take orders from Fessenden.'

But never again would orders be forthcoming from Fessenden at Brant Rock. As Reg was boarding the night train

back to Boston, an officer of the court served him with a legal notice forbidding him to have anything further to do with the Signalling Company's affairs.

Yes, he could return and gather his belongings; they would let him do that. No, he could not have his inventions. They did not belong to him any more; they were the property of the company. 'And you see the company belongs to us, not you,' gloated Mr. Given.

Though Mr. Stein and Mr. Pannill and the remainder of his assistants declared they would follow him anywhere that wireless experimenting might lead, Reg knew that this was the end – of everything. He had no money to build or run a wireless station on his own in the United States or Canada or anywhere else, and now that his inventions were gone as well there was no chance of raising any. All he could do was bid them good-bye and Godspeed.

While he had been in Pittsburgh, old, faithful Mikums had taken suddenly ill and crawled into the cardboard carrying case to die. Somehow life lingered until Reg's return and only when he was cuddled against his master's massive chest did he breathe his last. Then, speaking to no one, Reg trudged to the farthest guy anchor and hacked out his friend's final resting place in the frozen earth. When this was done he left Brant Rock.

25. The Way His Heart Told Him

On a day in late August, 1914, a giant of a man, grey of beard and with hair now worried to a cream white, sat bolt upright at a roll-top desk in the study of his quarters in Boston. He was alone. Every now and then his emotions seemed to drive him to fits of frenzied writing; his lips moved as he read what he had just scrawled. It didn't suit. The huge head shook from side to side and the paper, crunched into a fist-sized ball, flew to join a growing pile in the wastebasket. He whirled round in his swivel chair and stopped, as he had done dozens of times during the long afternoon, to gaze intently out the little sun-polished panes of the study window.

Reginald Fessenden knew what words he must finally place on the writing paper; the still tender feeling for Canada lurking in his heart would see to that. But they did not come easily, not when he reflected back over the past years at what had been a one-sided love affair. For longer than he cared to remember his country had given him the back of its hand: 'No, Mr. Fessenden, there is no place for you at McGill, the university has hired an electrical engineer from the United States. No, Mr. Fessenden, you cannot build a wireless station on Sable Island or anywhere else in Canada. You see, we have already loaned money to Mr. Marconi for that very purpose.' Then when they had at last grudgingly said 'yes' it had been too late; his inventions had been taken from him.

The two long years after Brant Rock had been little better. There was no work for him in Toronto or Montreal, not a thing where he could use an ounce of brain power. And he had taken to inventing and peddling 'funny' things, such as aluminum bags to hold tea, and violins with electric amplifiers built into them, and plans for a mechanical parking garage for automobiles. This last the business world had treated as a great joke. 'Don't tell us you have wasted your time on this thingamajig, Fessenden,' the financiers laughed. 'Why, there will never be enough cars that structures like this will be needed.'

In the meanwhile he and Helen fought to get back on their feet, living in run-down rooming houses and selling their few worldly possessions, one by one, for rent and food money, and to pay their lawyers. Every day was court day, for never would he let Given and Walker make off for good with his patents, not if he could possibly help it. In the ups and downs he both won and lost, but never finally either way. The opposing lawyers had learned one thing: backing Fessenden against the wall was like cornering a porcupine; he only became more dangerous. Month after month the battle raged and it looked as if it could go on forever. And all the while his future stood stock still; he was getting nowhere.

Then one day in 1912, when little hope and no more money remained, he was standing in Boston's South Station with no place to go when he met an old friend, Mr. Fay of the Submarine Signal Company. Fay suggested, 'Come to see me at the office, Mr. Fessenden. I would like your opinion on what we are doing.'

The Signal Company was in the business of making gear for communicating under water and for detecting icebergs and other obstacles. As the *Titanic* had gone down in the North Atlantic only a few months before with the loss of fifteen hundred lives, there was a terrible urgency about their work.

'Could you tell us what help your radio waves would be in conversing between submarines when they are submerged and in finding these rocks and bergs?" Mr. Fay also asked during the chance meeting. When he arrived at Mr. Fay's office the next morning Reg had the answers ready and well thought out. Sensing a job in the offing he had sat up all the night before reading about underwater signalling, and when he found that

hearing a bell tinkling at a distance of a few hundred yards was the best that could be expected he had at once set to work on the problems.

He landed a job all right, and in only three months he developed a whole new form of wireless by which submarines could signal from one to the other even over distances as great as fifty miles. And the real secret of his work had been the same as always, ever since he had stowed away the snowballs so long ago at Fergus. He had gone back to mathematics and then come ahead on his own, rejecting everything which had been attempted by others. This was the Fessenden way, and here again it proved to be the right way.

Only the past spring his old friend Dr. Kennelly had come down from Harvard with a number of members from the Academy of Arts and Sciences and Reg had given a demonstration of his apparatus. Dr. Kennelly had said laughingly, 'I see, Reginald, at last you're experimenting where the ions can't get at you.'

'No, but plenty of other things can,' he had joked back. Afterwards he had told Kennelly of the days when he had banged rocks together in the Grand and listened to the sounds. 'The density of the water varies, Doctor,' he had said, 'and that plays hob with the radio waves.'

On the whole it was a light-hearted visit. But when they got to talking of the *Titanic* and of other ships being sunk by reefs and bergs all around the globe, the discussion turned deadly serious, for Kennelly was as concerned as Reg about the needless loss of life.

The test had gone off well and in the months following, with the dreaded war clouds gathering over Europe, he laboured at top speed to find out still more about his devices, convinced that soon there would be a greater need for them than ever before. During the spring and summer, off the coast at Newport and the Grand Banks of Newfoundland, he had sent his signals pouring forth into the sea. 'I can bounce my radio waves off icebergs miles away, accurately gauging their distance from the ship,' he jubilantly entered in his notebook. 'And today, April 27, I tried another experiment; I sent the waves to the bottom of the ocean and found that I could tell the depth of the water from the interval between when I sent the

signals and received the answering echoes. When I have time I want to do more work here because I'm sure it will lead to something important. Think what an advantage it would be for sea captains to always know the depth of the water under their keels, and while the ships are moving, no less!'

It was now nearly four months to the day since he had made that prophecy and meanwhile almost the whole world had become a madhouse. War was declared in Europe and the idea of measuring depths would have to wait. Instead, his underwater radio waves were claimed for another more urgent purpose – helping to hunt down big, sleek, shark-like metal fish which he knew, even now, must be sliding from their lairs at Bremen and Kiel. Soon the German submarine fleets would begin stalking the high seas for prey, and, except for listening by ear, the Allied sailors would have no way of detecting them.

Reg returned to the job at hand: the writing of the letter he had been attempting all the long hours since noontime. But all at once, recollections of the shabby tricks his country had played on him seemed of little consequence. He put them out of his mind and no longer stared out the study window debating where his duty lay. True, he and Helen would have welcomed the money which the war would guarantee for his new inventions; they were buried in lawyers' bills and had no nest egg at all. But life was more than fretting about yesterdays or wishing on tomorrows; a man had to live with himself today too. In the end, he gripped the pen firmly and the words poured onto the writing paper in the very way his heart told him.

> The Honourable, the Minister of Militia, August 25, 1914.
> Ottawa, Ontario.
>
> Sir:-
>
> Will you please accept this letter as a tender of my services with the Canadian Contingent in any capacity you may think best.
>
> I am a Canadian, the son of Clementina Fessenden, the founder of Empire Day.
>
> The Ontario Power Transmission from Niagara Falls was designed by me as Engineering Commissioner. In addition, since that time, I have made a number of inventions which may be of help to the Government.

As regards payment for services, the writer is possessed of sufficient private means. Concerning my inventions, a list of which you will find on an attached page, these are tendered without charge during the period of the war. If at the close of the war it is desired to continue the use of any of them, any arrangement proposed by your office will be satisfactory.

Your obedient servant,
(Signed) Reginald A. Fessenden

26. In the Name of War

The Great War began on the first day of August. Before it ran its course of more than four long years, ten million men would die – in the air, on the land, and in the depths of Fessenden's old foe, the Atlantic.

A few short days after Fessenden sent his letter to the Minister of Militia, he, along with Helen and Mr. Madden of the Submarine Signal Company, arrived in London. In his pocket he carried a letter of introduction to top officials of the War Department, and in his arms, covered by the folds of an inverness cape, a mysterious black box. This he guarded personally, as if his life depended on it, and, indeed, as he had told Mr. Madden on the way over, 'maybe it does, as well as the lives of thousands of others'. Also he had brought along cases of specifications, plans of his detection apparatus and other gear, and in his head, in the thinking-out stage, a whole batch of additional notions on winning the war.

Though he loathed the very thought of men killing or maiming one another in such a fruitless fashion, still the trappings of battle brought out 'the boy of the thunderstorm' in him. The danger and the knowledge that London was where the great decisions were being made left him flushed with excitement. He hurried from one appointment to another, explaining his equipment and ideas at every opportunity.

And 'they' listened; here was no fuzzy-brained inventor of

the kind that crops up like mushrooms in time of war, trying to sell impossible schemes. Although some of Reg's ideas appeared to the staid generals and admirals as utterly outlandish, there could be no mistaking the reasoning, insight, and sincerity that lay behind them.

In such a category was the device in the black box and the incredible plans Reg was working out for its employment. In these early stages of the war slight use was being made of airplanes to bomb the enemy. The little cloth and wood machines would hop about in the skies over the trenches, singly or in small packs, all the while doing scant damage to the great armies below. Only rarely would the pilot lean over the side to fling a tiny bomb. To Fessenden this meant wasted opportunity and his mind wrestled with a better method. Then one day, November 5 to be exact, in the London offices of the Signal Company, all the pieces of what would be a remarkable solution suddenly jelled, and he set about at once putting it down in the form of a memorandum to the War Office.

Here was the Fessenden of old, of the glorious days at Brant Rock, face flushed with enthusiasm, arms flapping while he smoked one cigar after another and, striding back and forth, dictated so rapidly that Mr. Madden had to place a secretary at either end of the office to catch his words.

'Airplanes in mass!' That was his answer, his trump card. 'Send them in flights of thousands at a time to destroy the German communications and supply depots!'

'Where will we obtain thousands of airplanes?' Reg anticipated the authorities asking disdainfully, 'Why, we can produce only a few dozen a month at present.'

'I will build a factory in Canada capable of making two hundred a day,' he directed the secretaries to put down. 'We will turn them out like automobiles, like Henry Ford who makes seven hundred cars every twenty-four hours.'

'Where would the fliers come from?' they were bound to inquire. And he had an answer: 'If a man with no motor training can be fashioned into a chauffeur in a few days, it should require no more time to turn a chauffeur into an airman.'

Then, as a last point in the memorandum, he revealed the secrets of the object in the black box. His airplane engine! Reg

had invented this marvellous machine in the doldrum days after he was fired at Brant Rock. Nothing like it existed, for its pistons pulsed as silently as muffled oars at midnight and from its depths surged the strength of more than a hundred horsepower, enough to thrust the biggest bombers deep into the heartland of the enemy.

Reg presented the memorandum to Lord Kitchener, the Secretary of State for War, fully expecting the old general to request his appearance immediately to discuss the matter. But just as talking through the air without wires had been considered impossible, it seemed that here again his thinking was of another age, a time, as events would later prove, still a couple of decades into the future. Lord Kitchener never sent for him and he brooded for days in his hotel, saddened to the bottom of his soul as he remembered the thousands dying on the battlefields and sure in his own mind that his plan could greatly reduce the length of the war.

But from day to day his other ideas continued to flood the War Office and, in time, a vast array of them was put to use by the Allies. He invented a means of detecting enemy artillery, and new sights for guns were built after his designs. Then, when the poison gases poured over the Canadian lines, it was his suggestion to 'ignite petroleum in front of the trenches and thus cause the gases to rise on heated air' that was finally heeded.

Soon, in the dark skies over London, another discovery of Fessenden's would prove its worth. Back in 1910, when Reg had been in England to secure the radio licence, an emissary from King Edward had called at his rooms for advice on the problem of artillery batteries communicating with one another while in battle. Reg had worked out a solution using his new wireless direction antenna and in the process had found a way of employing radio signals to determine the position of aircraft. In a few months, when German Zeppelins would nose through the fog and blackness to bomb London, the 'King Edward Method', the same one given the monarch, would reveal their whereabouts to Allied gunners and airmen.

But it was in the cold grey bowels of the Atlantic that Fessenden's genius truly came to grips with the enemy. The British admiralty was quick to see the advantages of his detection and

underwater signalling apparatus, and by the time Reg left for home, orders for hundreds of sets were on their way too.

Many a German U-boat commander, his craft splitting apart at the seams from the explosions of Allied depth charges, must have been utterly bewildered as to how his little spot in the deep had been found out. But to the Canadian and American and British warships hunting him, it was no mystery at all. With headphones tightly pressed to their ears, the seamen would listen for the telltale throb of the U-boat's engines and even when the German lay fathoms down not making a solitary sound, they would still ferret him out by bouncing radio signals off his metal hull.

The time came when it seemed to Reg that he had accomplished all that could be hoped for in England. Back home a number of matters were crying for attention: production of apparatus must be stepped up for now there was no doubt but that it would be in great demand until the end of the war, and as well, the Signal Company was opening new offices in Montreal. This he looked forward to because it would mean seeing Norman Trenholme again and Minden Cole, with perhaps even time for a few side trips to Peterborough and Hamilton to chat with Uncle Cortez and his mother. In addition, many Allied governments were seeking his advice on various matters to such a degree that there appeared to be no end to it; the problems he faced could best be worked out in the laboratory, or off the ports of Newport or Halifax while down in the submarines himself.

'How can our submarines identify themselves so that our own surface ships won't blow them to smithereens, thinking they are the enemy?' the Navy people were asking. In time he would produce the answer: a little code wheel which would work together with an Allied submarine's electric propelling motors, giving out a secret beep, beep, which as much as told the knowing captains, 'Don't fire at me, I'm your friend.'

'And what if a submarine is in trouble way down and needs help instantly? How could we locate her?'

'Have her fire a cartridge filled with chemicals from the torpedo tube,' he would reply. And he would go on to make such a device, which, when it reached the surface, would explode with a bang audible for miles while at the same time a

coloured light would emblazon the sky and clouds of black smoke would spew forth into the glow. How like Fessenden it was, this leaving of nothing to chance!

But over and above his war work, there was always somewhere in his mind the question of how to get back his radio inventions. On every hand he would see the heterodyne and the alternator being used to the limit and without a by-your-leave from him. Well, the day the war ended he would put a stop to that larceny.

Enough of the distant future. In London Reg found himself looking forward to the sea voyage home. He needed a rest to prepare himself for the hurly-burly to come and at the moment he was tired, 'dead tired', he confided to Helen. And she had wormed from him the additional information that of late he had often felt an aching heaviness in his chest, accompanied by a certain numbness creeping along his arms. In the end he allowed her to persuade him that the doctors in Montreal or Boston should look him over.

However, one more call remained before he would consider leaving. On December 1, he travelled to Oxford to spend a few hours with another Canadian, the great doctor Sir William Osler. Osler had also attended Trinity school; hence the two of them had a lot to talk about besides the war. And just as well, because before long it would tear at the souls of both, leaving scars that would never heal. In a few short months Osler's son would die on the western front and Ken, now a strapping lad, big-boned like his father, and looking forward to his military training, would go to France, too, and at the war's end would return home with the balance of his mind not all that it should be. At another time, from the very shadow of his father's grave, when the Second World War had added to the muddle left by the First, Ken would put to sea in a small boat, never to be heard of again.

But on this day at Oxford, near the end of 1914, the two fathers – the physician and the scientist – talked of school days and relaxing things, though down in their hearts both must have doubted the sanity of all men.

27. The Bitter and the Sweet

Finally, after four long years, the world wearied of its bloodletting and once more the time came when man could turn his talents away from destroying and back again to improving his lot. As the 1920s began, there surged a sudden desire to make up for lost time, to taste the good things that life had to offer. At or near the top of everyone's list appeared a new device called radio. All at once those feeble voice sounds, transmitted in the beginning so long ago at Cobb Island, were to explode into a great continuing torrent of 'keeping in touch'.

'Is it snowing where you are, Mr. Thiessen? If it is, telegraph back and let me know.' Somehow on that fateful day Fessenden's poor, pitiful little words had made it through the static and the spark's roar the one mile to the other mast. And then on to Roanoke and Brant Rock where they winged for a thousand miles and more. And then the darkness. And now the new life. To and from every corner of the earth they streamed at all hours of the day: from ship to ship and ship to shore, airplane to airplane and airplane to ground, and between all the continents as well, daring even the ionosphere to do its worst. As he took time out in Boston to consider things, Fessenden could hardly believe his senses; at long last his prophecies were coming true!

In the newspapers barely a day went by but he read of great new towers going up in every city of the land, put there by

radio stations to transmit the songs of Caruso, the voice of the newscaster telling of happenings of only an hour before, the weatherman's forecast of the morrow's rain or shine, and of a thousand other things. And he remembered the day in 1900 when he had set out down the Potomac; his job, to find ways and means of transmitting reports on the weather!

'Glory to God in the Highest and on Earth Peace to Men of Good Will.' And he recalled a far-off Christmas Eve and the first broadcast from the old station on the lonely Massachusetts coast.

'Listen! I hear an angel's voice in my headphones,' the operators on the fruit ships had exclaimed, 'and music and singing too!' And the seamen had come running to gather in the wireless rooms and witness the miracle. They had written and told him so. Now, he realized, it was a miracle no longer. Why, he even spent Sunday afternoons himself in the living room, twisting the big dials and tuning his own radio set.

'Soon there will be five million radios in homes in the United States and Canada,' the newspapers boasted one day. And Reg, still battling for possession of his patents, took note of the report and added a few million dollars more to his claim against 'the trust'. This giant partnership, made up of many of the largest wireless and electric companies in the world, had purchased the alternator and the heterodyne along with many more devices from Mr. Given and Mr. Walker, and he had fought it every inch of the way since the war's end. The nest egg for his and Helen's old age, and much more, hinged on the outcome. These instruments, without which there would be no such thing as radio, these he had fashioned with his own brain, his own hands. They were a part of him; their final loss would be worse than death itself.

At this time he and Helen lived in a fine old house in Boston, now and then spending part of each summer in the Laurentians north of Montreal. On such occasions he would travel on over to Hamilton to see Tren and visit the graves of his father and Vic and Clementina at Ancaster. His dear mother had died in the last year of the war, refusing to the very end to go and live with Helen and him and become 'one of those Americans'.

'But I'm not an American, Mother,' he would remind her. Still it had made no difference. Even as an old lady her dislike

of the United States was such that when it was announced that a statue of George Washington would be erected in Westminster Abbey she had organized a campaign against it. Already each year a group of ladies, calling themselves the Daughters of the Empire, met at her graveside to pay homage to the woman whose labours had led to the founding of Empire Day in Canada.

Often, too, Reg would stop by for a chat with Cortez and they would recall the day of the thunderstorm in Fergus and the months spent in 1897 about Chemung Lake. 'I guess you have proven me wrong,' the old man would say with a wink. 'It is possible to send speech through the air without wires.' And they would laugh together at the memories of long ago. Then one day in 1924 Reg stood in Mount Pleasant Cemetery in Toronto while Cortez was lowered into his final resting place, and a bit of himself went along with his dear uncle and friend. At happenings such as these and whenever his chest pained or the numbness returned to his arms, he was reminded that his own days must be numbered as well.

For the first time in all his life Fessenden had plenty of money to spend. Just after the war he had invented what would be his last 'jewel of great worth', the fathometer, as he called it, and the Submarine Signal Company had given him a handsome settlement. Now the device hummed happily away on the largest ocean liners of the day, accurately measuring the water depths beneath their speeding keels and performing exactly as he had predicted a decade before. But still there was little chance of setting anything aside for his and Helen's remaining years. Nest eggs have a way of disappearing once lawyers find the key to the henhouse, and all through the early and mid 1920s and later, barely a month passed that he did not require their services. As a result, where the future was concerned the family exchequer continued to be as bare as ever.

But more things than financial gain can come along to enrich a man's life when his days of deeds and daring near an end. As time went on a generous supply of medals and accolades came Reg's way and he accepted them gratefully. It was good to know that his works were well received not just by people in general but by his fellow scientists as well. Not long after the war he was called before the Board of Directors of the

Institute of Radio Engineers. This august body, of which many members were also inventors from the earliest days of wireless, had voted to bestow their Medal of Honor on the greatest pioneer of them all. It was the highest award in the radio engineering profession; 'To Reginald Fessenden for outstanding scientific achievement,' it said, and he clutched it fervently. His old rival, Marconi, had won it on a previous occasion and under no circumstances could he suffer that man stealing a march on him.

Only one other distinction shared his deepest affections. It was the habit of the city of Philadelphia, under the terms of the will of one John Scott of Edinburgh, to give a cash prize and the Scott Medal to those whose labours had been of great benefit to mankind. Marie Curie had won the award earlier for her discovery of radium and Fessenden received it at a time when he most needed it, when his struggle with the Trust had reached a crucial stage.

Many a time in the months that followed he needed all the encouragement available. Often the nights were spent rummaging through piles of packing cases filled with files from years before, in the hope that a document could be found and the date or place of a certain invention pinned down. Sometimes the searches were fruitless, his temper would get the best of him, and he would leave Helen in tears while he trudged off to court, convinced that their cause was lost. But a number of things were in his favour. His lawyers were the best that money could find and when it was a question of technical matters the Trust had no one who dared tangle with him. Early in 1928 his opponents realized that they were beaten and on March 31, a settlement was made in Boston. It called for payments in the hundreds of thousands of dollars to Reg, perhaps more money than any inventor anywhere had received up to that time.

Reginald Aubrey Fessenden was in his sixty-second year when he could finally pocket the fruits of his labours on radio. For most of two decades he had fought alone through the uneven contest, never shrinking from odds that would have appalled a lesser man. He had won, true, but at the same time he had lost, for in the coming months the doctors told him: 'No, Mr. Fessenden, your heart will not stand up to any kind of work that places an undue strain on it. You must seek a

warm climate and even limit your travelling. No, nothing can be done to repair the damage, though we will examine you from time to time whenever you feel it necessary.'

Well, it was necessary for four more years – four years while the condition of his heart and blood pressure continued to worsen. But he fought as he always had, trying to think of a cure on his own. 'Look, Helen,' he said one day in Bermuda, where he had gone seeking the warm climate, 'I see where the Rockefeller Institute is keeping a chicken heart alive in the laboratory and likely using electricity in some way.' Accordingly he experimented on himself but it was of no use. In the end, resigned to his lot, he turned to working about the grounds of his little domain, happy in the knowledge that here, at least, he could do some inventing without bringing down on his head the wrath of either Helen or the doctors.

With part of the proceeds from the radio settlement he had bought a 'tinkerer's delight' of a place, one he had kept an eye on ever since he and Helen had taken their rides along Harrington Sound in the old days. The waters of the Atlantic washed in on nearly all sides of the land, but here their fury was gone. They lay back in the long, narrow necks reaching in from the open sea, all quiet and obliging, as if they wanted to embrace their old foe and help him enjoy his last days in peace.

Anyone else would have been glad to blend into the gentle tranquillity of such a spot, but not the owner of this restless mind. Not when a made-to-order channel in which plump oysters could be raised lay right at the doorstep and all about stretched plenty of land in which he could experiment. Soon he was planting peach seedlings sent down from Niagara and avocado pears and russet apples and dozens of other kinds of fruits and vegetables, searching to find varieties which would grow best in Bermuda's coral soil. Not a square foot of earth must be wasted lest there be no space left over for the building of a swimming hole.

After the first couple of winters, when all was complete, word got about to the neighbourhood children that they were welcome at 'Grandfather' Fessenden's. And so they came each day, to be met at the front gate by a sleepy old donkey and a cart which jogged them along to the good things inside: the picnicking, the frolicking with the angelfish in the swimming

hole, and the fun of bouncing on the knees of the old gentleman with all the whiskers, who so plainly loved each and every one of them.

Finally, it seemed, Fessenden was at peace both with himself and with the world. For once his life was ordered. As regular as clockwork he rose with the dawn and was off on the rounds of his little kingdom, always in time to marvel at the sun chasing the mist off the bay waters and sparkling the dew drops on the grass and fruit vines. Often, before the tiredness returned, there was time for a look through one of the huge books which held the recording of all his inventions, all five hundred of them. Wherever Reg went, inside the house or out, the past was all around him, for he had planned it that way, even to the panelling in his study which had been shipped down from 'Hawkeye country'.

One day in 1931, the hellish angina suddenly came on worse than ever and in one shocking minute he was within an inch of death. After a while, when some of the lost ground had been made up, Helen took him on the steamer to New York, then north to Boston and the doctors. It would be his next-to-last long journey.

28. I Am Yesterday and I Know Tomorrow

Out at Brant Rock the August winds puffed in from the sea and up over the flatlands, rustling the long-stemmed grass which hid the last torn remains of Fessenden's tower. For some twenty summers, ever since the wreckers came with their dynamite in 1912 and, by order of Given and Walker, sent the big tube splintering to the ground, the winds had gently played among the ruins, as if they knew that some time the man himself would drop by for a last farewell. And now, this day in 1931, he came, driven down from Boston to stay an hour or two.

Very slowly Reg picked his way among the broken insulators, the guy wires, and the concrete foundations. Beside one of these anchors little Mikums was buried. Not even the passing years had dimmed his recollection of which one it was, and he went straight there, parted the thickly growing bayberry bushes and peered down at where the tiny grave must be.

In his mind's eye he saw his old friend in the middle of the roll-top desk, shadow boxing with the green glass lamp shade. Then he plucked some of the bayberry bushes to keep as a remembrance and looked up. In the distance he could almost hear the liquid barretter bubbling as the signals streamed in from Machrihanish and the buzz-swish of the alternator labouring to generate the continuous waves which would carry Mr. Stein's words on the long hike over the Atlantic to

Scotland. He strained even harder, cupping his hands behind his ears, and he thought he could catch the haunting sounds of 'O Holy Night', the squeak of the fiddle, and the Edison phonograph scratching out Handel's 'Largo'.

Suddenly the old memories came flooding back – the good ones as well as the bad. He had given his all in this place, fought like a tiger to rescue radio from the wrong road down which Marconi and others had been taking it. And he had succeeded. And he had been fired. If only they had let him stay, back in 1910, had let him finish his work!

Reg lingered longer at Brant Rock than he had intended. From a high bank he spent the last hours peering far out to sea, eyes raised to scan the horizon until he could no longer make it out. He saw the tide swell to its high point on the mud flats below and afterwards begin to shrink back into the depths which cradled it. When he turned to leave dusk had fallen.

Reginald Aubrey Fessenden died in his house by the sea in Bermuda on July 22, 1932.

He was buried in St. Mark's Church Cemetery and above his vault, in time, was erected a snow-white memorial flanked by fluted columns with a lintel across the top. On the stone were inscribed these words:

His mind illumined the past
And the future
And wrought greatly
For the Present

and a little beneath, in the picture writings of the ancient Egyptians was written:

'I am yesterday and I know tomorrow.'

Epilogue

'It sometimes happens, even in science, that one man can be right against the world. Professor Fessenden was that man. He fought bitterly and alone to prove his theories. It was he who insisted, against the stormy protests of every recognized authority, that what we now call radio was worked by continuous waves sent through the ether by the transmitting station as light waves are sent out by a flame. Marconi and others insisted that what was happening was a whiplash effect. The progress of radio was retarded a decade by this error. The whiplash theory passed gradually from the minds of men and was replaced by the continuous wave one with all too little credit to the man who had been right.'

New York Herald Tribune
editorial at time of Fessenden's death.

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A great many of Reginald Fessenden's articles and papers appeared in the following publications during the years 1892 to 1919: *Electrical Review, The Electrician, Scientific American, American Institute of Electrical Engineers, Electrical World, Electrical World and Engineer, Engineering, Electrical Engineer, American Academy of Arts and Science, Science, Chemical News*, the Official Report of the Ontario Power Commission, and the Transactions of the Toronto Astronomical Society. Information from these articles has been used extensively in the preparation of this book.