



When I Think Back...

by Neville Williams

Arthur David Spring - 1: A true 'hands on' electronics engineer

After compiling 99 previous instalments of 'When I Think Back', it still came as a surprise to find myself writing this 100th column on the life story of a friend whom I thought I knew — until I set about preparing it for publication. Fortunately, I managed to persuade him to interrupt his still busy life to spell out his memories of other days onto tape cassettes, to augment a recording he made for the 'Bright Sparks' series on ABC Radio.

Family records attest to the fact that Arthur Spring was born at Wellington in the NSW midwest, in July 1918. His father worked on the railways, which were at the time central to the existence of many such country towns.

On the job, his father had spent many hours in the company of Ben Chifley, who was later to become Prime Minister of Australia. That, and the impact of the bitter railway strike of 1918, probably generated in the Spring family an attitude often described as 'left of centre'. In his spare time his father busied himself with lodge activities and became an alderman on the Wellington council, where he sponsored the installation of the Wellington Park and a swimming pool to Olympic standards.

In this same time period, Spring Senior took up share-cropping at Mumbil — which I had never heard of until its mention in Arthur's tapes. (It must be close by, having the same postcode as Wellington.) While there, he introduced the Fordson tractor to the area. That phase lasted until 1925, when his father took the family to Sydney to become a Manager in a firm of funeral directors. So it was that Spring Snr, his wife (a girl from Orange), young Arthur and a brother two years his junior ended up at Petersham, then at Five Dock, where a third son was added to the family.

Being of school age, young Arthur began to absorb the three R's, mainly at Five Dock public and later at Stanmore Commercial School. This last was at the insistence of his father, who tried to impress upon him that there was good reason to study book-keeping and other 'commercial' subjects, in addition to

acquiring manual skills. In the taped interview with Stephen Rapley of the ABC, Arthur confesses that he found school utterly boring because it seemed so irrelevant to his real interest, which was in things practical and technical.

More to the point, in 1930 at age 12, he appears to have been bitten by the 'wireless bug' as evidenced by the fact that he built his first shortwave radio. How this came about is lost in the mists of time, although he does recall having

enjoyed reading the biography of Thomas Edison. He also remembers that his father had put together a couple of crystal sets; his contribution to the exercise had been to heat the soldering iron on a gas flame — without burning off the 'tinning'. Yes, he would have heard 2FC on a crystal set, but he couldn't recall any special reaction to the experience.

He did however recall a couple of boyhood friends who were interested in wireless, and he did scavenge wireless parts from old battery sets — sufficient to warrant a direction from his mother to 'clean up your room'.

The radio 'bug' bites

From that collection of oddments came the wherewithal to build a two-valve shortwave set, powered from batteries and driving an old cone type loudspeaker. Perhaps the wireless craze was born on the day that he picked up a signal direct from Germany and yelled for his parents to "come and listen to this"!

From overseas stations, young Arthur Spring's interest turned to amateur signals and the informal chatter that went on between the operators. This prompted the construction of a receiver for the five-metre (60MHz) band — in the days when transmitters were self-excited oscillators and the receivers superregenerative detectors. Arthur was very proud when he logged an amateur direct from Newcastle.

Back to the HF bands, Arthur and a mate thought it might be interesting to have 'mobile' equipment, and accordingly loaded their gear into their respective billy carts. Arthur had the receiver in



Arthur Spring in his prime, in 1965. Building on his early practical experience, he had become Chief Engineer of A.W. Jackson Industries, and had designed and produced the very successful 'Precedent' range of B&W TV receivers.

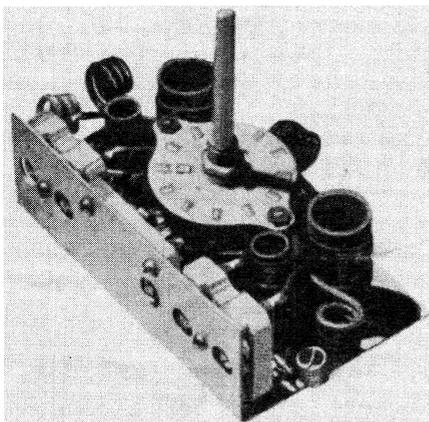
his; in his mate's cart was a car battery, an old Ford spark coil and a modified Emmco B-eliminator which rectified and filtered an HT supply for the set — involving a cable between the carts. Such was their enthusiasm, they trundled this unlikely outfit all the way to an amateur station in nearby Ashfield.

'Pirate' amateur

Inevitably, perhaps, Arthur was caught up by the urge to be a part of amateur radio, and the result was a simple HF transmitter with which he was able to join in the conversations — as a 'pirate', using the callsign VK2BB.

His father in particular was critical of such activities, mainly on the basis that he was spending half the night playing with 'that thing' when he should have been doing his school work.

All went smoothly enough until he responded to a 'CQ' from VK2AA, who casually inquired about the area where he lived. Arthur discretely omitted to answer the question, but minutes later the phone rang to the sound of a friend's



The first identifiable engineering product designed by Arthur Spring: the Crown model ID-2 dual wave coil bracket, as advertised in 1937.

voice: "That's the Radio Inspector you're talking to!"

Panic reigned, his parents were dismayed, and within record time, all trace of a transmitter had disappeared from the premises. Nothing more was heard of the incident, but VK2BB had been effectively silenced.

By age 15, Arthur had passed all subjects in his curriculum, but at different times. "I didn't officially leave school", said Arthur, "I just lost interest in formal education!"

Meanwhile, Australia was in the grip of the Great Depression, as Arthur discovered when he started looking seriously for a job. He spent endless hours stand-

The Crown Radio building as pictured on the cover of their 1937 catalogue. By stacking all and sundry employees into the various departments, the interior photos suggest a staff complement of an improbable hundred or so!



ing in queues, extending 'down the street and round the corner', only to miss out. But he did have one advantage that was to stand him in good stead: he was interested in radio, he had built his own shortwave set and he could solder. That finally commended him to Radiokes, at the time a prominent manufacturer and supplier of radio components to hobbyists and small receiver manufacturers. They offered him a job in 1935 at 13/6 (\$1.35) per week, working with other juniors, male and female. He recalls that he and a Colin Sanderson shared a bench with two girls, assembling small components for the market.

Assembling radio 'bits'

In the 'Lab' were Max Laurey and Harold O'Shea, who 'designed' the components and kept a check on production quality.

In 1936, says Arthur, Harold O'Shea accepted a job in a rival company, Crown Radio, in Crown Street (Sydney) and he in turn proceeded to surreptitiously 'poach' Arthur Spring. Arthur didn't mind in the least, because he was being offered 22 shillings (\$2.20) per week. That's how Arthur tells it, but subsequent events have suggested that the rivalry between Radiokes, Crown and RCS was largely posturing. Behind the scenes, it was convenient for all three to exchange information and facilities to their mutual advantage.

Crown Radio at the time was in incredibly 'pokey' premises towards the Woolloomooloo end of Crown Street, and the walk to work each morning took him past apartments occupied by sundry 'ladies of the night' who often made interesting suggestions to the 'callow youths' passing by...

Shortly afterwards, Crown moved to much larger premises at Pymont, with

more air, more light and enough room to spread the activities into separate 'departments' — including a quite respectable laboratory. Arthur recalls that, for the preparation of 'new look' literature (The Crown 1937 Catalogue) a photographer took shots of the various sections — but only after all and sundry had been shuffled to strategic positions to make the place look fully occupied!

Questioned about the role of unions at the time, Arthur said that for all practical purposes in small radio factories, their role was nil.

Employers paid what they had to, and hired and fired at will, depending on the supply of materials and the state of the Order Book. Work was seasonal: busy in winter, slack in summer and "at its worst in the Ides of March".

'Hands-on' tuition

Be that as it may, young Arthur refined a range of production skills at Crown, including the correct tinning and termination of multi-strand 'Litz' (Litzendraht) wire, observing the critical effect it had on the 'Q', gain and selectivity of tuning coils and IF transformers.

In the same context, he was made aware of the need for operator precision and hygiene in handling fine wire and the ruby mica dielectric in compression trimmers. (Perspiration from female operatives during their monthly periods presented a subtle hazard.)

He spent time in the laboratory, and contributed to the design of Crown pre-fabricated dual-wave coil brackets which were used by hobbyists and small manufacturers.

By 1937, he had absorbed sufficient practical know-how about wireless workshop practice to compete for a job in his own right — which is how he ended up at the then-nearby Breville

Radio, again on the heels of Harold O'Shea. There he found himself involved in the production of receiver components, much as in Radiokes and Crown, except that Breville was making them for use in its own receivers.

As one assignment, he was directed to study the design and layout of a new battery powered receiver that was being readied for production and release. His commission was to prepare a set of wiring guides in full colour which could be used on an assembly line. As the chasses were moved along, each operator would instal the particular leads and components shown on their individual display board.

It so happened that Arthur found one of the female coil winders, Myrtle by name, particularly attractive. In due course, after all the usual preliminaries, they were married in 1942 and set up home at the same street address in Henley where Arthur still lives. It was a happy marriage, and Arthur adds that he was 'devastated' in 1964 when his wife died quite suddenly of a heart attack.

In terms of his career, Breville Radio provided a more purposeful engineering environment than in Arthur's earlier years. It was headed up by none other than Noel Smith who, in evening hours, was final-year lecturer to the first generation of radio graduates coming through

the Sydney Technical College — now the University of Technology.

Learning by doing

It was about this time that a maturing Arthur Spring realised that he didn't have a head for routine 'book learning'. I quote: "The shutters went up. I came to grip with theory by actually doing things, and working out why they were so in the hands-on context."

If he was going to get anywhere in life, his best prospect would be to apply himself seriously to the subject they were describing as 'electronics' and seek to become really good at it. Success would be consummated by becoming a chief engineer, a manager or running a company of his own.

For the present, he was warned by Breville management to get more rest instead of staying up into the small hours merely fiddling with radio. Under pain of 'the sack' he simply must turn up for work on time and alert!

He recalls how he once asked Noel Smith: "Should I enroll at tech"?

"No", said Noel; "Do what you're doing now — but keep your mind on the job!"

"The important thing is not to carry all the facts in your head, but to know where to find them when you need them!" For him, Arthur reckons, it was timely advice...

Breville Radio moved to Missenden Road, Camperdown (Sydney) in early 1937, poised to become a major manufacturer of domestic radios and other retail products under the Breville Radio banner. Painted on the building for all to see was the motto favoured by the proprietor, Bill O'Brien: 'Eventually — Why Not Now?'

Typical of an expanding enterprise, it had a machine shop on the ground floor, radio assembly facilities on the floor above and a laboratory in a first floor extension 'out the back'. In summer, Arthur recalls that the lab was "as hot as Hades", trapped as it was between a galvanised iron roof above and coke ovens below operated by the manufacturer of 'Bonzer' automobile leaf springs.

Arthur knew about the annexe, because he would seem to have become a kind of technical 'handyman', poised somewhere between the lab staff and production.

The problems were gradually sorted out, however, and five test booths were installed, double screened with chicken wire — three for production testing and two for the lab, which had been relocated in what had originally been a showroom. Reminiscing about traditional Australian radio factories, Arthur observed:

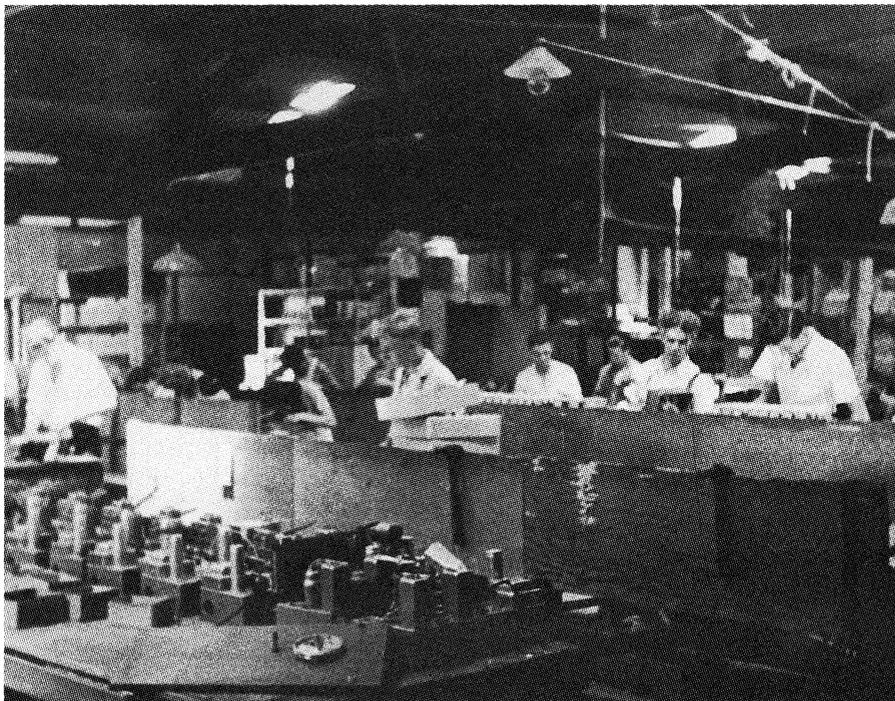
"Blokes like Alan McKeown in the final test rooms were usually very good technicians, not necessarily certificated but very experienced. Arguments between them and the lab most commonly arose because designers didn't make sufficient allowance for cumulative tolerances in production components."

"Final testers had to sort things out when particular chasses tended to come off the line unstable, because factors enhancing the gain met up with unduly low tolerance bypass capacitors."

"The testers tended to complain that 'It's one thing for you blokes to build up a couple of prototypes — it's quite another when we have to mass-produce hundreds of them!'"

That's what Arthur Spring was about when war broke out in 1939. Along with many other manufacturers, Breville was informed that their expertise and facilities would have to be re-directed to meet defence needs, and that their key employees would be provisionally classified as: 'in a Reserved occupation'.

At a purely personal level, this suited Arthur Spring. In personal conversation he told me that he had never been interested in subjects like astrology or religion — being, in fact, an atheist. He was also a pacifist at heart and could generate



An inside shot of the Breville factory in 1938. An unusual fact Arthur remembers was that the operatives were not issued with stools. They were expected to work standing up, behind high benches!

no enthusiasm for a 'foreign' war. This, despite the fact one of his brothers was an Army officer. Defence of one's country was one thing; a shooting war about European politics was quite another!

At Breville he was in a reserved occupation. Better still, he became involved in a group required to develop and produce mine detectors for the Australian Forces. For him, any personal conflict had been resolved; he was helping the war effort, not by destroying people but by decreasing their chances of being maimed or killed. He was also engaged in practical technical research. More about that later. Radio production under wartime conditions posed some weird problems, particularly when they were called upon to produce a quota of civilian and/or welfare receivers without absorbing scarce raw materials. Ganged tuning capacitors were a case in point, where they had to stamp the plates from zinc rather than fine gauge aluminium. The increase in mass was such that they would tend, in the presence of vibration, to rotate heavy section down — thereby re-tuning themselves towards the low frequency end of the band!

Spring's electric car

Arthur's interest in technical projects was underscored in 1942 by his decision to build himself an electric car, (a) to discover whether it was practical and (b) to sidestep civilian petrol rationing. His starting point was an old Fiat, the likes of which I well remember from my own youthful past.

Arthur replaced the petrol engine, gearbox and radiator with a specially wound six horsepower electric motor, driving the layshaft by cogs and chain. Reversing was achieved by switching the polarity of the motor feed.

He stripped off most of the bodywork to save weight, and rearranged things to accommodate an array of lead-acid accumulators. How many and how he came by them is not part of the story, but he did reach one important decision.

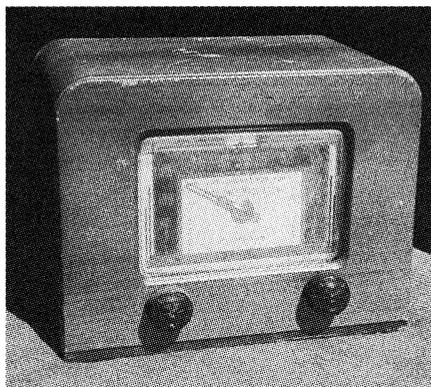
He could have connected them in series-parallel to provide a low voltage (e.g., 48V) high current supply, but the efficiency of the system would have been compromised by resistive losses in the cables, the connections and switching.

So he decided on a series connection, giving him a high voltage (nominally 200V) lower current system, with a motor to suit. A further consideration, I gather, was that, with care, a high voltage battery bank would be easier to charge from the AC mains than one demanding a massive step-down transformer and rectifier...

Put to the test on a (then) gravel road between Five Dock and nearby Haberfield, the electrified Fiat whipped up to around 60mph in no time flat — being faster off the mark than his father's V8 Ford!

Having spent some of my own youth riding around in 501 and 509 Fiats, I can assert that the only way they would normally ever reach such a speed would be downhill with a tail wind! What's more, such were their sluggish cable brakes, that the driver might then have needed uphill and a headwind to stop within a respectable distance!

Arthur had known beforehand that back EMF could pose a problem, especially at the instant when, at speed, the motor was disconnected from the batteries. With no batteries to peg down the voltage, residually energised fields and the



An obvious indication of the enthusiast element in the Breville lab — an FM tuner based on the American 'Pilot' design, but intended for use on the ABC's 'experimental' FM channel.

rotor spinning at speed, the back EMF — in Arthur's words — could build up to "thousands of volts".

On one memorable evening, Arthur was doing his thing on the gravel track when the copper stop-go switch that served as an accelerator arced across the gap and welded itself 'on'. The 'flying bedstead' was out of control, drawing 36A and hitting 58mph without effective brakes!

Arthur had provided for just such an emergency with a knife switch on the fascia. The trouble was that when he reached across to 'save his neck', the resulting arc fried his fingers...

He subsequently tried various tricks with carbon block make-before-break contactors, but in the evening shadows, the 'naked' electric Fiat's progress through the streets of Five Dock was still marked by "more sparks and arcs than a Bondi tram".

The motor didn't like the peak currents,

either, and he tired of having to repair it. All told, at that point in time, an electric car was judged not to be an attractive proposition, so he settled for a Morris Minor and a motor bike running on whatever petrol he could get.

Whatever else he learned from the experience, Arthur didn't need any formal lessons about the reality of the back-EMF effect, no matter what the academics might say about the terminology.

Mine detectors

Back at Breville, Arthur remembers the day when a rather talkative man made his appearance with "an idea that might be of interest to the Armed Forces". At the time, Rommel was trying to battle his way into Egypt, while the Allied Forces were just as keen to push him back the way he had come.

Both sides had planted landmines in the desert, with the result that it had become a very dangerous place to venture. Invisible under a few inches of sand, the mines were a major hazard to vehicles, animals and foot soldiers alike.

The talkative one had worked out that it might be possible to detect the mines with the aid of an electronic search coil that would react to the presence of a metallic object under the sandy surface. It would alert the operator by changing the pitch of an oscillatory tone or a heterodyne whistle.

Army officers he had spoken to were interested, but not to the point where they were prepared to put the proposition to the Department of Supply. Perhaps Breville could have a look at the idea 'unofficially' and see whether it might be practical. Why not? So the idea was referred to 'the blokes in the lab'. Initially that boiled down to a certain non-academic but inveterate fiddler and experimenter: young Arthur Spring.

The talkative one had put together a prototype, using batteries and battery type valves which were accommodated in a pack meant to be strapped to the operator's back. The search coil was mounted on a separate wand with a lead plugged into the equipment, along with conventional pair of headphones worn over the ears.

It worked in a fashion, reacting to steel whatnots buried under the turf, but it was obvious to Arthur that a desert soldier might not want to walk around fully erect carrying a cumbersome back pack and manipulating a wand carrying a search coil. If shooting started, he would need to make himself as inconspicuous as quickly as possible — face down, flat on the sand!

In short order, mine detectors became

the subject of much discussion within the Company and with representatives of the armed forces both here and overseas.

Breville's prototype

In the ultimate, when Arthur assembled the Breville prototype, the probe coil and electronics were concentrated at one end of a stout telescopic rod and the batteries at the other. The weight was balanced so that the rod could be slung from a strap over either shoulder and manipulated with one hand or both. It could be dropped easily onto the sand and nudged along with the operator lying prone.

Arthur recalls that he became so involved in the project that he worked alone in the factory for 36 hours straight, over one weekend, interrupted only when the boss turned up with a bowl of hot soup!

Breville finally made up an experimental batch, which was despatched to North Africa by military air transport — a memorable occasion when the heavily loaded plane barely lifted off the end of the runway. ("Phew!")

Fortunately the prototypes made it to their destination and proved to be a practical proposition, well worth pursuing. Indeed, mine detectors were to feature prominently in Breville's future activities, and

Arthur tended to specialise in them.

When the emphasis shifted from the Sahara Desert to islands in the Pacific Ocean, conventional landmines were replaced by Japanese anti-personnel mines. About the size and shape of a 'stubby', they were buried upright as often as not, under black wet magnetic sand which shrouded them from magnetic sensing. When triggered, they would jump up about a metre and explode, smashing ceramic marbles into a soldier in a body area where a man is particularly vulnerable!

Detectors had to be devised with a two-way switch for (a) magnetic sensing and (b) eddy current, phase shift effects caused by non-ferrous metal components. Assembled on a long telescopic rod, they were too heavy and awkward to be handled gently during a beach landing but were simply tossed over the side of the landing craft, then recovered and carried through the surf onto the beach, where they were pushed up the slope ahead of operators lying prone on the sand.

At the factory, the electronic unit was final-tested by being placed in a tub of water about four feet (1.3m) deep for a specified time. Any suggestion of bubbles would be interpreted as a leak and a need to re-check the sealing. Personnel mine detectors manufactured by Breville became standard issue to Australian troops under the classification: 'Detectors, Mine, Aust No.2, Mark 3'.

Other military projects

Yet another activity had to do with mines of the original under-sea type. Mine sweepers would patrol the sea lanes using paravanes with cables fanning from either side of the prow. The idea was for the paravane cable to collide with the cable anchoring the mine to the sea bed. Sailors on watch would rest a hand on the paravane cable to sense

any such encounter.

It was a tedious job which demanded constant alertness and at Breville, Arthur was able to come up with a clamp-on magnetostriction microphone and amplifier system, which could 'listen' for scraping noises on the paravane cable and sound an alarm.

Amongst the other wartime projects at Breville which Arthur recalls was a general purpose multiband receiver ostensibly for use in Bren Gun carriers. Arthur was involved because of his background in shortwave communication, but during the course of its development, the emphasis shifted progressively to a general purpose role. The specification, however, still required that prototypes be suitable for installation in a Bren Gun carrier.

Arthur says that he can still remember the official visit to the specified Army Base in the quiet comfort of Bill O'Brien's Studebaker. The Bren Gun carrier would be waiting, antenna fitted and crew on standby.

On arrival, the receiver was bolted into place and connected to the antenna — a stout telescopic rod, nominally vertical but free to flex any-which-way by reason of a rubber joint part way up from the bottom.

The route and terrain negotiated for the test run had to be experienced to believe. The Breville personnel had to hang on for dear life, and all the while the rubber-jointed antenna was whipping around their ears like a 'stockwhip from Hell'.

The receiver didn't fall to pieces, but that's about as far as it went. The Army covered the development costs, paid for the prototype and that was that!

They also expressed an interest in a multiband UHF receiver. Breville's Lab did the necessary development work at the Army's expense, but when the time came to place a bulk order, they decided not to go ahead with it. The reason, it seems, was that American radio equipment was appearing on the scene, inhibiting local military planning.

Along similar lines, Breville was requested to quote for equipment to monitor the landing beams serving Mascot Airport. If these were interrupted for any reason, the military wanted to know, without waiting to be told. This option, too, was not taken up.

By way of compensation, however, orders were placed by the US Armed Forces as, for example, timing equipment based on transmissions from WWVH in Hawaii. (To be continued) ♦



The Breville Mine Detector, largely the work of Arthur Spring, being demonstrated by his brother in Army uniform.