

Special Operations Executive – The B2 spy set *Ken Brooks G3XSJ*

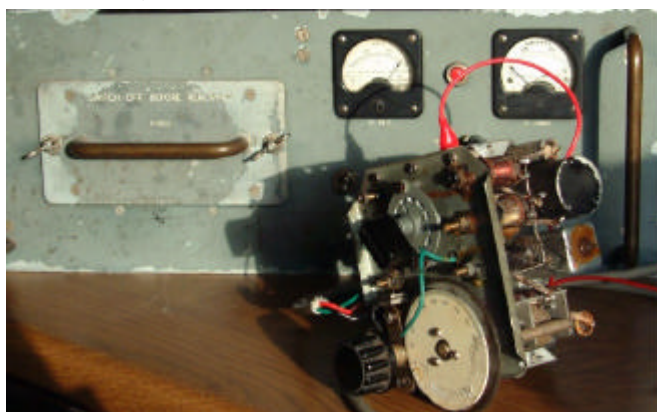
Anyone growing up in the 1960's as I did could not avoid seeing stories of spies and espionage. Television programmes seemed to feature numerous films on World War Two, the Cold War was at its height and of course James Bond was dazzling cinema audiences with his array of technical gadgets. So it wasn't surprising that when I first became interested in older wireless sets I took envious notice of the odd spy radio that popped up in sales.



B2 transmitter and receiver. The coil and crystal stowage was added by the previous owner and although not original adds visual interest.

Many years later and with interest in operating older equipment becoming more widespread I decided to try and find a set that I could use. The Model 3/II, or B2 as it is more commonly known was one of the most successful clandestine sets of WW2. It was developed by Major John Brown of SOE and comprises a separate transmitter, receiver and power supply. The frequency range is 3 – 16 MHz and the transmitter power level is around 20 watts, transmission being CW only whilst the receiver functions on AM and CW. Illustrations often show these sets built into suitcases but they were also supplied in steel parachute drop boxes. These little sets are light and compact, and ideal for transporting and operating in a clandestine environment.

To help evade detection on active service, a dual purpose power supply allowed the set to operate from the domestic



Testing the receiver RF unit.

mains but to be switched over quickly to battery power. As German detection services closed in on a clandestine transmitter, a common technique was to cut the mains to a street or building and if this resulted in the transmission going off air they could more easily identify its location. The B2 power supply design helped to avoid detection by this method but it would be a brave agent who continued transmitting for so long, as other methods could also be used.

Having searched far and wide for a B2 I was offered one in nearby Dorset. The set has an interesting provenance - In 1947 the RSGB operated a surplus transmitters scheme where job lots of ex services equipment were purchased and offered to individual society members. This seems to have been highly successful with demands for equipment exceeding supply as in those austere days there were limited sources of ready built equipment. This example had been bought in 1947 through the RSGB scheme and used until the mid 1950's when it was put away. It remained unused and in storage for about 25 years when with a rekindling of interest in radio it was resurrected and brought back to life. There are press cuttings showing it being used for special occasions like the 40th anniversary of the Yeovil Amateur Radio Club, the 50th anniversary of VE Day, and records of it making contact with special event stations. One of these was a UK B2 to a Danish B2 contact which was actually overheard by ex Bletchley Park wireless operator "Ursula" in Montserrat, West Indies. Also on offer with the set was an unusual Japanese Navy morse key, liberated in 1945 from a Japanese W/T station on the edge of the jungle in Malaya and brought back in the new owners' kit bag.

After a brief inspection of the equipment a deal was struck and it was brought home. The transmitter was not quite



Completed B2 receiver following repairs.

original although working, but I had been warned that the receiver was modified for bandspreading and not working. RSGB Bulletins of the time contained a number of features about the transmitter from winding the plug in tank circuit coils to adding AM capability, and for the receiver, bandspreading. As the equipment had been recently used I omitted my usual first step of conditioning the capacitors using my capacitor reformer but I did follow my second instinctive habit of

lubricating rotary switches and variable capacitor bearings. This immediately improved the feel of the controls and reduced the loading on mechanical parts.

The B2 transmitter uses just two valves, a VT52 as a crystal oscillator and a 6L6 as a power amplifier. Like the receiver it is built around a thin steel front panel with a sub chassis for the valves, and fits into a lightweight metal container with corrugations to add stiffness. Crystal control only allows the transmitter to send on the frequency, or multiples, of the plug in crystal but would have been ideal for clandestine equipment of the time.

Those listening for their agent would know exactly where to look on their receivers, and by not having a variable frequency oscillator the design eliminated the extra complexity of precision frequency determining components. A single meter on the front panel can be switched to monitor circuit functions and perform basic checks.

Two small modifications had been made to the transmitter, one allowed the power output to be further reduced for low power operations, and the other involved the addition of a small pushbutton to activate the oscillator and provide a signal for setting the receiver to the transmit frequency. The first modification was not needed and was easily reversed, but the second would leave a small unused hole in the front panel and as the function is useful it has been left in place for now.

The transmitter was readily put on 80 metres with a Heathkit receiver and the little rig surprised me by reaching Italy on the very first session. Having been delighted with a few European contacts I thought it time to examine the non working B2 receiver as all that could be heard was a faint mains hum. An added paper tuning scale and dial light suggested extensive internal modifications and on removing the set from its case an alarming sight presented itself. A non original output transformer flopped out held only by its connections, there was a fair bit of new wiring, and two of the original and prominent orange colour ceramic coil trimmers had been replaced by more modern postage stamp trimmers. I could also see replacement capacitors used for the bandspread modifications and a broken coil former. If this were not enough, one of the coil tuning slugs had lost its ferrite core. All in all, it was a fairly depressing prospect.



Beautiful simplicity - B2 transmitter with its two valves.

As the receiver was part of a set with significant history I decided to attempt bringing it back to its correct internal appearance and circuit, and hopefully to have it working. Looking at what had taken place in the past it appeared to be a fairly difficult recovery with the absence of some visually prominent and vital parts. The first step was to separate the receiver into its two sub chassis of RF and IF units. These sub chassis units are very compact and each is palm sized, the single loctal valve RF unit comprising the tuning heart, oscillator and mixer whilst the IF and detector unit is a three valve unit, also using loctal valves. Work commenced by removing non original wiring but the difficult bit would be the

RF unit, as unlike the IF unit which is one component layer deep, the RF unit is three layers deep and the lowest layer where some components were to be replaced is extremely hard to access. These problems were put to one side whilst more immediate repairs were made.

A grey plastic jack socket had been added to the front panel in addition to the original headphone connector. This looked out of place and although I was keen to remove it, the problem then was what to do with the now vacant 8mm hole. A well known figure in the vintage wireless movement has disparagingly commented that the receipt of an amateur transmitting licence is accompanied by a presentation box of twist drills with which precious equipment could be disfigured. With the consequences of this wry observation very much in mind I now had to find an acceptable method of repair. On a blank unpainted chassis a repair section could have been welded in place but an approach requiring lots of heat was clearly impractical for assembled equipment. The repair method finally decided upon was similar but avoided extremes of temperature, being a tiny steel disc filed to be an exact fit in the hole. With the disc flush to the panel it was secured with araldite, and after a little black paint was applied with a fine sable brush the repair passes inspection although it is not invisible.

The broken coil former was sanded square and very carefully repaired with araldite while the ferrite tuning slug that had made a bid for freedom was replaced by a section from a donor transistor radio, araldited in place. Ferrite is very hard and cannot be easily cut in the conventional sense. The trick is to score around the circumference with a file and snap a piece off - nerve wracking stuff but I managed to cut the rod without it breaking in the wrong place and then secured it to the threaded brass adjustment stud. One of the spring clips used to hold the former in place was missing so a substitute was made from thin sheet steel liberated from a scrap computer power supply case and coloured to look like spring steel. It doesn't function as a clip but the coil spigot and wiring perform this function and it seemed unwise to needlessly increase the loading on a fragile repaired component.

Next, the two modern postage stamp trimmers for bandspreading were removed together with two paxolin trimmer mounting panels. Fortunately two of the original style orange trimmers were found in a scrap Gee RF unit to replace them. With the trimmer panels out of the way deep heart surgery was performed around the bandswitch where most of the earlier modifications had taken place, and comprised fitting replacement silver mica capacitors and reinstatement of wiring in the oscillator section.

Although the circuit is relatively straightforward the mechanics of replacing these parts was what might be called "challenging", needing tweezers and a steady hand to fit and solder components in places that are almost completely obscured from view by surrounding parts. The trimmer panels were refitted this time with the correct countersunk fasteners sourced from the junk box. Again this was a fiddly operation as they would initially have been secured early in the assembly sequence in the factory. All this more or less completed the RF unit. With the mixer circuit temporarily disabled, power was applied to check the oscillator. A quick check confirmed it was working on each of the three bandswitch positions.

The IF section only appeared to need tidying of wiring that had been disturbed earlier, dealing with the missing output transformer, and replacing the connector cable. While looking for trimmers for the RF unit I happened to notice that the output transformer of an incomplete Class D wavemeter looked identical. Although not the exact part number, testing showed it having similar electrical characteristics and could pass for original. With this in place further testing revealed something wrong, traced to a missing wire in an internal loom. Some cotton covered stock came to the rescue, coloured with a felt pen to look authentic and then loomed back into place



Transmitter and receiver in action with the Japanese Navy key. The Heathkit HW101 is usually used as the receiver but not on this occasion.

with some thick black cotton thread bought in a craft shop. With the IF section rebuilt, resistance checks between every valve pin and chassis confirmed an absence of potentially catastrophic errors, and it was powered up from a period bench supply. Initially it did not pass any signals from a signal generator but an open circuit screen resistor was the culprit and when replaced it all worked. The non original output transformer seemed not to affect performance. The BFO on – off switching is novel and had me puzzled at first as it was not at all obvious how the BFO was switched on and off. Close inspection of the 360 degree BFO tuning capacitor showed that one of the vanes was intentionally bent to short out the capacitor for 180 degrees of rotation, allowing it to perform the dual function of a pitch control and switch.

By now both sections had been powered up in isolation but it was time to see if they worked together. With such compact units it didn't seem appropriate to put everything back together for a first test where there would then be limited

access if things went wrong, so the two chassis were interconnected with flying leads. An aerial and headphones were connected and power applied. To my surprise and delight signals came through on each of the three wavebands but on checking the coverage this did not quite correspond with the marked ranges, even after adjusting tuning slugs and trimmers.

With the set all back together a little cosmetic touch was added. In common with much equipment of the time all the solder joints were dabbed with purple inspection marks. After some thought as to how these could be replicated, a rummage through my wife's nail varnish stock identified a nice purple colour that I was given permission to use. This gave the new solder joints an authentic appearance and the success of this little trick has had me searching through the cosmetics counters in search of different colours for other projects. It did occur to me that the sight of a middle aged male sifting through all those fancy packs of alluringly named nail varnishes would attract adverse attention from shoppers and staff alike but I am not sure whether I should be pleased or disappointed that my presence attracted no attention whatsoever.

Performing this restoration brought home how difficult it can be to make progress without having access to original components. Finding matching trimmers and an output transformer was fortunate considering limited junk box resources. Even humble BA fasteners are becoming hard to find especially those with the less common round and countersunk heads. It all lends support to the "never throw anything away" mentality.

Despite the limitations of crystal control the B2 is a delightful transmitter to use. The receiver has more limited capabilities but given its size would have represented a significant design achievement. To get a feel of what it must have really been like operating under clandestine conditions it is tempting to pack the set in a battered old suitcase and operate from a field somewhere, but a second sighting by those shoppers and staff who saw me earlier might result in some difficult questioning !