A Portable Hellschreiber Variant

In 1945 I was working at the Post Office Research Station, Dollis Hill (in north London) [*FD: where the GPO Hell Printer No. 1 was developed*]. In the latter part of the year we began to see many examples of former enemy communication equipment, including a military Hellschreiber. It was the first time I had ever heard of the system. It was very solidly built in typical military style, and though it was less than half the size of a teleprinter it was still a large and very heavy piece of equipment.

I was impressed by it; a simple printing system which could work over a very noisy channel using visual judgement to decide whether or not a character remained legible through the noise. I also admired the way it avoided the need for synchonism by increasing the width of the printing head so that when timing errors displaced the line of print, at least one line of characters was always visible.

Shortly after that I was searching a shelf in an annexe to the telegraph lab where I found a plastic-cased portable instrument with a three-row typewriter keyboard. Nobody I could ask knew anything about it, or even that it was there.

The case was made of paxolin, with metal angle along the edges and a webbing carrying handle. When opened, the shallow part formed the base with the machine fixed to it. The mechanism was very lightly built with nickel-plated brass plates and round pillars. All parts of the mechanism were open.

The printing mechanism was immediately behind the keyboard with the paper tape running from right to left. Beneath the tape path was a small D.C. motor, a short gear train and a one-revolution clutch released by an electromagnet. The one-revolution shaft turned a rotary stud switch, a hub with five radiating flat springs with small contact domes near their tips and the tape feed roller. The springs were not radial, but tangential to a circle concentric with the shaft and their tips trailing the direction of rotation.

About 15 thin bare wires (I did not count them) were stretched beneath the keyboard, with tension springs at one end, and spacing combs. They formed contacts with the bottom edges of the key levers which were notched to set up some sort of code.

The feed roller drew paper tape from a reel, passing over a wick in the neck of a flat plastic liquid container, and then over a flat plate where contact points at the ends of the flat springs swept across the width of the tape. A cam held the tape clear of the wick when the mechanism was not running. I believe another cam locked the keyboard when the mechanism was turning, although I am not quite certain of this.

After examining it, I could see how it worked. On depressing a key, one contact wire served by all keys switched the electromagnet and the mechanism made one turn. The rotary switch scanned the other contact wires and so transmitted the code selected by that key. It must have connected to the transmitter keying circuit, and very likely to the local printer as well. I could not follow the wiring in enough detail to be sure of that, and had no opportunity to operate it under power.

A signal from the receiver operated the clutch magnet and was connected to the rotating springs. During their single turn the five springs swept across the tape in succession, marking the tape wherever the spring was energised, by electrolysing the liquid and releasing a dye. In this way it built up the characters exactly like a Hellschreiber.

Although I could easily see how it worked, I was puzzled by the application. It did not fit any of the Post Office services, so it must be military, yet it seemed poorly designed for that. The German army Hellschreiber in the next room showed the way the Military liked it; portable, yet rugged to withstand abuse and rough conditions. This piece of clockmaking would not stand up to such treatment for a moment.

It carried no name or type number, but certain details showed it was British manufacture.

The choice of other details was eccentric, to say the least. The electrochemical printing system was a long-forgotten idea from the distant past,* but what possible advantage did it have to justify reviving it here? Why synchronise the instruments with a start-stop action when the Hellschreiber solved the problem so easily by avoiding the need for synchronising altogether?

Recently my son, who is interested in old radio equipment, was telling me about a very small lightweight battery-powered world war 2 transceiver he had seen. It was intended for clandestine operations, and while discussing it I remembered the start-stop Hellschreiber I had seen.

We wondered if they could have been used together.

I saw it made such good sense, it was probably true. Every feature which seemed such a poor choice for most purposes offered real advantages in that application.

A secret agent may have to operate in all manner of locations – in the open, in forests, in small buildings, in hideouts in dense urban areas – and wherever he is, he must draw no attention to his presence or activities. To send messages with a radio transmitter, the easiest means is speech, but besides being difficult to use over a very noisy channel, he is necessarily audible – and not only the microphone might hear him. The usual answer to those problems was a morse key, but that required training. Agents were difficult to train; they had much to learn in a short time which had nothing to do with radio techniques and acquiring morse skills was a burden which extended the training time.

That start-stop Hellschreiber could solve both these problems. Its immunity to noise at least equals morse, while the typewriter keyboard is easy to use. The standard Hellschreiber has a fixed transmission cycle, and keying in step with it demands fair typing skill, but by changing to start-stop operation, even the one-finger non-typist can pick out a short message.

For clandestine operations, such a machine must be small and light to make it easy to carry and conceal, operate silently, run from radio batteries consuming very little power and be compatible with the radio inputs and outputs.

This machine meets all these requirements. Even the cumbersome electrochemical wet printing system was the best choice from those available at that time for it was silent, and no kind of impact printer could provide that. It could even operate from an audio tone output of a few volts from the radio.

I have never heard any mention of such an instrument, so what was its history? At least one such machine existed, because I saw it, and it gave the appearance of being made as a small batch rather than a one-off, yet it could not have been used in large numbers because its details were not designed for quantity production.

I would be interested in any comments you may have, and I would like to hear of any record or memory that such a machine was ever used in service.

David H. Jones, October 2011

Post script, 25 January 2014:

"I can add a little more now. It had a 3-row keyboard with the usual typewriter layout (3-row with double shifts were usual on portable typewriters at that time). However, the feature that confirms it was British, is the scanning switch, which I recognised. It was a standard component made by Painton. It was a high quality version of the wafer switch.

Manually operated wafer switches, which were very widely used in radio and electronic instruments, were assembled from a twelve-position indexing mechanism and any number of contact discs (wafers). The wafers were stamped from laminated plastic with contact clips riveted on.

Painton produced a much better made version with many more than 12 positions, used in high grade instruments and some professional sound equipment. The contacts were turned metal studs, moulded into a thermoplastic (bakelite?) wafer. The obvious reason for choosing it for this machine was the need for more than 12 positions. Only the wafer was used, mounted on top with the printing mechanism.

The keys with their levers were probably typewriter parts, modified by cutting notches along their lower edges to match the code. The contact wires beneath them were very thin, tensioned with coil springs at one end. The wires appeared to be made of brass. The scanning operation was as you suggested. Do not rely too much on the number 15; it fits my impression, but I am not certain I counted them.

The whole mechanism was very open. The framing of the machine certainly did not form a box. It fitted in a carrying case made of panels of laminated plastic (paxolin) joined by external strips of brass, angle screwed along all the edges. One sheet was hinged with the machine fixed to it and forming the base when it was in use.

The liquid container was like a flat bottle laid on its side, with an offset neck. It was transparent and appeared to be moulded, which I now realise was unusual. At that time, what mouldable transparent plastics were there? The container laid beneath the print mechanism and extended most of the width of the machine."

Post scripts, April 2018 (responding to the G.T.L. Telewriter description and photos):

This is a most interesting find. It is not the machine I saw. In the notes it is called a Lightweight Telewriter, but it is obviously much heavier than the one at Dolllis Hill. They are identical in principle and I am sure that they could communicate with each other over the same circuit.

Besides their construction, their keyboards are different. While they both follow the standard typewriter layout, the heavy machine has a four row keyboard while the lightweight version has the three row without figure keys, as was common on light portable typewriters.

The notes point out that its construction required tooling, so it was designed for serial production but the mechanism of the lightweight machine was more like clockmaking, with brass plates separated by round brass pillars. Another sharp difference was the rotary switch which scanned the keyboard. Instead of the specially made stud switch, the lightweight used a standard electronic component. Everything about its construction suggested a small batch made in the model shop rather than the production line.

What we need know is some evidence about the use of both of these machines.

The heavy machine was constructed using castings and mouldings, so it was meant to be made in significant numbers. The Dollis Hill machine was not only very much lighter; it was more like clockmaking, built with brass plates linked by round brass rods. It was the product of small batch production in the model shop rather than the production line.

Another telling difference was use of standard components. Compare the rotary switches which scanned the keyboards. The Dollis Hill machine used a standard switch wafer. It was professional grade, but still an electronic component. The other machine used specially made parts.