Telephony 101 – The Harmonic Telegraph November 10, 2012

Hello All,

As always, please send any questions about the reading assignment directly to me at oldtimetelephones@goeaston.net. I will bundle questions if necessary, repeat the questions, and give answers in an e-mail to the TCI List Server before moving on to the next reading assignment. This way everyone will benefit from these questions and answers. By sending questions directly to me, we will avoid unnecessary clutter on the List Server.

Please back up and read the rest of p. 13 and continue through the paragraph below Fig. 1-7

Figures 1-4 and 1-5 return to the subject of the telegraph. Here the make-and-break principle was used to generate a pulsating current having the frequency of a vibrating metal reed.

Figure 1-4 is like many circuits you will see in the book, and it assumes that there is some other device on the other end of the line to complete the circuit. In the case of harmonic telegraphs, that other device is Gray's receiver in Fig. 1-5 or Bell's receiver in Fig. 1-6. They complete the circuit so the current can get back to the battery.

Figure 1-4 is quite similar to the Morse telegraph circuit in Fig. 1-2. In this case, however, when the wires are connected, current flows through the electromagnet and pulls the reed down rather than pulling down a heavy armature. But when the reed is pulled down it opens the circuit, current stops, the magnetic field collapses, and the reed then springs back up to make contact again.

How fast will the reed move up and down? It depends on its length and stiffness. For a given length and stiffness, a steel reed will have a natural, or resonant, frequency. If you're not familiar with resonant frequencies, just try to swing a clock pendulum faster (or slower) than it wants to go, or try to rock in a chair faster than its natural rhythm. It's the same phenomenon.

In Gray's application, imagine the line in Fig. 1-4 connected to the binding posts in Fig. 1-5. The pulsating current would produce a squeal in his Page-effect receiver, and that squeal would sound different for different reed vibrating frequencies. During Gray's experimentation with his multiple telegraph device, he sometimes heard complex voice-like sounds and became convinced that speech transmission was possible. Although this was valid observation, it does not appear that Gray did any testing at that time to develop a practical telephone.

Bell used the same type of tuned telegraph transmitter, but his receiver used tuned reeds similar to the transmitter. The receiver circuit is shown in Fig. 1-6. So if you imagine the line from Fig. 1-4 connected to the line in Fig. 1-6, the pulsating current would try to attract the receiving reed at the frequency of the transmitter. But the receiver's reed was also tuned (length and stiffness), and it would only really get vibrating when its length and stiffness matched that of the transmitter.

So Bell hooked up three transmitters with different frequencies across (i.e., in parallel or bridging rather than in series) a single line and then similarly hooked up that line to three receivers, each of which had been tuned to match a transmitter. It worked. He could get a signal from Transmitter No. 1 to Receiver No. 1 while the others were also being used on the same line (just 2 wires).

Since we are not going to pursue multiple telegraphy, you only need to understand this long enough to see how the telephone got launched. This will be in our next reading assignment, and it is fascinating!

If there are any questions about the above, we will deal with the questions before moving on to the next reading assignment.

Ralph

Telephony 101 – The Harmonic Telegraph November 13, 2012

Hello All,

In response to a request, the Telephony 101 notes are being put in the TCI on-line library. The URL for these notes is http://www.telephonecollectors.info/telephony-101/.

One reader asked with regards to Gray's and Bell's research on early transmitters and receivers, were they trying to transmit voice as in a telephone? To the best of my knowledge, the answer is "no." Although they were undoubtedly aware of Reis's work and that voice transmission would be a big prize, both were being paid to develop telegraph multiplexing and there was strong motivation to do this. Gray, as you will read, only briefly diverted his attention to voice transmission and then went back to work on the multiple telegraph. Bell, on the other hand, switched completely to voice transmission.

Another question had to do with Figure 1-7, which shows Bell's "tuned telegraph" receiver and transmitter. What activated the transmitter? The receiver, pictured on the left, is described by the circuit in Fig. 1-6. The transmitter, pictured on the right, is described by the circuit in Fig. 1-4 which includes batteries, of course. The wires marked "Line" in Fig. 1-4 were connected to the wires marked "Line" in Fig. 1-6. At the instant Bell connected the line wires together, the circuit was completed and current flowed because the switch contact in Fig. 1-4 (the thumb screw in the picture) was touching the relaxed reed. The electromagnet then pulled down on the reed and in a fraction of a second the reed had moved down far enough to break the contact between the screw and the reed. The magnetic field collapsed. Then the reed sprung back up and touched the screw again. This cycle was repeated many times per second – at the resonant frequency of the reed. These current pulses also went through the receiver's electromagnet causing it to pull on its reed.

If you have any follow-up questions, send them directly to me. We will now move on to the next reading assignment, which I will post soon.

Ralph