Telephony 101 – Resistance Transmitters November 19, 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. Previous reading assignments, notes, questions, and answers are available in the TCI Library at http://www.telephonecollectors.info/telephony-101/.

Please start reading Chapter 2 on p. 17 and go up to the last paragraph on p. 20. This will cover resistance transmitters from 1877 – just a year after Bell's patent – up to the 1930s.

Bell's induction transmitter, which appeared in the gallows transmitter and was described in his patent, was of the generating type. Its design evolved a little and became identical to Bell's receiver, so we will say a little more about the induction transmitter in Chapter 3 on receivers.

This chapter will focus on the modifying type of transmitter and will therefore always presume that there is a battery in the circuit (transmitter on one end of the line, and receiver on the other). For the rest of this chapter on resistance transmitters, keep in mind our third observation in the first reading assignment.

> Ohm's observation (Ohm's Law)
>
> V = RI (i.e., voltage equals resistance times current). You can think about this in several ways. For example, if the resistance is constant and you increase the voltage, the current will increase. Or if the voltage is constant and you increase the resistance, the current will diminish.

Thus in all the resistance transmitters, we are relying on Ohm's law. Pressure waves from spoken sounds vibrate a diaphragm, which causes increases and decreases in resistance in the circuit. Since the battery voltage is constant, the current has to vary (inversely) with the resistance changes in accordance with Ohm's law. This varying current is going to make a receiver work.

Also notice that this phase of development consists only of geometrical design ideas, improvements in carbon granules, and experimentation. No more science is involved beyond Ohm's simple law. And here's some more opinion that is not in the book. Thomas Edison's name comes up several times in the telephone's early history. In this instance and later, I am not impressed by Edison's intellect. Here he is in competition with a dry-goods clerk (Berliner). Later, in Chapter 4, you'll see that I don't think Edison knows what he is doing. This is in sharp contrast with the intellectual brilliance of Bell's work in June of 1875.

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

Ralph

Telephony 101 – Resistance Transmitters November 22, 2012

Hello All,

A reader asked the following: If you remove the mouthpiece and all the carbon granules spill out, can you substitute granules from a piece of carbon?

You won't normally have to worry about accidental spillage. The Bakelite mouthpiece is not attached to the chamber (button) that holds the granules, so you would have to be intentionally taking the chamber apart to spill the granules. If you did spill the granules, however, I doubt that you could make satisfactory granules from a piece of carbon or graphite. I say this because of the long development period during which carbon granules were modified to reduce friction and packing. I believe people who want to replace carbon granules in a very old transmitter use granules taken from modern transmitter capsules such as an F1 or T1.

With regard to the general subject of resistance transmitters, I should comment further on the type of current that is produced. Because of the batteries, there will be a steady current through the transmitter. When sound vibrates the carbon granules, changing their resistance, the current will increase a little and then decrease a little. This will happen very fast, with each up-and-down cycle occurring a few hundred to a few thousand times per second (see the section on Sound in the Appendix for voice frequencies). This is what Bell called "undulatory currents."

Let's say the undulatory current starts from a steady value of 50 mA (milliamperes) and goes up to 51 mA and then down to 49 mA, repeating this cycle at a voice frequency. This is equivalent to a direct current (dc) of 50 mA plus an alternating current (ac) where the ac part goes up and down 1 mA at the voice frequency. Because we can separate this undulatory current into a dc component and an ac component, we can usually talk about the dc behavior of a circuit and the ac behavior of a circuit separately. Generally, I just think of an ac current riding on top of a dc current. You can do the same if you're talking about voltages – an ac voltage riding on top of a dc voltage.

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