Telephony 101 – Kellogg's Anti-sidetone Circuit February 21, 2013

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 in Chapter 17 on the bottom of page 132 and read through page 137.

Although the Western Electric AST circuit is a variation of a booster circuit, I incorrectly said in the 1st edition of my book that Kellogg's Triad circuit was also a booster circuit. I wrote a *mea culpa* note about this in the December 2003 TCI newsletter, which I have placed in the Telephony 101 archive. Kellogg's Triad circuit is a bridge-type circuit, and similar bridge-type circuits are used throughout Europe. To me, the Wheatstone Bridge (Appendix page 226) is a beautiful circuit, and you're going to see yet another really nice application of this circuit in the next chapter.

In a Wheatstone bridge circuit with resistors, you want the voltage between c and d to be zero (see Fig. A-9 on page 226). Because the receiver is not physically connected to c and d, the Triad bridge (Fig. 17-8) is a little different, but you still want the voltage across the receiver to be zero when the bridge is balanced. This would occur if the magnetic fields produced by the primary and the tertiary windings cancelled each other such that no voltage was induced in the secondary winding.

To see that these fields oppose each other when transmitting, you can look at Fig. 17-9 and imagine current flowing out of the upper transmitter terminal and wanting to get back to the lower transmitter terminal. Some of this current goes up through the primary winding, out Line (+) and back in Line (-), finally returning to the lower transmitter terminal. However, some of this current also goes up through the tertiary winding, through the resistor and condenser, and then returns to the lower transmitter terminal. The primary winding and the tertiary winding are in fact just one long winding with a center tap, so looked at from the transmitter's vantage point one of the windings is clockwise (CW) and the other is counter clockwise (CCW). Thus the fields oppose each other -- qed.

When receiving, however, the fields of the primary and tertiary windings add to each other. To see this, remember that the current source is now between Line (+) and Line (-), and imagine that the current wants to flow out from Line (+) and get back to Line (-). Some of this current goes down through the primary, then through the transmitter (just a passive resistor), and back to Line (-). But some of this current also flows down through the primary, then up through the tertiary, through the resistor and condenser, and finally back to Line (-). The currents through the primary and tertiary windings are now running in opposite directions (one down and one up in our imagination). Since one winding is CW and the other is CCW, the fields add. Viola.

Although the magnetic fields oppose each other when transmitting, they don't cancel each other completely and you don't get a zero sidetone. However, you do get substantial sidetone reduction, and the Triad puts a pretty good voltage on the line.

Looking back at the measured voltages, I could have made further comments in the book about the Triad's performance. The No. 89A receiver used in these tests had an impedance of 250 ohms at 1,000 cps, and this is significantly higher than the HA1 receiver's impedance in the Western Electric AST measurements. Thus the sidetone power when transmitting is less than that of the WE AST notwithstanding the same measured voltage of 30 mV. The power in the receiver in the Triad when receiving is 10 microwatts compared with 7.5 for the WE AST, and this is out-of-the-noise better than the WE AST. In summary, Kellogg's Triad circuit showed better anti-sidetone characteristics in my measurements, but its lower line voltage was less desirable. Not bad, though, and Kellogg stuck with the Triad.

You will see three minor variations of the Triad circuit in Kellogg phones. The first version was used in Kellogg's AST subset, which used the No. 103-A coil. That circuit version was also used in the No. 900 "Pyramid" Masterphone with the No. 106-A coil. You'll find the origin of the unusual siamese "53" terminal marking in the book. The next variation appeared in the No. 925 "Ash Tray" Masterphone with the same No. 106-A coil. And the final version of the Triad appeared in the No. 1000 "Red Bar" Masterphone with a No. 113-A coil. The properties of these coils are all similar, but an evolution is seen in Table 17-2.

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 – Kellogg's Anti-sidetone Circuit February 23, 2013

Hello Again,

One of our readers pointed out an apparent problem on page 136 with the statement in the next-to-last paragraph that says, "...with the impulse switch between L2 and terminal 7." The problem is not in the paragraph, however. There is an error in Fig. 17-14 where the labels L1 and L2 should be interchanged. When these labels are switched, the paragraph is correct. Please mark this correction in your book.

This reader also suggested that it would have been better if the graphical symbols in Fig. A-1 (page 217) included a shunt switch. Sorry about that. A shunt switch would look just like the dial impulse switch without the "V." Sometimes shunt switches are normally (i.e., when talking rather than dialing) open such as between BB and BK in Fig. 17-5, and sometimes they are normally closed such as between BB and W in that same figure. Please let me know if you are having trouble understanding the diagrams.

Ralph