WOK, mid-1920s and TRF Selectivity

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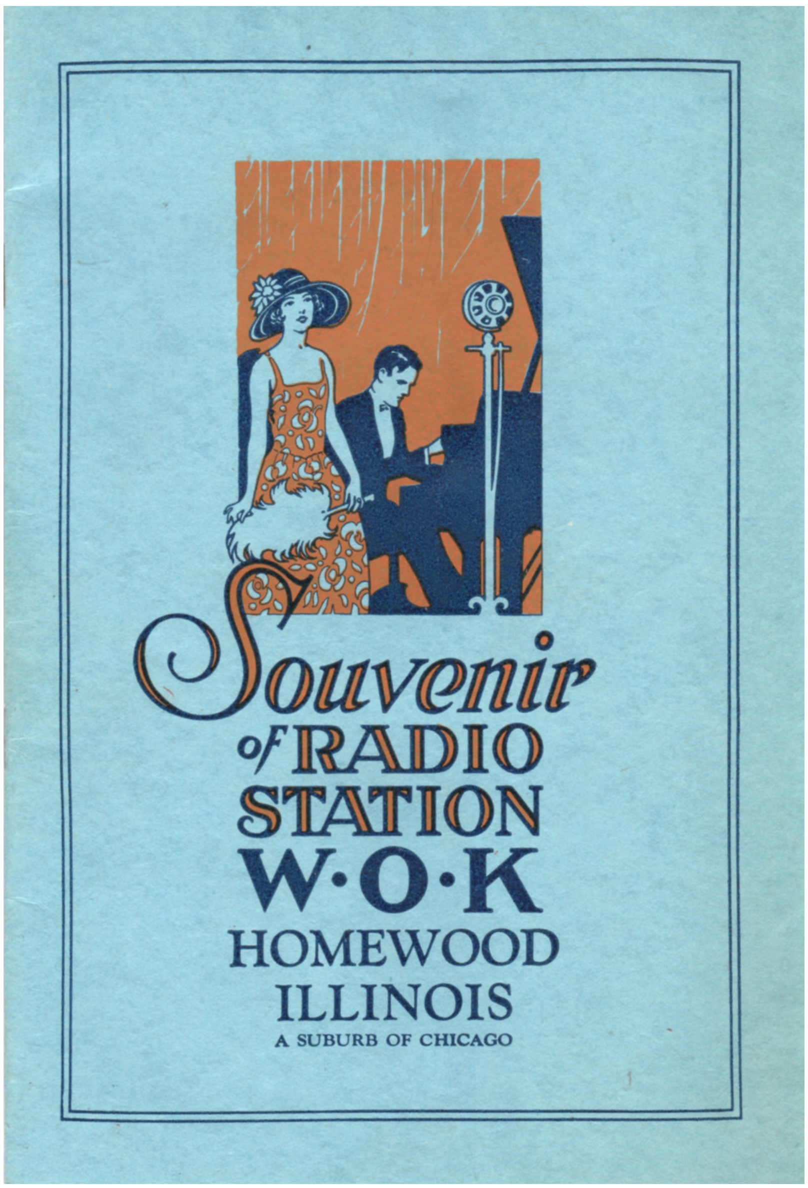
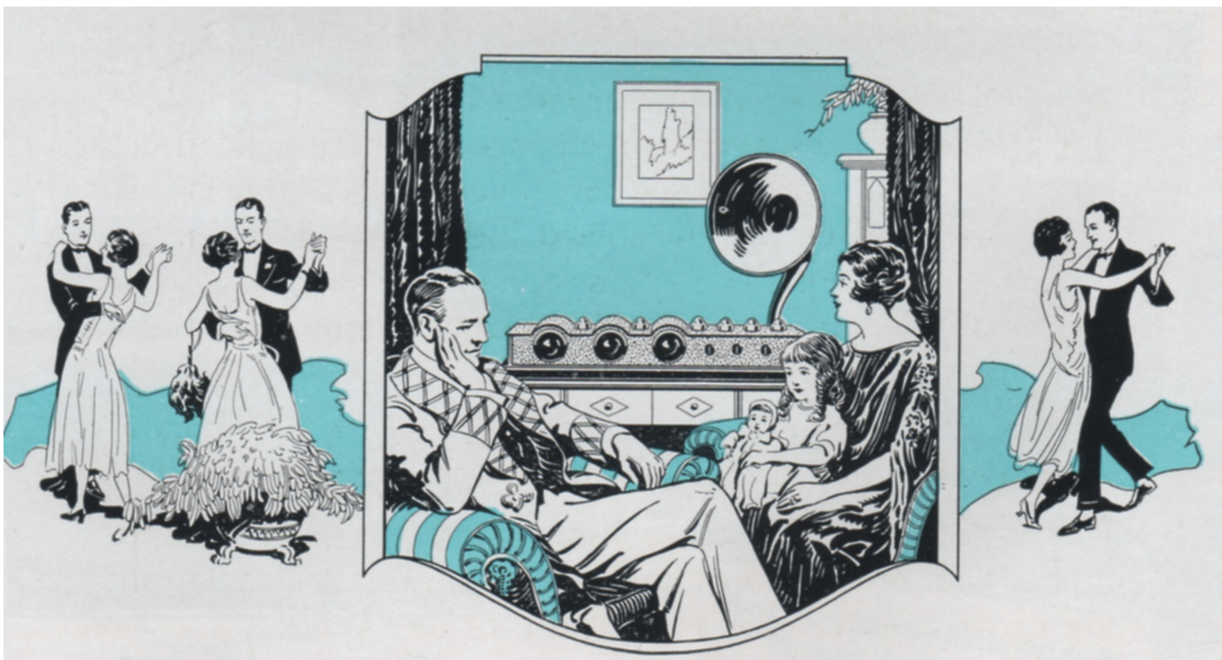
The nearby graphics come from a promotional booklet about radio station WOK, Homewood, Illinois (studios in Chicago), and the Neutrowound radio, *circa* 1926.



The Neutrowound Radio Manufacturing Company of the Chicago area owned WOK and operated it at 5,000 watts, partially in support of radioset marketing efforts. The term “Neutrowound” implies an inductive neutralization of tendencies to oscillate. The artist’s drawing of the family enjoying a radio program features a Neutrowound set.



The station and the radio operated from batteries – five thousand of ’em! (See next graphic).

Most stations used AC power, but WOK claimed that motor-generator ripple got into the carrier, requiring over-modulation, hence the huge bank of DC batteries for power.

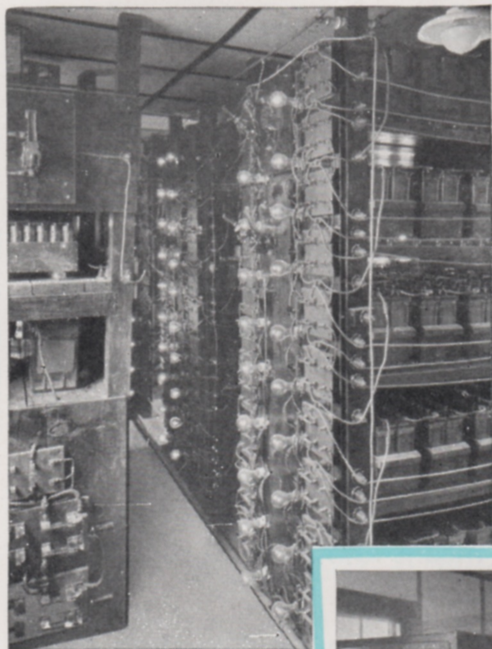


Fig. 1

Battery room in Station WOK. There are more than 5,000 cells of specially constructed large wet storage batteries in this room, from which is obtained the power for broadcasting.

Fig. 2

WOK's modern and efficient broadcasting units. This equipment is the most scientific devised. The operators desk also is shown.

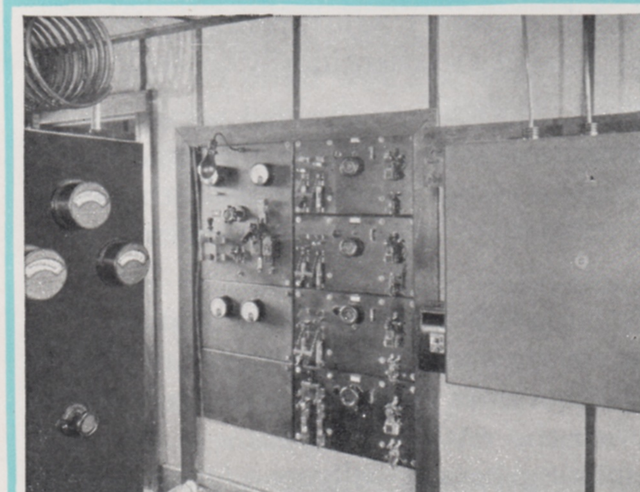
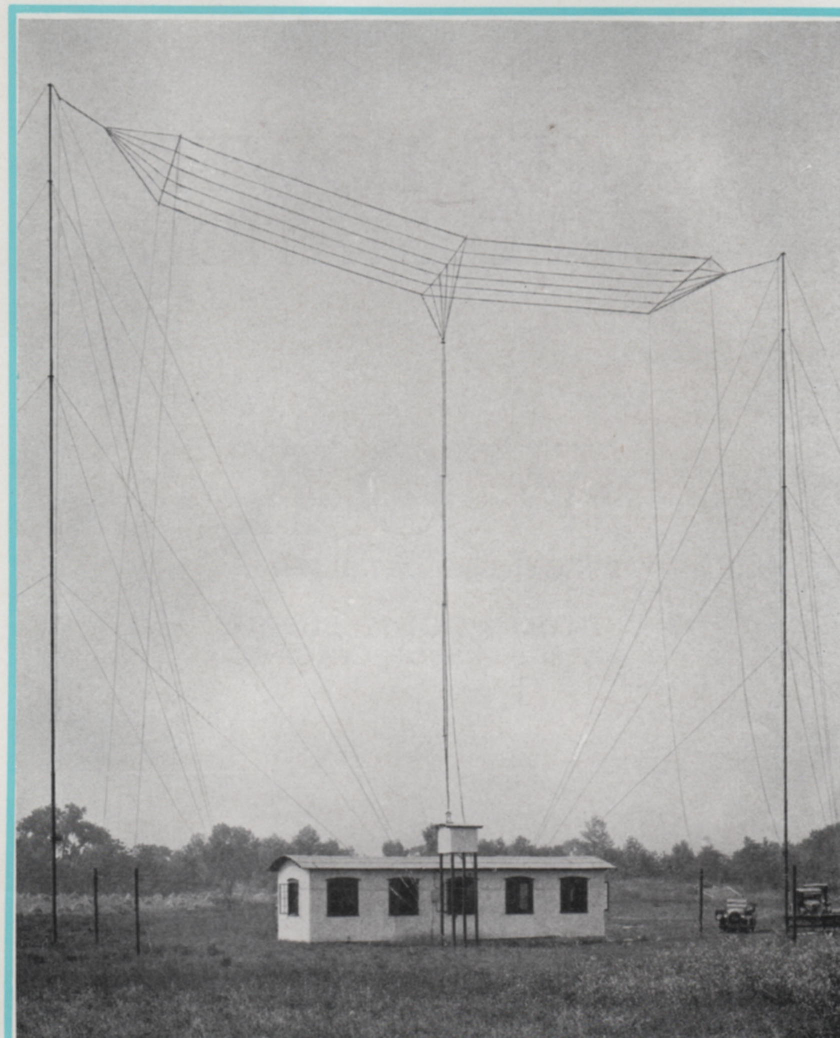


Fig. 3

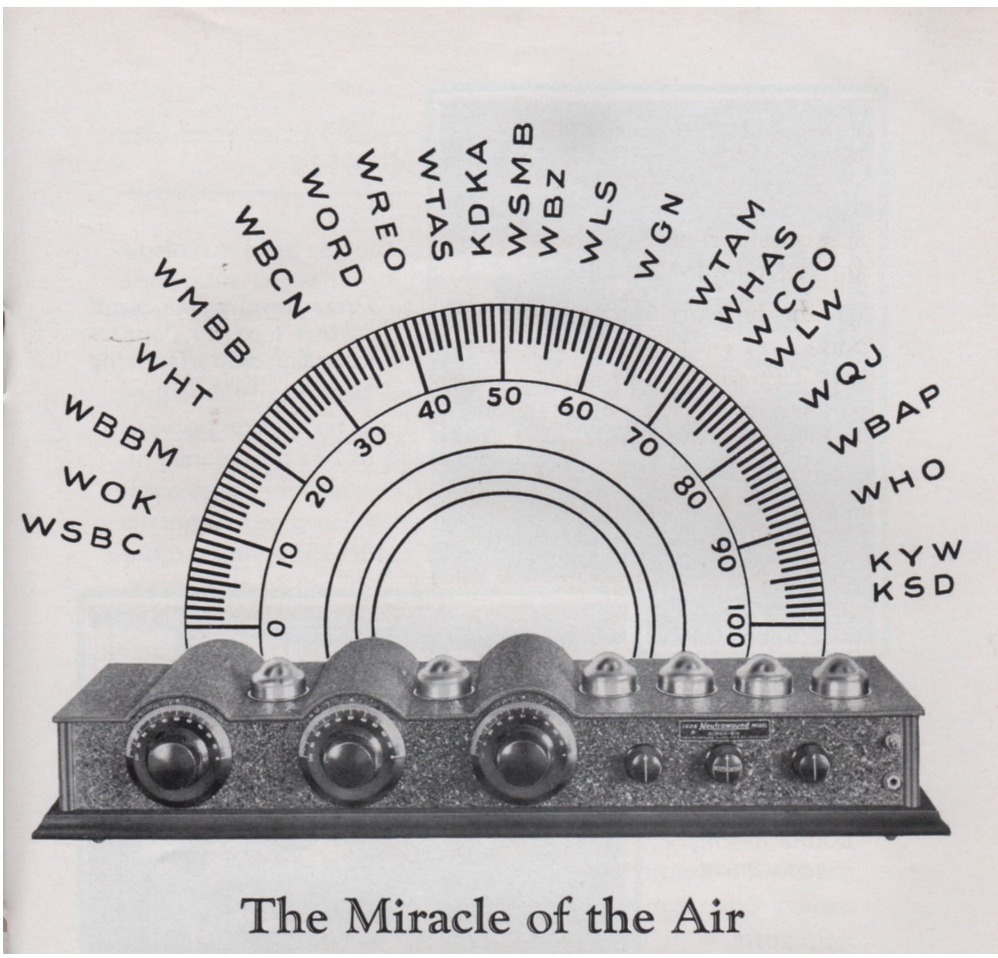
The large circuit breaker which automatically opens when trouble develops, is in the cabinet to the right of the unit for recharging batteries, against the wall.

The company liked battery power for its quietness. It continued to sell battery-powered Neutrowound radios after AC power came into vogue. AC mains operation provided for convenience if nothing else, to radio audience tired of charging and replacing batteries.



Radio Broadcasting Station WOK, at Homewood, Ill., showing station, "T" type Antenna and Steel Towers. The towers are 100 feet high. The station, which operates on a wavelength of 217.3 meters, is a pioneer among battery-operated stations.

The radio itself has been called “an armored breadboard.” It sits on a wood base, encased in metal sides and a top. Perhaps it didn’t want to look like an AK breadboard. The circuit features three separately tuned radio frequency (TRF) amplifiers (left to right) followed by audio circuits.



The Miracle of the Air

Wherever on the dial the stations might be, the dials presented their 10 KHz spectrum spacing as an equal interval on the dial.

The “neutrowound” term describes a work-around to avoid the Neutrodyne patents of Hazeltine. Triode TRFs easily went into oscillation without some sort of neutralization of stray capacitance. Hazeltine used small “gimmick” twisted wire caps for negative feedback. Clarence Tuska used a variometer-like coil for magnetic field negative feedback. The Neutrowound radio did something similar. The company claimed that its circuit could give the TRF circuit higher selectivity at higher frequencies. (That loss of high-end selectivity eventually doomed the TRF circuit).

WOK operated at 217.3 meters or 1380 KHz. WOK could be found at the then “the top of the dial.” It was broadcasting on a high frequency in those days, double the initial 600+ KHz of the earliest stations. The radio also used straight-line frequency variable capacitors, three of them, although “single-dialers” with ganged capacitors had appeared. These straight-line variable capacitors helped overcome the lack of higher end selectivity by spacing out the high-end stations. Thus the Neutrowound company claimed that each station had its own equally spaced place on the linear (albeit circular) dials, as shown in its dial illustration.

Perhaps a radio company with so much enthusiasm for the processes of the past did not have that much of a future. In any event, it was out of business by 1929.

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For those of a technical bent, the CHRS groups.io reflector has recently discussed the selectivity issues. Ron Roscoe noted, in connection with the Airline inductively tuned AA4 Superhet:

> Another benefit of inductive tuning is that the bandwidth of a parallel tuned tank is not dependent on the value of the inductance, which of course varies with the tuning. The bandwidth of most AM radios using a variable capacitor is dependent on the capacitance, so the bandwidth of the antenna tuning circuit varies as you tune it. Since it’s a superhet, the antenna tuned circuit is only important for reducing the image response.

In a TRF radio, the bandwidth gets narrower the larger the cap at the low end of the dial, but at the high end the bandwidth opens up!! BW = $1/2\pi RC$

As the bandwidth opens up, so rises the likelihood of interference from a station nearby in frequency.

Arden Allen notes the significance of the quality of the circuit, of "Q":

[There is some] confusion as to how radios tune station frequencies. If the "Q" of a tuned circuit can remain constant across the frequency band the selectivity (station separation on the dial) would remain constant. Q (quality factor) characterizes the efficiency, or energy loss, in a circuit. The greater the Q, the less the energy loss. The lower the Q the poorer the selectivity. In a capacitance-inductance tuned circuit most of the energy loss is due to the ohmic resistance of the metals used in the construction of the components. The Q of the tuning capacitor is low compared to that of the inductor. The Q of the inductor suffers greatly from the resistance of the long, thin wire that produces the coil's inductance.

As either the tuning circuit capacitance (C) or inductance (L) is *separately* changed, the LC *ratio* changes, thus causing the Q to change. It can be seen that with a capacitively tuned circuit Q decreases as frequency increases. "Straight line" tuning, dependent on the value of capacitance change with rotation, has no effect on selectivity; it still decreases as frequency increases. To maintain constant selectivity a complicated system of simultaneous capacitance and inductance change must be employed.

As Neutrodyne, Neutrowound and others struggled to solve the varying TRF radio selectivity problem it eventually became moot as the unchanging Q of the superheterodyne's fixed frequency IF amplifier effectively hid the selectivity issue from radio listeners.

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So, even though the Neutrowound radio could spread-out high-end stations (*e.g.*, WOK) as evenly as those on the lower part of the broadcast band, it couldn't keep them separated as well as the lower frequency ones. Too bad for station WOK – and then came the '29 crash and the depression anyway…

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