

# VoBW: Voice over Barbed Wire Fences

## Rural Telephone Line Development

By Jan Verhelst, Mortsels, Belgium.

The Homestead Act of 1862 provided the opportunity for a U.S. citizen to apply for a plot of uncultivated land (a "homestead") in the newer states in the Midwest, such as Iowa and Kansas, and also in the territories that later would become states<sup>1</sup>.

The Homestead Act was not only popular with American citizens and Civil War soldiers, but also with immigrants who hoped for a better future in their new country. A citizen (*or an immigrant who stated his intention to become a citizen*) could file an application to claim 160 acres (*about 64.8 hectares*) of surveyed government land. The homesteader could then settle on that land. After five years of labor the homesteader could file papers (*called "proof papers"*) claiming ownership of the land.



Barbed wire fences were introduced to surround the homesteads, and one can imagine you need a lot of wire to protect 160 acres.

Before barbed wire, the lack of effective fencing limited farming and ranching practices, and the number of people who could settle in an area. The new fencing changed the West from vast and undefined prairies/plains to a land of farming, and widespread settlement.

## Barbed wire fences and Telephony

After Alexander Graham Bell filed his patent on telephony in 1876, he and his companies obtained for a number of years a monopoly to deliver phones and exploit telephone networks. Bell system typically served only two subscribers per mile of pole line in rural areas, but 40 or more subscribers per mile in urban areas. Because the costs per mile of pole line were largely fixed, the investment cost per subscriber tended to be higher in rural areas. These higher costs, coupled with the strong demand for service in urban areas, discouraged the Bell system from serving rural areas during the monopoly years.

When Bell's patent expired in the 1890s, the telephone business boomed with many different rather small telephone operating companies, but also they had the same economic constraints in rural areas.

But almost instantly after Bell's patent expiration **Sears Roebuck** and **Montgomery Ward** began offering telephone sets in their catalogs. Just because you bought a telephone didn't mean you could use the thing. It had to be hooked up, some way, to other telephones. That meant wire had to be strung between houses that had telephones.

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<sup>1</sup> Background information: [http://en.wikipedia.org/wiki/Homestead\\_Act](http://en.wikipedia.org/wiki/Homestead_Act) and <http://archiver.rootsweb.ancestry.com/th/read/ANDERSONVILLE/1999-02/0919381449>

Some unknown genius discovered that if you hooked two purchased telephone sets to the top wire on a barbed-wire fence, you could talk between the telephones as easily as between two 'town' telephones connected by a "regular" wire through an operator's switch-board. *A rural telephone system that had no operators, no bills—and no long-distance charges—was born.*

It seems to be difficult to judge in 2013 how good or bad the transmission quality was of such lines. I presume it depends on a lot of parameters, such as what material was used for the barbed wire, how was the status of the barbed wire (rusted or not), how was the weather? And how good were regular telephone lines around 1900?

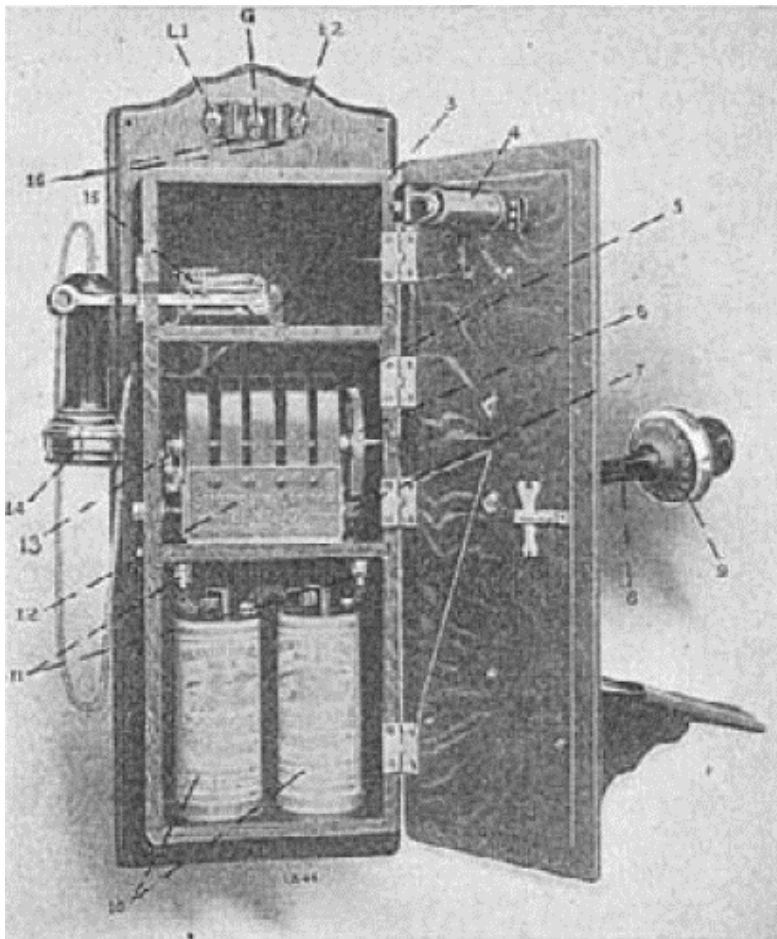


Fig. A.

- |                      |                          |
|----------------------|--------------------------|
| L1—Line Binding Post | 9—Transmitter            |
| L2—Line Binding Post | 10—Dry Batteries         |
| G—Ground Connection  | 11—Battery Binding Posts |
| 3—Induction Coll     | 12—Generator             |
| 4—Ringer Movement    | 13—Shunt Springs         |
| 5—Generator Magnet   | 14—Receiver              |
| 6—Generator Gear     | 15—Hook-switch           |
| 7—Generator Pinion   | 16—Lightning Arrester    |
| 8—Transmitter Arm    |                          |

**Figure 1: Stromberg-Carlson's "Farmer phone".**

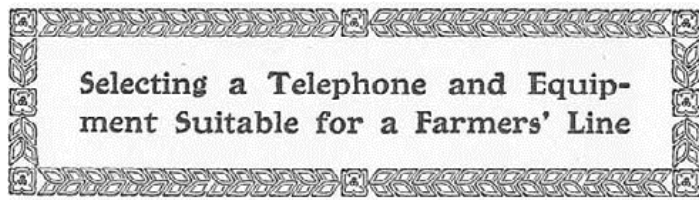
Source: "How the Telephone helps the Farmer" (SC, 1905)

Some telephone manufacturers had a special phone for the rural market segment. In *Singing Wires* of February 2008<sup>2</sup>, one can read:

*"During the first two years of Stromberg-Carlson's existence, the country fell into a depression and by 1896 the Company was down to nine employees from fourteen at the beginning. Alfred Stromberg was an excellent salesman and realized there was a need for more sensitivity to the rural customers. In many cases, rural transmission lines were nothing more than barbed wire fencing. Stromberg and Carlson had the foresight to recognize that the specific needs of the rural market were still not being met by the other telephone companies. Stromberg-Carlson pitched their equipment to meet the need of farmers and other rural customers, whose homes were located many miles from the nearest*

*cities. The transmitter and receiver styles specific to S-C were a result of developing and providing equipment geared to transmitting and receiving over greater distances. As a result, Stromberg- Carlson gained the nickname, 'Farmer's Telephone'."*

<sup>2</sup> Article: *The Stromberg-Carlson Portable Desk Telephone No. 337: The "Oilcan"*, By Jonathan D. Finder, M.D.



We have found a beautiful Stromberg-Carlson booklet, "**How the Telephone helps the Farmer,**" from 1905 which was scanned by TCI member Jack Ryan<sup>3</sup>. This was intended as a help to setup a rural

telephone network (mostly with party lines) and the choice of a decent telephone.

## Rural Telephone cooperatives were born

Then came a **rural revolution**. American farmers already had a long tradition of cooperative association. There were thousands of farmers' cooperative *insurance groups, grain elevators, and irrigation systems*.

By the turn of the century, farmers had come to see many uses for the telephone to get them out of their isolation in rural areas. Not surprisingly, they started rural telephone cooperatives by the thousands. Each linked together a few, or a few dozen, farm households.

## Network topology

Early phone lines, even the barbed wire variety, were usually party lines, shared by neighbors. It was in building the network connecting homestead to homestead that the farmers' ingenuity came to the fore. Instead of erecting new poles and wires, many either ran phone wires along the top of wooden fence posts or used the barbed wire itself to carry signals.

## Physical line

Where it became necessary for a telephone system to cross a road, all that was required was two posts about 15 feet long, buried about 3 feet into the ground for stability, and enough wire to go from one top fence wire up to the top of the post, across the road, and down the other post to the top fence wire on the other side.

A similar approach was necessary at fence gates. The signal may not be interrupted.

Ida Hawley, a farmer's wife from Sheldon, Elk Grove, California told the following about living on their ranch in 1910: "*When we came here, a lot of telephone lines were on the fences. We didn't realize that. My husband went out one day to fix our fence. He had a man working for him, and they were up there fixing the fence along the road. A fellow came along, somewhat upset and asked the men what they were doing. My husband told him that they were fixing the fence. 'You have wrecked my telephone,' the man replied. My husband was startled and could not figure out how the fixing of the fence had wrecked a telephone.*"

## Signaling over barbed wire

Proper etiquette dictated that you pick up the phone to see if the line was busy, before you cranked the appropriate number of rings for the party with whom you wished to speak.

Each family had a **combination of rings**, *some long, and some short*. For example, your signal might have been one long ring followed by two short ones. When you heard this

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<sup>3</sup> See <http://www.strombergcarlsontelephone.com/S-C%20PDF/1905%20S-C%20FARM%20LINE%20BROCURE.pdf>

combination, you knew the call was for you. This allowed the use of somewhat private calls, although in reality, there was nothing private about them.

A witness said, "When your combination of rings was heard, not only did you know it was your call, but so did everyone else on the party line. Anyone could pick up the phone and listen in—and they did."

Due to the nature of the system, it was completely independent, and couldn't call anyone on standard phone lines. If people on the barbed wire network wanted to call anyone in town, they would have to contact a ranch that had access to both the barbed wire network and the standard phone lines, and have them deliver the message.

Since there was no central operator, there was no way to direct calls. Most systems agreed on "one long"—a single long ring made by turning the crank rapidly five or six times—as a "line call." A "line call" denoted an emergency. Everyone picked up the telephone to hear what was wrong.

### Possible causes of line problems

One of the bulls or cows could get through the fence, cut the wire and so the phone connection got broken.

A thunderstorm could generate glitches on the line, which lead to unwanted tinkling of the phone bells.

A big enemy was a heavy rain that soaked both the ground and the fence posts, it grounded the entire system and rendered it unusable until the posts dried out. Few pioneers realized it was because the wire was stapled directly to the fence post and grounded out when wet. So a need for insulators came up.

### Use of insulators

(No Model.)

J. M. PATTERSON.  
INSULATOR.

No. 541,332.

Patented June 18, 1895.

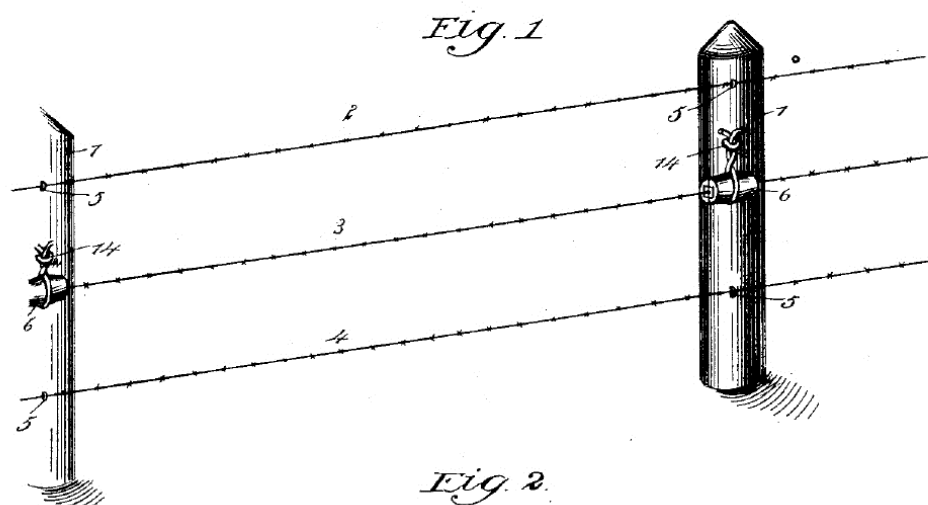


Figure 2: US Patent 541,332 on insulators for telegraph and telephone networks

As insulators became popular, the clever, most-innovative cowboys used every conceivable device as an insulator to suspend the wire and improve the faint telephone transmissions. They used almost everything: from leather straps folded around wire and nailed to the posts, broken whiskey bottle necks affixed with big nails, snuff bottles, corncobs, pieces of inner tube wrapped around the wire and short car tire straps holding barbed wire telephone wires.

Saloons discarded bottles: *beer bottles, whiskey bottles, wine bottles*. You name it, if it came in a bottle, saloons stocked it and, when the bottles were empty, discarded them. Glass is one of the best electrical insulators there is. Bottles were collected from behind the saloons, the necks were broken off, wooden pegs were whittled to fit into the broken bottle-necks, holes were drilled in the pegs, and the "glass insulators" were nailed to fence posts. Wire could then be strung along the insulators.

US Patent 541,332, filed by J.M. Patterson of Springfield, Texas and patented on June 15, 1895, shows an improvement on insulators for telegraph and telephone networks. 1895 was the time of the telephony booming, after the Bell license expiration.

US Patent 732,231 patented in 1903 was an improvement on wiring fences.

## Social aspects

A party line system has advantages and disadvantages. In a time before there was television, radio, internet, it could be used as a broadcast system.

### Advantage: Emergency use

Known examples were emergency cases such as *accidents, fires, illness, stolen horses, mad dogs, robbers, and threatening weather, or a bull that got through the fence*.

In cases of emergency, no party code was "cranked", but a long, continuous ring, a signal similar to 911 service today, so everybody knew an important message was on his way.

### Our "Sure-Ring" Bridging Telephone

There has always been more or less trouble on farmers' telephone lines, caused by subscribers failing to hang their receivers on the hook the moment they are through talking. This not only prevented their being called, but in some cases made it impossible to ring up others on the line. Another annoying trouble sometimes experienced on party lines, where certain parties have a tendency to listen in, is the difficulty in ringing a party if you failed to get them the first time.

We have devised and patented (Patent No. 743,421, Nov. 10, 1903) a simple, positive and efficient arrangement which entirely overcomes these troubles. It consists of a specially built condenser, connected in the telephone circuit, which is so arranged that the condenser is cut in series with the receiver when the receiver is off the hook. This arrangement makes it possible to ring the twentieth telephone on a line of twenty bridging telephones with the receivers of the other eighteen removed from their hooks, or to ring any party you want with one or more receivers off—that's why we call it the "SURE-RING." You get the party every time.

We will furnish our Farmers' Telephone with this additional equipment, at an additional cost of 50 cents per telephone.

**Figure 3: Stromberg-Carlson: Farmer's "Bridging" Telephone (1905)**

Source: "How the Telephone helps the Farmer" (1905)

## Advantage: Community use

Little by little, the phone became the main communication source for isolated farms and ranches.

A witness told about Sunday evenings after supper when families gathered around the telephone for their once-a-week entertainment. People sang, read poetry, told tall tales, and shared the news. Picnics, hayrides and dances were planned and arrangements made. At the end of the social hour, a favorite song was sung by all: *Good Night Ladies, Good Night Gentlemen*.

Some people started to have radios, and started to 'broadcast' news to their neighbors. Others had records, and started to share their music with the community.

## Disadvantage: privacy

Early phone lines, even the barbed wire variety, were usually party lines shared by neighbors. Eavesdroppers were the biggest problem with those early-day communication networks, and secrets were rare. When a caller raised the receiver and cranked out a call, clicks could be heard up and down the line as neighbors carefully listened in.

A woman who was confined to a wheelchair was miraculously able to stand when the telephone rang. It was called "rubbernecking" or listening in on the conversations of others. Though it was pretty much frowned upon, and no one ever admitted to it, many folks could not control their curiosity. However, "listening in" became a prime rural pastime, and it was unwise to discuss anything intimate on the telephone.

Some folks quickly learned how to clear neighbors from the line: *"Our Ranch foreman was well-known to cuss a lot. When he cranked out his call, he waited until everyone on the party line picked up their receivers, then announced, 'All you old biddies better hang up because I'm gonna talk about castrating a stud horse.' The hang-up clicks that followed in rapid-succession provided virtually unheard-of private conversation."*

For people whose lives had no daily newspaper, no radio, and no television, the shrill ring of the telephone was their call to the drama and excitement of the day. *"People like gossips, that's something from all times.*

An old rancher once told: *"The neighbors always knew when my wife was pregnant before she did."* to give an idea how fast gossip was passed!

One of the problems with overcrowded party lines was getting a chance to speak on the phone. If you wanted to make a call, the phone was almost always in use, and you simply had to tell your talking neighbor that your call was an "emergency" and ask the person to get off the line so you could use the phone.

## Connection to networks

As telephone systems in small towns expanded they took in the ranches nearest the towns. However, if you lived forty miles from town you could have a very long wait before the "telephone company" built a line to your front gate.

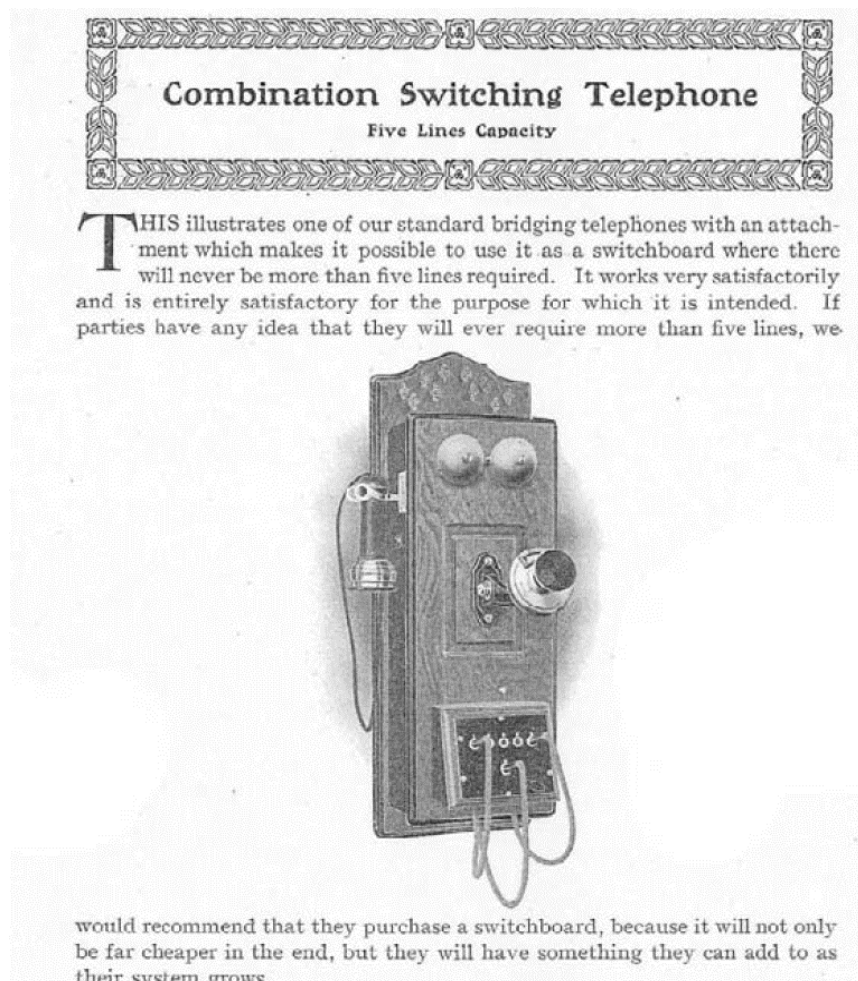
As a result, a number of "fence-line systems" became, in effect, **telephone cooperatives**. They put in a switchboard at a location close to town and paid the ranch wife who operated it a small monthly cash salary to run the thing. That switchboard would be able, through the "town" telephone in the house, to hook the fence-line system into the town system.

It still had a disadvantage, though. Most ranch families went to bed early, so the switchboard usually shut down about 9 PM and didn't reopen until about half past 5 the next morning.

It was nearly always shut down until 2 or 3 PM on Sunday so the family could go to church. Quite often it also shut down on Saturday night if there was a dance in town.

In the beginning of the 20<sup>th</sup> century, a switchboard was setup by a local doctor in Elk Grove, California. Dr. Briggs and his son, George, strung a line along the barbed wire fence on an important road in town. He set up a switchboard in his house, and his wife and family members acted as "Central." It was a wonderfully innovative way for a doctor to save lives, and a way to keep him from making unnecessary trips with his horse and buggy. There were about 16 families in the beginning, but the use of the telephone grew drastically between 1900 and 1910.

Hundreds of farmers' lines were organized throughout the countryside in the early years. In some cases; groups of local farmers and businesses organized to build a local line and later petitioned for connection with a larger company. In other cases, local parties formally organized and chartered a company to provide local and long distance service. Barbed wire enabled hundreds of thousands of farmers to translate their fencing revolution into a communications revolution, making them, for a few decades, the best-networked population in the nation.



**Figure 4: Stromberg-Carlson Combination Switching Phone**

Source: "How the Telephone helps the Farmer" (1905)

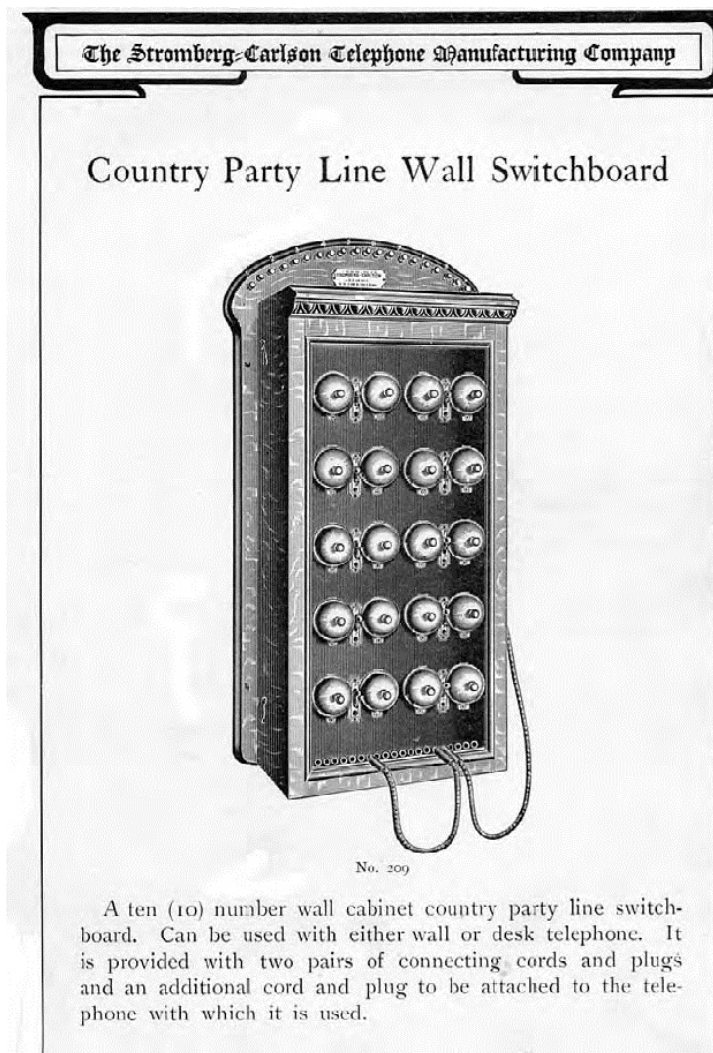
## Party lines numbering scheme

Roger Conklin explains: *A typical rural phone number would consist of the line number and the ringing code. Usually the line number and the ringing code would be separated by a letter or sometimes by a hyphen.*

*One typical numbering plan commonly used was for that letter to be either F or R. The letter R signified that the ringing code started with short rings followed by long rings, whereas the letter F signified that the ringing code started with long rings followed by short rings. For example:*

*5 R12 would be line 5, 1 short, 2 longs*

*5F12 would be line 5, one long, 2 shorts.*



**Figure 5: A Stromberg-Carlson country party line switchboard (1901)**

*Source: 1901 Stromberg-Carlson catalog*

The system in Figure 5 is a switchboard to interconnect 10 party lines. At the top 10 wire pairs can be connected. This switchboard had 2 cord pairs, so two simultaneous calls could be completed at any one time by the operator, who with her own telephone (not shown) would “ring up” the called party and then connect the two together.

Operating Companies such as Pacific Bell in the US and the Australian Post Office in Australia encouraged their customers to install a rural network, but gave them detailed instructions how to setup and maintain their network, which had to be separate from, but connected to the main network. They wanted to deal with only one person who had to be responsible for the whole setup. They tried to emphasize the importance of maintenance of their section of the network.



## Barbed Wire Fence Networks internationally

Using barbed wire fences as a carrier for a telephone network seems to be typical for the United States and Canada. They were very popular in the rural areas of the Western states.

### Australia

In Australia, rural fences are sometimes viewed as community resources. If a tree branch brings down a telephone wire and there is a fence nearby either the fence becomes part of the line or a wire is taken from the fence to repair the phone line.

Travellers often carried pliers in their tool kit. If an exhaust pipe fell off, there was sure to be a donor fence nearby for some wire to repair it!

As an ex-farmer and bush mechanic, I have some experience of such telephone lines. They are less the product of any particular policy and more of economic expedience coupled with ignorance of things electrical.

A barbed-wire-fence is any wire fence that includes barbed wires. Not all of the wires are barbed and rarely are the barbed wires used as telephones wires. One (or several) of the plain iron or steel wires is used. Sometimes an additional wire is added to the top of the fence posts using nailed on insulators like those used on an electric fence. The ground is used as a return path.

This form of telephone line was never, to my knowledge, used by the telephone company. It was only used by (usually) farmers to extend rural lines to their own property. As these were often quite high maintenance lines, it was not long before a "proper" telephone line appeared. Some of the problems encountered:

1. Stock has a habit of wanting to be on the other side of a fence. This is often achieved by leaning on the fence wire until it breaks.
2. Uninsulated fence wires without insulators work well in dry weather but not so well when it rains.
3. Old fence wire is rusty causing poor conductivity because of the many joins (see point 1)
4. New fence wire (and electric fence wire) is often galvanized or zinc coated. Joins in such wire tend to form rectifiers.

*(Source: Jack Ryan)*

### Europe

In most European countries barbed wire fence networks were not used, and in most cases should have been illegal. In dense populated countries such as Belgium and the Netherlands, farmlands were usually rather small, so there was less a need for such a solution.

### United Kingdom

There was no similar activity in Britain as far as I know. Until liberalization the British Post Office (later British Telecom) had an almost exclusive monopoly as far as the public telephone system was concerned. In a small number of towns the local municipality was given a license to operate a public telephone system and interconnect it to the national public network. This is still the situation on the city of Hull (Kingston Upon Hull). See [http://en.wikipedia.org/wiki/KCOM\\_Group](http://en.wikipedia.org/wiki/KCOM_Group)

The government monopoly never applied to private telephone networks run by organizations for their own internal use; if their wires were erected on their own property (as with the railways), there was no restriction on the size of the network. In a few cases private traders had connections to the railway telephone system and were able to make calls to other traders but this was fortuitous (an 'accident').

(source: Andrew Emmerson )

## Germany

Any phone line and any phone communication between real estate lots belonging to different owners, even if not connected to the public telephone network, was part of the Reichspost/Bundespost monopoly in Germany.

(source: Dietrich Arbenz)

## Austria

I never heard that fence wires of any kind were used as telephone lines in Austria (or earlier, the Austro-Hungarian Empire). By law, private telephone systems which are not connected to the public telephone network may only be operated if all telephones are on one and the same piece of land; at one time, one could request permission to expand such a network to connect a building on an immediately adjacent plot of land, and such permission was often granted.

The Austro-Hungarian Empire, and later the Republic of Austria, officially operated the equivalent of "farmer's lines." This type of **party-line service** was available in rural areas of Austria and only on magneto telephone lines. The service was officially titled "Landschluss" (*literally rural connection*), and potential subscribers had to sign away their otherwise guaranteed right to secret telephone connections and service in a special contract.

(source: Herbert Schwarz)

## Belgium

The Belgian administration had more or less the same rules as in the rest of Europe. Any phone line or intercom system running on private property was allowed. As soon as you want to connect the intercom to your neighbor, the connection came under control of the Public Telephone Operating Company.

(source: Jan Verhelst)

## Norway

Norway was a large and sparsely populated country, so the solution as early as 1880 was to allow private companies ("*telefonforeninger*" in Norwegian) to organize the telephone network with some limitations. The government had the right to buy each company back for a nearly symbolic amount. The system of "*telefonforeninger*" was widely spread, and at the countryside the user might save money by providing their own line for the last kilometers to the farm. Little or no control of this might have been the reason of that fence solution (*by my opinion not trustworthy when covered by snow*). In 1894 we had 14,000 telephones in Norway, or approximately 1 telephone per 140 citizens.

We have a story in Norwegian of *using fences as phone wires*. In the early days some farmers organized themselves in a cooperative. They installed the line to the farm by themselves. In a little valley called "Andebu" the technician had solved a problem. In his trouble report he wrote: "**cow-shit on the line**". That was all he reported.

(Source: Dag S Karlsen)

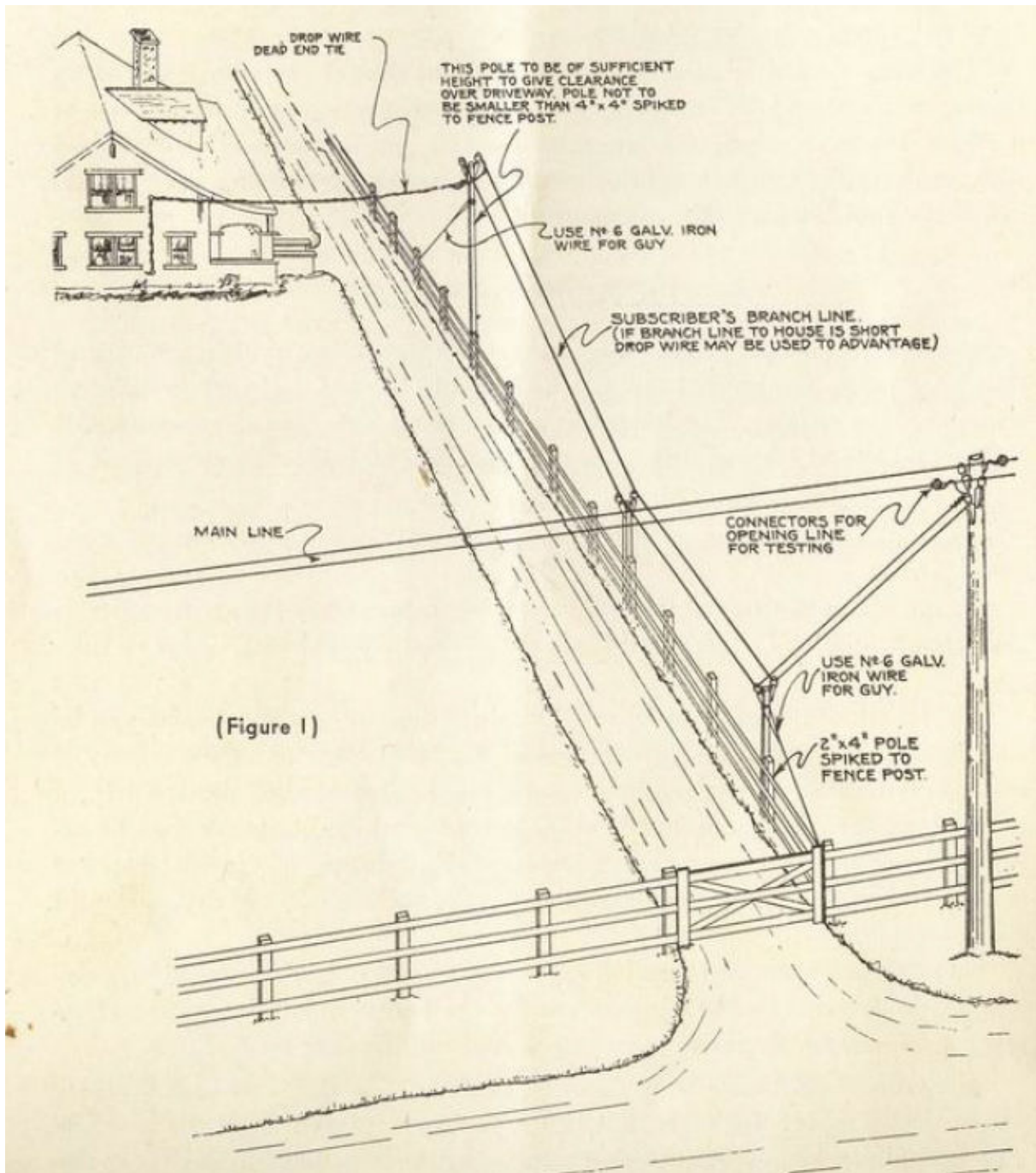


Figure 6: Pacific Bell instructions to setup a rural network

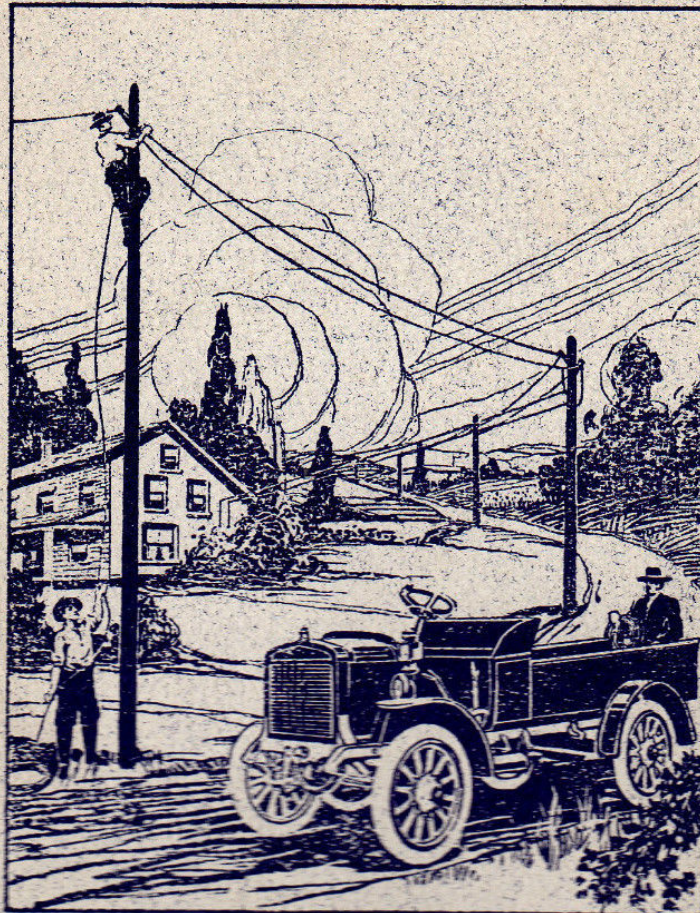
## VoBW?

**IP networks were not intended to carry voice**, in other words telephony. Voice over IP proves this seems to be possible.

**Barbed wire fences were not intended to carry voice**, in other words telephony. Voice over barbed wire fences proves this seems to be possible.

That's the reason why I titled this article "*Voice over Barbed Wire Fence*".

# RURAL TELEPHONE LINES HOW TO BUILD THEM



INSTRUCTIONS ON LINE CONSTRUCTION  
AND THE INSTALLATION OF TELEPHONES

ALSO CONTAINS A LIST OF MATERIALS  
AND ACCESSORIES REQUIRED ❦ ❦ ❦ ❦ ❦

**MONTGOMERY WARD & CO.**

CHICAGO    KANSAS CITY    FORT WORTH

Figure 7: Montgomery Ward instructions on line construction

## Sources

1. **Plafken James** "Good old days: Rural telephone network was built using barbed wire fences", January 2013 at <http://www.geek.com/news/good-old-days-rural-telephone-network-was-built-using-barbed-wire-fences-1534417/>
2. **Trew Delbert**, "Barbed Wire Telephone Lines Brought Gossip and News to Farm and Ranch", September 2003 at <http://www.farmcollector.com/farm-life/it-all-trew.aspx>
3. **Eckhardt Charley**, "Before Maw Bell- rural telephone systems in the west", at <http://www.texashillcountry.com/Stories/RuralTelephoneSystems.htm>
4. **Sicilia, David B**, "How the West was wired, a look at how Great Plains farmers used barbed-wire fences to transmit telephone calls" at <http://www.inc.com/magazine/19970615/1416.html>, 1997.
5. **Vulcan and District Historical Society**, "Talking Across barb-wire", Vulcan, Alberta, Canada, Feb 26, 2001 at <http://vulcancountyhistory.com/2011/02/talking-across-barb-wire/>
6. "The history of our telephones on the barbed wire fences", October 2012 at <http://www.egcizen.com/articles/2012/10/04/lifestyle/doc506de5fdb5fdb751986751>
7. **Migowsky Duane**, "Fence Phones", Canadian Cowboy Country Magazine, March 2011 at <http://www.cowboycountrymagazine.com/2011/03/fence-phones/>
8. "Fence phones", January 2013 at <http://bldqblog.blogspot.be/2013/01/fence-phone.html>
9. **Texas State Historical Association**, "The Handbook of Texas Online: Electric Fence" at [http://www.tshaonline.org/handbook/online/articles/aoe01\\_22/](http://www.tshaonline.org/handbook/online/articles/aoe01_22/)
10. "Volcano Telephone celebrates 100 years", 2003 at <http://www.volcanotelephone.net/aboutvolcano.htm>
11. **Trew Delbert** "Barbed Wire Telephones", 20 February 2004, at <http://www.texasescapes.com/DelbertTrew/Barbed-Wire-Telephones.htm>
12. **Mc Fadden, Paul** "The Sutton '666' Story -and More", Singing Wires, February 1998.
13. **Finder, Jonathan D M.D.** "The Stromberg-Carlson Portable Desk Telephone No. 337: The "Oil-can", Singing Wires, February 2008.
14. **Stambaugh, John**, "Long Magneto rural Lines", Singing Wires, July 2008
15. "The Role of Farmer Lines in the Early History of the Telephone Industry in the United States" at <http://www.annenbergnorthwestern.edu/pubs/speed/speed2.htm>
16. "Fascinating facts about the invention of barbed wire by Joseph Glidden in 1873"; at <http://www.ideafinder.com/history/inventions/barbwire.htm>
17. *Stromberg-Carlson catalog 1901*, obtained from the TCI library.
18. "How the Telephone helps the Farmer" (1905), at <http://www.strombergcarlsontelephone.com/S-C%20PDF/1905%20S-C%20FARM%20LINE%20BROCCURE.pdf>
19. Homesteads, at [http://en.wikipedia.org/wiki/Homestead\\_Act](http://en.wikipedia.org/wiki/Homestead_Act)
20. *History of barbed wire* at <http://inventors.about.com/od/bstartinventions/a/BarbedWire.htm>
21. *Rural Telephone Lines: How to build them*", issued by Montgomery Ward at the TCI library
22. "Rural Telephone Lines", by the Pacific Bell Telephone and Telegraph Company, at the TCI library
23. "The care and use of the Telephone" by the Australian Post Office Telephone System (+/-1930) obtained through Jack Ryan

Thanks to:

Dag S	Andersen	Norway
Dietrich	Arbenz	Germany
Roger	Conklin	USA
Andrew	Emmerson	United Kingdom
Paul	Fassbender	USA
Jack	Ryan	Australia
Herbert	Schwarz	Austria

For their well appreciated help.