The History of Telecommunications

The Telephone and its Several Inventors

by

Wim van Etten

Outline

1. Introduction
2. Bell and his invention
3. Bell Telephone Company (BTC)
4. Lawsuits
5. Developments in Europe and the Netherlands
6. Telephone sets
7. Telephone cables
8. Telephone switching
9. Liberalization
10. Conclusion

Reis

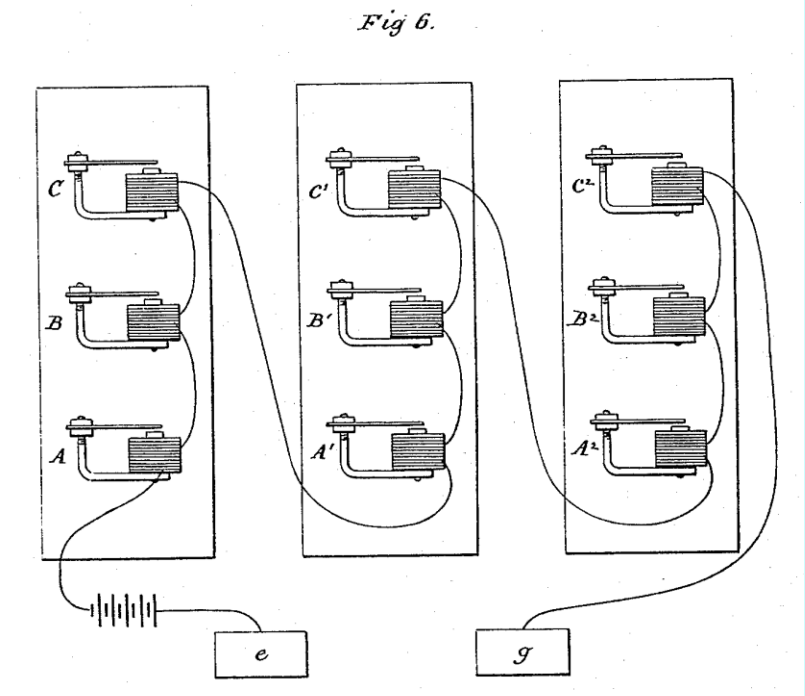
Johann Philipp Reis
1834-1874

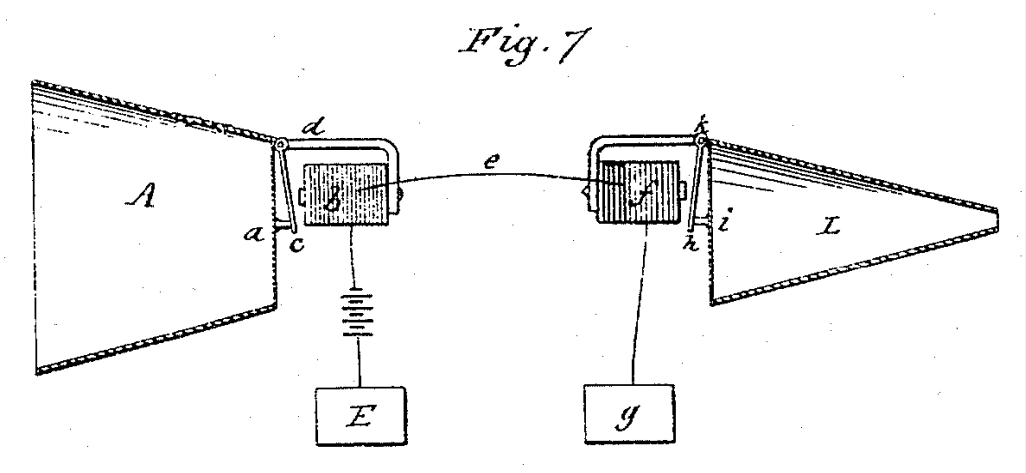
- German physicist and school master
- 1861: vibrating membrane touched needle;
  reproduction of sound by needle connected to electromagnet hitting wooden box
- several great scientists witnessed his results
- transmission of articulated speech
  could not be demonstrated in court
- submitted publication to *Annalen der Physik*: refused
- later on he was invited to publish; then he refused
- ended his physical experiments as a poor, disappointed man
- invention not patented

The telephone patent

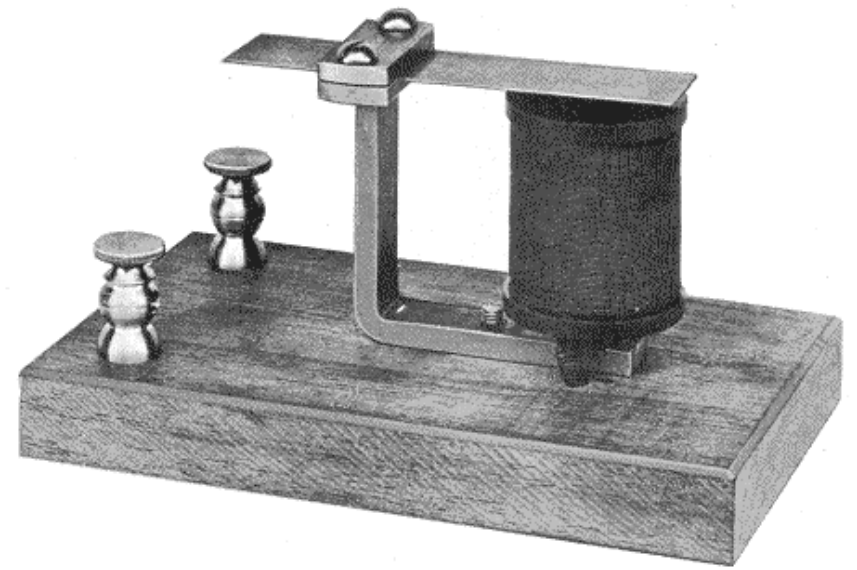
1876: February 14, Alexander Graham Bell applies patent "Improvement in Telegraphy"; patented March 7, 1876

Most valuable patent ever issued !

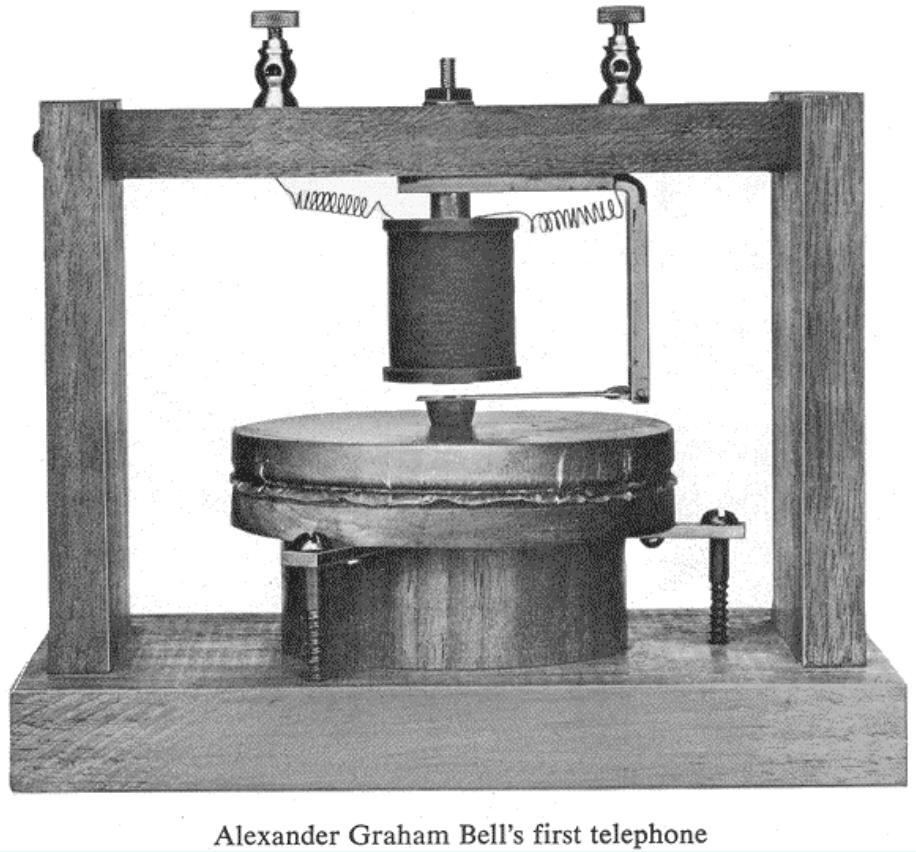




Bell's first experiments

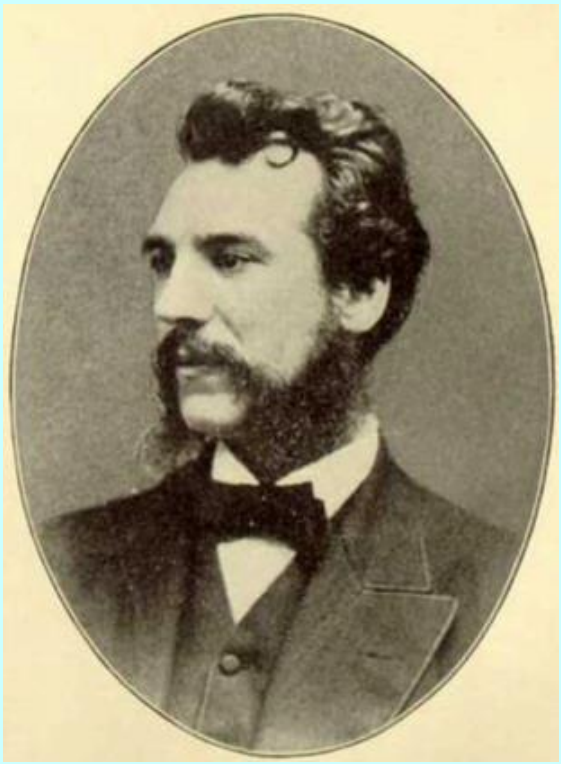


Prof. Bell's vibrating reed—used for a receiver



Alexander Graham Bell's first telephone

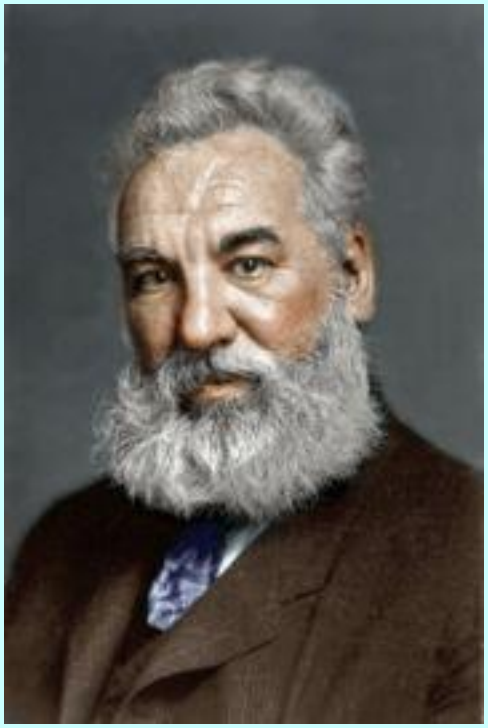
Alexander Graham Bell



Alexander Graham Bell
(1847-1922)

- born in Scotland 1847
- father, grandfather and brother had all been associated with work on elocution and speech
- his father developed a system of “Visible Speech”
- was an expert in learning deaf-mute to “speak”
- met Wheatstone and Helmholtz
- when 2 brothers died of tuberculosis parents emigrated to Canada
- 1873: professor of Vocal Physiology and Elocution at the Boston University School of Oratory: US citizen
- 1875: started experimenting with “musical” telegraphy
- had a vision to transmit voice over telegraph wires

Bell (continued)



Alexander Graham Bell
(1847-1922)

- left Boston University to spent more time to experiments
- 2 important deaf-mute pupils left:

  Georgie Sanders and Mabel Hubbard
- used basement of Sanders' house for experiments
- Sanders and Hubbard gave financial support, provided

  he would abandon telephone experiments
- Henry encouraged to go on with it
- Thomas Watson became his assistant
- March 10, 1876: "Mr. Watson-come here-I want to see you."
- June 1876: Centennial Exposition in Philadelphia;

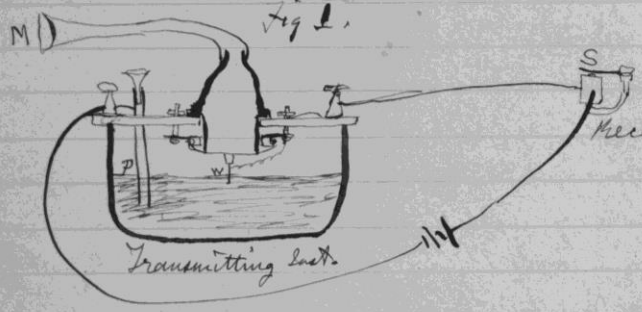
  Dom Pedro, emperor of Brasil: "My God – it talks."
- 1877: series of lectures and demo's

Bell's notebook March 10, 1876

40

March 10th 1876

Fig 1.



1. The improved instrument shown in Fig. I was constructed this morning and tried this evening. P is a brass pipe and W the platinum wire M the mouth piece and S the armature of the Receiving Instrument.

Mr. Watson was stationed in one room with the Receiving Instrument. He pressed one ear closely against S and closed his other ear with his hand. The Transmitting Instrument was placed in another room and the doors of both rooms were closed.

I then shouted into M the following sentence: "Mr. Watson – Come here – I want to see you". To my delight he came and declared that he had heard and understood what I said.

41

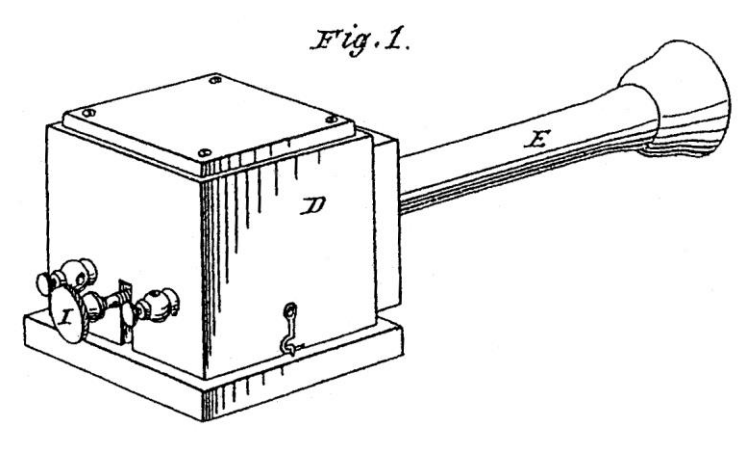
I asked him to repeat the words – ~~He said~~ He answered "You said 'Mr. Watson – come here – I want to see you'."

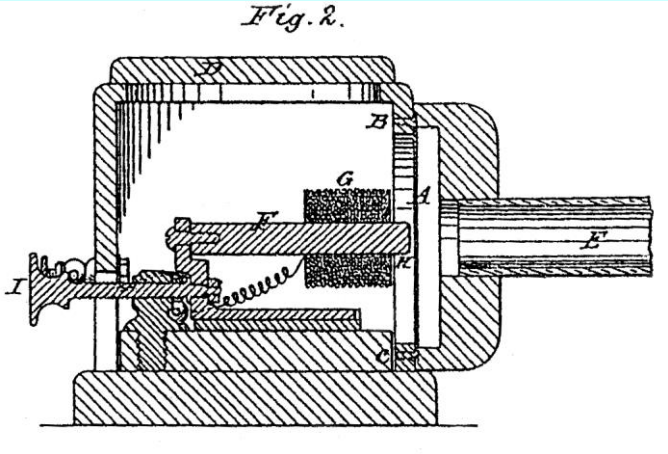
We then changed places and I listened at S while Mr. Watson read a few passages from a book into the mouth piece M. It was certainly the case that articulate sounds proceeded from S. The effect was loud but indistinct and muffled.

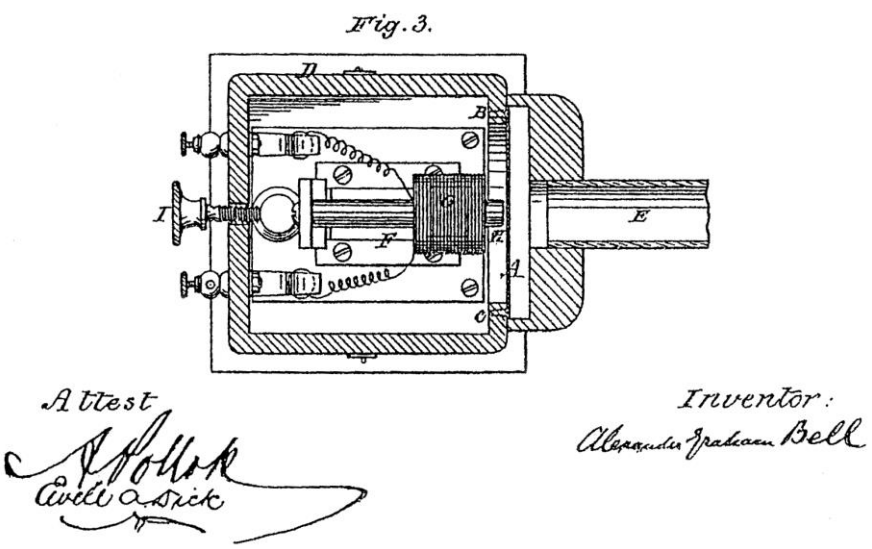
If I had read beforehand the passage given by Mr. Watson I should have recognized every word. As it was I could not make out the sense – but an occasional word here and there was quite distinct. I made out "to" and "out" and "further"; and finally the sentence "Mr. Bell Do you understand what I say? DO-YOU-UNDER-STAND-WHAT-I-SAY" came quite clearly and intelligibly.

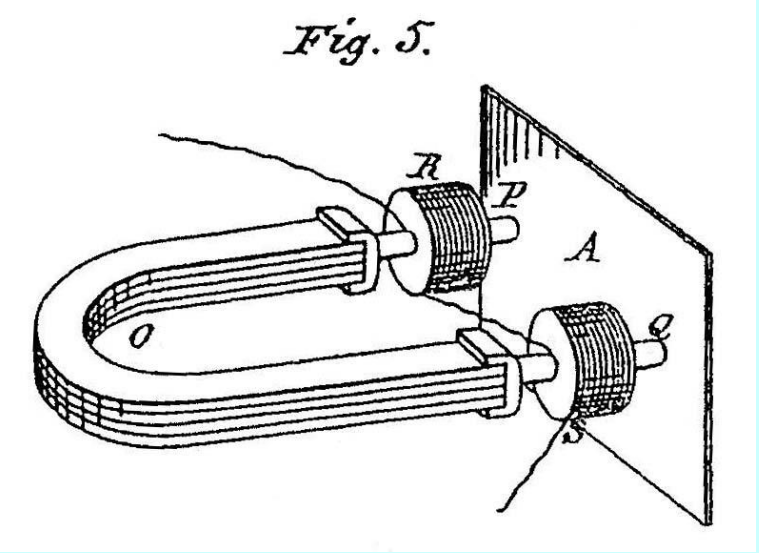
No sound was audible when the armature S was removed.

Jan. 1877 patent of Bell









Godfathers of telephony

Thomas Watson

Thomas Sanders

Gardiner Hubbard

Bell Telephone Company (BTC)

- July 9, 1877: "Bell Telephone Company" (BTC) established;

  Shares: Bell 30%, Sanders 30%, Hubbard 30%, Watson 10%
- July 11, 1877: Bell marries Mabel Hubbard
- On honeymoon trip to Europe Bell presents his invention. No contract from UK
- BTC doesn't run well. Returning from honeymoon Bell asks BTC for money
- BTC in crisis
- All telephone rights offered to Western Union for $ 100,000. Refused by WU (toy!)
- Berliner-Blake transmitter (as good as Edison's of WU) offers solution for BTC
- September 1878: BTC starts lawsuit against WU on Bell's telephone patents
- November 1879: WU stops the lawsuit. Agreement between BTC and WU

BTC (continued)

1882: • Sanders, Hubbard and Watson sell their shares for lots of money (millions);
Bell offers his shares to his bride

• Bell is offered position of chief inventor
He refuses: “I can not invent on command”

• 125 telephone companies in operation

1885: Foundation of AT&T (American Telephone and Telegraph Company)

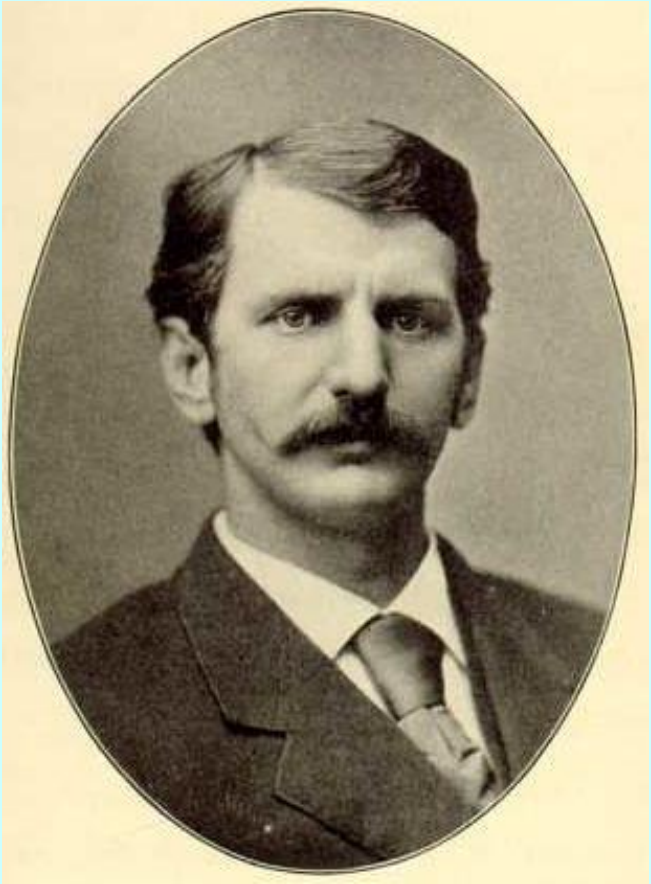
BTC business model

BTC business model introduced by Theodore Vail (general manager)

- BTC partner in entire telephone business
- no equipment sold, only leasing
- only BTC produced equipment is allowed to be connected to BTC network
- local telephone companies under BTC umbrella (RBOC's)
- every agent had to report on infringement of Bell's patents (expired 1893-1894)
- new inventions (patents) in the field of telephony are bought or a lawsuit is started against the inventor
- standardized telephone equipment by control of production
- "One policy, one system, and universal service."

Theodore Vail

General Manager BTC 1878-1885
President AT&T 1885-1887and 1907-1919



1878

1918

Lawsuits 1

1878: BTC starts lawsuit against Western Union (WU):
Elisha Gray, Amos Dolbear, Thomas Edison

1879: Agreement:

- Bell was confirmed as the inventor of the telephone
- WU sold his telephone network to BTC
- BTC will not operate a telegraph network in the US
- WU gave BTC use of its telephone patents
  (a.o. carbon microphone of Edison)
- WU received from BTC 20% on all telephone rentals

David won the battle against Goliath,

and became a Goliath itself within a few years !

Lawsuits 2

Elisha Gray

Amos Dolbear

Thomas Edison

Lawsuits 3

- Edison invented a.o. the carbon microphone, which was superior to Bell's micro
- Dolbear invented a.o. the "tin can telephone" and the electro-static telephone

Gray:

- co-founder of Gray & Barton, which later became Western Electric
- invented the liquid microphone, initially used by Bell
- invented the telautograph (transmitted handwriting by telephone wires)
- filed a caveat similar to Bell's patent on February 14, 1876, the same day as Bell applied for his famous patent; Gray was 2 hours later

("Of all the men who did not invent the telephone, Gray was the nearest")

Lawsuits 4

Antonio Meucci

- Italian immigrant who started a candle factory in the US
- owned several patents in different areas,

  but none on electrical equipment whatsoever
- filed a caveat on telephone invention in 1871; renewed in 1872 and 1873
- too many suspicious events:
  - no money for telephone patent, in the meantime applied for 5 others (1872-1876)
  - newspaper that reported on his experiments in 1871 could not be traced
  - no working equipment could be shown in court
  - his wife sold equipment to pay hospital bills; equipment could not be retraced
  - his journal contained impossible dates
- in 2002 the US House of Representatives adopted a resolution stating:

  “.. that … his work in the invention of the telephone should be recognized”

Lawsuits 5

- for 11 years a real battle was fought against Bell's patents
- Bell had to defend his patents in 13 lawsuits of national interest
- 5 were carried to the Supreme Court
- 587 other lawsuits of various nature
- with the exception of 2 trivial contract suits BTC won them all

Why was BTC so successful in the lawsuits?

- the patents were very well written by Bell himself
- they had a team of eminent lawyers (a.o. Hubbard)
- Bell was BTC's main witness; he was well-spoken
- Bell made an honest impression
- Bell well documented his daily achievements in a journal

Developments in Europe

UK: government owned – private – government owned

Germany: government owned; mix of different local systems

France: mess; different rates and equipment; no plan; no standardization

Belgium: government owned; unity, but bureaucracy

The Netherlands:

1879 First public networks

1881 Nederlandsche Bell Telephoon Maatschappij (NBTM)

1887 NBTM installs long distance lines

1896 Local governments take over local networks

1897 Rijkstelefoondienst (later on PTT)

1904 Law on Telegraph and Telephone services. Gradually taking over of local networks by PTT. Last ones in 1940 (A'dam, R'dam, the Hague)

Europe in general:

Lots of bureaucracy; lack of standardization; lack of consistent plans

Distribution worldwide

Worldwide distribution of telephony at the end of the 19-th century

Year	US	Europe	Rest of world	Total
1880	47,900	1,900	-	49,800
1885	147,700	58,000	11,800	217,500
1890	227,000	177,000	31,500	435,500
1900	1,355,00	800,000	100,000	2,255,000

Old-time telephones 1

Skeleton (Ericsson 1892)

French desk phone (1902)

Old-time telephones 2

Danish desk phone
(Ericsson design 1904)

Compact wall phone
(Western Electric 1910)

Old-time telephones 3

Wooden wall phone
(Ericsson 1911)

Candlestick (1920)

Round base
(Western Electric 1930)

Old-time telephones 4

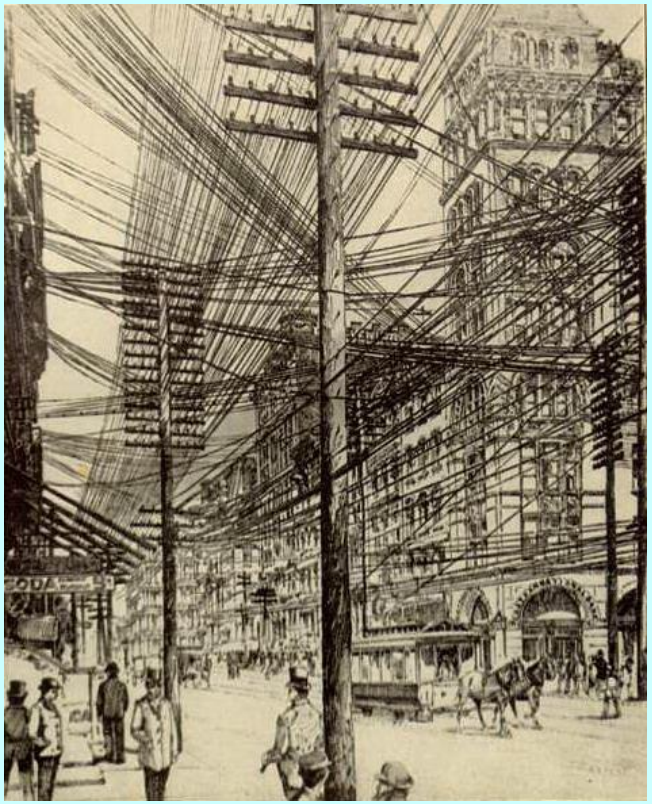
Ericofon
(1950)

Bakelite phone
(Heemaf 1961)

Electronic phone
(Philips 1989)

Telephone cables 1

- copper wires as overhead lines on poles
- later on cables buried in the ground



Broadway, New York, 1890

Telephone cables 2

In 1956 the first transatlantic telephone cable was laid;

until then telegraphy was the only fixed line

transatlantic telecommunication service

Telephone cables 3

Data of transatlantic telephone cables

name	year	# voice channels	remarks
TAT-1	1956	36	1st transatlant. telephone cable
TAT-7	1985	4,000	last transatl. copper cable
TAT-8	1989	15,000	1st transatl. fiber cable
TAT-13	1996	130,000	optical repeaters

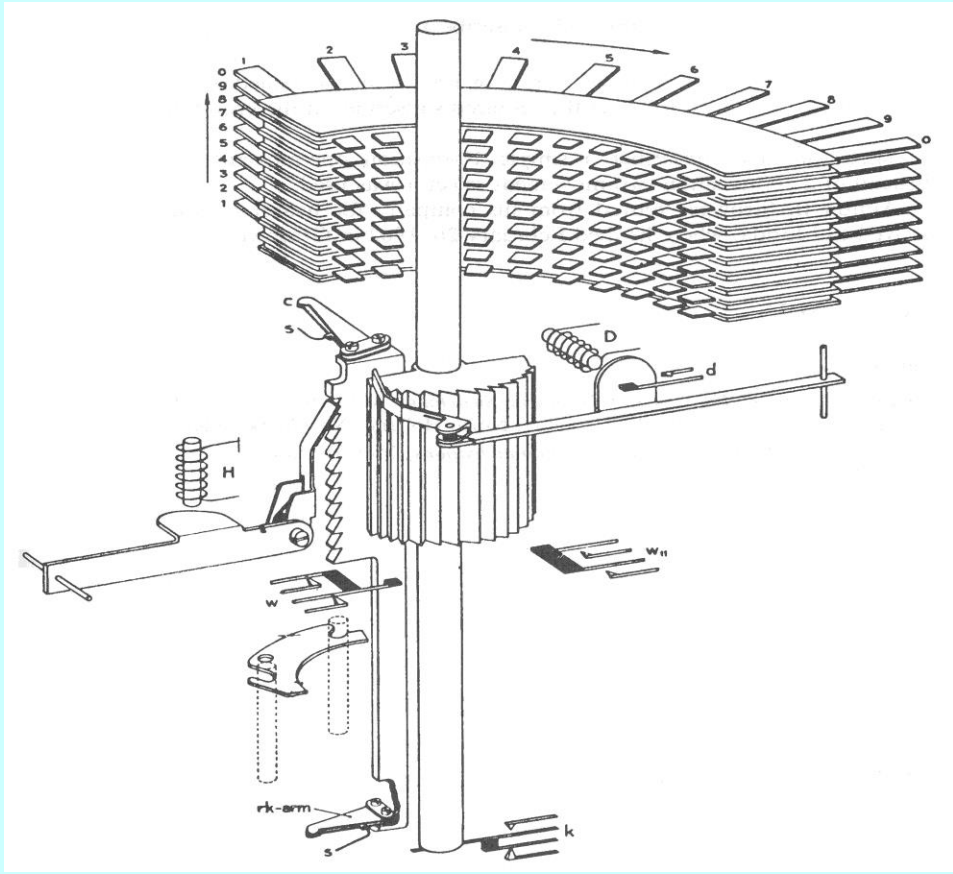
Telephone switching 1

Manual switchboard

Manual exchange office

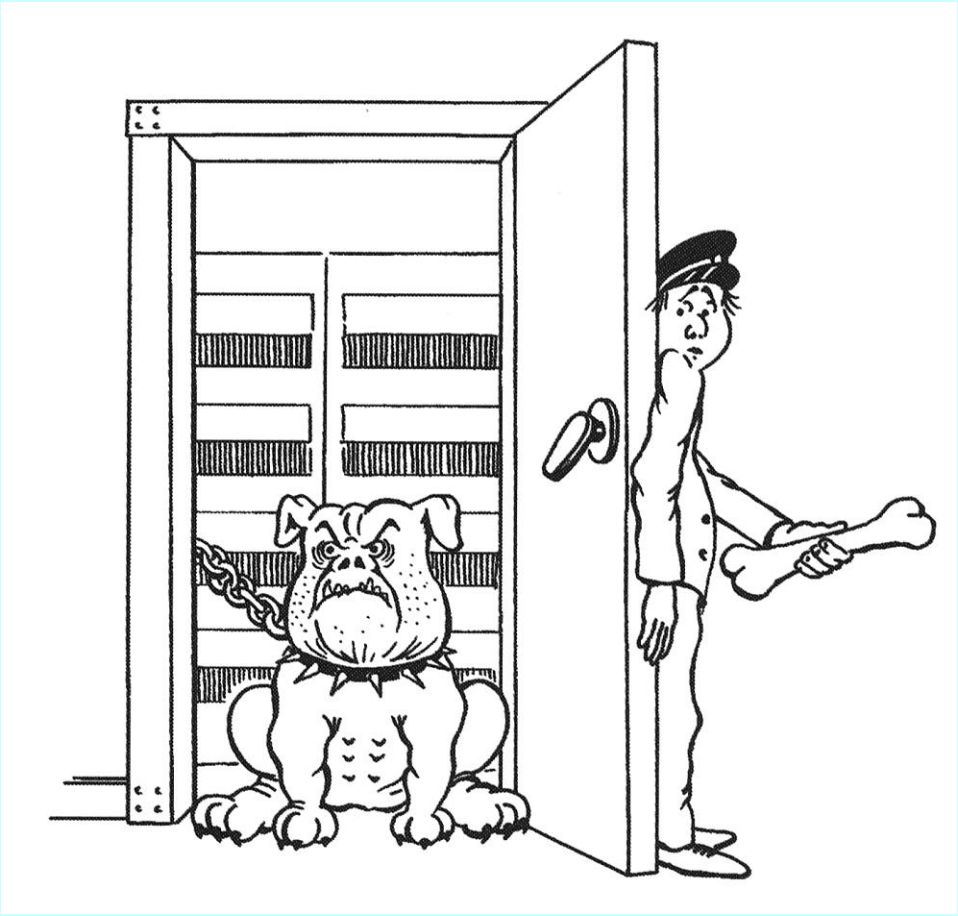
Telephone switching 2

Automatic dialing



Strowger selector

Telephone switching 3



What staff is required for an automatic exchange?

Wherefore is the dog?

Wherefore is the man?

Deregulation in US

- AT&T was the biggest company in the world
- had virtually a monopoly in US for many years

Under pressure of competitors and government it slowly gave up

1981 MCI wins a lawsuit against AT&T on exploitation of radio relay links between cities and private lines

1984 Divestiture of AT&T:

- 7 RBOC's
- AT&T (Long Lines, Western Electric, Bell Labs)

1996 Further break up of AT&T

- AT&T (communication services and small part of Bell Labs)
- Lucent (previous Western Electric and major part of Bell Labs)

Deregulation in Europe

In Europe the monopoly was with the governments (PTT's)

1987 Commission of the EU publishes a plan on liberalization telecom market

1992 Evaluation of the impact

1997 Full liberalization in all EU countries

- Charges went down by 35 % on average
- 500,000 jobs extra
- Volume increased significantly

Independent authorities to control the market (in the Netherlands: OPTA)

Problem:

Reluctance of incumbent operators to open the local loop for competitors

Concluding remarks

- Bell should be considered as the inventor of the telephone
- until a few years ago the telephony network was the major telecom network;
  data was transferred via this network
- nowadays it is the other way around:
  - the data network (Internet) is the most important network (all IP)
  - telephony lost the lead and now uses the Internet as transport medium (VoIP)
- liberalization gave a new impetus to telecom services and lowered rates

References

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- *The Worldwide History of Telecommunications,* by Anton Huurdeman, Wiley, 2003
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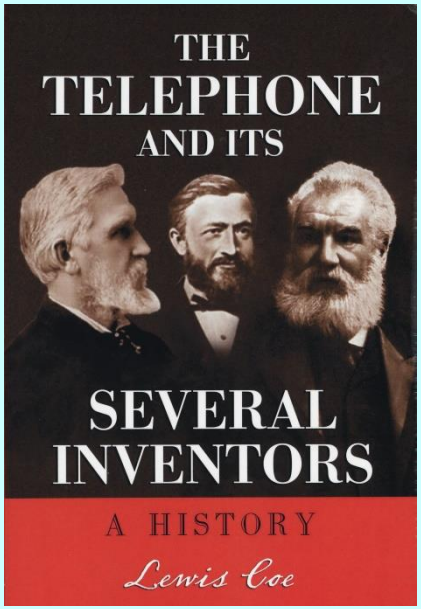

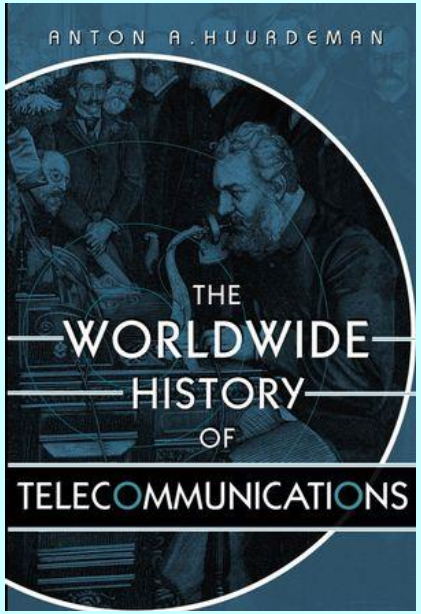

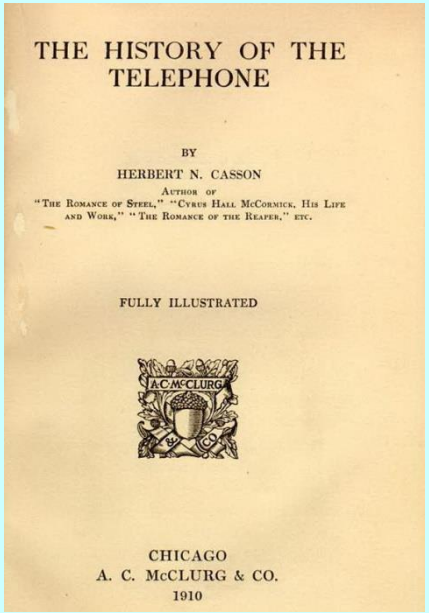

THE END

Thank you for your kind attention