# 100th Anniversary of the first Panel Office in NYC

*This article is a backgrounder on the first Panel telephone system installed in NYC in 1922. A new letter/number dial was also introduced. These events were a ripple in what became a sea change of Panel installations over the next 30+ years.*

In 1920 there were ~128,000 Bell System operators (11) using switchboards to make connections for subscribers. At the same time there were some constrained dial-based automatic exchanges (no operator needed) installed in smaller cities. Engineers were eager for all customers to dial their own numbers without operator assistance, especially in large metro areas. With this goal, the Panel type telephone switch was developed by the Bell System. (Endnote A).

On October 14, 1922, the first 7-digit Panel switch began serving subscribers in NYC. The exchange was located near New York's Penn Station so took on the name, "Pennsylvania Exchange". This led to the now famous phone number Pennsylvania-6-5000 (PE-6-5000), made popular by Glenn Miller in 1940 (see Endnote B).

Fig 1 shows the building housing the Pennsylvania Exchange (1)

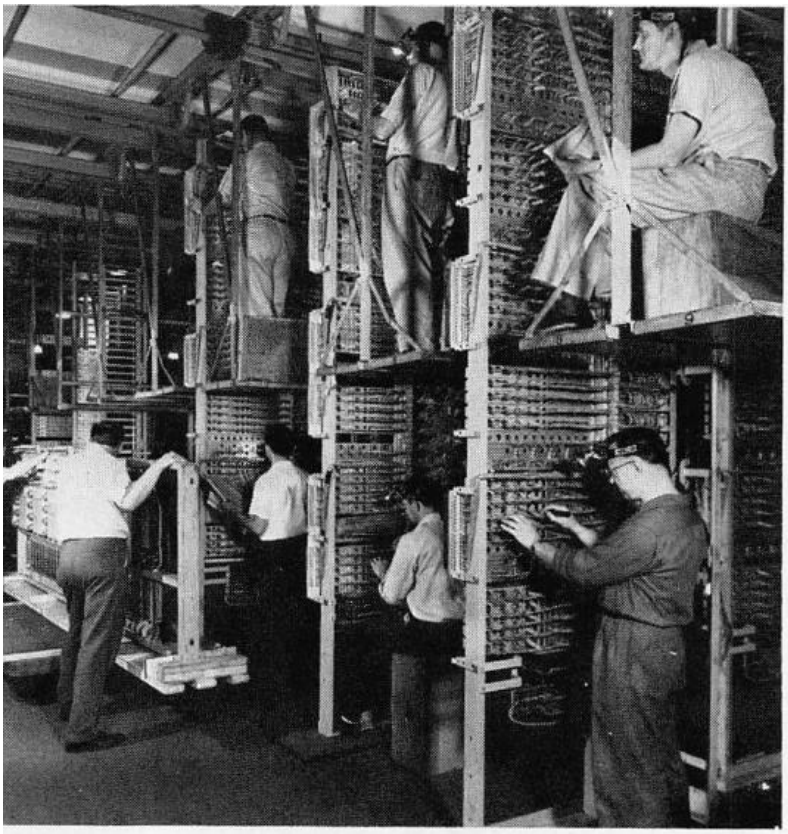
Fig 1 -- The Pennsylvania Exchange building, West 36th Street, NYC

From 1892 until about 1912 many Step-by-Step and Rotary switching systems were installed worldwide. These systems had acceptable cost effectiveness in smaller cities. By 1912, the

Western Electric Company proved that their Panel test system had great potential for serving metropolitan areas. So, all future switching development efforts were focused on Panel. However, efforts crawled partially due to economical (at the time) operator-based switching and WW1 slowdowns. (2)

The first full, dial-based, electro-mechanical, Panel office came alive December 10, 1921 in Omaha, Nebraska. This was a **6-digit** system. The first true **7-digit** metropolitan area office was the NYC Pennsylvania Exchange. By 1930 every dial telephone in Manhattan connected to a Panel office (there were many). Many iterations of the Panel design were made over the years with final improvements into the 1960's (3, 5).

A 7-digit Panel installation took about two years with many installers (Fig 2). About 200 would do the iron work first. Then about six months later 100 installers would do the assembly and wiring. So about 40% of the total installation effort was only for iron work! The first large scale exchanges were a hardy mix of electro-mechanical components and iron infrastructure (4).



*Panel installations took as long as two years and a lot of manpower.*

Fig 2

"*Growth of Panel continued at the rate of about 100,000 lines a year through 1926, after which it increased more rapidly, reaching a rate of nearly 400,000 lines a year by 1931* (~40, 3-digit office codes/yr)." (2)

There are many excellent references for understanding Panel System operations. In 1926 E.H. Goldsmith wrote the foundation booklet "Panel Type Machine Switching" covering Panel basics. See too, R.E. Hersey (7, 8). The **Connections Museum of Seattle** and docents have published many fine articles/videos on system ops -- https://en.wikipedia.org/wiki/Connections_Museum

I like what H.P. Charlesworth said in 1925,

> *"I do not know of any mechanical device that reminds one so much of the functioning of the human brain as does this mechanism (*Panel system*) for completing calls following the dialing operation."* (1)

The table below gives a neat overview of the development of automatic exchanges (see Endnote C) over the years. Panel installs peaked with 528 central office codes in 1965 then started to decline with Crossbar switching (X-Bar) and Electronic Switching System (ESS) replacing Panel. Step-by-Step (S X S) was typically, but not always, reserved for smaller cities and towns.

Table I—Number of central office codes

| Dec. 31 | Manual | Panel | S × S | X-Bar | ESS | Total* |
|---|---|---|---|---|---|---|
| 1950 | 3,257 | 502 | 4,107 | 604 | | 8,470 |
| 1955 | 1,991 | 512 | 6,087 | 1,161 | | 9,751 |
| 1960 | 715 | 494 | 7,511 | 2,258 | | 10,978 |
| 1965 | 94 | 528 | 8,212 | 4,281 | 1 | 13,121 |
| 1970 | 11 | 451 | 8,393 | 5,637 | 264 | 14,756 |
| 1975 | 1 | 144 | 7,911 | 6,549 | 2,183 | 16,788 |
| 1977 | 1 | 68 | 7,223 | 6,537 | 3,477 | 17,306 |

* Some buildings are multi-entity facilities containing more than one central office code. Therefore, the number of Bell System central offices exceeds the actual number of central office buildings.

Each central office code supports ~10K lines -- Table from Ref 9

The new NYC Pennsylvania Panel office relied on phones with dials. To many, the dial was a new gadget. Would it confuse users that were accustomed to working with operators?

## Learning how to dial

The first rudimentary dial was patented in 1898. It took another ~25 years for it to mature into a dial with 10 finger holes, letters, and numbers.

Up to 1921, in NYC and most other metro areas, calls were operator assisted. So, before the NYC Panel exchange cut-over, the public needed to learn how to use a dial phone!

Newspaper articles, AT&T advertising material and public demos (Fig 3) helped users to adapt to the new “dial tone” and dialing the 3L + 4D format.


Photo courtesy of AT&T Archives and History Center

Fig 3

Below is a portion of a 1922 **New York Times** article (one week before exchange cut-over) on how to dial. Dialing using 3 letters and 4 numbers (ex: PENnsylvania + 4 digits) may not be intuitive for all users.

*“To make a local call the first three letters of the exchange wanted are dialed and then the four figures of the number. When the receiver is removed from the hook a low* ***humming sound****, equivalent of the operator's "number please," will be heard. Then the user will place a finger in the hole where the first letter shows and turn the dial until a stop prevents further rotation. Then the other two letters and each figure of the number will be manipulated in the name way.”* (6)

By 1930, 9% of the Bell System's offices were dial; by 1940, the figure was 38% and by 1960 it was 94%. (9)

## Office names using 3 letters

The motivation for the 3-letter prefix was it's easier to remember a name plus 4 digits than to remember 7 digits. In the insightful 1925 article "*General Engineering Problems of the Bell System*" (1), H. P. Charlesworth discusses how difficult it was to select city-wide "office codes" using 3 letters (Fig 5).

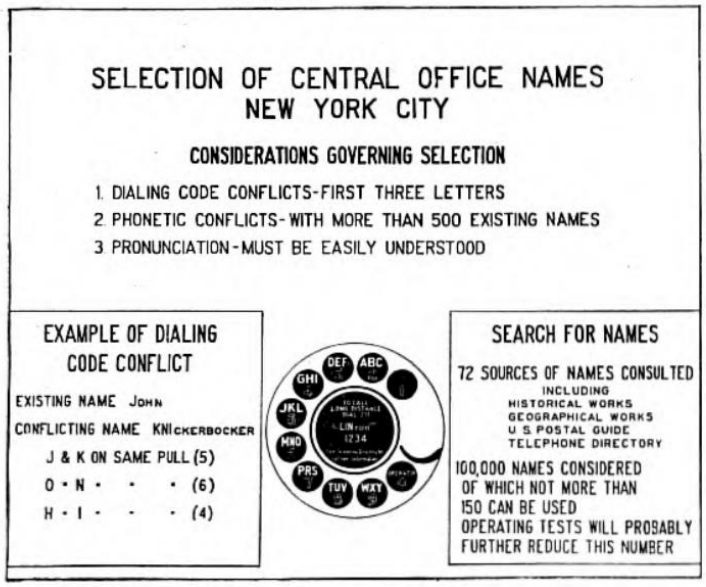



Fig 4 Selecting Office Code names (by H.P. Charlesworth)

"*It is interesting to note that while the name "John" does not seem in any way to conflict with the name "Knickerbocker," yet these two names could not be used together in the same city because of conflict in the dialing process. Phonetic conflicts are also exceedingly important in telephone operation. In fact, they form one of the most important factors that must be considered in the selection of an office name.*

*The pronunciation of a name must also be easily understood. Thus, we find that in the case of the metropolitan area something like 72 sources of names were consulted: for instance, historical works, geographical works, postal guides, telephone directories, and other sources, and out of* ***100,000*** *names considered*

*not more than **150** could be used and possibly some of these on further study will have to be eliminated."*

At first glance, picking "word-based" office codes (mine was **KLondike,** living in San Francisco as a kid) would seem a piece of cake. Seems not! Letter-based office codes lasted until 1958 when 10-digit, including the area code, "all number calling" started.

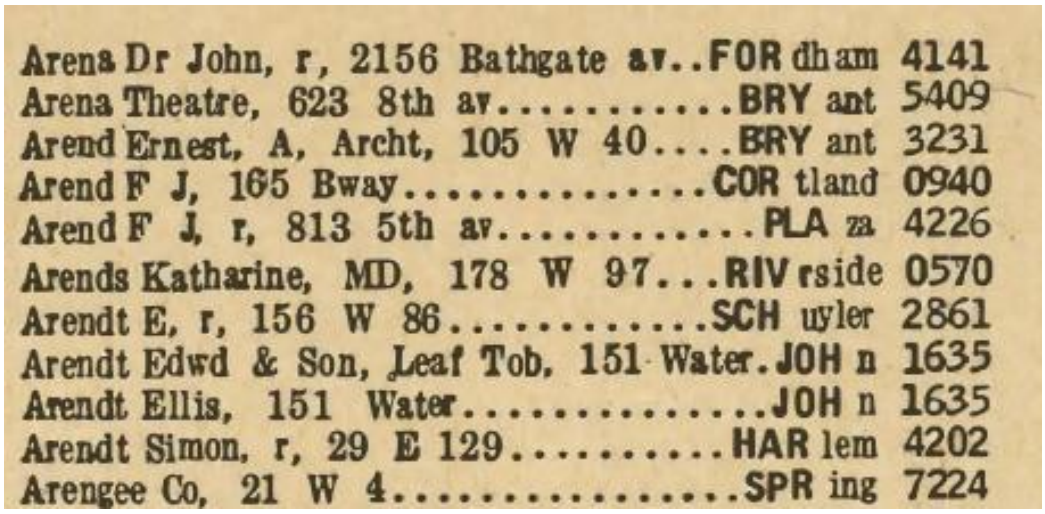

Arena Dr John, r, 2156 Bathgate av..FOR dham 4141
Arena Theatre, 623 8th av.....BRY ant 5409
Arend Ernest, A, Archt, 105 W 40....BRY ant 3231
Arend F J, 165 Bway.....COR tland 0940
Arend F J, r, 813 5th av.....PLA za 4226
Arends Katharine, MD, 178 W 97...RIV rside 0570
Arendt E, r, 156 W 86.....SCH uyler 2861
Arendt Edwd & Son, Leaf Tob, 151 Water.JOH n 1635
Arendt Ellis, 151 Water.....JOH n 1635
Arendt Simon, r, 29 E 129.....HAR lem 4202
Arengee Co, 21 W 4.....SPR ing 7224

Fig 5 Typical examples of the new 3-letter plus 4-digit format (from Ref 10)

## Final words

Transferring many thousands of subscribers instantly (often at midnight on a weekend) from an operator-based office to the dial-based office was an art. The Panel system article in (10) concludes with these words,

*"Enough has already been accomplished to demonstrate that the introduction of this new system* (Panel exchange) *will be carried on successfully in the usual Bell way, that is, in an economical and orderly manner, without inconvenience to the subscriber, and without derangement or interruption of the service."*

So, looking back on the grandaddy of all metro systems, it's fitting to appreciate the 100th anniversary of the first 7-digit Panel dial exchange in NYC. Three cheers for the brilliantly engineered Pennsylvania Exchange.

## References


(1) H. P. Charlesworth, Bell System Technical Journal, October 1925 page 538
(2) Engineering and Science in the Bell System - The early years 1875-1925
(3) Bell System Technical Journal, November 1952, page 1094
(4) “The Last Panel System”- WE (Western Electric Magazine), First Quarter 1983 issue
(5) "Improving Maintenance in Panel Offices", Bell Laboratories Record 41, November 1963
(6) New York Times, Sunday, October 08, 1922
(7) E.H. Goldsmith, “Panel Type Machine Switching”, 1926, New York Telephone Company
(8) R.E. Hersey, “Panel Dial Systems”, 1929, Bell Labs,
    a. https://archive.org/details/a-132_panel-dial-systems
(9) W. Pferd, Bell System Technical Journal, February 1979, page 427
(10) The Bell Telephone News, April 1920
(11) The Boston Globe, July 17, 1930, page 15



Author: Al Kovalick, Santa Clara, Ca.

Resume: https://www.theavitbook.com/about-the-author


Oct 14, 2022

## Endnotes

**A:** In this article telephone switching equipment with names such as **Rotary**, **Step-by-Step, Panel,** and **Crossbar** are referenced. These systems use different connecting methods for making dial-based calls between subscribers (no operator). Most users never knew what system they were using since the switching operations were largely hidden from the caller.

**B**: The original phone number was PEN-5000 using the 3L (PEN= 736) + 4D (5000) format. But by 1940 most phone numbers were using the 2L+5D format so PE-6-5000 was used. The PEN part is called an *office code* and each code supports ~10K lines (4D).

**C**: The terms *Central Office* (CO), *Office*, and *Exchange* can have different meanings in the context of telephone switching. First, any of these can refer to the building that houses switching equipment. For example, “The Crossbar Central Office and Panel Central Office are 10 miles apart.”

Second, these terms can also refer just to the equipment associated with ONE “office code”. For example, the PENnsylvania office equipment (~10K lines) and the GARfield (~10K lines) office equipment can share the same CO (or Exchange) building. Alexander Graham Bell first coined the term Central Office.