

By 1870, the Parisian network begun in 1865-67 employed small-diameter tubing (of no more than several inches), and in this period spanning the Seven Weeks' War (1866) and the Franco-Prussian War (1870), only limited spatial development (Figure 2) of the Pneumatique was possible (U. S. Postmaster General, 1891, p. 151). The network employed non-continuous air flow, sent along one-way tubes, that required the dispatch of trains of pneumatic carriers at regular (one-quarter hour) intervals. During this time the need for alternative mail delivery was evident; war-related bottlenecks in traditional surface routing in and around Paris led to the use of gas-filled balloons to air-lift pigeons carrying mail in and out of Paris (Pringle, 1908, p. 66).

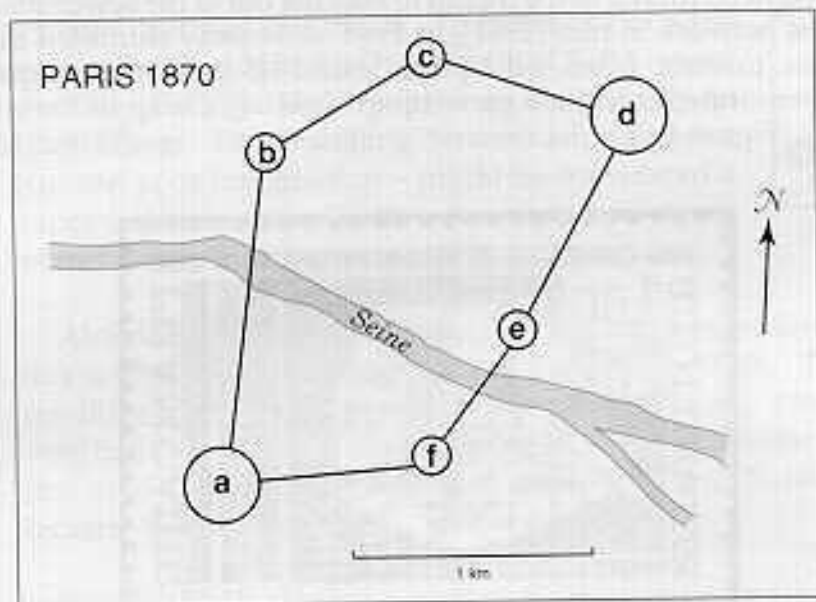


Figure 2. Parisian pneumatic postal connections: 1870.
 a: 103 Rue de Grenelles (P. T. T.); b: Boissy d'Anglas; c: Grand Hôtel; d: Bourse;
 e: Louvre; f: Saint Péres. Source: U. S. Postmaster General, 1891, p. 151.

IN THE PERIOD FROM 1871 to 1918 the extension of the earlier system, with stations connected to form closed polygons, continued; by 1876, seventeen new pneumatic substations had been added to this French network (U. S. Postmaster General, 1891, pp. 155, 159). The Bourse on the Right Bank and the general office of the Postes, Télégraphes, et Téléphones (P. T. T.) at 103 Rue de Grenelles on the Left Bank, the earlier focal points, remained central in this enlarged network. The Parisian network continued to develop rapidly until 1907, when 210 miles of tubing joined 120 pneumatic stations (Figure 3) (U. S. Postmaster General, 1909, pp. 140-141). The stratification of dispatchers into a hierarchy (suggested by circle size in Figure 3) reveals the one-way connection of small pneumatic substations along sets of single closed polygons, while larger offices are connected by two-way tubing. With this sort of connection pattern, local mail, written on special blue stationery (hence the name "Petit Bleu" as the Réseau Pneumatique came to be known), moved around individual polygons without focusing congestion on the busiest centers. Moving a message across the entire system, however, required shifting it from one polygon to another, thereby reducing both the security and speed of the mail (Gissot, 1910-1911, pp. 32-53 *passim*); indeed, this sort of "hand-off" difficulty seems a persistent one, whether in a relay race, a pneumatic postal transmission, or the currently avant-garde microcell/macrocell mixed cell hierarchy of mobile telecommunications networks.

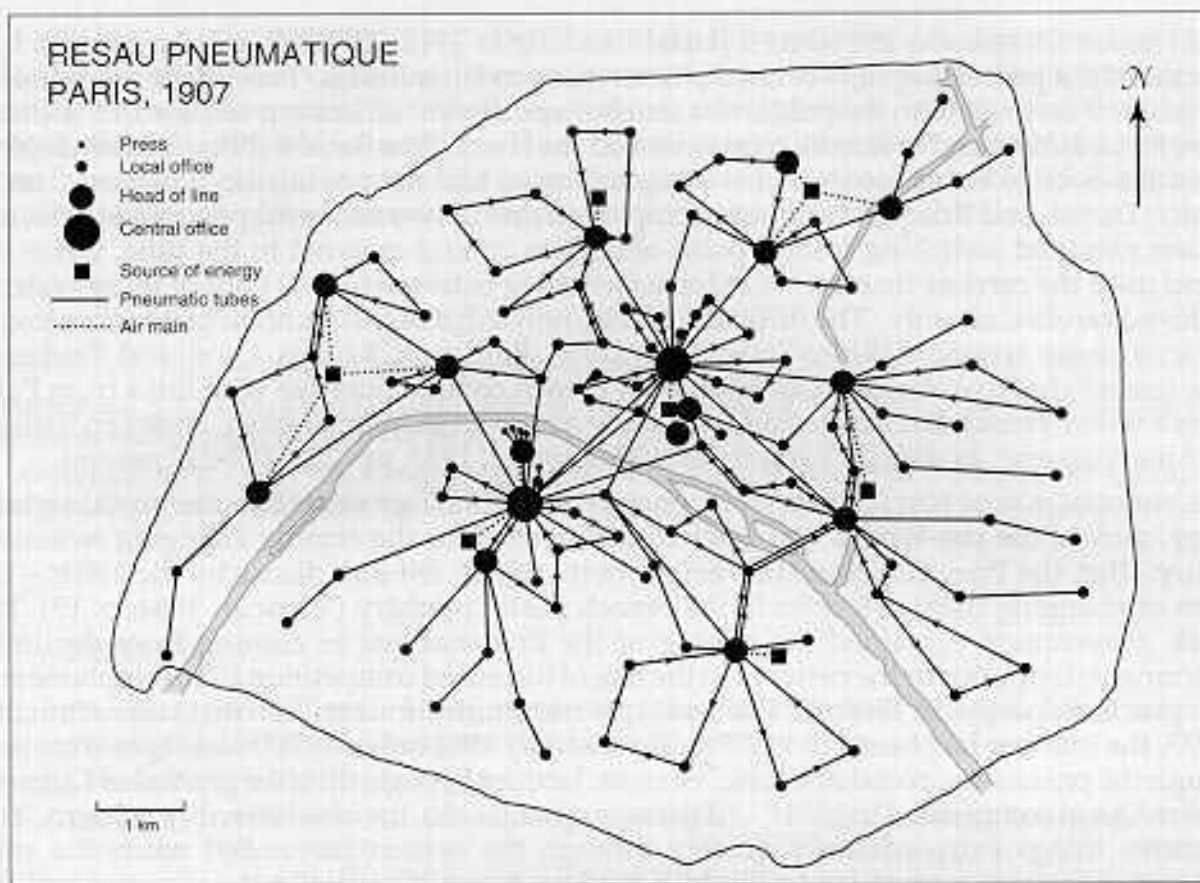


Figure 3. Réseau Pneumatique, Paris, 1907.

Source: U. S. Postmaster General, 1909, interleaf, pp. 140-141.

THE SPEED OF TRANSMISSION within the Paris system permitted the exchange of about 12,000 messages per hour between adjacent offices joined by two-way tubing. R. L. Maddox, Acting Superintendent of the Division of Foreign Mails in the United States Post Office, reported in 1913 that in Paris, "In 1907, the number of articles of pneumatic correspondence was 9,069,285 and the proceeds therefrom amounted to 2,746,350 francs (\$530,045)" (U. S. Pneumatic-Tube Postal Commission, 1913, p. 142). These records cited by Maddox were of a network using the Gissot pneumatic apparatus which was introduced to replace, in 1905, the earlier Hermann-Fortin apparatus. The Gissot apparatus retained all the flexibility of the Hermann-Fortin transmitter yet reduced the transmitter façade from 47 to 14 inches and the weight on the floor from 3310 pounds to 400 pounds. According to Gissot in 1909, the "installation has not failed since it was put into service in December 1905" (Gissot, 1910-1911, p. 43). The reduction in weight came from putting in the basement the tubing that led into the general lines and from joining multiple taps to a single tap that controlled remotely the workings of those in the basement. Thus, the chambers that received the carrier trains were placed conveniently in sales offices where postal clerks dealt with the public, while the heavy machinery used to forward messages into the general underground pneumatic lines remained in a more remote location. Various other technological improvements to the basic Gissot system kept pace with the changing needs of the Pneumatique, so that in the period following World War I, the pneumatic postal system of Paris changed little in underlying spatial design – the "hardware" was in place, and it was instead, applications of contemporary advances in banking practices and in engineering techniques that helped promote the persistence of this commercial pneumatic network in Paris until 1984.

THE FRENCH GOVERNMENT introduced postal checking in 1918. By 1930, this innovation had reduced the processing time of checks from thirty to ten minutes. Pneumatic tubes linked the cashier who dealt with the public to a number of different offices out of view of the client, where those authorized to handle money cashed the check. The Société d'Équipement de Voie Ferrés, the Société Française de Tubes Pneumatiques, and the pneumatic transport firm of Saunier, Duval, and Frisquet commonly employed one of two technical pneumatic systems: the first executed switching from a point of remote control external to the tube, while the second used the carriers themselves to force switching between tubes. Both of these systems employed rarefied air only. The diffusion of the knowledge of this technology to other towns in France began around 1930: to Strasbourg, Dijon, Bordeaux, Rennes, Lyon, and Toulouse. Thus, one might have imagined an additional French commemorative with links from Paris across a wider French landscape and eventually across a German, English, Austrian, Italian, and American one, as well (E. Lapiere and M. Raynier, 1933, pp. 208, 207-217 *passim*).

THE INTRODUCTION OF POSTAL CHECKING, a pneumatic technology related to the postal technology, moved the pre-World War I network forward into the rapidly changing twentieth century. But, the Pneumatique, at its height in the 1930s, fell into disuse by the 1980s – the victim of changing fiscal priorities in the French postal ministry (Vinocur, 1984, p. 19). The French government explained the closing of the Pneumatique as coming from declining governmental support for the network in the face of increased competition from telephone and telecopier technology. In 1960, the Pneumatique transmitted four million messages annually; in 1973, the number had been cut to 2.7 million, and by 1982 only 648,000 messages were sent through the pneumatic postal network. Even so, Jacques Lepage, director general of Lamson-Saunier-Duval commented in 1984 "...if the equipment is old, the idea is terribly modern. You can move things extraordinarily quickly through the system here. But when the state telecommunications people try to think in modern terms it's usually the obvious and the electronic" (Vinocur, 1984, p. 19). The commercial pneumatic postal networks had ardent supporters and critics; these networks were built in a period of intense urban systems development designed to convey a rapidly increasing volume of materials and ideas across limited space, and all are now defunct – thanks largely to changing budget priorities, the aging of physical equipment, and the advent of more competitive forms of technology (U. S. Senate, 1948, pp. 14-18 *passim*; U. S. Congress, House, 1935, pp. 58-59).

THIS MATERIAL offers merely a brief glimpse of the story behind the map on the French stamp, Scott 1168. Indeed, when confronted with the evidence of maps from contemporary government bodies, one might consider whether or not the "map" on this stamp is in fact a map, or simply an impressionistic mapping of the idea in commemoration of this great technological achievement. The network portrayed on the stamp appears to contain two closed polygons and is therefore evidently not the original network of 1870, but rather a suggestion of the Pneumatique at a later date. If that is the case, then one might consider (since clearly it is also not the full-blown network of Figure 3) that the stamp map, if indeed it is accurate, should be a subgraph of the graph (as a structural model) in Figure 3. That is, all nodes and edges on the stamp map should be contained within the connection pattern in Figure 3. This, however, is not the case – there is no direct linkage from the station at the Rue Jean Jaurés to any pneumatic station to the north west of the Bourse; there is such a connection on the stamp map but none on the 1909 map (supposedly complete). One might be tempted to conclude that therefore the stamp map is in error or is in fact not even a map; perhaps this is the case. Then again, perhaps it is a map of the system as it appeared somewhere in the time between 1870 and 1909, which included the link that might later have been closed or destroyed. Once again, the evidence of stamp maps (or non-maps) offers new directions in which to probe the historical (and other) literature!

AS WE APPROACH THE TWENTIETH-FIRST CENTURY, and the third millennium, it is indeed intriguing to wonder how our various systems will come to be visually encapsulated, including on stamps or their electronic (or other) equivalent, as nuggets of information to spark the imaginations of interested observers. Thus, one might envision the lessons of the pneumatic postal system as a basis for networks as far-flung as a broadly-based mobile telecommunications network or a global computerized library accessible from one's desk.

More extensive treatments of the topic of pneumatic postal networks, and related material, may be found in:

1. Arlinghaus, S. L. 1985. *Down the Mail Tubes: The Pressured Postal Era, 1853-1984*. Monograph #2. Ann Arbor: Institute of Mathematical Geography. 86 pp.
2. Arlinghaus, S. L. 1977. *On Geographical Network Location Theory*. Ph.D. Dissertation, University of Michigan, Department of Geography.

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- U. S. Senate. 1948. "Pneumatic Tube Mail Service," *Hearing*, 80th Congress, 2nd Session, Washington (March 29).
- Vinocur, John. 1984. "Paris Pneumatique is now a dead letter," *The New York Times*, Saturday, March 31.

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