

# Scientific Developments of Heating and Ventilation Professional Unions and Learned Societies in France during the First Part of the 20th Century

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The first professional unions of stove manufacturers appeared in 1817, followed by those of central heating constructors: Chambre syndicale des entrepreneurs de couverture, plomberie, eau, gaz assainissement et hygiène, Chambre syndicale des entrepreneurs poêliers-fumistes [1829], Chambre syndicale du chauffage et de la force motrice par le gaz et l'électricité [1858]. During the early 20th century, other new unions were created including that of the thermal engineers, the Association des ingénieurs de chauffage et de ventilation de France [AICVF] [1908] and Chambre syndicale du chauffage par l'eau et la vapeur [1900]. Professional unions also convened specialized committees such as the Comité technique de l'industrie du chauffage et de la ventilation [Costic] [1906] and the Comité français de l'éclairage et du chauffage [1925]. One of the first tasks of these unions was to create procedures for public and private tenders in order to guarantee temperature standards and to reduce the cost of preliminary studies [1900, 1909, 1923] (Fig. 1).<sup>1</sup> After 1918, unions and learned societies interested in heating and ventilation multiplied initiatives and set up committees in order to solve the big problem of the time: a significant deficit of energy sources. Wood had been overexploited during WWI to feed the troops. The price of coal, coming mostly from the north and northeast of France, which were for a while occupied by Germany, or from England, increased dramatically, as gas and most electricity was produced with coal at the time. In 1921, one ton of coal cost 45-55 francs, while it had been only 25 francs before the War (Grasset 1921, 2). In 1925, the

price of coal had risen to 400 francs for retail sales (Debesson 1926, 291).

The unions and learned societies also performed experiments on heating surfaces and new fuels, oversaw specialized education curriculum, published theoretical and practical literature and held regular congresses. Those different events represent an increasing technical proficiency of the central heating manufacturers and engineers: from experimental, the field became almost scientific.

## The previous situation and the heating context

Central heating was invented and developed in France at the end of the 18th century, as it had been in other countries. A hot water system named "thermosiphon", invented in France by Jean-Simon Bonnemain [1743-1830], was the most widespread, but hot air and steam systems were also present (Gallo 2006). All the different heating systems were improved, in the 19th century, notably after the invention of electricity [1881], with electric motors for pumps or fans. The introduction of modular and standardized radiators and furnaces, patented in the United States, helped modernize heating. The heating systems of the first part of the 20th century, were similar to ours, but modern thermal comfort was limited to public buildings and some luxurious housings complexes, as Jean Fourastié had noted in his history of consumption (Fourastié 1979, 137), something stressed by the AICVF president: "a building with



central heating was considered, for a long time, a luxury building" (Debesson 1925, 287).

During this period, the most important improvements were the introduction of fuel oil as an energy source, the development of radiant heating [mostly in floors and ceilings], the planning of district heating networks [Paris, Villeurbanne, Dax], the beginning development of gas and electric heating systems [despite the costs that were still high], and the spread of devices like meters, clocks, valves, expansion coils, joints and pressure gauges.

### **Heating and ventilation congresses**

Starting in 1923, three different unions [AICVF, chambre syndicale des entreprises de fumisterie, chambre syndicale du chauffage par l'eau et la vapeur] invited professionals to regular congresses with the approval of the State. The first meeting was organized in Strasbourg, during the scientific and international hygiene exhibition, in honour of the 100th anniversary of the birth of Pasteur [10-12 July] (Fig. 2). The architect Augustin Rey

[1864-1934] attended the first congress as the president of the "Association des Techniciens et Hygiénistes Municipaux."<sup>2</sup> At the first congress, 300 firms from the 2,000 contacted were present. Most of the congresses, after the first one, took place in Paris, but the 1933 congress was organized in Belgium [Bruxelles, Liège, Anvers].

French-speaking congresses imitated foreign examples, like those of Germany, such as the "Kongreß für Heizung und Lüftung" organized by the "Vereins für Gesundheitstechnik" since 1896 (Usermann 1993, 502-526). In North America, the American Society of Heating and Ventilating Engineers held congresses since 1895, one year after its founding.<sup>3</sup> Some French heating manufacturers attended these events, like Gustave Debesson and Paul Grasset in Frankfort in 1909, who were also members of the ASHRAE since 1900 and of the British Institution of Heating and Ventilating Engineers. Auguste Baurienne, who had joined the American ASHRAE, presented several times the results of the research done by this group like the relationship between the human body and thermal comfort (Baurienne 1926).

The different congresses delved into various topics but often focused on to the lack of energy, the importance of the efficiency of boilers and systems, the methods necessary to obtain good combustion, particularly popular topics in foreign congresses. Some speakers addressed district heating networks in Germany [ Wuppertal, Berlin, Dresden] but also housing block networks. Numerous studies discussed improved combustion for all types of boilers, heat circulation into pipes, efficiency, economy, heat regulation. The different sources of energy were examined: gas, electricity, fuel oil, or how to make a good choice. In 1925, Mourgue suggested the standardization of symbols and signs to measure and calculate heating devices or insulation (Mourgue 1926, 334). He also sought the possible unification of accessories.

The unions organized visits of buildings during congresses: the Dietrich plants in Niederbronn, Zinswiller and Metzwiller and Strasbourg's hospital and municipal bath [1923]. In 1925, they examined the heating system of the Chaptal College and the public baths of the Butte aux Cailles in Paris; in 1937, it was the indoor menag-



Fig. 2: Poster of the Scientific and International Hygiene Exhibition in Strasbourg.

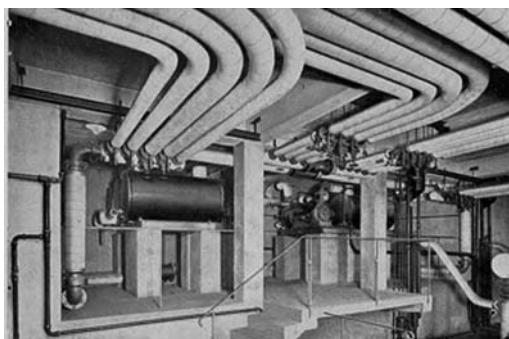


Fig. 3: Chaptal College heating system (*Architecture d'Aujourd'hui* 1932, 5, 123).

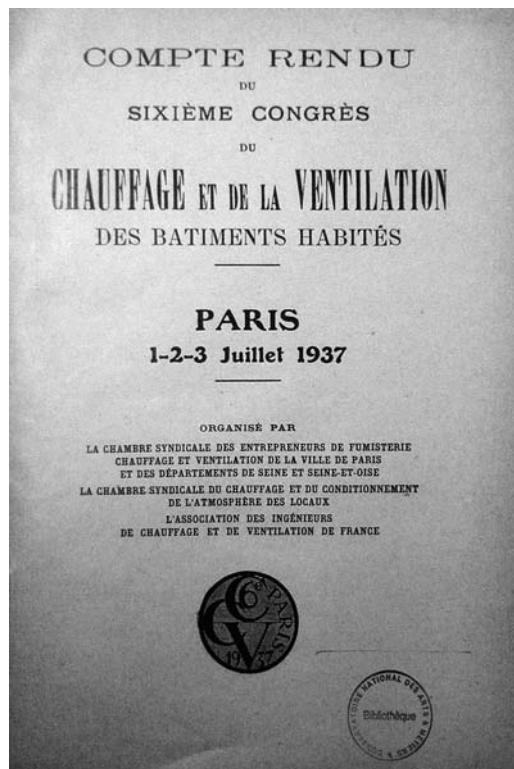


Fig. 4: Title page of the Comité Chauffage Eau Vapeur, 1938.

erie of the "Jardin des Plantes" in Paris, which had been air conditioned by André Missenard (Fig. 3 and 8).

Congresses gave rise to detailed publications, to disseminate important information to profes-

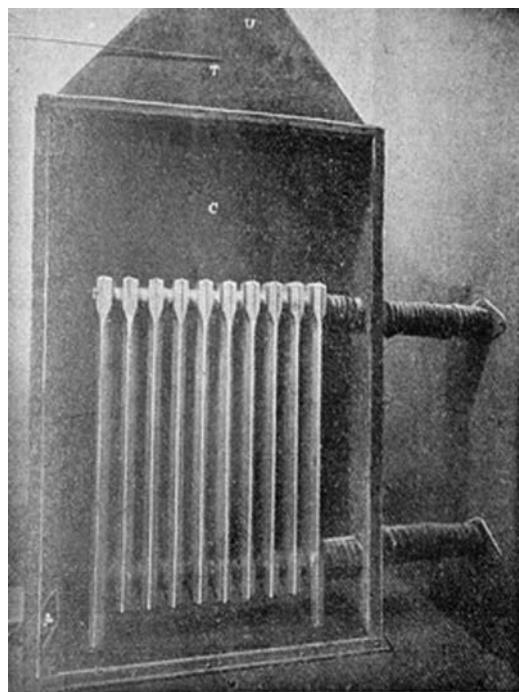


Fig. 5: Radiators tests done by the "École centrale" (Comité Chauffage Eau Vapeur, 1926, 119).

sionals and to students in engineering schools (Fig. 4).

### Tests and experiments

During the 1937 congress, André Nessi mentioned research performed in the École centrale des arts et manufactures and the Conservatoire National des Arts et Métiers. Members of the Ecole centrale studied how to calculate heating devices, the coefficients of heat emission of cast iron radiators, finned pipes made with cast iron or steel from different producers (Costic 1939, 15) (Fig. 5). Radiators in decorative envelope were also assessed [with four to 26% emission reduction]. At the CNAM, the researchers tested cast iron boilers burning coal with manual loading or fuel oil [with special burners] (Costic 1939, 15-16). Since 1936, the Costic and the Centre d'études et de recherches du chauffage

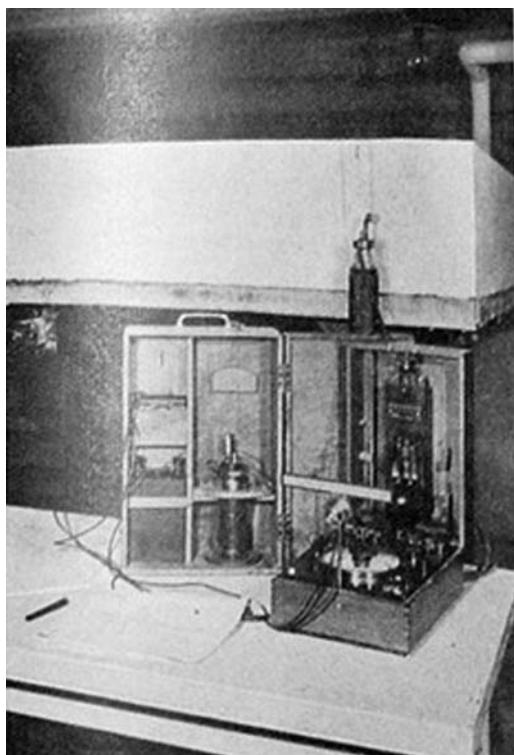


Fig. 6: Tests done by the Costic (Comité Chauffage Eau Vapeur, 1938, 875).

par rayonnement extended its testing to the thermal exchanges by building a special room built with double insulated walls (Costic 1939, 6) (Fig. 6).

The Unions tried also to improve already existing heating systems to maximize economy and studied new systems necessary for better efficiency. For this purpose, the Costic set up a consulting activity: studies, tests, control, approval of work, as we could see in their advertising "mon problème de chauffage m'embarrasse" (Fig. 7).

### Institutional publications concerning heating and ventilation

#### *Press*

With the turn of the new century, several scientific journals appeared: *Revue du chauffage*

Fig. 7: Costic advertising in (Comité Chauffage Eau Vapeur, 1938).

*industriel* [1907], *Hygiène du bâtiment* [1908], *Chaleur et Industrie* [1920], *Chauffage, ventilation, conditionnement* [1921]. These journals conveyed scientific contents corresponding to the new theoretical approach of the field. Some were oriented toward industrial heating and boilers than domestic technologies. This specialized press addressed the varied interests of professionals on fuel economy, air pollution, history, district heating in Europe and the United States, regulation, tests of different systems, radiant heating, physiological studies, professional education, "thermosiphon" calculations, pipe insulation, studies on conductivity. It also gave accounts of visits to new buildings with interesting heating systems like the Maison internationale of the Cité Universitaire by the Nessi brothers and the Parisian district heating networks of the Compagnie Parisienne du Chauffage Urbain [CPCU]. One finds in these journals advertising for different firms that manufactured boilers, ventilation, hot air systems, electric pumps, radiators, and burners.

Some of these topics were also covered during the congresses and were available in their reports. Papers were published both in congress reports and in different journals like André Nessi's work on "solving practical problems of discontinuity of operation in central heating systems." These papers show that the engineers were able to theorize their practice. The amount of new research and informa-

tion made it necessary to publish regularly in the new press, unlike their predecessors who published textbooks and treatises, less reactively.

Some sections of the journals included congress reports and news like weddings, obituaries, sales, union activities [AICVF], accounts on patents, information on foreign journals like *Gesundheit Ingenieur* [since 1881] and *The Heating and Ventilation Magazine* [since 1904]. The architectural press, at the initiative of *Architecture d'Aujourd'hui*, regularly published the papers of André Nensi and also L. Charpentier, informing the readership about radiators, insulation systems, new forms of energy, etc. In 1935, the journal devoted an entire special issue to heating and ventilation systems with the participation of authors from the professional heating press (1935).

#### *Scientific publications*

After 1927, the Costic began to test materials for heating systems in order to establish the general basis for the calculation and control of systems. They published several reports giving the results of their research and included elements necessary for establishing specifications or to perform calculations. The first report, entitled "Examen des clauses relatives aux essais et réception des installations de chauffage central, d'après le règlement de la chambre syndicale du chauffage par eau chaude et vapeur," examined how to control heating power (Costic 1939, 9). The second report, "Eléments de calcul de la transmission continue de la chaleur à travers les matériaux de construction des bâtiments," documented the conductivity coefficients of building materials in continuous rating and allowed for a unified method of calculation. The third report, "Tables de calcul pour le chauffage intermittent," gave calculation tables in order to size intermittent heating systems. The fourth report, "Documentation statistique sur les températures minima en France", presented information about temperatures in the entire country and became useful to calculate the heat loss and select the appropriate boiler. The fifth report, published after the War, "Étude des apports de chaleur par insolation dans les bâtiments habités," studied solar gain through the walls.

#### **Professional unions and education**

Even if the Ecole centrale had trained most inventors and manufacturers of heating systems, it did not provide a real specialized education, just courses in industrial physics. The situation was the same in other French engineering schools, even if it is not the case in other countries like Switzerland, the United States, the United Kingdom, or Germany (Debesson 1924, 42). In Germany, Hermann Rietschel [1885-1910] created the Institut für Heiz und Raumlufttechnik in the Technischen Hochschule Charlottenburg [Berlin] the first university to include instruction in heating systems in his country. It was followed, in 1918, by Oscar Knoblauch [1862-1946] and his Forchungshaus für Wärmewirtschaft in Munich in his work on insulation materials. In France, heating unions began giving technical education for professionals or for teenagers at different levels, for engineers but also technicians [AICVF since 1921]. "Women were welcomed to the association and our courses" (*Chaudage et Ventilation* 1921, 1, 19) (Fig. 5). The Chambre syndicale du chauffage also organized classes for assemblers and assemblers' aids. During the 1925 congress, a visit of the École d'application was organized, demonstrating the interest in professional education.

The heating manufacturer unions were convinced that the architectural schools did not spend enough time on heating, ventilation, water and other networks in their educational program. In 1935, André Missenard taught briefly a class on the topic in the Beaux Arts architectural school, as well as a longer one in the Ecole Spéciale des Travaux Publics [for architects and engineers]. Henri Arquembourg taught in the Ecole spéciale d'architecture in Paris during Gaston Trélat's directorship [1909-1931]. The Unions also tried to democratize heating systems with public exhibitions organized, like the one at the Grand-Palais in Paris in December 1921.

#### **The actors**

One can mention several heating professionals, mostly engineers, involved in unions and in scientific, teaching, publishing activities: Henri

Arquembourg [1858-1940, ECP 1879], Gustave Debesson, Paul Carton, Paul Grasset, Charles Herody, André Leroy [ECP 1888], Deschaux, André Missenard [1901-1989, polytechnicien], Auguste Baurienne [1876-1964, ECP 1900], André Nesi [1874-1960, ECP 1895], Joseph Nesi, Armand Boerenger [1869-1935, ECP 1890], Victor Maubras [1869-1933, ECP 1890], Marcel Gandillot, Paul Carton [ECP 1898], Jeanne Mouret [1902-1944, ECP 1926]. Most of them were trained in the Ecole Centrale [ECP] but André Missenard was trained in the polytechnic school.

### A foreshadowing of the post-war years

The history of heating was important in the different congresses as well as in the professional press. Mister Arquembourg wished in 1933 that the important role French engineers and manufacturers played in the international context be recognized. Inventors are often referred to: Jean-Simon Bonnemain and his thermosiphon, Grouvelle and his steam and hot water heating, the Duvoir brothers, Geneste and Herscher. Some public buildings are also frequently mentioned: Palais de la Bourse, Palais du Luxembourg, Hôtel de la Monnaie. It seems that this interest vanished

after WWII and the beginning of the real democratization of thermal comfort.

All those activities were the opportunity for young engineers to get involved in research, publishing, teaching and participating in professional institutions. André Missenard is a good example of this involvement. He gave a talk at the 1933 congress, and invited congress participants in 1937 to a visit of his flagship project, the indoor menagerie of the Jardin des Plantes, before developing an impressive career, followed by a veritable dynasty of engineers after the War (Fig. 8).

Heating and ventilation technologies were the first to be industrialized in the construction sector. Heating and ventilation systems of a building might be unique, but its components [stoves, boilers, radiators, pipes, taps, chimney pots] were mass-produced. During the first part of the 20th century, unions and committees enabled the profession of heating and ventilation to abandon empiricism and attain a scientific basis.

All these developments are a prelude for post-war building organizations, like the Centre Scientifique et Technique du Bâtiment [CSTB] [1947], when the industrialization and the scientific method became a necessity in the entire construction sector. The AICVF and its journal *Chaudage, ventilation, conditionnement* still exists. They show the evolution of the profession. The

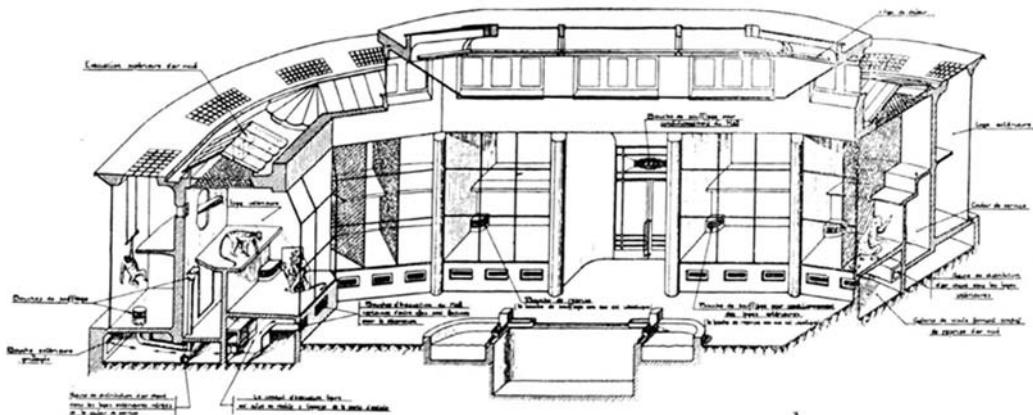


FIG. 8. SINGERIE DU MUSÉUM D'HISTOIRE NATURELLE

Fig. 8: Indoor menagerie of the "Jardin des Plantes" air conditioned by André Missenard (*Architecture d'Aujourd'hui* 1935, 45).

Costic, restructured by André Missenard after the War, is still promoting research and education for engineering students and professionals at different levels. They were early actors in the search for solutions to the energy crisis, even if government agencies are leading now.

## Notes

1. I have found one of these rules of tenders in the Salvation Army Building heating file (CCV files in Fondation Le Corbusier J1-18-17-003).
2. Augustin Rey is one of the architects concerned by domestic heating and the author of studies of two district heating networks in Paris.
3. [www.ashrae.org/aboutus/page/ashrae-and-industry-history](http://www.ashrae.org/aboutus/page/ashrae-and-industry-history).

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