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WROCŁAW SCHOOL OF BUILDING WATER SUPPLY

The paper presents the origins, activity and achievements of research team specializing in supplying water to buildings. This team has been working at the Wrocław University of Technology within the Environmental Engineering Department since the foundation of the department in 1950 till now. Along with numerous organisational changes in the last 50 years, the team has been known under various names. It was established as the Department of Sanitary Installations. Nowadays it adopts the name of the Sanitary Installation and Balneotechnics Department. Throughout all the years of scientific activity of the team, the integrated treatment of warm and cold water systems was a primary subject of the studies. The achievements in this field have been appreciated, hence the honest opinion about the Wrocław School of Building Water Supply is widely accepted.

1. INTRODUCTION

In 1950, together with the foundation of the Environmental Engineering Department of the Wrocław Technical University, Professor Tadeusz Jeżewski established the Department of Sanitary Installation, specializing mainly in the systems of water supply to the buildings. The achievements of Professor Jeżewski were based on assembling an appropriate research and teaching team and establishing a proper material and laboratory basis. He prepared original plans of the studies and thought up the programs of lectured subjects. These activities resulted in a the large number of students enrolled on a master program and engineering evening programs as early as in the fifties, and also in a high level of education, including the teaching of water supply systems.

In 1953, Professor Mikołaj Marczuk began his scientific career in the Department, and in 1963, after the death of Professor Tadeusz Jeżewski, became its head. Professor Mikołaj Marczuk, who was of a particularly inquiring scientific disposition, critically studying literature and possessing wide experience, set an original scientific course. This course, though adopted to new times and technical development, has remained unchanged till now. Originality of this scientific profile can be mainly ex-

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plained by its integrated approach to supplying warm and cold water to buildings. This problem was not studied in other centres, not in Poland, nor abroad. The studies carried out in our Institute have brought numerous successes that as early as in the eighties justified the opinion about the Wrocław school of supplying water to buildings.

This paper characterizes the specificity of the research in the field of water supply systems and presents the most important research and development of the Environmental Engineering Department during 50 years.

2. CHARACTERISTICS OF THE RESEARCH

In the present day, water supply to buildings is a complex scientific and technical problem when compared with the old simple solutions. In the past, external water-supply lines were the only and sufficient source of water and energy for all water uptake points in the building. In modern buildings, there is observed a constant pursuit of a greater comfort of water supply, and at the same time greater difficulties in obtaining drinking water and energy necessary for internal water pipes appear.

Central installations of warm utility water are the basic equipment of modern buildings. Besides, the stations of pressure elevation are constructed. Therefore, the conception of water supply to the building should pertain to the whole system of installation as well as to heat and hydraulic equipment that conduct warm and cold utility water to uptake points. The cold and hot water installations have the same source of water, the same from the hydraulic viewpoint, uptake point (battery) and the same recipient (consumer). Therefore, in all scientific studies and technical solutions this coherence should be taken into account. Otherwise construction of effective and economical systems is impossible. This obvious fact did not find its reflection in scientific inquiries. Usually, both in literature and in practice, the installations of cold and warm water are considered as separate systems. Therefore, the studies of hydraulic and thermodynamic processes connected with the dynamics of uptake, transportation and storage of hot water were not conducted. This means that the subject directly connected with cold water systems has not been studied.

Now this situation is substantially different due to the research conducted at the Wrocław University of Technology. These investigations resulted in the papers describing both integrated installations for hot and cold water. This approach allowed many accomplishments and became the main subject investigated in the Wrocław school of water supply to the buildings.

3. ACCOMPLISHMENTS

In the fifties, besides the organisation of team and formulation of teaching programs for students, the activity of Professors Tadeusz Jeżewski and Mikołaj Marczuk

together with Doctor Edmund Nowakowski resulted in many research and engineering works. They dealt with the rebuilding of important objects destroyed in Wrocław and Lower Silesia area during the Second World War. In the contemporary understanding, however, their activity cannot be called as strictly scientific.

Scientific activity was initiated and organised by Professor Mikołaj Marczuk at the end of the fifties. One of the first scientific problems was that concerning warm utility water systems with a pressure container and a loading pump in a low position. Among others, he described [1] the relatively complex hydraulic processes occurring in these systems, giving the foundations of its further designing. They are still valid, since in practice, naturally modified and automated hot water systems are nowadays the most widespread systems.

In the sixties, the team constructed modern pipeline systems in high buildings and established foundations of the designing and exploitation of hydrophore devices. The results obtained were presented in about 30 publications, in one book [2] and many papers [3]–[5]. Edmund Nowakowski patented five original constructional solutions of water-pipe systems in the buildings.

In the next decade, the seventies, an electronic computation became the basic tool in our research. Testing the methods allowing calculation of water streams in internal water pipes [6] and in circulation systems of hot utility water [7] was undertaken. New constructional solutions of hot water systems were patented (two patents) by Professor Janusz Jeżowiecki. In this period, the work started earlier on the enlargement of water pressure stations was continued. An important practical problem dealing with the volume of intermediate surge tanks was solved [8]. Besides this hydraulic properties of float valves used in low-pressure tanks were examined in laboratory, and the results were published in the monograph [9].

The main topics of our interest were as follows: technological and water-pipe solutions in laundries, restaurants, health centres and balneotechnical facilities. The accomplishments in these areas are gathered in the book [10].

The most intensive development of our team, both in the number of studies conducted and achievements, was observed over two last decades when Professor Janusz Jeżowiecki became the leader of the team (in 1984 Professor Mikołaj Marczuk retired). This period was initiated by his monograph [11], which established theoretical basis of the operation of the integrated systems of hot and cold water supply. The results of this paper determined directions of further studies. They can be distinguished as the following thematic blocks:

- mathematical modelling of hot utility water uptake and the requirement for energy; the results are included, among others, in papers [12], [17],
- stochastic modelling of water uptake in internal installations, treated as the phenomenon which occurs at a certain moment [18]–[22],
- simulation methods of water-pipe installation operations consisting in artificial trials, i.e. in a generation of the variable, which is appropriately large in number and composed of the vectors characterizing a water uptake [23]–[26],

- probabilistic methods of the evaluation of water-pipe installations [27]–[29],
- basis of multi-pump integrated hydrophor devices and circulation systems of hot utility water [30]–[32],
- loses of the pressure in plastic water-pipe installation [33]–[35].

The results of the studies described above, mainly of basic character, can be applied in numerous practical solutions that are used in the design of water supply systems. The team defined many guiding rules for design and standards, including several Polish Standards. The results of scientific activity was at once presented to students and used in their master theses.

The team have many successes in the teaching field. Four manuals [36]–[39] for students seem to be the most important. Moreover, many unpublished instructions for project and laboratory classes and other educational equipment were prepared.

4. CONCLUSIONS

Water is supplied to buildings by means of water-pipe and sewage systems, which are the subjects of environmental engineering. Environmental engineering deals with a narrow range of scientific problems compared with other disciplines. Relatively small number of researchers are active in this field in Poland and abroad. Therefore, a considerable weight should be given to the successes and opinions about the Wrocław school of water supply to buildings reflecting the range of the problems investigated by our team.

The publications cited were considered as most important. In such a short paper as this, it was impossible to present others, equally valuable. At the end our team will be presented in terms of numbers. The number of researchers have always approached 10 and over 50 years of its existence altogether 30 people were employed. They published about 500 scientific papers, 3 books, 8 manuals for students and 10 scientific monographs. They issued 30 patents and 4 Polish Standards. The results of our research were presented at many scientific meetings in Poland and abroad; among others in Piestany, Minneapolis, Sorrento, Copenhagen, Monastyr, Pécs, Nitra, Losanne, Karlsruhe, Vilnius and Istanbul. In our team, six theses were written on water supply, three persons presented theses for doctor of sciences, and one person obtained the title of full professor. This information and numbers do not fully evidence the weight of our achievements, but they can illustrate in some degree the 50-year activity of our team.

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WROCŁAWSKA SZKOŁA ZAOPATRZENIA BUDYNKÓW W WODĘ

Przedstawiono powstanie, działalność i osiągnięcia zespołu naukowo-badawczego specjalizującego się w zaopatrzeniu budynków w wodę. Zespół ten istnieje na Politechnice Wrocławskiej na Wydziale Inżynierii Środowiska od 1950 roku. W ciągu minionego 50-lecia w zespole nastąpiły liczne zmiany organizacyjne i zmieniała się jego nazwa. Powstał jako Katedra Instalacji Sanitarnych, obecnie jest to Zakład Instalacji Sanitarnych i Balneotechniki. W całym okresie działalności naukowej zespołu oryginalnym kierunkiem badań było zintegrowane traktowanie systemów zimnej i ciepłej wody. Osiągnięcia na tym polu ukształtowały opinię o istnieniu wrocławskiej szkoły zaopatrzenia w wodę.