

## PAGES FROM THE HISTORY OF FLUID POWER IN ROMANIA

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**Abstract:** *Fluid Power has a good tradition in Romania, with a history of over 60 years. Over the years there have been several factories or special sections within large industrial plants in which both equipment and hydraulic systems were manufactured.*

*It should also be noted that there have been several research & design centres of good technical level among which the most important was the one which today is known as IHP Bucharest.*

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### 1. Introduction

There are data about Hydraulics published since antiquity, when the first technical books with chapters related to water or air drive were written, such as Archimedes' work on buoyancy of bodies. After the black period of nearly 1,000 years of ante and early Middle Ages with no significant technical and scientific achievements, interesting ideas arose again in the middle period of the Middle Ages. Leonardo da Vinci's work "On Motion and Measurement of Water" is a reference in this respect. A real technical explosion occurred in the 16th and 17th centuries when in countries (or regions of these countries) such as Italy, France, Germany, England or Russia, research has been developed, books have been written and many equipment and machines have been developed, which, in course of time, have entered the history of Fluid Power; so are the writings of Galileo and Newton. Starting with the 18th century, the basic technical and scientific elements of the Hydraulics were created by personalities such as Leonhard Euler, Daniel Bernoulli, Chezy, Darcy, Stokes, Reynolds, Jukovski, Prandtl, and suchlike.

In Romania, the first achievements in the Hydraulics belonged to professors such as D. Pavel, A. Barglazan, I. Anton, George Constantinescu, Dionisie Ghermani, Caius Iacob, D. Dumitrescu, St. Zarea, M.D. Cazacu, E. Carafoli, C. Mateescu, in mid-20th century. However, there still could be no mention of achievements in the field of hydrostatic or pneumatic drives and not even a clear definition of this field.

The first field practitioners emerged in the 1960s and 70s of the 20th century when engineers such as Marin Virgil, Theodor Demetrescu, N. Oprea, S. Dobrescu, I. Mazilu, A. Popov, G. Radulescu, G. Brebu, L. Sandu, C. Bogoiu, G. Tarlescu, R. Visan, P. Drumea M. Iordanescu, I. Solomon, V. Popa, I. Campean, D. Teneslav, I. Irimia, D. Lazar, C. Arama, R. Moscovici, D.C. Popescu, C. Corodeanu, M. Comes, M. Popescu, S. Medar, G. Trica, have designed and introduced into production the first hydraulic and pneumatic equipment. At that time, the first specialized factories appeared, such as those in Sibiu, Ploeni, Bucharest, Focsani, Ramnicu Valcea, Bistrita, Sinaia, Cluj-Napoca, Stei, Braila, Galati. Nowadays the field has been and still is kept up by several production units located in Bucharest, Iasi, Ramnicu Valcea, Sibiu, Brasov, and several research centers such as INOE 2000-IHP Bucharest (M. Blejan, I. Lepadatu, T.C. Popescu, N. Ionita, C. Cristescu, G. Matache, R. Radoi, C. Dumitrescu, L. Dumitrescu, I. Balan, R. Sauciuc) and the research centers of the technical universities in Iasi (C. Chirita, D. Calarasu, A. Hanganu), Cluj-Napoca (L. Deacu, I. Pop, L. Vaida, D. Opruta, L. Marcu, D. Banyai), Bucharest (N. Vasiliu, C. Calinoiu, M. Avram, D. Prodan, A. Olaru, P. Patrut, I. David, N. Tonciu, N. Alexandrescu), Timisoara (I. Bordeasu, E. Dobanda, V. Balasoiu, M.O. Popoviciu), Galati, Brasov and Constanta.

## 2. Research and design centres

Hydraulic drives have reached great bloom in Romania through the emergence of specialized design and research centers and also through the establishment of factories or departments within large enterprises, which produced hydraulic equipment and systems.

During the period 1950-1965 many research and design units of national interest, called "Institutes", have emerged in Romania; within them there were created fluid power departments, called "design workshops". In this sense, the most famous ones were those from IPROMET (Dipl.eng. Tarlescu), IPROLAM (PhD.eng. B. Pitigoi, Dipl.eng. Gh. Vladescu), IMUAB (PhD.eng. Popov, PhD.eng. I.Mazilu, S. Medar, D. Hancu), ICPAT Brasov (R. Moscovici, B. Tavidian, T. Cocis). The most famous and also the most important unit of its kind was the research and design workshop for hydraulics and pneumatics created in the years 1958-1962 at the ITCM institute, known later as ICTCM. The organizational finalization was accomplished with the arrival of the engineer Marin Virgil along with the young engineers Theodor Demetrescu and S. Dobrescu from the Pump Manufacturer (later known as Aversa). The first headquarters of this team was in the Machine Tools Institute (IMUAB) area, until they moved to the headquarters in the South Market. During this period, for several years, until 1971, the hydraulic workshop also had a headquarters in the Arsenal area for microproduction and laboratories. After 1970 the main task of this team was to develop the nomenclature of the products that were assimilated by the specialized factories (HESPER, Balanta Sibiu, HERVIL Rm. Valcea, etc.), or large specialized sections (Plopeni, Braila, Focsani, Bistrita, etc.) of some industrial complexes. To better meet this task, the design workshop was organized between 1979 and 1991 in specialized teams according to the manufacturing profile of a partner plant. Thus there arose Focsani Hydraulics Team initially led by C. Barhala, then led by Gabriel Radulescu, Sibiu Hydraulics Team led by Radu Visan, Valcea Hydraulics Team led by Petrin Drumea, the (2) Hesper teams led by Lucian Sandu and Corneliu Corodeanu, the Team of Pneumatics whose leader was Dan Popescu, with V. Tutunaru and Ileana Oprisescu as principal design researchers; it collaborated with Balanta Sibiu and Mecanica Bistrita. Following the regrouping of the hydraulic plants within the Precision Mechanics Center, it was also decided to move the hydraulics and pneumatics workshop from ICTCM to CCSITMFS, in June 1980, and to transform it into a sector and then into a subsidiary of the new institute, without changing profile, tasks or leadership. With the moving of the team to the new building on Cutitul de Argint Street, in 1983, the staff grew to over 300 people, out of which about 200 people were involved in the research & design activity, which led to a great increase of the field, which soon surpassed the number of 35,000 staff involved. Since 1995 the subsidiary has detached itself from the Precision Mechanics Institute and has turned into ROMFLUID Trading Company with a research profile, with Radu Visan as general manager and Petrin Drumea as technical director. In 1996 the research sector of ROMFLUID has separated itself and, together with an Optoelectronics Center on the Magurele Platform and a Research Center in Cluj-Napoca, made INOE 2000. The hydraulics and pneumatics team has become the Hydraulics and Pneumatics Research Institute (IHP), with the status of a subsidiary of INOE 2000. The Director of IHP since its founding has been Petrin Drumea (from 1996 to 2014), and from 2004 to 2011 Gabriel Radulescu has been technical director. Starting with 2014, the directorate of IHP has been taken over by Catalin Dumitrescu. In these years (after 1992) the structure of the institute has changed by giving up the plant-dedicated teams structure, and switching to 3 large departments which cover the basic directions of research in the field, namely: Hydraulics and general hydraulic systems; Pneumatics and renewable energies; Mechatronics, electronics, hydrotronics. The heads of these departments are Ion Lepadatu, Gabriela Matache and respectively Radu Radoi. Apart from the research and design activities, the Institute has undertaken editing of the specialized magazine "Hidraulica" (Managing editor P. Drumea, Editor-in-chief G. Matache), coordination of the International annual Symposium HERVEX and coordination of the professional association FLUIDAS. IHP has also undertaken organizing training courses in accordance with the requirements of the European Association CETOP.

### 3. Hydraulic or pneumatic equipment manufacturers

The first production of hydraulic equipment can be considered the manufacturing of gear pumps by the pump factory in Bucharest, also known as Aversa, under technical coordination of Dipl. eng. Ganea.

After 1960 the manufacturing of various equipment specific to the production of tractors and trucks began at I.M. Sinaia, or even in Brasov. At some point, part of manufacturing of Sinaia was transferred to Breaza and other localities from the Brasov area.

An extremely important step was made by introducing into fabrication axial piston hydraulic pumps and motors at I.M.Plopeni (I. Irimia, D. Teneslav, G. Bucurescu, I. Daisa, G. Rotaru, I. Juncu), under a Brueninghaus license (today at Bosch-Rexroth), gear pumps and hydraulic cylinders. The experience gained by the specialists here in assimilating gear pumps standard Plessey has enabled rapid integration of these new equipment, with great influence in the industrial development of the country.

A new step in the development of hydraulics was the beginning of the manufacturing of 200-bar hydraulic equipment (designed in Romania by the team led by Th. Demetrescu and then by Radu Visan) at I. Balanta Sibiu, with the creation of the new plant Balanta2, later known as Hidrosib. Right during the manufacturing phase of the 300-bar family of appliances a license was purchased from Germany from Bosch for pressure valves and hydraulic directional valves of 300 bar. The manufacturing was coordinated technically and organizationally by a series of engineers, among which we mention Solomon, Ocos, Mandea, Lazar (transferred from Plopeni), Popa, Necula, Campean, Pascu. Currently the plant decreased in number of employees from 2000 to 35. About the same time and in the same place, namely in Sibiu, but at Independenta, pneumatic air preparation equipment (filters, regulators and lubricators) was introduced into production. Today there is no pneumatics manufacturing.

The company ISEH Focsani, turned to ROMSEH, has introduced into production the first stack style directional valves, under the coordination of engineers A. Bourceanu, L. Veber, Pricop, starting from the designs drafted in IHP under coordination of engineers C. Barhala, G. Radulescu and P. Drumea. The plant soon developed its production with monoblock stack valves and proportional stack valves. Although this manufacturing has been successful, effective production has quickly ceased. In those years (1985-1990), hydraulic throttles and regulators were also introduced in the manufacturing, and also stands for hydraulic equipment, according to own designs or designs elaborated by IHP. Nowadays, there is no kind of hydraulics manufacturing in our country.

For many years (starting from 1965) pneumatic equipment has been manufactured in Sibiu by the two large factories Independenta (air preparation units - FRL) and Balanta (directional control valves and regular valves), but starting from 1972 manufacturing of pneumatic equipment has been transferred to I.M. Bistrita by Mr. Dan Popescu from IHP and by the specialists of the plant led by Mr. I. Fiscutean. Nowadays, there is no such manufacturing in the country.

Of great interest was the appearance in the group of hydraulic manufacturers of the plant in Ramnicu Valcea (G. Popa, O. Fota, Gh. Rizoiu, C. Dinescu, G. Surlin, Cichirdan), which, based on the designs of S. Medar, G. Trica from ICSIT TITAN, P. Drumea, M. Stefan, I. Balan, N. Oprescu, N. Ionita from IHP, have assimilated into series manufacturing families of hydraulic filters, pneumatic-hydraulic accumulators, proportional devices and servovalves, hydraulic cylinders and lubricating equipment. A family of high-pressure (700 bar) equipment and devices has also been introduced into fabrication by the specialized team of IHP located in Ramnicu Valcea, led by I. Galea and coordinated from IHP by P. Drumea. Today the plant is taken over by an Indian manufacturer and is restricted to manufacturing of hydraulic cylinders.

An interesting case is the plant HESPER, former Steaua Rosie, in Bucharest, which in the 1970s, under the directorate of Mr. Bratulescu, introduced in manufacturing hydraulic power steering and slow orbital engines. The real step towards the big hydraulics was made when the gear pumps were assimilated in the manufacturing; such equipment has been developed especially since 1993, under the coordination of the Ph.D. engineer Mircea Pricop. Today, the plant, privately owned, with

Romanian capital (business owner Mircea Pricop), produces and exports intensively gear pumps, and it is the most powerful Romanian company in the field of hydraulics.

The factories in Galati (hydraulic cylinders), Braila (slow-type motors, hydromotors and hydraulic systems and cylinders), Sinaia, Breaza, Stei, Sibiu (Independenta), Fagaras (pneumatic equipment) have reduced their production capacity close to zero.

#### 4. Field support activities

The event called "HERVEX" was born in 1993 due to the desire of the management of the hydraulic equipment production company (IEH Ramnicu Valcea, which later became HERVIL) to make a different type of marketing through a complex exhibition of company achievements. In this respect, the company director, Dipl.eng. O. Fota, together with the main collaborators, Dipl.eng. C. Dinescu, Dipl.eng. Gh. Surlin and Dipl.eng. Gh. Rizoiu, have asked the colleagues at the Hydraulics and Pneumatics Institute in Bucharest (Dipl.eng. R. Visan, Dipl.eng. G. Radulescu, Dipl.eng. P. Drumea, Dipl.eng. I. Lepadatu, Dipl.eng. St. Breazu) with which they have been collaborating since the plant was set up, to add a technical and scientific touch to the exhibition formula. If in the first year this cooperation was manifested through general discourses and presentations, starting with the second year besides the exhibition a second direction of the event materialized, namely a technical and scientific symposium. Also, a third partner joined the first two partners (HERVIL and IHP); thus, the partnership included the Chamber of Commerce and Industry Valcea (CCIVL), which, as time went on, has taken over a large part of the organizational activities through the involvement of the then (and current) President, Dipl.eng. V. Cismaru. It was very important the transfer of Dipl.eng. Gh. Rizoiu from HERVIL to CCIVL as thus the organizational level increased, considering the fairly rapid increase in the size of the event, and the Chamber of Commerce has become, together with the Institute in Bucharest, a pillar of the organizational process. After the first three years, HERVEX has become quite known nationwide, and in the following years it became known internationally, too, both through its exhibition direction and through its technical-scientific direction. During this period, the technical universities in Bucharest, Iasi, Cluj-Napoca and Timisoara joined the three original partners by including in the organizers' team some personalities like Prof. P. Svasta, Prof. Al. Marin, Prof. E. Murad, Prof. C. Chirita, Prof. L. Vaida, Prof. D. Opruta and Prof. I. Bordeasu. The spectacular leap was achieved by including PIA Aachen, Germany (through Dr. Ing. Elmar Dorgeloh) and the University in Wroclaw, Poland (through professors Chrostovski, Domagala and Kędzia), in the group of organizers. Thus, the number of annual exhibitors has grown to 55 companies, and the number of participants to over 400 people. A lot of participants that we could not record officially added to this number. Of course, the involvement of the FLUIDAS Professional Association as an organizer and the support from ANCS have expanded the area of European knowing and recognition of HERVEX, let only consider the fact that it has been included in the international catalogue of events of CETOP (the European specialized Association). During this period the organizers found an extremely welcoming and cooperative host in Calimanesti-Caciulata through the hotel complex Cozia - Oltul - Caciulata, and especially through the person of the economic director, Mr. Necsoiu. Initially, the event was also supported and encouraged by local officials both in the Calimanesti town hall and in the Valcea County Council; the managers of these authorities even used to attend the opening ceremonies of the event. Over time, their involvement has diminished to the situation of recent years when we have not had with us any person in the board of the local authorities, even if HERVEX became interesting and emblematic for the county. As at some point the number of participants and the level of national interest decreased, several years ago, two steps were taken to bring us back to the standards that the world became used to when it came to HERVEX. The first step was to switch from the annual basis to the biannual basis of HERVEX organizing. The second step was to include, as main organizer next to IHP and CCIVL, the KOMAG Institute in Katowice, Poland, thus the event taking place alternately one year in Valcea and the next year in Poland. Although things went really well for four years, the Polish institute has recently undergone transformations that prevented it from continuing this agreement. With the decline in hydraulic and

pneumatic manufacturing, the exhibition section has dramatically decreased; it has been compensated for a while by the symposium section, which has been maintained at a good level both quantitatively and qualitatively. In this respect it is worth mentioning the presence of outstanding representatives of the university research centers in Aachen, Dresden and Darmstadt - Germany, of research centers in Milano and Torino - Italy, Poitiers and Angouleme - France, Wrocław, Katowice and Cracow - Poland. Throughout this period HERVEX has preserved hydraulics and pneumatics as its main areas, in spite of all the problems created by the dramatic reduction of production and even use. To keep the symposium at a high technical-scientific level the organizers have opened in the last few years also directions like the environment and renewable energies hoping to add new co-organizers to replace those who are not as close to us as they used to be in previous years. The organizers also decided that only two or three specialized companies should be presented per each event issues; the chosen companies were those able to expose their industrial and development offer.

Foundation of the Professional Association FLUIDAS has represented an extremely important achievement during the rather unclear period regarding the situation of the domain in the years following 1990. Domestic manufacturers were totally confused about the development of the field, and foreign manufacturers did not have enough data on needs and areas with development potential. At that time, there were countless attempts to coagulate manufacturers and distributors of hydro-pneumatic equipment in an association, without achieving the desired results. Only in the years 1995-1996, under the coordination of IHP and with sustained support of CCI Valcea, Hydramold Iasi, HESPER Bucharest and some young companies in Brasov, Constanta and Bucharest, the founding of a professional association, with a well-defined status and a firm organization, was finally successful. In addition to the over 40 companies that adhered to FLUIDAS there was also created a section of specialists in the field, regardless of whether they were working in production, education or research. The first president was Mr. P. Drumea from IHP, and had as main collaborators Mr. Rizoiu (Valcea) and Mr. C-tin Chirita (Iasi). Shortly (1997-1998), FLUIDAS became a member of the European Professional Association CETOP, attending all meetings of European interest, until recently. The association's problems arose when almost half of its members have entered into insolvency (or bankruptcy), and no new-entries of the industrial landscape have been co-opted.

Another element of interest for the field was the appearance of the specialized magazine HIDRAULICA. Slowly, it was turned into a scientific journal with international spread, and this reason has made it to move away from hydraulic and pneumatic manufacturers and distributors. However, there is still a great interest in it, the magazine being quite appreciated internationally, especially as it was directed mainly at the field of applied research, including primarily scientific papers about pieces of equipment that are the subject of manufacturing. Another important element is the team of specialists who review the works and do not allow insignificant material to be published.

## 5. Conclusions

- 5.1 Hydraulics and pneumatics represent a field of great interest.
- 5.2 Domestic production has decreased over the last years and has not managed to recover.
- 5.3 There is a great interest in the design and development of hydraulic and pneumatic drive systems.
- 5.4 In the past few years, an increasingly intense maintenance direction has been developing.
- 5.5 There are still resources in the field of research and design in hydraulics and pneumatics.