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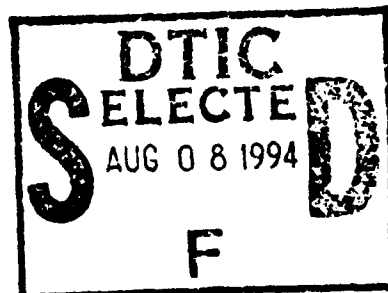
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SCIENTIFIC SEMINAR ON PNEUMATIC-HYDRAULIC AUTOMATION

- USSR -

[A Translation]

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SCIENTIFIC SEMINAR ON PNEUMATIC-HYDRAULIC AUTOMATION

[A Translation]

Avtomatika i Telemekhanika

A. I. Semikova

[Automation and Telemechanics],
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The Third All-Union Conference-Seminar on Pneumatic-Hydraulic Automation was convened from 18 to 19 May 1959 at the Institute of Automation and Telemechanics, Academy of Sciences USSR.

The Conference was attended by 308 persons from 18 cities; altogether, 98 organizations working in the field of pneumo-automation were represented.

On opening the session, the Chairman of the Seminar, M. A. Ayzerman, noted the important role played by annual conferences in the cause of the organization of activities, and familiarization with new developments in the given field of science. Personal acquaintanceships contracted during such seminars are also very important.

The Conference began with a plenary session at which several reports were heard, whereupon the activities of the Seminar were conducted to two Sections: Pneumatic Automation and Hydraulic Automation; general discussion was initiated at the final plenary session.

The first report to be read was that of Z. Ya. Beyrakh concerning an electronic-pneumatic auto-regulation system combining electric measuring and summing devices with a pneumatic actuating mechanism, which is more reliable than an electromechanical one. The data pickups and amplifiers used in this system are the serially manufactured elements of an electronic regulation system. The error signal, amplified in the electronic part of the system, guides, through an electro-pneumatic relay, a piston-type pneumatic servomotor.

This system makes it possible to automate the types of production susceptible to the hazard of fire and explosion, in which connection all electrical elements and circuits can be spaced at a considerable distance from the production object.

V. D. Mironov (Moscow) in his report on "A Pulsed Electronic-Hydraulic Regulator" described an electronic-hydraulic version of a sequential pulsed electronic-mechanical regulation system. The lecturer provided a description of the design of two versions of pulsed electro-hydraulic actuating mechanisms. The first version contains an original driving element -- a toothed hydraulic turbine guided by a flexible valve. The second (simplified) version consists of a diaphragm-type actuating mechanism guided by two electro-valves.

The report of A. A. Tal' and T. K. Berends (Moscow) on "New Elements of Discrete-Action Pneumatic Devices" contained a description of a new system of elements making it possible to construct complex relay-contact pneumatic schemes with any terminal automatic devices. The pneumo-throttles and pneumo-relay make it possible to execute the elementary operations of instantaneous logic (negation, repetition, conjunction, etc.) and any primitive (single-cycle) schemes. Moreover, a discrete single-cycle-delay element devised on the basis of the same apparatus has made it possible to construct, in combination with instantaneous-action elements, nonprimitive (multiple-cycle or sequential) schemes. The continuous-memory cell devised for this apparatus is independently of importance.

The elements developed in this way served as the basis for devising devices of major industrial importance such as: isodromic regulator with automatic readjustment, regulating chromatograph, etc.

E. S. Araumanov (Kirovokan) discussed multiple-point pneumatic-electric and pneumatic recorders.

The Section on Pneumatic Automation

At the Section on Pneumatic Automation the first lecturer was L. A. Zalmanzon, who read a report on "The Characteristics of Small Inter-Throttle Chambers," describing a study of the characteristics of chambers in which, owing to the contraction of air flow by the walls, pressure varies considerably with length of chamber. The report cited generalized characteristics and indicated the methods of computing certain types of chambers. It pointed to the possibility of utilizing small inter-throttle chambers as correctors or converters of one pressure as a function of another.

I. V. Vayser (Moscow), in her report on "Analysis of the Possibilities of Converting the Operation of Pneumo-Automatic Devices to Low Feed Pressures," examined the possibility of converting pneumo-automatic devices to a feed pressure of 100

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millimeters of the water column, which would yield considerable technical and economic advantages.

The report cited the results of experimental testing and comparison of the performance of the principal elements of pneumatic systems, when operating under feed pressures of one atmosphere and 100 millimeters of water column. It examined a relay of the "nozzle-vane" type, a diaphragm unit, dead-end and through-flow chambers, and long lines.

The results of experimental investigations made it possible to conclude that the transition to a feed pressure of 100 millimeters of the mercury column does not deteriorate the performance of the elements of pneumatic systems, and that, moreover, it simplifies appreciably the supplying of instruments with water.

A communication on new design developments of pneumo-automatic instruments by the Design Department of the TsLA [Central Laboratory of Automation] was made by P. M. Shanturin (Moscow), who described the design developments of parts of pneumatic instruments from plastics.

The plastic parts, produced by the pressing method, display higher strength and are easy to machine. The serial assembling products is greatly simplified, because finishing and adjustments are no longer necessary. The instruments constructed from plastics can be employed in aggressive media, display resistance to frost and heat, and, moreover, yield substantial economic savings.

V. G. Ponomarenko (Khar'kov), in his report of "Using the Pneumatic Regulation Apparatus for Automating the Benzol-Scrubber Department of a Coke-Chemical Plant," described schemes of the automation of the benzol department and the performance of a coupled-regulation device which makes it possible, in the presence of quality sensors, to construct schemes of quality control and to concentrate the regulation of all parameters within a single assembly.

A communication by N. L. Kharas, V. R. Anders, and T. K. Berends (Moscow) concerning joint operation contained a description of a pneumatic control unit of a regulating chromatograph, designed for continuous control of the composition of gas fluxes directly on technological installations. The industrial chromatograph equipped with that pneumatic control unit unlocks new prospects for over-all automation. The control unit's design is based on discrete-action pneumatic apparatus. It contains a timer (command device) and actuating devices (two disjunctive schemes and continuous-memory cells).

A. A. Tagayevskaya (Moscow) discussed, in her report, a new attachment to the external regulator for adapting the latter for use on objects in which the "optimiziruyemaya (optimized)?" magnitude depends on n positions of control organs. The attachment has been executed from elements of a system of pneumatic logical discrete-action devices.

A. I. Senikova (Moscow), in her communication on "Experimental Investigations of the Characteristics of the Jet-Flow Elements of Pneumatic Automation," shed light on the results of experimental studies of the effect of the change in the geometrical dimensions of elements on their output characteristics.

A report on the subject of "Dynamic Characteristics of Pneumatic Regulators and Their Adjustment in Industrial Objects" was made by R. A. Auzan (Moscow). The report cited the results of experimental investigations of the dynamic characteristics of sequential pneumatic control apparatus.

The data yielded by these investigations made it possible to characterize and evaluate the dynamic qualities of standard units -- the AUS (standardized assembly system), the MAUS (small standardized assembly system) and the TsLA (system of the Central Laboratory of Automation under the Chernmet /Scientific Research Institute of Ferrous Metallurgy) -- and to draft instructions for adjusting the AUS regulators to a large class of industrial objects. The results were illustrated on one of the standard units of an AUS. Also cited was an evaluation of the rapidity of action of several old-type and compensating data pickups.

N. L. Ianin (Moscow) described, in his report, a continuous-operation pneumatic analog installation. The machine's solving elements have a virtually unrestricted time of integration.

Schemes of the differentiating link and the delay unit were presented.

V. I. Chernyshev reported on a project conducted jointly with V. N. Dmitriyev (Moscow) concerning the study of a pneumatic piston-type actuating mechanism with a constant load on the piston rod. The report described a graph-analytic method of computing the rate of that actuating mechanism. The lecturer provided a comparison of experimental and computed data.

A communication on the subject of "A Pneumatic Piston-Type Follow-Up Drive for General-Industrial Purposes" was made by V. M. Gorokhov (Khar'kov). The new design of automatic drive is

distinguished from the other designs by its simplicity, compactness and high sensitivity.

The joint communication by V V Volkov, E. Yu. Gutnikov and M P Kogon (Sverdlovsk) touched upon the automation of long-stroke pneumatic devices.

A report by C I Berezovets on a study conducted jointly with Postgraduate Student Chou Ching-lien (Moscow) described the results of an experimental investigation of the characteristics of the diaphragms of pneumatic regulators. It cited the experimental characteristics of the change in the effective area of diaphragms owing to the displacement of the rigid center and owing to pressure drop, and also the results of a study of the performance of diaphragms executed from various materials. It provided an evaluation of the effect of diaphragm characteristics on the quality of performance of pneumatic devices.

I I Kazeyev (Kirovokan) in his communication provided recommendations concerning the methods of computing and selecting control valves.

Ye. A. Andreyeva (Moscow) discussed the results of a study of the power and delivery characteristics of the elements of the nozzle-vane type, as related to the flow of a compressible viscous fluid. Her communication cited a comparison of experimental and computed curves.

In their joint communication A G Arkad'yev and M. L. Podgoyetskiy (Moscow) described pneumatic converters transforming small stresses of 0.2 to 10 grams into standard compressed-air pressures of 0.2 to 1 atmosphere, and the development of a pneumatic data pickup with an isodrome amplifier in the feedback line. The pickup contains dynamic-adjustment elements.

The Section on Hydraulic Automation

V N Veller (Moscow), in his report on "The Theory and Design of High-Sensitivity Piston Mechanisms," expounded a solution of the problem of increasing the sensitivity of piston mechanism by utilizing self-centering pistons. Owing to special annular grooves and drainage belts on the working surface of the piston, the latter, while in operation, maintains itself in a rigorously coaxial position in relation to the cylinder axis.

I. Yu. Klugman (Odessa), in his report on "Certain Considerations Regarding the Selection of Hydraulic Copying Systems for Machine Tools,"

examined the systems of hydraulic-copying machine tools and their principal elements -- valves, actuating mechanisms, and power sources (pumps).

The quality of the systems was determined by the ratio of the diameters of the cylinders of a given system to the diameter of the cylinder of the system with minimal dimensions. Recommendations were provided as regards the selection of hydraulic copying systems.

Yu. Ye. Zakharov in his communication "On the Hydrodynamic Force and the Delivery Coefficient in Valves" described a calculation of the hydrodynamic forces and the delivery coefficient by the method of the theory of "airfoil flow".

A. F. Arkhangel'skiy reported on a newly developed small-size high-capacity high-pressure pump for the hydraulic system of a 250-HP tractor.

In his communication, M. S. Tumarkin offered a uniform method of approach toward studies of hydraulic systems by three stages:

- (1) Examination of systems to be conducted from the standpoint of both their design and the guidance of actuating mechanisms;
- (2) Evaluation of systems to be conducted according to six fundamental characteristics (rate, tractive power, coefficient of intensification of rate, mismatch, coefficient of rigidity, coefficient of insensitivity);
- (3) Testing of systems to be conducted by plotting the characteristics in the form of total response curves while feeding a signal with a constant acceleration.

N. S. Garmynin in his communication provided a characterization of the hydraulic assemblies employed in follow-up systems. The lecturer cited rate, frequency and load characteristics, as well as the transmission functions of the hydraulic-system elements (valves, pump drive) and of the hydraulic system as a whole.

The report of V. M. Dvoretzkiy (Moscow) was concerned with a device for obtaining small and stable fluid deliveries, operating on the principle of control of the pressure drop in a fixed restrictor.

V. D. Konstantinov, in his communication on "The Hydraulic Assembly as an Object for Regulating the RPM of Synchronous Generators" examined a hydraulic assembly consisting of the drive and a synchronous generator, cited various design schemes, derived

differential equations, and provided an evaluation of the delay time.

At the concluding plenary session G. I. Papernyy (Leningrad) read a report of "A Pneumatic System of Automatic Regulation of the Combustion and Feeding Processes in Boiler Installations," in which he described such a system developed at the TsKTI [Central Scientific Research Institute for Boilers and Turbines]. This system was developed on the basis of the principle of the compensation of forces, considered to be the most promising basis.

The industrial trials of the pneumatic system of automatic regulation of the combustion and feeding processes in boiler installations have demonstrated the workability of all elements of this system and their high sensitivity.

The report by B. L. Korobochkin (Moscow) contained the results of studies of the dynamics of the hydraulic drive of a copying machine.

Lastly, V. S. Prusenko read a communication concerning certain instances of the construction of schemes of cascade and inter-coupled regulation of thermal processes, on the basis of the instruments of a general-industrial-purpose standardized pneumatic assembly system.

The Comrades taking part in the debates have unanimously emphasized the great importance of the annually convened conferences, and have expressed a number of comments and suggestions for improving the organization of the exchange of experience among the organizations participating in the Conference's work.

Certain Comrades -- P. M. Shanturin (Moscow), A. F. Arkhangel'skiy (Chelyabinsk), L. A. Sopochkin (Lisichansk) -- offered suggestions for improving the organization of the annual conferences: speedier publication of the Trudy [Proceedings] of the Conference, prior mailing of the theses of the reports, organization of exhibitions, and the publication of a special bulletin on our Seminar.

I. F. Kozlov (Moscow), V. G. Ponomarenko (Khar'kov), and other speakers, have also expressed the desire for a broader mobilization, in the activities of the annual conferences, of the workers of plants and allied branches of industry on whom depends the realization of the developed designs.

The chief designer of the "Tizpribor" Instrument Plant, M. I. Zhutovskiy, stressed the duplication of work in various organizations

and argued in favor of the necessity of coordinating activities. The work on coordination should, in his opinion, be guided by the IAT AN SSSR and TsNIIKA [Institute of Automation and Telemechanics, Academy of Sciences USSR and the Central Scientific Research Institute of Automatic Control].

A. P. Kopelovich argued in favor of the necessity of coordinating with the users the drafting of technical requirements for newly designed instruments prior to their mass production.

Z. Ya. Beyrakh also expressed the wish for a rapprochement between the KBs [design bureaus] and the plants [users] and encouragement of the plant-maintained KBs, through a change in the system of remuneration.

B. F. Stupak mentioned the necessity of organizing the publication of catalogs by the manufacturing plants.

Furthermore, it was proposed that the two front pages of the periodical Priborostroyeniye [Instrument Building] be reserved for various advertisements and information.

Subsequent speakers, such as L. L. Feygel'son, G. I. Papernyy, Yu. Ye. Zolotarev, and others, shared their professional experience with the gathering and pointed to the inadequacy of current information on research in progress and the obtained results. In this connection, the tremendous importance of such annual conferences was once again emphasized.

In conclusion, the gathering turned to the Central Committee of the Communist Party USSR with a letter on problems relating to the status and developmental prospects of pneumatic-hydraulic automation.

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