

# Research of Pneumatic Systems of Automatic Dosing of Liquid

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*Abstract – The theoretical generalization and given practical solution are important national and economic significance of the scientific and technical problem of creating a competitive single-type liquid dosage equipment for automation of the technological process containing contours of the dosage of liquid supply. The paper presents research materials and proposes structural and circuit design solutions for the creation of a complex of pneumatic systems for the automatic dosage of liquids with dose measuring on indirect parameters, representing a new original technology in this area.*

Keywords – dosage, dosing device, automatic control system, automatic dosing system, technological process, actuator, control unit, object of management.

## I. Introduction

In scientific work is solved a large scientific and technical problem, which has an important national economic significance, – the creation of a competitive dosing equipment of the same type for the automation of production technological processes (TP) containing contours of dosed fluid supply. In connection with this, a new technology for the construction of automated dosage systems (ADS) of liquids, which is considered as a set of dispensing devices (DD) as an object of control and control devices (PU), which provide management of executive bodies of the DD for a given algorithm. The design of ADS is based on the use of methods of measuring the dose by indirect parameters, equipment of industrial pneumatic automation in the control units and sensors of flow parameters of bubble-type fluids.

## II. Actuality of work

1. A significant part of the TP of chemical, petrochemical, food, textile, perfumery, paint and varnish, packing (liquid products in the packaging) and other industries is characterized by the presence of operations for which implementation of the automatic submission to the control object (CO) is required to be established by the technological regulations doses or costs of liquid components. At the same time when designing the equipment it is necessary to take into account the diversity of physical and chemical properties of the dosage compositions, provide a fairly high accuracy and wide range of dosage.

The task of automation of dosing operations is complicated if it is necessary to implement an automatic regulation system (ARS) of TP parameters, the effect of which is achieved by introducing into the OM dose of a fluid. In this case, the ADS should be considered and, accordingly, projected as an actuator in the ACS, in which, in addition to the means of automatic control and

regulation of the main parameters, the control circuits of the actual processes of the dosing should be contained.

2. Among the above-mentioned productions, connected with tasks of automation of processes of dosing of liquids, packing production occupy a special place. This is due to the fact that in the last decade Ukraine has been developing the packaging industry. A number of small and medium-sized businesses that produce and package liquid products in packaging form. In connection with this, the problem of creating high-precision, inexpensive, reliable and compact import-packing equipment, which takes into account the specific conditions of small-scale production, becomes extremely urgent.

## III. The purpose of the work

Research and development of principles of construction, design techniques and hardware implementation of the ADS system of wide-use fluids, including the following systems.

1. Universal ADS for the construction of ADS TP with a resettable structure for Om, having inertial latency and parametric non-stationary (for example, OM processes of purification of industrial waste water galvanic production).

2. Universal autonomous ADS for the automation of processes of partial and continuous dosage of liquids in the quantities set by the technological regulations.

3. High-precision, low-cost and compact import-replaceable grease for packing of liquid products into containers for small industries, including typical ones with manual installation of containers for the position of infusion, and built on the basis of typical – individual systems built into conveyor belts with wide functional capabilities. on the operational adjustment of both the dose value and the range of dosing.

4. Systems of multicomponent dosage.

## IV. The scientific novelty

The scientific novelty of the work consists in the development, substantiation, analytical and experimental study of new original technologies and circuit decisions based on the methods of measuring the dose by indirect parameters for the creation of a complex of liquids. This generalized formulation of the scientific novelty of work is revealed by the following innovations:

1. A new classification of ADS has been developed on the basis of the presence or absence of sensors in the system of control of its initial parameters and methods of control of these parameters, on the basis of which developed rational principles for the organization and construction of ADS.

2. On the basis of the proposed new method of portioning of liquids, a new class of closed universal SAD with a single output parameter – the current value of liquid flow at the output of the remote control, is transformed into compressed air pressure.

3. The methodology of the analysis of systematic errors of the processes of a portion dosage of liquids is proposed, and it is also acceptable for the analysis of metrological characteristics of similar processes.

4. The principles of construction, methodology of designing and nomenclature of typical SAD on indirect parameters for small manufactures on the basis of the use of sensors of flow parameters of bubble-type fluids and equipment of industrial pneumatic automation are developed.

A new classification of ADS has been developed. The basis of which is the indication of the presence or absence of control of its initial parameters and methods of control of these parameters in the system of data-chips. At the same time, in the case of ADS, adapted for work in the structure of ACS with a resettable structure, the principle of dosage is better, based on the use of closed systems according to the initial parameter. This principle corresponds most to the ADS on the basis of the remote control with a single output parameter.

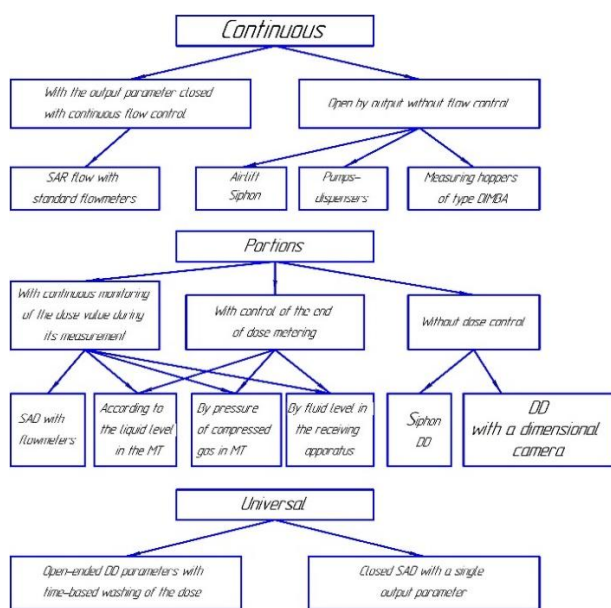


Fig. 1. Classification of SAD

### Conclusion

As a result of our research and experiments, we can significantly simplify the design and reduce the cost of

designing and manufacturing ADS, as well as provide them with a number of positive qualities, including:

- the possibility of construction of uniform unified standard dosage systems in the form of a set of technological elements of the DD, forming an OM, and a pneumatic (or pneumatic) control device (CD);
- Simplicity of providing the necessary accuracy and wide range of dispensing;
- admissibility of dosing of liquids in containers of different volumes and configurations;
- the possibility of using the same type of equipment on liquids with a wide range of changes in physical and chemical properties;
- smoothness of regulation and operative setting, both the dose and the upper limit of the range of dosage;
- absence of "interoperative" drop formation;
- implementation (on their basis) of multi-channel and multi-threaded dosing systems and their combination with conveyor lines;
- fire safety when using only pneumatic tools, simplicity and safety of service.

### References

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