The list of examination questions on the educational program 8D07104/8D07109 – "Automation and control"

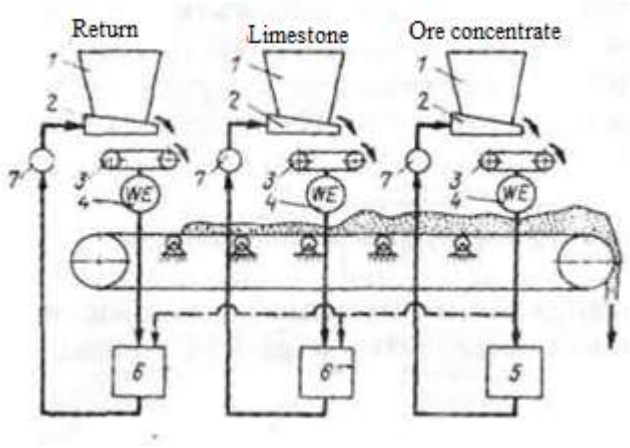
Module 1

1. Amplifying elements of automation systems.
2. Classification and general characteristics of automation schemes.
3. Purpose, classification and architecture of programmable logic controllers.
4. Functionality and technical characteristics of modern programmable controllers and programming languages of modern programmable controllers.
5. Classification of control and measuring devices.
6. Architecture of control and protection systems.
7. Modern automation concept.
8. Classification and purpose of information measuring systems.
9. Reliability of technical systems.
10. Methods and devices for measuring the flow of steam, gas and liquid.
11. Automated monitoring and diagnostics system. Principles of technical diagnostics.
12. Types of primary converters.
13. A set of technical means of a multi-level control system.
14. Measurement of technological parameters.
15. Levels of integrated and distributed automated control systems.
16. Information processing tools and devices.
17. Local automatic control systems.
18. SCADA systems. Definition and general structure of SCADA systems.
19. MES systems.
20. ERP systems.
21. Languages of system modeling of system engineering.
22. The process of system development. The life cycle of the system.
23. 23. Purpose, purpose of creation and functions of the automated process control system.
24. The concept of an integrated production system.
25. Measurement of errors and their compensation.
26. Secondary devices for measuring potential difference.
27. Methods of setting up equipment and tool settings.
28. Typical structures of automation and process control systems.
29. Purpose and composition of technical means of automation and control systems.
30. The main technical characteristics of controllers and software and hardware complexes.
31. Methods of resistance measurement.
32. Methods and devices for measuring the level.
33. Classification, purpose, goals and functions of ACS.
34. Definition and general structure of SCAD.
35. Structures of distributed automated control systems.
36. The typical composition of the technical means of self-propelled guns.
37. Classification of sensors by type of input value.

38. Classification of sensors according to the principle of operation.
39. Methods and devices for measuring temperature.
40. Classification of executive mechanisms and regulatory bodies.
41. Generalized functional diagram of a system with digital (discrete) control.
42. Classification and scope of industrial robots.
43. Classification and principle of construction of robotic complexes.
44. Proportional control law.
45. Proportional differential control law.
46. Proportional-integral-differential control law.
47. Methodology of system research.
48. Information technology management.
49. Classification of information technologies.
50. Methods and devices for measuring pressure and discharge.

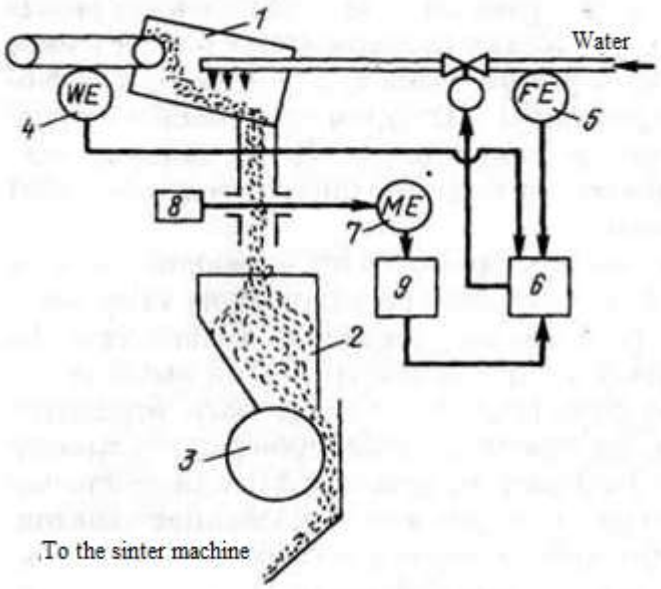
Module 2

1. Develop a block diagram and algorithm of control for one of the parameters of the process of weight dosing of 3 materials. Make a choice of technical means of automation. Draw and supplement the functional diagram with technical means for performing various functions (registration, indication, regulation, etc.).



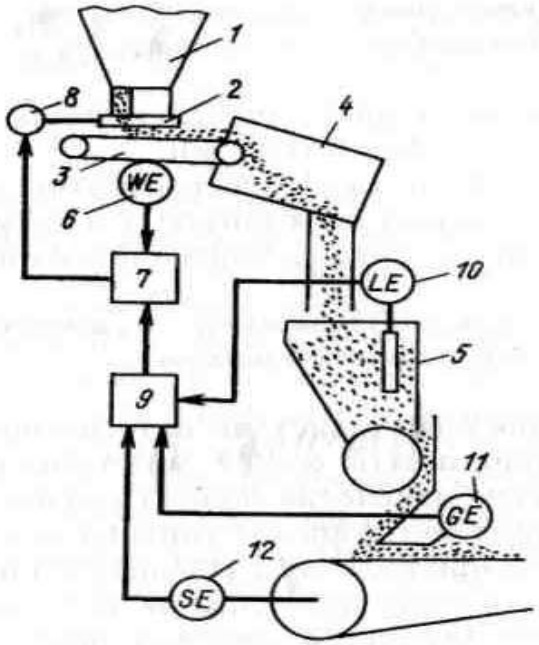
Scheme of automatic weight dosing of three materials

2. Develop a block diagram and algorithm of control for one of the parameters of technical process for controlling the charge moisture. Make a choice of technical means of automation. Draw and supplement the functional diagram with technical means for performing various functions (registration, indication, regulation, etc.).



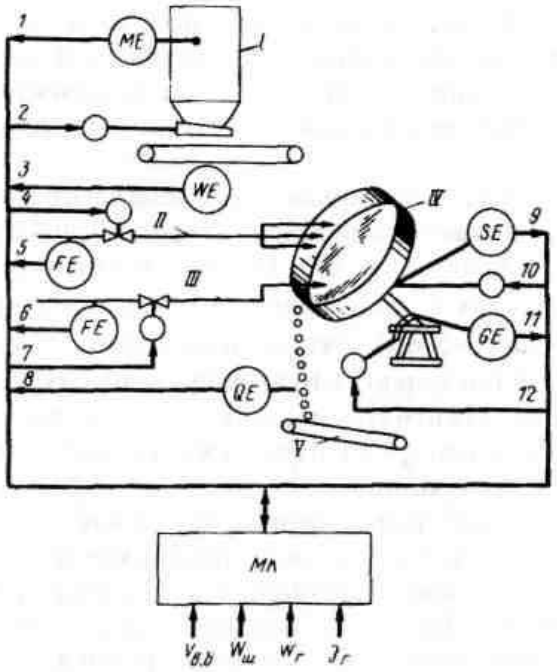
Automatic system for controlling the charge moisture

3. Develop a block diagram and algorithm of control for one of the parameters of the process of level control in the intermediate bunker of the sintering machine (according to the scheme). Make a choice of technical means of automation. Draw and supplement the functional diagram with technical means for performing various functions (registration, indication, regulation, etc.).



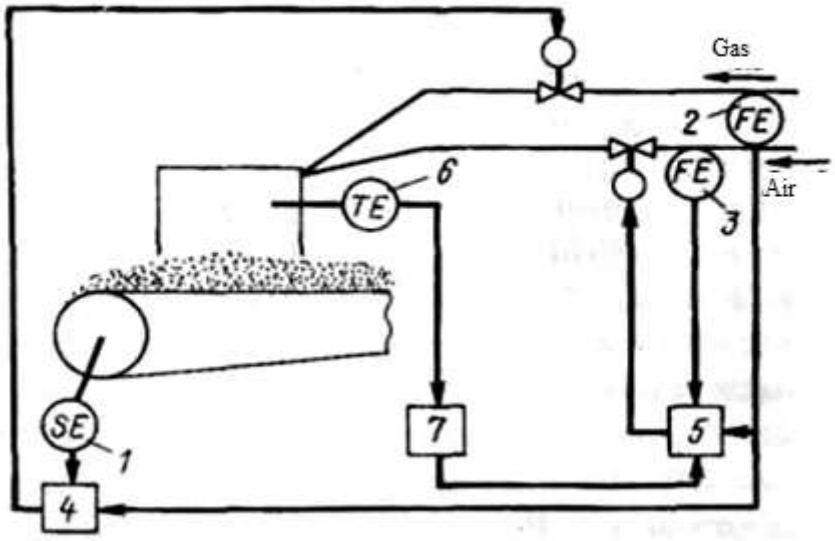
Level control system in the intermediate hopper of the sintering machine

4. Develop a block diagram and algorithm of control for one of the parameters granulator control process (according to the diagram). Make a choice of technical means of automation. Draw and supplement the functional diagram with technical means for performing various functions (registration, indication, regulation, etc.).



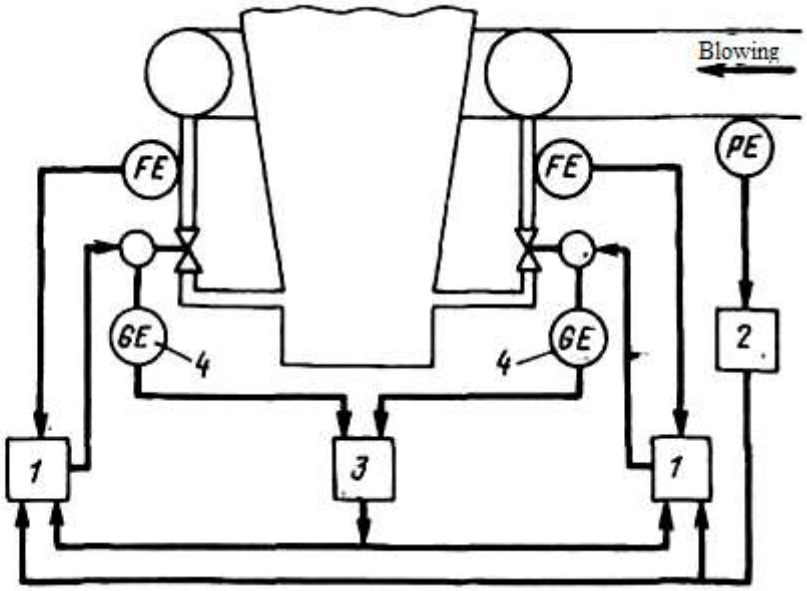
Granulator automatic control system

5. Develop a block diagram and algorithm of control for one of the parameters of the system for automatic control of the charge ignition process. Make a choice of technical means of automation. Draw and supplement the functional diagram with technical means for performing various functions (registration, indication, regulation, etc.).



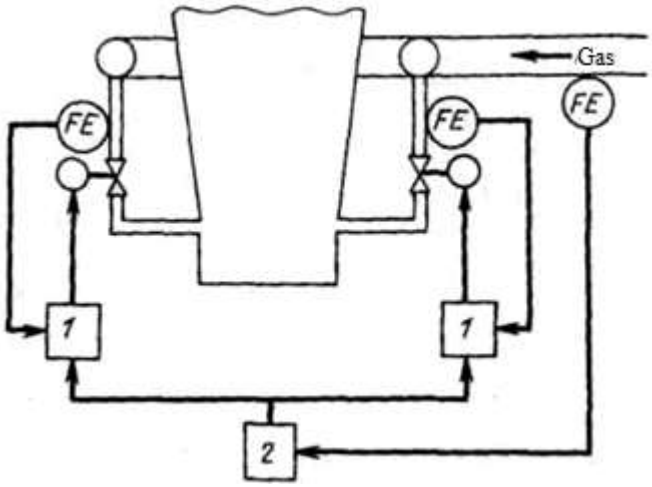
System for automatic control of the charge ignition process

6. Develop a block diagram and algorithm of control for one of the parameters of the process of blast distribution for tuyeres. Make a choice of technical means of automation. Draw and supplement the functional diagram with technical means for performing various functions (registration, indication, regulation, etc.).



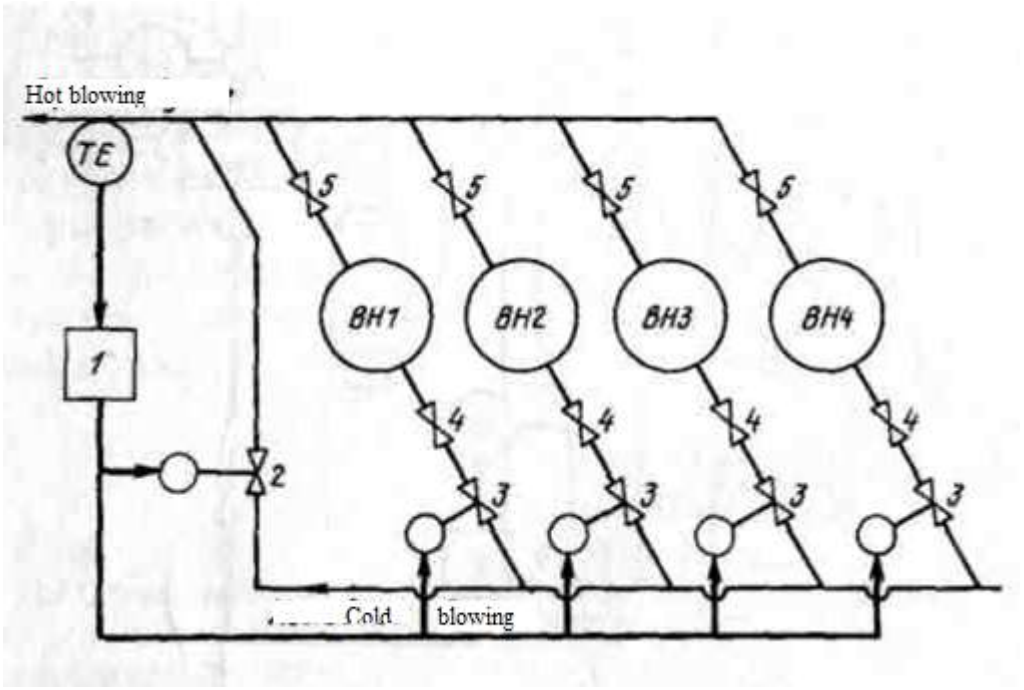
System of the automatic blast distribution for tuyeres

7. Develop a block diagram and algorithm of control for one of the parameters process of automatic distribution of natural gas by lances. Make a choice of technical means of automation. Draw and supplement the functional diagram with technical means for performing various functions (registration, indication, regulation, etc.).



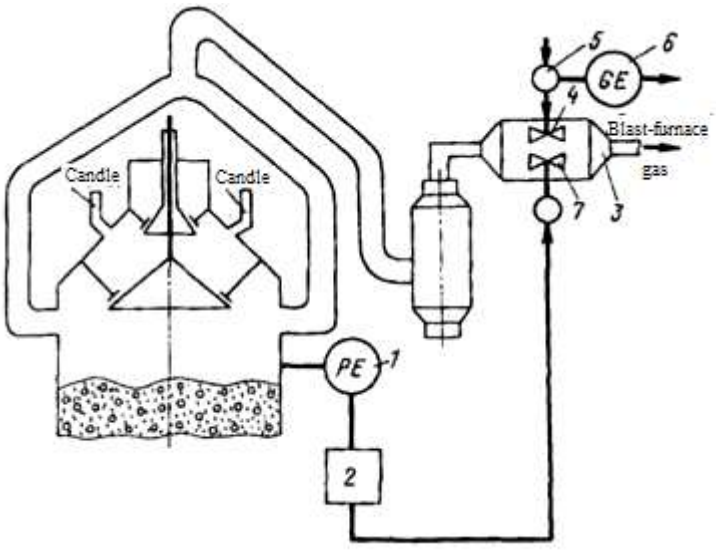
System for automatic distribution of natural gas by lances

8. Develop a block diagram and algorithm of control for one of the parameters of the process of control the hot blast temperature. Make a choice of technical means of automation. Draw and supplement the functional diagram with technical means for performing various functions (registration, indication, regulation, etc.).



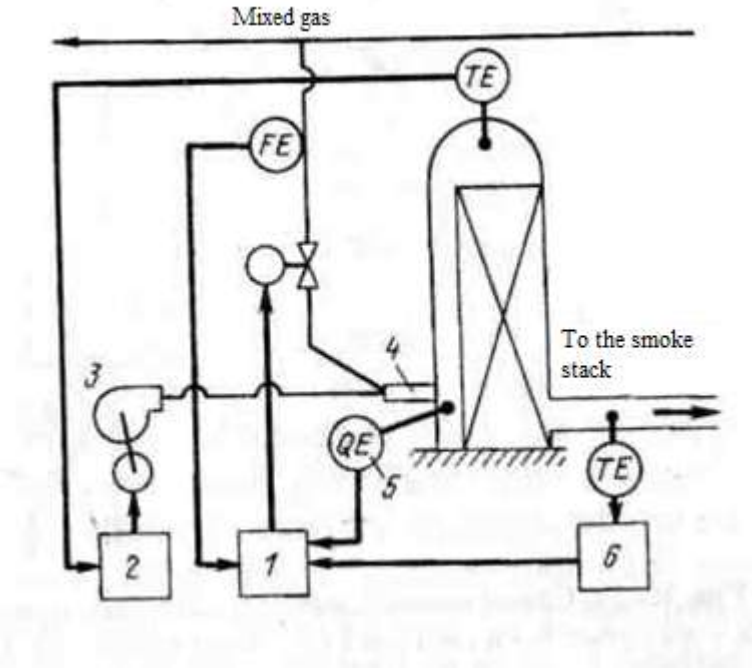
System of control the hot blast temperature

9. Develop a block diagram and algorithm of control for one of the parameters of the process of regulation gas pressure on the blast furnace top. Make a choice of technical means of automation. Draw and supplement the functional diagram with technical means for performing various functions (registration, indication, regulation, etc.).



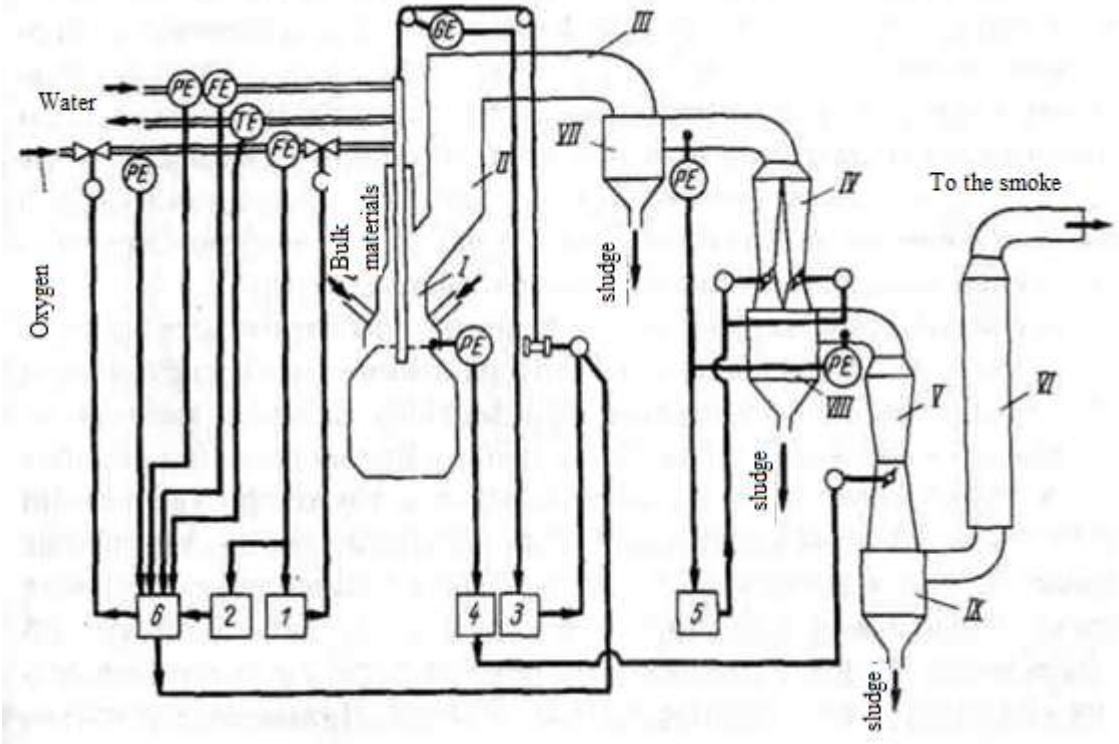
System of automatic regulation gas pressure on the blast furnace top

10. Develop a block diagram and algorithm of control for one of the parameters of the process of regulating the heating of air heaters (according to the diagram). Make a choice of technical means of automation. Draw and supplement the functional diagram with technical means for performing various functions (registration, indication, regulation, etc.).



System of automatic regulation of heating the air heaters

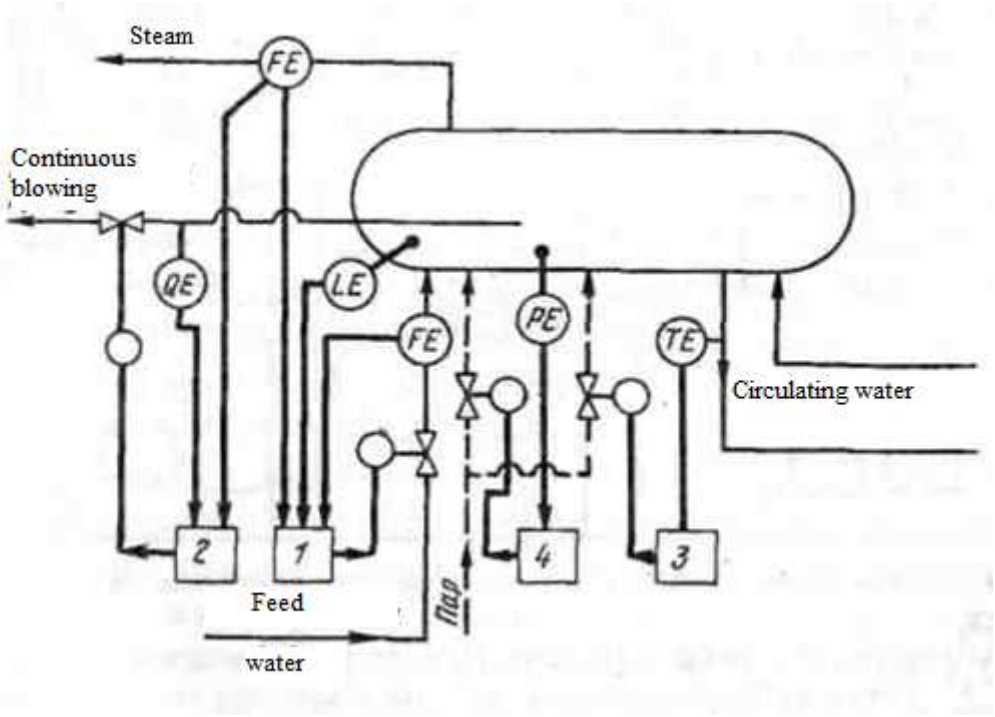
11. Develop a block diagram and algorithm of control for one of the parameters technical process according to the presented scheme of the local control system in the converter. Make a choice of technical means of automation. Draw and supplement the functional diagram with technical means for performing various functions (registration, indication, regulation, etc.).



Local control system in the converter

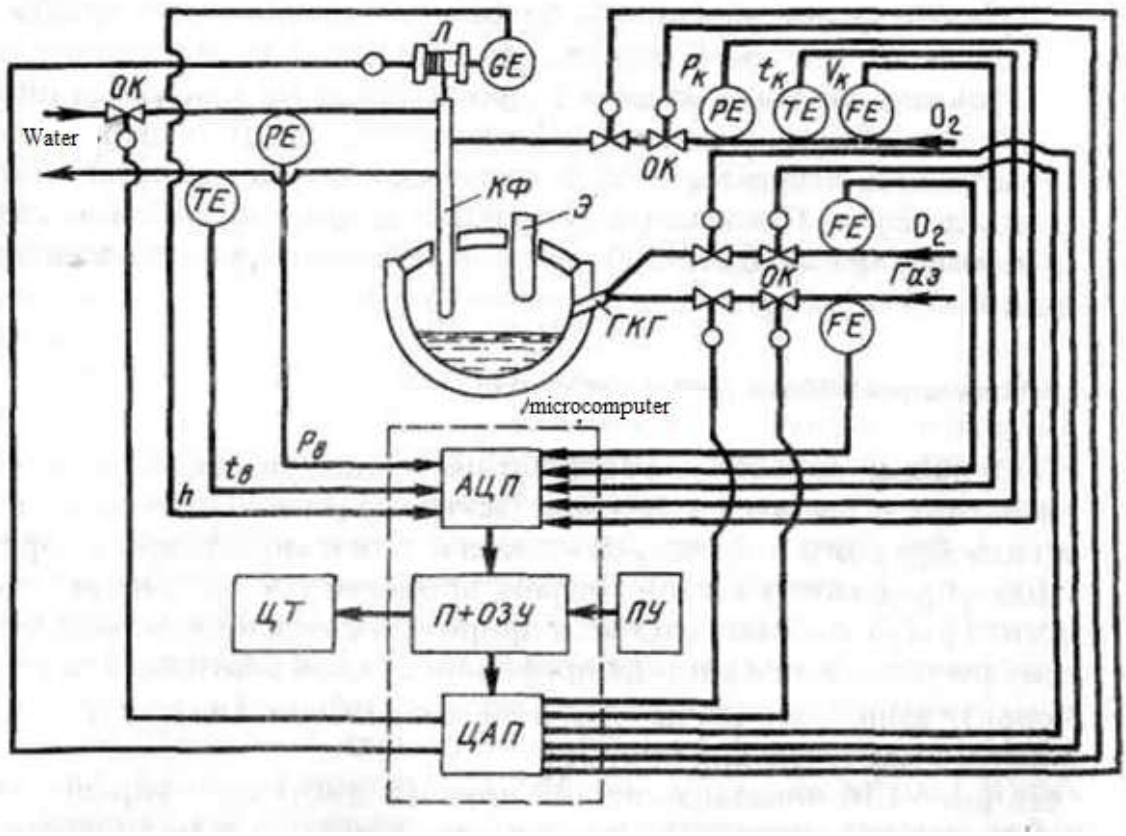
12. Develop a block diagram and algorithm of control for one of the parameters technical process according to the presented scheme of the local system of control of the converter gas cooler. Make a choice of technical means of automation. Draw

and supplement the functional diagram with technical means for performing various functions (registration, indication, regulation, etc.).



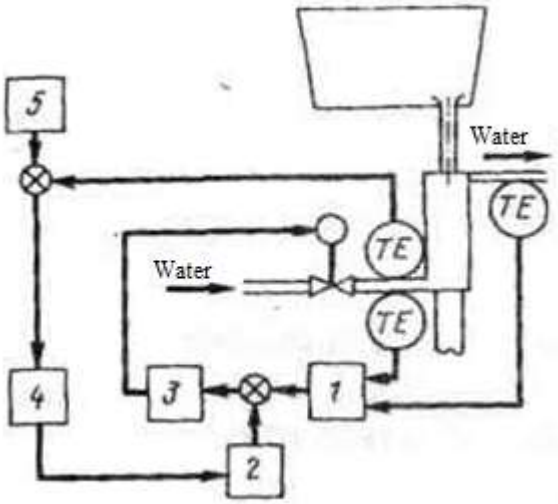
Local system of control of the converter gas cooler

13. Develop a block diagram and algorithm of control for one of the parameters technical process according to the presented scheme of the system of control the operation of a gas-oxygen burner and the supply of oxygen to the bath of an arc steel-smelting furnace. Make a choice of technical means of automation. Draw and supplement the functional diagram with technical means for performing various functions (registration, indication, regulation, etc.).



The system of control for the operation of a gas-oxygen burner and the supply of oxygen to the bath of an arc steel-smelting furnace

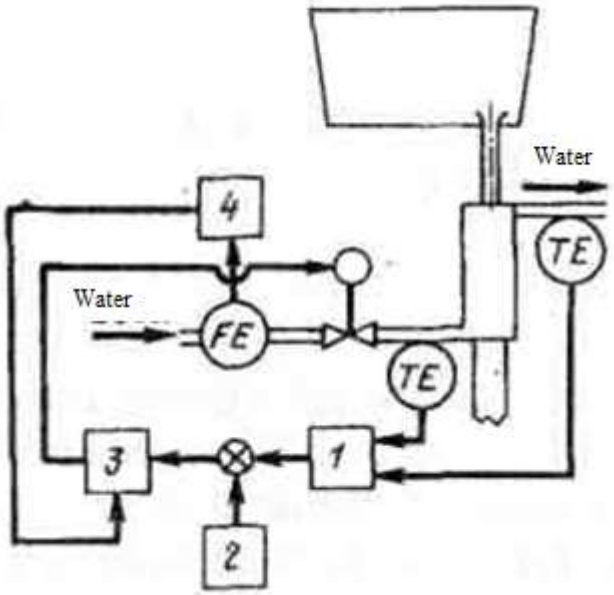
14. Develop a block diagram and algorithm of control for one of the parameters technical process according to the scheme of system of control of thermal regime of the CCM mold. Make a choice of technical means of automation. Draw and supplement the functional diagram with technical means for performing various functions (registration, indication, regulation, etc.).



CCM mold thermal regime control system with cooling water temperature correction

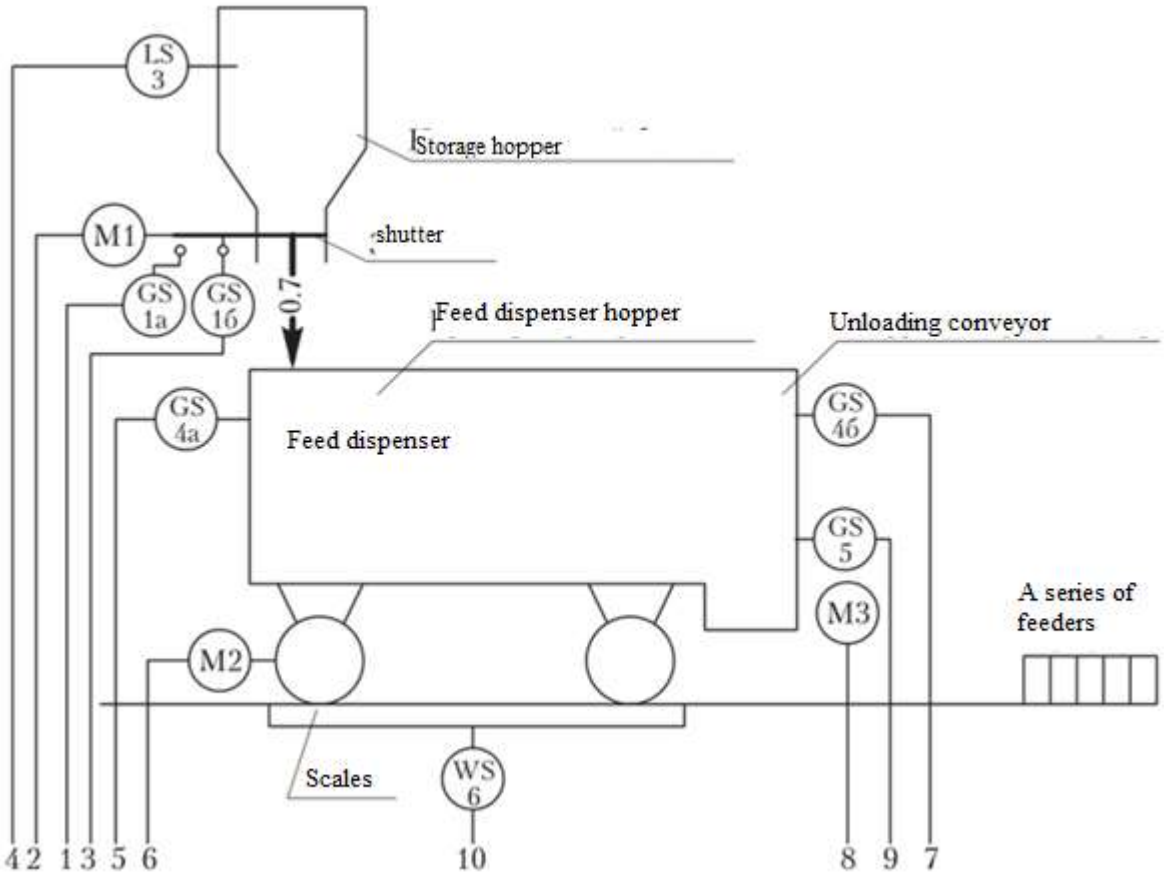
15. Develop a block diagram and algorithm of control for one of the parameters technical process according to the presented scheme of the system of control of the

CCM mold thermal regime. Make a choice of technical means of automation. Draw and supplement the functional diagram with technical means for performing various functions (registration, indication, regulation, etc.).



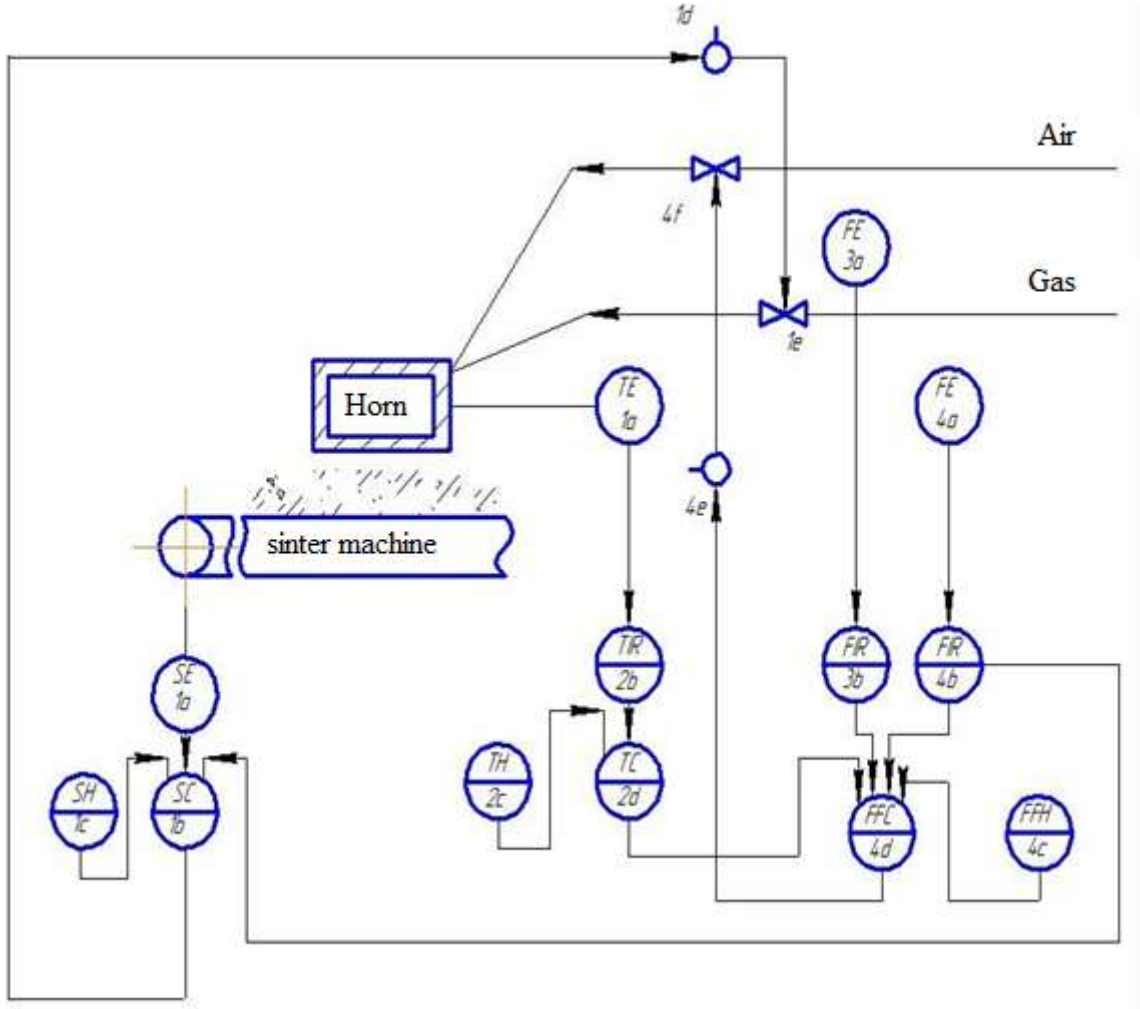
The system of control of the thermal regime of CCM mold according to the ratio: temperature difference - cooling liquid flow

16. Develop a block diagram and algorithm of control for one of the parameters of feed distribution process. Make a choice of technical means of automation. Draw and supplement the functional diagram with technical means for performing various functions (registration, indication, regulation, etc.).



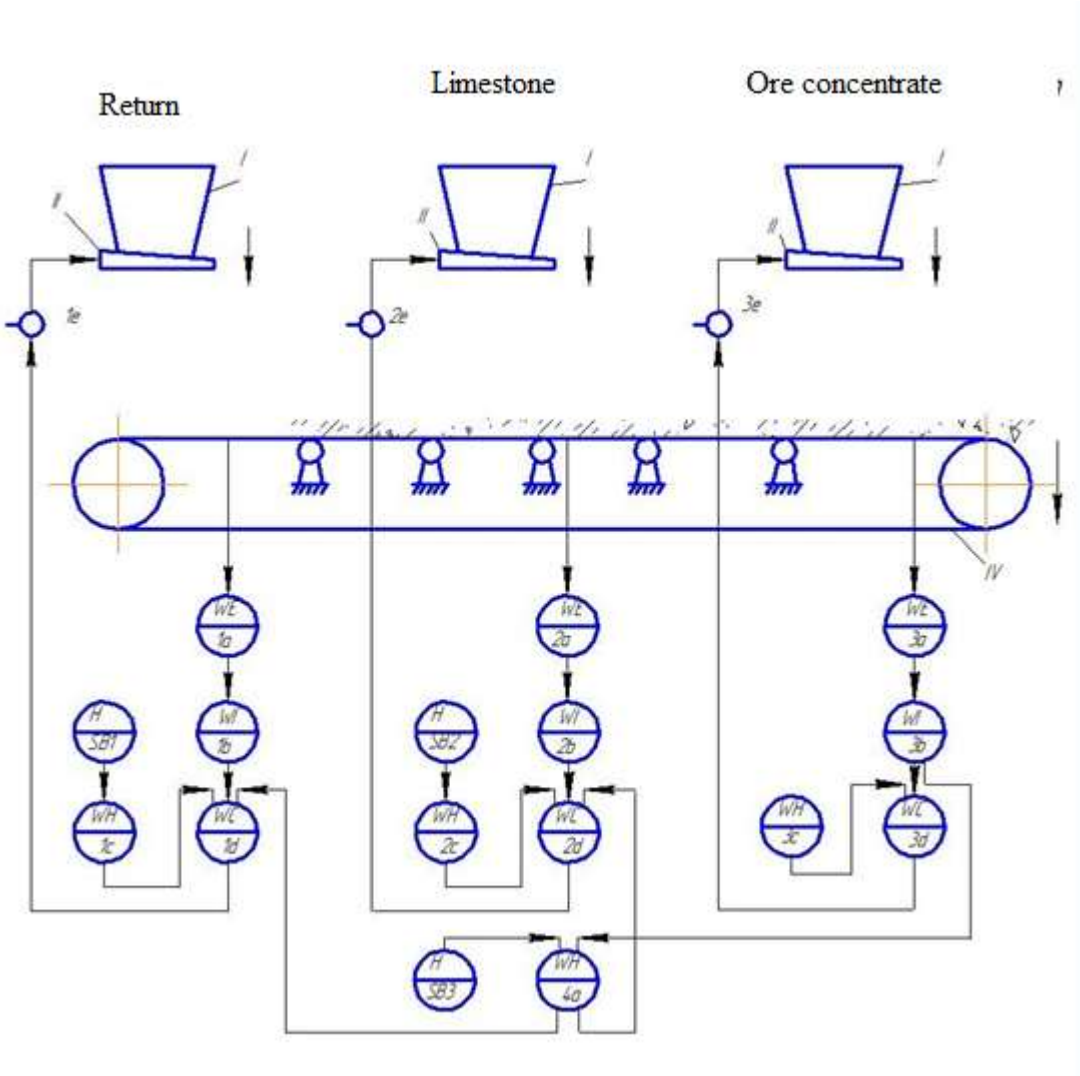
Scheme of automation of the feed distribution process

17. Develop a block diagram and algorithm of control for one of the parameters of agglomerate sintering control process. Make a choice of technical means of automation. Draw and supplement the functional diagram with technical means for performing various functions (registration, indication, regulation, etc.).



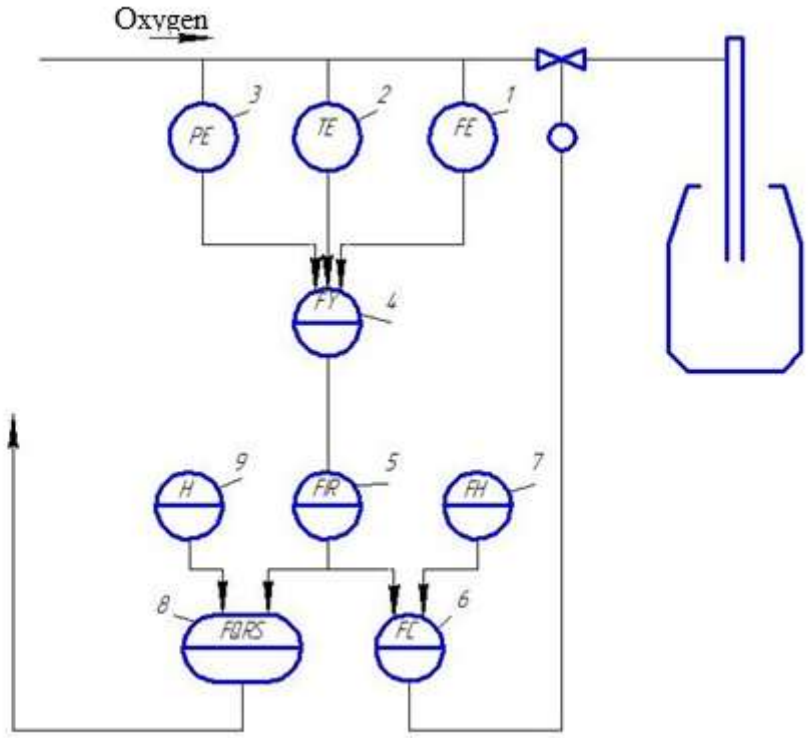
Scheme of automatic control of agglomerate sintering

18. Develop a block diagram and algorithm of control for one of the parameters of technical process for regulating weight dosing. Make a choice of technical means of automation. Draw and supplement the functional diagram with technical means for performing various functions (registration, indication, regulation, etc.).



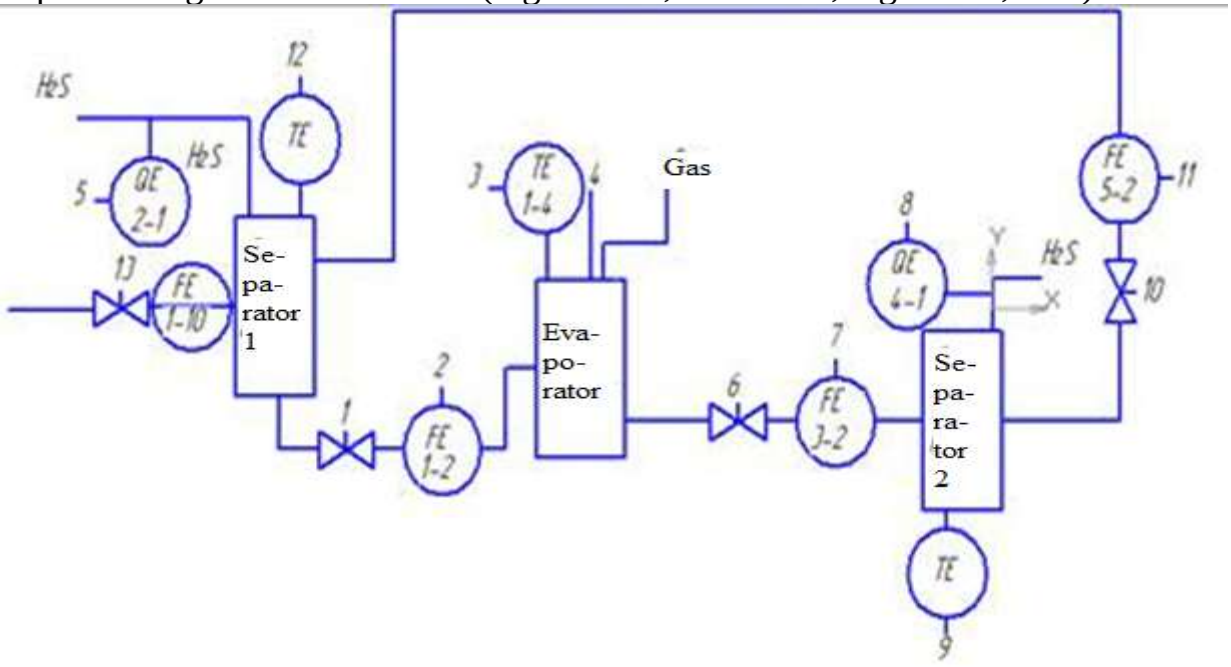
Scheme of automatic regulation of weight dosing

19. Develop a block diagram and algorithm of control for one of the parameters of process of regulation of oxygen flow for purge. Make a choice of technical means of automation. Draw and supplement the functional diagram with technical means for performing various functions (registration, indication, regulation, etc.).



Scheme of regulation the flow of oxygen for purge

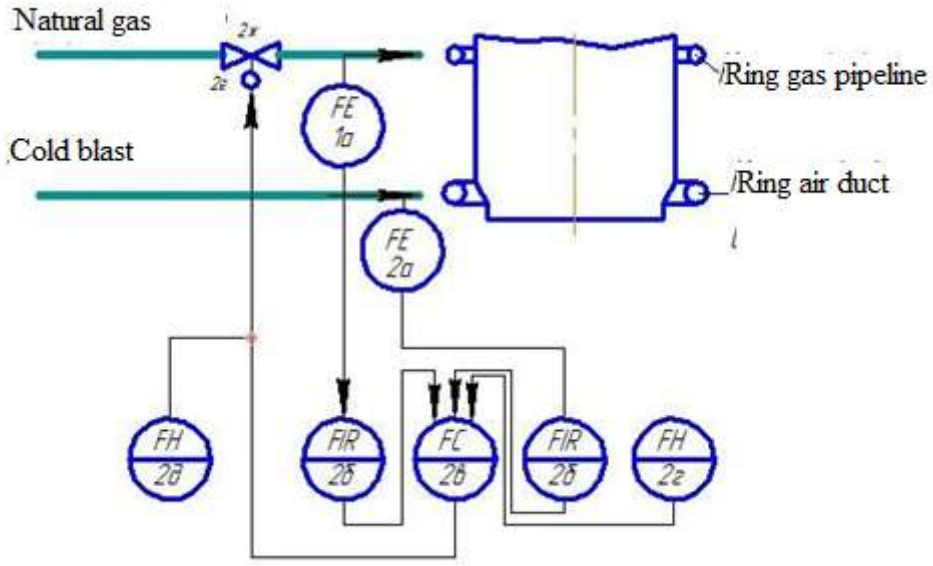
20. Develop a block diagram and algorithm of control for one of the parameters of technical process of hydrogen sulfide separation. Make a choice of technical means of automation. Draw and supplement the functional diagram with technical means for performing various functions (registration, indication, regulation, etc.).



Functional diagram of the control system for the separation of hydrogen sulfide from impurities

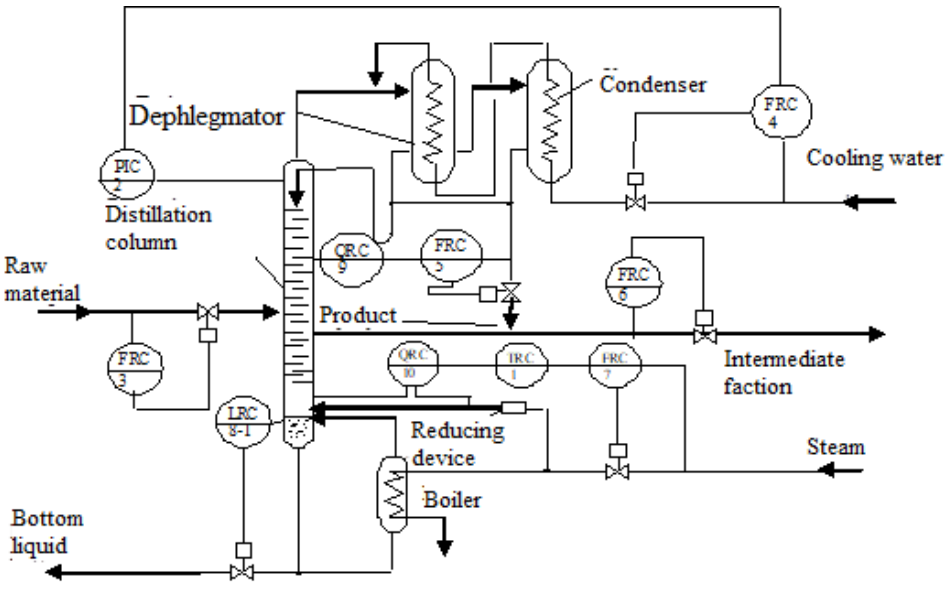
21. Develop a block diagram and algorithm of control for one of the parameters of the technical process according to the scheme of automatic regulation of the blast-gas ratio. Make a choice of technical means of automation. Draw and supplement

the functional diagram with technical means for performing various functions (registration, indication, regulation, etc.).



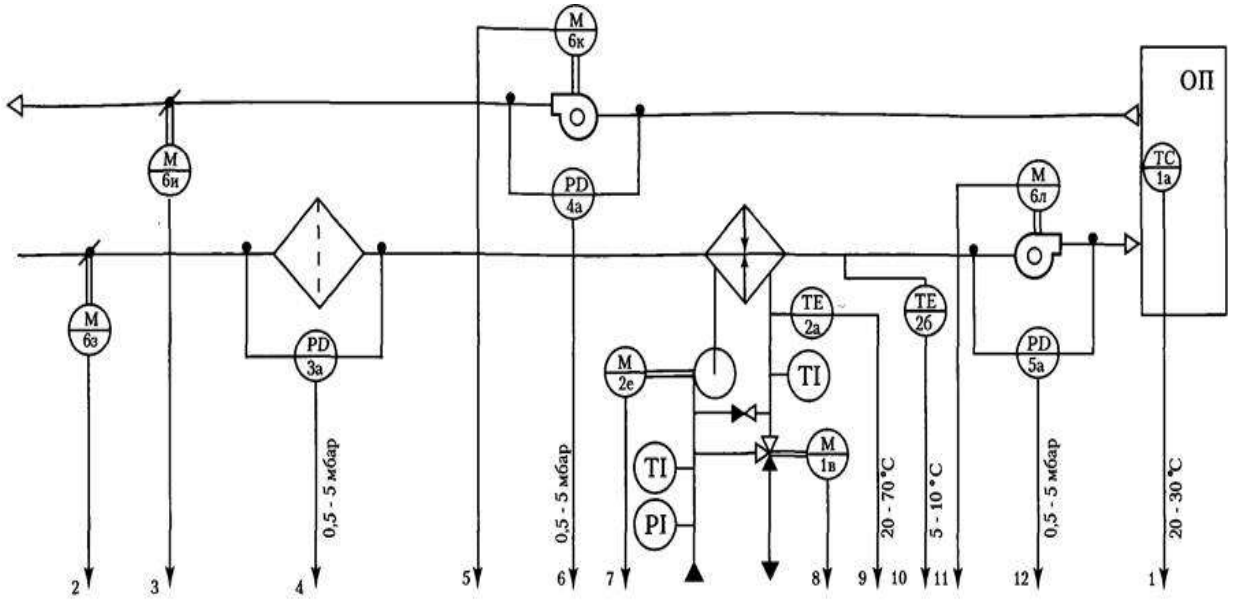
Scheme of automatic regulation of the blast-gas ratio

22. Develop a block diagram and algorithm of control for one of the parameters technical process according to the operation scheme of the distillation column. Make a choice of technical means of automation. Draw and supplement the functional diagram with technical means for performing various functions (registration, indication, regulation, etc.).



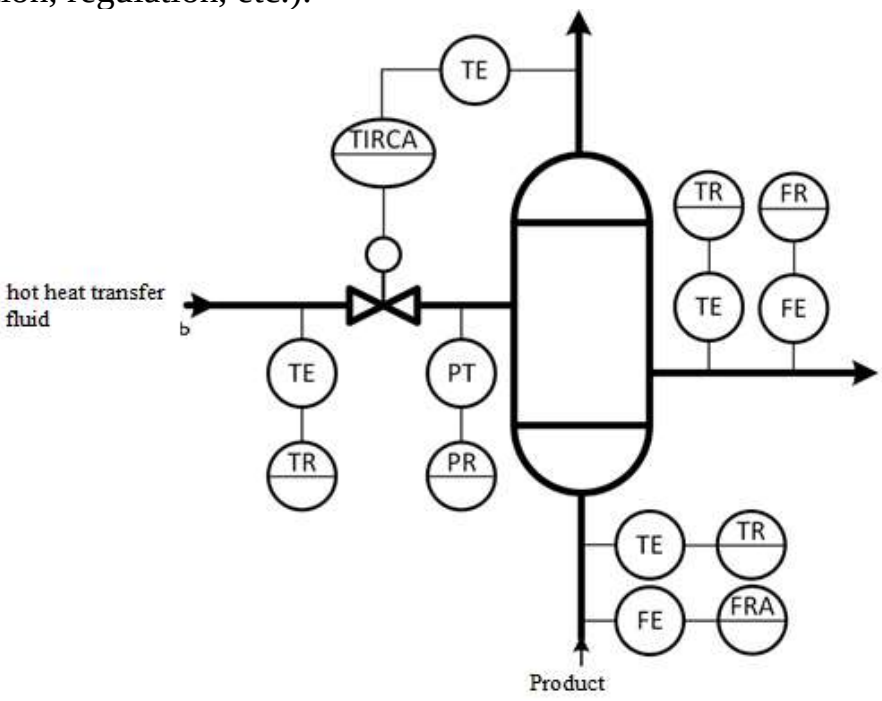
Distillation column control scheme

23. Develop a block diagram and algorithm of control for one of the parameters technical process according to the scheme of the supply and exhaust ventilation system. Make a choice of technical means of automation. Draw and supplement the functional diagram with technical means for performing various functions (registration, indication, regulation, etc.).



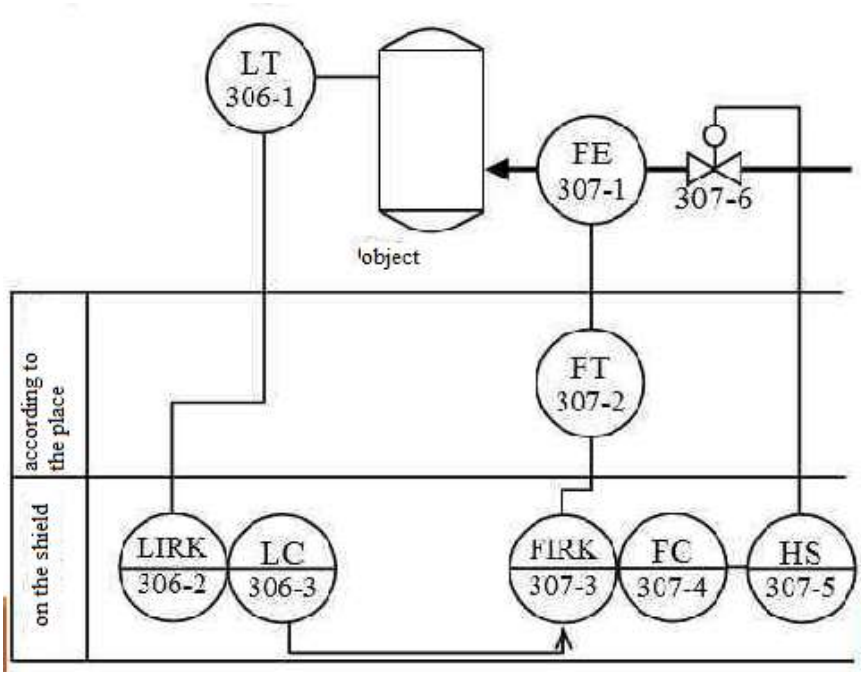
Scheme of automation of the supply and exhaust ventilation system

24. Develop a block diagram and algorithm of control for one of the parameters the technical process presented in the heat exchanger automation diagram. Make a choice of technical means of automation. Draw and supplement the functional diagram with technical means for performing various functions (registration, indication, regulation, etc.).



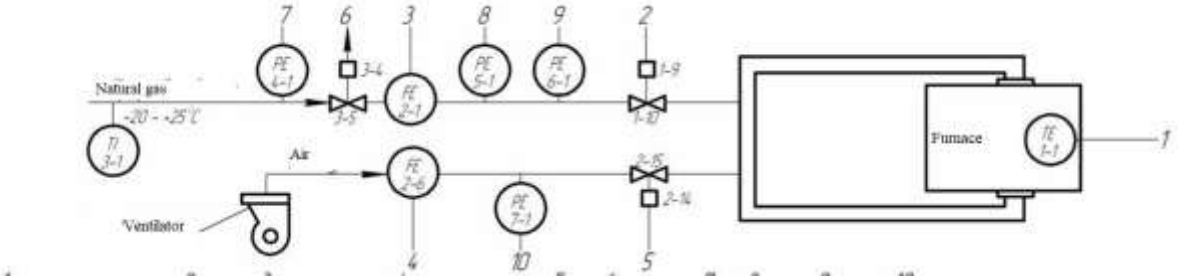
Functional diagram of automation of the heat exchanger by changing the flow rate of the heat transfer fluid

25. Develop a block diagram and algorithm of control for one of the parameters of technical process presented in the functional diagram. Make a choice of technical means of automation. Draw and supplement the functional diagram with technical means for performing various functions (registration, indication, regulation, etc.).



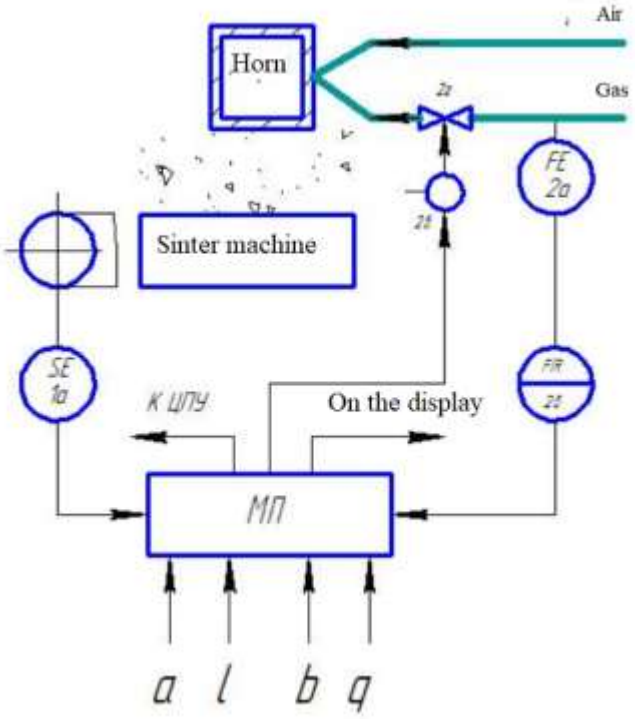
Functional diagram of technical process

26. Develop a block diagram and algorithm of control for one of the parameters the technical process shown in the functional diagram of the automation of the heating furnace. Make a choice of technical means of automation. Draw and supplement the functional diagram with technical means for performing various functions (registration, indication, regulation, etc.).



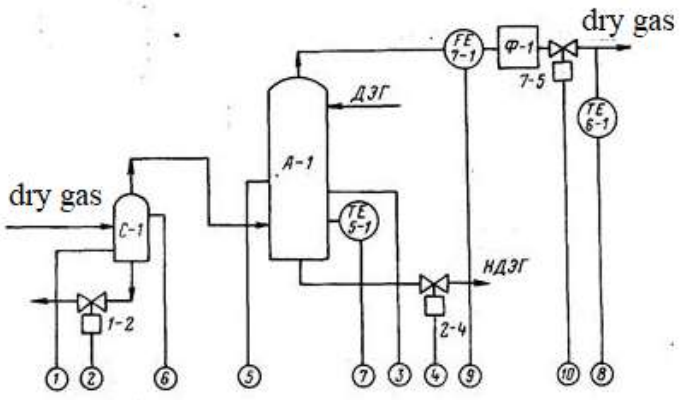
Functional diagram of heating furnace automation

27. Develop a block diagram and algorithm of control for one of the parameters of the ignition process according to the presented scheme. Make a choice of technical means of automation. Draw and supplement the functional diagram with technical means for performing various functions (registration, indication, regulation, etc.).



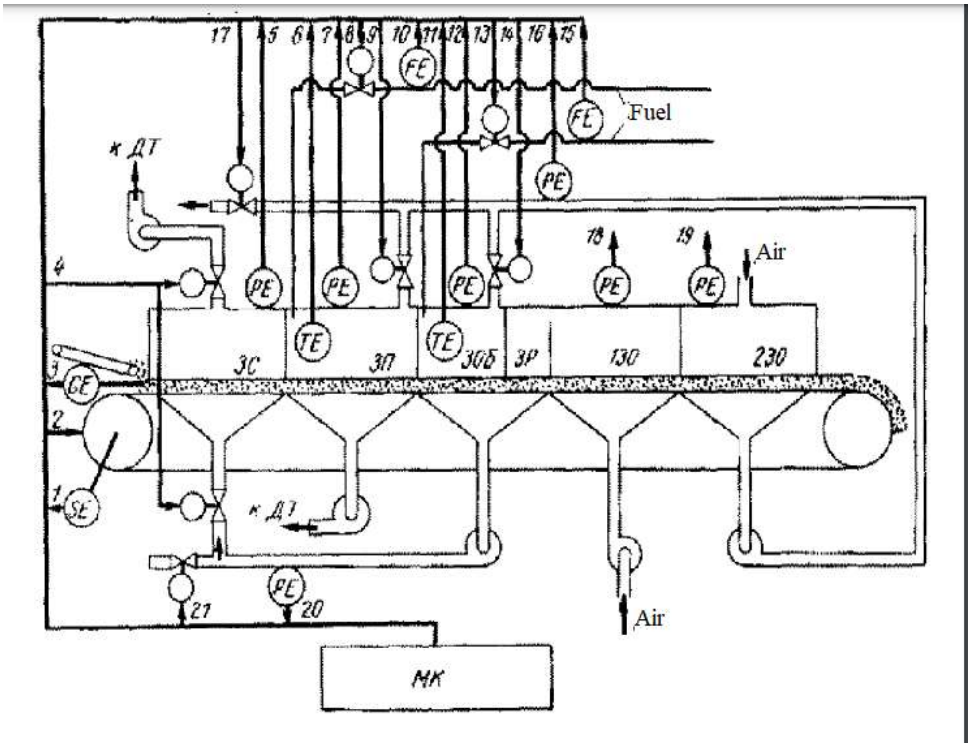
Ignition process control circuit using a microprocessor

28. Develop a block diagram and algorithm of control for one of the parameters of technical process of natural gas absorption. Make a choice of technical means of automation. Draw and supplement the functional diagram with technical means for performing various functions (registration, indication, regulation, etc.).



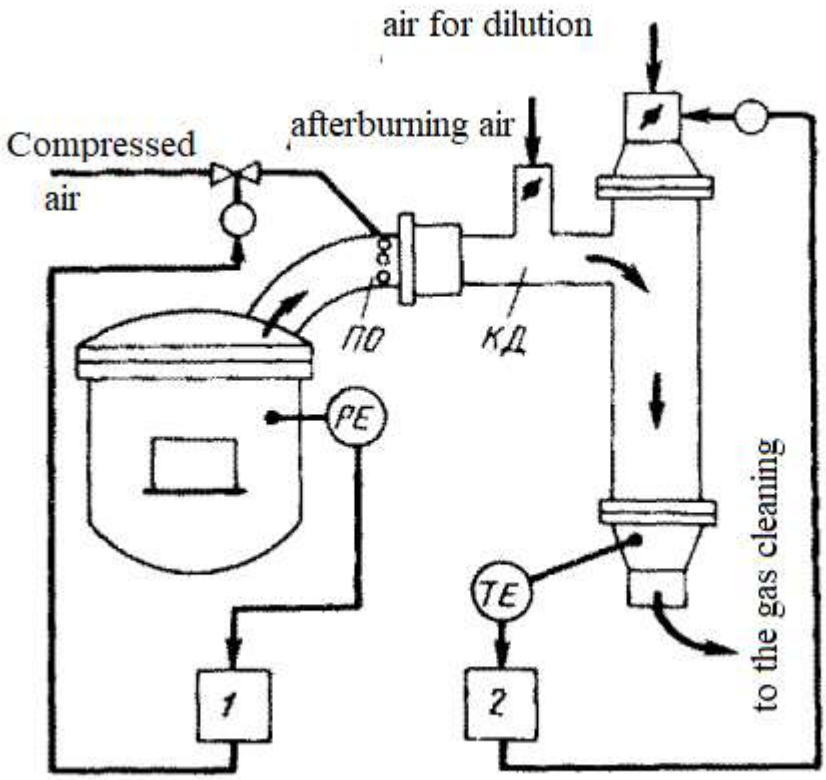
Functional diagram of automation of the natural gas absorption process

29. Develop a block diagram and algorithm of control for one of the parameters process according to the presented scheme of automatic control of the roasting machine. Make a choice of technical means of automation. Draw and supplement the functional diagram with technical means for performing various functions (registration, indication, regulation, etc.).



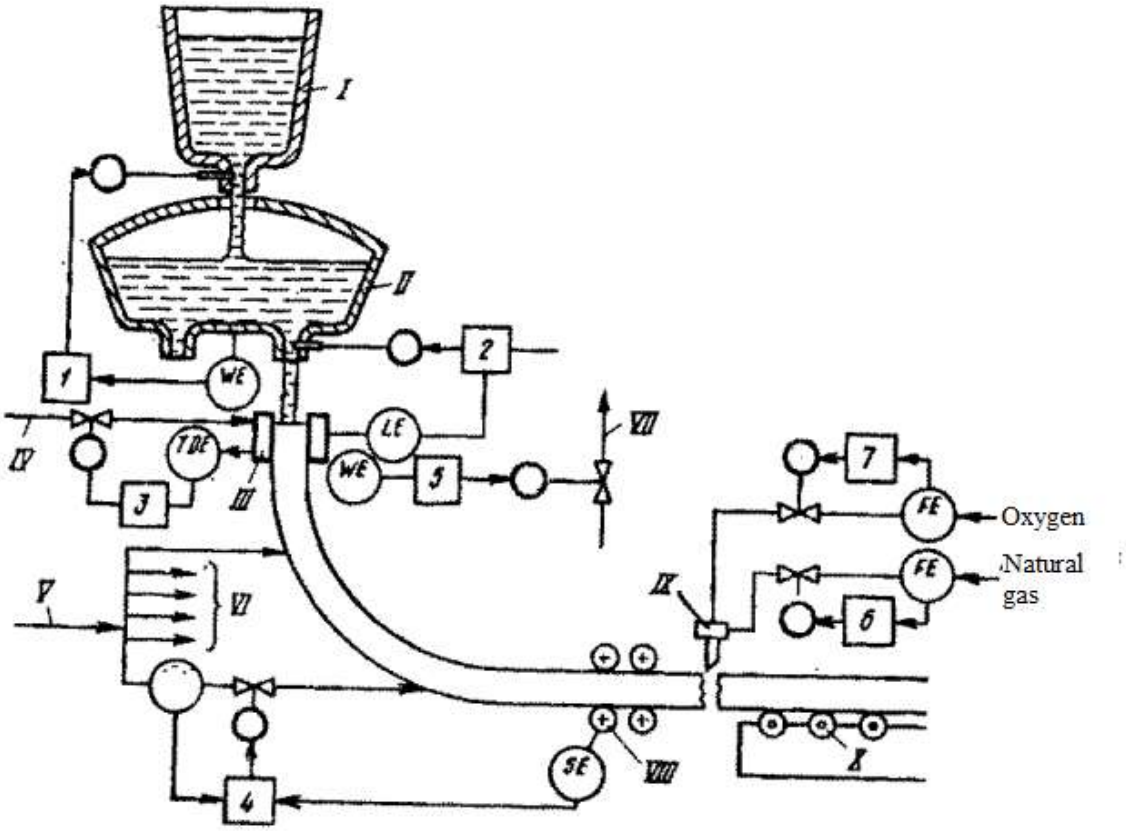
Scheme of automatic control of the roasting machine

30. Develop a block diagram and algorithm of control for one of the parameters of flue gas extraction process. Make a choice of technical means of automation. Draw and supplement the functional diagram with technical means for performing various functions (registration, indication, regulation, etc.).



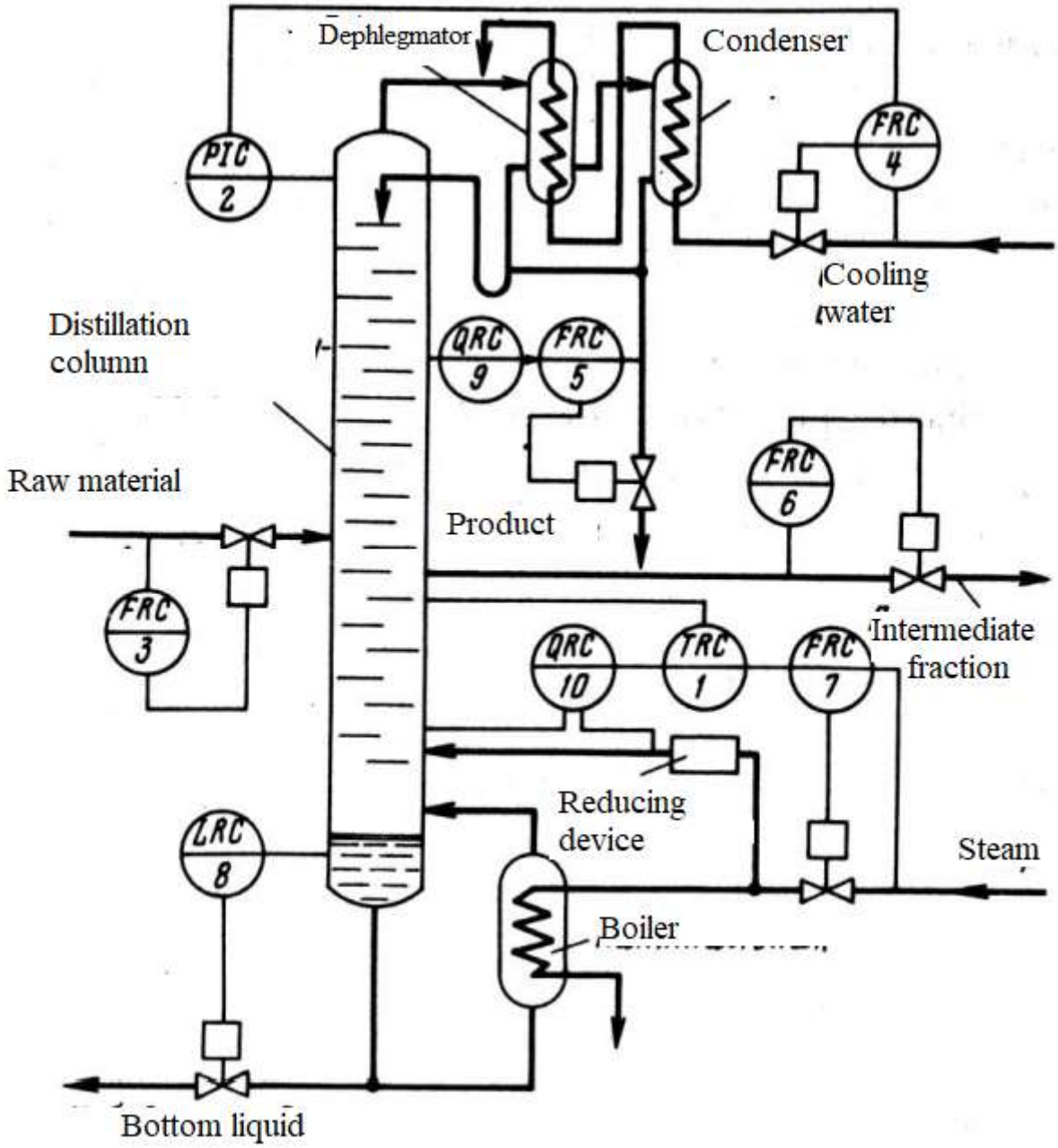
Structural diagram of the flue gas extraction control system

31. Develop a block diagram and algorithm of control for one of the parameters of the technical process, which is presented on the functional diagram of CCM automation. Make a choice of technical means of automation. Draw and supplement the functional diagram with technical means for performing various functions (registration, indication, regulation, etc.).



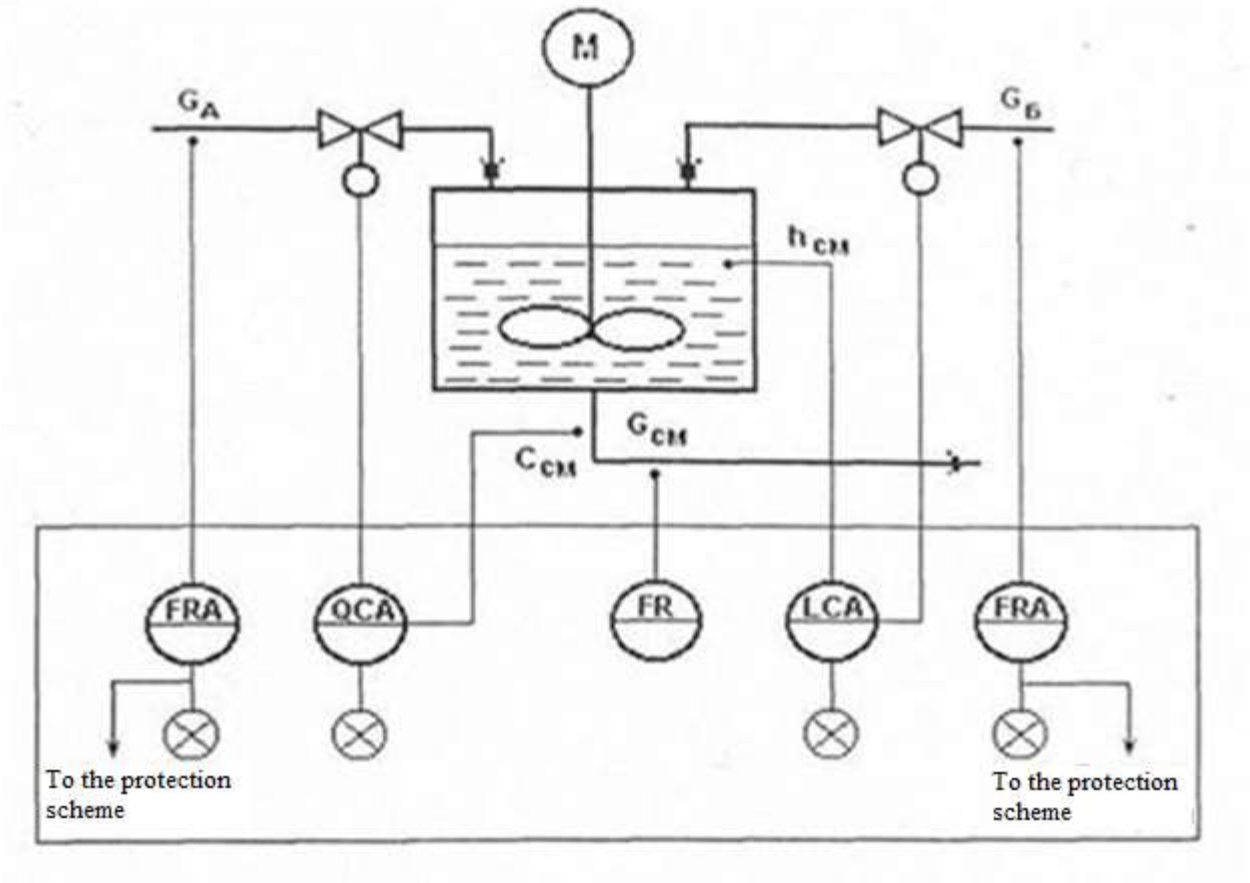
Functional scheme of CCM automation

32. Develop a block diagram and algorithm of control for one of the parameters of technical process, which is shown in the functional diagram. Make a choice of technical means of automation. Draw and supplement the functional diagram with technical means for performing various functions (registration, indication, regulation, etc.).



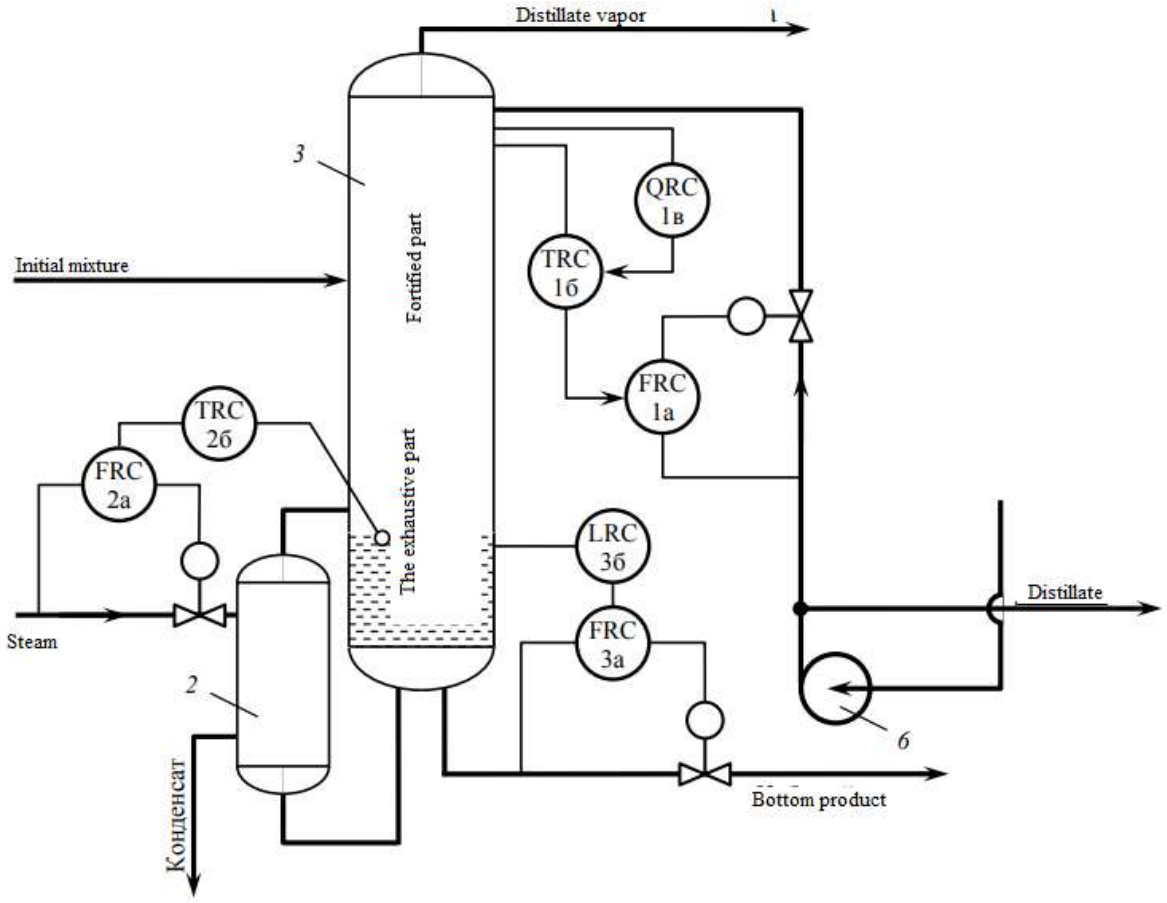
Functional diagram of automation

33. Develop a block diagram and algorithm of control for one of the parameters of technical process, which is shown in the attached functional diagram of automation. Make a choice of technical means of automation. Draw and supplement the functional diagram with technical means for performing various functions (registration, indication, regulation, etc.).



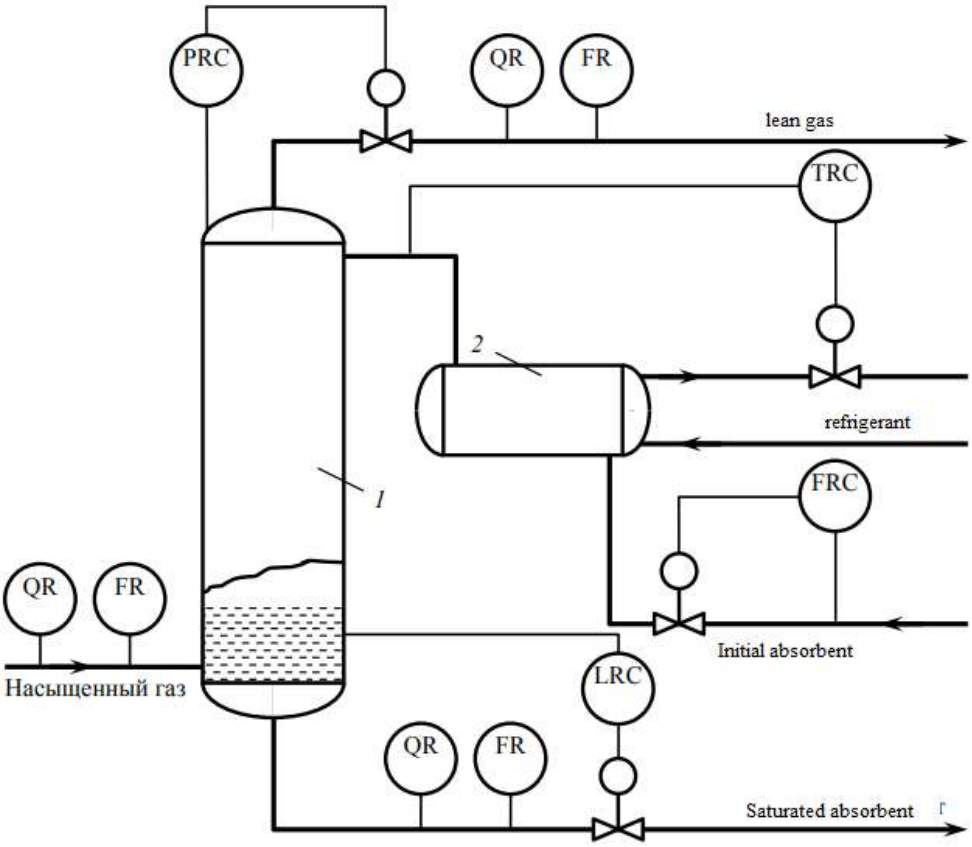
Functional diagram of automation

34. Develop a block diagram and algorithm of control for one of the parameters of technical process according to the given scheme of stabilization of the rectification process. Make a choice of technical means of automation. Draw and supplement the functional diagram with technical means for performing various functions (registration, indication, regulation, etc.).



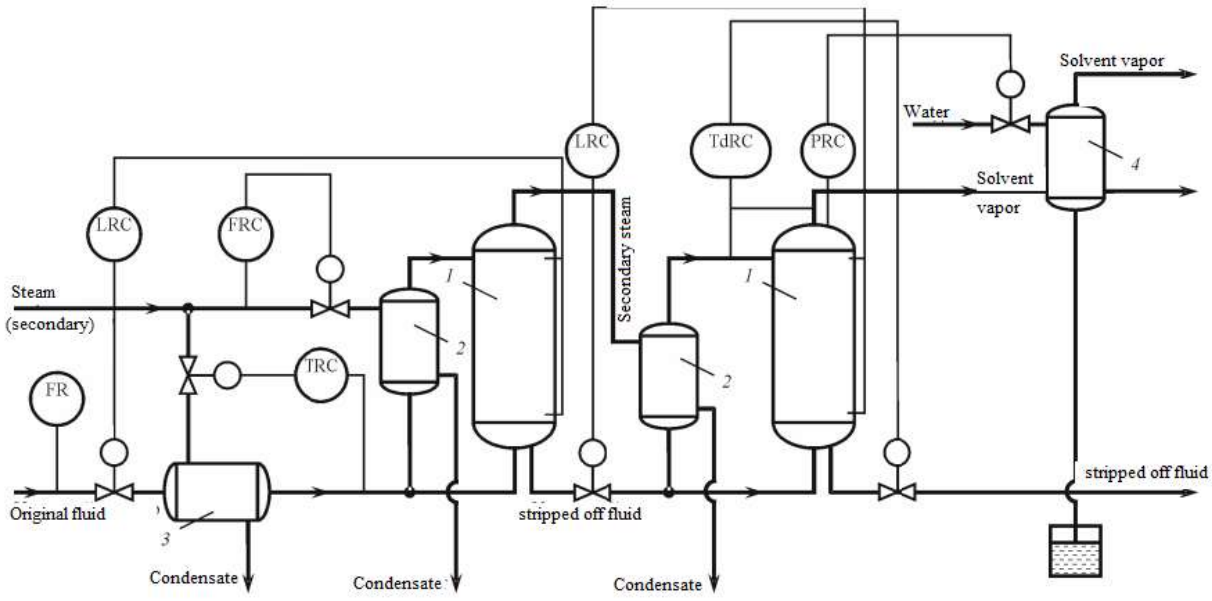
Scheme of stabilization of the rectification process

35. Develop a block diagram and algorithm of control for one of the parameters of technical process according to the given scheme of stabilization of the absorption process. Make a choice of technical means of automation. Draw and supplement the functional diagram with technical means for performing various functions (registration, indication, regulation, etc.).



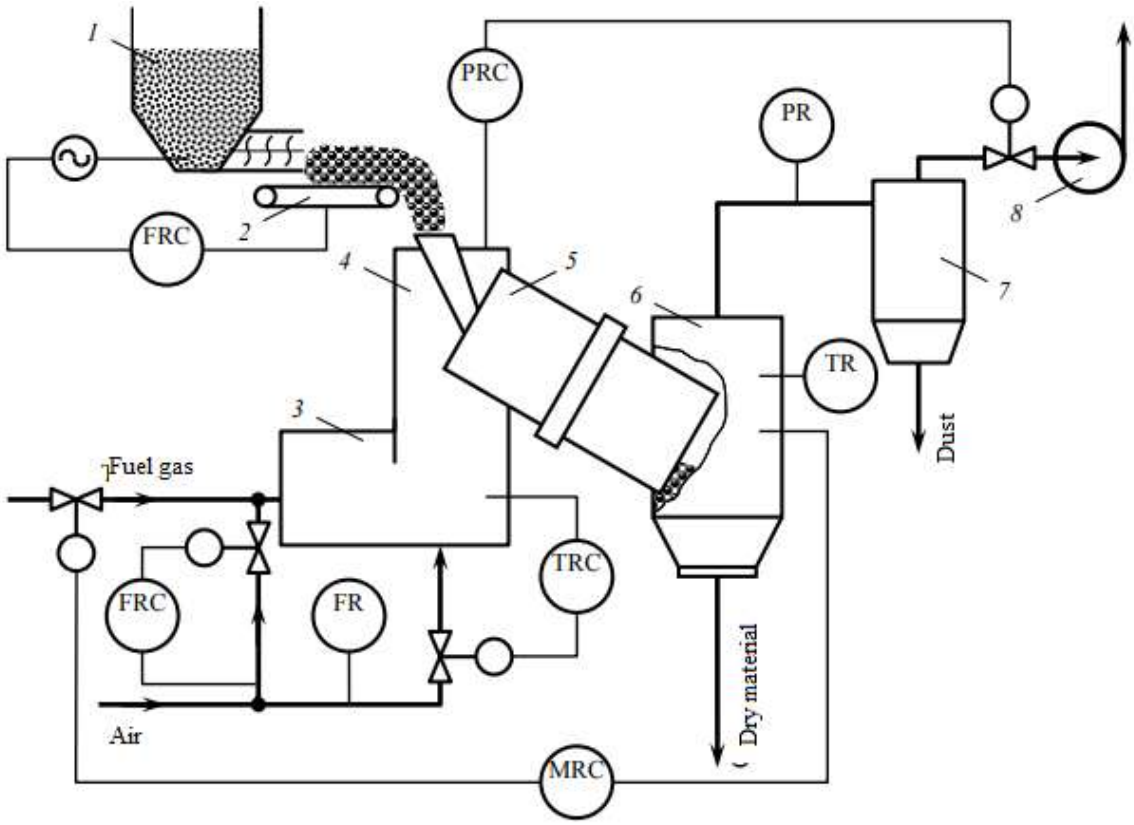
Scheme of stabilization of the absorption process

36. Develop a block diagram and algorithm of control for one of the parameters the technical process shown on the scheme of stabilization of the evaporator plant. Make a choice of technical means of automation. Draw and supplement the functional diagram with technical means for performing various functions (registration, indication, regulation, etc.).



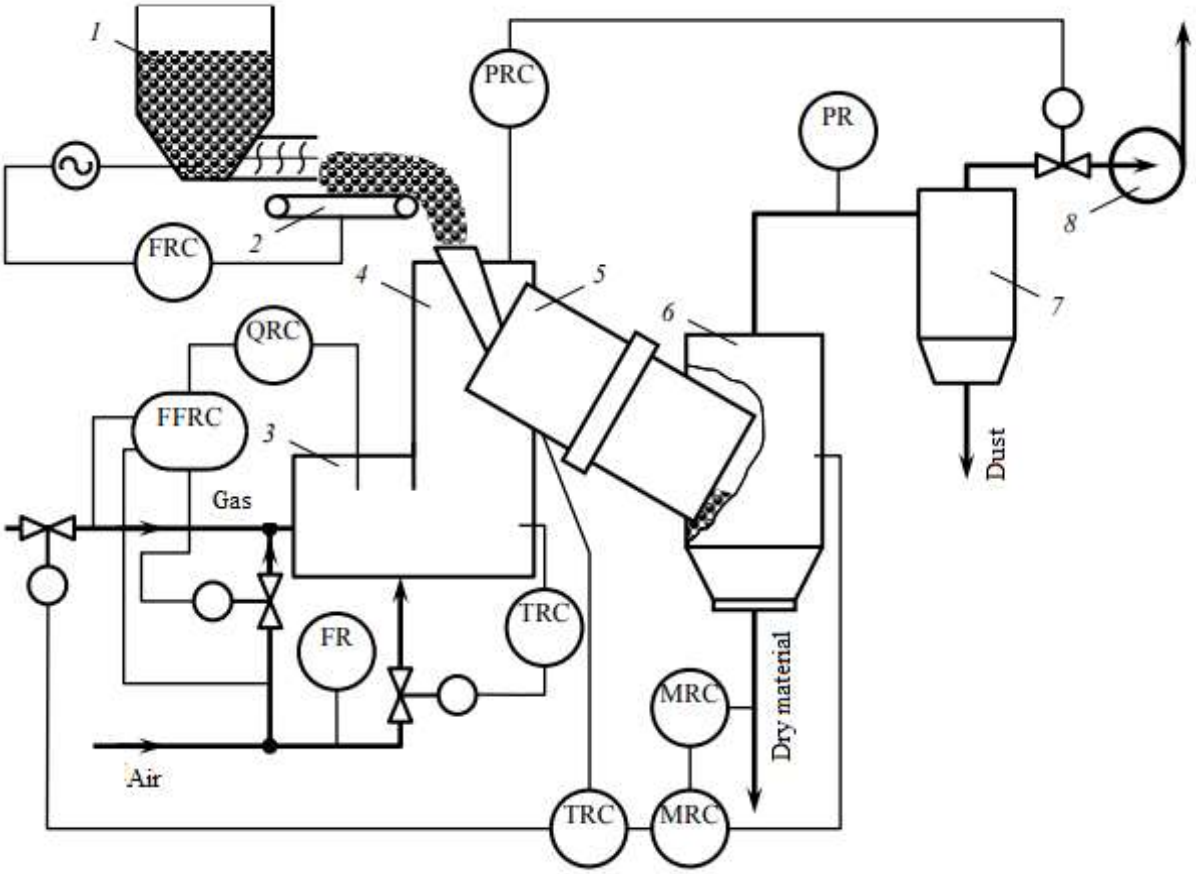
Scheme of stabilization of the evaporator plant

37. Develop a block diagram and algorithm of control for one of the parameters of technical process according to the scheme presented below. Make a choice of technical means of automation. Draw and supplement the functional diagram with technical means for performing various functions (registration, indication, regulation, etc.).



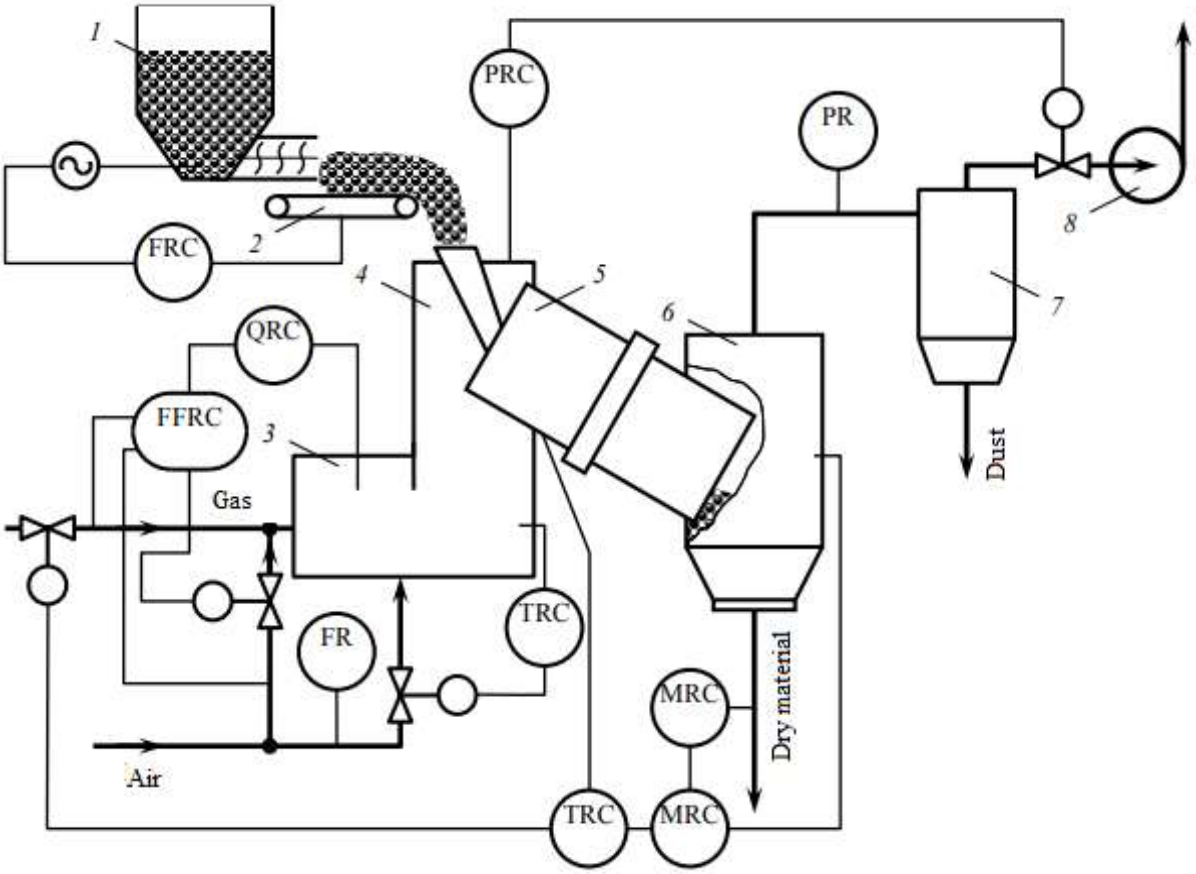
Scheme of stabilization of the drying process in a drum dryer

38. Develop a block diagram and algorithm of control for one of the parameters of technical process according to the presented scheme (scheme of multi-circuit regulation of the drying process in a drum dryer). Make a choice of technical means of automation. Draw and supplement the functional diagram with technical means for performing various functions (registration, indication, regulation, etc.).



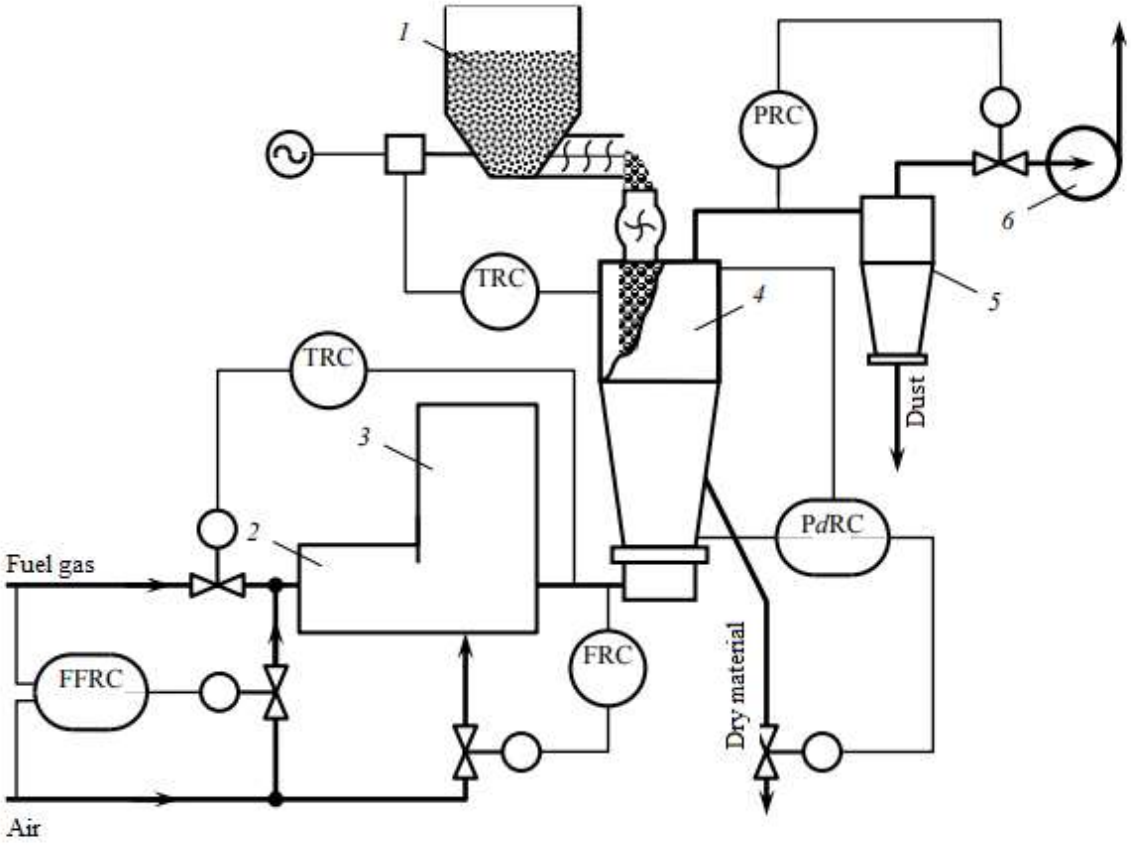
Scheme of multi-circuit regulation of the drying process in a drum dryer

39. Develop a block diagram and algorithm of control for one of the parameters of technical process according to the presented scheme (scheme of regulation the drying process in the apparatus with a fluidized bed of the material to be dried). Make a choice of technical means of automation. Draw and supplement the functional diagram with technical means for performing various functions (registration, indication, regulation, etc.).



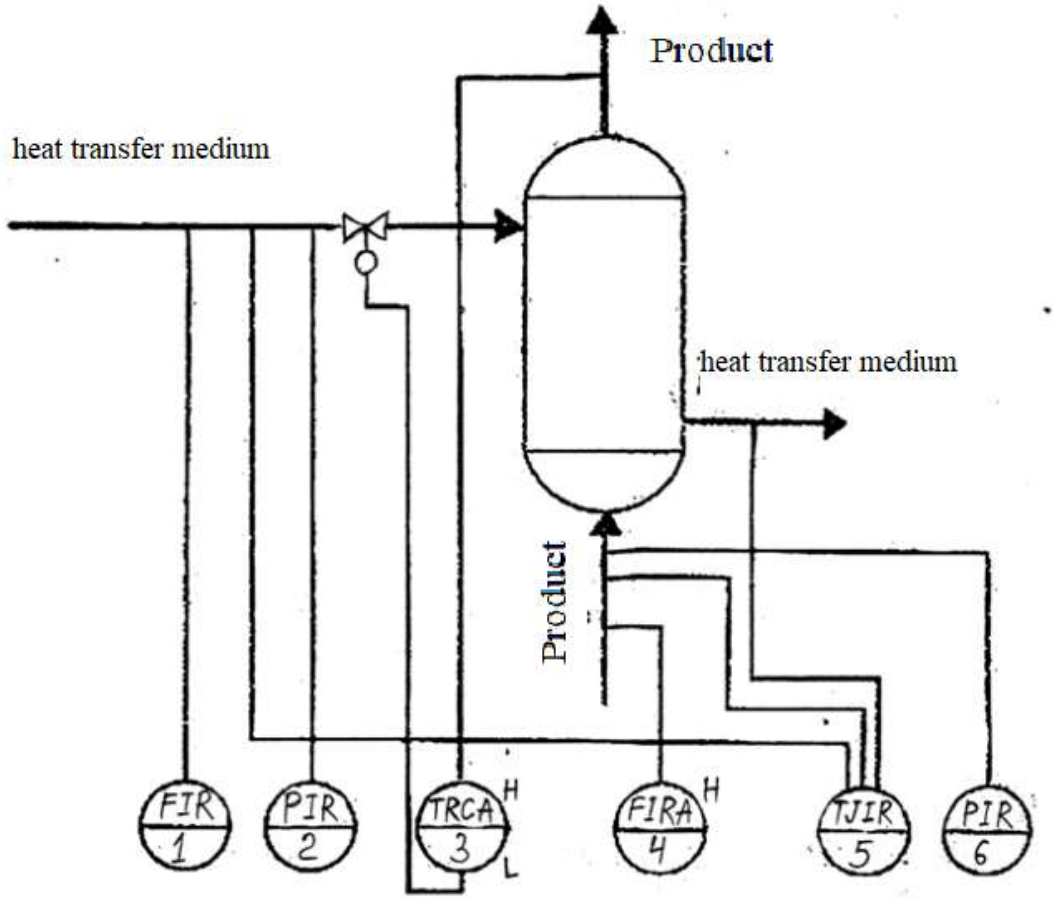
Scheme of regulation the drying process in the apparatus with a fluidized bed of the material to be dried

40. Develop a block diagram and algorithm of control for one of the parameters of technical process according to the scheme of regulation the drying process in the apparatus with a fluidized bed of the material to be dried. Make a choice of technical means of automation. Draw and supplement the functional diagram with technical means for performing various functions (registration, indication, regulation, etc.).



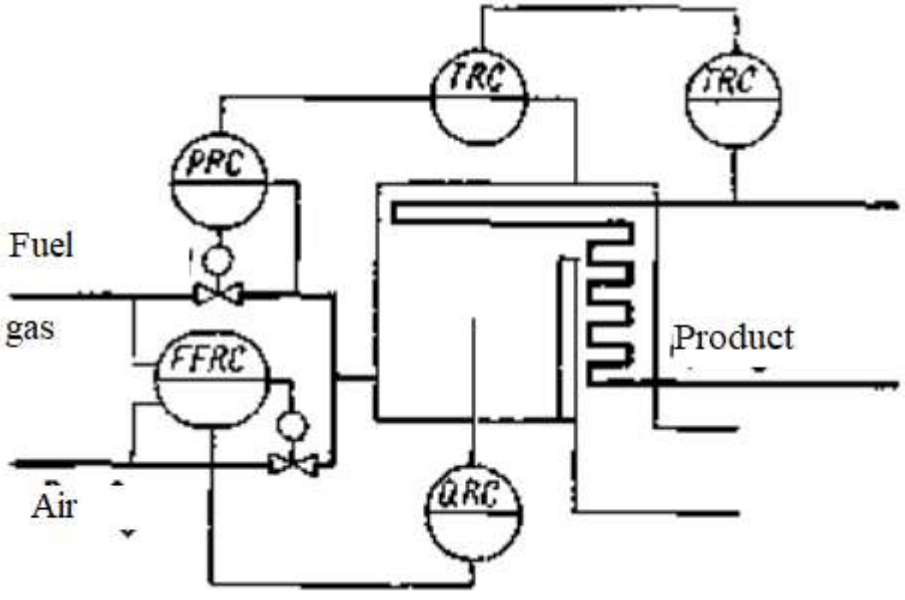
Scheme of regulation the drying process in the apparatus with a fluidized bed of the material to be dried

41. Develop a block diagram and algorithm of control for one of the parameters of technical process of maintaining the flow of hot heat transfer medium. Make a choice of technical means of automation. Draw and supplement the functional diagram with technical means for performing various functions (registration, indication, regulation, etc.).



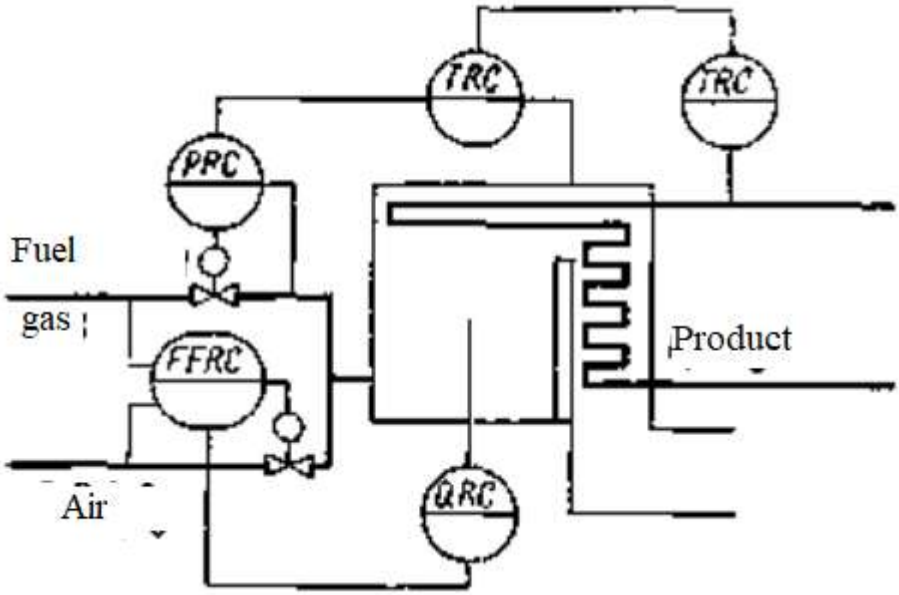
Functional diagram of maintaining the flow of hot heat transfer medium

42. Develop a block diagram and algorithm of control for one of the parameters of process according to the scheme shown below (functional diagram of maintaining the flow of hot heat transfer medium). Make a choice of technical means of automation. Draw and supplement the functional diagram with technical means for performing various functions (registration, indication, regulation, etc.).



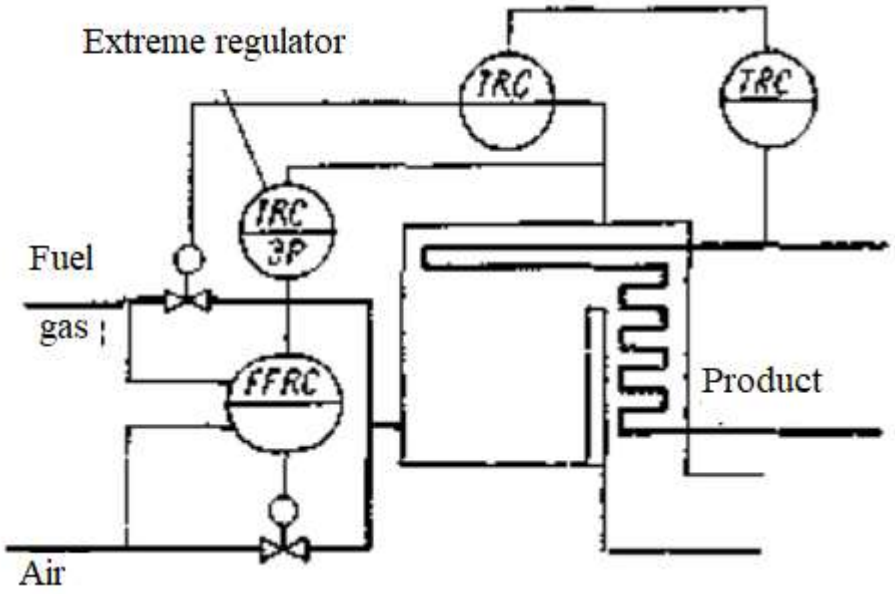
Functional diagram of maintaining the flow of hot heat transfer medium

43. Develop a block diagram and algorithm of control for one of the parameters according to the presented scheme of automation of tube furnaces. Make a choice of technical means of automation. Draw and supplement the functional diagram with technical means for performing various functions (registration, indication, regulation, etc.).



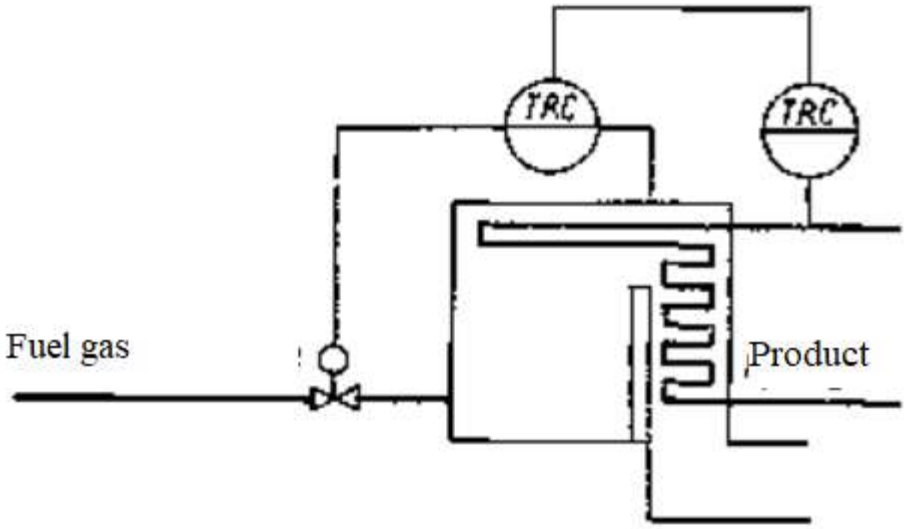
Scheme of automation of tube furnaces

44. Develop a block diagram and algorithm of control for one of the parameters, using the below scheme of automation of tube furnaces. Make a choice of technical means of automation. Draw and supplement the functional diagram with technical means for performing various functions (registration, indication, regulation, etc.).



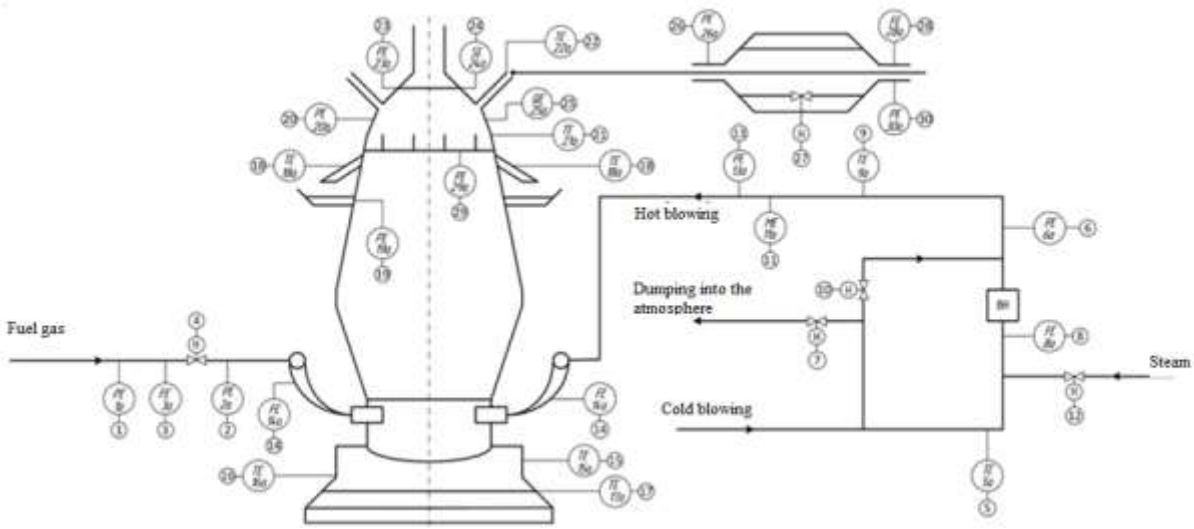
Scheme of automation of tube furnaces

45. Develop a block diagram and algorithm of control for one of the parameters (according to the below scheme of automation of tube furnaces). Make a choice of technical means of automation. Draw and supplement the functional diagram with technical means for performing various functions (registration, indication, regulation, etc.).



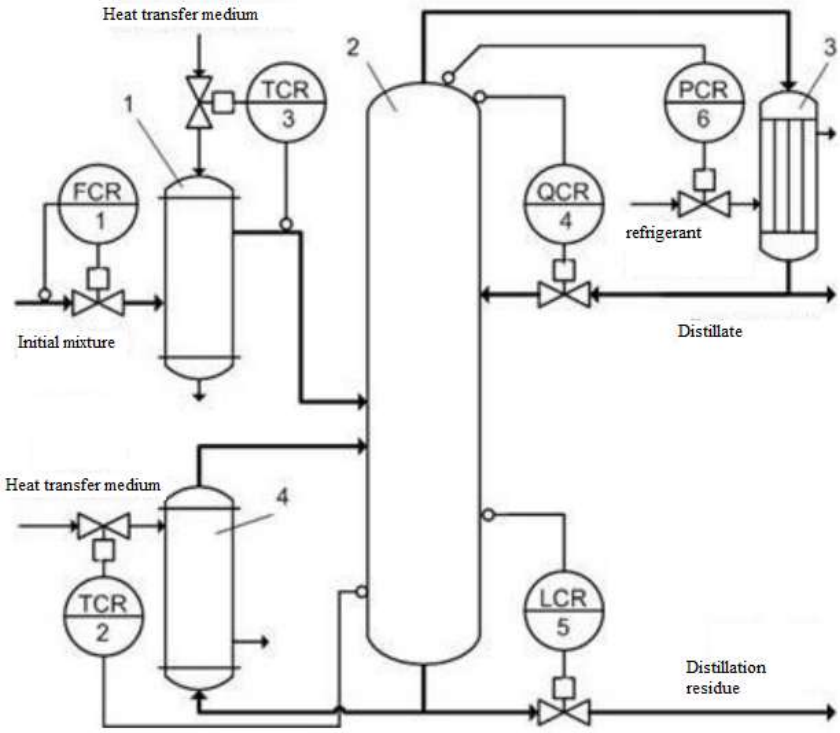
Scheme of automation of tube furnaces

46. Develop a block diagram and algorithm of control for one of the parameters (according to the blast furnace automation scheme, which is given below). Make a choice of technical means of automation. Draw and supplement the functional diagram with technical means for performing various functions (registration, indication, regulation, etc.).



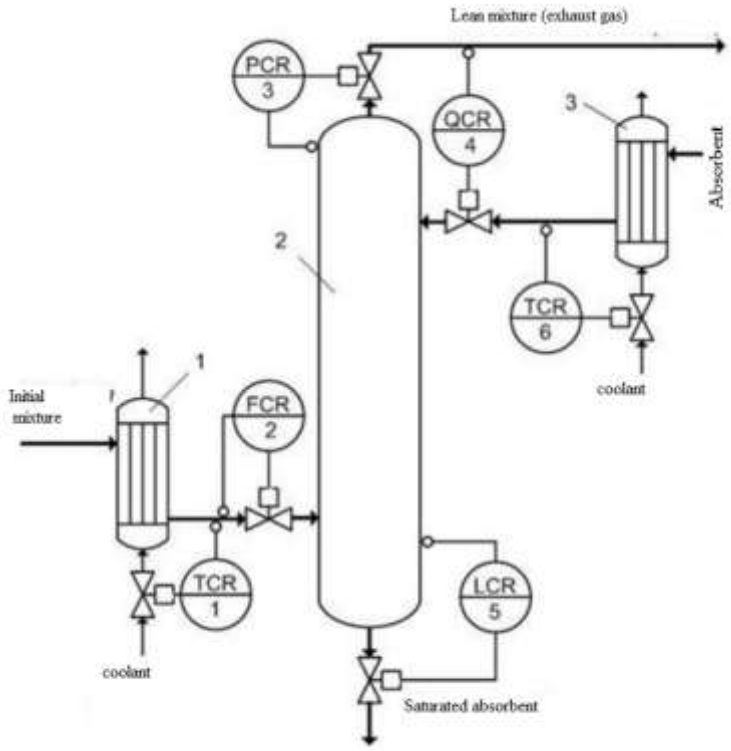
Blast furnace automation scheme

47. Develop a block diagram and algorithm of control for one of the parameters of technical process of rectification (according to the presented scheme). Make a choice of technical means of automation. Draw and supplement the functional diagram with technical means for performing various functions (registration, indication, regulation, etc.).



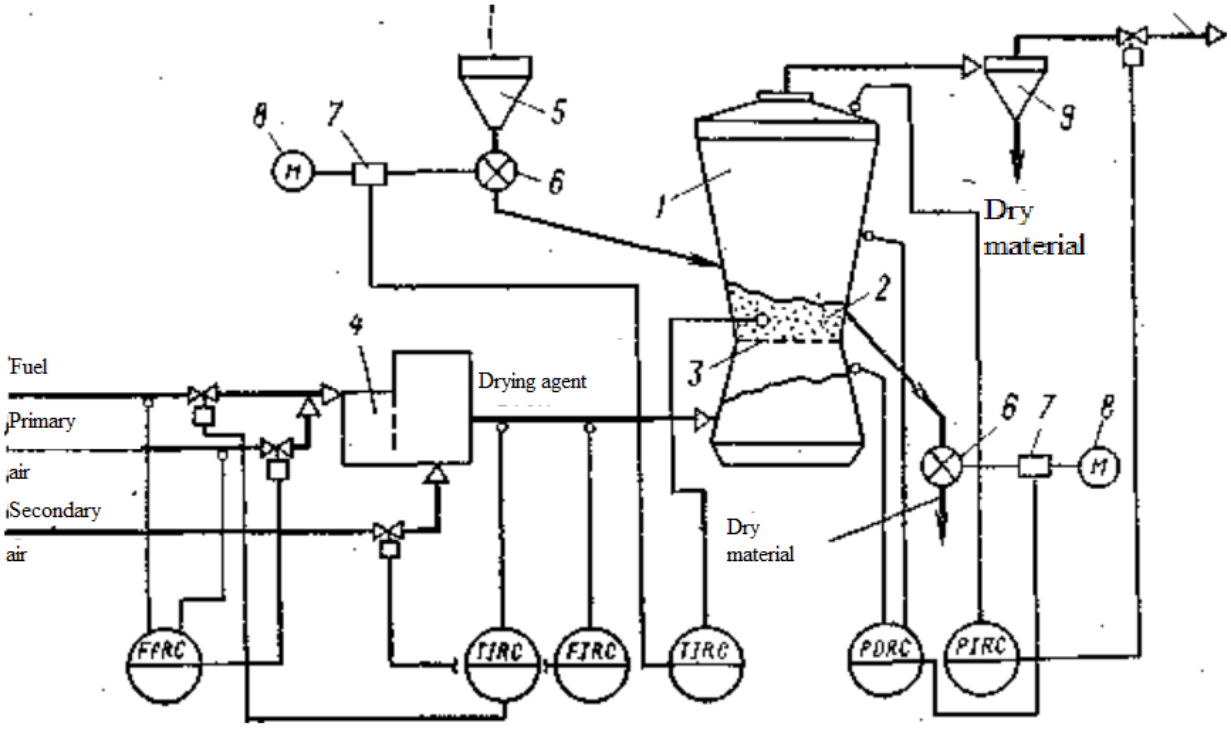
Functional scheme of automation of the rectification process

48. Develop a block diagram and algorithm of control for one of the parameters (according to the presented scheme of automation of the absorption process). Make a choice of technical means of automation. Draw and supplement the functional diagram with technical means for performing various functions (registration, indication, regulation, etc.).



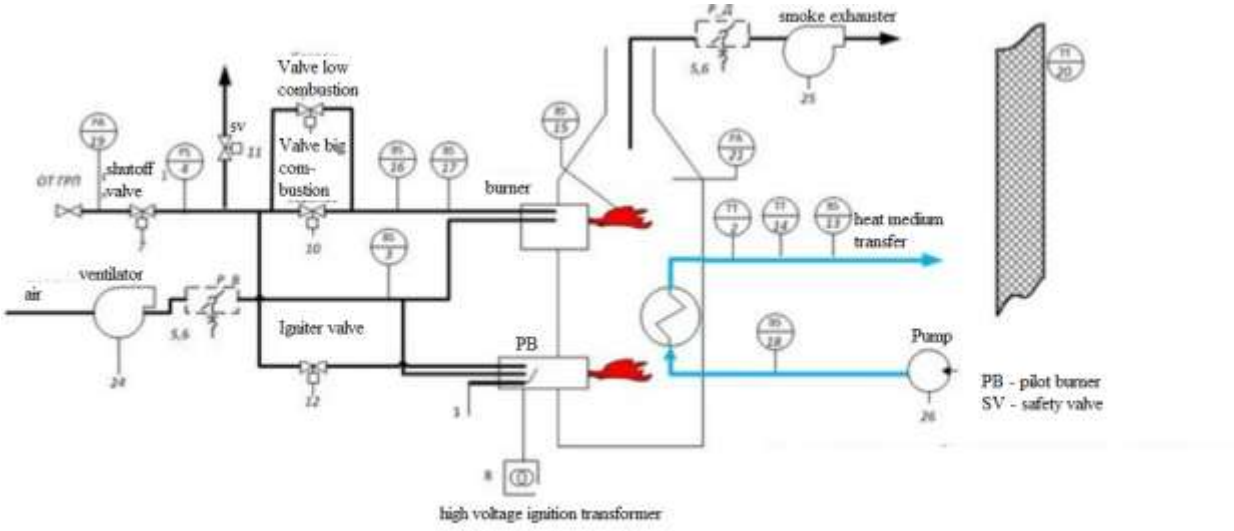
Scheme of automation of the absorption process

49. Develop a block diagram and algorithm of control for one of the parameters according to the presented scheme of regulation the process in fluidized bed dryers. Make a choice of technical means of automation. Draw and supplement the functional diagram with technical means for performing various functions (registration, indication, regulation, etc.).



Scheme of regulation the process in fluidized bed dryers

50. Develop a block diagram and algorithm of control for one of the parameters of technical process (according to the scheme of regulation of process in fluidized bed dryers). Make a choice of technical means of automation. Draw and supplement the functional diagram with technical means for performing various functions (registration, indication, regulation, etc.).



Scheme of regulation of process in fluidized bed dryers

Module 3

1. Flexible automated systems. Types of flexible production systems.
2. Switching devices and distributors.
3. Basic concepts of robotics. Industrial robotic systems and their classification.
4. Actuators and mechanisms.
5. Programming of regulators for the automatic control system.
6. Technical specification for the design of automated control systems.
7. The composition and content of the work on the creation of automated process control systems.
8. General requirements for the creation of automated control systems.
9. Transfer of information to the automated control system of the production system.
10. Building an automated control system based on the concept of open systems.
11. Automation of software development of the automated control system of the production system.
12. Design and implementation of information measuring systems.
13. The concept of integrated automation in mass production.
14. The concept of integrated automation in small-scale production.
15. The method of network planning and management of complex work projects.
16. The process of system development. Validation of design solutions (verification and evaluation).

17. The process of system development. Organization of system engineering.
18. The process of system development. Methods and processes of system engineering.
19. The process of system development. Stages of development of engineering and technical solutions.
20. Software implementation of regulators. PI and PID regulators.
21. Aggregate means of automatic measurement, testing and control systems.
22. Algorithmic and software support for automatic measurement, testing and control systems.
23. Implementation of measurement, testing and control systems.
24. Conceptual foundations of computer-controlled production.
25. Microprocessor systems in the management of non-stationary processes.
26. Devices for obtaining information about the object. Sensors..
27. Signal conversion devices.
28. Measuring transducers.
29. Industrial data transmission networks.
30. Protection of equipment from interference.
31. Principles of construction of regulators for digital (discrete) systems.
32. Discretization of processes and models of control objects based on amplitude-pulse modulation.
33. The discrete Laplace transform.
34. Classical types of stability of discrete systems.
35. Types of stochastic stability of discrete systems.
36. Principles and methods of systemic research.
37. The tasks of the macro approach to research.
38. The tasks of micro-approach to research.
39. Functional characteristics of complex systems.
40. Principles and rules of system modeling.
41. Simulation modeling as a tool for the study of complex systems.
42. Stages, goals and means of mathematical and computer modeling.
43. Models of the organization of information processes of transmission, processing, and accumulation of data.
44. Information technologies of artificial intelligence.
45. Modes of interaction between the user and the computer system.
46. Properties of fuzzy relations.
47. Information technology user interface.
48. Information technology of data processing.
49. Operations on fuzzy relationships.
50. Logical operations on fuzzy sets.

List of recommended literature for exam preparation

1. Иванов А.А. Автоматизация технологических процессов и производств: учеб. пособие / А.А. Иванов. – М.: Форум, 2021. – 224 с.
2. Основы автоматизации технологических процессов: учебное пособие / А.В. Щагин, В.И. Демкин, В.Ю. Кононов, А.Б. Кабанова. – М.: Юрайт, 2019. - 163 с.
3. Автоматизация и управление в технологических комплексах / А.М. Русецкий [и др.]; под общ. ред. А.М. Русецкого. – Минск: Беларуская навука, 2014. – 375 с.
4. Косяков А., Свит У. и др. Системная инженерия. Принципы и практика. Пер. с англ. Под ред. В.К. Батоврина. – М.: ДМК-Пресс, 2014. – 624 с.
5. Гапеев В.В., Бекбай А.Т., Мусиралиев Т.К., Николаев В.Е. Техническое решение по автоматизации производства: Учебное пособие. Нур-Султан: Некоммерческое акционерное общество «Холдинг «Кәсіпқор», 2019. – 167 с.
6. Дмитриева О.В. Проектирование систем и средств автоматизации и управления: учебное пособие / О. В. Дмитриева, Н. Б. Сбродов, Е. К. Карпов, М. В. Неизвестных. – Курган : Изд-во Курганского гос. ун-та, 2019. – 112 с.
7. Федоров Ю.Н. Справочник инженера по АСУТП: проектирование и разработка. Комплект в двух томах. Том 1. – М.: Инфра-Инженерия, 2016. – 448 с.
8. Ковалев А.А. Автоматизированные системы управления технологическими процессами: курс лекций / А.А. Ковалев, И.А. Баева. – Екатеринбург: УрГУПС, 2019. – 95 с.
9. Латышенко К.П. Автоматизация измерений, испытаний и контроля: Учебное пособие. – Саратов: Издательство «Вузовское образование», 2019. – 307 с.
10. Асадуллаев Р.Г. Нечеткая логика и нейронные сети: учебное пособие. – Белгород, 2017. – 309 с.
11. Федоров Ю.Н. Справочник инженера по АСУТП: проектирование и разработка. Комплект в двух томах. Том 1. – М.: Инфра-Инженерия, 2016. – 448 с.
12. Попова Е.П. Методическое пособие по МДК 04.01 «Теоретические основы разработки и моделирования несложных систем автоматизации с учетом специфики технологических процессов отрасли» для обучающихся по специальности 15.02.07 Автоматизация технологических процессов и производств. – Краснодар: ГБПОУ КК КТК, 2014. – 72 с.
13. Старостин А.А. Технические средства автоматизации и управления: учеб. пособие / А.А. Старостин, А.В. Лаптева. - Екатеринбург: Изд-во Урал. ун-та, 2015. - 168 с.
14. Григорьев В.В., Быстров С.В., Бойков В.И., Болтунов Г.И., Мансурова О.К. Цифровые системы управления: Учебное пособие. – СПб: Университет ИТМО, 2019. – 133 с.
15. Петров А.В. Моделирование процессов и систем: учебное пособие. – СПб.: Лань, 2021. – 288 с.

16. Коломейченко А.С. Информационные технологии: учебное пособие для вузов / А.С. Коломейченко, Н.В. Польшакова, О.В. Чеха. – 2-е изд., перераб. – СПб.: Лань, 2021. – 212 с.
17. Лозовецкий В.В. Роботехнические комплексы – средства автоматизации технологических процессов и производств лесной промышленности: учебник для вузов / В.В. Лозовецкий, Е.Г. Комаров; под. ред. В.В. Лозовецкого. – 2-е изд., стер. – СПб.: Лань, 2021. – 568 с.

Essay topics

1. Actual problems of production automation development in Kazakhstan
2. Application of scientific research methods in the design and maintenance of automation systems
3. Development of autonomous robotic systems in industry: assessment of technological and economic aspects of the introduction of autonomous robots for managing production processes.
4. What competencies should a modern specialist have in the field of automation and control?
5. Digitalization and transformation of production processes through automation: studying the impact of digitalization on production processes and developing strategies for the introduction of digital technologies in industry.
6. The position of production automation in the world
7. Automation and control at the interface with other scientific fields
8. Research of automatic control systems in conditions of uncertainty
9. The place and role of modern information technologies in automation
10. Cyberphysical systems and their application in production automation
11. MES systems as an integral component of production automation
12. Scientific and technological progress in the field of automation and control
13. Ethics and social aspects of the use of artificial intelligence in industry: the study of ethical issues related to autonomous systems in the context of public acceptance and impact on the workforce
14. Modern methods and tools for the development of automation and control systems
15. The place of the theory of automatic control in the system of sciences
16. Application of SCADA systems for enterprise automation
17. The Internet of Things as a component of automation
18. Automation of production and the risk of technological unemployment
19. The role of artificial intelligence in the field of automation and control
20. Integration of smart cities and IoT networks to increase the sustainability and comfort of life: a study of the role of automation and management in the development of smart cities and their impact on the quality of life of citizens.