MINISTRY OF THE HIGHEST AND AVERAGE VOCATIONAL EDUCATION OF THE REPUBLIC OF UZBEKISTAN

BUKHARA ENGINEERING INSTITUTE OF TECHNOLOGY

Faculty "Chemical - technology"

The department of "Technology of the Oilchemical Industry"

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GRADUATE QUALIFICATION WORK

Theme : The analysis of installation primary distillation of oil feedstock with a productivity of 500 million tons/year and calculation the rectifying column

HAS EXECUTED:	**student of group 1-12 NGKST Fayzullev Farkhodbek**
HEAD:	**Yamaletdinova A.A.**
CONSULTANT:	**Saliev I.R.**

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Fayzullayev Farkhodbek

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Dean of faculty of “ChT”: dots. Ataullayev Sh. N.
Head of department of “TOI” : dots. Bozorov G.R.
Head: A. Yamaletdinova
Graduate: F. Fayzullayev

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INTRODUCTION

The report of the President of the Republic of Uzbekistan Islam Karimov on the enlarged meeting of the Cabinet devoted to results of social and economic development of the country in 2015 and to the most important priority directions of the economic program for 2016.

In the agenda of enlarged meeting of the Cabinet - results of economic and social development of the country for the expired 2015 and the statement of the major priorities of development of national economy for 2016.

Analyzing progressive advance of the country on the way of democratic transformations and a sustainable development, we have all bases to declare that in the expired year the plunge in implementation of essentially important reforms directed on achievement of our main goal is taken - to reach the level of the developed democratic states of the world with the strong socially oriented economy providing the worthy level and quality of life of our people.

The speech, first of all, goes about implementation of comprehensively thought over Program aimed at providing deep structural transformations, reliable protection of interests of private business and small business and that is essentially important, - in legislative, normative legal and practical as it is provided in our Constitution, providing a priority role of a private property, progressive reduction of presence of the state at economy of Uzbekistan.

It is recognized reasonable at this stage of our development under a direct control of the state to keep only the enterprises which are carrying out production and processing of a hydrocarbonic raw material, precious and non-ferrous metals, uranium, and also the strategic infrastructure industries of natural monopolies - iron and highways, air transportation, generation of the electric power, electric and utility networks.

The task has been set and conditions for bulk selling of the state assets, first of all to foreign investors are created. So, at "zero" redemption cost about 22 thousand new workplaces have been implemented on a competitive basis to new investors

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of 506 property complexes with adoption of investment obligations by investors of about 1 trillion sum and 40 million US dollars, and also creation.

Among the objects put into operation especially would like to note the Ustyurtsky gas-chemical complex constructed together with South Korean investors and specialists on the basis of a field Surgil. This complex worth over 4 billion dollars is one of the most modern hi-tech and large productions in the world. Its commissioning will allow to receive annually 83 thousand tons of polypropylene which was imported to the republic before, to increase polyethylene output by 3,1 times, to employ more than 1 thousand highly qualified specialists.

Defining the main priorities of social and economic development of our country for 2016, we cannot but consider the serious problems arising in connection with the proceeding global crisis, sharp reduction of demand, uncertainty and essential the increased fierce competition in the world markets the falling of growth rates of production and all effects following from here which have concerned the majority of the states in the world.

In this regard the difficult problems facing us in 2016 dictate need of full refusal of the become obsolete methods of inertial forecasting from the reached level, relying on average values of development.

Continuous technology and technical updating of production, and also continuous search of internal reserves, implementation of deep structural transformations in economy, modernization and diversification of the industry should be the main reference point for us.

In other words, time demands to pass to consecutive 3-4-phasic cycles of processing of raw materials into products demanded in the world market according to the scheme: basic raw materials - primary processing (semi-finished products) - ready materials for industrial production - finished goods for final consumption.

Thus there is a need during the developing and implementation of programs to trace a full cycle of deep processing by each type of primary raw material - a semi-finished product up to finished goods of final consumption.

In a word, it is necessary to provide forecasting of all cycle of the organization of production - from raw materials to finished goods with justification of expediency and an economic return.

As show calculations, as a result of production with a high value added production of petrochemical products can be increased with development of its new types by 2030 by 3,2 times, products from non-ferrous metals - by 2,2 times, from ferrous metals - by 2,3 time, products of chemical industry, including mineral fertilizers, - by 3,2 times.

Along with it increase in production of modern finished goods with the high value added demanded in foreign markets will become a basis of steadily high growth rates of its export.

It is necessary to tell that this work in the country is already begun. However she demands cardinally new program integrated approach on each perspective view of raw materials and the semi-finished products possessing high potential to have the specific program of deep processing calculated on 2020, 2025, 2030.

We have all bases, proceeding from the deep analysis of tendencies of development of world economy, a real assessment of our resources and opportunities today, to set for themselves the target task - not less than twice to increase the volume of gross domestic product of our country by 2030.

Installations of primary oil refining make a basis of all oil refineries, quality and exits of the received components of fuels, and also raw materials for secondary and other oil refining processes depend on work of these installations.

In industrial practice oil is separated into the fractions differing with temperature limits of boil-off. This division is carried out on installations of primary distillation of oil using processes of heating, distillation and rectification, condensation and cooling. Straight run distillation is carried out at atmospheric or a little elevated pressure, and the remains - under vacuum. Atmospheric and vacuum tubular units (AT and W) build separately from each other or combine as a part of one installation (AVT).

Atmospheric tubular installations (AT) subdivide depending on the technology scheme into the following groups:

1) installations with single evaporation of oil;

2) installations with double evaporation of oil;

3) installations with preliminary evaporation in an evaporator of light fractions and the subsequent rectification.

The third group of installations is practically option of the second as in both cases oil is exposed to double evaporation.

Vacuum tubular units (W) subdivide into two groups:

1) installations with single evaporation of fuel oil;

2) installations with double, fuel oil evaporation (two-level).

Owing to a big variety processed nefty and the wide range of the received products and their quality not always reasonablly to apply one standard scheme. Installations with the preliminary stripping column and the main rectifying atmospheric column, contents, operable at considerable change, in neftyakh gasoline fractions and dissolved gases are widespread.

The exit and quality of components of fuels and lubricating oils and technical and economic indicator of the subsequent processes of processing of oil feedstock depend on work of AVT. The close attention was always paid and paid to problems of increase of overall performance and an intensification of the AVT installations.

On installations of primary oil refining high extent of automation is reached. So, on factory installations use the automatic analyzers of quality ("on a flow") defining: the content of water and salts in oil, flash temperature of aviation kerosene, diesel fuel, oil distillates, temperature of boil-off of 90% (masses.) tests of light oil product, viscosity of lube fractions, the maintenance of a product in drain waters. Some of analyzers of quality join in schemes of automatic control. For example, supply of water vapor in a nizotparny column is automatically adjusted on flash temperature of diesel fuel determined by the automatic analyzer distemper flash rounds. Use chromatographs to automatic continuous detection and registration of structure of gas streams.

TECHNICAL PART

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1.1. Theories of an origin of oil

There are three theories of an origin of oil: mineral, organic and space.

The theory of a mineral origin of oil has arisen at a dawn of oil industry and developed as alternative of the biogenous concept. It has been caused by that the biogenous theory at all its aspiration to universality could not explain many important facts or well prove some own basic theoretical provisions. Treat extreme irregularity in distribution of oil reserves on Earth number of such facts and provisions; lack of any essential specific signs of "petromaternal" rock formations, except availability of the scattered oil close on structure to normal oil; impossibility quantitatively to explain formation of the largest and huge oil fields and gas at the expense of the organic substance disseminated in surrounding breeds, etc. The essence of the mineral concept briefly is as follows. Oil-and-gas formation and forming of oil and gas fields is considered as one of manifestations of broader natural process - decontamination of Earth. This process in different forms - one of the main factors of evolution of Earth which have created modern look of its outer jackets which have created the hydrosphere, the atmosphere and, eventually, the biosphere at early stages of geological history. Deep decontamination is connected, mainly, with active zones of earth crust for which are characteristic availability of deep-seated faults, high seismicity and a volcanism. Major components as a part of gases are vapors of water, CO2, H2S, H2, N2 and hydrocarbons. A. Humboldt has stated the first this theory in 1805. Experiences of scientific 1860-1870th years have given rise to development of the theory of D. I. Mendeleyev. On October 15, 1876, at a meeting of the Russian chemical society D. I. Mendeleyev has stated the hypothesis of formation of oil. The great chemist considered that during processes of mountain building on the cracks breaks dissecting earth crust water deep into arrives. Filtering into a subsoil, it eventually meets iron carbides and under the influence of high temperatures and pressure enters chemical reaction. As a result of this reaction iron oxides and hydrocarbons are formed. The formed substances on breaks of bark rise in its top coats and saturate porous rocks. Oil fields are as a result formed. In the first half of the XX century interest in a hypothesis of a mineral origin of oil has been generally lost. But since 1950, because of absence of proofs of the organic theory, development of the mineral theory has gone at full speed. The geologist, N. A. Kudryavtsev, has stated that oil and gas are formed in deep zones of Earth of mix and as a result of reactions of direct synthesis of hydrocarbon from CO and: and also polymerizations of radicals of CH. Geological proofs of a mineral hypothesis - availability of traces of methane and some oil hydrocarbons in deep crystalline rocks, in the gases and magmas which are throwing up from volcanoes, manifestation of oil and gas on some deep-seated faults, etc. - are indirect and always allow double treatment. The chemical base of a mineral hypothesis is the catalytic synthesis and conversion of hydrocarbons at high temperatures and pressure in many respects mastered by chemical technology. The mineral concept explains such main features of distribution of hydrocarbons, including their accumulations: - oil and gas can lie in any rock formations having free tanks and conditions for deduction and preservation of the fluids which are in them. These conditions are answered, mainly, by sedimentary rock formations; - the majority of accumulations of oil and gas in rock formations have arisen much later (later tens and hundreds of millions years) formations of rock formations. Now have remained, generally only relatively young fields as ancient most likely have been destroyed by geological processes; - availability on Earth of huge and superhuge oil fields and gas as the sizes of these fields in upper floors of earth crust are limited only to the sizes of the reservoirs which are available in rock formations and preservation conditions; - confinedness in oil-and-gas areas of accumulations to breeds of a certain age in area or the pool that is connected with a community of conditions of formation of rock formations, forming in them capacity and other physical properties; - high concentration in neftyakh metals, a wide circulation of bituminous substances in some ores; - a wide circulation in any rock formations of oil-and-gas regions of scattered hydrocarbons as oil in fields is the only insignificant part of a powerful flow of hydrocarbons taken by traps; - availability of extreme formation pressures in oil and gas deposits. Theory of an organic origin of oil. The founder of this theory - M. V. Lomonosov. Bases of the theory were stated in one of paths of the scientist where he wrote: "It is expelled by underground heat from the preparing coals, it is a brown and black oil matter... and this is the birth liquid a different grade of combustible and dry zatverdely matters what an essence stone oil, Jewish pitch, oil, gagate, and this similar which though purity differ, however come from one beginning". Later this theory changed and varied, but a theory essence such is - the organic material transformed at first to coal, and then to oil. Sedimentary rocks always contain very insignificant amount of organic substance (only 0,2-0,9%). Studying of its structure has shown that it consists of the substances reminding the zhiropodobny substances containing in the remains of plants at the bottom of the seas. And on the molecular structure it is similar to the connections which are a part of oil. Thanks to it some scientists consider the oil proved possibility of formation of hydrocarbons from lipids, proteins and carbohydrates which were a part of animal organisms. In 1921 the Japanese scientist Kobayasi managed to receive artificial oil at distillation of fat of fishes without pressure, but in the presence of the catalyst - the reaction accelerator. Similar experiments have been made also by other researchers. It has suggested to them an idea that the clays containing substances catalysts can be such catalysts in nature, and that in clay thicknesses scattered organic substance turns into oil. Therefore such clay thicknesses have received the name "petroleogenetic", or "petromaternal". The biogenous concept of an origin of oil explains the main features of distribution and composition of oil: - more than 99% of oil fields and gas are concentrated in sedimentary rock formations, i.e. in the breeds formed of ground deposits of ancient water basins in whom life developed; - sedimentary rocks (clays, sandstones, limestones, etc.) are characterized by a wide circulation of disperse bituminous substances ("diffusion and scattered oil"), relatives on structure to normal oil. The total quantity of scattered oil in a sedimentary cover of Earth much more exceeds total quantity of oil in fields; - in oil-and-gas regions of the oil deposit and gas are stratified, i.e. in each region are dated generally for layers of rock formations of a certain age; - in fields and composition of scattered oil in rock formations many similar lines with structure of live substance have chemical composition of oil: at them there are biomolecules or their fragments (isoprenoids, porphyrines, etc.) which part causes the optical activity of oil inherent live, etc. The biogenous concept of an origin of oil does not represent the uniform finished theory. In its framework there are debatable most fundamental issues to this day: stages of a litogenez with which it is connected, generally petroeducation; power sources for synthesis of oil hydrocarbons from kerogen; the mechanism of collecting of scattered hydrocarbons in accumulations; forms and energy of migration of oil in rock formations; origin of types nefty and others. On all these questions the biogenous concept does not give definite answers yet: the majority of decisions have alternatives. Theory of a space origin of oil. In 1892 M. A. Sokolov has made a hypothesis of a space origin of oil. The essence it is reduced besides to mineral synthesis of hydrocarbons from simple substances, but at an initial, space stage of forming of Earth. It was supposed that the formed hydrocarbons were in a gas cover, and in process of cooling were absorbed by breeds of the formed earth crust. Being released then from the cooling-down magmatic rocks, hydrocarbons rose in upper part of earth crust where formed accumulations. At the heart of this hypothesis there were data on availability of carbon and hydrogen in tails of comets and hydrocarbons in meteorites.

1.2 Products of primary distillation of oil

Depending on composition of oil, option of its processing and special requirements to fuel and lube fractions the structure of products of installations of primary distillation of oil can be different. So, when processing standard east oil receive the following fractions (with conditional limits of boil-off according to the preferential maintenance of target components): petrol N to. - 140 (180) °C, kerosene 140 (180) - 240 °C, diesel 240-350 °C, vacuum distillate (gasoil) of 350-490 °C (500 °C) or narrow vacuum oil shoulder straps of 350-400, 400-450 and 450-500 °C, the heavy rest> 500 °C - tar.

The exit of fuel and lube fractions depends first of all on composition of oil, i.e. on the potential maintenance of target fractions in neftyakh. Data on an exit of the fuel and lube fractions from romashkinsky and samotlorsky oil differing with the potential maintenance of fuel fractions are given as an example in tab. 1 - the maintenance of fractions to 350 °C in these neftyakh makes about 46 and 50% (Mas.).

Table 1. Temperatures of boil-off and an exit of products of distillation of oil on the AT installations when processing different the oil

Product (fraction)	Boiling range °C	Fractions output. % (wt) oil	
		Romashkinskoye	Samotlor
• Gas	–	1.0	1.1
• Gasoline fraction	c.n. – 62	2.0	4.1
	62-85	2.7	2.4
	85 – 180	6.4	6.0
• Kerosene fraction	180 – 240	9.8	9.5
• Diesel fuel	240 – 350	17.0	19.0
• Broad lube fraction	350 – 460	17.8	21.0
• Tar	> 460	35.0	28.4
• Losses	–	0.8	1.0

Let's consider the directions of use of products of primary distillation of oil and fuel oil.

Hydrocarbon gas consists generally of propane and butane. The propane-butane fraction is used as raw materials of gazofuktsioniruyushchy installation for allocation from it individual hydrocarbons, receiving household fuel. Depending on the technology mode and hardware registration of primary distillation of oil propane - the butane fraction can turn out in the liquefied or gaseous state.

Petrol fraction (28-180 °C). Generally is exposed to redistillation with receiving fractions.

Kerosene fraction (180-240 °C) is used for receiving reactive fuels, and also as lighting kerosene.

The fraction **of diesel fuel** (180-340 °C) after cleaning is used as diesel fuel; receiving components of light (winter) and heavy (summer) diesel fuel of the relevant fractional structure, for example 180-240 and 240-350 °C is possible. The fraction of 200-220 °C to a parafinistykhnefta is used as raw materials for production of liquid paraffins - bases for receiving synthetic detergents.

Atmospheric gasoil of 330-360 °C - the darkened product, turns out on the AVT installation working by fuel option; it is used in mix with vacuum gasoil as raw materials of installation of Catholic cracking.

Fuel oil - the rest of primary distillation of oil; the facilitated fuel oil (the rest is above 350 °C) can be used as boiler fuel, the weighted fuel oil (it is above 360 °C) - as raw materials for the subsequent processing on lube fractions to tar. Now fuel oil can be used also as raw materials of catalytic cracking unit or hydrocracking (earlier it was applied as raw materials of installations of a thermal cracking).

Broad lube fraction (vacuum gasoil) of 350-500 °C or 350-550 °C is used as raw materials of catalytic cracking unit and hydrocracking.

Narrow lube fractions of 350-400, 400-450 and 450-500 °C after the corresponding cleaning of sulphurous connections, polycyclic aromatic and normal paraffinic hydrocarbons it is used for production of lubricating oils.

Tar - the rest of vacuum distillation of fuel oil - is exposed to further processing for the purpose of receiving residual oils, coke and (or) bitumen, and also boiler fuel by decrease in viscosity on visbreaking units.

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1.3. Principles of primary oil refining

Oil represents difficult mix of paraffin, naphthenic and aromatic carbohydrates, different on the molecular weight and boiling temperature. Besides, oil contains sulphurous, oxygen and nitrogenous organic compounds. And with specific properties apply methods of division of oil into fractions and groups of hydrocarbons to production of numerous products of different function, and also change of its chemical composition. Distinguish primary and secondary methods of oil refining:

- refer processes of division of oil into fractions when its potential opportunities on the range are used, to the primary to quantity and quality of the received products and semi-products - oil distillation;
- refer the processes of destructive oil refining and purification of oil products intended for change of its chemical composition by thermal and catalytic influence to the secondary. By means of these methods it is possible to receive oil products of the set quality and in large numbers than at oil straight run distillation.

Distinguish distillation with single, repeated and gradual evaporation. At distillation with single evaporation oil is heated to a certain temperature and select all fractions which have passed into a steam phase. Distillation of oil with repeated evaporation is made with step-by-step heating of oil, and collecting at each stage of fractions of oil with the corresponding transition temperature in a steam phase. Distillation of oil with gradual evaporation generally is applied in laboratory practice to receiving especially exact division of a large number of fractions. Differs from other methods of distillation of oil in low productivity.

The steam and liquid phases formed in the course of oil distillation subject to rectification in columns.

1.4. The major factors defining an exit and quality of products of primary distillation of oil

Distillation (distillation) is a process of physical division of oil and gases on fractions (components) differing from each other and from initial mix on temperature limits (or temperature) boilings. On a way of carrying out process distinguish simple and difficult distillation.

Simple distillation is carried out by gradual, single or repeated evaporation.

Distillation with gradual evaporation consists in gradual heating of oil from initial up to the final temperature with continuous branch and condensation of the formed vapors. This way of distillation of oil and oil products generally apply in laboratory practice when determining their fractional structure.

At single distillation liquid (oil) heats up to the set temperature, formed and reached balance, couples once separate from a fluid phase - the rest. This way, in comparison with distillation with gradual evaporation, provides a big share of distillation at an identical temperature and pressure.

Distillation with repeated evaporation consists in consecutive repetition of process of single distillation at more high temperatures or low pressures in relation to the rest of the previous process.

From processes of difficult distillation distinguish distillation with dephlegmation and distillation with rectification.

At distillation with dephlegmation the formed couples condense, and part of condensate in the form of a phlegm give towards to steam flow. As a result of single engagement of steam and liquid flows couples leaving system in addition are enriched with low-boiling components, thereby the clearness of division of mixes increases a little.

Distillation with rectification - the mass-exchanged process, most widespread in chemical and oil and gas technology which is carried out in devices - rectifying columns - by repeated counterflow engagement of vapors and liquid. Engagement of flows of steam and liquid can be made or is continuous (in packed columns) or is step (in dish rectifying columns). At interaction of counter descendants of steam and liquids at each step of engagement (a plate or a layer of a nozzle) between them there is heat - and a mass exchange, systems caused by aspiration to an equilibrium state. As a result of each contact components are redistributed between phases: steam is a little enriched low-boiling, and liquid - high-boiling components. At sufficient long contact and high performance of a contact device of couples and liquid, leaving a plate or a layer of a nozzle, can reach an equilibrium state, that is temperatures of flows will become identical, and thus their structures will be connected by managements of balance. Such contact of liquid and steam which is coming to the end with achievement of phase balance it is accepted to call an equilibrium step or a theoretical plate. Selecting number of contact steps and parameters of process (temperature condition, pressure, a ratio of flows, phlegm number, etc.), it is possible to provide any required clearness of fractionation of oil mixtures.

The input place in rectifying to colon of the heated overtaken raw materials is called feeder section (zone) where single evaporation is carried out. The part of a column located above feeder section serves for rectification of a steam flow and another is called concentration (strengthening), and - the lower part in which rectification of a liquid flow - distillation, or exhaustive section is carried out.

Classification of rectifying columns:

The rectifying column represents the vertical cylindrical device of different diameter (1,5-3,5 m), heights (from 10-12 to 30-35 m). The column from special brand of steel is produced, and it is equipped with special contact devices.

All rectifying columns divide on several signs:

1) on the technology mode in a column distinguish: the columns working with an atmospheric pressure or close to it; the columns working under excessive pressure; the columns working under vacuum;

2) as contact devices distinguish: columns of nozzle type; rotor and disk columns; dish columns.

3) by quantity of the selected products distinguish simple and difficult columns. Idle time call a column in which select two products - upper and lower. Difficult call a column in which select three and more products: from above, from below and sideways columns.

Simple columns provide division of initial mix (raw materials) into two products: rectificate (distillate) - removed from column top in a vaporous state, and the rest - the lower liquid product of rectification.

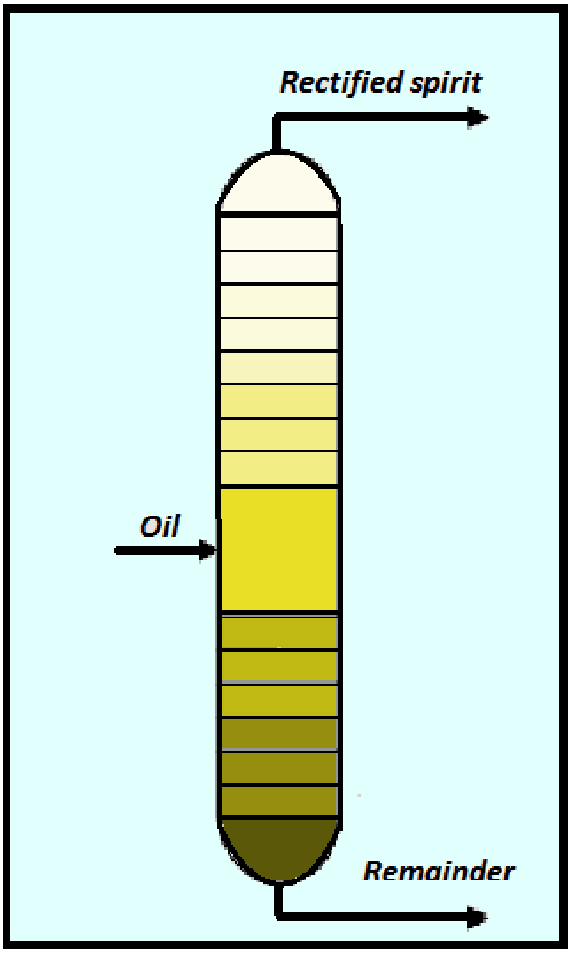

Figure 1.1. - Simple rectifying column

Difficult columns provide division of initial mix into three and more products.

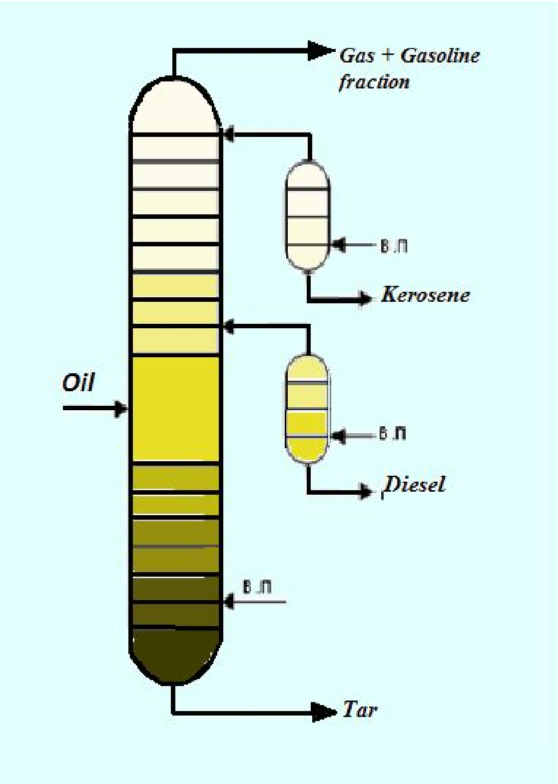

Figure 1.2. - Difficult rectifying column

Fractionization - the main indicator of overall performance of rectifying columns, characterizes their separating capacity. It can be expressed in case of binary mixes by concentration of a target component in a product. In relation to rectification of oil mixtures it is usually characterized by group purity of the selected fractions, that is a share of the components which are boiling away on curve ITK to the set temperature border of division displace in the selected fractions (distillates or in the rest), and also selection of fractions from potential. As a kosenny indicator of the clearness (purity) of division in practice often use such characteristic as a naleganiye of boiling temperatures of the next fractions in a product. In industrial practice usually do not impose ultrahigh requirements in relation to the fractionization clearness as for receiving superpure components or supernarrow fractions it will be required respectively superbig capital and operational expenditure. In oil processing, for example, as criterion rather high on fuel fractions it is considered separating capacity of columns of distillation of oil a naleganiye of boiling temperatures of the next fractions within 10-30 °C.

It is established that on separating capacity of rectifying columns considerable influence is rendered by number of contact steps and a ratio of flows and liquid and steam phases. For receiving the products meeting the set requirements it is necessary to have, along with other parameters of the rectifying column (pressure, temperature, a place of input of raw materials, etc.), sufficient number of plates (or nozzle height) both the corresponding phlegm and steam numbers.

The phlegm number (R) is characterized by a ratio of a liquid and steam flow in concentration part of a column and is calculated as $R=L/D$, where L and D - quantity according to a phlegm and rectificate.

The steam number (P) characterizes the ratio of the contacted flows of steam and liquids in distillation section of a column calculated as P = by G/W where G and W - quantities according to vapors and a bottom product.

1.6 Classification of installations of primary oil refining

Process of primary oil refining (straight run distillation), for the purpose of receiving the oil fractions differing on boiling temperature without thermal disintegration carry out in vat or tubular installations with the atmospheric and increased pressure or in vacuum. Tubular installations differ in lower sufficient temperature of the overtaken raw materials, smaller cracking of raw materials, and big efficiency. Therefore at the present stage of oil processing tubular installations are a part of all oil refineries and serve as suppliers of both commodity oil products, and raw materials for secondary processes (catalytic cracking, reforming, hydrocracking, coking, an isomerization, etc.).

Depending on pressure in rectifying columns tubular installations are subdivided into atmospheric (AT). Vacuum (W) and atmospheric and vacuum (AVT).

On number of steps of evaporation (to quantity rectifying colon) tubular installations distinguish

- single evaporation - on one rectifying column receives all distillates - from gasoline to viscous cylinder. A distillation residue is tar.
- double evaporation - at first with an atmospheric pressure oil is overtaken to fuel oil which is overtaken then in vacuum before receiving in the tar rest. These processes go in two columns.
- triple evaporation - two atmospheric columns and one vacuum are used. In the first colon from oil select only gasoline, in the second - stripped oil is overtaken to fuel oil, in thirds - fuel oil to tar.
- quadruple evaporation - installation with a doisparitelny vacuum column for tar in end part.

The option of oil refining is chosen depending on the code of oil. Because light fractions (to 350 °C) are always used as fuels, options of oil refining choose depending on group and subgroup of oil. The process flow diagram of AVT is accepted after a processing option choice

At a choice of the scheme it is necessary to consider structure and characteristics of the overtaken oil, and also the range, requirements to quality of the received products.

I. Atmospheric Pipe Still (APS). This block is intended for selection from oil of light oil products with an atmospheric pressure. In atmospheric part the scheme of distillation can be with single evaporation and twofold evaporation: a) with a preliminary otbenzinivaniye of oil; b) with preliminary evaporation of light fractions.

The choice of this or that scheme depends on type of oil and its class (especially on sour sulfur), and also the dissolved gases containing in oil. At a choice of each of these schemes it is necessary to consider their shortcomings and advantages.

1. Installations with the single evaporation (SE) are applied at distillation stable nefty with the insignificant content of dissolved gases. They provide the minimum energy costs and smaller metal consumption in comparison with other

schemes. An essential lack of these installations - lack of technology flexibility for transfer into new raw materials, etc. the range of products, and also big losses of the fractions which are boiling away to 350 °C with fuel oil of fig. 1.3.

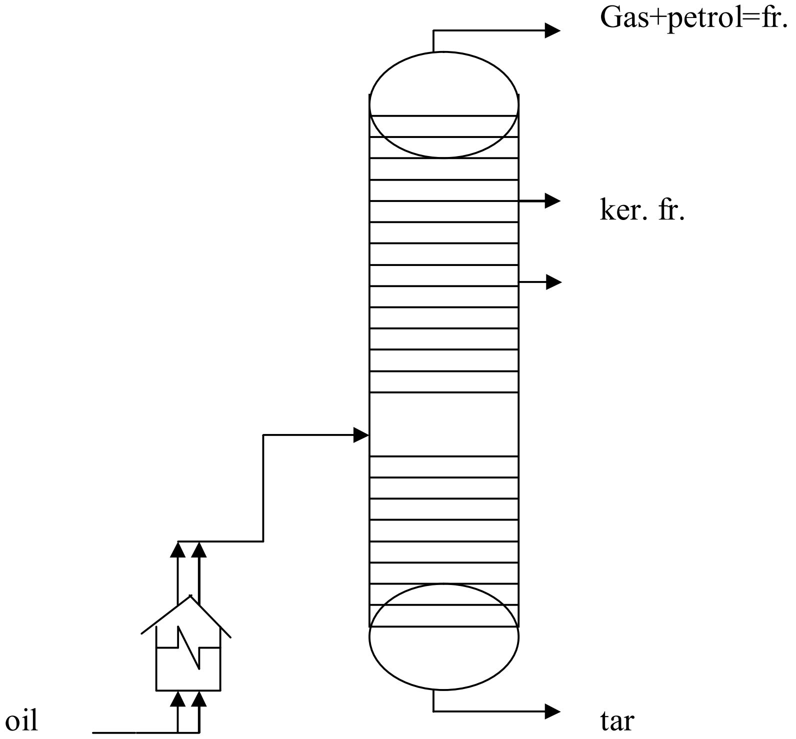

Figure 1.3. - Diagram of installation with OI

2. At double evaporation with a preliminary otbenzinivaniye. Gasoline fraction and UV gas are selected in the stripping column, and basically is selected easy, heavy kerosene fractions. This scheme of oil refining is applied in the presence in oil of a large amount of dissolved gases and gasoline fraction, and when processing watered, sulphurous nefty. The advantage of this installation is high technology flexibility, possibility of pressure decrease and loading of the furnace from light fractions that allows to destroy thereby the main rectifying column and to prevent its corrosion. A lack of this installation is the power consumption caused by need of heating of the lower part the "hot stream" stripping columns. Stripped oil should be heated to more high temperature (390 zs) that reduces quality of the buttered distillates which are in fuel oil.

3. A kind of the AT block with twofold evaporation is the scheme with preliminary evaporation of light fractions, i.e. with an evaporator. According to this scheme, the oil heated in the heat exchanger or in the furnace comes to the evaporator in which at the expense of OI, it is separated into steam and liquid phases. The steam phase from the evaporator moves in feeder section of the difficult rectifying column. Advantages is decrease in load of the furnace and hydraulic resistance of the furnace. A shortcoming is the increase in loading on couples in the difficult rectifying column since in it there is a rectification and vapors from the evaporator and vapors formed due to heating of a fluid phase in the furnace. This scheme of oil refining is applied extremely seldom.

II. Vacuum Pipe Still (VPS). This block is intended for fuel oil distillation. Depending on oil refining option from fuel oil select vacuum gasoil (350-500 zs) - fuel option or buttered distillates (350-400, 400-450, 450-500 zs) - fuel and oil option. At selection from fuel oil of vacuum gasoil apply the scheme with OI, i.e. fuel oil after heating in the furnace comes to a vacuum column where from it vacuum gasoil is selected, and from below columns tar is removed.

In case of selection from fuel oil of oil distillates and when the high definition of division is required, apply the scheme of the vacuum block with twofold evaporation. In this case in the first vacuum column broad lube fraction is selected from fuel oil (350-500 and 350-520 zs), and then this fraction is separated into narrow oil distillates in the second vacuum column, but operational costs on distillation of fuel oil according to this scheme are much higher (fig. 1.4).

Now atmospheric and vacuum blocks build as a part of one installation that allows to lower considerably:

a) extent of pipelines;

b) number of intermediate tanks;

c) operational expenses;

d) number of the serviced personnel

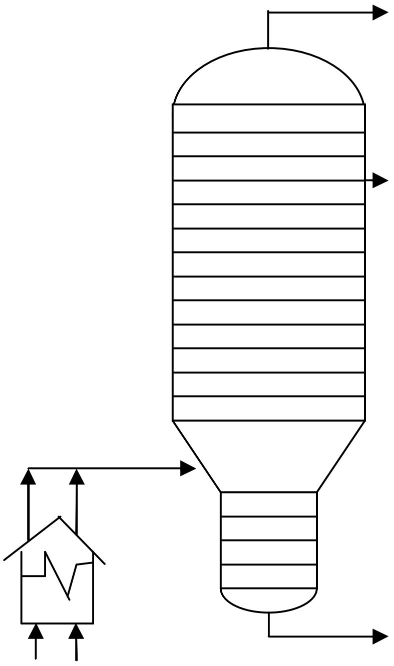

Figure 1.4. Installation scheme with OI
(The distillation of mazut fuel option)

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TECHNOLOGY PART

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2.1 Process of primary distillation of oil

The Primary Distillation of Oil (PDO) - the most fulfilled and settled process which cornerstone oil rectification is.

Initial information for it is oil indexation, i.e.:

- oil class (sulfur content: to 0,5%; 0,51-2,0%; it is higher than 2,0%)
- oil type (the maintenance of fractions to 350 °C: it is higher than 55%; 54,9-45%; less than 45%);
- group of oil (according to the content of oils in % for oil and for fuel oil);
- subgroup of oil (on an index of viscosity of oils - from 95 to 85 and below);
- a type of oil (according to the content of hard paraffin - from 1,5 to 6% and above).

Depending on this indexation we choose the scheme PPN and the subsequent cleanings of distillers.

PPN carry out on atmospheric and vacuum tubular (AVT) installations as a part of which there are some blocks:

- block of desalting and dehydration of oil;
- block of atmospheric and vacuum distillation of oil;
- gasoline stabilization block;
- the block of redistillation of gasoline on narrow fractions;
- block of a zashchelachtion of gasoline and diesel fuel.

All these blocks, for an exception of the second, are servicing and are urged to prepare qualitatively oil and to improve products of its rectification.

Assignment of the first block - deep dehydration and desalting of oil to the residual content of salts no more than 5 mg/l (because of danger of hydrolysis of magnesium chloride and formation of corrosion-activchlorinehydrogen acid).

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The electrochemical method - 2-3-staged processing in dehydrators is for this purpose used; electrical desalting plants (ELOU) usually combine with the atmospheric and vacuum pipe stills (AVPS).

The main device - a horizontal electrodehydrator of type 1-EG-160 (capacity of 160 m3), working under pressure of 1,0-1,4 MPas and at a temperature of 160-180 °C.

On an oil input give a demulgator (the surface-active substance destroying protective sheaths globul the emulsified water in oil), and also the fresh rinsing water reducing salinity in the emulsified trade water to an elektodenidrator.

The deemulgator expense, depending on the nature and quality of oil, makes from 10 to 250 g/t, and amount of the pumped fresh rinsing water-5-6% for oil.

The most effective are vertikalnyeelektrodegidrator with chamber electrodes. Their productivity is 4-5 times higher, than at horizontal, and thus volume is much less.

The oil prepared on the ELOU block usually contains 5-6 mg/l of oil of chlorides and 0,1-0,2% of water. After heating in heat exchangers to 220-240 °C oil arrives on atmospheric rectification.

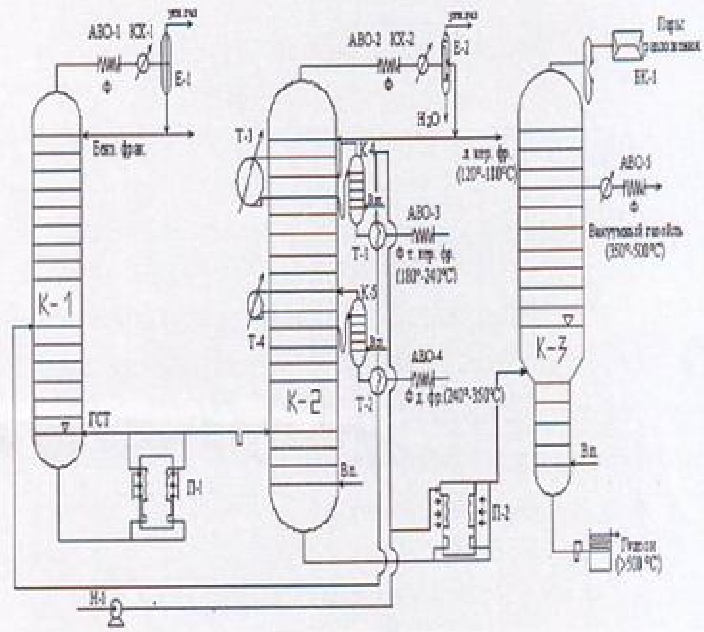
2.2 Scheme of primary distillation of oil

The Primary Distillation of Oil (PDO) is one of the oldest processes with which oil processing actually began. At the first stage of development of this process it carried out function of receiving some one product (in particular, kerosene) as ready fuel. Then - two-three products (gasoline, kerosene, diesel fuel), but too as ready fuels.

In process of oil processing improvement the role of PPN changed. Now primary distillation of oil, happens in the AVT installations is head process in the scheme of any oil refinery (oil refinery), and AVT and carry out generally dispatching functions. It means that distillers of AVT go for the subsequent secondary processes of processing (redistillation, reforming, hydrotreating, etc.) for the purpose of receiving finished commodity products or components of commodity products.

Modern AVT have the maximum power on oil of 3-8 million tons per year, number of the received distillates - from 6 to 10. Process is one of power-intensive: specific fuel consumption makes 20-22 kg/t of oil (AT) or 30-35 kg/t of oil (AVT). The general fuel of costs of AVT (including the electric power, water, air, etc.) make 45-50 kg/t of oil, i.e. 4,5-5,0% of all oil.

Fig. 2.1. Process flow diagram of AVT



Description of the technology scheme AVT

The dehydrated and desalinized oil is pumped over by the pump N-1 via T-1 and T-2 heat exchangers where it heats up to temperature of 180-200 °C, in the simple stripping K-1 column on division. From oil select the low-boiling fractions. Pressure of gases is supported in a column slightly above the atmospheric. From above columns select couples of gasoline fraction with the dissolved hydrocarbon gases which separate further from fraction. The part of gasoline fraction moves back in a column, as a cold irrigation, and the balance quantity is output from installation. The rest of the stripping column is stripped oil which moves in the P-1 furnace where doisparyatsya and heats up to temperature of 350 °C and further comes to a difficult column of K-2. The part of stripped oil returns to a simple column of K-1 as a hot stream. In the difficult K-2 rectifying column select three distillates, from above columns select couples of light kerosene fraction and water which are cooled in the air cooler, dookhlazhdatsya in the condenser - the refrigerator and come to capacity dehydrator. The part of light kerosene fraction returns to K-2 column as an irrigation, and the balance quantity is output from installation. Heavy kerosene and diesel fractions are removed from installation through side shoulder straps which come to T-1 and T-2 heat exchangers where give the heat of oil, dookhlazhdatsya in AVO-3 and AVO-4 and are removed from installation. The rest of the difficult rectifying column is fuel oil which comes to the P-2 furnace where heats up to temperature of 420 °C and comes to a vacuum column of K-3. Temperature is maintained in the P-2 furnace within 420 °C in order to avoid thermal decomposition of molecules. In a vacuum column of K-3 the vacuum the creating equipment works specially. From above columns are removed by the steam-ejecting ejector via the barometric condenser couples - decomposition. Vacuum gasoil is removed by side shoulder straps, the rest of a vacuum column is tar which is cooled up to the temperature of 20-40 °C in the refrigerator of submersible type and is removed from installation.

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2.3. Oil atmospheric vacuum distillation installation

Installation is intended for receiving from oil of distillates of gasoline, kerosene, diesel fuel, three lube fractions of different viscosity and tar. Except these products on installation dry and greasy gases, liquefied gas (reflux), light vacuum gasoil turn out. On distillation usually arrive oil or mix nefty with the content of the light distillates (which are boiling away to 350 °C) from 42 to 50% (masses.).

Modern installations of big power consist of the following blocks:

preliminary heating of oil in heat exchangers;

electrodesalting and dehydration of oil (ELOU block);

the subsequent heating in heat exchangers;

oil otbenzinivaniye (a column of an elevated pressure with the heating furnace);

atmospheric column (with the heating furnace and steaming columns);

fractionations of fuel oil under vacuum (with the heating furnace, steaming columns and system of creation of vacuum);

stabilization and redistillation of gasoline on narrow fractions.

The technology scheme of installation is presented on drawing. Original oil the pump 1 several parallel flows (on the scheme four flows are shown) passes through group of heat exchangers 7, 8, 9, 10, 11, 12 and. 13 where it heats up to temperature of 100-130 °C. Use of such system of heating of oil allows to create more effective heat exchange. After heat exchangers for averaging of temperature oil streams mix up in the general collector (on the scheme it is not shown). Further oil again four parallel flows goes to two steps of electrodehydrators 14 (ELOU block). After an exit from the ELOU block oil heats up in **heat exchangers 15 and 16** connected in parallel in the beginning, and then in the heat exchanger 18.

The oil heated to 200-250 °C comes to the stripping column 19 on two tangential inputs. This column is left from above by gases, vapors of water and light gasoline fraction (from the end of boiling of 120-160 °C). For steam condensation and cooling of mix the air cooler 20 and the water refrigerator 21 located behind it serve. In a separator 22 from the condensed light gasoline fraction gas and water separate. Gas, having passed the valve regulating pressure in system a column 19 - a separator 22, goes to section of cleaning of hydrogen sulfide, and water from a bottom of a separator 22 which is supplied with the regulator of interphase level (water-gasoline), comes to system of sewage treatment.

The circulating part of gasoline (irrigation) returns to a column by means of the pump 25, and its balance quantity is taken away from this block and transferred to the gasoline stabilization block, to a column stabilizer 59. For maintenance of temperature of a bottom of a column 19 partially stripped oil gets the pump 24, passes coils of the furnace 23 and, heated to 350-370 °C, returns to the lower part of a column. The balance amount of stripped oil by means of the pump 26 passes through coils of the furnace 27 and with a temperature of 370-380 °C moves on two tangential inputs in an atmospheric column 30.

From a column 30 vapors of heavy gasoline and water, and also the decomposition gases formed when heating oil in the furnace 27 from above are taken away; they pass the air cooler 31 and the water refrigerator 32. The received gas-liquid mix gas - gasoline-water is separated in a separator 33 from which top gas goes (to fuel system), and from a bottom - water condensate (it is taken away, drained, in system of water purification). Condensate of heavy gasoline fraction is taken away by the pump 44 and together with fraction of light gasoline is transferred to stabilization. As an irrigation of an atmospheric column 30 the upper circulating irrigation is used. The circulating liquid (phlegm) from the third plate (from above) of a column 30 arrives via the air cooler 34 and the water refrigerator 37 on reception of the pump 43 and this pump is pumped **to** an upper plate of a column.

Kerosene fraction is removed from a bottom of a steaming column by the 35th pump 42 via the heat exchanger 7 and the air cooler 6 is taken away from installation.

The fraction of diesel fuel is brought out of a steaming column by the 36th pump 41. Warmly diesel fuel it is used in the heat exchanger heater 78 of a column 68, then - in the heat exchanger 9. After cooling in the air cooler 4 the fraction of diesel fuel is taken away from installation. For increase in selection of diesel fuel in a bottom of a column 30 water vapor moves overheated (400 °C). Steam moves and in steaming columns 35 and 36 for removal of light fractions.

The atmospheric column 30 has two more circulating irrigation. The average circulating irrigation - a phlegm gets from a rectifying perfect plate the pump 38, is pumped over via the heat exchanger 10, the air cooler 28 and returns to a column 30 to three plates above the perfect. The lower circulating irrigation - a phlegm gets from a perfect plate the pump 39, is pumped over via the heat exchanger 15, the air cooler 29 and returns to a column to the third plate located above.

From a bottom of an atmospheric column the 30th pump 40 pumps out fuel oil which heats up in a coil of the vacuum furnace 56 and on two tangential inputs moves in a vacuum column 48. In the section of a power supply of this column over input of raw materials fender plates for prevention of "drift" of drops of the liquid rest are established. For an irrigation of top of a column 48 the upper circulating irrigation is used: the first lube fraction with the third top. to it plates of a vacuum column gets the pump 51, it is pumped over via the heat exchanger 12, the air cooler 47 and after it the circulating part returns to an upper plate of a column 48. The balance number of the first lube fraction is taken away from installation.

The components, uncondensible at the top of vacuum column representing mix of light fractions, gases of decomposition, vapors of water and air (sucked in through thinnesses), are brought out of a column 48 and cooled in the air cooler 46 (it can not be), then in the water refrigerator of surface type 45 after which gas-liquid mix comes to system of creation of vacuum.

The second lube fraction is removed from a bottom of a steaming column by the 49th pump 54 and after the heat exchanger 11, the air cooler 3 is pumped out from installation. The third lube fraction is taken away from a bottom of a steaming column 50 and goes the pump 52 via the heat exchanger 13 and the air cooler 2 to the reservoir.

The lower circulating irrigation of a vacuum column 48 is carried out by means of the pump 55 with which the phlegm returns via heat exchangers 16 and the air cooler 17 to a column. For increase in selection of the third lube fraction 48 give water vapor to a bottom of a column. Tar from a bottom of a column 48 is taken away the pump 53 and pumped out from installation via heat exchangers 18 and 8 and the air cooler 5.

Wild gasolines from separators 22 and 33 pumps 25 and 44 two parallel flows pass heat exchangers 60 and 61 in the beginning, then come to a column 59. A power supply of a column two flows of gasolines (easy and heavy) in different sections allows to reduce power consumption by gasoline stabilization. In a column 59 from gasoline fraction dissolved gases which are removed from above are removed and go to the air cooler 58, then to the water refrigerator 57 and a separator 72. In a separator 72 fat gas separates from the condensed light hydrocarbons, liquefied gas (reflux). The circulating part of liquefied gas is forced by the pump 73 on top of a column 59 as an irrigation, and the balance quantity is taken away on gas fractionation installation where also direct also fat gas. The heat input in a bottom of a stabilization column 59 is carried out by circulation of stable gasoline by means of the pump 74 through a furnace 75 coil.

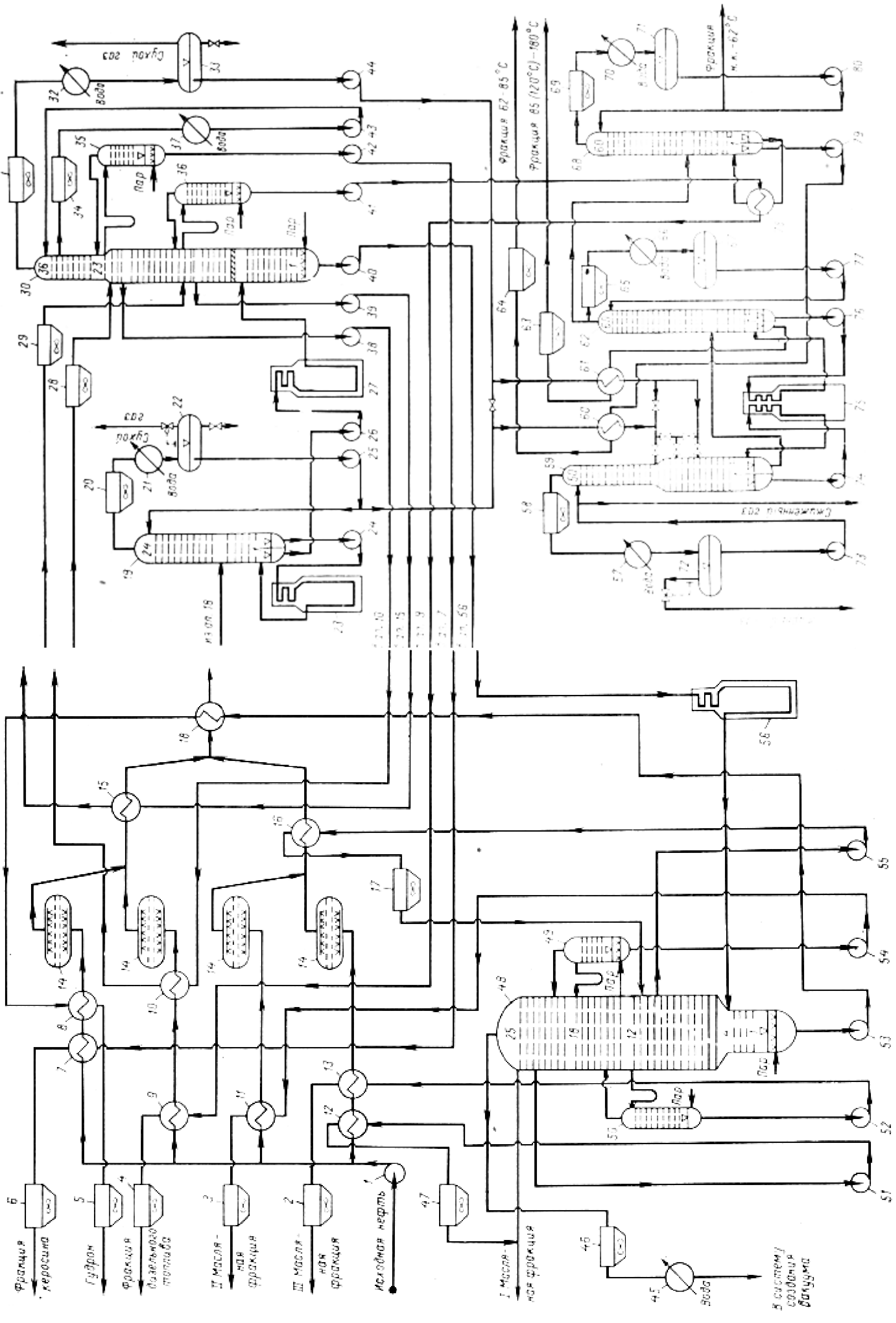
Stable gasoline is selected from a bottom of a column 59 and transferred to the block of secondary fractionation in columns 62 and 68. From top of a column 62 the fraction of N is taken away to. -85 °C which goes to a column 68 as a steam power supply. The circulating part of fraction of N to. -85 °C come to the air cooler 65, further in the refrigerator 66, the collection 67 and the pump 77 moves on an irrigation of a column 62. From a column bottom the 62nd fraction of 85-120 °C (or 85-180 °C) is taken away from installation via the heat exchanger 61 and the air cooler 63. From top of a column 68 the fraction of N is taken away to. -62 °C which comes to the air cooler 69, the water refrigerator 70, the collection 71, from where the circulating part move on an irrigation of a column 68, and the balance quantity is taken away from installation. Warmly in a bottom of a column 68 it is brought from the heat exchanger 78 due to heat of diesel fuel. The 68th fraction of 62-85 °C removed from a column bottom is taken away by the pump 79 from installation via the heat exchanger 60 and the air cooler 64.

Pressure and temperature in the main columns:

column No.	Pressure at the top of a column (excessive), MPa	Temperature, °C		
		Top	Bottom	Input of raw materials
19	0,4-0,6	150-170	240-250	180-250
30	0,07-0,10	170-190	330-350	350-370
35	0,07-0,10	-	200-250	-
36	0,07-0,10	-	280-300	-
48	7,85-8,85 kPas	180-200	350-360	380-400
49	7,85-8,85 kPas	-	260-270	-
50	7,85-8,85 kPas	-	330-350	-
* kPa				

System of creation of vacuum. The vacuum in a vacuum column 48 is created by means of system of steam ejectors. After an exit from the water condenser refrigerator 45 gas-liquid mix comes to a vacuum separator 1, from where liquid (hydrocarbon mixture and waters) flows down on a vertical pipe (length more than 10 m) in a settler 2. Gases and air are sucked away from a separator by 1 three consistently connected ejectors 3. Vapors and gases after each ejector come to the condenser 4 (surface type) of water vapor. The formed condensate flows down in a settler 2. After the third ejector and the last condenser gas is taken away from system and goes to nozzles of pipe furnaces where it is used as fuel.

In a settler 2 light gasoil separates from water and further by the pump 5 is pumped out from installation. Water condensate is most often used for washing of oil in the ELOU block.



The technology scheme of installation (pic 2.2.)

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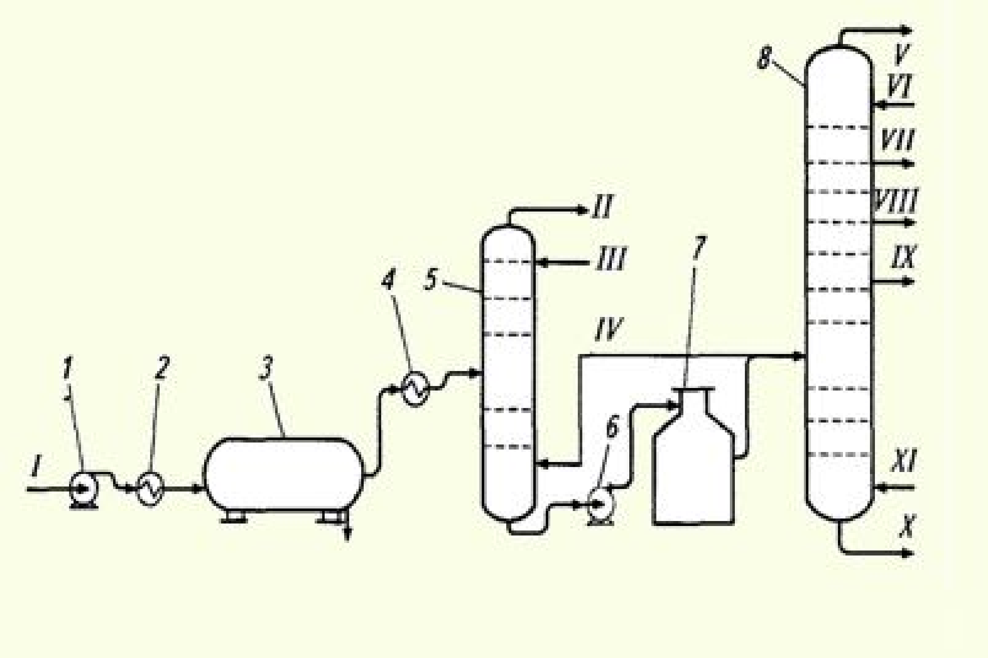
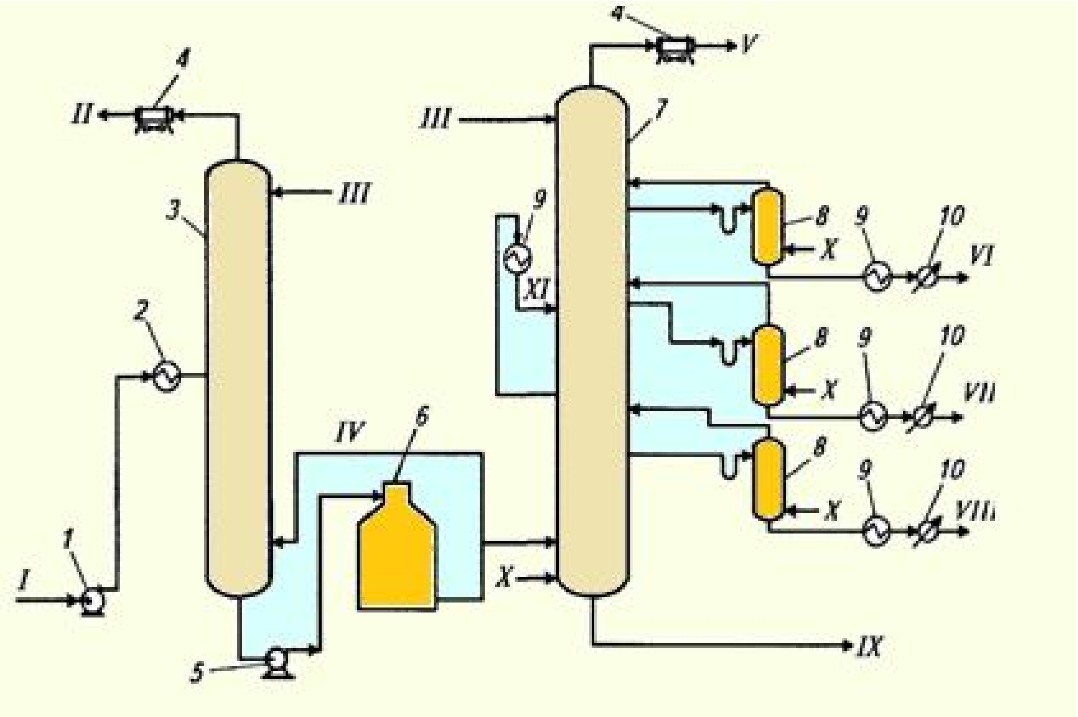
2.4. Installation with twofold evaporation

Due to the increase in scales of processing gas-polluted sulphurous the nefty distillation is most widespread on the scheme from dvukhkrastny evaporation - in two rectifying colons (fig. 2.3.).



Crude oil gets the pump 1 and via the heat exchanger 2 moves in an electrodehydrator 3 for dehydration. The settled heated oil passes the heat exchanger 4 and arrives in primary rectifying to colon 5 where from top it light fraction of gasoline of N is selected to. - 85 °C. The rest from the first column 5 - semi-stripped oil - the pump 6 moves via the pipe furnace 7 in the main rectifying to colon 8 in which all other required fractions - components of light oil products and the rest - fuel oil are selected. Part of the oil heated in the furnace return to the first column (a hot stream). Heating of a hot stream is possible in the separate furnace, According to this scheme are processed oil with high content of the easily boiling gasoline components and gas. Thus gases leave from top of the first column together with light petrol steams. As a result of preliminary allocation from oil of part of gasoline components it is possible to avoid big pressure in a furnace coil. During the work on this scheme more high temperatures of heating in the furnace are necessary, than at single evaporation (with one column), owing to separate evaporation of the easily boiling and heavy fractions. The installations working according to the scheme of twofold evaporation were based in 1955-1965. They are available at many oil refineries in our country and abroad.

At the end of the 40th years of the AVT installation had productivity of 500-600 thousand tons/year. Soon these capacities were insufficient for satisfaction of the growing need for mass oil products. Since 1950 the accelerated rates have started building establish AVT working according to the scheme dvukhkratnoo evaporations, a mozhnost of 1, 1,5 and 2 million tons/year. The scheme of the 2 million tons/year such commercial unit is provided in (fig. 2.4.).



Previously dehydrated and desalinated and desalinized oil gets the pump 1 and after heating due to heat of hot flows in the heat exchanger 2 moves in the first rectifying to colon 3 (number of plates 28). Gases and light petrol steams are removed about top of a column and go in the condenser refrigerator 4. Semi-stripped oil from a column bottom the 3rd pump 5 moves in the furnace 6, from where, heated approximately to 350 zs, goes to the main rectifying column 7 (number of plates 40). The part of heated semi-stripped oil returns from the furnace 6 as a hot stura to the first rectifying to colon 3 for a poluchaniye of additional amount of heat. The column 7 is equipped with a trekhsektsionnoyotparny column 8. Eim installations are expected processing of stable and unstable low-sulfur and sulphurous petro east regions of the country.

In columns different pressure is created. It is known that pressure in a column is defined by fractional structure of a head shoulder strap and eventually - the residual pressure of saturated steam of liquid after steam condensation of a head shoulder strap and their department in the capacity (gas separator).

In K-1 in a steam phase light (head) gasoline fraction of N is selected to. - 62 zs or N to. - 85 zs, and in K-2 - the heavy gasoline fraction which is boiling away higher than 62 zs or 85 zs therefore pressure in K-1 is higher, than in K-2 (0,4 - 0,5 MPas in comparison with a 0,15-0,20MP). It is caused by need after steam condensation of preservation of fractions for a fluid phase at a temperature final coolings 30 - 35 zs. However full condensation is difficult to more light fraction. Fuller condensation is reached by application of additional water cooling (after air). Thus it is possible full to condense light gasoline fractions (especially it important in summertime and in hot climate).

These physical patterns remain in columns of stabilization of gasoline and the gas-functioning installation in which as a head shoulder strap the corresponding gas fractions are selected. Industrially it is necessary to condense and cool them in air and water devices without use of special cooling systems.

At some oil refineries installations of primary distillation with preliminary evaporation of light fractions in a hollow column of preliminary evaporation (the evaporator, an evaporator) were used earlier.

RATED PART

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3.1. Calculation part. An exit of products of primary distillation of oil with a power of 500 million tons of oil a year.

Rectification is carried out under atmospheric pressure. Initial mix and phlegm is entered into the device at a boiling temperature.

Calculation:

1. Determination of productivity on distillate and a distillation residue

On the equations (3.5), (3.6) at af = 0,400 mas.d., are = 0,985 mas.d. and aw = 0,015 mas.d. and Gf = 5000 kg/h are received Gp values = 1985 kg/h, Gw = 3015 kg/h.

2. Determination of molar concentration of initial mix, distillate and distillation residue

On the equation at values of molecular mass of MA methanol = 32 both MB waters = 18 and to concentration of af = 0,400 mas.d., are = 0,985 mas.d. and aw = 0,015 mas.d. the following molar concentration of easily volatile component of the mix xf = 0,273 mol.d are defined., xr = 0,973 mol.d. and xw = 0,009 mol.d.

3. Creation of an equilibrium curve and isobar of boiling temperatures and condensation

On the basis of the experimental data (tab. 3.3) in coordinates

ooh we build a balance curve for mix methanol-water with an atmospheric pressure and curves of boiling temperatures and condensation (see fig. 3.1. and 3.2).

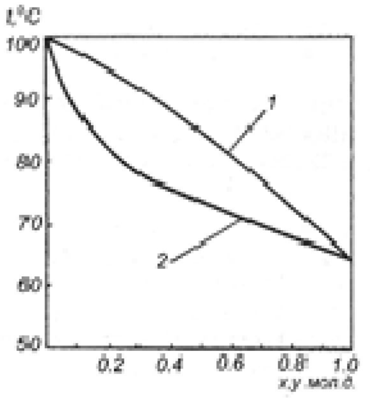

Fig. 3.1. Isobars of temperatures of boiling and condensation mixes methanol-water: 1 – steam; 2 – liquid

Table 3.1

x, мол	**0**	**5**	**10**	**20**	**30**	**40**	**50**
***y*, мол %**	0,0	26,9	42,2	58,1	66,2	73,3	78,7
***t*, °C**	100,0	92,84	88,10	82,12	78,28	75,57	73,45
***x*, мол**	60	70	80	90	95	100	
***y*, мол %**	83,1	87,6	92,0	96,2	98,2	100	
***t*, °C**	71,52	69,70	67,97	66,27	65,40	64,53	

4. Definition of the minimum flegmovy number

On the chart x - at (fig. 3.2) we put a point 1 with xw coordinates = to yw = 0,973 and on a balance curve a point 3 with xf abscissa = 0,273.

From a point 2 (crossing of a diagonal of a square ooh with xp abscissa = 0,973) we draw through a point the 3rd straight line before crossing with chart ordinate axis. On ordinate axis we receive the piece equal to Bmax = 0,515

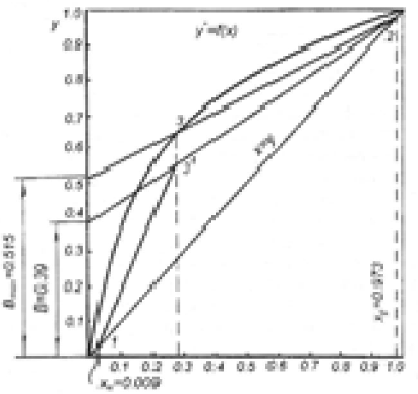

Fig. 3.2. To definition of optimum flegmo number

In size of this piece we find the minimum flegmo number (section 4, the equation

$$R_{\min} = \frac{x_p \quad \overset{B}{} _{\max}}{B_{\max}} = \frac{0{,}973 \quad 0{,}515}{0{,}515} = 0{,}89.$$

5. Definition of optimum flegmovy number

For a number of values of flegmovy number, big 0,89, we find values of pieces In (section 4)

Table 3.2.

R	**0,95**	**1,0**	**1,2**	**1,5**	**3,0**
B	0,498	0,487	0,444	0,390	0,243

Pieces In we postpone on the chart ooh (fig. 3.2.). Connecting the top points of pieces In on the chart to a point 2, we receive a number of working lines of the top part of a column (for example, for To = 1,5 line 2-3').

Connecting points of 3 crossings of working lines of the top part of a column to the xf line with a point 1, we receive a number of working lines of the lower part of a column (for R = l, the 5th line 1-3').

For each chosen flegmovy number and values x within the set concentration of liquid from xw = 0,009 to xr = 0,973 according to the chart we find driving forces of process x-x * as sizes of pieces across between a curve of balance and the respective lines of working concentration, and we calculate sizes 1 / (x-x *). We write down the received results in tab. 3.5.

Table 3.5.

R	**0,95**	**1,0**	**1,2**	**1,5**	**3,0**
x	**1/(*x*-*x**)**				
1	*2*	*3*	**1/(*x*-*x**)**	*5*	*6*
0,009	167	167	167	167	167
0,1	16,7	15,9	15,4	15,4	13,3
0,2	12,1	10,9	10,5	9,5	7,4
0,273	50,0	33,0	18,2	10,5	6,7
0,3	35,6	25,0	14,3	9,5	5,7
0,4	19,6	14,3	9,5	6,9	4,4
0,5	14,3	11,8	8,7	6,2	3,9
0,6	13,1	11,1	8,3	6,2	3,9
0,7	13,1	12,4	10,0	7,4	4,7
0,8	15,4	15,4	12,5	10,0	6,9
0,973	33,0	33,0	33,0	33,0	33,0

In sizes in tab. 3.5 for each value by R method graphic integration we find number of units of transfer

$$m_x = \int_{x_w}^{x_p} \frac{dx}{x - x^*}$$

The example of a graphic itegrirovaniye for R = l, 5 is shown in fig. 3.3.

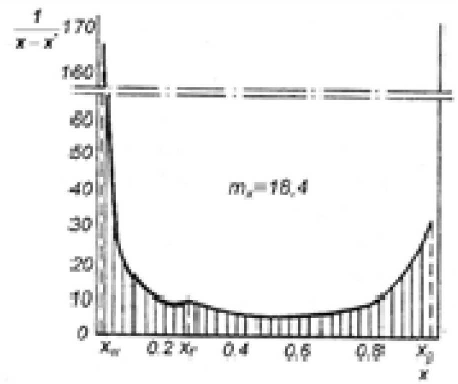

Fig. 3.3. Graphic integration for flegmovy number R = l, 5 Results of integration we reduce in tab. 3.6.

Table 3.6

R	*R*+1	m_x	m_x(*R*+l)
0,95	1,95	26,1	50,9
1,0	2,0	23,2	46,4
1,2	2,2	20,2	44,4
1,5	2,5	18,4	46,0
3,0	4,0	16,5	66,0

We apply on the chart mx (R+l) - R (fig. 3.4.) the obtained data from tab. 3.6. We find a point of a minimum of M, which there corresponds the optimum working flegmovy number of Ropt = to l, 25.

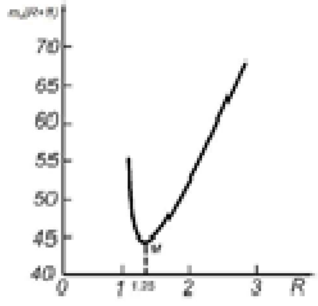

Fig. 3.4. Definition of optimum flegmo number

6. Definition of streams of steam and liquid in a column the Volume stream of steam in a column

$$V \frac{22{,}4\ 98100\ G_p(R_{\text{опт}}}{+1)(273+t)^{\text{п}}\ 3600\ 293\ P},$$

(k.mol.) / h (31,7 – the average molecular mass of distillate); Ropt. – optimum flegmovy number; t – average temperature is couple in a column, equal 85 C; P – pressure in a column, Pa.

Molar consumption of liquid in the top part of a column

L=Gp R

Molar consumption of liquid in the lower part of a column of L+Gf.

On these equations values are received

Gp = 62,7 (k.mol.) / h, Vp = l, 15 m3/s, L = 78,5 (k.mol.) / h and L+Gf = 307,8 (k.mol.) / h (with an average molecular lot of food 21,8).

7 – 8, Determination of approximate diameter of a column and main constructive characteristics of the contact device

As in further calculation of speed limit of steam in a column the formula which doesn't include constructive characteristics of the contact device is used, the approximate diameter of a column and the main constructive sizes don't define.

9. Calculation of working speed of steam

On the equation for the average density of liquid in a column ρx = 859 kg/m3 and the average density of a steam phase in the column calculated as

the constructive sizes don't define.

$${}_y = \frac{M_{\text{ср}}}{22{,}4}\,\frac{293P}{(273+t)98100},$$

where Msr – average molecular weight in a column, equal 24,8; t = 85 °C – the average temperature of steam in a column, are received values ρy = 0,906 kg/m3 and wpr = by l, 54 m/s.

We accept the working speed of steam in the free section of a column 15% below than the limit

10. Determination of diameter of a column

$$D_к = \sqrt{\frac{4\ 1{,}15}{3{,}14\ 1{,}31}} = 1{,}05\ м$$

11. Lattice choice

The contact device – a mesh plate (on a task). According to recommendations (section 8) we choose diameter of openings of do = 2 mm. Openings we will have on tops of an equilateral triangle with a step 3,5do = 3,5 × 2 = 7 mm.

Free section of openings of a mesh plate we accept equal 10% of the free section of the device.

12. Hydraulic calculation of the contact device

We determine the general hydraulic resistance of a plate by the equation .

At ξ = 1,82, steam speeds in plate openings of wo = l, 31/0,1 = 13,1 m/s, ρy = 0,906 kg/m3, ΔPcyx = 141 Pas.

At σ = 42,1·10-3 N/m [6, 7, 8], do = 0,002 m, ΔPσ = 82 Pas. At To' = 0,5, hnep = 0,04 m, ρx = 859 kg/m3 (without taking into account sizes of excess of level of liquid over plums) ΔPcт = 219 Pas.

General resistance of a plate

$$P_т = 141 + 82 + 219 = 442\ Па.$$

13. Definition minimum plates

$$H_{\min} \quad 2\frac{\text{т}}{g \quad \text{х}}$$

$$2\frac{442}{9{,}8\ 859}=0{,}105\ \text{м.}$$

We accept distance between plates (section 8) of 350 mm>gt; 105 mm.

14. Determination of kinetic coefficients massootdacha Coefficient in a steam phase pays off
on the equation .
Molar consumption of steam in a column

$$G = G_g(R+1) = 62{,}7(1{,}25+1)=141$$

Square of a plate (we accept that the space of cross section of a column occupied drain and
to receptions pockets, makes 15%)

$$f_{\text{т}} = \frac{D_2 \quad \text{к}}{4}0{,}85 = \frac{1_2}{4}0{,}85 = 0{,}67\ \text{м}^2,$$

$$F = w\sqrt{\quad_y} = 1{,}31\sqrt{0{,}906} = 1{,}25\,.$$

Value of coefficient of a massootdacha in a steam phase

The massootdacha coefficient in a liquid phase pays off on the equation (7.35).
For steam speed in the free section of a column of w = l, 31 m/s, 'xf =3375
k.mol /m2ch at D'x value, for system
ethanol-water, equal 4,57·10-9 sq.m/sek. MB = 18 – the molecular mass of methanol and water respectively

$$D_{ж}^{20°C} = 4{,}95\ 10^{9}\ м^2/с,$$

$$D_{ж}^{75°C} = D_{ж}^{20°C}\ 1 + \frac{0{,}2\sqrt{\ \ }_{x}}{\sqrt[3]{\ \ }}(75\ \ 20) =$$

$$= 4{,}95\ 10^{9}\ 1 + \frac{0{,}2\sqrt{0{,}82}}{\sqrt[3]{859}}55\ = 10{,}2\ 10^{9} м^2/с.$$

coefficient in a liquid phase for system methanol-water

$$= \sqrt{\frac{10{,}2\ 10^{9}}{4{,}57\ 10^{9}}} = 3375\ \ 1{,}49 = 5042$$

As size m is a variable on column height, we find its values for various concentration, using the chart .

Previously we apply a curve of balance of y*=f (x) and the line of working concentration on the chart 1-3-2 at

optimum value of flegmovy number R = 1,25. Thus

$$B = \frac{x_p}{R+1} = \frac{0{,}973}{1{,}25+1} = 0{,}43\ .$$

Ranging from xw to xp we choose a number of values x. For each value x we determine by the chart the sizes y*-y and the X-x * as distances between the equilibrium and working line, and then on these values we find size m.

We write down results in tab. 3.5.

Table 3.5.

x	0,009	0,1	0,2	0,273	0,3	0,4
y^*-y	0,035	0,215	0,150	0,055	0,060	0,075
$x-x^*$	0,008	0,065	0,100	0,085	0,075	0,110
m	4,37	3,30	1,50	0,85	0,80	0,68
x	0,5	0,6	0,7	0,8	0,9	0,973
y^*-y	0,075	0,065	0,055	0,040	0,025	0,015
$x-x^*$	0,130	0,140	0,130	0,090	0,070	0,040
m	0,58	0,46	0,42	0,44	0,36	0,38

Substituting the found xf, yf and m values for various values x in a formula we find Kyf values.

Table 3.6.

x	0,009	0,1	0,2	0,273	0,3	0,4
K_{yf}	271	287	320	333	334	337
x	0,5	0,6	0,7	0,8	0,9	0,973
K_{yf}	340	342	344	344	345	345

15. Creation of a kinetic curve and definition of number of plates

For creation of a kinetic curve we use a formula

$$y^* \quad y_к = (y^* \quad y_н)e^{\frac{K_{yf} f_т}{G}}$$

Values of a difference (at * – at) for a number of values x ranging from xw to xr are given in tab 3.5, Kyf – in tab. 3.6.

Molar expense couple G = 141 (кмоль) / h, working area of a plate of ft = 0,67 sq.m.

On the chart we postpone pieces u*-uk from the equilibrium line down, we connect the received points the smooth line 1 '-3 '-2'. The constructed curve is a kinetic curve.

Number of real plates which provides the set division clearness, we find by creation of the step line between working and kinetic lines. Creation of the step line it is carried out from concentration of xf to xr and from xf to xw. The number of steps within concentration of xf - xr is equal to number of real plates strengthening column sections, number of steps within concentration of xf – xw is equal to number of real plates of exhaustive section of a column.

As a result of construction we receive:

– number of real plates in strengthening column section – 11;

– number of real plates in exhaustive section of a column – 11,

– total number of plates in a column – п = 22.

16. Determination of hydraulic resistance of a column

$$P_{к} = P_{т} n = 442\ \ 22 = 9724\ \text{Па}.$$

17. It is executed sketches of a plate and a column

Table 3.7. An exit of products of distillation of oil on the AVD installation

Product	Product yield, % (Mas) for oil. highly viscous oil
Gas	1.0
Gasoline	19.6
Kerosene	9.8
Diesel fuel	17.0
Broad lube fraction	17.8
Tar	35
Losses	0.8

Let's accept that the power (productivity) of installation G established in a task year = 500 million tons per year that makes G24hr = 500.000.000/333 = 1501501.5t and Ghr = 62562.5 t. On the basis of balance data of table 3.7 we find way out of products of the AT installation.

At the beginning we will transfer the exits given in the table as a percentage mass to mass fractions, having accepted the mass of the processed raw materials for 1.

Then mass fractions of the received products turn out as unit share division of a percentage exit on 100:

mass fraction ofgasoline (the Tax Code - 180 °C) mb = 19,6: 100 = 0,196;

mass fraction of mk kerosene = 9,8: 100 = 0,098.

Similarly we calculate shares of all products of the AT installation. Having received values of mass fractions, it is easy to define exits of distillates and residual products of both atmospheric, and vacuum sections, and also gasoline redistillation installations.

Petrol

Annual exit of gasoline Mbg = Gyr x mb= 500.000.000 x 0,196 = 98 000 000 t.

daily exit of gasoline of Mbs = G24hr x mb = 1501501.5 x 0,196 = 294294.3 t.

hour exit of gasoline of Mbch = Ghrxmb = 62562.5 x 0,196 = 12262.2 t.

Kerosene

Annual exit of kerosene Mbg = Gyr x mb= 500.000.000 x 0.098 = 85 000 000 t.

daily exit of kerosene of Mbs = G24hr x mb = 1501501.5 x 0.098 = 147 147 t.

hour exit of kerosene of Mbch = Ghr x mb = 62562.5 x 0.098 = 6 131 t.

Diesel fuel

Annual exit diesel fuel Mbg = Gyr x mb= 500.000.000 x 0.17 = 49 000 000 t.

daily exit diesel fuel of Mbs = G24hr x mb = 1501501.5 x 0.17 = 255 255 t.

hour exit diesel fuel of Mbch = Ghrxmb = 62562.5 x 0.17 = 10 635 t4.

The received results it is tabulated.

Table 3.8. An exit of products at usual distillation of oil feedstock with a productivity of 500 million tons/year

• Product	G year.	G24 h.	G hour.
• Gas of	5 000 000 t/yr.	15 015 t / 24 h	626 t/h
• Gasoline	98 000 000t/yr.	294 294 / 24 h	12 262t/h
• Kerosene of	49 000 000 t/yr.	147 147 t / 24 h	6 131t/h
• Diesel fuel of	85 000 000 t/yr.	255 255 t / 24 h	10 635 t/h
• Total:	234 000 000 t/yr.	711 711 t / 24 h	29 654 t/h.

As the balance of AVT, amount of the received fuel oil (the rest of atmospheric distillation) is given in table 3.7 we will find on a difference between the mass of oil and the distillates received from it:

Fuel oil m = Ggod − (Mb.g + Mk.g +mdt.g) = 500 000 000 - 234 000 000 =

266 000 000 t/yr. = 798 800 t / 24 h or 33 283.3 t/h.

HEALTH AND SAFE ACTIVITY PART

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4.1. Safety measures at service of the rectifying

Rectifying columns before start-up should be examined, operability and availability for service of all related devices and pipelines, operability of instrumentations, temperature controlers and pressure in a column, fluid level measuring instruments in the lower part of a column rectificate receivers, rectifying tanks and tanks of the rest is checked.

Start-up of the rectifying plant in work should be made strictly in the established sequence which should be specified in the technology instruction.

During the operation of the rectifying column it is necessary to control continuously parameters of process and operability of the device.

For catching of liquid which can be thrown out together with couples and gases via the safety valve outside on the line for safety the valve it is necessary to have a separator. The fluid level in a separator should not exceed the set limit.

In winter time on open installations at least once in change it is necessary to check a condition of a column, product lines, water lines, drainage shoots on steam lines and the device, spuskny lines, etc. During this period it is necessary to provide continuous fluid movement in communications for prevention of their gap. Spuskny and drain lines, and also the most dangerous sites for water supply, alkalis, other freezing liquids should be warmed.

It is necessary to watch that the damaged sites of heat insulation of rectifying columns and their support timely improved. Heat insulation should be pure, corrected and is executed so that at leaks the hidden fluid flows on the body could not be formed.

Cleaning of an inner surface of a column should be conducted carefully not sparking tools. The deposits removed from walls when cleaning need to be put in metal ware and to delete from the room or from installation.

At detection of leak in rectifying columns it is necessary to give water vapor or nitrogen to admission places for prevention of possible ignition or formation of mixes of explosive concentrations. At emergence of accident or the fire after decrease in internal pressure in the device it is necessary to give in its water vapor or nitrogen.

In workshops or on open installations it is necessary to check availability of emergency firefighting equipment and operability of the available stationary or semiportable fire extinguishing systems.

Columned devices of big height (40m and more) should be provided with stationary systems of water or air and foam cooling and suppression, the state and which availability should be checked systematically.

Safety measures during the work an isoprene - 1-methyl butadiene

Storage conditions and transportations._The isoprene is stored in presence of inhibitors, for example, by au nitrophenol that slows down processes of a samopolimerizatsa. The isoprene is transported in steel tanks. Store lower than +15 degrees.

Precautionary measures during the work with substance._It is a combustible material. Couple it is heavier than air and can extend on a floor. Forms explosive mixes with air at ambient temperature. Pay attention to ignition. In case of ignition formation of harmful gaseous products is possible. It is necessary to avoid contact with substance. Not inhale substance. Provide the corresponding ventilation.

First-aid treatment._At inhalation: fresh air and to call the doctor. At contact with skin: wash out a large amount of water. Get advice at the doctor. At contact with eyes: wash out a large amount of water and call the oculist.

Fire extinguishing means: carbon dioxide gas, foam and dry powder.

4.2. Organization of lighting and ventilation

Workplaces, objects, drives and approaches to them, passes and transitions to a night-time should be lit. Artificial lighting is carried out according to requirements of "Rules of the device of electric units" (PUE), construction norms and rules, Construction Norms and Regulations 23-05-95.

In production rooms, except the worker, it is necessary to provide emergency lighting, and in zones of works on the open areas - emergency or evacuation lighting.

Lamps of working or emergency (evacuation) light should be powered from independent sources. Instead of the device of stationary emergency (evacuation) lighting use of manual lamps with accumulators is allowed. The choice of a type of lighting of production and auxiliary rooms should be made taking into account the maximum use of natural lighting.

Rooms of objects of oil refining should have constantly operating system of a supply and exhaust ventilation. Frequency rate of air exchange is calculated from conditions of providing maximum concentration limit in air of harmful substances.

Actions for accident prevention:

- modernization of processing, hoisting-and-transport and other production equipment,

- improvement according to rules of electrical safety of different adaptations for automatic protective shutdown of transformer installations, cameras, power plants, power lines, electric precipitators and other systems and units. Improvement of the automatic adaptations and interlocking devices interfering an accidental touch to current carrying parts, and also monitoring systems of a condition of isolation of electric networks. Any device grounding of the operating electric units of heavy currents of low and high tension and lightning protectors. Installation of hermetic lighting wiring, acquisition of indicators for definition of availability of tension in a network etc.;

- installation of starting devices and the device of adaptations with necessary blocking and the alarm system: the automatic signaling devices warning about emergence of dangerous concentration of gas-air mixtures in production rooms (on a drilling working site, especially when drilling with use of gaseous agents, pumping on pumping of oil, compressor stations of GRB, etc.); indexes of tension, devices of control of static electricity, etc.; stationary and figurative gas analyzers for determination of concentration of harmful gases in the equipment and in air; indicator of hydrosulphuric ISV-2, etc.; KPD-1 and PR-1 devices for a radiation control of radioactivity, etc.; defectoscopes;

- implementation of the automatic, semi-automatic and other two-sided light-sound alarm system providing safe working conditions at service of units, machines and processing equipment, and also the one-sided alarm system in drives, and transitions through railway tracks and in other places when transporting materials etc., production and acquisition of signs of safety;

- installation of means television and radio controls by technology processes, lifting and transport devices, installation of intercoms between the driller and other members of watch etc.;

- mechanization of cleaning of production rooms, cleanings of air ducts, ventilation units, and also cleanings and rubbings of lighting fixtures, windows, transoms of the light lamps and adaptations for their opening called by need of providing safe working conditions;

- reduction in compliance with requirements of safety rules of steam, water, oil, gas, air, acid and other production communications.

4.3. Calculation of industrial ventilation

Calculate natural ventilation of a site - length A=20m, width V=15m, height N=6m at a normal microclimate and lack of any harmful allocations will make necessary air exchange:

$$M\ Q=N \bullet Z=50 \bullet 20=10003/h$$

where Z - a necessary consumption of air on one working, at Z1 = (And • In • H) / N=36 m^3, as at Z1=30-40 m^3 according to sanitary standards of Z=20 m3/h. If the area of the lower ventilating apertures m Fn=3 is accepted^2, air motion speed in them will make:

$$V=qn / (M \bullet Fn) =0,28 / (0,15 \bullet 3) =0,62m/with$$

where m Qn=10003/ch=0,28 m3/with - necessary the air exchange and M=0,15 coefficients considering coefficient of disclosure of shutters.

Loss of pressure in receiving air vents:

$$_{Nn} = (V2\ of\ N \bullet gn) / (2 \bullet g) = (0,622 \bullet 1,1) / (2 \bullet 9,81) =0,021\ kgfs/m^2$$

In this formula the specific weight of fresh air for a warm and transition period.

$$_{gn} = (0,455 \bullet P) / (273+tn) = (0,455 \bullet 700) / (273+17) = 1,10\ kgfs/m^3$$

where P=700 mm rt.st - pressure of an atmospheric air, and tn=17 - the average temperature of fresh air for a warm and transition period of year temperature of the air leaving the room can be established from the following ratio:

$$_{tv} = (trz-t1+m \bullet t1) / m = (20-17+0,82 \bullet 17)/0,82=210\ ^\circ C,\ tv=291\ ok$$

where $_{trz}$ - the normalized value of air temperature in a working zone which for category and works of average weight of Pa and a transition period of year makes 200 ° C: m=0,82 coefficient for cold workshops of engineering plants. Then the specific weight of the air deleted from the room:

$$_{gv} = (0,455 \bullet P) / (273+tv) = (0,455 \bullet 700) / (273+21) = 1,083\ kgfs/m^3$$

Losses of air pressure in upper ventilating apertures:

$$Nv=n \bullet (c_{\ of\ N} \bullet {}_{gv}) = 6 \bullet (1,10 \bullet 1,083) =0,102\ kgfs/m^2$$

Required total area of exhaust ventilating apertures

$$Fv=q / (M \cdot m) ({}_{Nv} \cdot 2 \cdot Q)_{/\text{гв}}) =0{,}28 \cdot / (0{,}15 \cdot 2) (0{,}102 \cdot 2 \cdot 9{,}81)/1{,}083) =1{,}4\ m^2$$

For a uniform extract of the air leaving workshop longwise overlappings it is reasonable to provide 3 ventilating hatch of 0,47 m^2 through everyone 5meters.

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4.4. Fire safety

Actions for fire safety are separated into four main groups:

- prevention of the fires, i.e. exception of the reasons of their emergence;
- restriction of the sphere of spread of fire;
- ensuring successful evacuation of people and material values from the sphere of the fire;
- creation of conditions of effective suppression of the fires.

Main tasks of scheduled maintenance:

- development and implementation of the actions directed on elimination of the reasons which can cause emergence of the fires;
- restriction of distribution of the possible fires and creation of conditions for successful evacuation of people and property in case of fire;
- ensuring timely fire extinguishing.

Scheduled maintenance includes the following:

- daily checks of a condition of fire safety of object in general and its separate sites by forces of a fire brigade and fighting calculations of fire guard, and also timely performance of the offered actions;
- a constant control behind carrying out fire-dangerous works, implementation of fire-prevention requirements, norms and rules on objects of new construction, at reconstruction and re-equipment of workshops, warehouses and other rooms;
- check of operability and correct contents automatic and emergency firefighting equipment, fire-water supply and systems of the notice on the fires;
- briefings, conversations and special occupations with workers and employees of object concerning fire safety (also with temporary employees) and other actions for fire promotion and propaganda;
- preparation of staff of a fire team and fighting calculations for carrying out scheduled maintenance and suppression of the possible fires and fire;

- annual carrying out fire and technical inspections of object with delivery of management of object of the instruction of the State supervision;
- implementation of actions for the equipment in workshops, on installations, warehouses, separate units and rooms of installations and systems of fire automatic equipment.

Recommendations about drawing up plans of accident elimination on fire and explosion hazardous objects

1. The Plan of Accident Elimination (PAE) should be made on each fire and explosion hazardous object or its fire and explosion hazardous site, workshop, etc.

2. Should be provided in PLA:

2.1. Possible accidents, places of their emergence and condition, life-threatening people.

2.2. Actions for rescue of the people overtaken by accident.

2.3. Actions for accident elimination in an initial stage of their emergence, and also first-priority actions of the production personnel at emergence of accidents.

2.4. The locations of means for rescue of people and accident elimination.

2.5. An order of interaction with gas-rescuing, fire and antigushing groups.

3. PLA are developed by the commission consisting of the specialists appointed by the order on the enterprise. PLA are reviewed 1 time in three years. At change of technology, working conditions, safety rules for PLA corresponding changes and additions in accordance with the established procedure should be made.

4. PLA in number of five copies is approved by the technical lead of the enterprise in the presence of inspection statements: conditions of monitoring systems of technology process; conditions of ventilation devices; availability and operability of means for rescue of people, fire-fighting equipment and technical means for accident elimination in their initial stage; serviceability of the alarm signaling, communication, emergency lighting.

5. PLA should contain:

5.1. Operational part in which all types of possible accidents on this object should be provided, the actions for rescue of people and elimination of accident, and also the person responsible for performance of actions, and performers, the locations of means for rescue of people and accident elimination, action of gas-rescuers, fire and other divisions are defined.

5.2. Distribution of duties between the individuals participating in accident elimination.

5.3. The list of officials and establishments who should be immediately informed on accident.

5.4. Schemes of an arrangement of the main communications (technology scheme).

5.5. Lists of tools, means of individual protection, the materials which are in emergency cabinets (rooms) with the indication of their quantity and the main characteristic.

6. Should be provided in operational part of PLA:

6.1. Ways of the notification about accident (a siren, the light signaling, loud-speaking communication, phone, etc.), ways of an exit of people from dangerous places and sites depending on nature of accident.

6.2. Actions of the persons of technicians responsible for evacuation of people and carrying out the provided actions.

6.3. A ventilation operating mode at accident emergence, including inclusion of emergency ventilation (in the presence).

6.4. Need and sequence of switching off of the electric power, stop of the equipment, devices, overlappings of sources of harmful and dangerous substances.

6.5. Exposure on the ways of approach (entrance) to dangerous places of posts for control of the admission in gas-polluted and dangerous zones.

6.6. Ways of accident elimination in an initial stage. First-priority actions of technicians for accident elimination (fire), to the prevention of increase in their sizes and complications. Implementation of actions for the prevention of serious consequences of accidents. An order of interaction with gas-rescuing and other specialized services.

7. Acquaintance with PLA of the technological personnel should be issued documentary in personal cards of instructing on receipt.

8. PLA (or its operational part) should be hung out in a visible place, determined by the head of object (site). Full copies of PLA should be at the technical lead of the enterprise, in a dispatching office, at gas-rescuers, in department of safety measures and on a workplace.

9. Responsibility for timely and correct drawing up PLA and its compliance to the valid situation on production is born by the head of object and the technical lead of the enterprise.

10. Frequency of carrying out educational and training classes in development of skills of performance of actions of PLA, except the cases stipulated by these rules is established by the organization taking into account specific conditions, but at least once a year.

4.5. Application of the means of individual protection (MIP)

Treat SIZ: overalls; special footwear; headdresses; gloves; mittens; adaptations for protection of respiratory organs, sight, hearing.

Protective properties of overalls are defined by properties of fabric of which make it.

For oil industry of fabric should be with good heat-insulating properties, air-tight, impenetrable for oil, and also possess a small moisture capacity. The overalls should not constrain labor movement. The quantity and type of means of individual protection of respiratory organs on each object should be defined by the project with specific works.

For the majority of professions of SIZ should be the following:

- a suit from mixed fabrics with maslovodoottalkivayushchy impregnation;
- raincoat waterproof;
- boots kersey;
- mittens tarpaulin.

In the winter in addition:

- a suit from mixed fabrics with maslovodoottalkivayushchy impregnation on the warming laying;
- the mittens warmed.

For protection of respiratory organs use the filtering gas masks. Depending on a type of the performed works as SIZ goggles, rubber boots, rubber aprons, respirators, hose gas masks, protective helmets can be also used.

CONCLUSIONS.

Analyzing progressive advance of the country on the way of democratic transformations and a sustainable development, we have all bases to declare that in the expired year the plunge in implementation of essentially important reforms directed on achievement of our main goal is taken - to reach the level of the developed democratic states of the world with the strong socially oriented economy providing the worthy level and quality of life of our people.

The speech, first of all, goes about implementation of comprehensively thought over Program aimed at providing deep structural transformations, reliable protection of interests of private business and small business and that is essentially important, - in legislative, normative legal and practical as it is provided in our Constitution, providing a priority role of a private property, progressive reduction of presence of the state at economy of Uzbekistan.

It is recognized reasonable at this stage of our development under a direct control of the state to keep only the enterprises which are carrying out production and processing of a hydrocarbonic raw material, precious and non-ferrous metals, uranium, and also the strategic infrastructure industries of natural monopolies - iron and highways, air transportation, generation of the electric power, electric and utility networks.

The task has been set and conditions for bulk selling of the state assets, first of all to foreign investors are created. So, at "zero" redemption cost about 22 thousand new workplaces have been implemented on a competitive basis to new investors of 506 property complexes with adoption of investment obligations by investors of about 1 trillion sum and 40 million US dollars, and also creation.

Among the objects put into operation especially would like to note the Ustyurtsky gas-chemical complex constructed together with South Korean investors and specialists on the basis of a field Surgil. This complex worth over 4 billion dollars is one of the most modern hi-tech and large productions in the world. Its commissioning will allow to receive annually 83 thousand tons of polypropylene

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which was imported to the republic before, to increase polyethylene output by 3,1 times, to employ more than 1 thousand highly qualified specialists.

Defining the main priorities of social and economic development of our country for 2016, we cannot but consider the serious problems arising in connection with the proceeding global crisis, sharp reduction of demand, uncertainty and essential the increased fierce competition in the world markets the falling of growth rates of production and all effects following from here which have concerned the majority of the states in the world.

In this regard the difficult problems facing us in 2016 dictate need of full refusal of the become obsolete methods of inertial forecasting from the reached level, relying on average values of development.

Continuous technology and technical updating of production, and also continuous search of internal reserves, implementation of deep structural transformations in economy, modernization and diversification of the industry should be the main reference point for us.

In other words, time demands to pass to consecutive 3-4-phasic cycles of processing of raw materials into products demanded in the world market according to the scheme: basic raw materials - primary processing (semi-finished products) - ready materials for industrial production - finished goods for final consumption.

Thus there is a need during the developing and implementation of programs to trace a full cycle of deep processing by each type of primary raw material - a semi-finished product up to finished goods of final consumption.

In a word, it is necessary to provide forecasting of all cycle of the organization of production - from raw materials to finished goods with justification of expediency and an economic return.

As show calculations, as a result of production with a high value added production of petrochemical products can be increased with development of its new types by 2030 by 3,2 times, products from non-ferrous metals - by 2,2 times, from ferrous metals - by 2,3 time, products of chemical industry, including mineral fertilizers, - by 3,2 times.

Along with it increase in production of modern finished goods with the high value added demanded in foreign markets will become a basis of steadily high growth rates of its export.

It is necessary to tell that this work in the country is already begun. However she demands cardinally new program integrated approach on each perspective view of raw materials and the semi-finished products possessing high potential to have the specific program of deep processing calculated on 2020, 2025, 2030.

We have all bases, proceeding from the deep analysis of tendencies of development of world economy, a real assessment of our resources and opportunities today, to set for themselves the target task - not less than twice to increase the volume of gross domestic product of our country by 2030.

As a result of performance this degree ratota installation of primary distillation of oil in 500 million tons of oil a year has been calculated and described.

The components received after primary processing usually are not used as a ready-made product. Light fractions pass in addition cracking, reforming, a hydrogenation upclassing which purpose is receiving by the low price of the greatest volume of the final products with the most exact satisfactory quality indicators. Heavy fractions after distillation overwork in addition on the bituminous, coking and other installations.

Thus, labor protection demands the integrated, purposeful and system approach considering all aspects of a production activity: legal, social and economic, organizational and technical, sanitary and hygienic, treatment-and-prophylactic, psychological and others. The special attention in questions of labor protection needs to be paid to work with people as often "the human factor" when workers neglecting all precautionary measures becomes the main reason of accidents even more often and safety make the actions or acts conducting to their death or traumatizing.

In increase of the status of labor protection the flexible system of stimulation for effective work on improvement of conditions and labor protection, "competitive spirit" (holding different review competitions, competitions) can play a positive role. Important also a position of the first heads concerning labor protection. Health issues and safety of people should win first place at meetings of any level, meetings of labor collectives, and also in the list of primary production questions.

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