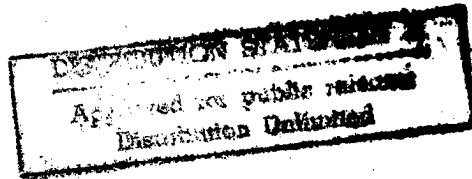


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# USSR Report

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## OIL AND GAS

### NEW SOLUTIONS PROPOSED TO GAS TRANSPORT PROBLEMS

Moscow GAZOVAYA PROMYSHLENNOST' in Russian No 9, Sep 82 pp 1-5

[Article: "Program of Technical Re-equipping in Operation: New Planned Solutions in Gas Transport"]

[Text] To create and introduce into production basically new equipment and materials and progressive technology. To guarantee a growth in the output of machines and units of large unit output and productivity, highly economical equipment, finished systems of machines for comprehensive mechanization and automation of production.

From the Basic Directions for Economic and Social Development of the USSR for 1981-1985 and for the period up to 1990.

The Ministry of the Gas Industry in close cooperation with the related industries is doing a lot of work to realize the comprehensive program for technical re-equipping of the gas industry.

The development and introduction of new progressive technical solutions in gas transport, the creation of highly effective gas-pumping equipment, unification of the projects for compressor stations, and the use of industrial lightweight foundations under the gas pumping units occupy a considerable place in the program.

Taking into consideration that the majority of the enlarged construction sites of the gas industry are located on the territory of West Siberia, new technical developments must satisfy the increased requirements made for them by the harsh natural-climate conditions of this kray. Thus, for example, attention should be drawn to questions of guaranteeing lengthy stability of the main gas pipelines laid on the flooded territories and in permafrost ground. Solution to this problem depends a lot on the planners and designers who are faced with developing new technological methods of laying and reinforcing gas pipelines.

By successfully implementing the program for technical re-equipping of the sector, the Ministry of the Gas Industry focuses especial attention on the exchange of leading experience, deep working out of the questions of introducing progressive technological equipment with broad participation of specialists and scientists of the sector.

One of the clear examples of creative business-like approach to the tasks of further improvement in the block-set method of construction was the seminar which recently took place in the sector on questions of reducing labor outlays for construction of compressor stations.

The subject section of this issue of the journal acquaints the readers with the main technical solutions in gas transport whose introduction makes it possible to significantly improve the technical-economic indicators of this most important subsector of the gas industry.

Increase in the length of the gas trunk lines laid in the zones of permafrost ground and swampy locality complicate the construction and start-up of gas pipelines, and especially compressor stations. Only the creation of qualitatively new equipment in gas transport will make it possible to accelerate construction of the compressor station, and at the same time improve productivity of the gas transport systems. This new equipment is the gas-pumping units of block-container type with aviation drive currently manufactured by domestic industry in series. The area of application of the unit is very vast, and it encompasses all the necessary needs of the gas industry.

These units have recommended themselves especially well at the compressor stations of the main gas pipelines with diameter 1000 and 1200 mm with pressure 5,5 MPa.

Modification GPA-Ts-6.3/76 has been manufactured. It is designed to work on the gas pipeline with diameter 1200mm with pressures 7.5 MPa. The systems of gas pipelines Perm-Kazn-Gorkiy, Orenburg-Kuydyshev, Central Asia-center of the country (third line), and Gryazovets-Leningrad have been equipped with this unit.

The unit GPA-Ts-6.3 is very promising in forced power. Preliminary calculations indicated that increasing gas temperature before the turbine engine NK-12ST up to flight parameters will make it possible to obtain a unit with output 10MW with efficiency of the engine on the order 27-28% in the interval of dimensions of the GAP-Ts-6.3.

The creation and introduction of the GAP-Ts-10 unit into the gas industry will yield a significant economic effect.

In order to supply larger streams of gas from the fields in the North Tyumen Oblast to the center of the country on gas transport systems made of pipes with diameter 1400 mm with working pressures 7.5 MPa, it is not enough to use gas pumping units with power of 6300 kW. Therefore, a gas piping unit GPA-Ts-16 (power 16 MW) has been developed and accepted for operation by the inter-departmental commission. It is a further development and improvement in aviation equipment in the gas industry based on the unit GPA-Ts-6.3.

The engine for the unit selected was a 2-contour turbine-jet engine switched for working under surface conditions.

The unit GPA-Ts-16 is a block-container unit operating in open air in a temperature range of the surrounding air from  $-55^{\circ}$  to  $45^{\circ}\text{C}$ , i.e., practically in all climate zones of the country.

The supercharger is designed for transporting  $31.2 \text{ m}^3/\text{day}$  of gas with a degree of compression 1.44 and pressure from 5.2 to 7.6 MPa. The engine efficiency with regard for losses is 27.5%. The service life of the engine before major repair is no less than 15,000 h. Full operating time is no less than 3000 h.

The supercharger is designed so that it can operate at working pressure 10 MPa.

Series manufacture by industry of gas pumping units with aviation drive made it possible to take into consideration all the positive qualities of these machines in designing the compressor stations.

The completion of the technological equipment of the CS has been simplified to a considerable degree. This is because not only the unit itself, but all the technological equipment (dust-traps, filter-separators, units of air cooling of gas, blocks of fuel, start-up and pulse gas, and all the fittings) are supplied by one ministry in the form of technological blocks of plant preparation.

The units GPA-Ts-6.3 and GAP-Ts-16 because of their design features do not require construction of buildings of compressor shops.

High degree of automation and system of protection of the units made it possible to abandon the constant presence of service personnel at the working machines. Moreover, instructions forbid the personnel from entering the container of the working machines.

These systems made it possible to create centralized monitoring and control of one room, the operator room located in the production-energy block where comfortable conditions were created for the watch personnel. Auxiliary services guaranteeing normal operation of all units will also be placed there.

The units themselves do not require an external heat source since hot air is taken from the axial compressors and is supplied special pipeline to the neighboring nonworking machines. Oil is heated in the blocks by an electric heater until pre-start-up condition.

For conditions of the first start-up in the cold time of the year, aerodrome air heaters of the type MPI-700 are used. In order to supply heat in the cold time of the year to all the building and structures, secondary energy resources, heat recoverers are used.

The high rotation frequency of the rotor GPA-Ts-6.3 and GAP-Ts-16, the high accuracy of dynamic balancing of the rotors of the turbines and superchargers, as well as reliable monitoring and protection from vibration make it possible to redesign the foundations for these units, and mainly to switch to industrial

plant preparation of block precast reinforced concrete foundations.

Fabrication of these foundations yields considerable decrease in labor intensity, reduces the consumption of concrete 1.2-1.3 fold, and reduces to a minimum the "wet" processes for constructing foundations.

Series manufacture of foundation blocks under plant conditions is expedient.

In building compressor stations under conditions of permafrost and sagging ground, as well as with the presence of piling equipment it is very progressive to erect piling foundations. In this case the consumption of concrete is reduced 6-8 fold as compared to monolithic foundations.

Unification of the planned solutions of the compressor station with different types of units resulted in the fact that the units for cooling, purification of gas and others were made quite the same regardless of the type of drive. All the design solutions of the compressor stations are single-type. As a result of this, the density of build-up increased from 35 to 45%, and the engineering networks, roads and other structures are efficiently distributed.

Under conditions of the increased volumes of construction and a shortage of labor resources, the most important factor for accelerating the start-up of objects is the transfer of construction to industrial rails. At the same time, industrialization of construction is unthinkable without unification and standardization of the planned solutions.

As the result of many years of work of the planning institutes of the Ministry of the Gas Industry and organizations of the Ministry of Construction of Oil and Gas Industry Enterprises, standard planned solutions for unified compressor stations with different types of gas pumping units have been developed. They are based on: the use of new highly effective equipment and progressive solutions for its arrangement; set-block supply to the compressor station platform of unified buildings (their elements), block-boxes, blocks of equipment, installation assemblies and intermediate parts made in the final form under plant conditions; use of industrial methods of construction at the compressor station platform itself: pre-cast reinforced concrete or piling foundations, practically complete exclusion of "wet" processes, surface laying of pipelines on low supports.

Taking into consideration the common nature of the production-technological purpose of the compressor station regardless of the types of gas pumping units, the planned solutions were developed on the principle "start-to-finish" unification, i.e., unity of the technical solutions for all buildings, structures, and units (with the exception of individual ones associated with the specific nature of some gas pumping units). This made it possible to develop a unified principle for constructing general plans for the compressor station with any



type of gas pumping unit. In this case in order to guarantee the best and safest conditions of operation and to reduce the length of the pipelines, the buildings and structures on the CS platform were arranged with precise isolation of two zones: production where the buildings, structures and units directly associated with the process of gas compression were arranged, and service-production complex (SPC) with arrangement within its limits of all the other auxiliary buildings and structures of the CS.

The SPC zone is stipulated only at the CS of single-line gas pipelines, as well as at the first phase of the CS of multiple-line systems. Subsequent phases are solved by adding the first phase of only the standard production zone which includes units of purification, compression and cooling of gas, preparation of fuel, start-up and pulse gas, diesel electric plant, warehouse of oil and production-energy block (PEB).

The PEB holds services which guarantee control and energy supply of the gas pumping unit (GPU) (operator shop, apparatus room, control-technical point with electric panel room, storage battery, etc.).

The other auxiliary services (communications center, mechanical workshop, garage, chemical laboratory, laboratory of control and measuring instruments, etc.) as well as the administration-general rooms are blocked in a service-operating and repair block (SORB) located in the SBC zone. This same zone has water structures, power plant, cafeteria, buried warehouse, warehouse of methanol, etc.

Blocking of the energy surfaces, rooms of the control, measuring and automatic service and remote control in one building of the PEB, and the auxiliary and administration-general services in one building of the SORB considerably simplifies the technical solutions for the interrelationship of these services, improves the operating conditions, reduces the dimensions of the CS platform, the length of different types of pipelines, the volume of construction-installation work (CIW) at the CS platform. The design solutions of the PEB and SORB buildings are given in two variants:

- framework-panel design similar to buildings of GPU with the use of metal carrying and enclosing designs (light-weight profile rolled material and vertical panels with effective solid heater);
- SORB made of four buildings: administration-general block in designs of the WRC (watch residential complex) of the gas repair and warehouse block in designs of the ADB (adding designs of buildings), communications center in the designs of the BCH (blocks of changing height) and the control technical point in the block-box UB-12; the PEB in the designs of the BCH.

The units which do not require the constant presence of service personnel and can be set up on a platform in complete plan readiness are provided in block-set design (diesel power plant, boiler house, pump warehouse of oil, etc.).

The installation of all GPU (with the exception of GTK-10-4 and STD-1200) is adopted in individual buildings. This increased the degree of fire safety and also improved the servicing conditions. The use for all units of two-stage heaters made it possible to significantly simplify the outer gas shell of the

GPA and to reduce the cost of construction.

The arrangement of the main technological equipment (dust traps, apparatus for air cooling, unit for preparation of fuel, start-up and pulse gas) is group-centralized. This makes it possible to use a single type of equipment at the compressor station with GPU of any unit output and productivity for gas.

The adopted planning solution significantly improved many indicators as compared to analogs (compressor station with GTK-10-4) constructed according to previously developed drafts: density of build-up increased from 39-45%, metal consumption decreased by 35-40% (for the compressor station with GTK-10-4--by 12%), volume of CIW and labor intensity directly at the site decreased by 42-65% (for the compressor station with GTK-10-4--by 15%). As indicated by the presented list of main indicators, the effectiveness of the planned solutions at the basis for the unified compressor stations is indisputable. In the planning business alone, the use of unified solutions will considerably increase labor productivity of the planners, release them from a large volume of routine work, permit a faster introduction of the system of automated planning of compressor stations.

At the same time, unified solutions of the compressor stations in the form approved today is not the height of perfection. As any planning solution, it will and must be improved but the changes are made centrally with rigid control and precise coordination. In this case this is not done every day, but as the best solutions are accumulated with regard for the possibility of reconstructing both the completing and the construction organizations.

There is no doubt that the final goal can be attained only with comprehensive solution to all questions--planning of the compressor station based on unified standard projects with their correlation to local conditions.

The traditional designs of the GPU foundations at the active and many compressor stations under construction are a reinforced monolithic massif which corresponds in configuration to the total dimensions of the GPU lowered into the ground and average of 1.5-2 m.

Fabrication of these foundations is labor-intensive, and the consumption of concrete is from 20-40% of the total volume of reinforced concrete structures at the compressor station.

The striving to reduce the use of monolithic concrete resulted in the development of precast designs of foundations of different type: made of a set of blocks connected by welding of the insertion parts; component parts made of beam-walls resting on precast plates; assembled from long-dimensional flat horizontal frames and plates. The shortcomings of these designs are practically the same: considerable consumption of concrete, increased consumption of metal, large volume of excavation work, etc.

A considerable improvement in industrialization of construction of the compressor station can be attained if foundations of GPU made of light-weight designs are used. Their drafts were developed for six domestic GPU's (GTN-6, GTN-16, STD-12500, GPA-Ts-6.3, GPA-Ts-16, and GPU-10).

Features which are common for all the GPU's which are taken into consideration in developing the designs of the foundations are the following: high frequency of rotary rotation, i.e., theoretical equilibrium of the GPU assembly; presence of rigid support frames made of welded rolled profiles included in the GPU element; insignificant static load transmitted through each support assembly of the framed foundation; minimum values of possible decentering of the shafts.

The technical solutions and the working documents of light-weight industrial foundations for different GPU's have common design features. They include: driven or drilling-packed pilings; precast or precast-monolithic piling heads; precast reinforced concrete beams connecting the heads or drilling-packed pilings and creating a horizontal rigid frame; connected to the pilings (or heads) thin (200-250mm) reinforced plate at the level of the floor.

The appearance, cross section and length of the piling for each compressor station unit are defined for each type of foundation in accordance with the engineering-geological data of the ground. These data are subsequently pinpointed using the results of field tests.

The carrying capacity of the piling must be fivetimes greater than the calculated load. This condition which guarantees the lack of settling caused by vibration is called upon to guarantee high reliability of the foundations.

The Soyuzgazproyekt and the production-technical firm "SIBORGGAZSTROY" have developed a design of industrial piling foundation under the GPU STD-12500 for the South Balyk compressor station whose platform is characterized by weak ground and high water level.

The foundation consists of twelve packed pilings made in pipe-shells with diameter of 720mm and connected at the top by rigid metal grill. The pilings are arranged at the points of application of loads from the heater and engine and are submerged into the ground with consistency indicator 0.5-0.6.

The calculated loads which do not exceed 15T in accordance with the recommendations of Scientific Research Institute for Foundations and Underground Structures are roughly 20% of the carrying capacity of the pilings determined by static tests.

The grill which is rigidly connected to the pilings is a metal horizontal frame made of rolled I-beams No. 45 and 30 and its transverse beams are arranged at the sites of transfer of the loads from the GPU.

Although the weight of the metal frame of the grill as compared to the monolithic grill is low, when it operates together with pilings in forced fluctuations, the mass of the connected ground partially participates. In addition, the rigidity of the upper structure of the foundation increases because of plant frames of the unit. All of this reduces the vibration characteristics of the unit-foundation-ground system to quantities established by the standard documents. This is also confirmed by experimental studies on the operation of single pilings conducted in the Scientific Research Institute of Foundations and Underground Structures at the South Balyk compressor station. These studies established that under a load corresponding to the planned, and with vibrations which can be transmitted from the unit, the movements of the pilings practically are missing, and the fluctuations are dampened in the upper one-third of the piling.

As indicated by the calculations, the natural frequencies of the main current of vertical and horizontal-rotating fluctuations of the foundation do not exceed correspondingly 750 and 1000 fluctuations per minutes. This is considerably lower than the frequency of rotation of the engine and heater rotors both in the working and in the critical operating regimes. Although possible fluctuations of the design will be in the area far from the resonance frequencies, it is impossible to completely exclude the appearance of resonance. Based on this prerequisite, the plan provides for conditions which make it possible to tune the system out from possible resonance by increasing the rigidity of the frame by welding on additional ties or partial concreting.

When the GPU is installed, especial attention should be focused on balancing the rotors, installing bearings and connecting the unit frame to metal grille of the foundation.

Vertical and horizontal amplitudes of fluctuations in the foundations are extremely insignificant and do not exceed the maximum permissible for this type of GPU, and there is practically no settling.

By now 24 foundations under units STD-12500 have been built on the two gas pipelines Komsomol'Skoyé-Chelyabinsk and Urengoy-Chelyabinsk and have been successfully operating for almost 2 years.

The use of the examined design made it possible to reduce the labor intensity of building the GPU foundations at the compressor station by no less than 1.5-fold, to almost cut in half the consumption of concrete. The economic effect from the new design for the foundations is about R one million only for one compressor station.

The institute "Soyuzgazproyekt" has developed another two variants for industrial foundations of light-weight type made of twelve drilled-packed (or driven) pilings with beam grill or with thin reinforced plate of the floor connected to the pilings.

In the first variant, the beam grill located on two levels connects all the pilings in longitudinal and transverse directions, and at the site of drop in altitude, a precast reinforced concrete beam-wall is installed. In the precast

beams of the grill , there are prismatic openings for passage of fittings of the piling and installation of anchor bolts.

In the second variant, instead of the beam grill , there is a reinforced concrete plate of the floor whose fitting is connected to the fitting of the piling. In this case attachment of the anchor bolts is done directly in the cavity of the drilled-packed pilings.

The light-weight foundation under GPA-Ts-6.3 includes reinforced concrete pilings and piling heads as the main elements.

Arrangement of the pilings is stipulated at the sites of support assemblies of the plant frames and each has a head which serves as a connecting element for the piling and the unit and transmits the load from the GPU to the piling.

The pilings can be driven with square section with minimum dimensions (0.3x0.3m) or drilled-packed with minimum (0.4m) diameter.

The heads are precast reinforced concrete rectangular or rounded shape with standard precast reinforced concrete rings. Each foundation uses only type sizes of heads: rectangular 1.1 x 0.8 and 0.8 x 0.8m and rounded with diameter 1.16 and 0.86m with height 0.9 and 0.5 m.

Support steel plates and attachment anchor bolts are installed in the heads.

In addition, the foundation design includes a reinforced concrete floor 0.2 m thick whose contour corresponds to the overall dimensions of the support frame under the turbine unit block, and the fitting of the floor is connected to the insert parts of the heads. The auxiliary blocks are installed on a reinforced thickened floor or on precast reinforced concrete plates 0.25 and 0.6 m thick.

The design of the foundation under the GPA-Ts-16 is assumed to be similar to the foundation under GPA-Ts-6.3 with the addition of cross precast reinforced concrete beams installed at the level of heads of the turbocompressor block to increase the transverse rigidity of the frame, and the device of the piling foundation under the auxiliary blocks.

The experimental foundation made in February of this year under GPA-Ts-6.3 at the Kupyanskiy compressor station of the Ostrogozhsk-Shebelenkagas pipeline by now has worked for 2000 h without significant changes.

Comparison of the indicators of the light-weight foundations under different GPA confirms the greatest economy of the foundations under units of increased unit output. Thus the consumption of concrete and steel for one compressor station without output 96-100 MW under foundations of GPA-Ts-16 as compared to foundations under GPA-Ts-6.3 are reduced 1.4-1.6 fold. The estimated cost is reduced 1.3-1.5 fold and the labor intensity is diminished just as much.

In conclusion it is necessary to note the following: the foundation of the unit is one of the most important elements in the GPU-foundation-base system since it has enormous influence on the work of the units and the entire compressor station. Therefore the foundation design must guarantee complete stability of

the position of the GPU, vibration and strength reliability of the foundation both in operating and emergency regimes of GPU operation. Precisely in this respect with the introduction of light-weight foundations, fairly rigid requirements are made for engineering-geological conditions of platforms of construction and five-fold reserve is provided for the carrying capacity of the piling.

Taking into consideration the small volume of data to study the settling and dynamic characteristics of the foundations of the new type, their construction is limited to platforms which are formed of argillaceous ground with indicator of consistency in the base no more than 0,6 or sandy ground with an average density. The driven pilings should not be used with solid and semi-solid ground and in fine grain sand, while the drilling-packed pilings should be made with an expansion.

The theory of calculation of the suggested designs of the foundations under the GPU has currently not yet been developed. The behavior of individual elements of the new foundations with different operating regimes of different types of units has almost not been studied.

The main stages in the development of industrialization of construction of the foundations under the GPU could be the following:

study at the active compressor stations of deformation and vibration conditions of experimental light-weight foundations and GPU installed on them;  
creation of a test site for conducting of the corresponding experimental studies for operation of the GPU-foundation-base system. In this case it is necessary to pinpoint the requirements made for the enterprises-manufacturers for limiting the amount of decentering of the shafts, level of vibration and deformations of the foundations;  
development of a support frame of the GPU which corresponds to the functions of both the support plant element and the piling grills ;  
creation of a technique for calculating light-weight piling foundations for high-frequency GPU and development of technical requirements for planning them.

Industrial erection of the GPU foundations as one of the most important trends of technical progress in the construction of the compressor station is a complicated multiple-plan problem whose solution is possible based on unification of efforts of the manufacturing plants, designing and scientific research institutes, as well as construction organizations erecting the foundations.

L.L. Polyakov (All-Union Scientific Research and Planning Institute of Gas Extraction), N.V. Shuran (All-Union Scientific Research and Planning Institute of Gas Transport), R.M. Makarm E. V. Troitskiy, N. A. Glikman (Soyuzgaspro ekt) participated in preparing material on new planning solutions in gas transport.

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## OIL AND GAS

### USSR COAL AND GAS ARRANGEMENT DISCUSSED

Moscow GAZOVAYA PROMYSHLENNOST' in Russian No 9, Sep 82 pp 12-15

[Article by G. P. Tamrazyan and S.T. Ovnatanov, Armenian Geological Society, All-Union Scientific Research Institute for Organization and Control and Economy of the Oil and Gas Industry: "General Laws Governing the Arrangement of Gas and Coal in the USSR"]

[Text] Features and laws governing the arrangement of gas and coal in the USSR are important information which has definite importance in long-term use in practice of prospecting and exploration and forecasting of the regions of their greatest concentration.

General features and laws governing the arrangement and distribution of gas and coal in the USSR are as follows.

Geostructural confinement. A large part of the gas (over 90%) is confined to platforms and plates, and the smaller part to intermontane and marginal basins (troughs). More than half of the USSR coal (60%) is found in coal basins of the platform type, and the remaining part in geosynclinal basins [1,2].

Level of concentration in large deposits. A large part of the gas is concentrated in a small number of fields, concentrated into large accumulations. Thus, in the 25 explored fields (of the 740 considered) almost two-thirds of all the gas in the country is concentrated, and almost half in ten of them.

In relationship to coal, examination of this question is complicated since the coal basins contain series of coal fields, often almost continuing each other. One should apparently examine primarily the coal basins and regions. The 30 coal basins available in the country and about 100 coal-bearing areas and regions with total explored reserves of hard coal and lignite of categories ABC<sub>1</sub>C<sub>2</sub> are 427 billion T. The main mass of coal (346 billion T) is concentrated in six coal basins (Kansko-Achinsk, Kuznetsk, Donetsk, Irkutsk, Karaganda, and Pechora), and about 300 billion T of all the initial explored reserves of coal in the country are concentrated in the first three. On the whole the coal is concentrated into individual large accumulations just as frequently as gas, and even surpasses the latter in its level of concentration.

Stratigraphic confinement. The main mass of initial explored gas reserves is confined to the Mesozoic (81.5 percent), considerably less (14.5 percent) to the Paleozoic and even less (4.0 percent) to the Cenozoic. The distribution of gas by stratigraphic complexes indicates that the Cretaceous is in the first place (62.6 percent), Jurassic is in second place (18.3 percent), and further there is a great gap between the Carbonaceous (6.5 percent), Permian (5.8 percent) and Tertiary periods (4 percent). There is little gas, but nevertheless it is a noticeable quantity, in the Devonian, Triassic, Cambrian and Late Precambrian (less than 1 percent in each of them).

The coal is distributed differently. Its maximum quantity is found in the Paleozoic (55 percent) and Mesozoic (41 percent). The Cenozoic has about 4 percent of the explored reserves.

The distribution of coal reserves by stratigraphic complexes significantly differs for its various types. Hard coal is 87 percent concentrated in the Paleozoic deposits, while lignite is 88 percent in the Mesozoic deposits. This is related to the fact [1,2] that in the Mesozoic as a consequence of the reduction in the areas of geosynclinal regimes of development, coals of a low degree of metamorphism were dominant, while in the Paleozoic coals of medium and high degree of metamorphism dominated. In the Cenozoic with a dominance of platform regimes, the percentage of hard coals was very low (0.9%). In general, the proximity of the coal basins to the regions of intensive tectonic movements corresponds the most to an increase in the degree of metamorphism of coals and their transformation into stone differences. The geological time during which the ancient coals could be transformed more and more frequently on the path of increasing the degree of metamorphism apparently has definite importance.

Comparison of the distribution of gas and coal by stratigraphic complexes indicates that the maximum gas reserves belong to the younger surrounding complexes, Jurassic and Cretaceous. In the USSR the youngest (Pliocene) coals are found in Armenia (Dzhadzhurskiy field) and in the extreme southern section of Sakhalin. The most ancient coals are confined to the Devonian (middle Devonian, upper part of the Lower Devonian). Gas is found in the broader stratigraphic range (from quaternary deposits to Late Proterozoic).

Rates of gas-concentration and coal-accumulation. In order to compare the data on gas and coal, it is necessary to compare not only the stratigraphic complexes among themselves, but also to take into consideration the quantity of gas (coal) in the deposits of these complexes formed in a unit of time (for example, in 1 million years). We will use for this the concept regarding the coefficient of gas content (coal content) of the stratigraphic complex ( $K_g$ ). By this concept we mean the quantity of gas (in billion  $m^3$ ) or coal (in billion tons) in the deposits of the surrounding series formed in 1 million years. Using the calculated coefficients of gas content ( $K_g$ ) and coal content ( $K_c$ ) of the stratigraphic complexes, the corresponding curves were constructed (fig. 1).

Two maximums of gas concentration and two maximums of coal accumulation are noted in the Phanerozoic as a whole. In this case, the epochs of maximum coal accumulation occurred earlier than the epochs of gas concentration. The first



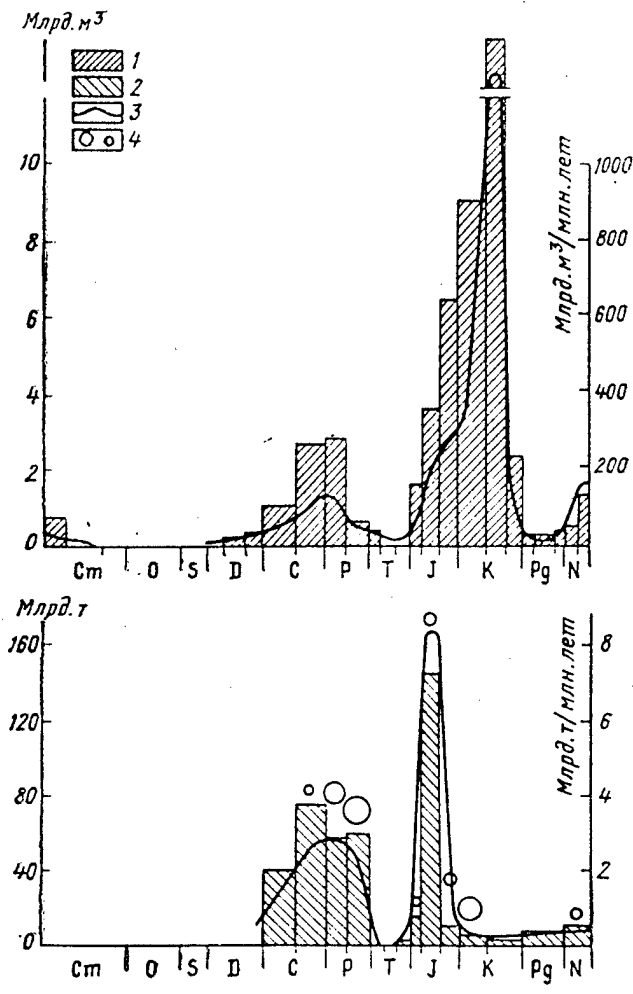


Figure 1. Distribution of Initial Reserves of Gas and Oil (Hard, Lignite) of the USSR by Stratigraphic Complexes (from data of [1,2,3,4].

Key:

1. Gas
2. Coal
3. Specific masses (K) of gas and coal in the deposits formed in 1 million years (scale on the right)
4. Possible and probable deposits of coal (possible deposits totally for one order and probably for  $\sqrt{10}$  are numerically larger than the reliable)
5. Billion  $m^3$
6. Billion tons
7. Billion  $m^3$ /million years
8. Billion tons/million years

maximum of coal accumulation occurs in the Middle and Upper Carbonaceous and Permian ( $K_c = 2.5-2.9$  billion T/million years). Then coal accumulation slows

down (almost stops), and only in the Late Triassic does it seem to be stimulated. In the Jurassic it is intensified and in the Middle Jurassic reaches colossal rates ( $K_c = 8$  billion T/million years). In the Upper Jurassic there is a considerable drop ( $K_c = 0.3$  billion T/million years), and then the rates of coal formation are held at a low level on the whole ( $K_c = 0.1-0.5$  billion T/million years).

The rates of gas concentration seem to follow the rates of coal accumulation, slightly lagging behind the latter. The first maximum of gas accumulation takes place in the Middle and Upper Carbonaceous ( $K_g = 91$  billion  $m^3$ /million years) and the Lower Permian ( $K_g = 140$  billion  $m^3$ /million years). The second maximum of gas concentration occurs in the Middle and Upper Jurassic ( $K_g = 200-266$  billion  $m^3$ /million years), the Lower Cretaceous ( $K_g = 346$  billion  $m^3$ /million years) and especially the Upper Cretaceous ( $K_g = 1250$  billion  $m^3$ /million years). The second maximum of gas concentration is significantly behind, confined to the Upper Cretaceous, while the second maximum of coal accumulation was earlier, in the Middle Jurassic.

The data presented in figure 1 indicate how the rates of gas concentration and coal accumulation change during the Phanerozoic. In this case it is necessary to bear in mind that it primarily reflects the combined result not only of the formation of gas and coal, but also the degree of their preservation from the subsequent processes of destruction (with denudation) associated with vertical tectonic movements which bring the gas- and coal-containing complexes above the level of the ocean where they are exposed to erosion to a certain measure. The gas is usually at great depths (1-6 km and more) and is confined to the regions of considerable submersions. This guarantees greater preservation of its initial masses during denudation of the near-surface complexes. The coal is usually confined to shallow depths, and computation of its reserves is done from the surface zones often to depths of 1 km or slightly more. The more ancient coal fields (Mesozoic and Paleozoic) in a number of regions have been denudated and destroyed. Therefore the available data on the coal reserves in the ancient deposits in any case are incomplete.

Data on gas occurring at great depths would seem to be more reliable. However, the gas, in contrast to the coal, is very mobile and prone to migration even with insignificant changes in the hypsometric and structural conditions of their surrounding complexes.

Spatial dislocation of gas and coal. Based on an analysis of the distribution of geological reserves of coal, the migration in the Phanerozoic to the east of the coal accumulation as the surrounding complexes become younger has been noted for a long time [1,2]. The youngest coal deposits are mainly located in the eastern regions of the USSR. The coal content of the Carbonaceous is confined to the European sector of the USSR (Podmoskovnyy and Donets Basins) and the neighboring regions (Karaganda and partially the Kuznetsk Basins). The coal content of the Permian is mainly confined to the Pechora, Taymir, Tunguskiy and Kuznetsk Basins. The Mesozoic coal accumulation begins in the Urals (Triassic coals of the Chelyabinsk Basin), then coal formation in the Lower Jurassic is concentrated in the Ural-Caspian Basin, in the North Caucasus, in

Kazakhstan and Central Asia. To the east of the Kuznetsk Basin to Baykal, there is a zone of the Middle Jurassic coal accumulation. In the Transbaykal there occurs a further drop in age of the coal-containing deposits (in the western part the coal accumulation begins in the Middle Jurassic and ends in the Upper Jurassic, while in the eastern section it begins in the Upper Jurassic and ends in the Cretaceous). In the eastern Magadan Oblast and in the Chukotsk-Koryak Oblast, Cretaceous and Tertiary coal accumulation. Migration of coal accumulation to the east continues in the Cenozoic: in the Far East the Paleogene coal accumulation is confined to the western part (Kivdo-Raychikhinskiy field and Uglovskiy Basin), while in the east (Kamchatka and Sakhalin), the coal accumulation also covers the Neogene (Miocene).

Spatial dislocation of gas is distinguished by complex mosaic. The Paleozoic gas deposits are found in the limits of both the European sector of the Soviet Union, and on the entire length from the North Arctic Ocean in the north to the Caspian in the south, and in the east (in East Siberia) where the gas is not only found in the Upper Permian deposits, but also in the lowermost stratum of the Paleozoic (in the Cambrian) and even in the Late Precambrian. The Cenozoic gas is also widespread and is present both in the west (West Ukraine, North Caucasus, Transcaucasus and West Turkmeniya), and in the regions which are central in longitude (republics of Central Asia) and far to the east (Sakhalin). The Mesozoic gas is widespread from the North Arctic Ocean to the southern margins of the country (Central Asia), from the western oblasts (West Ukraine, Caucasus) to East Siberia.

One can present an interesting feature for the Mesozoic gas which is so widespread in our country. G. P. Tamrazayn developed the idea about the West Siberian continental drift, as a result of which the geotectonic elements were formed, primarily of the plate type (West Siberia, Turanskiy, Skifskiy, etc.). The majority of initial gas reserves of the Mesozoic deposits in the USSR occur in regions which developed as a result of the West Siberian continental drift. It is precisely in these regions that there are no significant coal basins. It is possible that the geotectonic conditions in these regions fostered the formation of gas and not the formation of coal beds.

Zonality of gas concentration and coal formation. The idea about the zones of coal formation was advanced a long time ago and was reflected in the work of P. I. Stepanov at the 17th International Geological Congress in 1937. The work of A. I. Yegorov [5] which creatively developed the fundamentals of this theory, strongly stresses the idea about the presence of zones of coal accumulation. However, the zones of coal accumulation were discussed in the past only in a general form, and the zones themselves were represented as extending to half the dimensions of the continents and more. Further, this conclusion was insufficient and prevented the further development of the theory. The ideas about zones of coal- and oil-gas-accumulation today need further creative and deepened development.

The modern distribution of gas and coal by latitudes reveals interesting ratios. The greatest concentrations of coal (88 percent) of categories A+B+C<sub>1</sub>+C<sub>2</sub> are concentrated in a narrow latitudinal zone 48-57°. In this case the coal mainly (by 88 percent) has a Paleozoic age; the percentage of Cenozoic coal is extremely insignificant (0.5 percent). The main reserves of lignite (92 percent)

are also found at these latitudes (48-57°). A total of 78 percent is found in the narrow (three degree) latitudinal zone 54-57°. In the broad latitudinal zone 48-57° the lignites are mainly of the Mesozoic age (92 percent) while the percentage of Cenozoic coal is less than 1 percent.

The Cenozoic coals whose total percentage among all the Phanerozoic coals of categories A+B+C<sub>1</sub>+C<sub>2</sub> is only 2%, in contrast to the Mesozoic and Paleozoic are more dispersed in latitudinal zones and only 26 percent of the reserves for the country are in the zone of 48-57°. The remaining part of the Cenozoic coal is located outside the noted latitudes (48-57°) of the maximum Mesozoic-Paleozoic coal-occurrence, and is concentrated in the latitudinal zones neighboring from the south (42-48°, 43 percent of the reserves) and north (57-66°, 30 percent of the reserves).

On the whole the coals of the USSR are concentrated in a narrow 10-degree latitudinal zone (47-57°) in which there are 90 percent of all the explored reserves of categories A+B+C<sub>1</sub>+C<sub>2</sub>. This is very remarkable if you bear in mind that the continental territory of the USSR stretches between the latitudes 35-77°, and the coal is even found at latitudes of 80-81°. The impression is created that the most important coal basins and fields of the country seem to be stretched towards a certain latitudinal "coal main zone" which stretches from the Carpathians in the west to the Pacific Ocean in the east, extending over 8000 km. All the main coal basins are located in this "coal main" zone.

The latitudinal distribution of gas reveals the maximum concentration at latitudes 63-72° (here there is gas which is mainly Mesozoic). The gas is distributed less concentratedly in the dominant 9-degree latitudinal zones, while there is a lot in the other latitudinal zones (36-42°, 48-54°, etc.).

Comparison of the latitudinal distribution of gas and coal reveals the following features. First, the coal is mainly more southern (47-57°) than gas (63-75°). Secondly, the gas has a broader latitudinal arrangement (36-75°). Thirdly, there is a shift towards the north of the main masses of minerals in a direction from hard coal to lignites and further to gas. Fourthly, the main masses of coal and gas of the Paleozoic age are arranged more to the south than the Mesozoic age, although gas has a broader range of latitudinal arrangement.

Paleolatitudes of gas and coal fields. Because of the drift of the continents, the modern latitudes significantly differ from the ancient latitudes in the time of formation, and the deposits surrounding the coal and gas. For the Cenozoic deposits the difference is small, for the Mesozoic it is considerably greater, for the Paleozoic the difference is the maximum. Since the main initial reserves of gas are confined to the Mesozoic to which 41 percent of the coal (88 percent of the country's lignite) also belongs, then we will dwell on the paleolatitude data precisely in the Mesozoic (fig 2).

According to the modern latitudinal indicators, the Mesozoic gas and coal significantly differ among themselves. The gas is concentrated mainly in the latitudinal zone 63-72°. The second zone of increased gas content is confined to latitudes 36-45°. The Mesozoic coals are concentrated mainly in the latitudes 51-57°. Thus, the maximum of the Mesozoic gas is located on the whole for the country is 12° to the north of the maximum for coal. This pattern is

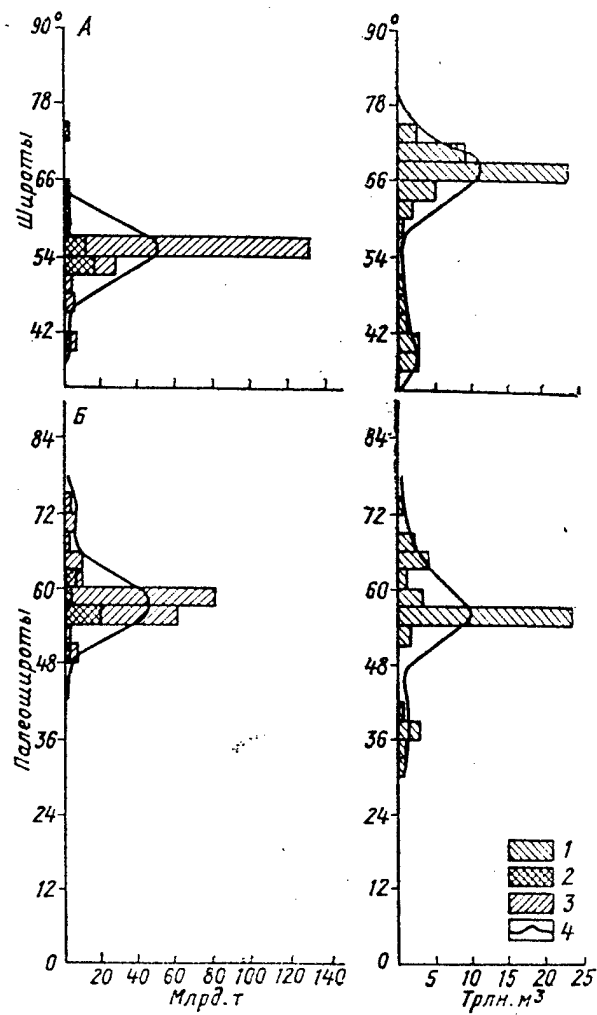


Figure 2. Modern (a) and Ancient (b) Latitudinal Arrangement of Mesozoic Gas and Coal of the USSR

Key:

1. Gas
2. Hard coal
3. Lignite
4. Distribution of gas and coal by twice sliding three-zonal three-degree latitudinal intervals
5. Latitudes
6. Paleolatitudes
7. Billion ton<sup>3</sup>
8. Trillion m<sup>3</sup>

revealed especially clearly and reliably from the averaged curve (by twice slipping three-zonal three-degree latitudinal intervals).

The paleolatitudinal distribution of the gas and coal fields reveals a surprising correlation to each other: both the gas and coal have the same paleolatitudes computed in quantities of 54-60°, which hold almost 80 percent of the coal (66 percent of the hard and 80% of the lignite). This pattern of correspondence to each other of the paleolatitudes of the Mesozoic oil and gas fields is distinctly manifest on the averaged twice slipping curve. At the same time, the areas of main accumulations of the oil and gas fields are located enormous distances from each other (1500-3000 km), not to mention the fact that they belong to completely different geotectonic regions and different stratigraphic complexes.

Further working of the oil and gas fields must take into consideration the latest data on their distribution and arrangement.

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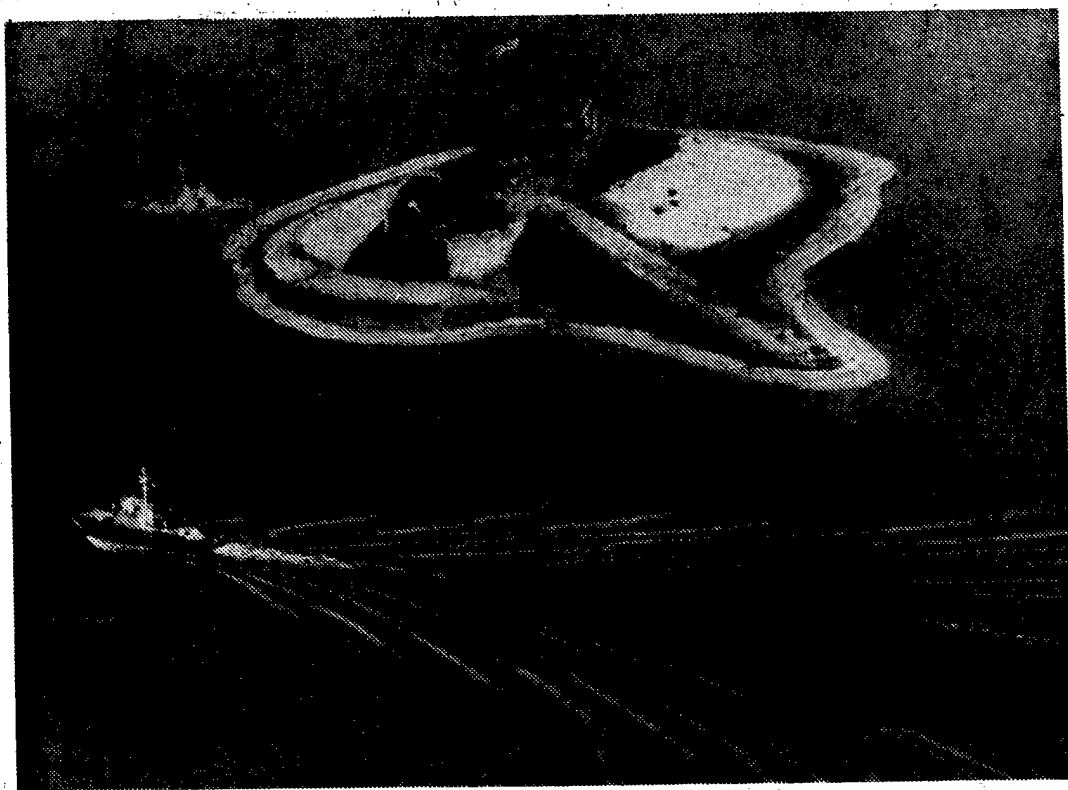
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CSO: 1822/39

OIL AND GAS

OFFSHORE OIL WELLS DRILLED AT WATER RESERVOIR

Moscow PRAVDA in Russian 22 Sep 82 p 1



[Text] The archipelago of artificial islands was created at the Nizhnekamsk water reservoir to facilitate oil extraction.

Because of construction of the Nizhnekamsk GES, 3 fields were in the flooding zone. A total of 60 wells had to be elevated onto islands and multiple-kilometer dams built. Because of the system of hydraulic engineering structures, oil extraction did not stop. The Prikamsk oil workers successfully preserved high rates under complicated conditions.

In the picture: one of the oil islands at the Nizhnekamsk water reservoir.

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CSO: 1822/12

DISSERTATION OFFERS SOLUTION TO GAS PIPELINE REPAIR PROBLEMS

Moscow GAZOVAYA PROMYSHLENNOST' in Russian No 9, Sep 82 p 27

[Article: "Organization of Repair Work on Gas Pipelines"]

[Text] With an increase in length of the gas pipeline network, the volumes of work for major repair of the line part of the main gas pipelines increases. Consequently the problem of improving the technology, technical resources, organization and control of major repair of gas pipelines acquires especial urgency.

The dissertation of F.S. Aflyatonov for defense of the scientific degree of candidate of technical sciences covers the solution to the listed questions. This work was done in the Scientific Research Institute of the Gas Industry and the Central Asian Institute for Gas Transport.

The author has suggested and substantiated new technology for organizing major repair of main gas pipelines of large diameters and length by comprehensive line repair-construction (CLRS) which guarantees parallel-successive conducting of a full cycle of repair operations, including opening of the gas pipeline, lifting-cleaning, sorting, restoration of the strength of the pipewall, insulation-laying and covering for conditions of Central Asia.

A technique has been developed for calculating synchronization, production of repair of gas pipelines with establishment of the maximum permissible conversions between individual types of work.

For the first time technology has been suggested for fulfilling lifting-cleaning operations of the gas pipeline without opening it with the use of standard excavation equipment which is available at the repair mechanized columns, by the method of continuous "extraction" from the trench which makes it possible to reduce the time for implementing this operation 3-4 fold.

The practical value of the work is that the developed technique of line production of major repair of main gas pipelines of large diameter and length by the CLRS method and the new technology of lifting-cleaning operations guarantees an increase in the level of mechanization of work for opening and lifting the gas



pipeline in dry and normal ground to 100%, labor productivity of repair operations 1.5-2-fold and decrease in the net cost of repair to 10% with the use of standard mechanisms, machines and equipment available in the repair columns.

Introduction into practice of these developments in repairing main gas pipelines of large diameter in the association "Sredaztransgaz" alone guaranteed an economic effect over R 250,000.

The library of All-Union Scientific Research Institute of the Gas Industry has the dissertation for detailed examination.

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## OIL AND GAS

### NEW BOOK PUBLISHED ON CORROSION PROTECTION OF UNDERGROUND PIPELINES

Moscow GAZOVAYA PROMYSHLENNOST' in Russian No 9, Sep 82 p 32

[Article by A.V. Detochenko (Ministry of the Gas Industry): "Aid for the Installer to Protect Gas Pipelines"]

[Text] The reliable operation of the resources for protecting underground pipelines from corrosion and consequently, reliability of the gas and oil conducting trunk lines depend a lot on the level of professional training of the worker cadres in this field.

The book of Ye.A. Nikitenko and Ya. M. Edel'man "Assembler for Protection of Underground Pipelines from Corrosion" which was published in 1981 in the publishing house "Nedra" was a great help in this respect. It was recommended by the USSR State Committee for Professional-Technical Education as a textbook for training workers in production.

The textbook was written in accordance with the program for training assemblers for protection developed by the Central Educational-Method Office for training of cadres of the Ministry of the Gas Industry and is designed for training workers by individual, brigade, or course methods. Individual sections of the textbook can be used in training workers of other specialties of line-operating service of pipelines.

The textbook consists of seven chapters. They examine the main questions for materials technology of electrochemical protection, fundamentals of electrical engineering and industrial electronics, problems of underground corrosion of pipelines and methods of controlling it. A lot of attention is focused on installation, assembly, operation and repair of structures of electrical protection, accident prevention in protecting underground pipelines from corrosion.

For the first time the textbook successfully presents questions on a modern scientific-technical level with correct method and describes the work which according to the requirements of the rate-qualification reference, the assembler must know and must be able to fulfill for protecting the underground pipelines from corrosion.

In addition to theoretical questions, the textbook covers practical methods of organization and management of work for protection of pipelines from corrosion. Possible malfunctions of the units of electrical and chemical protection are

presented in the methods for eliminating them, and a system is examined for preventive maintenance of structures of electrical and chemical protection.

Questions for repetition at the end of each chapter help the students to reinforce the educational material, and two-color figures facilitate an understanding of the operation of the electrical circuits and design assemblies of the units.

The book which has been published by "Nedra" for workers of the line section of main and field pipelines is very useful and timely.

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CSO: 1822/ 39

## OIL AND GAS

### BRIEFS

INCREASED OIL OUTPUT--Chernigov-- Oil from the ancient Devonian oil-bearing beds lying at great depths can be extracted in industrial scales, if a special emulsion composition is used that was created by the colleagues of the Chernigov department of the Ukrainian Scientific-Research Geological-Exploratory Institute. Two wells at the Yadutinskiy and Kinashevskiy areas in Poles'ye treated with the new preparation yielded an influx of oil. The solutions previously used to treat the productive bed are not very effective because of low concentration in them of hydrochloric acid and its low specific weight in total mass. Increase in the quantity of this acid in the composition usually ran into significant obstacles: it is very aggressive in relationship to the production equipment, and its active reaction when it encountered rocks did not make it possible to inject fluid into the deep beds. The long search of the scientists was successful. Resources were found which protect metal and rock from the destructive effect of hydrochloric acid. This made it possible to inject a concentrated fluid to a considerable depth, to create long drainage channels in the bed, and at the same time increase the influx of oil or gas. [Article by A. Oleynik] [Text] [Kiev PRAVDA UKRAINY in Russian 14 Sep 82 p 3] 9035

OIL INDUSTRY COMPUTER USE--Nebit-Dag (Turkmen SSR), 22 Sep--For the first time in the oil industry of the republic, the trust "Turkmenneftepromgeofizika" has introduced into operation a modern computer type "YeS-1033." Its use will permit introduction of an automatic system of collection and processing of geophysical well studies. Geological-geophysical data for each well and field will be placed in the electronic memory of the machine. The electronic brain of the computer rapidly and with great reliability will be able to issue data which will permit acceleration of the evaluation of the outlook for the new exploratory fields. [Article by A. Yezerkiy outside correspondent of PRAVDA] [Text] [Moscow PRAVDA 23 Sep 82 p 2] 9035

INCREASED OIL OUTPUT--The field workers of the administration "Tebukneft'" the senior in the association "Kominert'" are successfully working. Since the beginning of the year they have sent about 1,500 T of above-plan oil for refining. The fields of the administration "Tebukneft'" have switched to optimal regimes of extracting oil and maintaining bed pressure. This year the administration "Tebukneft'" will send over 3.5 million T of first-grade product for refining. [Text] [Ashkhabad TURKMENSKAYA ISKRA in Russian 14 Sep 82 p 2] 9035

NEW BELORUSSIAN CITY--This city does not yet have a name. The architects and builders call it Atomgrad, but in the official documents it is designated as the settlement of the Minsk nuclear central heating and power plant which will supply the capital of Belorussia with heat and electricity. The young cities are like landmarks which mark the birth and development in the republic of promising sectors of the national economy. Atomgrad whose construction was started several dozen kilometers from Minsk, marks our development of nuclear power engineering. The new city is a match for the new sector. The architects of the Belorussian State Scientific Research and Planning Institute of City Construction have designed it with regard for modern requirements. The housing massif was planned with regard for demographic composition of the population and the specifics of work. Many workers of the nuclear central heating and electrical plant will receive apartments made of 2-4 insulated rooms. For the useful spending of free time, development and application of creative abilities of each person, the Palace of Culture, house of pioneers and students, children's music school, movie theater, athletic complex with gymnastic and playing halls, and swimming pool have been planned in the social center of Atomgrad. In examining the mock-up, I note how unique is the architectural appearance of the settlement of nuclear workers: there are no closed quarters, the houses are of different height from 1 to 9 stories and form an impressive silhouette. The construction of the first phase of the settlement will be completed in the next five-year plan. [Article by N. Il'yushenko, correspondent of BELTA] [Text] [Minsk SOVETSKAYA BELORUSSIYA in Russian 9 Sep 82 p 2] 9035

NEW OIL PREPARATION UNIT--Usinsk (KomiASSR), 24 Sep--A new unit of oil preparation has been constructed at this oil field. It is now being tested. The installers from Ukhta and Usinsk jointly with specialist from the GDR are involved with start-up and adjustment of equipment. This already is the third oil purification plant at the source of the northern oil pipeline Usa-Ukhta-Yaroslavl. Liquid fuel extracted from the depths of the Vozeyskiy field will be refined here. [Article by A. Kurkov, outside correspondent of PRAVDA] [Text] [Moscow PRAVDA in Russian 25 Sep 82 p 6] 9035

CSO: 1822/12

COAL

UDC 622.33;002.5

DEPUTY MINISTER ANALYZES COAL MACHINE BUILDING STATUS, DEVELOPMENT

Moscow MEKHAIZATSIIYA I AVTOMATIZATSIIYA PROIZVODSTVA in Russian No 8, 1982  
pp 1-4

[Article by Deputy Minister of Coal Industry V. P. Gerasimov]

[Text] The 26th CPSU Congress instructed our country's coal industry to increase coal mining to 770-800 million tons in 1985 and to promote further development of subterranean mining of coal, especially coking coal.

The "Basic Directions of the USSR's Economic and Social Development in 1981-1985 and in the Period to 1990" adopted by the 26th CPSU Congress foresee, in support of this task, an increase in the productive capacities of coal machine building, acceleration of the development and assimilation of series production of highly productive complexes of equipment to remove coal in complex mining and geological conditions and to conduct preparatory operations, and expansion of the creation and introduction of automated resources for mining coal in shafts without the constant presence of people at the working faces.

In 1976-1980 coal machine building enjoyed certain successes in developing production of mining equipment and in raising the technical level of the produced machines.

During the 10th Five-Year Plan 78 percent more capital investments into development of coal machine building enterprises were assimilated and 1.6 times more output capacities created by capital construction were placed into operation than in the 9th Five-Year Plan.

Assembly and mechanical shops were placed into operation at the Gorlovka Machine Building Plant imeni S. M. Kirov, a prop production building was placed into operation at the Kamensk Machine Building Plant, a belt conveyor shop is now working at the Aleksandrov Machine Building Plant imeni K. Ye. Voroshilov, a fully mechanized shop is producing chutes for a scraper conveyor at the Krasnyy Luch Machine Building Plant, and other facilities are now operating as well.

While the number of employees involved in industrial production increased by 2.4 percent, commercial production grew during the five-year plan by 20.3 percent; about 90 percent of the increment was achieved through growth in labor productivity.

During this period production of mechanized props and complexes increased by 27.3 percent, production of extraction combines increased by 13.3 percent, the output of graders increased by 12.8 percent, production of tunneling combines grew by 14 percent, and production of spare parts for mining equipment increased by 12.2 percent.

The level of full mechanization of extraction operations in mines increased from 52 percent in 1975 to 69 percent in 1981. This includes an increase from 60 to 76 percent for coal seams with up to a 35 degree slope, and from 4 to 12 percent for coal seams with a slope greater than 35 degrees.

Given a significant increase in the volume of preparatory operations, the level of mechanization of rock loading operations was 81 percent in 1981, as compared to 79 percent in 1975, while the volume of coal extraction by combines increased from 30 to 39 percent.

Production of GSh68 and KShZM extraction combines, characterized by a high power per unit ratio, increased by 45 percent in the 10th Five-Year Plan, while production of mechanized "Donbass" and LMK97D mechanized props for thin seams (0.9-1.2 meters) increased by 35 percent.

Series production of type-size 1 mechanized M88 props for seams more than 1.05 meters thick and KGU props for thin steep seams has been assimilated.

M87P and M130 mechanized props are now being produced for work in more-complex mining and geological conditions, to include in shafts with hard-to-work roofing.

Deliveries of type ANShch and lAShchM grading units to the mines have increased almost twofold. These units are intended for mechanized working of thin and moderately thick steep seams.

The assortment of series-produced scraper conveyors has been significantly updated, and series production of improved SP87P and SP202 base conveyors has been assimilated.

A family of GPKS rock tunneling combines has been designed and placed into series production at the Kopeysk Machine Building Plant imeni S. M. Kirov. These combines are intended for horizontal and sloped (from +20 to -25 degrees) extraction of coal and rock.

Despite the increase in production of the basic kinds of mining equipment, coal industry's demand for the most important types of mining equipment is not yet being fully satisfied by plants of the "Soyuzuglemash" All-Union Production Association. Series production of effective fully mechanized resources for extraction operations under the following mining and geological conditions is being assimilated too slowly: thin seams less than 0.9 meters thick; seams 0.9-1.1 meters thick.

Props with the required resistance for the seams characterized by hard-to-control roofing and a range of seam thicknesses of up to 1.15 meters and over 1.9 meters have not yet been placed in series production.

Coal industry's demand for light and medium duty PKZR, 4PU and GPKS tunneling combines is now being almost completely satisfied.

But at the same time the demand for heavy duty type 4PP2 tunneling combines produced by the Ministry of Heavy and Transport Machine Building's plant in Yasinovataya is being satisfied only 50 percent.

Enterprises and organizations of the "Soyuzuglemash" did a certain amount of work in the 10th Five-Year Plan to raise the technical level and quality of the articles they produce.

The average life of series-produced mechanized props has risen: by 10 percent for M87, by 40 percent for MK-97, by 15 percent for M81 and by a factor of two for "Donbass" props. The life of extraction combines until their first overhaul has been increased. Production of articles in the second quality category dropped from 13.1 million rubles in 1975 to 0.65 million rubles in 1980, and 90 articles were removed from production and replaced by new or modernized ones.

By the end of 1980 the volume of articles produced in the top quality category attained 19.4 percent of the total production volume of coal machine building plants (almost four times greater than in 1975). Nineteen of the sector's plants now produce articles of 94 kinds bearing the State Seal of Quality.

However, the effort thus far has not yet insured an increase in the technical level and quality of series-produced articles to the required level.

The CPSU Central Committee and USSR Council of Ministers decree "On Measures to Accelerate Reequipping of Mines of the USSR Ministry of Coal Industry" devoted a great deal of attention to significantly raising the technical level of coal machine building plants and raising their output capacity. This emphasizes the important, decisive role played by plants of the "Soyuzuglemash" and its institutes in accelerated reequipping of underground coal mining operations.

Production of a larger volume of the basic mining machines and complexes and growth in their working life would be possible only with accelerated growth in technical level of "Soyuzuglemash" plants in relation to all limiting factors of production.

A significant increase in production of precision castings and of castings with minimum tolerances, and full mechanization of their manufacture would be most important to raising the technical level of casting production in the coal industry.

With this purpose in mind, and in order to increase the total casting production volume, there are plans for introducing the following in the period to 1985: into 11 casting shops of the "Soyuzuglemash" plants--fully mechanized lines and sections manufacturing steel castings in molds, compacted by compression molding at high unit pressure and by high-speed (shock) compression molding, based on shuttle and carousel casting units designed by the All-Union Scientific Research, Planning and Technological Institute of Coal Machinery and sandblast compression-molding machines designed by the VNIILITMash [not further identified]; procedures



and equipment for producing precision shaped castings requiring minimal mechanical working out of high-strength cast iron for parts to be used in the hydraulic blocks of mechanized props, pneumatic drills, pneumatic drives and so on to replace blanks made from rolled metal and blanks that are stamped and welded, which will make it possible to significantly reduce the mass of the blanks and the laboriousness of their manufacture. For example replacement of the body parts of hydraulic blocks, made from rolled metal and containing drilled grooves, in just the KM-130 prop alone by parts cast from high-strength cast iron with cast grooves will reduce labor-intensiveness by 50,000 man-hours in just 1 year and decrease the weight of the blanks by 15-20 percent; the level of mechanization of rod manufacture will increase from 37.5 to 65 percent, which will make it possible to reduce application of heavy manual labor and decrease the labor-intensiveness of manufacturing the rods by about 50,000 man-hours.

There are plans for reequipping the casting shops of a number of plants: Seven casting flow lines, two fully mechanized blending sections and other production facilities will be introduced.

In the area of blank forging production, a significant amount of work has been done at the principal plants of "Soyuzuglemash" to replace obsolete and worn equipment with modern equipment. In 1978-1980 39 units of progressive blank forging equipment were introduced into the forging shops, to include 16 edge-milling and cutting tools for precision cutting of blanks, 2 upsetting machines and presses exerting a force of 1,250-2,500 tons.

A semiautomatic precision blank hot-stamping line and a semiautomatic ring-rolling machine capable of precision forging of ring-shaped parts were introduced at the Kopeysk Machine Building Plant imeni S. M. Kirov.

Forging manipulators intended for heavy forgings, high-power sheet metal breaking machines for sheets up to 40 mm thick and high-power plate-straightening machines and cutting tools were introduced at a number of plants.

Creation of a unique section of heavy presses consisting of two crankshaft presses with a force of 2,500 tons and a hydraulic press with a force of 1,250 tons, outfitted with high-powered pneumatic and hydraulic hoists and intended for production of a number of parts for mechanized props, is planned at the Druzhkovka Machine Building Plant imeni 50-Letiye Sovetskoy Ukrainy in order to raise the technical level of blank forging production.

A section consisting of two crankshaft presses generating a force of 2,500 tons is to be introduced at the Kiselevsk Machine Building Plant imeni I. S. Chernykh to produce parts for new VDK-2.5 mine carts and parts for mechanized props.

In terms of overall labor-intensiveness of manufacturing mining equipment, the proportion of welding production is significantly greater than casting, forging and pressing production, and it is exhibiting a tendency towards further growth.

The average mechanization level of welding operations attained 61.9 percent in 1980. When we consider manufacture of round-link pull chains, this level is 84.8 percent, as compared to an average level of 53.1 percent for mechanization of welding operations in Soviet machine building. Welding operations at plants

of the "Soyuzuglemash" are basically performed at 130 flow and fully mechanized lines and sections.

Forty-two fully mechanized lines outfitted with automatic manipulators are operating in a special shop producing chutes for scaper conveyors at the Krasnyy Luch Machine Building Plant. The mechanization level of welding operations in the shop has attained 82 percent.

The average mechanization level of surfacing operations in "Soyuzuglemash" plants is 76 percent, as compared to an average mechanization level for such operations of 60.3 percent in Soviet machine building.

Efforts are being made to improve the procedures and to introduce progressive equipment into production of carts of a new design--VDK-2.5, and tops and bases for mechanized props and complexes, and to improve the welding of the cylinders of hydraulic props at their slit gap in order to raise the technical level of welding production.

In the area of thermal gas surfacing and plasma surfacing with powdered materials, there are plans for developing the procedures and equipment (a complex of mechanized assembling and welding lines) for production of racks for a chainless combine feed system, and for introducing a specialized device for air-plasma cutting of rolled sheet metal.

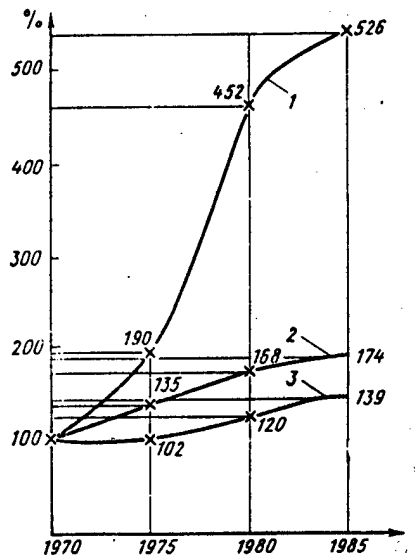
The most effective method for raising the quality and life of coal mining machinery is to improve the procedures used in the thermal and chemicothermal working of parts for mining equipment.

The technical level of heat treatment has risen significantly at "Soyuzuglemash" plants in recent years (see figure). Modern thermal shops have been placed into operation. They are outfitted with progressive equipment making use of a protective atmosphere, to include SKZA tunnel hardening and tempering conveyor units, STZA pusher-pipe units, SNTsA mechanized compartment units, and compartment kiln lines equipped with a mechanized loader.

The heat-treatment capacities are to be increased in the 11th Five-Year Plan through new construction and through reconstruction of existing thermal shops. This will make it possible to raise the quality of important units such as parachutes and suspension units for mine frameworks, parts for extracting and tunneling combines and so on.

The proportion of volume heat treatment will decrease, while that of superficial strengthening methods will increase.

The following equipment is being introduced into plants of coal machine building industry: automated compartment and tunnel heat treatment units outfitted with the latest equipment for preparation of the controlled atmosphere and its automatic adjustment; tempering presses that temper gear wheels with little deformation owing to the use of special dies and a pulsating pressure cycle in the press, differentiated loading of the hub and the rim of a gear wheel and adjustment of the flow of oil in terms of quality and time. This reduces deformation of the slotted hole and end warping and improves the meshing of gear wheels in coal extracting combines.



Dynamics of the Volumes of Part Heat Treatment in Coal Machine Building: 1--Heat-treated parts; 2--parts heat-treated in protective atmospheres; 3--chemicothermal treatment

The lack of production space in thermal shops at "Soyuzuglemash" plants is detaining introduction of progressive production processes, to include heat treatment in a controlled atmosphere and in a vacuum, low-temperature nitro-cementation, nitration, ionic and ionic-plasma treatment using a glow discharge, laser heating and so on.

We need to accelerate growth in the capacities for heat treatment of parts for mining equipment at "Soyuzuglemash" plants in the current five-year plan.

The quotas assigned to coal machine building plants of the USSR Ministry of Coal Industry in the CPSU Central Committee and USSR Council of Ministers decree "On Measures to Accelerate Reequipment of Mines of USSR Ministry of Coal Industry" require a significant rise in the technical level of mechanical working.

Coal machine building plants have been given a short time to assimilate production of mechanized props to be used in the mining of thin coal seams. A new shop is to be organized for the manufacture of hydraulic apparatus at the Kamenskiy Machine Building Plant. New type KMT and LUKP props are to be manufactured at the Druzhkovka Machine Building Plant imeni 50-Letiye Sovetskoy Ukrainy. This will require reequipment of a number of shops. The "Kargormash" Production Association (Karaganda) is to begin producing type 2UKP props; this will require introduction of a new mechanized pile shop. Unified rollers are to be produced for belt conveyors on the basis of a completely new system of automatic lines.

Insufficient unification of mining equipment is retarding improvements in production procedures and growth of the level of mechanization and automation of

production processes at coal machine building plants. In particular, much work has to be done to assimilate production of a unified series of coal extracting combines.

The grouping of machine tools into a processing center to work body parts has been proposed as a production innovation.

In the next few years the technical level of mechanical working in series and small-series production at "Soyuzuglemash" plants will be raised by concentrating the working operations performed at the same machine tool, by employing multiple-arbor, multiple-support part working, and by combining part working with active control.

In large-series production, we will start making use of fully mechanized lines with built-in automatic manipulators in the manufacture of pistons and cylinders for mechanized props, axles and wheels for mine carts and gears for coal extracting combines.

The effectiveness of using the new technology, for example in the processing of rods for BGA-4 drilling rigs using central-drive machine tools equipped with partial programmed control, is shown in the table below.

<u>Indicators</u>	<u>Using Existing Technology</u>	<u>Using New Technology</u>
Production Program, units	180,000	180,000
Labor-Intensiveness per Unit, hours	0.46	0.006
Number of Operations, each	6	1
Machine Tool Requirement, units	24	4
Number of Workers	44	7
Processing Cost, 1,000 rubles	136.3	33.3
Annual Economic Impact, 1,000 rubles	136.3	187.0

By 1985 the proportion of special, specialized and banked machine tools at "Soyuzuglemash" plants will attain 12.2 percent, the proportion of automatic and semiautomatic tools will attain 13.1 percent, the quantity of machine tools with partial programmed control will reach 2.1 percent, and the quantity of machine tools intended for finishing operations will attain 16-18 percent.

The technical level of production of coal mining machines and complexes is to be raised in the "Soyuzuglemash" as a whole prior to 1985 by introducing 100 fully mechanized sections and mechanized flow lines, and 1,200 special, specialized and banked machine tools and machine tools equipped with partial programmed control.

The increase in technical level of production and existing shops and the foreseen growth in output capacities of "Soyuzuglemash" machine building plants should insure the following production increases by 1985: 19 percent for mechanized props, 27 percent for tunneling combines, more than 30 percent for mine conveyors, 35 percent for mine carts and more than 31 percent for spare parts.

Modernization of equipment and development of new structures have been foreseen as a means for raising the technical level of mining equipment.

In the current five-year plan "Donbass" complexes are to be replaced by 1KM103 complexes, KM97D complexes are to be replaced by KMK97M complexes, and M87 complexes are to be replaced by 1KM88 and KM87M complexes. Mechanized complexes intended for mining conditions in which such complexes have not yet been operated are being created. This includes complexes to work longwalls with hard-to-work roofing rock (KMT, LUKP, KMT130) and new types of combines (K103, RKU10, RKU25) and scraper conveyors (SPTs 151, SPTs 161, SPTs 261, SPTs 271, SP 301).

Plans have been made to improve the technical level of series-produced tunneling combines--their dust-suppression effectiveness, their dependability and life. Their areas of use in hard rock are to be expanded, and remote control systems are to be assimilated. There are plans for assimilating production of new models of the UPK combine, which will replace the PK-3p and 4PU combines.

Further improvements will be made in series-produced loading and drilling-loading machines, with emphasis laid on longer life.

As a result of efforts to raise the technical level of production and the quality of mining equipment, 49 articles produced by the "Soyuzuglemash" are to be awarded the State Seal of Quality in 1981-1985, and the volume of articles produced in the top quality category is to be increased by 1985 to 30 percent of the total production volume of coal machine building plants.

In order to support the planned production of mining equipment, most enterprises of coal machine building are to be reconstructed and expanded, for which purpose 1.5 times more capital investments are to be allocated in the 11th Five-Year Plan than were assimilated in the 10th.

Special attention is being devoted to developing enterprises manufacturing equipment for mechanized complexes: mechanized props extracting combines and movable scraper conveyors. Almost half of all capital investments allocated to coal machine building are being channeled into development of the output capacities of these enterprises. Construction of a new tunneling and underground drilling equipment plant is to begin in the 11th Five-Year Plan. It will produce heavy tunneling combines and tunneling complexes. Construction of this plant will make it possible not only to raise production of tunneling equipment but also to significantly increase the level of specialization at existing enterprises by transferring production of some mining machines to the new plant.

To insure proper proportions in the development of mechanical assembly and intermediate production in 1981-1985, new casting and forging shops are to be built, to include large basic shops at the Kiselevsk Machine Building Plant imeni I. S. Chernykh, the Druzhkovskiy Machine Building Plant imeni 50-Letiye Sovetskoy Ukrainy, at the Kamensk Machine Building Plant and elsewhere.

Development of the output capacities of coal machine building through capital construction and reequipping of existing production operations will make it possible to successfully complete the tasks, posed by the 26th CPSU Congress,

of supplying highly productive, dependable mining equipment, and to satisfy the pledges adopted by the country's miners in honor of the 60th anniversary of the USSR's formation.

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NEW COAL MINING EQUIPMENT, PROCEDURES INTRODUCED

Moscow MEKHAIZATSIIYA I AVTOMATIZATSIIYA PROIZVODSTVA in Russian No 8, 1982  
pp 5-8

[Article by USSR Academy of Sciences Corresponding Member A. V. Dokukin:  
"Technical Progress in Coal Industry"]

[Text] Beginning with the 9th Five-Year Plan, reequipment became the foundation for development of coal industry.

Preference was given to development of the most economical open-pit coal mining method, and much attention was devoted to full mechanization of extraction operations and to use of combines to work the mines. As a consequence open-pit coal mining increased by more than a factor of 1.6, coal extraction by mechanized complexes in mine working faces increased by a factor of 2.7, and the volume of mining operations performed with combines increased by a factor of 1.8 in the last 10 years.

Creation of the technology and mining equipment which would satisfy the requirements of effective and safe development in the various mining and geological conditions encountered at coal deposits served as the basis for scientific-technical progress. This made it necessary to organize a broad network of scientific research and planning-and-design institutes, and to significantly strengthen the experimental and machine building base.

An effort was made to solve problems associated with effective disintegration of coal and rock, with control of rock pressure, with mechanization of coal mining and loading processes, with digging and reinforcing mine shafts, with transportation and with creation of explosion-safe mining equipment and equipment with an arctic design for open-pit operations.

In recent years we have developed the scientific principles and created spark-proof electric equipment, and we have developed systems that shut off current with an anticipation time of up to 3 msec. This has made it possible to electrify development of steep coal seams in shafts containing excess methane.

Complex problems arose in the assimilation of underground coal mining at great depths. Creation of a favorable microclimate and more effective airing and control of the state of the rock were required. Considering the need for economization of natural resources, we found it necessary to develop ways to control

high gas concentrations and sudden blow-outs of coal, gas and rock, so as to avoid the closing of coal enterprises working explosion-hazardous seams. Active methods were introduced for controlling rock pressure (chipping away vibration-unstable seams from shielded tunnels), and methods of stabilizing the rock with wells drilled from the surface and from mine shafts are enjoying development. Methods are being created for effective control of rock pressure at worked faces of mines, and of removing gas from gas-bearing seams for the purposes of excluding phenomena associated with gas dynamics.

Improvements are being made in the ZUA5 seismoacoustic safety system, which is now being used at 50 mines, and geophysical reconnaissance apparatus intended to detect geological and tectonic disturbances of coal seams in mines is being created. Improvements are being made on the AMTZ automatic gas safety system, which is presently in use at 400 mines working gas-bearing coal seams, on degassing systems being used at 200 mines, and on air conditioning systems used at 20 deep mines.

Remote-control mining equipment is being developed to work thin seams (drilling worm conveyor systems for gently sloping seams and drilling systems for steep seams), and automated machine units are being developed for thin and moderately thick seams.

Development of the open pit method of coal extraction is based mainly on development of the highly rich deposits in the country's eastern regions by means of high-output open pits.

The "Bogatyr" open pit, which has an output capacity of 15 million tons of coal per year, is already operating at the unique Ekibastuz deposit. In the Kansk-Achinsk basin, the "Berezovskiy" open pit is now under construction. Its output capacity will be 55 million tons. Preparations are being made to develop an open pit with an output capacity of 30 million tons at the Taldinskiy deposit in the Kuznetsk Basin. Open pits with output capacities of 10-15 million tons per year are being built in the southern Yakut ASSR and in the Far East.

Technical progress in the open pit method of coal mining, the volume of which is now more than 38 percent of total mining production, and which will exceed 50 percent in the future, is based on the use of mining and transportation equipment characterized by a high relative capacity. This primarily includes rotary complexes with a productivity of 2,500, 5,520 and (projected) 12,500 m<sup>3</sup>/hr, high-capacity swing chutes with cantilevers 190-220 meters long, large walking draglines with 40-100 m<sup>3</sup> buckets and 80-120 meter booms, mechanized stripping shovels with a bucket capacity of 35 m<sup>3</sup> and booms 65 meters long, and highly productive quarry excavators with a bucket capacity of 12.5-20 m<sup>3</sup>.

Use of economical mining systems equipped with built-in swing chutes and flow-line technology is expanding at new coal open pits. Such equipment is outfitted with rotary equipment and conveyORIZED transportation.

The open pits are using high-power direct and alternating current hauling units with a coupling force of 360-372 tons, and dump cars with a capacity of 140-165 tons. Mining motor transportation is developing in the direction of the use of



dump trucks with a loading capacity of 75, 110 and 180 tons, and coal freighters with a capacity of 120 tons.

Designs are being drawn for cutters capable of directed drilling of wells with a diameter of up to 380 mm and a depth of up to 60 meters, and for machine tools, converted for hydraulic operation, with cutters capable of drilling wells with a diameter of 200 mm.

High-output thermal electric power plants are being built at highly productive coal open pits. Their electric power will be transmitted to the Ural and to the country's European territory.

The Soviet Union is the birthplace of full mechanization of underground coal mining operations based on the use of sectional mechanized piles converted for hydraulic operation. At present mechanized piles are doubling and tripling labor productivity at working faces and reducing the rate of industrial injury.

The level of coal mining by mechanized complexes was 74.3 percent in 1980, and in the immediate future it will be increased to 78 percent in coal seams having a slope of up to 35 degrees, while the level of such coal extraction from steep seams will grow from 11.5 to 22 percent. Full mechanization of mining operations in the Moscow, Pechora and Karaganda basins was practically completed by 1980. Its level attained 98.8, 94.4 and 91.5 percent at this time.

At fully mechanized faces, seams of moderate thickness are being worked for the most part by KM87 complexes--380 faces (seams 1.2-1.9 meters thick) and OKP complexes--240 faces (seams 1.6-4 meters thick), while the KMK97 and KMS97 complexes are being used most frequently with thin seams, at 220 faces (seams 0.8-1.2 meters thick). These complexes are undergoing modernization today.

The highest technical-economic indicators were achieved with OKP70 complexes working with shield-shaped props (Figure 1) and KM87 complexes with props serving shielding and supporting functions, the carrying capacity of which was raised to  $0.7 \text{ MN/m}^2$ .

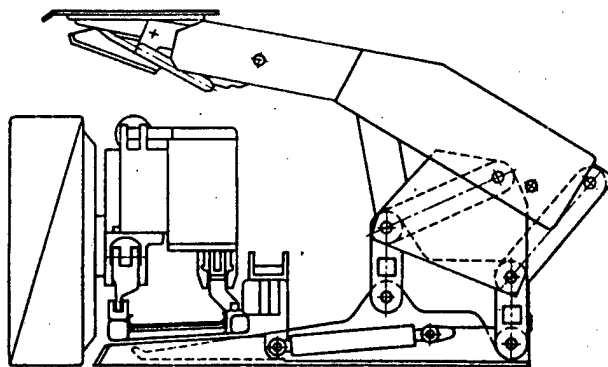


Figure 1. OKP70 Complex

The KMT, KM130 and UKP complexes were created to work beds with hard-to-control roofing. The carrying capacity of their mechanized hydraulic prop is, correspondingly 0.9 and 1.2 MN/m<sup>2</sup>, which makes it possible to develop coal seams with a slope of up to 35 degrees and heavy roofing (sandstone 10-40 meters thick).

The KM103 complex has now passed its tests, and it has been adopted for series production. It is intended for development of thin seams 0.7-1.0 meters thick. It replaces the "Donbass" complexes and excludes the need for precutting rock when working thin seams.

The greatest difficulties were encountered in creating mechanized complexes and machine units for steep seams. Such units are now based on the AShch and ANShch shield-shaped machine units, which are now operating at 90 fully mechanized faces exposing steep slopes with a thickness from 0.7 to 2.5 meters. In 1981 about 5.6 million tons of coal were mined by such units.

The AKZ automated unit has been perfected the most for development of steep seams. It can handle a load of more than 1,000-1,500 tons per day, and it has a productivity of 100-150 tons per trip, which excludes the need for the constant presence of human operators at the working face.

The experience of using the automated AKZ unit demonstrated the possibility for remote-control coal mining, which creates the most favorable conditions for developing steep seams.

The idea of hydraulic coal mining was first suggested in the Soviet Union (back in the 1930s). This method was applied at mines of the Ural, the Donets Basin, the Kuznetsk Basin and Central Asia. This made it possible to create sensible procedures and monitor and mechanical-hydraulic coal extraction systems for the largest hydraulic mine of the Kuznetsk Basin, "Yubileynaya," which has a planned output capacity of 3.4 million tons per year. Coal is transported by gravity flow and then by hydraulic pipeline inside the mine and on the surface as far as the concentration factory. At present the mine is working gently sloping seams at a productivity of about 200 tons per month. In the near future, hydraulic coal mining will increase from 8.5 to 11 million tons, for which purpose the necessary equipment has been created: 12GD-2 monitors with automatic and remote control, mechanical-hydraulic K562MG and Ural-33 combines and high-pressure pumps. Pipeline hydraulic transport from mines to coal consumers covering distances up to 250 km and greater with a productivity of up to 3,000 tons per hour will enjoy development.

Remote controlled procedures based on drilling out steep seams with drilling and combined drilling-worm conveyor devices are to be developed for thin seams 0.5-0.8 meters thick. The combined devices have been used for the most part in mines of the Lvov-Volyn Basin.

The modernized BShU drilling-worm conveyor machine can work coal seams 0.6-0.85 meters thick with a slope of up to 15 degrees and a coal cutting resistance of up to 2.5 kN/cm, using paired drill holes. Caterpillar tracks have raised the machine's maneuverability and the machine use coefficient. Production of these machines is being organized at the Kopeysk Machine Building Plant of the All-Union "Soyuzuglemash" Production Association.

Coal combines with a working organ outfitted with a worm conveyor continue to be the principal extraction machines at working faces. Their power has been increased to 400 kw (the 2KSh3 combine is an example).

The world's first direct current combine with a thyristor drive, the K128P, was demonstrated in 1975 at an international exhibition in Donetsk. It generates a power of 450 kw, and it is outfitted with radio and telemetric control, permitting automatic adjustment of its operating conditions. In 1978 this combine underwent testing at the Mine imeni Kostenko in the Karaganda Basin together with conveyors outfitted with thyristor drives. It proved itself to be significantly advantageous, improving the grade of the coal and raising labor productivity. In the future 500-600 kw direct and alternating current thyristor-drive combines will enjoy extensive application at coal deposits worked by automatic complexes.

Another way the elements of coal mining technology are being improved is by modernizing the highly productive SO75 and SN75 scrapers (working thin seams of 0.5 meters and more).

The high level of underground coal extraction that has been achieved, 450 million tons per year, has made preparatory digging to reach extractible coal reserves necessary. At present the digging distance is totaling about 6,300 km per year, to include more than 4,000 km of stripping and preparatory digging (64 percent).

Expansion of combine tunneling continues to be a general direction in mechanization of preparatory operations. This has made it possible to raise the combine tunneling volume from 16.8 to 38 percent in 10 years (1970-1980). Mechanization of combine coal mining was basically completed during this time (a level of 92.8 percent was achieved), while in relation to rock having a strength of 4-6 on M. M. Protod'yakonov's scale, the level of combine tunneling has reached only 10.8 percent. While in relation to the GPK family of tunneling combines with an arrow-shaped working organ and a cutting crown it was sufficient to raise their power to 95 kw, and while a GPK combine with a motor power of 142 kw was created to work sloped seams with a down grade of up to 25 degrees and a rise angle of up to 20 degrees, the 4PP2 160 kw arrow-shaped combine was found to be insufficient against rock with a strength of 4-6 and a cross section of up to 25 m<sup>2</sup>, thus necessitating creation of a tunneling combine generating a motor power of 350 kw (the 4PP5). The 900 kw "Soyuz-19" combine with a rotary working organ was designed to dig rock of greater strength (up to 8-10) at a cross section of 20 m<sup>2</sup>. The 440 kw KRT combine, intended to work a cross section of 16.5 m<sup>2</sup>, is also undergoing testing.

Metallic and reinforced concrete props are being used extensively to reinforce preparatory work. In 1980, such props were used in 84 percent of all mine workings. Use of anchor props and of chemical rock reinforcing systems is expanding.

The "Soyuz-19," KRT and 4PP5 tunneling combines are capable of high digging speeds--correspondingly 2.7, 1.4 and 1.9 meters per hour.

An automatic suspended high-productivity unit, the SK-1, was designed to dig shafts. A shaft 1,100 meters deep was dug with such a unit at the Mine imeni

Kalinin (in the Donetsk Basin). The maximum tunneling rate was 160 meters per month, and labor productivity attained 15 cubic meters per worker per shift. Twenty seams offering a blow-out hazard--a total of 100 meters--were crossed during the digging of the shaft by remote control from the surface, without people at the tunneling site.

The automatic self-propelled PPG unit has been designed for automatic (nareznyy) digging of steeply dropping seams. It is now tunneling sloped seams with a diameter of 0.72 meters at the "Koksovaya" mine (in the Kuznetsk Basin) at a rate of 50 meters per hour.

After coal industry receives new tunneling equipment, we will be able to rebuild the mines faster and eliminate the lag in preparation of new horizons at 135 mines. This will promote a rise in technical-economic indicators and attainment of the planned output capacities of the mines.

The effort to concentrate mining operations is continuing, and mine management is improving. As a consequence in the last 10 years the relative digging indicators of the coal mines have dropped from 18 to 14.3 meters per 1,000 tons of extracted coal. The relative indicators are lowest for the Pechora and Karaganda basins--respectively 7.5 and 9 meters per 1,000 tons of mined coal. The seams worked in these basins are predominantly gently sloping and moderately thick.

The horizon-by-horizon method of preparing working faces at gently sloping seams of up to 12 degrees is coming into broader use. It is now being used at about 16 percent of the working faces, reducing the volume of preparatory operations by 15-20 percent. The proportion of columnar mining systems is growing owing to a reduction of continuous mining systems, making it possible to raise the loading rate at the working faces and the technical-economic indicators of the mines.

At present, large mines with a productivity greater than 1.5 million tons per year are extracting about 150 million tons of coal per year, or more than a third of the total amount extracted by the underground method. Such mines include the "Raspadskaya" in the Kuznetsk Basin (7.5 million tons per year), the "Vorgashorskaya" in the Pechora basin (4.5 million tons per year), the Mine imeni Stakhanov in the Donetsk Basin and the "Tentekskaya" in the Karaganda basin (4.0 million tons per year each), and the "Podmoskovnaya" in the Moscow basin (2.2 million tons per year).

The highest levels of coal mechanization (91.4 percent) and the highest average loading rate at working faces (more than 1,000 tons per day) were also attained by mines with a productivity over 1.5 million tons per year. These mines are working seams with a thickness greater than 1.2 meters, and the mining and geological conditions impose the least restrictions upon the permissible loading rate at the working faces. The greatest labor productivity at fully mechanized working faces is observed in the presence of seams 1.5-3.0 meters thick. Concurrently, 45 percent of the working faces are mining seams less than 1.2 meters thick, achieving lower indicators.

High labor productivity (58.4 tons per trip) was achieved at fully mechanized working faces of mines belonging to the "Intaugol'" Production Association, which are working seams 2.2-3.2 meters thick.

In this connection the large mines are also characterized by a higher output-capital ratio in relation to seams greater than 1.8 meters thick, mainly owing to the high effectiveness of mechanization of mining and preparatory operations under these conditions and owing to the high level of concentration of mining operations.

Similarly, the capital-output ratio typical of mines of Donets Basin, which are working seams less than 1.2 meters thick is almost 1.5 times greater. Development of this basin consequently required greater capital investments.

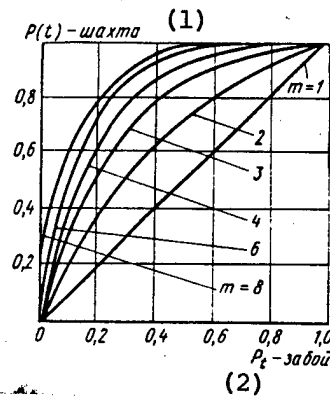
Technical progress in coal mining made it possible to introduce a major social reform in 1975-1980: The work day of miners was reduced from 7 to 6 hours, and the work week was reduced from 6 to 5 days, as a result of which miners now work 30 hours a week, rather than 42.

Technical progress in subterranean mining has promoted a miners' movement to achieve an extraction rate of not less than 1,000 tons of coal per day per working face. About 180 million tons, or more than 40 percent of all coal mined underground, are obtained at such faces. This 1,000 ton movement gave birth to a competition for extraction of not less than 500,000 tons of coal from a working face in the course of a year.

The main direction being followed in reequipment is represented by full mechanization and automation of production processes making use of highly productive mining equipment. Consequently the power-to-worker ratio and the weight of the mining equipment employed are growing as a rule. This is especially true of equipment designed for complex mining and geological conditions. It has become necessary to raise the loading capacity of mechanized props from 0.4 to 1.2 MN/m<sup>2</sup>, to increase the rated power of the motors of mining combines from 120 to 350-440 kw and of tunneling combines from 140 to 350-900 kw, the capacity of the buckets of excavators and mechanical shovels from 8 to 35 m<sup>3</sup> and of draglines from 15 to 100 m, and to raise the productivity of rotary excavators from 1,250 m<sup>3</sup>/hr to 5,500 m<sup>3</sup>/hr. This made it possible to create unique coal open pits with a productivity of 30-50 million tons of coal per year, and coal mines with a productivity of 3-7 million tons per year. It has also made it possible to concentrate mining operations more, to introduce full mechanization, and to expand the areas of application of combine coal mining and tunneling in strong rock and of mechanized props at working faces with hard-to-control roofing.

In the last 15 years the rated power of motors installed in mining and tunneling machine increased by a factor of 2.5-3, and correspondingly their productivity and weight increased by 1.5-2 times. At the same time, however, the machine time coefficient decreased by 5-8 percent.

This brought on problems associated with raising the dependability of the production processes and the machines, and of reducing equipment weight, while operation of mechanized complexes in areas of unstable roofing necessitated creation and assimilation of chemical methods for strengthening rock. Experience shows that the stability of rock can be raised and the load imposed upon a working face can be increased by pumping magnesian solutions and polyurethane resins into unstable rock.



Dependence of the probability of trouble-free mine operation on the number of operating working faces and the probability of trouble-free operation of each face ( $m$ --number of faces)

Key:

1. Mine
2. Face

The figure above shows the dependence of mine reliability and, consequently, the level of stable operation on the number of operating working faces and the reliability of the equipment used at these faces. This indicator can be raised by selecting the appropriate level of concentration of mining operations, which depends on the reliability of the production processes at the working faces. This reliability level must be not less than 0.85-0.9 (the probability of trouble-free operation), for which reason the number of operating working faces must be not less than 3-5 depending on the output capacity of the enterprise. This figure predetermines the level of concentration used in the plan for mine development. Special attention must be turned to improving the dynamics of mining machinery and to selection of the drive systems. By switching to adjustable hydroelectric drives run by high-torque hydraulic motors, we can raise the reliability of combines, do away with the mechanical reduction gear and simultaneously reduce the weight of coal combines by 2-3 tons, that of tunneling combines by 5-6 tons, that of rotary excavators by 200-600 tons, that of drilling rigs at open pits by 5-6 tons, that of scraper conveyor drives by 1-2 tons and so on. This goal can be achieved by assimilating large-series production of type MR high-torque hydraulic motors (of which there are seven type-sizes) generating power from 15 to 300 kw.

Manufacture of the structural elements of props out of lightened steel with a tensile strength and a yield point of up to 600-700 N·sec/mm<sup>2</sup> and a hardness of up to 250 NB [not further identified] and a transition to use of higher pressure in hydraulic systems will have great significance to mechanized complexes.

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11004

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## PROSPECTS FOR DEVELOPING EKIBASTUZ DEPOSIT ANALYZED

Moscow UGOL' in Russian No 9, Sep 82 pp 25-27

[Article by Doctor of Technical Sciences P. I. Tomakov and Candidate of Technical Sciences M. I. Variychuk, Moscow Mining Institute]

[Text] If we are to increase the output capacity of open pits of Ekibastuz to 150 million tons of commercial grade coal per year, over the long range we will need to move 300-310 million m<sup>3</sup> of overburden to dumps outside the pits. The total volume of rock to be worked will attain 380 to 400 million m<sup>3</sup> per year, or 1-1.2 million m<sup>3</sup>/day. Under these conditions the most important problem will be transporting the rock from the open pits in planned volumes. This will require solution of problems such as creating an efficient flow of quarry traffic as part of the overall system of stripping the working horizons during development of the entire Ekibastuz trough.

Today the Ekibastuz deposit is being developed by several open pits located along the perimeter of the trough, at places where the coal beds emerge in sections with a favorable stripping coefficient. Given the limited output capacities of the open pits, this order of operations may have been justified in the first period of the deposit's development. But as the mining operations go deeper, development of a trough-shaped deposit, which is what Ekibastuz is, by individual open pits means a sharp decline in the effectiveness of the work of rail transport.

Because the length of access ramps increases as the depth of the open pits increases, and because the length of the quarry fields is limited, we are compelled to install complex dead-end routes requiring several changes in the direction of movement of large trains and a large number of switches. All of this dramatically reduces the productivity of transportation and the traffic capacity of transportation lines, and it would not allow us to carry the planned volume of rock in the prescribed time, and all the more so achieve long-term stable freight traffic in the prescribed volumes, inasmuch as these difficulties will grow with increasing depth.

Research conducted by the Moscow Mining Institute showed that were the Ekibastuz deposit to be worked by a single open pit, the planned volume of rock could be handled in the future. This would require mutual coordination of all mining areas and unification of the stripping system and the associated

transportation system. In this case the deposit would be stripped as a system of grouped major trenches with a combined course (external and internal). The depth of the external part of a trench is 40-60 meters. The inner part of each major pit trench of a group is located permanently on the unworked side of the open pit, over the lower wall of bed 3, and it is used as a means to strip a group of horizons following a simple route (without change in direction of train traffic) covering the shortest distance. The necessary number of transportation exits has been planned in accordance with the calendar distribution of the volumes of stripped rock and coal on the different horizons. The exits are planned in such a way that during a peak period the traffic experienced by one group trench would not exceed 40 million m<sup>3</sup> per year.

The stripping system is formed in such a way that transportation carrying rock from horizons serviced by the group trenches would not intersect. Figures 1 and 2 show the stripping scheme in relation to different stages of the trough's development and different depths of mining operations.

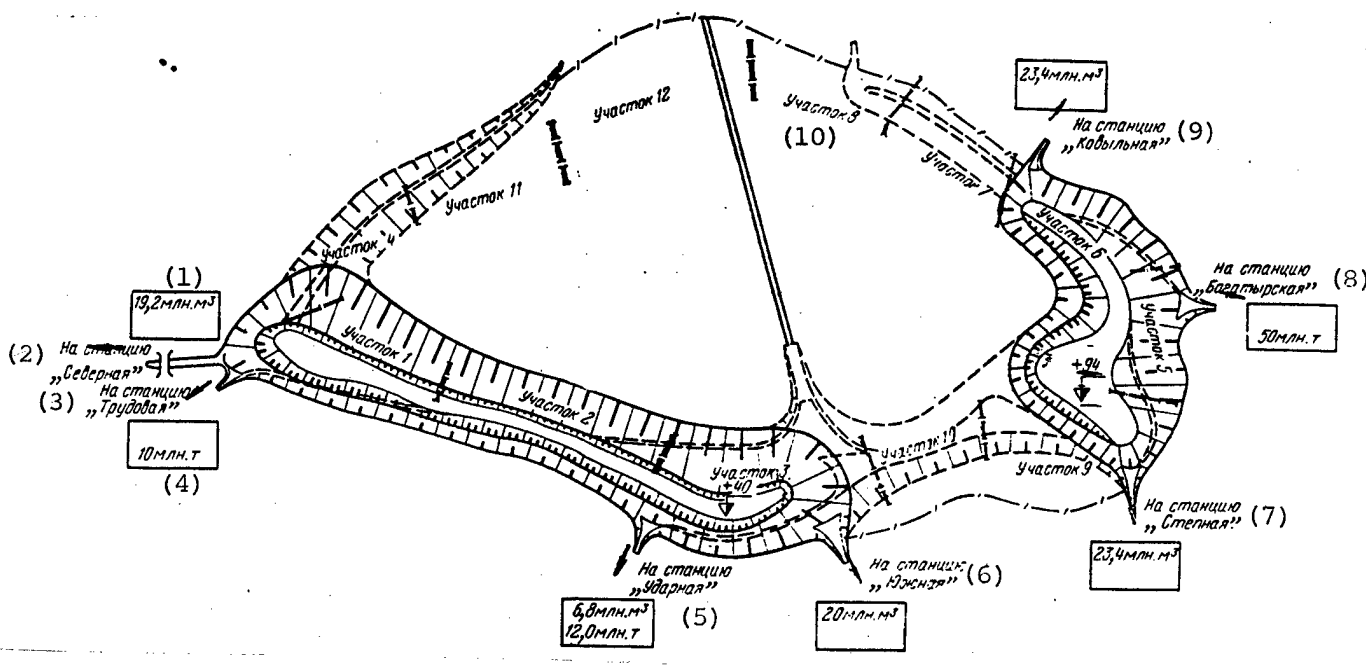


Figure 1. Stripping Scheme and Present Status of Mining Operations During Initial Development of the Ekibastuz Deposit

Key:

- |                           |                              |
|---------------------------|------------------------------|
| 1. Million m <sup>3</sup> | 6. to "Yuzhaya" Station      |
| 2. to "Severnaya" Station | 7. to "Stepnaya" Station     |
| 3. to "Trudovaya" Station | 8. to "Bogatyrskaya" Station |
| 4. Million tons           | 9. to "Kovyl'naya" Station   |
| 5. to "Udarnaya" Station  | 10. Section                  |



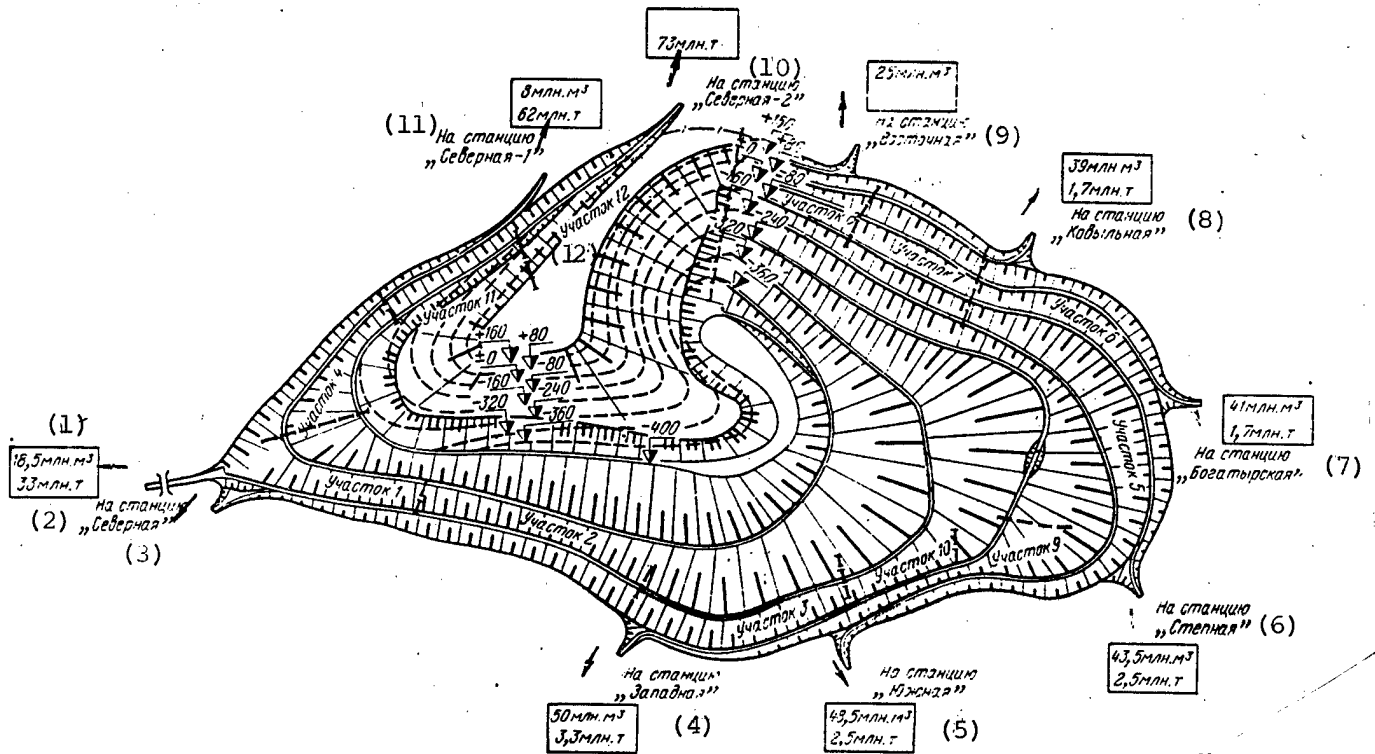


Figure 2. Stripping Scheme and Status of Mining Operations at the Ekibastuz Deposit at an Open Pit Depth of 600 Meters

Key:

- |                           |                              |
|---------------------------|------------------------------|
| 1. Million m <sup>3</sup> | 7. to "Bogatyrskaya" Station |
| 2. Million tons           | 8. to "Kovyl'naya" Station   |
| 3. to "Severnaya" Station | 9. to "Vostochnaya" Station  |
| 4. to "Zapadnaya" Station | 10. to "Severnaya-2" Station |
| 5. to "Yuzhnaya" Station  | 11. to "Severnaya-1" Station |
| 6. to "Stepnaya" Station  | 12. Section                  |

These stripping schemes and the order of working the deposit would insure the most sensible conditions for the mining operations. In this system, the maximum volumes of stripping operations are postponed to later periods. In comparison with development with two open pits (as was presumed earlier in the working papers of the Karagandagiproshakht [not further identified] institute), removal of about 1 billion m<sup>3</sup> of overburden could be postponed for about 15-18 years.

Multivariate analysis performed at the Moscow Mining Institute established the sequence of transition to development of the Ekibastuz deposit by a single open pit entailing mandatory observance of the following conditions: maximum utilization of the areas already being worked and of the transportation lines of the "Severnnyy" and "Bogatyr'" open pits; the possibility for consistent fulfillment of planned coal extraction quotas both in the near future and in the long range.

In the first period (in the next 1-2 years) we would need to accelerate mining operations in sections 9-10 in the zone containing the greatest abundance of coal, located in the vicinity of a local anticlinal uplift of beds 1,2,3. For this purpose a trench joining the "Severnnyy" and "Bogatyr" open pits will be dug across the field of sections 9-10. (see Figure 1). The axis of this trench will be 2,000-2,300 meters from the western boundary of these sections (approximately above the axis of the anticlinal uplift of beds 1,2,3). The direction in which mining operations are to be developed is basically toward the final position of the side of the open pit, in sections 9-10. This will make it possible to develop the system for stripping deeper horizons later on. Intensification of the mining operations would become possible owing to through travel of transportation on the upper horizons, using the existing "Yuzhnaya" and "Stepnaya" main trenches (see Figure 1).

One of the most laborious operations associated with transition to development of the deposit by a single open pit is that of equalizing the bottom elevations of the mining zones of the existing open pits and of the new sections. For this purpose the depth to which mining operations are carried out would be reduced (operations would be practically halted) in the southern part of the "Severnnyy" open pit (section 3), while the major part of the mining will be concentrated in sections 1,2,9,10,5,6,7.

Construction of an additional main trench, "Severnaya-1," along the terminal contour of sections 4,11 will make it possible to compensate for the decline in extraction in section 3 of the "Severnnyy" open pit by initiating incidental mining operations in sections 4,11. The main purpose of the trench would be to provide a high capacity transportation channel for coal, which would make it possible to free the transportation routes of the unworked side of the "Severnnyy" open pit for organizing highly intensive stripping traffic from the lower part of the working zone. The required depth and position of the "Severnaya-1" trench would be determined by surveying direct access ramps practically to the end of the developed part of the deposit, as described in the proposed stripping scheme, with direct access ramps leading to the lowest horizons. The depth and location of this trench will also be defined by the positions of the northeastern section of the open pit's side, as it will appear in its final form, and of the transportation entrances to the northern and eastern dumps.

Were these measures to be implemented, a single open pit could be formed in the future with an extraction and stripping front supporting stable extraction of 150 million tons of coal per year.

Later on, as the mining operations go deeper, the mined areas of the "Severnnyy" open pit could be used as a continuation of the "Severnaya-1" main trench. The decrease in length of the extraction front would be compensated in this case by an increase in the number of mining benches occurring as the coal beds in sections 5,6,7 or flattened.

When the mining operations in the southern part of the single open pit reach a depth of 150-200 meters, the "Severnaya-2" trench will begin operating or underground overburden stripping operations will start, promoting more intense mining of the fields of sections 11-12 (see Figure 2).

The "Severnaya-2" trench should be laid with a steeper ascent (tentatively 60<sup>0</sup>/<sub>00</sub>), which will improve the conditions for mining operations in subsequent periods. The loss of front length in the southern part of the deposit would be compensated simultaneously.

Because the quality of the transported material (its volume in relation to coal and overburden) decreases dramatically as the bottom of the open pit drops lower, and in order to permit redistribution of transportation on the traffic routes, creation of a ring two-track route along the external margin of the quarry field has been proposed. This would also be necessary because the trough shape of the deposit presupposes extraction of coal at practically all horizons, though in different volumes. Presence of a ring system would make it possible to use the receiving capacity of the dumps and the blending areas more effectively. Some increase that may be possible in the distance transportation resources will have to travel will be compensated by organization of a flowline system for loading rail cars by a high capacity excavator and attainment of high train speeds on the surface.

Presence of a ring railroad around the Ekibastuz trough would promote organization of two-stage transportation of overburden and the fastest possible introduction of high capacity railroad transportation, which will make it possible to minimize the number of switches.

Thus the proposed long-range stripping scheme and order of development of the Ekibastuz deposit would insure:

effective use of quarry rail transportation at a substantial mining depth owing to traffic routes with a simple layout and the practically independent operation of high capacity transportation lines carrying rock;

the most sensible conditions for mining operations, with the maximum possible volume of stripping operations postponed to later periods;

stable attainment of foreseen coal mining quotas both in the immediate and in the more remote future.

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COAL

MINING DICTIONARY REVISED

Moscow UGOL' in Russian No 9, Sep 82, pp 62-63

[Review by doctors of technical sciences A. S. Kuz'mich and M. I. Ustinov, Mining Institute imeni A. A. Skochinskiy, of book "Gornoye delo. Terminologicheskiy slovar'" [Mining. Terminological Dictionary] by N. V. Mel'nikov, G. P. Demin'dyuk, G. D. Lidin et al., 3d edition, revised and supplemented, Moscow, Nedra, 1981, 478 pages]

[Text] Intensive development of mining and of scientific research on mineral extraction and processing, the need for broad exchange of the best experience and growth in the number of publications associated with different issues of mining require a systematic effort to improve mining terminology and insure uniformity in the interpretation of terms.

The appearance of new equipment in mining industry, development of scientific research and solution of a number of new important problems in mining on the basis of the achievements of associated areas of knowledge have caused the appearance of new terms and concepts, and necessitated introduction of changes both into the lexical composition of the third edition of the terminological dictionary "Mining" and in the interpretation of certain concepts. A large collective of authors working under the guidance of Academician N. V. Mel'nikov has created a dictionary that generalizes and systematizes extremely vast terminological material from different areas of mining: the theory and practice of enterprise planning, production organization and planning, mine and open pit construction, geology (general terms), surveying, technology of underground and open-pit development of mineral deposits, mechanization, automation and electrification of mining production, labor safety and protection, concentration of minerals and the economics of mining enterprises.

Terms associated with stripping, preparing and developing bed and ore deposits, ventilation and industrial safety are broadly represented, and the methods of controlling dust and gas and of preventing phenomena associated with gas dynamics are described. Drilling and blasting operations and drilling equipment for underground and open pit mines are also illuminated. Terminology associated with sensible use of the subsoil, with reduction of losses of minerals and with working ore out is reflected. Terms associated with the production complex at the surface of a mine are presented.

One major merit of the new edition of the dictionary is that it provides an impression of the present status of different aspects of mining, and thus it has an influence upon further development of these aspects and on utilization of associated areas of knowledge in mining science and practice.

But at the same time the dictionary does have certain shortcomings as well. Some terms are interpreted insufficiently broadly, while certain groups of terms require deeper systematization. Thus the group of terms concerned with degassing coal beds, rock and worked spaces should be systematized, and perhaps even combined into a single subsection, and the interpretation of these terms should be broadened with a consideration for the latest achievements in this sphere. The definition given to the term "Sudden Blow-Outs of Coal, Rock and Gases" require supplementation and reworking with a consideration for the theory of the phenomena of gas dynamics in coal mines, worked out in recent years, and achievements in the effort to fight such phenomena. The dictionary does not contain the terms "Protective Bed," "Protective Clearing" and "Protection Radius." The interpretation given to the term "Anticipatory Clearing" does not sufficiently reveal the content of the most effective method of preventing sudden blow-outs of coal and gas.

The interpretations of the terms "Concentration of Mining Production" and "Concentration of Mining Operations" are not sufficiently clear, owing to which the former contains some of the concepts associated with concentration of mining operations. It would be suitable to expand the content of terms associated with production planning and control with a consideration for achievements in creation and operation of automatic control systems in mining sectors of industry.

In connection with the noted shortcomings and considering the intense rate of scientific-technical progress in mining, it would be suitable to republish the dictionary of mining terms in the very near future with a consideration for the latest achievements in science and practice and for development of new directions in mining production.

On the whole this edition of the revised and supplemented terminological dictionary, which includes, besides the "classical" established terms, new ones reflecting the present level and trends in development of mining science, technology and production, would be extremely useful to a broad range of specialists in all sectors of mining industry. Engineers and technicians associated with mining production and scientists, instructors and students of mining specialties have received a good aid for their work.

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11004

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## COMPRESSOR STATIONS

### GTN-25 COMPRESSOR

Leningrad Leningradskaya Pravda in Russian 24 Oct 82 p 1

[Article by V. Matveyev, turner of the "Nevskiy Zavod" imeni V. I. Lenin Association: "Our First-Born -- GTN-25"]

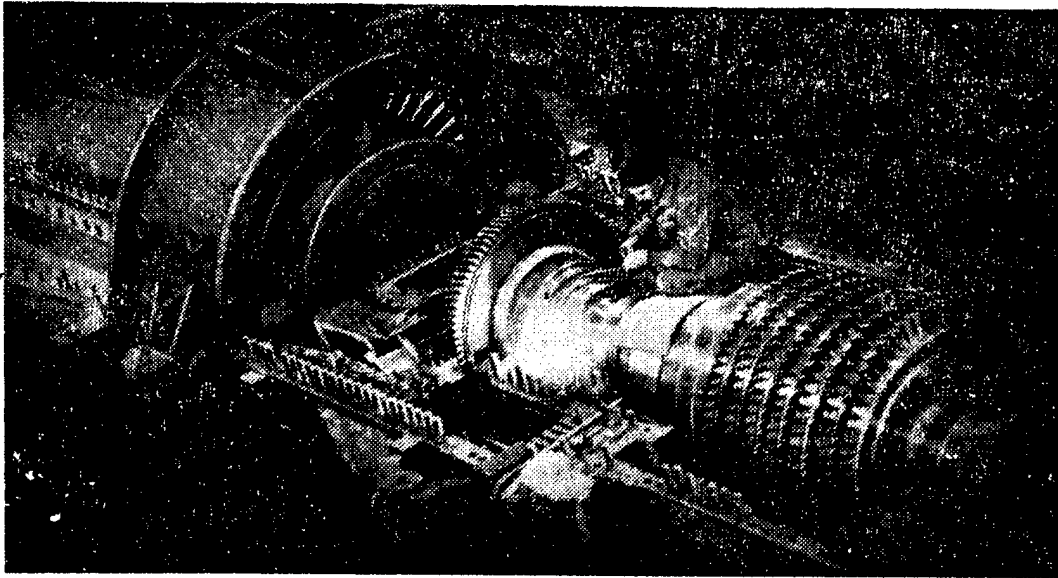
[Excerpts] Usually our brigade foreman, Sergey Rusanov, comes to the shop about 20 minutes before the shift starts but this morning he appeared still earlier. After him came Viktor Uglovskiy and a little later -- Vladimir Yegorov, Leonid Shamanin and other members of the brigade. The day was unusual for us: on the assembly stand of the neighboring shop, installation was being completed of a new GTN-25 superpower compressor. The previous evening the assemblers were especially excited: they were completing the last operations on the installation of the special design machine. And not simply a machine, but the first one made in series.

The Neva machine builders, in response to the discriminatory measures of the United States administration which wants to disrupt the construction of the Siberian--Western Europe gas export pipeline, obligated themselves to manufacture the first machine built in series ahead of schedule by December of this year. And how good it feels when you see that the collective has kept its word.

Disks... Already in September engineers, technologists, designers and we, the workers of the sixth shop spoke only about them. How to machine them and how to achieve that highest precision required by series produced machines? Also the schedule demanded speed. A stock of parts must be created for assemblers to start their work. But the program was still not available for the large surfacing machine tool of the newest design. Technologist Vladimir Lebedinskiy, we and our brigade foreman, are also concerned about our common job. Party committee secretary Ye. G. Gerasimov, previously a worker himself, visited the section many times. Everyone asks when the machine tool program will be ready?

Everyone was busy up to their necks -- parts for the famous 10,000 kilowatt compressor for pumping natural gas could not be ruled out of the brigade plan; on the contrary, more of them are needed. So it was decided to finish off the program "on the run" -- people have considerable experience and skills and there is also enough knowledge. It was impossible to differentiate in these days between who was a turner and who an engineer.

Finally, the program arrived and the supply of parts began to flow. A work front opened up for the entire assemblers brigade of Anatoliy Shagin. Sergey Rusanov, our brigade foreman, came up with a new idea: each worker must be able to work on all machine tools. This is not simple. The machine tools are so complex but there were no doubters: the brigade foreman posed the problem correctly. Not at once, but the workers did assimilate the machine tools. The equipment is now being utilized with maximum output.



GTN-25 Compressor

The GTN-25 series manufactured machines differ considerably from the first four experimental ones. They are more reliable, more efficient and more convenient to operate. But they are more difficult to manufacture; their precision is much higher and greater demands are made on the rotor disks of the high and low pressure compressors. To simplify and shorten the production cycle, the brigade decided to assume an additional operation: polish the disk faces. A new polishing machine tool appeared recently in the shop. "Give it to us" we asked. The shop administration met our request willingly. Vladimir Yegorov became a regular polisher.

And how many improvements were incorporated? Whenever possible, operations were combined, our own fittings were utilized and labor organization was improved. And this is natural: a high goal was demanded of the brigade, working on one order, a steep take-off. It could be provided only by a search for additional inner reserves. And they were found. Brigade foreman Rusanov set an example always and in everything.

The last two months were difficult. But the brigade provided all the necessary parts for the assemblers for two series produced compressors. Now there are still seven GTN-25 compressors in production. The rate is increasing. I can see the enthusiasm with which the brigades of Ivan Lukashov, Yuriy Tsvetkov, Sergey Kim and other collectives of our shop work. They also released ahead of schedule to the assemblers of the first series produced machine everything that was planned and now, enriched by the new experience, they are accelerating their movement to the goal by new successes in their efforts to meet the glorious date -- the 65th Anniversary of the Great October.

Four more large machine tools must appear in the shop. Let us take them into the brigade. If they are placed in a row with the existing ones, each two machine tools can be serviced by one operator. It will not be necessary to enlarge the brigade and possibilities will increase in the neighboring collectives. We agreed with Uglovskiy. We await the new machine tools and think about how to do still more efficient work.

2291

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GENERAL

CORRESPONDENT REPORTS ON LIFE WITH TYUMEN GAS WORKERS

Moscow KOMSOMOL'SKAYA PRAVDA in Russian 20,22, 27 Jul, 5 Aug 82

[Article by S. Oganyan, our special correspondent: "To Work by Airplane"]

[20 Jul 82 p 2]

[Text] "The riches of West Siberia should be taken, as considered by the party, by skill, precise calculation, and a creative approach to solving the developing problems. Take, for example, the watch and watch-expedition method of working new regions. In West Siberia among the "flying" trust and administrations there are dozens of thousands of young workers from Belorussia, the Ukraine, Bashkiriya and Tatariya. Unfortunately they often remain outside the field of vision of the Komsomol committees. It is necessary to establish strong contacts between the base and watch Komsomol organizations, to take under control the development and manufacture of special transport, mobile cafeterias and mobile clubs, prefabricated well-built settlements."

(From the accountability report of the Komsomol Central Committee to the 19th Komsomol Congress)

1. "Tighten Your Belts"

Within several minutes I am going to fly together with the oil workers of the Belorussian administration of drilling operations "BUBR" to the region of the Tyumen north. But now there is time to explain what these "flying" trusts and administrations are, and what caused them to appear in the economy of the country.

Thus, BUBR. About 4 years ago several words which drastically changed both the method of operation and the geography of application of its numerous forces were added to the official name of this organization. On the territory of Belorussiya they are no longer drilling for oil. Thus the new address of the work, drilling for oil wells in West Siberia, and the name of the method, watch-expedition.



The planned increase in volumes of oil extraction at the new Siberian fields today is already impossible to guarantee by the forces of only the Tyumen organizations. In order to create new drilling organizations in the uninhabited regions of West Siberia it is necessary to provide them with equipment, tools, mechanisms and materials. It is also necessary to provide the oil workers and their families with housing, schools, stores, centers for daily and medical services, cafe and movie theaters, not to mention guaranteed possibility of receiving television programs. But what if the oil worker is guaranteed only a work front, and he will live as he lived, in Belorussia.. There are several thousands of kilometers to the work site, and he will be sent there once a month by airplane and will be brought home after a 15-day watch. In this case he can get by with the minimum necessary general conveniences. It is simpler and more economical. They started from these considerations, developing temporary (we stress temporary) situation of the watch-expedition method for managing drilling operations. Skilled cadres of oil workers from the western regions of the country where the rates and scales of drilling do not compare at all to the Tyumen, were able to work well and earn good money under especially stipulated benefit conditions. The northern coefficient extended to them, they could spend longer time on vacation, and in addition they spent half a month at home preparing for the two-week watch.

Today the fields of the Tyumen north are worked by 19 "flying" administrations of drilling operations by the watch-expedition method.

How much time do we spend on the road to work and back? An average of two hours (for some it is even more). Thus in a week we spend 10 hours, and 20 in two weeks. This is the road to work for the Belorussian driller. This morning, when you read these lines, regardless of what city in the Gomel Oblast the oil worker lives, in the center, in Rechitsa or Svetlogorsk, or all together beyond the limits of the oblast, he is beginning to prepare for his watch. Airplanes fly to Nizhnevartovsk every day from Gomel. Every watch worker has a fixed day of flight, once a month. On this day he must be at the Gomel airport at 21:00, from which he flies on the route Gomel-Ufa-Nizhnevartovsk at 00:30 on a special trip made by "TU-134." The watch workers are brought to the Gomel airport by their "Ikus's," while their own buses also bring them from Nizhnevartovsk to the work site, roughly a hundred kilometers from the city.

The time spent on flying to both ends and traveling on the buses is about 20 hours; same time is spent every two weeks.

At the Rechitsa service station waiting for the departure of "Ikus" we converse with the first secretary of the Komsomol gorkom Sasha Burmich. All formalities have been taken care of associated with my being included in a list of watch workers flying out today. It is already been stipulated which brigade I will work with and who should meet me at the site. The evening before, the secretary of the party committee of BUBR, Aleksandr Sukhov, former first secretary of the Rechitsa Komsomol gorkom, looked at me with anxiety:

"If we go straight from the airplane to the drilling cluster then you are not properly attired. I will write a note so that they equip you there."

In order to get to West Siberia it seemed at first glance that I took an absurd route: from Sheremetyev to Gomel, from Gomel to Rechitsa, where the apparatus of BUBR shuffles papers in solitude. It is in solitude because no oil workers are laboring here. The work site of the Belorussian drillers is 3,000 kilometers to the east of Rechitsa. A considerable number of the watch workers simply live in Rechitsa. Their road to work begins at the local service station.

The "Ikrus" finally moves. There is not one free place in it. I involuntarily remember the announcement on the doors of the section of the BUBR: "There will be no hiring during 1982."

The airport. "Ikrus" rolls up to the section of aviation transfers of BUBR. At the announcement board I become familiar with the instructions.

"Assistant driller comrade Mikhaylov Gennadiy Arkad'yevich came to the airport for takeoff in an intoxicated condition and was removed from the flight. Days of non-flight are considered absence from work. I ordered that there will be a strict punishment, deprivation of bonus by 100%, deprivation of reward for results of work for 1982 by 100%. The head of the Belorussian administration of drilling operations for drilling oil wells in West Siberia S. P. Mazurok (based on a certificate of the doctor's assistant of the service of aviation transfers)"

A medical examination has been made at the request of BUBR since June of last year: pressure is measured and an examination is made for the presence of alcohol in the body. The watch workers take it before sitting in the airplane. Selective checks of the state of health of the flying oil workers indicated that after two years of constant flying many of them have high pressure. But some increase their pressure artificially. Then the doctor's assistant of the special medical station uses the only sanction he has at his disposal, he removes them from the trip. The consequences of this measure are clearly written in the instruction. What does the watch worker do in this case? After recovering he flies on another day, but at his own expense. The ticket to Nizhnevartovsk costs R 62.

When it was found that my health would not prevent my flight to Nizhnevartovsk, I asked permission of the doctor's assistant T. Lednevaya to sit for a while in the medical station.

Tamara Grigor'yevna looks doubtfully at her next patient:

"I am not pleased with your pressure today".

"This because I am excited. I was checked the other day and they told me that there was nothing wrong."

"How many times have you already flown?" Tamara Grigor'yevna looks through the card in search for his last name and does not find it. "Two years? Good today I will allow you to fly. Next time do not come without the information."

The next one. He steps forward timidly, but not from embarrassment. The doctor's assistant recognizes him:

"Maksimenko?! What's the matter with you?"

Maksimenko says:

"You know doctor only a glass of wine. For it is a holiday today. And pressure it is normal. Would you like to check?"

"No we will not check."

Maksimenko does not fly with us.

The inspection ends. We summarize: 4 out of 150 people were not permitted to fly. I say goodbye to Tamara Grigor'yevnaya.

"We will meet you again at the landing" she says.

We passed through the special control on schedule. Tamara Grigor'yevna watches so that none of those not permitted to fly "accidentally" gets on the plane. Maksimenko sadly looks at the watch workers.

We met him a day later, when I came to the drilling cluster of the foreman Petr Khodakovskiy.

"How did you get here?"

"I paid myself."

The foreman Anatoliy Anatol'yevich Karpov is my new friend. He is an experienced oil worker who drilled wells at Mangyshlak, and worked in the Krasnodarskiy Kray. Now he lives in Svetlogorsk Gomel Oblast and has been flying for 4 years with his brigade to Samotlor. A garrulous and a reliable man, he rapidly introduced me to the course of beginning watch at the drilling cluster № 886 which is located on the territory of the Belozerskiy Oil and Gas Extracting Administration.

The concreted roads extended from Nizhnevartovsk many dozens of kilometers. Our "pazik" (with the Gomel series on the state number) covered a hundred kilometers of the concrete road in 2 hours. At each junction of the concrete slab we were tossed up with the untiring accuracy of a metronome. The watch workers, as if they did not notice that the bus was traveling as it hobbled, even managed to sleep.

We did not go on the concrete road immediately from the airport. First we made a visit to the base of the production service of BUBR, this is next to the airport. Then Anatoliy Karpov and the fellows from his brigade ran to sign some invoices and to obtain from them the necessary materials, while I succeeded in talking to the deputy head of the BUBR Aleksandr Anatol'yevich Nedyak. Despite the early morning, our conversation was interrupted by the just arrived drillers, each one had an urgent business. The following monologue resulted from the separate answers of Nedyak:

"The fact is that our entire work front of BUBR is concentrated here in West Siberia. The Belorussian oil workers depend entirely on the mood of the customer, and in our case on the production association 'Nizhnevartovskneftegaz.' But our customer is inclined to cooperate mainly with the local drilling organization. Their orders are fulfilled first. Our orders are outside any turn, that is all the conceivable periods passed, then the inconceivable, and only after infinite requests, appeals and reminders do we finally get something. It is difficult to work this way. This fatigues more than any work. The drilling rig installers, the sealers and the developers are idle too often."

Thus, we have not reached the work site, and the first problem of the "flying" trust was already visible.

The "gait" of the bus suddenly changed: we had turned from the concrete road to the log road, a specifically taiga road which was similar to a layered pastry made of logs sprinkled with sand. The logs in places had separated and been replaced by puddles. Slush. Within a week the log road had completely fallen apart, and we were brought from the well cluster to the concrete road by the fearless "Ural," perhaps the only machine which is on familiar terms with slush. But I am running ahead.

[22 Jul 82 p 2]

[Text] As noted at the 19th Komsomol Congress, in West Siberia there are tens of thousands of young workers from different regions of the country working the "flying" trust and administration. Our special correspondent flew together with the regular watch of the Belorussian drillers to the Tyumen Oblast. Today he is reporting on the work of the young oil workers at the drilling cluster.

## 2. How Are You Borehole?

What is a drilling cluster? It is a small poured area, essentially an expanded log road, a type of small parcel on the flimsy length of the road. Only there are no roads further. The 40-meter drilling derrick, the boiler house, pump station, and a dozen trailers. This is the watch settlement and the drilling cluster.

The complexity of drilling in West Siberia is the fact that you cannot install a drilling unit wherever you want. The Tyumen north is a continuous pillow of peat with traps of swamps and sprinklings of islands of taiga. The area from which the drilling will be done is prepared in advance, and the drilling machine drills not 1, but 16 wells. All of them are at different angles. Thus the drilling covers a large territory, while the inclined wells make it possible to take oil even from under the bottom of the surrounding lakes. The 16 shafts, each 2200-2400 meters deep, are like a powerful root system which penetrates the oil beds. This is also the drilling cluster.

The house trailers crowd together at a respectful distance from the drilling derrick, this is required by the safety rules. They stand on the perimeter of a small area which has been designated as the entrance for trucks. The area is sprinkled with clean dry sand, the drillers after their watch walk here in slippers, this is like a challenge to the impassable slurry that surrounds the area.

At the same time the developers brigade of foreman Karpov with whom I arrived is going to "conquer" their housing, left 2 weeks ago. During their absence other workers lived here and we met them in the morning at the Nizhnevartovsk airport.

I also go to get settled. Karpov invites me to his billeting, to the foreman's trailer. I will say directly that it is comfortable. There are four soft cots in two tiers, a kitchen with a table, a hotplate and refrigerator, sink and to crown it all, a shower with hot water. The autonomous system of energy supply heats the trailer and the water. This is how we will live the four of us, the foreman Anatoliy Karpov, the welder Mark Gorelik, electrician Valeriy Dem'yankov and I. They recently settled in this trailer. This happened after the regular summary of the results of the socialist competition where the brigade together with the challenge red banner for high indicators received a comfortable trailer "Taiga-2" (by interesting coincidence "Taiga-2" is the title of the brigade). Before this they were crowded into standard trailers where 10-12 people live at once. The driller Vyacheslav Bepomochnyy, assistant driller Sergey Tkachev, who on the day of arrival became 27, and other fellows who came together with us settled in these trailers.

It had become dark when I came out of the trailer. The first taiga night. Our borehole, high and narrow, was lit up by large lights. It looks like a giant periscope of an underground storeroom.

Thus it happens that in starting a direct description of the work of the Belorussian oil workers in West Siberia, I begin it with a story about the brigade of the developers, although the leading link of all work is the drillers. Their drill, like the knife of a sculptor, creates the basic pattern of activity of the entire administration. Work is judged by meters of drilling not only of the drillers, but also the developers, tractor drivers, derrick installers, drivers, mechanics, engineering-technical personnel and even the cooks. Everything is judged and evaluated in large rubles. "The drillers make a hole in the earth and leave, starting another," Karpov develops the thought. "And what happens further? Without us, without the developers the well will not produce oil. It is still raw like the navel of a newborn. We have to be its nursemaid. During one flight we have to develop three wells."

We head for the reading corner where the radio sputters. "Taiga," I am "Taiga-2," Karpov speaks to the man on duty at central engineering-technical service, "this is one hundred kilometers at the base BUBR in Nizhnevartovsk. Three times a day, Karpov, by the way like the foreman of all the brigades, each with their call sign must go on the air with a report of the work done and orders.

"I hear you Anatol'yevich," the dispatcher answers almost momentarily.  
"What is your output. Have you started already?"

"Thank you we have started. Today we should salt five cubes."

Thus they spoke in their jargon for about five minutes. I did not understand anything. While they were speaking I tried very hard to understand the contents of the instructions hanging at eye level regulating the actions of the developers during the practice alarm on the signal "blow-out." Later I found out that by pure accident I had quite logically linked the incomprehensible "salt cubes" with the puzzling signal "blow-out."

On the way to the borehole Karpov patiently explains: "as soon as the drillers drill a well, it becomes potentially dangerous. The pressure of the bed on these fields is very high. At any minute a blow-out of oil and gas could occur. In order not to allow this, we fill the well with salty water. Salty because it increases its specific weight and with its heaviness it suppresses the uncontrollable oil."

At a small warehouse on wheels (here everything is either on wheels or runners: the trailers, the bath, the borehole derrick) we stop. The interview has ended, on time, of course. Karpov glances into the half dark maw of the warehouse. Concentration and concern appear in his entire fixset figure.

This time the well was proper. The geophysicists have already made measurements of the resistance and the resistability of the rock, defined the oil-bearing and water-bearing beds, and have checked the radioactivity of the rocks. The perforation party has already been here, drilling a stream in several places in order to open the road to the oil. It remains for the brigade to start lowering the pump-compressor pipes. The crowning point of their work in the direct and figurative sense becomes the installation of the gusher fittings. It is called gusher because it is equipment which prevents the blow-out of oil and does not allow it to gush. The fittings directly decorate the tamed well, giving it an attractive working appearance.

Eight thus prepared wells arranged in strict positions are similar to small anti-aircraft batteries. They are commanded by the NGDU, the oil and gas extracting administration. The operators connect the battery to the oil pipeline. The daily flow of Tyumen million is formed of such small rivers.

What distinguishes the operational drilling from exploratory? It is the nature of emotions. In operational drilling you never experience the momentary joy of discovery accompanying a successful prospecting. I did not become acquainted with the oil explores. But it is clear that their element is prospecting. The driller-operators are distinguished by patience. Patience generated by the monotonous, tiring work.

A strong fellow purposefully breaks into the radio room. His way hair hanging down from under his helmet makes him look like an attacking hockey player. This is the driller Misha Timoshenko.

"Sergeich, the pipe broke again!"

The drilling foreman Mikhail Sergeyevich Balykov tears himself away from the radio and turns a tired face to him.

"The pump has stopped again, it is necessary to call the repairers, only other ones," Misha patters and removes the helmet from his splendid head of hair.

Last year the brigade of drilling master Bashlykov passed 30,000 m. Now there are complications. In the beginning of the year the brigade was sent to an emergency cluster to correct someone's mistake. Instead of drilling, the brigade removed from the well the broken string. Only when they started drilling, the pump went out of order and interruptions began in the supply of fluid, and they found a shortage of bits and pipes.

They nevertheless want to finish this well, 2425 m deep, in 12 days, twice as fast.

Mikhail Sergeyevich prepares a splendid tea party. We discuss in his trailer with the door open wide, the borehole is spread before our eyes. He takes a sip of the aromatic Indian tea in which it seems that all the spicy smells of the warm waters were concentrated, and develops the idea about the brigade contract.

"I doubt it will work here. I understand that if you increase the interest of all who guarantee drilling and whose wages are influenced by additional meters of drilling, that this will help to eliminate interferences in our work. The tools will always be in operating order, and the idling will pass into memory. But the fact is that we are in the Tyumen Oblast, where dozens of organizations are concentrated. Today it is impossible to unite them into a single economic chain and to concentrate them into achieving the final results." I became convinced of the accuracy of these estimates later, in the brigade of the Ivano-Frankovsk foreman Ivan Simovonyuk, where the contract has been introduced. But it only encompasses the Ivano-Frankovsk workers. The Nizhnevartovsk colleagues are not a part of the contract.

"What they say there about the brigade contract," Mikhail Sergeyevich waves his hand, "we are preparing to proclaim our brigade as Komsomol-youth, but the committee of the BURB Komsomol was not able to complete this business. Our lads are strong, young and some came here directly from the army. Thus we do not know whether we have the right to be called Komsomol-youth."

The brigade of Bashlykov is among the constant winners of socialist competition. There are no secrets in drilling for the lads. But it is a secret to them what the name of the secretary of the administration Komsomol committee is. The 23-year-old Valeriy Kozlovskiy was put on the Komsomol account 2 years ago, and Viktor Zhiburt, he is 21, has only been flying for 5 months. There is no difference: neither one knows the Komsomol secretary.

After the bit reaches the 2000 meter mark, the rock becomes considerably harder, and its resistance rises. The drilling string has to be lifted more often, every 70-80 m. Only complete strain of forces, will and skill ensures drilling. What moves the driller? The goal and desire to reach it. To reach it by overcoming the increasing resistance, against all obstacles. How many are on the path of the driller? Among them are many artificial ones, those same barriers drilling foreman Petr Khodakovskiy later discussed. A strong Komsomol organization could have eliminated many of these obstacles.

[27 Jul 82 p 2]

### 3. Patronage under Code

It was noted at the 19th Komsomol Congress: It is necessary to establish strong contacts between the Komsomol organizations of the "flying" administrations of drillers and the base enterprises in West Siberia. Today our special correspondent talks about the experience and problems of this cooperation.

I spent the entire day in the Komsomol-youth brigade of Lenin Prize laureate, drilling foreman Petr Khodakovskiy. His drilling cluster is located next to ours, 30 minutes walk.

The "Tatry" hauling sand to fill the future drilling cluster rushed past us on the "log road." Yesterday when foreman Mikhayl Sergeevich Bashlykov and I had climbed under the very crane-beam of the derrick, the panorama of the drilling clusters which had "grown up" on Samotlor was revealed in all its completeness. The plan of the roads here seemed like a circulatory system: the road is the aorta, the "log roads" are the capillaries, and the orange "Tatrys" seemed to be red corpuscles. A true living organism where man is the precise organizing nerve.

Petr Khodakovskiy is such a person.

Although he works in the Belorussian Administration of Drilling Operations, he lives in Siberia, in the city of Strezhevoy in the Tomsk Oblast. This is quite close to Nizhnevartovsk. Khodakovskiy is a true master of this borehole. He is well-formed, tall with an impressive commanding voice. He speaks plainly. This quality of his is illustrated especially well by the barrier which has been installed in front of the area on whose perimeter the house trailers have been set up. It is clear that not only is it impossible to drive in here, but you couldn't if you wanted to.

I found other invisible barriers during my conversation with Khodakovskiy.

The scourge of the drillers from the Komsomol-youth brigade is idling. The watch workers work without seeing the outlook: they drill the cluster and do not know when and where they will be sent. Exceptions happen of course: the previous cluster was finished by the brigade of Khodakovskiy ahead of schedule and was sent by pure chance to this one almost immediately, with only 4 days of idling. For comparison: the transfer to the next cluster for the local drillers generally takes no more than 12 hours.

"A meeting was recently held in Surgut for the drilling brigades," Khodakovskiy recalls. "I was sent and admonished: do not forget, they said, to talk about the enormous idling because of the lack of shipments, the poor quality of repair of the turbodrills and other tools and equipment, that the Nizhnevartovsk organizations are only concerned about their own drillers. I refused to speak. I do not see the sense. Everyone knows about this, then why rend the air for no reason? It is better to talk about something else." With sudden irritation he said: "This question touches many nerves!"



Khodakovskiy motions to the wireless radio. It is not quiet for a minute, it sputters and breaks out in dialogues, is tiring with its monotonous monologues of summaries, calls to someone...

By the 19th Komsomol Congress the brigade of Khodakovskiy, despite the complications, had fulfilled the 6-month plan for drilling.

"What offends the fellows? We drill 40,000 meters a year. Who knows this? Only the leadership of the BUBR. The Gomel obkom of the Komsomol does not know what we look like, and is not interested in our work. My fellows are excellent workers, and I say this as a foreman. But in 3 years no one from our Komsomol-youth brigade has been awarded a single Komsomol award. Who will present them for the award? For the Tyumen workers we are newcomers, for the Belorussians, we are not their own. We are in a vacuum!"

This is the comparison. I hear from the young drillers: the Komsomol meetings in the BUBR are held once a year and are called fiscal-elective. The fellows do not know who is selected at them. Komsomol meetings are held on the same schedule in the brigade of Khodakovskiy. The agenda is naturally the same. The brigade has a group Komsomol organizer and no meeting protocol. I did not have the grounds not to believe Vitaliya Chugayev, the group Komsomol organizer, when, squinting in the taiga sun, he said:

"We do not hold meetings, ever," and went into the cafeteria over the soft sand.

One should apparently not be especially surprised that the 25-year-old fellows do not consider themselves Komsomols, by age.

The BURB Komsomol committee released all the group Komsomol organizers of the duty of collecting the Komsomol dues. The computer does this. The drillers receive wages according to a calculation sheet where each type of income and withholding has its own code. The watch workers call this calculation sheet the "ciphering" (the ciphering has arrived they say about their wages). The Komsomol dues are withheld by the corresponding code. This is how the Komsomol work in the BUBR has been encoded.

Before the trip to West Siberia, back in Moscow, I became acquainted with an interesting document. This strictly predicted the topic of the business trip. I was shown a contract on patronage over the "flying" brigades which was concluded between the Rechitsa gorkom of the Belorussian Komsomols and the Nizhnevartovsk gorkom of the Komsomols. Everything was stipulated in this contract: organization of labor and recreation, cultural measures, protection of health, etc. Its existence was confirmed for me by the Komsomol workers in Rechitsa and Nizhnevartovsk. They confirmed it but did not show it. There was nothing to show, there was no paper. The contract is not being fulfilled.

Too bad. West Siberia is a kray which is rich in all senses. In the sense of educational work, it is wealth. It was not easy to arrive at the watch-expedition method of work. It was brought to life by necessity. It was not easy of course, to find new forms of Komsomol work oriented on the "flying" drillers. The BUBR Komsomol committee, if it intends to remain in Rechitsa further will be physically unable to keep a tie with its Komsomols, there is a space of 3,000 km between them. Business and only business will reduce

this distance. Contracts, reports and one-time measures will not fill the vacuum on the section which the overwhelming group of Komsomols of this administration are facing. The BUBR Komsomol committee must work as its Komsomols, on the watch-expedition method. There is little new in this suggestion: the administration party committee long ago transferred the center of its work to Samotlor.

Of course in this situation the Rechitsa Komsomol gorkom deserves more criticism than the Nizhnevartovsk. Only one administration flies out of Rechitsa, and 13 fly into Nizhnevartovsk. If the contract on patronage is to work, then this can only occur on the initiative of Rechitsa. Then the Nizhnevartovsk workers will have to respond.

Three o'clock at night, or perhaps, morning? I left the cluster with the fellows from the brigade of Bashlykov. This time of day is nevertheless more properly called night. In the boundless meadows the moon shines like a copper button. The invisible "log road" rocks us on its soft pits and bumps.

Within half an hour we reach the road and transfer to the "pazik" waiting for us. The even band of the unmerciful road is lit up by giant flares, blazing the sights of Samotlor. It is impossible to pass by. I also stop.

The side product of oil extraction is the round about name at Samotlor for gas. The Belorussians drill oil wells exclusively. They get gas on the side. It is not stipulated by the contract, therefore there is not a single gas pipeline here. Abundant gas manifestations are removed farther from the road and are burned for safety. Thus 300,000 m<sup>3</sup> are burned every day. This is a quantity sufficient for heating and the daily needs of such cities as Rechitsa or Nizhnevartovsk. But the gas is burned. All that remains of it is the letter in the NGDU abbreviation--oil and gas extracting administration. The local NGDU's are only involved in oil extraction. Gas is the privilege of Urengoy. Compared to its reserves, the manifestations of Samotlor seem like a drop in the sea.

Everyone in the bus suddenly became silent. Jokes and conversations were forgotten. We were passing in frightening proximity to an enormous flare. Even from a helicopter they do not seem small and inoffensive.

I say good-by to the brigade of foreman Bashlykov. Bashlykov himself remained because of a problem with the well. The helicopter platform was located next to the airport. I was to fly to the settlement of Severnyy Var'yegan where the Ivano-Frankovsk Administration of Drilling Operations had set up a base of production servicing (BPS) and sent an expedition here for deep operational drilling. This is roughly 250 km from Nizhnevartovsk.

We had not even become acquainted when the secretary of the party organization of the BPS Grigoriy Mikhaylovich Okrem suggested organizing a working trip with the participation of the representative of KOMSOMOLSKAYA PRAVDA. The engineering mechanic and the member of the BPS party office Miron Tanasiyuchuk, secretary of the Komsomol organization of the expedition of deep

operational drilling Yelena Litvinenko, member of the Komsomol committee office of the Administration of Drilling Operations, mechanic Vladimir Klimenko, secretary of the Komsomol office of the BPS carpenter of the construction brigade Vladimir Gutsulyak held a "roundtable" meeting.

The conversating began immediately and heatedly. I was barely able to summarize. The structural confusion in the Komsomol affairs does not suit the young watch workers. Here in Severnyy Var'yegan where the Ivano-Frankovsk Administration of Drilling Operations sent the expedition of deep operational drilling and where an excellent base was set up for the production service, there are several autonomous Komsomol organizations in operation. There are four: in the expedition, at the BPS, in the derrick installation and auto-transport shops. The forces are large but scattered. The center for controlling them is more formal than real; the Komsomol committee is located in Ivano-Frankovsk. Long-distance control naturally does not work.

A base is a true settlement for several hundred people. Excellent dormitories have been build for its temporary residents. They are not inferior to any hotel in their comfort. The cafeterias provide a wide selection of dishes. The residents of Severnyy Var'yegan eat here with pleasure with the Ivano-Frankovsk residents. One should apparently also name the bath-laundry trust and the growing sphere of services. But the fellows are disturbed because there are clearly not enough televisions at the base.

It is generally a complicated situation to have mass information media in West Siberia. The newspapers either do not arrive or are very late. This is surprising: all the correspondence can be sent here on the same airplanes that bring the watch workers every day to the north.

[5 Aug 82 p 2]

The 19th Komsomol Congress noted: the young oil workers working in West Siberia in the flying administrations of drilling operations are often outside the field of vision of the Komsomol committees. It was said at the congress that it is necessary to take control of the development and fabrication of special transport, well-built settlements, to create for the young drillers normal conditions of work, daily life and recreation. We are publishing the final report of our special correspondent who was included in the flying administration.

#### 4. Excellent State of Health?

The state of health of the oil workers flying into Tyumen does not always and in all ways depend only on the health, although each of them undergoes a special medical examination before departure. The moodf of the driller depends a lot on the organization of labor, the concern for him which the administration of the flying administration, Komsomol committees and loeal base organizations should display. And perhaps, the relationship to the driller is not manifest anywhere more perceptibly than on the road.

I spoke with Misha Baryurchak, the secretary of the Komsomol organization of the autotransport shop after the working meeting. I had become acquainted with him much earlier. He had brought me in his "Ural-62" to the drilling cluster of Ivan Simovonyuk.

On this road, the Ivano Frankovsk residents call it "mane," apparently because it passes over the nape of barely noticeable mounds, the cars do not skid. Here you do not hear the reassuring straining aria of the motor. Everthing is much quieter. The automobile smoothly submerges into the liquid mixture and sets for a long time, like a fly on sticky paper. The experienced drivers are usually with a small library in time for this slush.

Misha Bayurchak did not read a single line on this road. A total of 600 people are working in the autotransport shop. In the list of the very first who have been working in the north since the autumn of 1978, Misha is the 25th. We covered the 20 kilometers separating the borehole cluster from the base in 2 hours. We passed many cars firmly stuck in the quagmire. Some were helped to get out.

This is the work and the road of Mikhayl Bayurchak.

"This is not a road, this is the absence of a road. But according to the documents we travel on roads of the third category. Only the 'Uralys' can travel on them. I myself have seen."

There are a total of 120 transportation units in the autotransport shop. In the season of bad roads over half of the fleet is inoperative because of they are unfit. The second half of the fleet consisting of powerful "Uralys" operates with double and triple load. The work of the drillers would be paralyzed without them.

I spoke incorrectly again. If I want to stress the high maneuverability and passability of the "Ural" then I should say something like: "These wonder machines transfer people and equipment even on roads of the third category." It sounds lifeless, but then it does not disagree with the sparing statements adopted here. You cannot ban nature form separating the "mane" into fibers and converting it into an impassable slush. One can note the sign of bad roads and call it more delicately: road of the third category. Otherwise, if the fact of bad roads is officially acknowledged, the administration must increase the rate of the drivers by 40 percent.

"Turnover of personnel has begun," says Misha. "The old guard is leaving. Who will replace it? Novices and inexperienced workers. I ask a young man: did you ever travel on such roads? He nods and I see that the greatest is that he traveled over the glass with a rag. He still has to be taught our work. But time does not wait. You yourself know what kind of work we do. I heard that they are planning to create instead of our autotransport shop a new transport subdivision with its own repair base. This is good. But who will sit behind the steering wheel?"

Misha does not plan to leave.

Everyone knows that frequent flights affect the health. People who have to fly regularly are under constant medical monitoring. Once a year the watch workers take a preventive examination. By agreement with the administration of drilling operations, it is given by the Ivano-Frankovsk medical institute with the participation of all the "narrow" specialists.

"What pressure is considered normal," Leonid Kormilets repeats with a smile. My question probably sounded too amateurish. But Leonid solves my doubts: "If you really do not know this, then you can be envied. The watch workers know this. Thus, normal pressure is 120/80. This pressure is generally observed among the flying drillers at home. After the flight to the north it rises of course because of the change in time and magnetic zones and the shortage of oxygen. In these latitudes the shortage reaches roughly 15 percent. What else? Nervous experiences associated with landing in intermediate airports, with delays, with the lack for normal resting conditions in this period. The take-off and landing are generally the most strained moments of the flight. But the complaints of the watch workers of a disorder in vascular tone, or as we say, autovascular dystonia, is in third place after colds and injuries."

The scientists of the Institute of Physiology of the Siberian department of the USSR Academy of Sciences in March of last year concluded an agreement with the Ivano-Frankovsk Administration of Drilling Operations for joint scientific-research work on medical-biological problems of watch work in the oil and gas industry in 1981-1983.

The high quality and qualification of the Novosibirsk scientists became proverbial. They observe their wards at rest, in flight, at work, make measurements before the beginning of the labor process and after it. The observations of the physicians are reduced to a preliminary report on the program "Watch."

The scientists admit that until now there has not been a unified opinion on the optimal regimes of work and rest in shift work. The condition of the watch worker who has completed a lengthy flight through several time zones is characterized in the preliminary report as intermittent adaptation. The performance capacity is reduced by 20-40 percent by post-flight stress. It rises only from the fifth day and is stabilized. A repeated reduction in performance capacity is observed from the 10th-11th day of the watch. As we understand, the watch worker works from the first to the last day in one regime.

Although the studies will be continued for more than a year, the physicians have come to the conclusion even now that the optimal period for stay on the watch in the region of the new industrial development should be lengthened to 21 days. Not all of these days should be working: taking into consideration the sinusoid adaptation, special "windows" should be provided for the restoration of strength and removal of nervous strain.

My last meeting with the Nizhnevartovsk airport was prolonged as if it did not at all want to part.

I am flying away. Alone. The people that I have come to know have already left. People were arriving that I do not know and will not know. But I have come to know the work that they will be doing.

The route is Nizhnevartovsk-Moscow. There is still time before the take-off, but I have suddenly become a little infected with the anxiety of my future companions: what if the weather suddenly becomes unfavorable for flying: What if suddenly...

The Nizhnevartovsk-Moscow route is delayed to 12:00 Moscow time because of the meteorological conditions of Nizhnevartovsk.

Two hours of waiting. I collect a package of newspapers and magazines in the kiosk and go to the second story to the waiting room. But there is not a single empty seat. It would have been naive to count on anything else. The building is tiny. The new one that was started on a truly Siberian scale has been standing nearby for already a year, unfinished. On the other hand, the Nizhnevartovsk residents laugh, we have one of the longest landing strips in the country.

We flew out of Nizhnevartovsk in the beginning of the next day. We flew to Bol'shaya Zemlya, to the deep well-built rear area. We left the first line behind us, the shining of the fires from the drilling derricks. I had spent 2 weeks here, 14 days. In the near future this will be 14 million T of oil in the Tyumen Oblast. It will!

Every day a million.

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