

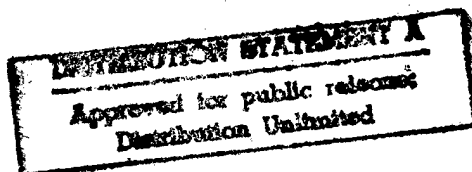
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27 APRIL 1987

# USSR Report

NATIONAL ECONOMY



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27 APRIL 1987

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NATIONAL ECONOMY

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## KHACHATUROV ADVOCATES ADDED INCENTIVES TO PROTECT ECOLOGY

Moscow EKONOMICHESKAYA GAZETA in Russian No 7, Feb 87 p 4

[Article by Academician T. Khachaturov: "Costaccounting Interests and Ecology"; first paragraph is EKONOMICHESKAYA GAZETA introduction]

[Text] How can one better combine the tasks involved in the further expansion of production and its intensification with the rational use of natural resources and the protection of the environment?

Natural resources are our public property. The maintenance of a truly proprietary interest in their rational use and in the protection of the environment has enormous economic, social and moral significance. Undoubtedly, it is one of the important avenues in the restructuring of our entire social and economic life, which has been unfolded in the country and whose problems the January CPSU Central Committee Plenum discussed.

Under the existing costaccounting system, enterprises are not interested in carrying out environmental protection measures. You see, their execution requires additional expenditures and this decreases the amount of profit. The enterprise itself does not receive any benefits if it does not count on an opportunity to use the trapped harmful impurities. As a rule, however, the income from this is not great and considerably less than expenditures for cleansing structures.

Yes, and the evaluation itself of the effectiveness of expenditures on conducting environmental protection measures is far from perfect. The main thing is that it is in no way connected with the practices of costaccounting relationships. Here, the "Temporary Standard Methodology for Determining the Economic Effectiveness in Conducting Environmental Protection Measures and for Evaluating the Economic Damage Which Environmental Pollution Causes the National Economy", which was approved by a USSR Gosplan, USSR Gosstroy and USSR Academy of Sciences Presidium decree in October 1983, is in effect. Attempts to make practical use of the methodology have, generally speaking, not provided satisfactory results.

## The Shortcomings in the Methodology

Why has this methodology not proven to be viable? One of the reasons, I suppose, consists of the fact that it does not contain instructions on how to economically stimulate expenditures on protecting the environment.

Another reason consists of the shakiness of the accounting methods themselves. Excessively averaged indicators have been proposed for determining the damage caused by pollution to the environment. For example, let us take the indicators that are used in the formula for determining the amount of atmospheric pollution. All of the coefficients and indicators in it do not have the required scientific and statistical justification. The average price for a standard ton of impurities has been set extremely roughly. The coefficients for installations in an area with a health-resort zone or pastures are conditional. It is necessary to say the same thing about the amendments on the nature of dispersing impurities in the atmosphere and their relative corrosiveness -- with respect to what? (cf. also the article by the author of these lines in *EKONOMIKA I MATEMATICHESKIYE METODY* No 5, 1986). The fact that impurities interact is also not taken into consideration. Thus, the interaction of sulphur dioxide and nitrogen dioxide and nitrogen dioxide and formaldehyde causes more significant damage than each of these gases individually.

The trouble, however, lies not only in this. As a rule, using data on the content of this or that harmful impurity in the atmosphere and reservoirs, it is very difficult to judge who is the one specifically guilty of harming the environment. This means that it is not clear against whom this or that measure should be taken in order to prevent the pollution. It is only possible to accurately determine the degree of guilt of enterprises or organizations, who are upsetting the purity of the atmosphere or reservoirs, in certain cases.

Calculations of pollution-caused damage in comparison with expenditures become possible if they are carried out not for individual culprits -- enterprises and other organizations -- but for the objects of pollution -- cities, rayons, krays, and oblasts. These calculations permit one to judge how great the damage is and what the measures, which are aimed at protecting the environment, are doing. Even here, however, it is hardly possible to use the obtained information by itself to induce enterprises and other organizations to protect the environment using some kind of economic measures.

How can all of these problems be solved?

### New Approaches

Work is now being performed to improve the temporary standard methodology. A working group under the chairmanship of the author of these lines has been established in accordance with the 9 July 1986 instructions of the USSR Academy of Sciences Presidium for this purpose. I will only dwell on certain questions that have to be solved during this work.

First of all, a question arose about the nature of environmental protection measures themselves. Three basic groups stand out in the set of measures to protect the environment on a given territory. They are the construction and operation of environmental protection structures; the development and incorporation of low-waste and waste-free production methods; and the control and management of environmental protection measures. In accordance with these, it is possible to group environmental protection activity according to the types of resources -- protection and rational use of water resources, the atmosphere, land, forests, mineral resources, and the animal world.

Negative effects on natural resources and the environment can be taken into account using the following model schema.

Water resources: water losses in water pipes because of their unsatisfactory condition; the release of polluted water into reservoirs without cleaning and of so-called norm cleaned water.

Atmospheric air: the discharge of harmful substances into the atmosphere (without cleansing) from stationery plants and transport.

Mineral resources: losses in the bowels of the earth (in tons and percentages for exhausted stocks); lowering the quality of reserves as a result of the optional working of deposits (decreasing the price component in the remaining part of the reserves); storing enrichment tailings, which contain valuable components, in piles.

Forests: unremoved wood and its spoiling, rotting and waste at procurement places; losses during transport; and waste during processing.

Animal world: losses of small game in the forest, the field, in rivers, and in the sea, including destruction by poachers.

The dynamics of this information and its change for the better or worse permit the effect of expenditures on environmental protection measures and the degree of this effect to be evaluated. Based on this information, a sound conclusion can be made about further expenditures and about this or that measure for increasing their effectiveness. We are talking about capital and current expenditures. Capital investments are taken into account for all sources for financing the building of new fixed capital of an environmental protection nature and for reconstructing and expanding operating fixed capital. This consists of construction and assembly work; the acquisition of equipment and tools; and scientific research, design study and other types of preliminary work. It is also necessary to add expenditures for the formation of working capital to capital investments in fixed production capital.

#### Calculating Expenditures

An accurate accounting of current operating expenses is still not always being organized. Expenditures for the maintenance and servicing of environmental protection fixed capital-- for the wages of service personnel; scheduled

preventive repairs, routine repairs and overhauls; depreciation; energy expenditures; and expenditures for reagents -- are relevant to these. Next, it is especially advisable to single out current expenditures on measures, which directly affect the environment and its improvement, and also expenditures for operating the fixed capital, which has the improvement of technology as its goal, in order to reduce the unfavorable effect on the environment.

When comparing capital investments and operating expenses in order to select the most effective version, it has been decided to use the norms that have been recommended by the standard methodology in effect for determining the effectiveness of capital investments.

What determines the economic effectiveness of the compared versions of a solution for single-purpose tasks within one and the same territory? The minimum of the combined annual operating expenses and capital investments (reduced to an annual dimension in accordance with the norm coefficient of comparative effectiveness) serves as the indicator here.

However, it is impossible to confine oneself to these calculations. In order to insure a costaccounting interest in the carrying out of environmental protection measures, it is necessary to establish those economic conditions for each enterprise and each economic organization under which it would not be economically profitable to not observe the maximum norms for discharging polluting impurities into the atmosphere, water and ground. In order to do this, it is advisable to introduce, first, fines or penalties for the discharge of gases, dust or sewage in an amount that exceeds the prescribed and rather strict norms. Second, it is necessary to award a bonus for fulfilling all of the requirements that insure the safekeeping of the environment.

#### Penalties, Fines

The amounts of the penalties or fines should be higher than the expenses for environment protection activity so that it will be more profitable to carry out the required measures and not pay the penalties or fines. The excess should be rather appreciable and be, for example, 5-10 percent or even more. The final payment of the penalties or fines should not be carried out against the account of the consumer of the product. This will increase the cost of the product. It is necessary to pay them from the profits -- more accurately from that part of the profits which remains with the enterprise and the collective.

In our opinion, such an approach to the economic stimulation of environmental protection activity in enterprises and other organizations has two tasks: First, fuller assimilation of the resources allotted for this and, second, the assurance of the effective functioning of existing environmental protection installations. In our opinion, the stimulation can be effective with the following amounts of penalties or fines if we are talking about water resources and the atmosphere. The sanctions should be 5-10 percent more than the prescribed water intake payments for losses of water and its expenditure above prescribed norms. Penalties in the same amount should exceed the

expenditures for cleaning polluted drainage when this drainage is discharged into reservoirs without cleaning. The use of water-pipe drinking water for production purposes should also be economically punished with an increase in the price of the water.

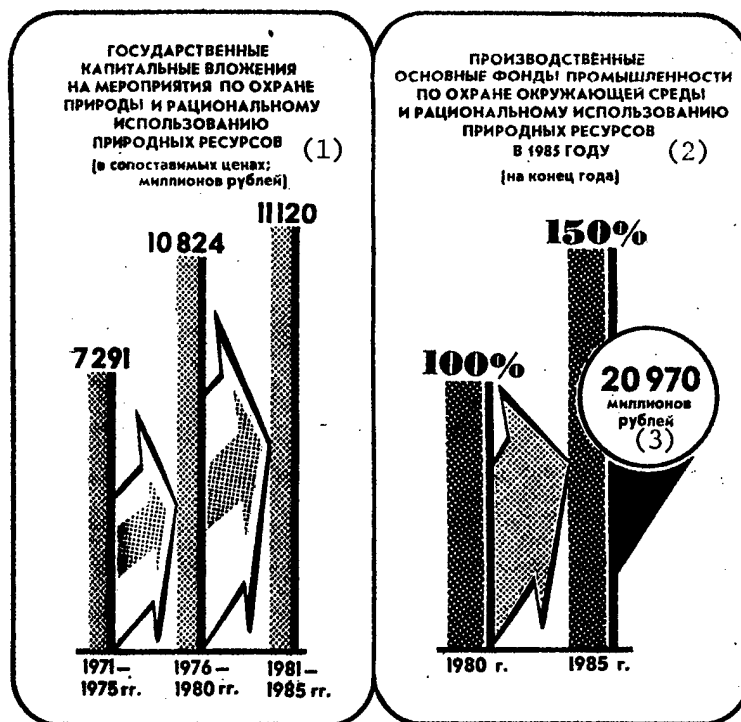
Fines, which exceed the resulting expenditures of an enterprise for the complete cleansing of the appropriate quantity of effluents, should be levied for discharging gases, dust and heated air. This is done in a case where there are cleansing installations. When they are absent, it is necessary to impose on the enterprise a penalty in an amount that exceeds the capital investments, which are required for their installation, by 5-10 percent.

#### The Special Fund and Bonuses

It seems that these examples testify rather graphically about the proposed approach to the problem of economic sanctions. The penalties should be set by representatives of the environmental protection control service completely independently of local and departmental organizations. All assets should be incorporated into a special regional fund -- for example, a Stroybank or Gosbank account. The fee for natural resources, penalty payments, the fee for credit granted to build environmental protection equipment and installations, and other receipts should also be sent to this fund. Part of the fund's assets could be used to grant bonuses for the exemplary carrying out of environmental protection measures through deductions in the material incentive funds of enterprises. This will provide an opportunity to pay bonuses to workers that have distinguished themselves -- bonuses designated by the environmental protection control service in agreement with the bank.

Bonuses could be paid for example, in the following amounts: for saving fresh water by means of a circulating water supply and other measures -- in an amount of 10 percent of the cost of the water from natural sources; and for the removal and cleansing of sewerage -- in an amount of 5 - 10 percent of the cost of the trapped useful components.

The draft of the methodology for determining the effectiveness of expenditures on protecting the environment and economic incentives for environmental protection measures was discussed by the Scientific Council for the Economic Effectiveness of Fixed Capital, Capital Investments and New Equipment at the end of December, when representatives from different organizations were invited to attend, and was basically approved with necessary revisions in accordance with the comments made. Undoubtedly, the discussion of the main propositions in this draft will help the work to improve the evaluation of the effectiveness of environmental protection activity and will link it more closely with the costaccounting interests of enterprises.



**Key:**

1. State capital investments on measures to protect the environment and rationally use natural resources (in comparable prices: millions of rubles)
2. Industrial production fixed capital for protecting the environment and rationally using natural resources in 1985 (at the end of the year)
3. Millions of rubles

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CSO: 1820/76

## MACHINERY, EQUIPMENT

### TIME REQUIRED FOR DEVELOPMENT OF NEW EQUIPMENT

#### Participation Must Be More Active

Moscow SELSKAYA ZHIZN in Russian 11 Nov 86 p 2

[Article by G. Gozman, head specialist of the Division for Mechanization and Electrification of the USSR Gosagroprom, winner of the USSR State Prize, candidate of technical sciences: "To Win and Not Simply To Participate"]

[Text] A new machine is always a great event in the life of rural workers. But frequently agricultural machine operators are also disappointed by their low technical level and low productivity. And because of this the "newcomer" is frequently obsolete by the time it arrives.

An analysis conducted by specialists shows that it takes an average of more than 6 years to develop, test and assimilate the production of new agricultural equipment. Of this time, 33 months go for designing and manufacturing experimental models, 31 months are taken up by the pre-startup period and acceptance testing lasts 7 months. From the results of this, recommendations are made concerning final improvement of the machines and then they are sent for more testing. The final testing for acceptance lasts an average of 5 months, after which the machine is recommended for production.

What is keeping us from creating and assimilating new machines in shorter periods of time? Setting aside for the moment such important questions as prompt and high-quality development of agro- and zootechnical specifications, and also the excessive volume of unnecessary paperwork and coordination work which has to be done by designers, we consider it necessary to turn attention to certain other factors that are important in the premature aging of new technical equipment.

Because of the poor quality of design developments, each new machine, before it receives a recommendation to be placed in production, is submitted for repeated state testing on an average of 2-3 times. In all cases the reason for returning the models to the developers have to do with the lack of correspondence between the designs and the agricultural requirements and technical assignment. For example, in the third test at the Northern Caucasus MIS and the KubNIITim of the AKP-5 set of combine equipment of the Odessapochvomash Production Association, unsatisfactory agrotechnical

indicators were discovered (the fields were not level enough, the depth of cultivation was not uniform and the reliability was poor). And even in "improved" models of the equipment that were submitted for the following year, again there were 16 points where they do not correspond to the technical assignment. Analogous results were obtained when testing the SVSh 7.2 snowplow and bank former (testing began in 1975). One can give many examples like these.

In many cases such blenders are explained by the low level of preliminary testing. We think that here the capabilities of state machine testing stations (MIS) are being utilized very poorly. As a rule, including these stations in the work in the stage of preliminary testing reduces the time period for the creation of new technical equipment by no less than 8-12 months. But this fact is not taken into account by everyone everywhere. Because of the fear of the designers about the possible discovery of shortcomings, only half of the machines that are subject to subsequent acceptance examinations are submitted for preliminary testing at MIS's.

The system of planning experimental design work and reporting on the fulfillment of plans does not stimulate improvement of quality. In the majority of cases the annual plans for this work are completed in the stage of "conducting acceptance tests" or "participation in the documentation of the results of acceptance tests." Here the results of tests have no influence on the fulfillment of the plans themselves. The Olympian principle that is in effect is quite unacceptable in this case: "It is not winning that is important but how you play the game." The amount of time it takes to create new technical equipment has no influence on the bonus.

We consider it unacceptable to place crude machines (the so-called "transitional models") in production, as certain specialists are suggesting. The completion of certain technical solutions for these machines is to be carried out during the process of their production. Under the conditions of agricultural production in our country, with the limited agrotechnical time periods for performing field work, the series production conveyor should receive only machines whose indicators correspond to the highest quality category. Incidentally, this is why during the first years of their manufacture an increment of up to 30 percent of the price is set for new machines "for effectiveness," that is, the same as for machines of the highest quality category.

The final evaluation of the readiness of machines to be put into production should be provided by the acceptance testing at state MIS's and the economic test runs of these machines on the fields of the kolkhozes and sovkhozes. But this is only the next, perhaps not the longest, stage in the creation of new technical equipment. The lengthy period of waiting for already created machines to be put into production--this is the stumbling stone for many of them. During the years of the 11th Five-Year Plan alone a kind of "portfolio of unrealized solutions" increased from 349 to 390. Almost one-third of the designs that had been developed lay there without moving for 5-10 years, and now at best they are suitable for reworking. Immense amounts of money have been spent on the creation of machines, and the return is zero!

Of course one cannot deny the machine builders' difficulties related to the limited production capacities, but many of the machines that are standing on the shelves could replace others in the shops of the plants without expanding the production volumes. There are many purely organizational disorders which impede more rapid advancement of a technical innovation to the plant conveyor. For example, for the majority of new machines the future manufacturing plant, whose participation in the planning could essentially accelerate their creation, is not determined for the majority of new machines. Prompt development of parts and components with the participation of plant specialists to check on the technology of manufacture, assistance in manufacturing experimental models and experimental batches, and the participation of plant workers in tests--all these are important factors in acceleration.

A practice has arisen and been legitimized by a number of documents whereby the preparations for the production of a new machine begin only after a decision is made concerning its mass output. Of course, the development and manufacture of fittings before the final determination of the design is fraught with unnecessary work (and suddenly the machine is not approved and does not go into series production or the design of certain parts is changed). But the cost of this work can in no way compare to the amount of losses to the national economy from delay in assimilating the output of new technical equipment.

Unfortunately, so far we do not have any normative time periods for assimilating the output of new machines that are differentiated depending on their complexity and the scale of production. Nor do we have effective economic stimuli or sanctions that give encouragement or punishment for the duration of the assimilation. The Basic Directions for the Economic and Social Development of the USSR envision the creation of organizational forms "of integration of science, technical equipment and production which make it possible to provide for efficient and rapid movement of scientific ideas from their conception to extensive application and practice." But to implement these ideas, in our opinion, it is necessary to take a number of measures.

It would seem that the Gosagroprom should be responsible for the development and introduction of a system of machines and, on the whole, for conducting a unified technical policy. But to do this it is necessary to give rights to the client and the agency that disposes of the funds for the creation of all new technical equipment. They should have the right to establish priorities in this work and, in conjunction with the USSR State Committee for Science and Technology, to evaluate the technical level of machines and equipment that are delivered to the entire agroindustrial complex.

The creation of new agricultural equipment in the country is envisioned by a multitude of various plans: the state plan for economic and social development, the target and comprehensive programs, departmental and interdepartmental plans and programs. Because of the lack of a unified plan it is almost impossible to effectively monitor the realization of the system of machines. Because of this the comprehensiveness of the mechanization of the most important branches of agriculture suffers and extensive introduction of industrial and progressive technologies is impeded.

Scientific and technical progress in the area of mechanization of agricultural production would be significantly accelerated with the development by the USSR Gosplan and the USSR State Committee for Science and Technology of unified five-year and annual plans for the creation and assimilation of series production of new agricultural equipment. It would be expedient to establish for design organizations and manufacturing plants joint responsibility for the creation and introduction of this equipment.

The development of provisions concerning incentives for early and prompt beginning of their output through the introduction of additional increments and sanctions would contribute to accelerating the assimilation of the production of new machines. For example, the removal of the Emblem of Quality or the deduction into the budget of some of the money obtained for the machines that are subject to replacement, reduction of the amount of increments for effectiveness when the beginning of the production of the new machines is delayed.

It is also necessary to develop normatives for the time periods for the assimilation of new technical equipment in production and to legalize the beginning of the preparation of production simultaneously with the planning and testing of the new machine. Leading enterprises of a number of branches of domestic industry and also many firms in industrially developed countries greatly accelerate the advancement of technical innovations this way. An example of this was provided by the Rostselmash Production Association. In October 1985 they completed testing on Don grain combines. In December the Interdepartmental Commission adopted a recommendation concerning delivering them to production, and within 2 months the collective of the association had manufactured an industrial batch of the new machines. Series output of the Dons began at the end of 1986.

#### Systems of Agricultural Machines Needed

Moscow SELSKAYA ZHIZN in Russian 25 Nov 86

[Editorial: "A System of Reliable Machines for Agriculture"]

[Text] On the Volgo-Don Sovkhoz in Volgograd Oblast the workers of the engineering service were able to mechanize almost completely one of the most labor-intensive branches of agriculture--vegetable growing. Through their own forces they designed and constructed a number of maneuverable and reliable machines. It is remarkable that the technical equipment created by these handymen under fairly primitive conditions has been operating reliably for many years.

Let us give what is due to the enthusiasm and the natural intelligence of the rural efficiency experts. Through their active intervention in technical progress they are filling many gaps in agricultural machine building. But does this technical creativity not evoke a keen sense of bitterness and confusion? Why must the rural engineer or machine operator design and build his own machines and equipment? His business is to use the equipment on the fields and farms with the greatest return, to use it to achieve a constant

increase in the production of farming and animal husbandry products. And to create machines for agriculture, even good ones that are of the highest technical level, is the direct responsibility of machine builders, designers and scientists.

Recently serious demands have been placed on the creators of new technical equipment for agriculture because of the great arrears in comprehensive mechanization of farming and animal husbandry. The 27th CPSU Congress and the April (1985) and June (1986) Plenums of the CPSU Central Committee set a large task for them: in the shortest possible period of time, to sharply increase the supply of technical equipment for the agroindustrial complex, to improve the quality of machines that are produced, and to accelerate the delivery to production of new, highly productive technical equipment.

In implementing the party decisions, the Gosagroprom and the USSR Ministry of Agriculture and Ministry of Machine Building for Animal Husbandry and Fodder Production have developed a system of machines intended for 1986-1990. This system envisions the creation of new technical means which will make it possible to increase labor productivity in farming by a factor of 2.5 and to considerably reduce the volumes of manual labor in animal husbandry. The basis of technical progress in fieldwork will be complexes of machines for producing grain, fodders, cotton, sugar beets and potatoes.

In animal husbandry there will be further development of improved machine technologies for producing milk, meat, eggs and wool on the basis of the most modern equipment. Automated sets of machines for preparing and distributing feeds, computer systems for optimization rations, automated installations for maintaining the microclimate, and other means of comprehensive mechanization and automation of agriculture will be delivered to the farms.

The machine builders have large plans. This gratifies the agricultural workers. But a certain amount of alarm is being caused by the rates of their fulfillment. At a meeting of the USSR State Agroindustrial Committee where they considered the plan for technical supply for agriculture under the 12th Five-Year Plan, this was discussed extremely openly by the director of the Nazarovskiy Sovkhoz in Krasnoyarsk Kray, Hero of Socialist Labor A. F. Zeprev: "Of course one must think about the future. But we are raising grain today. And meat must also be produced today. Yet we are still not receiving many of the kinds of equipment envisioned by preceding systems of machines."

Indeed, practically every postwar five-year plan has had its own list of new technical means that have been recommended for mass production which have been necessary for comprehensive mechanization of agriculture. But not a single one of them has been fully embodied in metal. An average of 50-60 percent of the technical innovations have made their way to the fields and farms. The last five-year plan, the 11th, was no exception in this respect.

As a result, by the beginning of 1986 the country's agriculture had only half of the technical equipment necessary for comprehensive mechanization of agricultural production. At the present time not a single crop has machines that provide for complete mechanization of technological processes for raising and harvesting it. Even with grain production, which is considered to be the

technically best supplied, manual labor comprises almost 45 percent of the overall labor expenditures if one keeps in mind also auxiliary work on threshing floors, in warehouses, topping shock and so forth. What then can one say about vegetable growing, potato growing, seed growing and the production of root crops!

At the Conference of the CPSU Central Committee Concerning Questions of State Acceptance in Associations and Enterprises of Industrial Ministries it was emphasized that acceleration of radical restructuring of the national economy should proceed primarily through technical progress and through a changeover to new technical equipment and technology. Improving product quality is an indispensable part of this work.

But can one really speak seriously about technical progress, for example, in animal husbandry, if up to this point the proportion of manual labor on dairy farms exceeds 40 percent, hog farms--60 percent, and sheep raising even more--80 percent? We have certainly not solved the problem of mechanization of small farms, of which there are several tens of thousands in the country.

The time periods for creating new technical equipment in our country are excessively and unjustifiably prolonged, in the opinion, for example, of twice hero of socialist labor, the well-known Orenburg Combine operator V. M. Cherdintsev. And one cannot but agree with this authoritative opinion. Without going into the details of the reasons for these arrears, let us say simply that many machine-building collectives are in no hurry to reorganize production and restructure their work to meet the new circumstances. And without this it is hardly possible to considerably improve the supply of high-quality technical equipment, the kind that would correspond to the best world models, for agriculture and the entire agroindustrial complex as a whole.

This is why it is so important for the new system of machines, which takes into account the basic gaps in the mechanization of agricultural production, to attract increased attention from the corresponding departments, mainly the USSR Gosplan, the Ministry of Tractor and Agricultural Machine Building and the Ministry of Machine Building for Animal Husbandry and Fodder Production. Let the ideas of scientists, designers and workers of industrial enterprises be embodied in concrete deeds as quickly as possible!

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CSO: 1824/154

## FOOD PROCESSING AND DISTRIBUTION

### GOSAGROPROM OFFICIAL CITES 1987 PLANS FOR DAIRY INDUSTRY

Moscow MOLOCHNAYA PROMYSHLENNOST in Russian No 1, Jan 87 pp 1-4

[Article by L. N. Kuznetsov, deputy chairman of USSR Gosagroprom, chief of the Department for the Production and Processing of Livestock Products: "Dairy Industry in the Second Year of the Five-Year Plan"]

[Text] The tasks of the agro-industrial complex defined by the 27th CPSU Congress--attainment of a stable growth of agricultural production, reliable provision of the country with food products and agricultural raw materials, and combination of the efforts of all its sectors for obtaining high final results in accordance with the USSR Food Program--are reflected in the state plan for the economic and social development of the USSR for the second year of the 12th Five-Year Plan. The further development of the APK, strengthening of its material and technical base, increase in the efficiency of all sectors, and on this basis a fuller satisfaction of the population's needs for food products are envisaged.

The dairy industry as an integral part of the APK should also take a new forward step. During the past year of the new five-year plan the planned volumes of production of dairy products were exceeded by almost 600 million rubles. This became possible owing to the fact that animal husbandry workers sold more than 71 million tons of milk to the state--3 million tons more than in 1985.

For its more efficient processing, the application of advanced technologies was expanded. For example, the proportion of closed processes in the production of sour cream rose to 83 percent and of sour milk products to 77 percent, and the scale of introducing the nontransplantation method of using ferments increased. More than 150 highly productive flow-mechanized lines were installed at enterprises. The output of milk and dairy products in new cardboard packaging of the "pure pack" type convenient for consumers was mastered in large industrial centers and capitals of the Union republics. The production of packaged products increased, on the whole.

The 1987 plan envisages the further growth of milk production, that is, up to 101.5 million tons, increase in the output of dairy products, and restructuring and improvement in the economic mechanism of management in all

APK sectors connected with the production, procurement, and processing of milk. The key indicators of 1987 correspond to the assignments of the five-year plan and lead the economy to the average annual rates of growth envisaged in it.

No less than 1,552,000 tons of butter, more than 30 million tons of whole milk products, 857,000 tons of cheese, and 1,520 million cans of canned milk should be produced during this year. The active work of livestock breeders makes it possible to set the task of fulfilling the plans for the output of dairy products everywhere ahead of schedule.

To do this, during the first days of the new year it is necessary to uncover and profoundly analyze the shortcomings existing in work organization at every enterprise, section, work place, and scientific subdivision, to take measures to eliminate them promptly, and to maximally utilize production and labor reserves, whose scale is sufficiently big, for intensifying the development of the dairy industry.

Cheese production requires special attention. During the current year its increase should total 26,000 tons, or 3 percent of the 1986 level. Taking into consideration the high degree of utilization of capacities in a number of basic cheese making regions, it is necessary to search for possibilities of increasing them by retooling shops, eliminating bottlenecks, selecting an efficient assortment, and, in particular, expanding the output of soft cheese without ripening and of melted cheese enriched with plant and protein components.

We must prevent the utilization of milk obtained in zones of cheese making plants for the output of other dairy products, as was the case in 1986 in a number of the country's regions and, especially, in Kalinin, Smolensk, Yaroslavl, Orel, Rostov, and other RSFSR oblasts. As a result, enterprises of the Russian Federation's Gosagroprom alone underdelivered more than 13,000 tons of cheese and did not fulfill the plans for its delivery to the Union stock. This is a direct breach of state discipline, which can be attributed to none other than the manifestation of localistic tendencies on the part of managers of some oblast agro-industrial committees. Such actions deserve the most serious condemnation.

During the new year the production of dry skim milk and whole milk substitutes is to be increased by 15 percent.

An increase in the output of these products, as well as of cheese, is closely connected with a sharp improvement in the utilization of the production potential, which is defined as one of the important tasks of 1987. Meanwhile, in the sector there are serious gaps in this respect.

Out of the surveyed 37 cheese making plants and 74 shops for dry skim milk, whole milk substitutes, and dry whey put into operation in 1976-1985, a total of 65 and 61 percent respectively do not fully utilize planned capacities. Calculations show that for this reason alone 19,000 tons of cheese and 70,000 tons of dry skim milk and whole milk substitutes were underdelivered in 1986. As a rule, this is the consequence of putting projects into operation with

flaws hampering the normal operation of enterprises and without housing and social, cultural, and domestic service facilities, of unsatisfactory personnel training, and of an untimely redistribution of raw material zones and material resources.

A thorough and overall processing and an efficient utilization of milk resources are the most important potentials for increasing output.

At present about one-half of the amount of secondary raw materials is allocated for industrial processing, but only 35 percent of the skim milk and buttermilk and 29 percent of the whey goes for food purposes. Membrane processing methods are introduced slowly. Volumes of output of a higher food and biological value with protein, fruit-berry, and other fillers are lowered in a number of places. Commodity output grows negligibly, totaling 236 rubles per ton of processed raw materials.

A reduction in losses of milk at all the stages of its processing, increase in the production of biologically high-grade low-fat and nonfat products, fuller utilization of secondary resources, and extensive introduction of membrane technology are the basic directions in the growth of output per unit of raw materials.

Dairy industry specialists should constantly study the experience of advanced collectives and the achievements of Soviet science and disseminate them everywhere. As always, there is good experience. For example, a number of enterprises in the Baltic region, Transcaucasian republics, and the Russian Federation, introducing overall raw material utilization technologies, fully process secondary milk resources, obtaining output worth 280 to 320 rubles per ton of processed milk.

In 1987 the industrial processing of skim milk and buttermilk should make up 53.1 percent and of milk whey, 52.9 percent of the resources. It is planned to process 250,000 tons of raw materials on ultrafiltration installations. To ensure the reliability of operation of this equipment, during the first six months the Ministry of the Chemical Industry will master the output of thermostable polysulfone and the technology of manufacturing support plates of ultrafiltration installations from it.

In accordance with the decree of the CPSU Central Committee and the USSR Council of Ministers "On a Wide Popularization of New Methods of Management and Intensification of Their Effect on the Acceleration of Scientific and Technical Progress" on 1 January 1986 dairy industry enterprises changed over to new conditions of management. As a result, the role of labor collectives in drafting plans for economic and social development increased, their interest in raising production efficiency intensified, contractual discipline was strengthened, higher indicators in the utilization of labor and material resources were attained, and work time losses were reduced.

However, the rights in the area of economic independence granted enterprises and agro-industrial committees are not yet fully realized. Specialists at a number of the sector's enterprises, committees, and RAPO have not profoundly studied the principles of the new system of management and, obviously, do not

apply them sufficiently in practical work. For example, measures directed toward the acceleration of scientific and technical progress and transition to an intensive path of development are not implemented everywhere and the extended rights of enterprises are not exercised fully to improve the planning and technical development of production and to introduce the achievements of science, technology, and advanced experience.

The 1987 plan is based on long-term stable economic norms closely connecting the expenditure of funds on production development and material incentives with the final results of the economic activity of enterprises and associations.

As stressed at the November (1986) conference at the CPSU Central Committee, improvement in the quality of products is a matter of tremendous social and economic significance. This directly applies to the dairy industry, which produces products for immediate consumption.

The task lies in accelerating the general introduction of intensive technologies in animal husbandry, improving the quality of procured milk, especially in zones of cheese making and production of baby products, further introducing advanced milk processing technologies, strengthening order in production, raising technological discipline, improving sanitary and hygienic conditions, and creating a situation of intolerance toward slipshod workers of any ranks. Every case of output of nonstandard products should be considered an extraordinary event.

On the basis of the further strengthening of direct relations among partners of the agro-industrial complex it is necessary to significantly expand the direct acceptance of milk on farms, which is closely connected with an improvement in its quality. In 1987 no less than 35 million tons of milk, or 50 percent of the total purchase volume, should be procured by this advanced method. Meanwhile, in a number of the country's regions the proportion of centralized milk delivery is extremely low owing to the lack of provision of many livestock sections with cold, absence of motor access roads to them, and inefficient utilization of specialized motor transport. The biggest lag occurred in Novgorod, Kaliningrad, Ivanovo, Yaroslavl, Saratov, Kurgan, and Perm oblasts, Mordovian, Mari, and Udmurt autonomous republics in the RSFSR, and Kirovograd, Odessa, Dnepropetrovsk, Vinnitsa, and Sumy oblasts in the Ukrainian SSR, where the proportion of the direct acceptance of milk on farms makes up from 15 to 25 percent of the total purchases.

Managers of republic and oblast agro-industrial committees should concentrate their special attention on further strengthening the material and technical base of the dairy industry. The technical level of many enterprises remains low. More than 1,000 plants, which for different reasons do not meet present requirements and are in an unsatisfactory technical state, still operate. There is a tense situation with respect to the provision with capacities in a number of oblasts in the RSFSR and in Ukrainian, Belorussian, Kazakh, and Uzbek republics. All this should be taken into consideration in the plan for preparing enterprises for the milk processing season.

In some rayons in the RSFSR, the Kazakh SSR, Central Asia, and the Transcaucasus milk delivery is hampered owing to the big distances of its transportation, or the locality relief. It is necessary to build milk acceptance centers here.

In 1987 it is planned to build 19 enterprises of different production structures and to commission capacities for the annual production of 19,900 tons of cheese, 53,700 tons of dry skim milk and whole milk substitutes, and 2.1 million tons of whole milk products.

We must see to it that allocated capital investments are utilized fully and are assigned primarily for the retooling and reconstruction of enterprises, capacities are commissioned promptly, and the opportunities for developing the production and technical base afforded by the decrees of the CPSU Central Committee and the USSR Council of Ministers "On Accelerating the Development of the Material and Technical Base of Processing Sectors of the Agro-Industrial Complex in 1986-1990" and "On the Further Improvement in the Economic Mechanism of Management in the Country's Agro-Industrial Complex" are used more widely.

During the new year 9 percent more equipment will be delivered to dairy industry enterprises than during the past year. Measures for the organization of closer cooperation with the Ministry of Machine Building for Light and Food Industry and Household Appliances in the area of development of new equipment on the basis of unified planning and financing of this work have been determined. Plans are made to master the series output of automated pasteurizing-cooling installations of a productivity of 25,000 liters per hour, flow mechanized lines for the output of cottage cheese for 5,000 liters of milk processing per hour, film-type vacuum evaporation installations for 2,000 and 4,000 kg of evaporated moisture per hour, the L5-OKA automatic machine for a continuous formation of sausage cheese, the Ya7-OPE tunnel press for pressing cheese, and other equipment.

It is planned to manufacture and test prototypes of reverse osmotic and electrodialytic installations, a modernized butter line of a productivity of 1,000 kg per hour, a unit for weighing out and packaging dry dairy products in kraft bags, automatic refractometers for controlling the content of dry substances in milk, and a number of other types of new equipment and instruments.

Foreign economic relations with socialist countries will be developed further. They will deliver a significant number of pasteurizing-cooling and vacuum evaporating installations, milk bottling lines, and equipment for cheese making, butter production, and the milk canning industry. CzSSR enterprises and organizations are embarking on the delivery of drying installations complete with light-weight building structures, which will help to significantly shorten the periods of construction of new and reconstruction of existing enterprises producing dry skim milk and whole milk products.

The role of sectorial science in the development of industry is growing. Its restructuring with a significant expansion of experimental designing and with

an emphasis on the development of facilities for production mechanization and automation is being carried out. The efforts of scientific research organizations should be concentrated on solving problems of utilizing raw materials overall and of developing fundamentally new waste-free, low-waste, and energy saving technologies and equipment, which make it possible to significantly increase labor productivity, to reduce the share of manual operations, to maximally lower losses of raw materials during processing, and to improve the quality of output. The sector's scientific potential should be maximally utilized for the fulfillment of scientific and technical "milk," "cheese," "butter," and "cold" programs, in which the most urgent problems connected with the development of the dairy industry are concentrated.

The year 1987 is the year of the 70th anniversary of the Great October Socialist Revolution. The socialist competition for an appropriate welcome for this big holiday and for a prescheduled fulfillment of the program for the second year of the 12th Five-Year Plan, which is widely expanding among workers of the dairy industry and of all APK sectors, will, undoubtedly, bear its fruits.

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## FOOD PROCESSING, DISTRIBUTION

### ORGANIZATIONAL INADEQUACIES IN RSFSR COOPERATIVES CITED

Moscow ZAKUPKI SELSKOKHZYAYSTVENNYKH PRODUKTOV in Russian No 2, Feb 87 pp 23-27

[Article by V. Shlemin, economist: "On the Path of Radical Restructuring"]

[Text] During the 10th and 11th Five-Year Plans many good changes were made in the Non-Chernozem Zone. There was extensive work on developing the material-technical base for agriculture and related sectors of industry and on the social restructuring of the countryside. More than 65 million rubles of capital investments were spent for these purposes. Kolkhoz and sovkhos productive capital doubled. More than 2.5 million hectares of drained and irrigated land were put into production. As a result, there was a noticeable increase in agricultural production and state purchases.

As a component part of the agro-industrial complex, consumer co-operatives have a major role in transforming the Non-Chernozem lands and in implementing the Food Program. Their trade, procurement and production activities have great economic and social significance.

There is a substantial reserve for increasing food resources in the more complete use of the potentials for procurement activities by consumer co-operatives, especially in purchasing surplus agricultural products from citizens' private plots. Co-operators are doing extensive work in this direction.

Last year Rospotrebsoyuz [RSFSR Union of Consumer Co-operatives] had to find 7 billion rubles worth of additional reserves. The purchase of agricultural products is regarded as the largest source of noncentralized resources. While up until 1986 co-operatives' sole source of purchases was citizens' private plots, now, as is known, kolkhozes and sovkhoses can sell consumer co-operatives up to 30 percent of their produce at contracted prices and count this towards fulfillment of the state plan.

Last year co-operators in the Russian Federation made state plan purchases of 7.5 million tons of potatoes, fruit and vegetables at contracted prices. This was 1 million tons more than 1985. About 1 million tons were set aside for co-operative trade, industrial processing and public food service in the interseason period. Overall, the target was met. However, the total figures conceal serious shortcomings in procurement organization.

Often there are agricultural products in an oblast or rayon and the co-operators have a good material-technical base but there are no increases in the volume of products they purchase. This shows the procurers' passivity.

In many consumer co-operatives the workers in the procurement office are not sufficiently active and persistent with suppliers and do not sign enough contracts with them for the top priority sales of high quality products.

Co-operators still make poor use of the potential for purchasing agricultural products at contracted prices, 30 percent of such purchases going towards plan fulfillment. Thus, in Moscow Oblast only 1,600 tons of produce were purchased under such conditions. In 30 oblasts, including 10 in the Non-Chernozem Zone (Ivanovo, Ryazan, Tula and others) co-operators did not purchase potatoes, vegetables and fruit from kolkhozes and sovkhoses at contracted prices. At the same time farms in these oblasts and autonomous republics sold more than 31,000 tons of these products at markets. This took much time and diverted many people and scarce vehicles from public production. If only farm managers would be more reasonable, a sizable part of these products could be easily sold to co-operators at prices agreed to on the spot. The co-operators here did not show any quickness.

In 1986 almost 600,000 tons of meat were purchased from the population. It was not easy to do this, all the more since the Vologda and Bashkir Consumer Co-operatives did not fulfill their target, while the Yaroslavl, Smolensk and others purchased even less than in 1985. Co-operators' unattentive attitude towards the owners of personal subsidiary operations negatively affects the procurement of animal products.

Here is a typical case. After having difficulties finding transportation 14 inhabitants of the village of Ordynka in Kalinin Oblast hauled bulls to the Kharkovskiy Rayzagotkontor to sell them. However, they were refused there, references were made to the lack of cold storage space. Only after interference by raykom workers did the procurers accept them on the condition that they be paid for at the price for animals of average nourishment level, even though they were higher than average. The suppliers had to agree, they could not take the calves back. This is outrageous! Kalinin Oblpotrebsoyuz managers should think about it.

At present brigade contracts are used at some procurement offices. Their introduction has had an marked effect. Some of the brigade members work at the reception point, others according to a schedule arranged for inhabitants of settlements. They travel to their sectors and receive all sorts of agricultural products and raw materials right at houses. This progressive method should be more boldly used.

Increases in purchases of livestock, potatoes and produce from the population create a reliable base for consumer co-operatives' own industrial processing, especially of food products, for increasing the commercial turnover of urban co-operative trade and for supplying public food service enterprises. In 1986 the republic's co-operators processed more than 200,000 tons of fruit and vegetables. It is important to completely eliminate the shameful practice of

producing products "for the shelf", that is, those not in demand or not being ordered. Unfortunately, this ailment has not been cured everywhere.

Product quality is still unsatisfactory. In the first half of last year alone, the rejection rates for products inspected by the State Trade Inspectorate were as follows: bread and bread products -- more than 7 percent, confectionary products -- about 9 percent, sausage items -- almost 17, canned goods -- more than 30 percent, nonalcoholic drinks -- up to 16 percent. Product quality control is poorer than average among co-operators in Arkhangelsk, Kostroma and Kirov oblasts. Obviously, it is not occurring to them that the spoilage of natural wealth means the unjustifiable waste of labor and financial resources and that this is scandalous mismanagement.

The condition of equipment in the co-operative industry has an influence upon product quality. In most cases bad work is due to irresponsibility, weak control and low demands made upon production workers.

In recent years the quality of hides procured has deteriorated. Of the total procurement volume, 4th grade pelt sheepskins account for 60 percent, while fur sheepskins make up 27 percent. Many consumer co-operatives do not give the necessary attention to the development of this type of procurement. Procurers are not diligently working with owners of subsidiary operations to sign contracts for delivering high quality hides. The final result of such work is the production of fur clothing and leather footwear.

Many procurement organizations do not have the necessary material-technical base. Thus, Ivanovo, Kirov and other Consumer Co-operatives are not fulfilling targets for the construction of animal product warehouses and slaughter points. There are not enough well equipped shops for processing hides and sheepskins. These reproaches should, above all, be directed to the Kaluga, Moscow and Bashkir Consumer Co-operatives. Enterprises are only working one shift, are not supplied with the required amounts of raw materials, chemicals and other materials, are not staffed with key personnel and equipment is inefficiently used.

In order to fulfill increased targets for the procurement of furs, in addition to the appropriate material-technical base it is also important to properly organize work with farms and the population. Material interests are an important support to this. Beginning in 1987, there will be return sales of automobiles to kolkhozes, sovkhoses and other agricultural enterprises, meat combinats and procurement organizations in consumer co-operatives which have attained good results in increasing high quality fur sales.

During the 12th Five-Year Plan the total volume of mass consumption goods (primarily food products) produced by consumer co-operatives will increase by 1.7 fold. To support this considerable growth it is necessary to renew the material-technical base, more completely use production capacity and work 1.5 to 2 shifts rather than 1. Consumer co-operatives should organize work in their industry so that each rayon can, using local materials, completely supply the public with sausage items, smoked items, ice cream, canned goods and other products.

Year after year Rospotrebsoyuz's material-technical base for procurement and production is being expanded and renewed. During the 11th Five-Year Plan more than 16,000 different facilities were rebuilt and reequipped and 11,000 additional reception-procurement points and point-stores for garden and orchard associations were opened. Cold storage capacity for a total of 153,000 tons of potatoes and produce was built. With the participation of Rosproyekt [Institute for the Design of Buildings and Installations for RSFSR Consumer Co-operatives] and its affiliates, consumer co-operatives are extensively rationalizing production processes at existing enterprises. In 1985 alone, 412,000 rubles worth of work was performed. This saved more than 100,000 rubles. Reconstruction of buildings and improvements in technology improved storage conditions, reduced losses and considerably reduced the use of manual labor. As a result, procurement turnover during the 11th Five-Year Plan increased by 3.8 billion rubles over the 10th Plan, growing 22 percent during the five-year plan.

Agricultural production volume is growing. Therefore, to more completely use commercial resources it is necessary to further expand the material-technical base for procurement and processing. Rospotrebsoyuz has worked out a targeted program "Comprehensive Rationalization of the Activities of Co-operative Organizations and Enterprises" for the 12th Five-Year Plan and up until the year 2000. This program provides for further developments in the material-technical base for procuring, storing and processing agricultural products, the optimal use of transportation and equipment and the extensive introduction of science, technology and practical experience.

During the 12th Five-Year Plan 3.5 billion rubles will be allocated to build, rebuild and reequip the material-technical base for the procurement and processing of agricultural products and raw materials in Rospotrebsoyuz. It will be necessary to build 4,500 procurement points, commercial storage areas totalling 1,750,000 square meters, storage units for 200,000 tons of potatoes and produce, and cold storage units with 61,000 tons total capacity.

It is important to see that in the immediate future universal reception-procurement points become the main element in the purchase of agricultural products. Such points should become the place where owners of private subsidiary operations could rent garden and orchard tools and transportation equipment. For these purposes, in 1985 consumer co-operatives were allocated more than 3,000 motorcycles with side-cars and in 1986 about 2,000 more.

Consumer co-operatives have been given a target to expand the network of stores-procurement points for garden and orchard associations. Last year alone more than 1,000 were opened. Such points bring procurers closer to suppliers. Purchases of agricultural products must be made at all small settlements of up to 100 people. It is advisable to set up stationary procurement points in them and to better utilize mobile points, making use of truck trailers.

It is planned to double potato storage capacity with active ventilation and artificially cooled vegetable storage units. This will reduce product losses. There are also provisions to rebuild storage facilities, equip them with

active ventilation units and expand the container storage of potatoes, fruit and vegetables.

New closed air circulation storage units have been developed. A 2,000 ton potato storage unit has already been built in Orel Oblast, making it possible to increase the storage of potatoes and reduce waste during storage from 20 to 10 percent.

Measures are being taken to reduce losses during transport. Compared to 1985 there has been a 5 fold increase in the palletized bin method of transporting agricultural products.

During the current five-year plan about 1 billion rubles are being invested in the processing industry. This is twice as much as was used in the 11th Five-Year Plan. In rural areas co-operators are expanding the network of Yugoslavian built standardized reception-points, so-called modules. Last year 370 were built. In 1985 Rospotrebsoyuz started receiving Yugoslav-built modules for processing agricultural products. These have shops for producing sausage and smoked meats.

Last year about 200 such enterprises were installed, two-thirds of them in the Non-Chernozem zone. During the current five-year plan hundreds of procurement and processing enterprises and 600 ton coolers built in Yugoslavia will go into operation in consumer co-operatives in this region.

Unfortunately, habitual slowness and lack of organization are tolerated in the installation of such enterprises. Rayispolkoms assign co-operators very inconvenient sites for the modules. These require extensive preparation costs. There are such cases in the Baskhir and Mordovian ASSRs and Gorkiy Oblast, where the module site was changed three times. In Kirov Oblast the construction of the module was changed to another rayon after its foundation had already been built. These are, so to say, fresh cases of mismanagement in the beginning stages of restructuring the economic management system.

During operation these imported modules require preventitive maintenance and repair. taking this into account, Rospotrebsoyuz is organizing regional base warehouses for module spare parts. Such warehouses are being set up in Pskov, Gorkiy and Moscow Oblasts. They will service all consumer co-operatives in the Non-Chernozem Zone.

There are many unsolved problems in major construction. Last year, while the plan was fulfilled overall, the targets for starting up dozens of potato and vegetable storage units and reception-procurement points were not met. There is lagging in construction in the Arkhangelsk, Vologda and Vladimir Consumer Co-operatives. In the Rospotrebsoyuz system, including the Non-Chernozem Zone, 150 long delayed construction projects are carried over incomplete year after year. Almost 200 million rubles worth of co-operatives' resources are frozen. This is already a chronic "disease". Rospotrebsoyuz's Main Administration for Capital Construction must overcome it. Fundamental measures are urgently needed.

The housing shortage at consumer co-operatives is also disquieting. This is an important social question. In the 11th Five-Year Plan 152,000 square meters less than the intended figure was introduced. Last year the plan for the Non-Chernozem was not fulfilled. Especially small amounts of housing are being built in the Tula, Leningrad and Yaroslavl Consumer Co-operatives. This is one of the main reasons for cadre turnover.

Life presents urgent problems, solutions to which cannot be delayed. In general, consumer co-operatives in the Non-Chernozem Zone fulfilled the 11th Five-Year Plan targets for state purchases of potatoes and vegetables, but attained this mainly by purchasing surpluses from the population. Most kolkhozes and sovkhoses in this zone do not observe their annual obligations for forward contracting, nor do they fulfill plans for delivering potatoes and the most important vegetables (onions, cucumbers and tomatoes) to the state. In 5 years farms in the Non-Chernozem were short by almost 1.5 million tons of tomatoes (17 percent of the plan). During the 1986 harvest RSFSR kolkhozes and sovkhoses failed to deliver consumer co-operatives almost 400,000 tons of forward contracted potatoes, more than 80,000 tons of cucumbers, 35,000 tons of onions and 34,000 tons of tomatoes. There were only very small sales of garlic, greens, cauliflower and quickly perishable produce.

Many farms are not building points for sorting produce directly at the place of production. Because of this, low quality potatoes and vegetables are sold. In the past 2 years alone more than 500,000 tons of substandard products were delivered to procurement points.

To assure high quality procured produce, it is necessary to receive it directly at the production site. During the 12th Five-Year Plan it is intended to complete the conversion of procurement to this very promising method. However, in a number of oblasts this work is slow. This requires strict executive and technological discipline by procurement and production collectives. Co-operative organizations must rely on help from RAPO and the ispolkoms of rayon and rural soviets.

Farms' failure to fulfill contractual obligations and to deliver products not meeting standards puts consumer co-operative procurement organizations in a difficult situation. Understandably, this cannot be overcome in a single season, but there must be more energetic work on putting things in order.

Co-operators in Russia annually purchase 3.5 billion rubles worth of agricultural products from the population. This is 63 percent of total procurements. Purchases from each commercial household average 385 rubles, including 81 kg of meat and 400 kg of potatoes, fruit and vegetables. This would seem to be quite a lot. However, here, as in no other sector, especially in the Non-Chernozem Zone, there are large reserves for increasing the purchases of meat, fruit and vegetables. Consumer co-operatives are far from having the same approach to using resources. Many rayon procurement offices have only a formal attitude towards this work, pointing to general figures showing growth in procurement volume. This is supported by the above-cited example from Kalinin oblast.

Party and soviet organs in a number of oblasts have come to the assistance of co-operators, granting them preferential rights in purchasing livestock from the population. However, these potentials are not utilized everywhere. To be successful a procurer should not service more than 300 rural households, but the Leningrad and Chuvash Consumer Co-operatives must service more than 500. Of course, they do not succeed in servicing all of them.

There are not enough reception-procurement points in rural areas, especially remote ones. The task has been posed to build them at each kolkhoz, but it is only slowly being implemented. In Kostroma and Kalinin oblasts, for example, each point services 6-7 farms. Therefore farmers bypass co-operative procurers and take their products to markets, where citizens must pay high prices for them.

Every year rural inhabitants of Tula, Bryansk and Smolensk oblasts complain about co-operators' refusal to receive apples. Procurers are rare guests at peasant households. At the same time, one cannot always buy apples in urban co-operative stores. Last year this question was discussed by the RSFSR Supreme Soviet Commission on Mass Consumption Goods and Services. The Commission recommended that Councils of Ministers of autonomous republics and ispolkoms in kray and oblast Soviets of People's Deputies give consumer co-operatives the necessary help, in particular, in assigning procurement workers to local areas and in activating the work of rural and settlement soviets in organizing the purchase of agricultural products from the population.

During this five-year plan co-operators in the Non-Chernozem Zone face extensive tasks in further developing procurement and in expanding and renewing the material-technical base. Active organizational work is necessary. Increases in the production and procurement of agricultural products and the more complete use of their resources are general concerns for workers at all levels of the procurement apparatus of consumer co-operatives and the agro-industrial complex. This is a matter of great state importance and it must be handled in a state and party manner.

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# CSA STATISTICS ON INCOME, EDUCATION, HOUSING

## Economic, Social Development Indicators

Moscow PLANOVOYE KHOZYAYSTVO in Russian No 1, Jan 87 pp 116-121

[Article: "Basic Indicators of USSR Economic and Social Development"; prepared from materials of the USSR Central Statistical Administration]

[Excerpts] Table 8. Rise in Material Welfare and Cultural Level of the People

| <u>Income, production, housing</u>                                | <u>1913 or<br/>nearest<br/>published<br/>year</u> | <u>1940</u> | <u>1960</u> | <u>1970</u> | <u>1980</u> | <u>1985</u> |
|-------------------------------------------------------------------|---------------------------------------------------|-------------|-------------|-------------|-------------|-------------|
| National income produced<br>(1913=1):                             |                                                   |             |             |             |             |             |
| Total . . . . .                                                   | 1                                                 | 5.3         | 23          | 46          | 75          | 90          |
| Per capita . . . . .                                              | 1                                                 | 4.5         | 17          | 30          | 45          | 52          |
| Industrial production of<br>consumer goods (Group "B";<br>1913=1) |                                                   |             |             |             |             |             |
| Total . . . . .                                                   | 1                                                 | 4.6         | 15          | 30          | 50          | 61          |
| Per capita . . . . .                                              | 1                                                 | 3.9         | 11          | 20          | 30          | 35          |
| Total area of available urban<br>housing (at end of year*):       |                                                   |             |             |             |             |             |
| Total, in million m <sup>2</sup>                                  | 180                                               | 421         | 958         | 1542        | 2202        | 2561        |
| On average per urban<br>resident, in m <sup>2</sup>               | 6.3                                               | 6.5         | 8.9         | 11.2        | 13.1        | 14.1        |

\* The entire housing space available in 1980 was 3572 million m<sup>2</sup>, in 1985--4071 million m<sup>2</sup>; on the average each resident had respectively 13.4 m<sup>2</sup> and 14.6 m<sup>2</sup>.

The rural housing space available in 1980 was 1370 million m<sup>2</sup>, in 1985--1510 million m<sup>2</sup>; on the average per resident it was respectively 13.9 m<sup>2</sup> and 15.6 m<sup>2</sup>.

Table 9. National Education and Culture

| <u>Educational, cultural items</u>                                                                               | <u>1913 or<br/>nearest<br/>published<br/>year</u> | <u>1940</u> | <u>1960</u> | <u>1970</u> | <u>1980</u> | <u>1985</u> |
|------------------------------------------------------------------------------------------------------------------|---------------------------------------------------|-------------|-------------|-------------|-------------|-------------|
| Total number of students,<br>in million persons . . . . .                                                        | 10.6                                              | 47.6        | 52.7        | 79.6        | 100.2       | 108.6       |
| Number of children in per-<br>manent preschool institutions<br>(at end of year), in million<br>persons . . . . . | 0.005                                             | 2.0         | 4.4         | 9.3         | 14.3        | 16.1        |
| Percent of number of children<br>of appropriate age . . . . .                                                    | -                                                 | -           | 13          | 37          | 54          | 58          |
| Number of public libraries<br>(at end of year), in thous.                                                        | 14                                                | 95          | 136         | 128         | 132         | 134         |
| Books, magazines in them,<br>in million copies                                                                   | 9                                                 | 200         | 883         | 1363        | 1824        | 2101        |
| Number of club institutions<br>(at end of year), in thous.                                                       | 0.2                                               | 118         | 129         | 134         | 138         | 138         |
| Number of movie projectors<br>(at end of year), in thous.                                                        | 1.5                                               | 28          | 103         | 157         | 153         | 152         |
| Number of movie showings,<br>in millions . . . . .                                                               | 106                                               | 900         | 3611        | 4652        | 4259        | 4100        |
| Number of theater visitors,<br>in millions . . . . .                                                             | 13                                                | 84          | 91          | 111         | 120         | 125         |
| Number of museum visitors,<br>in millions . . . . .                                                              | 5                                                 | 34          | 50          | 103         | 156         | 186         |
| Circulation of books and<br>pamphlets, in million copies                                                         | 99                                                | 462         | 1240        | 1362        | 1760        | 2151        |
| Single-copy circulation of<br>newspapers, in million copies                                                      | 3                                                 | 38          | 69          | 141         | 176         | 190         |
| Yearly circulation of maga-<br>zines and other periodical<br>publications, in million<br>copies . . . . .        | 117                                               | 245         | 779         | 2622        | 3226        | 3447        |

Table 10. Number of Persons who Have Received Higher and Secondary (General and Specialized) Education (in thousand persons)

| <u>Year</u>                 | <u>Number of persons who have received higher education</u> | <u>Number of persons who have received secondary (general and specialized) education</u> |
|-----------------------------|-------------------------------------------------------------|------------------------------------------------------------------------------------------|
| Total for 1918-1985 . . . . | 20,688                                                      | 111,865                                                                                  |
| 1940 . . . . .              | 126                                                         | 540                                                                                      |
| 1960 . . . . .              | 343                                                         | 1,263                                                                                    |
| 1970 . . . . .              | 631                                                         | 3,207                                                                                    |
| 1980 . . . . .              | 817                                                         | 5,069                                                                                    |
| 1985 . . . . .              | 859                                                         | 4,426                                                                                    |

The 27th CPSU Congress set a goal of creating a unified system of continuous education. With a view to this, a reform of the general education and vocational schools is being consistently carried out. The need to reorganize higher and secondary specialized education and to improve the system of training specialists and using them in production has been determined. Organization of qualification improvement and additional training for workers and specialists will be carried out in accordance with today's requirements.

Table 12. Housing Construction (in million m<sup>2</sup> of total (useful) area)

| <u>Year</u>    | <u>Total constructed</u> | <u>Including:</u>                                                                      |                                                                               |                     |
|----------------|--------------------------|----------------------------------------------------------------------------------------|-------------------------------------------------------------------------------|---------------------|
|                |                          | <u>By state and cooperative enterprises and organizations and housing cooperatives</u> | <u>By the population at their own expense and with the aid of state loans</u> | <u>By kolkhozes</u> |
| 1940 . . . . . | 24.5                     | 9.6                                                                                    | 14.9                                                                          | -                   |
| 1960 . . . . . | 109.6                    | 55.8                                                                                   | 53.8                                                                          | -                   |
| 1970 . . . . . | 106.0                    | 76.6                                                                                   | 26.7                                                                          | 2.7                 |
| 1980 . . . . . | 105.0                    | 84.0                                                                                   | 16.1                                                                          | 4.9                 |
| 1985 . . . . . | 113.0                    | 88.6                                                                                   | 16.3                                                                          | 8.1                 |

In 1918-1985 the housing put into operation constituted 4060 million m<sup>2</sup> of total area, including 2489 million m<sup>2</sup> by state and cooperative enterprises and organizations and housing cooperatives.

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# Social Security, Social Insurance

Moscow VESTNIK STATISTIKI in Russian No 1, Jan 87 p 80

[Statistical materials on expenditures for social security and social insurance]

[Excerpts] Expenditures for Social Security and Social Insurance (in millions of rubles)

| <u>Expenditures</u>                                                                                                                             | <u>1975</u> | <u>1980</u> | <u>1981</u> | <u>1982</u> | <u>1983</u> | <u>1984</u> | <u>1985</u> |
|-------------------------------------------------------------------------------------------------------------------------------------------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|
| Expenditures for social security and social insurance--total                                                                                    | 34,634      | 45,628      | 48,256      | 51,319      | 54,847      | 58,102      | 61,042      |
| Including:                                                                                                                                      |             |             |             |             |             |             |             |
| pensions . . . . .                                                                                                                              | 24,441      | 33,323      | 35,447      | 37,790      | 39,956      | 42,204      | 44,934      |
| allowances . . . . .                                                                                                                            | 9,228       | 10,956      | 11,297      | 11,878      | 13,286      | 14,242      | 14,427      |
| Of them:                                                                                                                                        |             |             |             |             |             |             |             |
| for temporary disability . . . . .                                                                                                              | 5,240       | 6,707       | 6,928       | 6,745       | 6,986       | 7,477       | 7,375       |
| for pregnancy and confinement, at childbirth and for care of a child up to one year . . . . .                                                   | 1,369       | 1,628       | 1,726       | 2,201       | 3,303       | 3,699       | 3,829       |
| for mothers with many children and unwed mothers                                                                                                | 389         | 311         | 305         | 509         | 545         | 566         | 592         |
| for children in families poorly provided for                                                                                                    | 1,219       | 1,082       | 1,038       | 1,007       | 986         | 985         | 1,007       |
| other allowances (lump sum assistance, allowances for burial, etc.) . . . . .                                                                   | 1,011       | 1,228       | 1,300       | 1,416       | 1,466       | 1,515       | 1,624       |
| other types of social security (maintenance of homes for extremely old people and invalids, expenditures for prosthesis supply, etc.) . . . . . | 965         | 1,349       | 1,512       | 1,651       | 1,605       | 1,656       | 1,681       |

Expenditures for national education, social security and social insurance are made mainly by means of funds from the state budget, as well as from state, cooperative, trade union and other public enterprises and organizations and kolkhozes. In 1985, funds from the state budget constituted about 90% of all the expenditures for education and social security.

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## CSA STATISTICS ON MARRIAGE, DIVORCE

Moscow VESTNIK STATISTIKI in Russian No 1, Jan 87 pp 50-68

[Section of article under the rubric, "To Assist the Canvasser and Propagandist": "From Materials of Press Releases of the USSR Central Statistical Administration"]

[Excerpt] With a view to providing the reader with broader and more practical information, beginning with this issue of the journal, under the rubric, "To Assist the Canvasser and Propagandist," a section, "From Materials of Press Releases of the USSR Central Statistical Administration," will be singled out, in which materials on the country's economic and social development will be published regularly.

### 1. Marriages and Divorces in the USSR

#### Number of Registered Marriages

| <u>Unit</u>          | <u>1970</u> | <u>1975</u> | <u>1980</u> | <u>1985</u> | <u>1986</u><br>(estimate) |
|----------------------|-------------|-------------|-------------|-------------|---------------------------|
| Thousand             | 2365        | 2723        | 2725        | 2718        | 2727                      |
| Per 1000 inhabitants | 9.7         | 10.7        | 10.3        | 9.8         | 9.8                       |

The number of families in the USSR is over 70 million. Every year there are over 2.7 million newly married couples. The absolute majority of men and women marry. According to the data from a socio-demographic survey in 1985, in the USSR only 2.6% of the men and 3.5% of the women between the ages of 45-49 have never married.

There is a clearly marked tendency in the country toward the rejuvenation of marriages: at present over 80% of the women and about 70% of the men from the young generations marry for the first time by the age of 25, while 20 years ago 70% of the women and 60% of the men married by this age. This indicator varies considerably according to the territory of the country: for example, for women in the republics of Central Asia it is 85-92%, in the RSFSR, the Ukraine and Belorussia--80-82%, in the Baltic republics--76-80% and in the Trans-Caucasus--68-74%.

If the existing levels for the death and divorce rate are maintained, 52.3% of the married couples can reach the "silver" wedding anniversary and 17.1%--the "golden."

Number of Registered Divorces in the USSR

| <u>Unit</u>          | <u>1970</u> | <u>1975</u> | <u>1980</u> | <u>1985</u> | <u>1986</u><br><u>(estimate)</u> |
|----------------------|-------------|-------------|-------------|-------------|----------------------------------|
| Thousand             | 636         | 783         | 930         | 933         | 943                              |
| Per 1000 inhabitants | 2.6         | 3.1         | 3.5         | 3.4         | 3.4                              |

Recently the divorce rate for married couples in the country has been 1.4% per year.

Over 700,000 children under the age of 18 are left without one of the parents each year as the result of divorce.

Men have a much greater chance of marrying a second time: over 50% of the men and only 25% of the women enter into a new marriage 10 years after divorce or being widowed. Second marriages break up, on the average, 75% more often than first marriages.

2. Number of Specialists With Higher and Secondary Specialized Education  
Employed in the National Economy (according to data from one-time recording on 15 November)

| <u>Year</u>               | total, in<br>million<br>persons | <u>including</u>                 |                                                     |
|---------------------------|---------------------------------|----------------------------------|-----------------------------------------------------|
|                           |                                 | <u>with higher<br/>education</u> | <u>with secondary<br/>specialized<br/>education</u> |
| 1970 . . . . .            | 16.8                            | 6.8                              | 10.0                                                |
| 1975 . . . . .            | 22.8                            | 9.5                              | 13.3                                                |
| 1980 . . . . .            | 28.6                            | 12.1                             | 16.5                                                |
| 1985 . . . . .            | 33.6                            | 14.5                             | 19.1                                                |
| 1986 (estimate) . . . . . | 35                              | 15                               | 20                                                  |

At present every fourth person employed in the national economy has a higher or secondary specialized education. The proportion for women is 60% of the total number of specialists with diplomas. Over half the specialists are employed in the production sectors of the national economy.

The relative proportion of specialists with higher and secondary specialized education is, among the directors of enterprises, institutions and organizations--92%; directors of divisions, departments, bureaus, sectors and groups--95%; chiefs of shops, shifts, sections, administrative departments and farms--74%; foremen and work superintendents--83%.

Along with the increase in the number of specialists holding diplomas, there continue to be essential shortcomings in utilizing them. About 4 million of them are working in positions that do not require this level of training. Out of 500,000 specialists with higher qualifications, 32% are working as personnel drawing higher earnings, 24% are working with their specialty not corresponding to the specialization of the enterprise, and 9% find a lack of appropriate vacancies.

At the same time, over 4 million positions of directors and specialists are occupied by persons who do not have specialized education. The proportion of them is higher than the average for the national economy in communications enterprises and procurement organizations and in housing and municipal services and everyday services.

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## LABOR

### LEGISLATION INVOLVING PRIVATE LABOR ACTIVITY CLARIFIED

Moscow POLITICHESKOYE SAMOOBRAZOVANIYE in Russian No 2, Feb 87 pp 28-36

[Article by A. Shokin, candidate of economic sciences: "Private Labor Activity: Problems and Prospects"]

[Text] The CPSU sees the loftiest meaning of acceleration in the country's socioeconomic development in steadily improving the well-being of the people, improving all aspects of their life, and creating favorable conditions for the harmonious development of the individual. The party is striving for a situation in which in a short time Soviet people will have felt the results of the common efforts to find cardinal solutions to the food problem and meet demand for high-quality goods and services. A major role in this will, of course, be played by state and cooperative production of goods and services. At the same time, private labor activity can become a significant supplement and help in this.

The Central Committee Political Report to the 27th CPSU Congress emphasized that "...while putting a stop to unearned incomes no shadow must fall on those who obtain additional income by their honest labor. Moreover, the state will help to develop various forms for satisfying consumer demand and providing services. It is necessary to look carefully at proposals dealing with bringing order to private labor activity." Realization of this congress line to discriminate between unearned incomes and legitimate additional income has been embodied as follows: subsequent to the party and state documents on intensifying the struggle against unearned incomes (Footnote 1) (For further detail on the content of those documents see V. Abolentsev and A. Pavlov. "The Struggle against Unearned Incomes: an Important Matter for Everyone," in POLITICHESKOYE SAMOOBRAZOVANIYE No 8 1986) the USSR Law "On Private Labor Activity" was adopted at a session of the USSR Supreme Soviet in November 1986. As is known, the USSR Constitution permits this kind of activity. The purpose of the new law is to create the actual legal, organizational and socioeconomic mechanisms for the functioning and development of this activity in conformity with the principles of socialist management and distribution.

We shall deal with some of the issues connected with the essential meaning of private labor activity and its place in our socioeconomic life, and the problems to which it may give rise and the prospects for its development.

What Is Private Labor Activity [PLA] and How Does It Differ from Other Kinds of Labor Activity?

First of all, it is of an individual nature in the sense that it is not associated with the labor relations between citizens and state, cooperative and other social enterprises, establishments and organizations, nor with internal kolkhoz labor relations.

Furthermore, PLA is distinguished from labor having to do with working for oneself in a domestic situation, and from private subsidiary farming aimed at consumption within the family in that it is associated with obtaining income, the marketing of goods and the provision of paid services for other citizens. We emphasize that given this, it should be of a socially useful nature and it should not be related to any kind of activity involving the acquisition of illegal unearned income. It is of fundamental importance that PLA excludes the possibility of involving hired labor based exclusively on the personal labor of citizens and members of their families.

What Are the Main Spheres and Kinds of Private Labor Activity?

Article 17 of the USSR Constitution, the Law on Private Labor Activity, and material from the USSR Supreme Soviet session at which the law was adopted, make it possible to distinguish the main spheres within whose framework PLA may be carried on.

First there is the sphere of agriculture. As is known, part of the population engages in private subsidiary farming on the land, and also engages in amateur horticulture and truck farming. These pursuits may be qualified as PLA only if the produce from private subsidiary farming, orchards and kitchen gardens is sold at market and is commercial in nature. Why has this kind of PLA not directly reflected in the law being considered even though it was talked about at the USSR Supreme Soviet session? The fact is that the existing system for its regulation as determined by earlier legislation remains fully in force and no additional decisions on this occupation are required.

Another kind of PLA is the handicraft-and-repair trades and the fabrication of articles for sale. Popular artistic crafts are also included in this sphere of PLA. In the services sphere the main kinds of PLA are the following: providing paid personal services to the public, and also providing paid sociocultural services. PLA covers the production of an extensive range of goods and a wide range of services.

Before adoption of this law individual kinds of PLA were entirely omitted not only from legislative acts but even normativ documents and provisions, and this created certain obstacles of an organizational and psychological nature both for citizens desirous of engaging in PLA and for the local authorities ("If it is not permitted then it is prohibited"). Some kinds of similar activities that are useful for society and promote better satisfaction of consumer demand for goods and services fell into the category of prohibited activities. The law on private labor activity provides for the abolition of all unjustified restrictions on engaging in socially useful kinds of PLA. It provides a substantial list (more than 30 categories) of trades and services

that can be engaged in as PLA. The kinds of PLA now permitted include, in particular, activities such as repair and servicing for automobiles and other means of transport, transport services for citizens by owners of private vehicles, and the provision of hairdressing and beauty-parlor services. Reviews by the ispolkoms of the local soviets of people's deputies will resolve the question of granting permission for kinds of PLA such as baking cookies and other bakery items, the preparation of traditional national dishes, family leases on cafes and so forth (we mention only some of the kinds of trades and services in which the advisability of engaging has been repeatedly discussed in the press).

We note that as pointed out in the law on private labor activity, its scope does not cover citizens' creative activity in the sphere of science, technology, literature and the arts, nor doing one-of-a-kind paid work, nor work that is insignificant in terms of payment.

#### Why Do People Want To Engage in Private Labor Activity?

To answer this question we must start with an analysis of the economic motives prompting a person to "earn a little extra" in the sphere of PLA. There are sufficient grounds for thinking that most of those engaged in PLA do it not out of greed or money-grubbing (although there are people with such motives) but because of the quite understandable desire to insure for their own life and their own family the consumer standards established in society.

This is confirmed by research figures. Thus, according to one study, in the families of 45 percent of seasonal workers the average monthly money income per family member would not exceed R50 without the seasonal work, while for 69 percent it would not exceed R75 and for 87 percent, R100. The desire to earn more was the main motive for seasonal migration among 96 percent of those polled. The clear-cut consumer thrust of extra income earned by seasonal workers is also typical. One in three of them intends to save money to build a house at his permanent place of residence, one of five saves to buy a car, and one in eight to buy furniture; and so forth.

The incentive to PLA occurs most often when the opportunities for increasing income in the main work place are limited. Wage leveling, not taking into account in wages the results and the complexity of the labor, the notorious wage "ceiling" and other defects in implementation of the principle of distribution according to labor sometimes give rise to the "overflow" of labor activity beyond the confines of socially organized production. Work in the sphere of PLA (including on the principle of holding down a second job) makes it possible under these conditions to maintain a high level of labor activity among those workers who do not realize this activity to the full in social production.

It should be noted that work in the sphere of PLA attracts people not only through its opportunities to improve material well-being. It sometimes happens that this work creates conditions in which an individual can realize his creative aspirations. For it is a well-known fact that not all workers, employees and kolkhoz farmers can fully reveal their capabilities and talents at their official work place. And for many of them it is not simply a "hobby"

but a secondary labor occupation that becomes their form of self-expression; in this there is no division of labor and a person himself is the executor, organizer and inventor.

Is Socialist Society Interested in the Development of Private Labor Activity?

Undoubtedly. It is interested because people's improved well-being insured by this activity and realization of the creative needs of the individual (mentioned above) correspond to the social aims of socialism.

At the same time this activity is an important factor in resolving the task of satisfying more fully consumer demand for various kinds of goods and services. For example, in the total volume of personal services offered the urban population, according to the economists, PLA accounts for 50 percent of shoe repairs, 45 percent of repairs to apartments, 40 percent of repairs to cars, and 30 percent of repairs to domestic appliances. In the countryside PLA reaches as high as 80 percent for personal services. In the total volume of commercial production in agriculture, according to the figures for 1985 private subsidiary farming accounts for 41 percent of potatoes, 14 percent of vegetables and 13 percent of meat.

In addition to reducing the shortages of goods and services, the development of PLA helps to increase the level of employment in the population through socially useful labor.

Special importance attaches to labor in the sphere of PLA by those citizens who for a number of reasons are unable to be involved in labor activity at state or cooperative enterprises (pensioners, persons with limited work capacity, homemakers, students). These make up a large number of people (for there are more than 55 million pensioners in our country and more than 5 million students). The number of people for whom PLA has already become or may become a form of secondary employment, that is, work outside the main work day in state, cooperative or other social enterprises, establishments and organizations, is large.

Thus, judging from the actual time spent by the public on tending private subsidiary farming plots (we have 34 million), on an average annual basis something on the order of 20 million workers are engaged in this occupation. If we take into account the fact that about half the output from these plots is commercial and sold in the market, then at least 10 million workers, on an annual average, could qualify as being engaged in PLA. A quite numerous contingent is also engaged in PLA in the personal services sphere. According to present assessments, from 1.7 million to 2.0 million people offer personal services on a private basis (compared with 2.8 workers in socially organized personal services).

This means that the problem of regulating PLA affects quite a large category of the population. Until recently, however, engaging in PLA without permission, registration or payment of taxes was a mass phenomenon. People engaging in PLA had no clearly defined status and there was confusion about whether only those engaged exclusively in this kind of labor should be classified under PLA or whether this contingent could be enlarged.

The law on private labor activity has established a range of persons permitted to engage in this activity. This right is afforded to adult citizens employed in social production in free time away from their main work, homemakers, invalids, pensioners and students. PLA may be done by citizens with the involvement of those family members living with them (spouses, parents, other relations and dependants who have attained the age of 16).

Thus, engaging in PLA can be qualified mainly as an individual secondary job. This status for PLA is very important from the standpoint of the interests of social production: engaging in PLA as a "second job" (this also applies to students) or as the main work for people whose nonparticipation in social production results from objective reasons, should not lead to an outflow of labor resources into the sphere of PLA.

The following is often asked: Will Not PLA Be Developed to the Detriment of the State and Cooperative Sectors of the Economy?

In order to prevent such detriment the law on private labor activity provides for measures to regulate and control it. At the same time PLA will not be developed in isolation but under the conditions now prevailing in the restructuring of the economic mechanism, which, in particular, is aimed at enhancing the prestige of honest, highly productive labor in socially organized production. And this is leading to an equalizing of opportunities for increased wages at state and cooperative enterprises and in the sphere of PLA through consistent realization of the principle of distribution according to the amount, quality and socially recognized results of labor. It is precisely the real opportunity for many to earn more at their own work place that, it seems to us, will make it possible to balance the spheres for the input of labor and will hold back any flood of labor activity into the sphere of PLA. Moreover, the entire economic mechanism is being reoriented away from the "diktat of the producer" toward the "diktat of the consumer" and his requirements and needs.

Definite shifts have already been made in this direction, and are still being made. From 1987 a start will be made on carrying out a reform of wages in the production sphere and on actively restructuring the economic mechanism in the agro-industrial complex, construction, light industry and consumer services. All this will make it possible to consider that the development of PLA will truly be a help and a supplement to the social sector of the economy and not at all a factor that diverts society's labor and resource potentials.

Of course, a certain contradiction does exist between PLA and the socially organized production of goods and services. But this dialectic contradiction is a source for progressive development, because thanks to the more attentive attitude toward the consumer and to better-quality goods and services, people engaged in PLA are now emerging as serious competitors to enterprises in light industry, agriculture, personal services, and social and cultural services. And it is thought that this will prompt the latter to turn more rapidly to the consumer and to react more flexibly and immediately to his needs and to fashion, and thus may serve as a unique accelerator for transformations in the economic mechanism in general.

We see that PLA is capable of being very useful to society. Why is public opinion divided in its assessment of private labor activity?

It is no secret that along with the positive assessments, some part of the population also has a negative attitude toward this activity. In our view, the main reason for this is that in the sphere of PLA there has been a spread in the illegal use of social resources. It is a question of using stolen raw materials, materials, spare parts, and state or kolkhoz transport and equipment for personal gain and so forth.

The negative attitude toward this activity comes about not least because incomes from it sometimes exceed, and exceed significantly, the level of income from labor activity at state enterprises and kolkhozes. This offers a reason for condemnation by part of the population of persons engaged in PLA (hence the reason for hanging on them the tag of "privateers," "undertakers," "lefties," "part-timers," "businessmen" and so forth). As is known, when it was decided to intensify the struggle against unearned incomes, exaggerations were permitted in some places. In one place, for example, incomes from private subsidiary farming were unjustifiably categorized as illegal and unearned. Proposals were made to limit "excessively" high incomes by the "privateers," and even to ban their activities.

The law on private labor activity has confirmed the right to the existence of private production for the market. In light of this law the answer to the question becomes clear, namely: is the income formed in the sphere of PLA labor income or unearned income? From the legal standpoint, income derived from PLA is earned income if this activity really is private labor and is conducted within the framework of the law. Here, the preamble to the law states that PLA is used to provide citizens with an opportunity to obtain supplemental incomes in line with their own labor input.

From the legal standpoint unearned income is primarily income from criminal, illegal activities (speculation, bribe-taking, theft and so forth). In this sense it also includes incomes derived from prohibited trades (for example, the manufacture of drugs, presses, copying machines and weapons, running gambling houses and so forth). Incomes derived from permitted trades but carried on illegally in violation of the law (for example, in violation of the conditions of employment in a craft shop, evading taxes and so forth) will also be deemed unearned.

The economic aspect of the question of the nature of incomes from PLA requires a more thorough examination, taking into account the fact that it differs significantly from the legal aspect. The fact is that incomes in the sphere of PLA are formed in a different way from those in the state and cooperative sectors of the economy. Calculated against exactly the same labor inputs they are noticeably higher. There are a number of reasons for this. Let us consider the most important of them.

Activity taking place outside the public sector of the economic is filling the "vacuum" formed either because of the time lag in organizing the production of particular kinds of goods or services, or as the result of the economic

unsuitability of producing certain kinds of output at large enterprises. Because of this a very favorable situation is created for PLA in terms of the balance between supply and demand, and therefore a special mechanism is formed here for pricing the output produced. The conditions in which this mechanism operates are such that as a rule prices are formed at a level significantly higher than that needed to cover labor inputs.

The possibility that this situation will exist for a long time is determined by the fact that state and cooperative production is not fully keeping pace with the growing consumer demand for high-quality goods and services. Working to cover this shortage, people engaged in PLA take advantage of the favorable balance created for them between supply and demand in order to raise prices.

In addition, a differential rent accumulates in private subsidiary farming. What is meant by this is the possibility of appropriating the additional income accruing because of the differences in natural fertility in plots of land used privately by citizens. For those now owning private subsidiary plots the differential rent is in practice not removed. The agricultural tax designed to fulfill this function averages R10 to R15 per plot. It is understandable that given the marked differentiation in the rates in the different regions of the country this tax can make no real difference to the income potential of the plot. As a result the differential rent makes up part income for the owners of particularly fertile plots located in favorable positions, while at the same time, according to the logic of the economic laws this should be income for the state, which, since it is the owner of the land, should be the owner of the rent.

Finally, there is another circumstance that should not be forgotten. Even if the results of labor obtained within the framework of PLA are sold at prices the same as for similar goods produced by the state or by a kolkhoz, and even if in the sphere of PLA labor productivity is lower than in socially organized production, private activity can still produce a higher income. This is explained by the fact that the structure of costs and the distribution of income are different in the sphere of PLA. For example, there are no management costs or social costs as there are at state and cooperative enterprises.

As a result of the action of all these factors PLA is a kind of activity that is capable of producing incomes that are significantly higher in comparison with socially organized production.

The following is often asked: could this situation be a basis for imposing penalties on persons engaging in PLA in the same way that they are imposed on persons earning excessively high incomes (which is often associated with unearned incomes)? In answering this question it must be noted that in contrast to illegal unearned incomes that are the result of illegal activity on the part of those who receive them, the higher incomes of persons engaged in PLA on a legal foundation are primarily the result of defects in the regulation of particular socioeconomic processes and shortcomings in the economic mechanism. Accordingly, in most cases they cannot be imposed on the persons receiving these high incomes, and it is impermissible to employ "measures" against them merely because they enjoy a high income. It is

another matter, from the standpoint of the principle of the socialist distribution according to labor, when a specific part of the income derived by persons engaging in PLA may be considered unjustified and not in line with labor input, and in this sense it is unearned income. First, however, it is a question here only of a certain part of income, and second, the mechanism by which this part is formed is a socioeconomic mechanism, and therefore measures to regulate in the sphere of PLA should be aimed primarily at eliminating the socioeconomic causes that give rise to the special and advantageous position of people engaged in PLA and to the unjustified redistribution in their favor of part of the income of other population groups.

But even the elimination of these causes will not mean that income from PLA will equal the average wage in the national economy or even in its leading sectors. The argument is made that receipts from PLA can be higher than incomes from the public sector and that this is economically justified.

This kind of argument can be considered primarily from the higher labor intensity in the sphere of PLA, which together with other factors such as improved quality and extra convenience for the client and so forth leads to a higher evaluation of the labor of person engaged in PLA.

Take, for example, the incomes of workers in the seasonal construction brigades. It is common knowledge that they may amount to R800 or more each month. However, it is essential to take into account the fact that these workers are highly skilled and are able to do three or four different jobs and do different kinds of work. The average length of the working day among the seasonal workers is 14 hours and, moreover, they usually work without days off and virtually nonstop. This means that in the seasonal brigades the intensity of work is considerably greater than among workers in state and cooperative enterprises and organizations.

Summing up all these special features of the workers in the seasonal construction brigades, we can conclude that a wage on the order of R800 is quite compatible with the wages of a highly skilled construction worker in a state or interkolkhoz construction organization (which come to about R300 a month).

Income from PLA can also be higher than the wages of a skilled worker because a person engaged in this activity must operate under conditions of greater economic risk and has additional costs in organizing production (the purchase of raw materials, equipment and so forth) and the marketing of his finished output.

The socioeconomic mechanisms regulating mutual relations between this sphere and the state should take into account these special features in the formation of incomes in the sphere of PLA.

On the one hand, the goal is set of not permitting unjustifiably high incomes from engaging in PLA. On the other, it is important not to allow incentive to this kind of activity to be undermined so that activity in the sphere of PLA becomes unprofitable or even ruinous. In and of itself state encouragement of PLA and the greater number of people engaged in it will probably promote

resolution of these tasks because healthy competition within the sphere of PLA operating in favor of the consumer and the greater supply of goods and services should lead to price reductions and perhaps to fewer opportunities for obtaining "superincomes" because of a "monopoly" position in the market. Among the mechanisms designed specially to regulate mutual relations between PLA and the state we should first of all mention the tax system for persons engaged in PLA. This is designed to insure that those engaged in PLA are involved in the funding for national expenditures and also to stimulate the kinds of PLA that society most needs (this can be promoted through tax rates differentiated by various kinds of activity). Finally, this system should make the situation with activity in the sphere of PLA such that incentives for work in social production do not lose ground. In the opinion of the specialists, the tax system for PLA needs improvement. Let us consider one way to do this.

While regarding as correct the idea of a differentiated tax policy as applied to PLA, at the same time we suggest that it would be advisable to retain the existing differences in the taxation of people engaged in trade and handicraft activities and "private practice" (the latter would have a higher rate on income tax and it would be progressive to a greater extent). There are hardly any serious arguments that the goods and personal services offered by craftsmen are now more essential for society than the services of dentists and orthopedic surgeons, or nurses or masseurs, or people employed in various kinds of teaching and coaching activities.

What Measures Are Envisaged in the New Law To Prevent Unearned Incomes in the Sphere of Private Labor Activity?

Until recently resources obtained by illegal means were frequently enjoyed in the process of PLA. As a result, the incomes of persons engaged in PLA could include elements of illegal unearned incomes. Economic-legal studies even included a special division--the determination of work within the PLA framework likely to give rise to crime. For example, expenditures to run private subsidiary farming plots may be compared with the resources obtained by these farming undertakings through socially acceptable channels. As a result an assessment is made of the resources that are put into circulation by the owners of private subsidiary plots in evasion of the law. Similar assessments can be made for construction materials used to build dachas, garages, garden houses and country homes, make repairs on apartments and so forth.

A situation sometimes develops in which encouraging private farming and private building in orchards and truck gardens while providing inadequate fodder or construction materials or capacities from the construction organizations and so forth simultaneously becomes encouragement to engage in illegal "entrepreneurship." In order to prevent this the law provides that the ispolkoms of local soviets of people's deputies and enterprises, establishments and organizations should provide help for citizens engaging in PLA to acquire raw materials, materials and other property, and also to market the output that they produce. Gosstab and its territorial organs the union republic councils of ministers have been assigned the task of providing the necessary material-technical resources for citizens engaging in PLA.

Yet another way to remove the causes promoting the emergence of elements of unearned income in the sphere of PLA is the legal status of persons engaging in this activity. The law defines precisely the rights and obligations of citizens engaging in PLA. Citizens expressing a desire to engage in PLA must obtain permission from the ispolkom of the soviet of people's deputies at the place of their permanent residence, and before starting this activity they must obtain a registered certificate or acquire a license from the local financial organ.

The legal status of persons engaging in PLA also assumes a definite safeguarding of their rights so that regulation of this activity does not depend on conjunctural considerations or parochial interests. The law provides that any decision to refuse permission to engage in PLA can be appealed in the executive committee of a higher soviet of people's deputies, the Council of Ministers of an autonomous republic and the councils of ministers of union republics not having oblast divisions. The authorities (at the level of oblast, kray, autonomous republic and union republic not having oblast divisions) have the right to draw up a list of kinds of PLA for which permission is not required.

The law points out that citizens engaging in PLA are obliged to observe the procedure established for such activity, and the rights and legitimate interests of purchasers, clients and other persons, and to insure that the goods they produce and the services they offer are of the proper quality.

It has been established that citizens engaging in PLA from which under existing legislation incomes are subject to tax are obliged to account for all incomes and expenditures made during that activity and to submit a declaration of income received to the financial department of the executive committee of the local soviet of people's deputies at their place of residence. The amounts of taxes imposed on incomes from PLA are established as a function of total incomes obtained and with due consideration of the public interests. Citizens who have licenses to engage in PLA are excused from paying income tax from income derived from that particular kind of activity because they pay an annual fee for the license.

The law provides for strict monitoring by the executive committees of the local soviets, financial organs and organs of internal affairs to insure compliance with the procedure established for engaging in PLA. Violation of this procedure entails a prohibition to engage in such activity. All incomes derived from PLA in violation of the law are subject to confiscation by the state.

In conclusion we must touch on a question that nearly always comes up when discussing the problem of PLA, namely, does this not mean that encouraging and providing incentive for this activity will give rise to elements of "private entrepreneurship" in our country? In our view there are sufficient arguments to reply to this question in the negative. Let us cite the main ones. First, no matter how the sphere of PLA may develop the absolute predominance of state and cooperative forms of ownership will be retained as the main sources for satisfying the varied and constantly growing demands of the population. PLA

can act only as an auxiliary form in the production of goods and services. Second, as already noted, PLA is based on personal labor participation and it excludes exploitation of hired labor. Third, regulation of incomes from PLA is aimed at observance in this sphere of the basic principle of socialism--"from each according to his abilities, to each according to his labor." Fourth, since PLA will as a rule be conducted on the principles of secondary employment, the persons engaging in it will still maintain a direct link with social production. Fifth and last, the law provides for various forms of cooperation between persons engaged in PLA and their contractual relations with state, cooperative and other public enterprises, establishments and organizations; which may be regarded as a definite degree of socialization in PLA.

Therefore, the measures implemented to expand PLA do not signify a return to any kind of private entrepreneurial activity whatsoever, and the inventions on this score by certain bourgeois politicians and Sovietologists have no basis at all.

At the same time it must be borne in mind that the development of PLA can give rise to other problems. Experience gained in other socialist countries where a private sector of the economy functions (Hungary, the GDR, Bulgaria) shows that along with the positive results there may also be negative trends. Thus, labor activeness and labor discipline in social production falls among some workers engaged in PLA as a second job. The pursuit of additional wages leads to rapid exhaustion of the work force because for some people the length of the work week goes beyond their physiological capabilities. Incentive for professional growth and improved skills at the main work place declines. Negative trends of a social and moral kind also develop: manifestations of individualism and the petty-bourgeois psychology are intensified.

This is why the regulation of PLA in a way that will fit it organically into the system of public production is being combined with the principles of socialist management--a far from simple matter that requires energetic and agreed measures of an economic, organizational, legal and indoctrinational nature. Adoption of the Law on Private Labor Activity, which comes into force with effect from 1 May 1987, is only the start of this complicated work.

The effect will, however, undoubtedly be worth the effort: the demands of Soviet people for goods and services will be more fully satisfied, the labor activeness of the masses will grow, and the sphere in which economic management methods operate will grow.

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## LABOR

### RESTRUCTURING OF MANPOWER IN BSSR RAILROADS

Moscow SOTSIALISTICHESKIY TRUD in Russian No 2, Feb 87 pp 53-56

[Article by V. Bachilo, deputy chairman of BSSR Goskomtrud [State Committee for Labor and Social Problems]: "Finding Jobs for Released Workers"]

[Text] The raising of the standard of living of the Soviet nation has always been in the center of our party's socioeconomic policy. This very important task until recently was resolved basically at the expense of state budget funds, and this did not always encourage the enterprises and organizations, or the labor collectives, to seek internal reserves for increasing labor productivity.

The situation is different nowadays. At the 27th CPSU Congress it was emphasized that the funds for increasing the wage and salary rates must be chiefly earned by the labor collectives as a result of the increase in production, an increase in its effectiveness, the mobilization of internal reserves, and the improvement of the organization of labor and the norms established for it. The improvement of the economic mechanism and the expansion of the rights granted to the associations and enterprises create the conditions for attaining this goal.

As has been shown by the experience of the Belorussian railroad workers, the increasing of labor effectiveness on the basis of the new conditions for paying for that labor is connected to a considerable extent with the freeing of workers and their redistribution. For this purpose the Belorussian Railroad has implemented a number of socioeconomic and technical-organizational measures that made it possible to reduce the personnel needs at enterprises and services, to regroup the workers, to raise their proficiency level, and to retrain them in other occupations and specialties. By 1 November 1986, 13,200 persons, or 13 percent of the total number of persons employed, were released. Of them, 5344 persons (40.4 percent) retired on pension, 5149 persons (39 percent) transferred to other branches of the national economy, 1107 persons (8.3 percent) were transferred from the basic activity to other types or to jobs in other enterprises in railroad transport which did not involve the basic type of activity; and 283 persons (2.4 percent) were transferred to vacant positions.

As early as 1984 the decision had been made to reduce the acceptance of people from the outside to fill vacancies, and as a result the total number of personnel on the railroad dropped by 2589 persons as people left at their own request.

The bulk of the released workers of able-bodied age consisted of workers (80 percent); the share of specialists and employees was 18 percent; and MOP [junior service personnel] and guards, 2 percent. More than half the persons released were dismissed as a result of a reduction in forces; approximately 40 percent were transferred to jobs in other branches of the national economy; and 8 percent remained in railroad transportation in jobs that did not pertain to the basic activity.

As for the occupational and qualification structure of the persons who had been released, in the locomotive sheds they were the assistant engineers on steam, diesel, and electric locomotives, crane operators, and fitters. In the car sheds there was a reduced need for such specialties as fitters, car inspectors, car washers, cabinetmakers, stokers, milling machine operators, electric welders, lubricators, and car cleaners; and at freight terminals, acceptance specialists, conductors, controllers, equipment personnel, signal operators, personnel at the ice station, and cleaning personnel. A considerable number of the released workers worked in nonprestigious jobs, which were basically occupied by retirees.

Specialists and employees at enterprises were released basically from various laboratories. A number of occupations that had outlived their usefulness in railroad transportation were eliminated, particularly attendants at an automated crossing, workers at the ice station, freight acceptance specialists, equipment personnel, controllers, signal operators, etc.

It was very important for the reduction in staff not to affect the railroad's operation unfavorably. Therefore the number of workers was frequently reduced although vacancies that could not be eliminated remained. In this situation it was deemed to be correct to fill the vacancies by drawing on the workers who were subject to being released but who expressed a desire to learn a new occupation. For those persons, course or individual instruction was organized at the railroad technical schools and enterprises. More than 5000 persons acquired new specialties.

In order to prevent possible errors or violations when reducing the staff, special seminars dealing with questions of discharging workers or transferring them to other jobs in conformity with the legislation that is currently in effect were conducted for enterprise managers and workers in the personnel department and the labor and wage department, with the involvement of specialists from the BSSR Ministry of Justice, the courts, and the procurator's office.

On the basis of a BSSR Goskomtrud regulation, information from the enterprises concerning the number of released workers, subdivided by specialties, was reported to the labor departments of the oblast ispolkoms, which, in turn, reported that information to the rayon employment bureaus. The rayon

employment bureaus rendered assistance to the released workers in selecting a job from those that were vacant and also supplied information about vacancies to the personnel departments at the enterprises.

The local labor agencies helped approximately 5000 persons to find jobs at enterprises and organizations in rayons where they lived. It must be emphasized that the workers who had been released as a result of the conducting of the experiment continued to maintain their unbroken labor longevity, while receiving payments from the state social insurance system, as well as being paid a lump-sum compensation based on the number of years employed, if the break in work did not exceed three months, not counting the time required to move to the location of the new job. The process of finding a job at the new location has been carried out basically without any complaints or censures on the part of the workers.

The results of the economic experiment on the Belorussian Railroad indicate that it makes it possible to resolve very important tasks of the socioeconomic development of the branches of the national economy -- to accelerate the increase in labor productivity, and to create a reserve of the enterprises' own funds to raise the wage and salary rates. During the experiment, there was a saving of more than 29 million rubles of wage fund, and that made it possible to provide the necessary funds for the gradual transition of the workers to the new conditions for paying for their labor. Despite the considerable reduction in the number of workers (practically every eighth worker was reduced), all the links in the railroad's economic mechanism have been working in a stable manner. The basic volumetric and technical-economic indicators are being fulfilled successfully.

In the republic, people have become aware that, without the reinforcement of labor and production discipline, it is impossible to reach the goals that have been set. All this has required the intensification of the explanatory work in the labor collectives, and to increase the responsibility borne by the enterprise managers for the use of manpower. As a result, in 1985 the number of persons who violated labor discipline dropped, as compared with 1984, by 11.6 percent; the losses of work time as a result of absenteeism dropped by 14.3 percent; and there was a reduction by almost one-fourth in the number of authorized failures to show up at work. But, on the railroad there was a slight increase in the work-time losses connected with whole-day and intrashift idle-time periods.

It will be necessary to do a lot to achieve the further deepening of the experiment on the basis of the technical-organizational restructuring, the acceleration of the introduction of the achievements of science and technology, and the improvement of the establishment of norms for labor and the administrative structure.

The principles of the economic experiment being conducted on the Belorussian Railroad have extended to the Minsk subway. The wage and salary rates for the workers in the basic activity of the subway have been increased on the average by 25 percent, and are being introduced at the expense of the economizing of money in the wage fund as a result of the introduction of efficiency-improvement measures (without a subsidy from the budget). The persons who

have been released from the basic activity of the subway constitute 17.9 percent of the personnel.

The innovative and progressive nature of the decisions that were employed during the construction of the subway did not, in any way, remove the need to raise the level of automation for controlling the train traffic or the escalators, the functioning of various kinds of electrical equipment, or the signal system. In addition, the operations involving the current maintenance of the track and the tunnel structures are being mechanized. The implementation of the technical measures has made it possible to release 80 persons. It is planned to develop the brigade form of organizing labor and providing incentives for it on principles of cost accounting, the combining of occupations and assignments; to expand the service zones; and to introduce train traffic schedules that have been adjusted according to passenger flows, and a progressive structure and technological scheme for the maintenance of the track and the tunnel structures. All this will provide the opportunity to reduce the personnel by 130 persons.

Last year labor productivity on the subway increased, as compared with 1985, by 17.1 percent; and the average wages by 14.3 percent (with a consideration of the payments from FMP [material incentive fund], it constituted 222.9 rubles a month); in 1987 they will increase, respectively, by 50 and 22.6 percent. BSSR Goskomtrud and the Minsk subway have developed a procedure for finding jobs for workers to be released in the course of the experiment.

When the new conditions for payment of labor are introduced, the experience gained by the Belorussian Railroads and in other branches is summarized and used. A number of the republic ministries and departments, having ascertained their capabilities, have already prepared recommendations concerning the changeover to the new wage and salary rates by drawing on internal funds. They include the Belorussian Civil Aviation Administration. The new conditions for payment of labor there will be introduced in three stages, which will require the location of 3,714,000 rubles in the wage fund. Simply as a result of the implementation of the efficiency-improvement measures in 1986-1987, 7.6 percent of the workers, with a wage fund guaranteeing 44 percent of the necessary funds, will be released from the basic activity.

It is planned to reorganize the administrative structure, and also to consolidate the production links, departments, and services, while eliminating the ones that exist parallel to one another. There will be a further development of the brigade form of organizing labor and providing incentives for it, and of brigade cost accounting. As a result of the introduction of the new wage-rate and proficiency-level handbook, there will be a reconsideration of the duties pertaining to the workers' position and proficiency level, with an expansion of the sphere and list of the duties and operations to be fulfilled by them.

Considerable additional wage funds will be received from the increase in the volume of air shipments, and the combining of occupations and assignments. In order to increase the wage and salary rates, it is also planned to use part of the material incentive fund. The wage rates of the workers will be increased on the average by 16.8 percent; the salary rates of specialists, by 27.4

percent, and of employees, by 30.7 percent; and labor productivity will increase, for the administration as a whole, by 21.1 percent.

Coordinating their actions with the decisions of the republic commission on managing the economic experiment, BSSR Minavtotrans [Ministry of Motor Transport], BSSR Minsvyazi [Ministry of Communications], and Minzhilkomkhov [Ministry of Housing and Municipal Services] carried out a large amount of preparatory work. In particular, the example of the railroad workers was followed by the workers at the Grodno Oblast Motor Vehicles Administration. All the funds necessary for raising their wage and salary rates are found by implementing the intraproduction reserves.

With the changeover to the new conditions for payment of labor, it is proposed to release 7.7 percent of the workers. On the basis of the redistribution of the functions of the departments and services and the assignment duties of the specialists, it is planned to release 348 persons. By increasing the individual-output norms by an average of 10 percent, the total number of repair workers will be reduced by 112 persons, and the total number of drivers employed in technical-economic services and the driving of motor vehicles, by 157 persons, and there will be a reduction of 36 persons among the junior service personnel.

The missing funds will be found in the increase in income; a reduction of 30 percent in overtime operations; a reduction by 15-20 percent in the work-time losses; the improvement of the quality of repair and servicing of the motor vehicles; and a reduction by one-third in the involvement of drivers in repair operations. In addition it is planned to increase by 12.5 percent the individual-output norms for the drivers of trucks and taxis. As a result, the labor productivity for the Grodno Oblast Motor Vehicles Administration will increase by 10.1 percent, and the average monthly wages will increase by 7.7 percent and will constitute 213 rubles.

The USSR Council of Ministers has conducted a seminar-conference of managers of the BSSR republic ministries and departments, where it was proposed that the state of the economy at their subordinate enterprises be reanalyzed and a determination be made of measures to locate growth reserves for labor productivity and internal sources necessary for introducing the new wage and salary rates. In order to render assistance to the ministries and departments, BSSR Goskomtrud, with the participation of the Belorussian Branch of the NII [scientific research institute] of Labor, developed recommendations for preparing for the changeover to the new conditions for paying labor.

As has been shown by practical life, the branches of the republic's national economy have large reserves for the growth of production and labor productivity, and for fulfilling the plans and assignments with a smaller number of personnel, and raising the wage and salary rates of workers and employees by drawing on internal sources. The broad application of the experience gained by the Belorussian railroad workers will make it possible, under conditions of a reduction in the republic of the increase of labor expenditures, to provide manpower for the production capacities to be newly activated.

The other branches of the national economy will also change over subsequently to the new conditions of paying labor by drawing on internal sources. Special attention here must be devoted to the finding of jobs for women, and to the carrying out of explanatory work among persons of retirement and preretirement age, so that the process of their transfer to a new place of work or their going into retirement proceeds painlessly. It is important to organize the training or retraining of cadres, and to teach them other or combined occupations. It is no less important to introduce order into the involvement of manpower in operations that are not linked with the basic activity.

The chief factor today is the restructuring of the mental attitude of the managers of ministries, departments, enterprises, and organizations, their ability to organize and direct the efforts of the labor collectives and every individual worker for the active search for internal production reserves.

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RELIABILITY OF ALUMINUM ENGINES EXAMINED

Moscow AVTOMOBILNAYA PROMYSHLENNOST in Russian No 1, Jan 87 pp 9-10

[Article by E. Syrkin, candidate of technical sciences, Gorkiy Polytechnic Institute: "The Reliability of Motor Vehicle 'Aluminum' Engines"]

[Text] Decreasing the weight of a motor vehicle is one of the main modern ways to increase its technical and economic indicators -- to decrease fuel consumption and material-intensiveness and improve dynamics. In connection with this, light alloys, especially aluminum ones, are finding more and more application in the production of motor vehicles. Their use is also being expanded for the manufacturing of engine items, including the cylinder block. Engines with such blocks have been named "aluminum" ones abroad.

Such firms as Citroen, Peugeot, Porsche, Alfa Romeo, etc. have manufactured them traditionally; and several others have mastered or renewed their production during recent years (Daimler Benz, Cadillac, Ford, Audi, Toyota, etc.). A large part of the automobile firms produce both "cast iron" and "aluminum" engines. Practically speaking, only one Japanese firm, Honda, produces only "aluminum" ones. However, Volkswagen, Audi, Daimler Benz, Layland, and Porsche have planned the use of "aluminum" engines, including diesel ones, in their "automobile 2000" programs. Aluminum alloys are being widely used, in particular, for manufacturing heads, pistons, pump and filter casings, and various branch pipes in our domestic engine building.

The Zavolzhsk Motor Works imeni 50th Anniversary of the USSR has available unique experience in respect to the production of "aluminum engines." All of the engines, which are manufactured by it, have basic members, including cylinder blocks, made of aluminum alloys. The first version of a four-cylinder engine with a displacement of 2450 cubic centimeters was mastered in 1960, and a V-8 with displacements of 4250 and 5530 cubic centimeters -- in 1964. The total production of these engines had reached several million by 1986.

The list of items made of aluminum alloys, which are used in ZMZ [Zavolzhsk Engine Works], are given in Table 1. It is evident from it that the weight of aluminum engines is approximately 28 percent of the overall weight of four-cylinder and 31 percent of the overall weight of eight-cylinder engines.

Table 1.

| Item                            | Alloy | Four-Cylinder Engine |                | Eight-Cylinder Engine |                |
|---------------------------------|-------|----------------------|----------------|-----------------------|----------------|
|                                 |       | Weight,kg            | Casting Method | Weight,kg             | Casting Method |
| Cylinder block                  | AL4   | 17                   | Metal mold     | 32.5                  | Under Pressure |
| Head                            | AL4   | 9.5                  | The same       | 10.5                  | Metal mold     |
| Exhaust pipe                    | AL4   | 2.0                  | " "            | 10.5                  | The same       |
| Timing gear cover               | AL4   | 1.55                 | Under pressure | 2.8                   | Under pressure |
| Upper and lower oil pump casing | AL4   | 0.95                 | The same       | 0.7                   | The same       |
| Distributor drive casing        | AL4   | 0.67                 | " "            | 0.34                  | " "            |
| Pistons                         | AL30  | 0.68                 | Metal mold     | 0.68                  | Metal mold     |
| Rocker cover                    | AL4   | 1.2                  | Under pressure | --                    | --             |
| Oil crankcase                   | AL4   | 4.6                  | The same       | --                    | --             |
| Rear gland holder               | AL4   | 0.3                  | " "            | 0.29                  | Under pressure |
| Pusher bar                      | D1    | 0.066                | --             | 0.062                 | --             |
| Cooling system branch pipe      | AL4   | 0.35                 | Metal mold     | 0.28                  | Metal mold     |
| Fan spacer ring                 | AL4   | --                   | --             | 0.37                  | Under Pressure |
| Water pump casing               | AL4   | 0.82                 | Metal mold     | --                    | --             |
| Oil filter casing               | AL4   | 0.96                 | Under pressure | 1.14                  | Under pressure |

Both positive and negative aspects of "aluminum" engines have been revealed during their production and operation. Both are primarily connected with the physical and mechanical properties of the material. Aluminum alloys have fewer than cast iron -- density, higher heat conduction and relative elongation. As a result, the specific indicators of the mechanical properties of, for example, the AL4 alloy, which is used most frequently for manufacturing casing items, are significantly higher (Table 2) than for SCh24 pig iron. Moreover, aluminum alloys are worked more easily by cutting and possess higher casting qualities (they can be cast in metal molds without using wrecking bars. This insures greater accuracy and a lowering of tolerances) and better shrinking properties.

Table 2

| Indicator                                                                         | Sch24 | AL4                               |                                   |
|-----------------------------------------------------------------------------------|-------|-----------------------------------|-----------------------------------|
|                                                                                   |       | T-1 thermal processing conditions | T-6 thermal processing conditions |
| Specific rigidity under tension and bending, MPa.m <sup>3</sup> /kg               | 15.5  | 26.4                              | 26.4                              |
| Specific strength for the ultimate strength under tension, MPa.m <sup>3</sup> /kg | 0.033 | 0.75                              | 0.087                             |

At the same time, the distinctive features of the mechanical properties and production of aluminum alloys also give birth to certain problems during the manufacturing of casing items.

The linear expansion coefficient of aluminum alloys is more than that of ferrous metals. That is why during their use the need arises to take special steps to maintain stable clearances between items made of different types of metals, especially in the "block-main bearing journals" and "valve-rocker" interfacing. This is achieved by making the covers of the main bearings out of KCh35-10 malleable pig iron and the rod of the rocker out of D1 duralumin (along with the introduction of additional posts on the rocker axis).

The second problem is internal stress relief that originates during the casting and thermal and mechanical processing of cylinder blocks. During operation, this leads to geometric distortion of the blocks. However, the lessening of the magnitude of such stresses is assured by optimizing heat processing conditions and eliminating reinforcing elements (oil line tubes).

The third problem is insuring the required rigidity of the cylinder block. The trouble is that the elasticity modules of gray cast iron is approximately 1.5-fold more than the similar indicator for the AL4 aluminum; and aluminum cylinder blocks, identical in construction with cast iron ones, will be 1.5-fold less rigid. Moreover, the method of casting under pressure is used in ZMZ to manufacture cylinder blocks. The method is a progressive one; it is being used for the first time in the world for V-8 blocks. However, the blocks, which are cast using it, do not have an upper partition (they have a water jacket opened to the top) since the presence of an upper partition requires the use of a wrecking bar. The absence of a partition lowers the block's rigidity even more. One must also not forget that the mechanical strength of the castings, which are obtained by casting under pressure, is lower than when casting in a metal mold or in earthen forms because it is impossible subject them to thermal processing in accordance with T-6 conditions (hardening and artificial aging) because of very small bubbles of gas that penetrate the item, and it is necessary to limit oneself to heat processing using T-1 conditions (artificial aging). As a result, the optimizing of a block's rigidity is a complicated task requiring the taking of a whole series of measures -- correctly sorting the form of the cross-sections

and ribbing, increasing the height of the block's casing, including additional rigid (usually poured) items in the design -- oil crankcase, rocker covers.

The correctness of this path is being confirmed by foreign experience, in particular. For example, it is known that many foreign "aluminum" engines have an extremely high degree of boost (more than 50 kvt/dm<sup>3</sup>), including that obtained by supercharging; however, they nevertheless operate sufficiently reliably. This testifies to the high rigidity of their blocks. Such rigidity is usually achieved by intensive ribbing. It is possible to cite as an example the aluminum cylinder block in the new series of engine for the Jaguar XJS vehicle (Great Britain) (Figure 1). Its liter capacity is 47 kvt/dm<sup>3</sup>; The rotational speed of the crankshaft under maximum power is 5,300 minutes<sup>-1</sup>; and the displacement is 3,590 cubic centimeters. The rigidity of the blocks is considerably increased if not wet but dry sleeves, which have been pressed into the block, are used. (This design is being primarily disseminated -- it is used in the mentioned engine.)

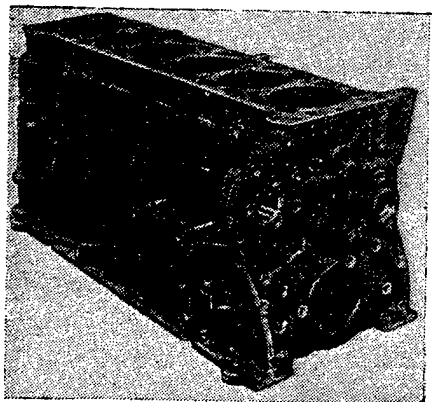


Figure 1

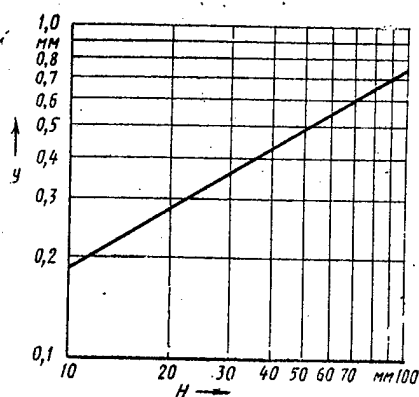


Figure 2

In our domestic practices, the required rigidity of certain designs is insured not only thanks to ribbing but also through the introduction of an upper partition in the block's design (engines for the UAZ [Ulyanovsk Motor Vehicle Works] and GAZ [Gorkiy Motor Vehicle Works]-3102 vehicles). In this case, the external part of the casting form is a metal mold, and the interior portion is formed with the help of a sand core.

The next problem in introducing aluminum alloys is the insuring of the corrosion resistance of the surfaces that come into contact with the coolant. The trouble is that the opinion that an oxide film rapidly forms on the aluminum alloys and reliably protects the basic metal from destruction, is not justified in many cases (especially if water is used as a coolant. We managed to solve the problem by introducing inhibitors (potassium bichromate --

dichromoacid potassium or sodium) into the coolant, and then Tosol A-40 non-toxic antifreeze. True, individual item interfacings, which contribute to the origination of crevice corrosion, are still being discovered during prolonged operating.

The solution of the technological problems connected with foundry and mechanical production has important significance in insuring the reliability of the engines. For example, in order to determine the pitch of the walls and the taper of the openings (the half-difference of the larger and smaller cone bases) obtained by casting blocks under pressure, empirical formulas have been introduced, based on which a graph (Figure 2) has been constructed which connects the slope and taper ( $\gamma$ ) with the height of the walls and the depth of the opening (H) respectively.

Naturally, the solution of the listed problems had a positive effect on the reliability of the "aluminum" ZMZ engines. They are operating under a control, which was organized in motor vehicle transport enterprises of the RSFSR, Ukrainian SSR, Uzbek SSR and other regions of the country in accordance with a specially developed procedure and which has confirmed this. For example, Table 3 shows the nine-year dynamics of changes in the average life of several items, listed for the first category of operating conditions: during the year when research under controlled operating conditions began (A); lots produced after five years (B); and lots produced after another four years (C). It is evident from it that the operating measures, which were adopted based on the results of the first years, led to a significant increase in the reliability of the aluminum items. Table 4, which reflects how the average life of engines (also listed for the first category of operating conditions) changed during 12 years, also testifies to this.

Table 3

| Item           | Year of Production of Engines |     |       |
|----------------|-------------------------------|-----|-------|
|                | A                             | B   | E     |
| Cylinder block | --                            | 333 | 375.2 |
| Sleeve         | 246                           | 260 | 282.8 |
| Head           | 292                           | 335 | 362.2 |
| Piston         | 242                           | 254 | 247.6 |
| Piston rings   | 157                           | 228 | 253.4 |
| Crankshaft     | 224                           | 261 | 270.3 |
| Inserts:       |                               |     |       |
| root           | 138                           | 182 | 185.4 |
| connecting rod | 159                           | 237 | 250   |
| Camshaft       | 305                           | 407 | 314.4 |
| Valve lifters  | 229                           | 363 | 425.4 |

Table 4

| Engine                                 | Four-cylinder,<br>2450 cc |      |      | Eight-cylinder,<br>4250 cc |      |      |
|----------------------------------------|---------------------------|------|------|----------------------------|------|------|
|                                        | 1970                      | 1974 | 1982 | 1967                       | 1973 | 1983 |
| Year of production                     |                           |      |      |                            |      |      |
| Service until overhaul<br>1000's of km | 150                       | 200  | 225  | 150                        | 200  | 250  |

Thus, the experience, which has been acquired at the present time, testifies that the use of aluminum alloys to replace ferrous metals is one of the most important and long-term ways to lower the weight of automobile engines. For example, the specific rigidity (the relationship of the modulus of elasticity to the density) and the specific strength (the relationship of ultimate strength under tension to density) of the AL4 aluminum alloy is higher (cf. Table 2) when compared with SCh24 pig iron and they are 1.5-fold and twofold more, respectively. This means that an accurately designed cylinder block made of the AL4 alloy is inevitably lighter than a block made of SCh24 with no less rigidity and strength. If one were to replace the heavy wet sleeves with thin-wall (1-2.25 millimeters) dry ones, the gain would be even more. An additional reduction in the weight of engines is being achieved (the Daimler Benz, Porsche and Citroen) by using coatings and alloys that insure the operation of the pistons and rings directly in an aluminum cylinder.

The cost of "aluminum" and "pig iron" engines can be made approximately equal thanks to the combined use of the advantages of the former -- opportunities to reduce labor-intensiveness and improve working conditions and other production factors.

In conclusion, let us point out that the many years of experience in producing and operating "aluminum" engines by the Zavolzhsk Engine Plant imeni 50th Anniversary of the USSR for GAZ motor vehicles, PAZ [Pavlovo Bus Works] and RAF [Riga Bus Works] buses, etc., have not revealed any specific deficiencies which testify to the lowering of the reliability of these engines when compared with "pig iron" ones.

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8802

CSO: 1829/174

## RAIL SYSTEMS

### SECTOR STILL LACKS MACHINERY FOR HANDLING FROZEN CAR LOADS

Moscow GUDOK in Russian 31 Jan 87 p 2

[Article by S. Drugal, laboratory manager of the Ural Division of the All-Union Scientific Research Institute of Railroad Transport and doctor of technical sciences, Sverdlovsk, under the rubric: "Why Isn't It Being Implemented?": "Interdepartmental Loosening"; first paragraph is GUDOK introduction]

[Text] A reply to the editorial board's inquiry on the snail's-pace rates in introducing vibrating looseners (GUDOK, 16 Jan 87) has still not been received from the Ministry of Railways, the Ministry of Heavy and Transport Machine Building and other concerned departments. Meanwhile thousands of people are "mining" freight from railway cars with picks and shovels each winter.

It has been calculated that 150-200 and more man-hours are spent manually unloading each gondola car with frozen freight. The Ural TsNII-SOZ vibrating loosener decreases these expenditures tenfold, replacing the labor of 20-30 workers. However, the national economy's requirement for this machine is being satisfied by only 10 percent.

It is hardly possible to calculate accurately the losses that the national economy is suffering as a result of the diversion of manpower, the damage to the cars, their demurrage over and above the norms, and the interruptions in the work of enterprises during the winter. According to the most understated estimate, they exceed 500 million rubles a year.

Of course, there are such losses! Where there are no special mechanized systems of the "warming room-car dumper" type -- and such enterprises are in the majority -- cars with frozen cargo are placed in heated shops and thaw for several days. In other places, the cargo is scraped out with clamshells, breaking the upper strapping and walls of the gondola car during it. From year to year, they try -- and always without substantial results -- to use jack hammers. Here and there, they smash the solidly frozen freight and along with it -- the car -- with a crane pile driver (a ram) without the knowledge of the inspectorate for safeguarding the railroad car pool.

When this has no effect, they take hundreds of people from primary production and send them to the transport shop. It's as if a second mining of raw

material takes place -- except that coal and ore are mined in a mine using combines, but from gondola cars using a crowbar, a pickax and a shovel. A ruble or two a ton -- there is the cost of such unloading for you!

To some degree, this happy-go-lucky attitude toward mechanizing the unloading of frozen freight has come from our science. There existed the "scientifically sound" conviction that different agents and additives would allegedly prevent dry freight from freezing. As experience has shown, however, all of this is -- as they say -- from the land of fantasy.

Practically speaking, the known agents against freezing are useless in the best of cases. They have attempted to apply a non-freezing compound to the walls of the cars -- but little good came of it. Subsequently, it was only possible to extract the massive cake from the body with the help of a car dumper. And then? Again, blow it up!

The only acceptable method for preventing freezing would be to lower the moisture content of the freight to a safe level. However, it is practically impossible to achieve this. The dehydration of huge masses of coal and ore is linked with enormous capital investments; yes, and you will not protect dry cargo from moisture on the road when transporting it over large distances.

Therefore, where is the way out? Many years of experience show that different mechanized systems are needed to loosen frozen freight directly in railroad cars during unloading. For example, drill looseners are being used with success. They are suitable for comparatively small unloading volumes and are especially suitable where the grinding of raw material is required for production conditions. More than 200 of these machines are operating in the national economy.

The experiences in using vibrating looseners, which are used as suspended attachments for cargo cranes, have been successful. The DP-6S vibrating loosener and its modifications have been introduced on the broadest basis. During the last 10 years, their total production exceeded 800 items. Almost all of the machines have settled in Ministry of Nonferrous Metallurgy, Ministry of the Construction Materials Industry and Ministry of Construction, Road, and Municipal Machine Building enterprises.

A more effective vibrating loosener -- the Ural-TsNII-SOZ that was developed by the Ural Division of the All-Union Scientific Research Institute of Railroad Transport -- has been designed. Combined with a boom or bridge crane, this assembly permits a gondola car to be unloaded in 15-90 minutes. How are things going with the introduction of these machines?

In general, the requirement of the national economy for all types of looseners is 5,000 pieces. However, today's production volume (approximately 200 a year) hardly permits the pool of these devices to be maintained at a level of 500 - 600 pieces since their service period does not exceed three seasons.

The following conclusions flow from this: If we are not able to arrange for the mass production of vibrating looseners in an amount of only 500 items a year, the problem of unloading frozen freight will not be solved. This is a state task. The mastery of the serial production of such equipment in such amounts is only within the capability of the Ministry of Heavy and Transport Machine Building.

However, it is impossible to say that the Ministry of Heavy and Transport Machine Building is evading the solution of this problem. The fact of the matter is that the question has simply not been posed to it. Each branch has started to arrange production in its own way. The Ministry of Power and Electrification has begun to produce vibrating looseners in Yuzhnouralsk; the Ministry of Nonferrous Metallurgy -- in Novosibirsk; the Ministry of Railways -- in Alaty; the Ministry of the Construction Materials Industry -- in Kuybyshev; and the Ministry of Construction, Road, and Municipal Machine Building -- in Chelyabinsk. Everywhere, the machines are being produced in small batches from odd materials. It is necessary to overcome the great difficulties in supply, complete sets, etc.

Such departmental "loosening" has even found expression in the coordination plan of the State Committee for Science and Technology for 1985-1990. The random collection of executors is striking.

Experience also shows that the points for unloading frozen freight must be equipped with powerful travelling gantry or overhead travelling cranes. Boom cranes are not suitable here. Moreover, the transport shops at many enterprises are out-of-the-way places for production. The equipment here is either generally unsuitable for operations during the winter or so antiquated that it does not emerge from repairs. What kind of introduction of loosening equipment can one talk about under these conditions?

The general reconstruction of the unloading assets in the transport shops of industrial enterprises is an urgent task. Of course, it requires definite capital investments, but they are repaid manyfold.

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## RAIL SYSTEMS

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### RADIOCOMMUNICATIONS REQUIREMENTS FOR LONGER, HEAVIER TRAINS

Moscow ZHELEZNODOROZHNYI TRANSPORT in Russian No 11, Nov 86 pp 26-28

[Article by Candidate of Technical Sciences Yu. V. Vavanov and Engineer A. I. Yashin: "Radiocommunications Requirements on Connected Trains"]

[Text] Driving trains with increased weight and length is being used even more widely in the network, and it is considered as the most important resource for assimilating the growing shipping volumes and intensifying operation of the steel main lines. At the present time processing methods have been worked out for making up, preparing and driving connected trains with a weight up to 16,000 tons in which locomotives are being allocated according to composition right along with an increase in traction "from the hauling end."

When driving trains, particular efficiency and coordination on the operations of the engineers of the driving and driven locomotives are necessary, so reliable communications between them are needed. These communications must be organized through various methods, but radiocommunications are the most universal. At the present time they are accomplished in a telephone mode of operation with the transmission of commands by voice, but for the long term they can be used also for transmitting the digital commands of remote control and remote signaling. Radiocommunications on a connected train are included among train radiocommunications (PRS), and that makes stringent demands on the quality and reliability of a communications channel, i. e. on the reliability of transmitting information. We will examine a number of important problems, the solution of which will facilitate the organization of stable radiocommunications on connected trains.

At the present time practically all railroads are equipped with train radiocommunications that operate in the hectometric wave range. In this range the radiointerference levels are rather large and, therefore, high levels of a useful high-frequency signal's field strength are necessary for ensuring a qualitative communications channel. This is achieved by channeling electromagnetic energy along directional wires, the role of which is performed by the wires of longitudinal electric power supply lines, networks of overhead communications lines, or special "waveguides." Electromagnetic energy in sections that are adapted to the use of electricity is propagated also along other "wave channels," which are formed between the waveguide wire and the wires that are suspended on the contact system's supporting structures.

The currents that flow along the contact system's wires affect the level of the high-frequency signal in the locomotive antenna right along with the currents that pass through the directional line. Similarly, the contact system also affects the transmission of signals from the locomotive antenna to the directional line. In this regard, the transmission of energy is accomplished by the locomotive antenna's inductive coupling with the directional wires and it is characterized by crosstalk attenuation, which can change within a range of 20 to 50 dB [decibels] depending on the size of the antenna and the distance of the locomotive from the directional wires. The quality of communications will change correspondingly too.

As calculations indicate, a satisfactory quality of radiocommunications in the hectometric range between locomotives in a connected train on sections that are not adapted to the use of electricity can be ensured when the distance of locomotives from directional lines (for example, from the overhead communications lines) is no more than 25-30 meters, and when the distance is no more than 10 meters on sections that are adapted to the use of electricity. The calculation results were confirmed by experiments at the East Siberian, Kemerovo, and Krasnoyarsk Railroads. It was established that communications are ensured with a train weight up to 16,000-18,000 tons and a distance up to 2.2 kilometers between locomotives. However, their quality considerably depends on the distance to the directional wires. This becomes apparent especially when passing stations and when the overhead communications lines are at a distance from the railway roadbed. Neutral inserts also affect the quality of communications. Communications between locomotives are practically absent on sections where there are no directional lines. This is explained by the low effectiveness of the antennas and their short height.

Accordingly, radiocommunications in the hectometric range between the locomotives of a connected train can not be recommended as a basic means of communications. At the same time, they are indispensable under complicated mountainous conditions and especially in tunnels, since the waves of this range are capable of being propagated along the directional wires and bending around obstacles.

At the present time the use of train radiocommunications by utilizing the metric wave range is expanding. Its basic feature is straight-line propagation of electromagnetic energy within the line-of-sight range. Calculations show that the voltage at the receiver input is 25-30 dB on medium-rugged terrain when an antenna is located on the roof of a locomotive within clearance limits and at a distance of 2.2 kilometers between locomotives in a connected train. A signal level like this ensures high quality of communications. The useful signal level can drop to 20 dB on highly rugged terrain, and in a number of cases it can be below the minimum discernible sensitivity of a receiver.

Measurements performed at the East Siberian Railroad showed that at a distance of 600 meters and 1,000 meters between locomotives the minimum signal levels are 24 and 22 dB respectively, and the maximum ones are 52 and 46 dB. Signal levels at the input of locomotive radio sets on a connected train at a distance of 1.5 kilometers between locomotives were found within the 30-50 dB range on the alternating current Ekibastuz-Sorokovaya section of the Tselina Railroad. Experimental research was performed as well at the West Siberian, Kemerovo, and

Krasnoyarsk Railroads. They showed that during the movement of a connected train (distance between the locomotives is on the order of 1.5 kilometers) along level sections the high-frequency signal level at the receiver input of the ZhR-U-LP radio sets on the average did not drop below 40 dB, and it did not drop below 25 dB under highly rugged terrain conditions, i. e. it was 11 dB more than the minimum discernible sensitivity of the receiver.

As is evident, for radiocommunications between locomotives in a connected train it is advisable to use the metric range, in which good quality of communications is ensured on a majority of railway sections. The hectometric range can be used as a reserve one basically on highly rugged terrain.

When organizing radiocommunications between locomotives on connected trains, it is necessary to proceed on the basis of the demands of universality in structuring a channel for all types of traction on the basis of using standard radio equipment. The possibility of conducting conversations between locomotive engineers in a telephone mode of operation and transmitting remote control and remote signaling (TU-TS) commands in a digital mode of operation must be ensured in this regard. In addition, communications of the engineers of a connected train must be maintained with the train dispatcher (DNTs), the station duty operator (DSP), and other parties supporting train operations and dispersed along the train route.

At the present time, the ZhR-UK-LP (42RTM-A2-ChM) locomotive radio sets are meeting the enumerated requirements. They consist of two independent complete sets that operate in the hectometric (ZhR-K-LP) and metric (ZhR-U-LP) ranges. Independent operation in each of the ranges makes it possible during the exchange of information inside the train to simultaneously answer a call and establish locomotive crew communications with the DNTs, DSP and other parties, i. e. to use the metric wave range for radiocommunications inside a connected train, and the hectometric range for train radiocommunications.

When a radio set is operating in the mode for controlling a connected train (TU-TS), channels one, two and three are set up by pressing the appropriate buttons. A special connector, which makes it possible to connect the equipment for remote control of the engineer's brake valve of the driven locomotive from the cabin of the driving one, is provided for transmitting commands. In addition, a special toggle switch (MKT-TU-TS) in the TU-TS position turns off the noise suppressor and the loudspeaker so that the control signals are not heard and do not interfere with the engineer's normal operation. Usually this is done where there is full automation of control and when a large number of TU-TS commands are being transmitted. Where there is partial automation (brake control only), it is advisable to switch the toggle switch to the MKT position. In this case the engineers will be able to conduct conversations and hear the TU-TS commands, and that will ensure acoustical monitoring of equipment operation. Listening to signals during braking of a train will not interfere with the work of the engineers because of the small volume of information being transmitted.

With regard to the fact that the ZhR-U-LP radio set ensures operation on one of three adjacent channels, it is possible in the proper manner to separate following outgoing or oncoming trains according to operating frequencies. It is

important, however, to bear in mind that, if following outgoing trains will not have an influence on each other by virtue of a spatial separation, then the influence of oncoming trains is not precluded. It was established that radio-communications disturbances are possible when locomotives pass at a distance of 300 meters or closer from each other, and, moreover, when there is simultaneous operation of radiocommunications on two trains.

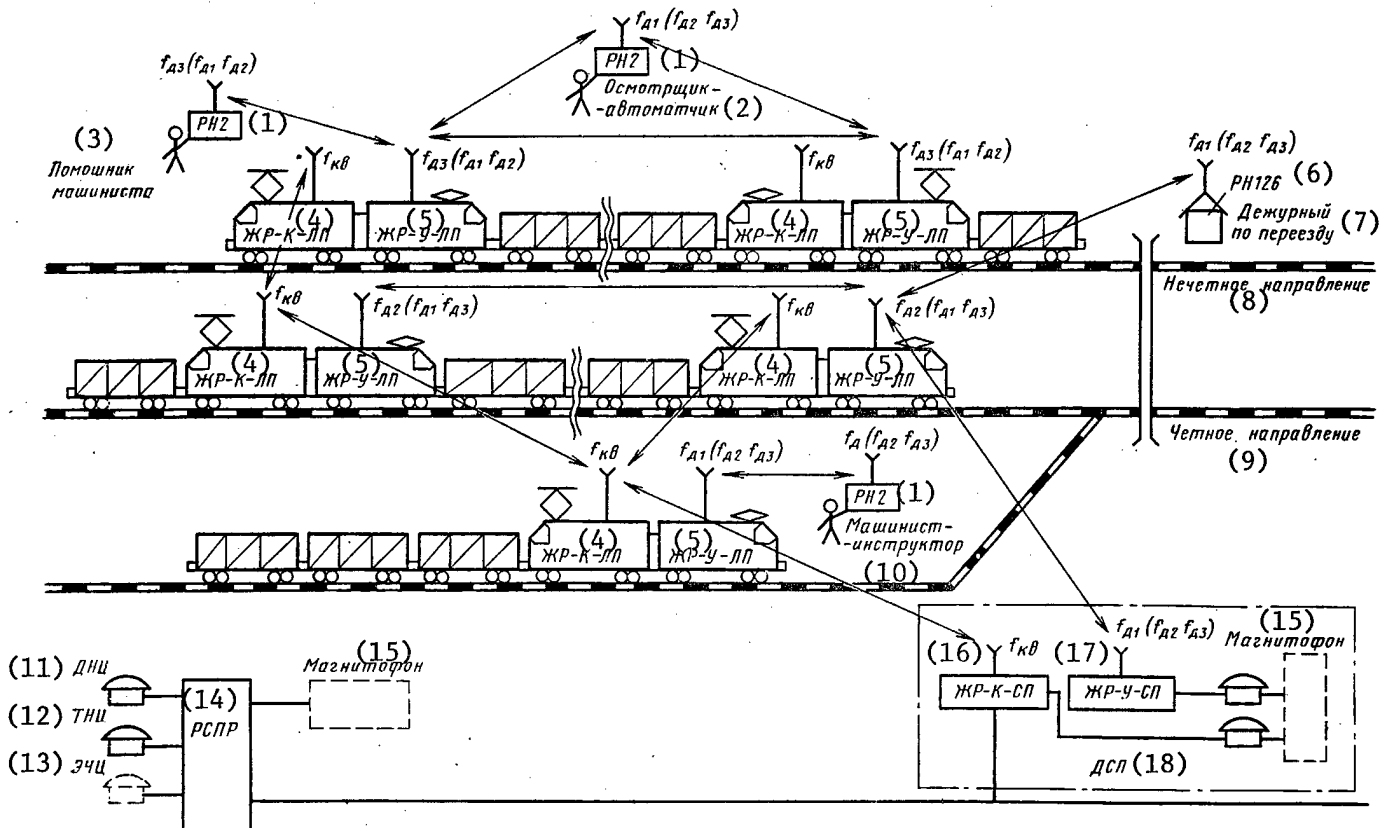


Figure 1. Functional Diagram for Organizing Radiocommunications of a Connected Train With the Use of ZhRU Type Radio Sets

Key:

- |                                           |                                       |
|-------------------------------------------|---------------------------------------|
| 1. RN2 portable radio set                 | 10. Instructor engineer               |
| 2. Automatic equipment operator-inspector | 11. DNTs (train dispatcher)           |
| 3. Assistant engineer                     | 12. TNTs (traction dispatcher)        |
| 4. ZhR-K-LP                               | 13. EChTs (electric power dispatcher) |
| 5. ZhR-U-LP                               | 14. RSPR (distribution station)       |
| 6. RN126 portable radio set               | 15. Tape recorder                     |
| 7. Railcrossing duty operator             | 16. ZhR-K-SP                          |
| 8. Odd-numbered direction                 | 17. ZhR-U-SP                          |
| 9. Even-numbered direction                | 18. DSP (station duty operator)       |

It is necessary to take into consideration also the limited three-signal (intermodulation) selectivity of the receivers (if two radio sets are operating on two adjacent frequencies, then the occurrence of a spurious signal or the disturbance of a communications channel is possible on the third frequency that is adjacent to them). The intermodulation interference zone, in which the use of three adjacent frequencies is precluded, is nearly 1 kilometer. This phenomenon is associated with the peculiarities of the ZhR-U-LP radio sets and it is eliminated in the RV-1 radio sets of the "Transport" system.

Accordingly, with regular use of the ZhR-U-LP type radio sets, which operate on three adjacent channels, it is possible to recommend automation of the engineer's brake valve control with the sporadic transmission of TU-TS signals. As regards conducting telephone conversations on matters of controlling traction and auxiliary equipment, full automation of handling a connected train with the recurring transmission of TU-TS signals is possible only on individual connected trains with the exception of other types of train radiocommunications in the metric range along the train route.

As was already noted, right along with communications between the engineers of a connected train their communications in the metric range are provided with the assistant engineer and the station and railcrossing duty operators, as well as communications with the automatic equipment operator-inspector and the train make-up technician. One version for structuring a radiocommunications configuration like this is shown in the illustration. As is evident from the diagram, radiocommunications are organized in an even-numbered direction on the second channel ( $f_{\Delta 2}$ ) and in an odd-numbered direction on the third channel ( $f_{\Delta 3}$ ) of the ZhR-U-LP radio set. The first channel ( $f_{\Delta 1}$ ) is an emergency one for calling the railcrossing duty operator, a reserve one for communications with the DSP, and a service one for calling the automatic equipment operator-inspector or the engineer instructor. The UKV [ultrashortwave] transceivers of complete sets on "individual" trains or locomotives are on the first channel.

The assistant engineer, leaving a locomotive at a train parking point, must have a portable radio set that is switched to the carrier frequency of the channel of his own locomotive for more rapid notification of the engineer concerning defects in the train or on the tracks. The hectometric wave range ( $f_{\text{H}}$ ) is the basic channel for engineer communications with the DSP and DNTs, as well as with the engineers of other trains. The use of two ranges meets the safety requirements for train traffic, since it makes it possible to conduct conversations simultaneously with the DNTs, DSP (on the KV [shortwave] channel), and with the locomotive engineers in the double train (on the UKV channel).

In 1985 the design bureau of the Signals and Communications Main Administration jointly with the VNIIZhT [All-Union Order of the Labor Red Banner Rail Transport Scientific Research Institute] developed a connected train remote brake control device (UTU-SP). It controls the attachment to the engineer's brake valve by means of a radio channel. Since braking is performed automatically according to commands from the hauling locomotive, in some cases one engineer without an assistant can handle a driven locomotive as a result of using the device. At the present time, work is being conducted on expanding the functional possibilities and increasing the reliability of UTU-SP.

Timely inspection, repair and adjustment of it are of great importance for maintaining radio equipment in good technical condition. For this it is important to improve the extent of equipping repair and monitoring and measuring stations with complete sets of measuring equipment for checking the parameters of radio sets, with devices for checking antenna feeder sections in both ranges, and others. It is necessary to improve the system for providing stations with spare parts for radio sets.

When the driving of connected trains is being organized on railroads, with regard to the nature of the terrain and the technical equipment of the sections it is necessary to perform proper preparatory work: to allocate locomotives equipped with dual-range ZhR-UK-LP radio sets, to assign ranges, and others. In the majority of cases, communications within the limits of a connected train must be accomplished in the metric wave range. In connection with the fact that at the present time only a portion of the locomotive rolling stock is equipped with dual-range radio sets, it is advisable to assign locomotives like these to connected trains.

The transmission of commands for handling connected trains is conducted in the telephone mode of operation between the engineers of the driving and the driven locomotives. If there are locomotives equipped with a remote control attachment to the engineer's brake valve, then it is necessary to install a connected train remote control brake line unit (UTU-SP) on them. In this case, the brake line control is automated and the commands for controlling the traction and auxiliary equipment are transmitted in the telephone mode of operation.

If there is a metric range, a hectometric-range radio set is used for engineer communications with the DNTs and the DSP, as well as for the engineers of oncoming trains among themselves. In addition, if necessary, it duplicates the metric-range radio set. When connected trains are not proceeding along a section, the metric range is used in accordance with the diagram presented in the illustration. During the time connected trains are moving, it is necessary to limit the use of the metric range to the maximum extent possible, ensuring only communications between the engineers of connected trains in this range. In this case, train radiocommunications are organized basically in the hectometric range. In those cases when a large portion of the route of connected trains passes along highly rugged terrain, the hectometric wave range can be used also for communications inside connected trains. In all cases when it is necessary to transmit urgent information, the metric and hectometric ranges accordingly provide duplicate facilities of each other.

For the efficient use of radiocommunications facilities with minimum time in occupying a channel and the elimination of errors in the destination and contents of information it is important to provide conversation rules and a clear procedure for using radio facilities when a connected train is being made up, when it is proceeding along a section, and when it is being reformed. During the time that a connected train is being made up in accordance with the railroad regulation that determines the operating channel number and the assigned call signs (prearranged one-digit numbers of the locomotive crews of the driving and the driven locomotives), the engineers establish the operating channel number and set up radiocommunications among themselves. Having made sure of their

normal operation, they begin an exchange of information associated with making up the train and moving it in accordance with the established conversation rules. When several locomotive crews are driving a train or the number of connected trains is large, it is necessary to assign two-digit numbers. The first digit will define the train's prearranged number and the second will define the locomotive crew's number. In this regard it is important not to use digits that are close in sound. Do not permit the use of call signs that correspond to the numbers of passenger trains cruising along a section. When there is automatic brake line control or fully automated handling of locomotives from the cab of the driving locomotive on a connected train, the procedure for establishing a channel, destination, and mode of operation (driving or driven) remains the same and it is established by the locomotive crews.

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## RAIL SYSTEMS

### HISTORY, PROBLEMS OF SAKHALIN ISLAND RAILROAD OPERATIONS

#### Operational Difficulties

Moscow ELEKTRICHESKAYA I TEPLOVOZNAYA TYAGA in Russian No 1, Jan 87 pp 10-12

[Article by B. N. Zimting, special correspondent: "The Easternmost Mainline: From a Journalist's Notebook"; passages enclosed in slantlines printed in bold-face in text]

[Excerpt] /I honestly admit that I have long wanted to visit Sakhalin Island. In my school geography book, I read that its shores are washed by the waters of the Sea of Japan and the Pacific Ocean, it is separated from Moscow by 8 time zones, that it extends almost 1,000 kilometers in a north-south direction, the northern end at the same latitude as Tula and the southern, the same as Odessa. I recall an old song, the hero of which, having settled down on the shore of Laperuz Strait, affirms that "on the island there is normal weather." I also knew that Sakhalin Island is rich in fish, natural gas, petroleum, coal, and many other mineral resources. And, most importantly, that the country's easternmost railroad operates on the island.

Recently my dream was realized. During the several days spent on Sakhalin Island, I met dozens of people who told me about the history of the mainline and the caprices of the weather, about peculiarities of their work and about the richness of nature in the area...

I remember the Sakhalin Island railroad workers as being in love with the island and their railroad, as calm, taciturn people. One of them is Anatoliy Fedorovich Kolesnik, a veteran of the Yuzhno-Sakhalinsk locomotive depot. He arrived in these parts in September, 1950, after his studies at the Odessa Rail Transport Tekhnikum. He worked as an assistant and as a locomotive operator, finished the KhabIIZhT [Khabarovsk Institute of Rail Transport Engineers] at night and became an engineer. Practically all of the formation of the railroad during the Soviet period took place before his eyes. It was from this same A. F. Kolesnik that I heard the story.../

#### ...of the History of the Mainline

As you recall, after the defeat in the war of 1904-1905, the southern part of Sakhalin was annexed by Japan. For the island's development, or more precisely

to pump out the island's natural resources more quickly, a railroad with a track gauge of 1067 millimeters was constructed here by the Japanese.

The Soviet period in the history of the Southern Sakhalin Railroad (now the Sakhalin division of the Far Eastern Railroad) began in 1946, after the island was liberated from the Japanese militarists.

They left behind an unenviable legacy: a relatively short track on a narrow prism (base) ['put na uzkoj prizme'], light rails and weak spikes. The bridges were mainly wooden, and the tunnels designed for small-capacity rolling stock. The cars held 6-12 tons of payload, and the steam locomotives were not very strong, similar to those in operation on domestic narrow gauge lines.

It stands to reason that this condition for transport could not satisfy us for the regular development of this age-old Russian island, although we initially had to restore and make use of captured equipment.

The question of converting the railroad to the wide, "mainland" gauge came up. But, to do this, we would essentially have to build the entire railroad from scratch. And the tunnels, of which there are many on Sakhalin, became the major obstacle. Therefore, a decision was made to leave the existing track gauge and renovate the railroad while in operation.

To run large-capacity trains, the track maintenance service would have to be reinforced immediately. Over a period of years the ballast prism was reinforced, and instead of the light rails, they laid first R50 and then R65 rail. All wooden bridges were replaced by metal ones, and their classification was increased six-fold. Many tunnels were repaired and improved.

In the mid-1950's, the railroad received new, more powerful steam locomotives and cars with a 40-ton capacity. The speed grew from 20-30 kilometers per hour to 70-80. All of this enabled us to organize a more complete form of transportation to be provided for the island's developing industrial regions.

In subsequent decades, the economic base for the Sakhalin mainline was further strengthened. New stations and depots grew up, the type of traction changed. The fact is that all life on the island is directly tied to the mainland. Until the mid-1970's, freight coming to Sakhalin and back was shipped by sea. The double transshipping in the seaports resulted in considerable transportation expenses.

Then a decision was taken to construct the Vanino-Kholmsk ferry crossing. Putting it into operation permitted freight cars with a gauge of 1520 millimeters to be transported to the island. In order to avoid the loading-unloading process this time, the railroaders carried out a proposal which was astonishing in its impudence: to use the "mainland" cars on 1067 millimeter bogies. Changing each car from one to the other turned out to be 2 and a half times less expensive than reloading!

Considering that truck transport is still underdeveloped on the island, all basic shipments of national economic freight are still made by rail. The railroad is coping with this important task in outstanding fashion!

/The Yuzhno-Sakhalinsk Depot is the largest locomotive facility on the island. During my excursion through its shops, my companion was Valentin Yevgenyevich Leshchenko, deputy chief of the repair depot. I studied with interest the old photographs which recorded equipment I had not seen before and examined the exhibits of an era 40-50 years in the past which they were preserving: the automatic couplers and bogies of various systems; I acquainted myself with the way things are today and listened to the story of V. Ye. Leshchenko.../

#### ...about the Locomotive Service

On the island 40 years ago there were 5 main locomotive depots at Yuzhno-Sakhalinsk, Vzmorye, Kholmsk, Tomari and Poronaysk stations, as well as 12 turn-around depots. Almost all were fan-type depots with revolving turntables. The fleet included 100 steam locomotives of 18 different series. More than half of them had been cannibalized, and many depots were in ruins.

It was necessary, as they say, to start from scratch. They restored and renovated the depots, repaired the locomotives, or, more precisely, they assembled a single one from several of those which were broken down; for practical purposes, the repair base was recreated.

It was difficult. But during the first year of development, the railroad "took off." The locomotive operators moved the first few hundred tons of the freight which was so sorely needed--building materials, equipment, fuel and foodstuffs.

Within 3 years, the locomotive fleet had been updated somewhat; they got 30 new Japanese D51 steam locomotives. These machines were much more powerful than those we inherited, and they remained in good working order until just recently. In 1956 a total of 60 Sh<sup>a</sup> steam locomotives were converted from wide to narrow gauge at the Ulan Ude plant.

With development of the island and the growth of the city of Yuzhno-Sakhalinsk came the need to organize passenger and suburban service. From 1958-1960 a total of 8 motorized rail cars were restored, and these came to be used in suburban service. These cars were recently removed from their wheels and they served as secondary facilities. Our workers installed diesel engines in them and mechanical transmissions, searched out and repaired bogies. A year later they got 8 series A1 diesel trains from Japan. By the way, these and the motorized cars are all in service today.

In the years 1967-1972, steam traction was completely phased out in favor of diesel. The mainline TG16 diesel locomotives, built at the Lyudinovo works and rated at 3280 horsepower, started pulling the trains at speeds up to 85 kilometers per hour. Over level terrain, the TG16 can pull up to 3,000 tons, and in the mountainous sections, on grades of 30 thousandths, they handle 750-800 tons.

The TGM7 switch engines started working at the stations, the number of which grew considerably in the post-war years. During the past 2 years, the depot has received 10 more new D2 diesel trains. They consist of 2 motor cars and 2 passenger cars. A single motor car is rated at 800 horsepower, and the speed of the diesel train is up to 100 kilometers per hour.

All of the diesel locomotives and diesel trains in operation on Sakhalin have hydraulic or hydromechanical transmissions (an electric transmission is no good under the high humidity conditions prevalent on the island).

Today 570 people work at the locomotive depot at Yuzhno-Sakhalinsk, half of them in the operations shop. One-third of all locomotive operators are licensed to operate the diesel trains, and half of the assistants have operators licenses.

The depot is atypical. In 1974 a wing, in which the TO-3 and TR-1 diesel locomotives are constructed, was added to the old Japanese fan-shaped depot. The old facilities are used for repair of the diesel trains and motorized cars. Major types of repairs are performed at the diesel locomotive and rail car repair plant, but when necessary we produce the TR-2 ourselves. A DIP-500 lathe has been adapted for turning the wheel pairs.

A creative collective has been selected, one with initiative. The unusually long service life of the captured and domestic equipment is the best example of the relationship between people and their job. Our efficiency experts and skillful workers eliminate design shortcomings in foreign equipment and adapt it to the island's climate conditions.

But, for certain questions we need assistance in managing the railroad and the MPS [Ministry of Railways]. Thus, at present there is no heated parking place for the new diesel trains. The heating system on the D2 is imperfect, and in the wintertime, the trains are cold when they arrive to take on passengers, a fact which causes justified unfavorable criticism from passengers.

/The Pacific Ocean region between Sakhalin Island, the Japanese islands, the Kuril Islands and Kamchatka is often called the "weather kitchen." It is here that typhoons and hurricanes of frightening destructive force are born. Their force is afterwards felt in various parts of the globe. But the local inhabitants take on the brunt of the elements themselves.

The railroaders on the easternmost railroad have to work under extreme conditions for practical purposes. And it is astonishing that those things which amaze and call up sincere admiration are entirely ordinary, everyday affairs.

Artur Yakovlevich Konikov, deputy chief of the locomotive department, did not have to adapt to the climate here. He is a true "aboriginal"; he was born in Aleksandrovsk, in the northern part of the island, in 1937 and moved to Yuzhno-Sakhalinsk in 1946. It was therefore interesting to talk with him about.../

#### ...the Weather's Surprises

To be frank, we long ago became accustomed here to the rains and the snow. The trade wind circulation causes uneven distribution of temperature and precipitation during the course of the year. The largest amounts come in the fall. There are days when during a 24-hour period as much rain falls as we get in 2 months. Then even the most unnoticeable streams, which, as they say, a sparrow can ford, turn into powerful currents which wash away bridges and shift track beds dozens of meters.

In the wintertime, we are constantly struggling with snowdrifts and avalanches. On the railroad there are more than 80 sectors which are endangered by avalanches. After snow removal equipment has passed, snow tunnels 7-8 meters high are often formed. The most complex conditions for operation are on the mountainous Polyakovo-Yuzhno-Sakhalinsk sector. In the most dangerous locations, protective tunnels have been built, the track has been moved in some places, and slope reinforcement and rail and concrete barriers have been installed.

In winter, of course, snow removal equipment is a subject of particular attention. Today we have 800-horsepower Japanese steam rotor machines which operate successfully. There are several ESO [expansion unknown] electric snow-removing machines rated at 820 horsepower, but they are not paying for themselves. The electric drive often breaks down due to the high humidity, and the commutators often burn up.

Recently our skillful workers from the locomotive depot made a fine, powerful and reliable snow-removing machine based on a TG16 diesel locomotive which had been written off. All of this equipment is being brought up to a state of "combat" readiness ahead of time and is being dispatched to the sectors with the most abundant snowfall.

/During the railroad's 40 years of operation, there have, no doubt, been those 'extraordinary instances'?/

Yes, there have been unfortunate and tragic accidents. I remember how during the winter of 1954-55 an avalanche covered a steam locomotive and the crew perished. At that site there is now a protective tunnel. And relatively recently, several years ago, a diesel locomotive also was hit by a slide. While they were digging their way to it, food was dropped to the crew from a helicopter.

But typhoons cause us the most trouble. Of the most recent ones, typhoon "Phyllis," in 1981, was the most powerful. The deluge raged with strong winds for more than 3 days, mudslides rushed down from the mountains, whole kilometer-long stretches of fill were washed out, heavy bridge structures were tossed about and electric power and communications lines were downed. Traffic was paralyzed for a month and a half.

I must give credit where credit is due. The collectives of many industrial enterprises were helping out however they could to restore service. The people understand, and this is not just high-blown language, that for the island, the railroad is a life-giving artery, without which everything stops.

But, the main thing, of course, is our workers. Although we have difficulties in organizing traffic, as you see, there is much less waste in our work than on other railroads where climate conditions are favorable.

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## Locomotive Operations

Moscow ELEKTRICHESKAYA I TEPLOVOZNAYA TYAGA in Russian No 1, Jan 87 p 13

[Article by P. T. Grebenyuk, doctor of technical sciences of VNIIZhT [All-Union Scientific Research Institute of Railroad Transport]: "Features of Locomotive Operation"]

[Text] The railroads on Sakhalin Island have a gauge which is 1067 millimeters in width. In accordance with this, the rolling stock which is operated here differs from that which is in general use throughout the network by virtue of design, capacities and dimensions. The growing shipping volume calls for improvements in the transportation process and increased efficiency in the utilization of traction equipment and cars on the railroads of an island with complex conditions of climate and topography.

Until 1974, freight destined for Sakhalin and back was shipped by sea. From the wide gauge cars, it was unloaded in sea ports on the mainland into the holds of steamships and delivered to ports on the island, where it was reloaded into railcars, but this time, of 1067 millimeter gauge. The significant transportation costs and low labor productivity made it necessary to organize a ferry crossing and the circulation of 1520 millimeter gauge cars on the railroads of Sakhalin. They solved this problem from many sides. On the one hand, they built the Vanino-Kholmsk ferry crossing, and on the other, they outfitted a center for placing the wide-gauge cars on the narrow-gauge bogies, reinforced the track and widened tunnels.

Putting the Vanino-Kholmsk ferry crossing into service made it possible to transport the wide 1520 mm gauge rail cars to Sakhalin without transshipment of the cargos. This reduced transportation costs and speeded up freight delivery. They place intermediate size bogies having a wheel diameter of 860 mm and a distance of 990 mm between the inner sides of the wheels under the 1520 mm-gauge cars, which comprise one-third of the car fleet. The 1067 mm freight cars are operated on diamond frame bogies with wheel diameter of 685 mm and on cast bogies with wheel diameter of 800 mm.

The cars are moved onto the ferries by diesel switch engine with their automatic brake systems connected. After the locomotive is uncoupled, the cars are connected to a stationary operator's brake valve via a distributive air line, and the brake system is pressured up to a charged pressure of 5.3-5.5 kgf/cm<sup>2</sup>. Then an inspector-repairman begins to inspect the automatic brakes of all of the groups of cars. After a holding time of 10 minutes, the brake pressure is calculated and a report is filled out on form VU-45, which is given to the ferry(man).

The locomotive traction on the Sakhalin division consists primarily of diesel locomotives with hydraulic transmissions which are built at the Lyudinovo Diesel Locomotive Works. The TG16 is used for trains, and the TGM3 and TGM7 are used for switching work. Moreover, diesel trains which include motorized and drawn cars, and individual motorized cars are also operated on the island's railroads. The latter have a control cab at each end and develop maximum speeds of up to 70 kilometers per hour.

The workers in the Sakhalin division of the Far Eastern Railroad are doing much to improve the equipment they service: they are modernizing the car and locomotive fleets and improving the condition of the track. Rail is being replaced with the stronger R65 rail, the ballast prism is being built out of crushed stone and gravel and they are installing cross ties with greater epure.

It should be pointed out that repair of the air line systems is centered at a single automatic brake inspection point. The operators' brake valves are maintained at the locomotive depot. Because of the great diversity of brake devices, their repair has been organized by position here. The older type of foreign equipment is being replaced with domestic for the sake of standardization.

Scientists are also making their contribution to the development of Sakhalin's railroads. In recent years, colleagues at VNIIZhT and KhabIIZhT have taken a number of experimental trips in order to know more precisely about the operating characteristics of the rolling stock. They studied factors influencing the start-off and the movement of the trains, as well as peculiarities in the operation of the brakes. They established that on the older type of passenger cars, the actual pressing force of the brake shoes on the axles is uneven and is a function of the amount of brake cylinder excursion. Therefore, it is recommended that the lever-operated gear be regulated for rod excursion length of 130-160 mm while in operation. This will provide a compression force of 4.5 tf on the axle during emergency braking. On the all-metal passenger cars, the compression force is 6-7 tf.

Actual braking pressure was also determined for traction equipment. On the TG16's, given a linear pressure of the disc-type shoes with solid inserts, the compression force when the air line system is under load does not exceed 6 tf per axle, and when unloaded, does not exceed 3 tf.

Before the experimental trips, the brakes on the train were checked in accordance with procedures established on the railroad. When freight trains depart for sectors with steep, protracted grades, they make a full, procedural brake test, keeping the brakes applied for 10 minutes. Brake cylinder rod excursion is set at 75-100 mm, and the charge pressure in the main brake line is 5.5-6.3 kgf/cm<sup>2</sup>. The pass sections were traversed with the air lines connected as they would be on level ground. The tightness of the air brake system of the freight trains corresponded to the time for reduction of pressure by 0.5 kgf/cm<sup>2</sup> in the TG16's main reservoirs, which was equal to 60-90 seconds for 156 axles.

On the basis of 70 kilometers per hour being the greatest permissible speed, the following norms were set for least braking pressure per 100 tons of train weight (taking the weight of the locomotive and its brakes into consideration): for passenger trains on all sectors -- 35 tf and for freight and freight-and-passenger trains in mountainous sectors with steep, protracted grades -- 28 tf. For freight trains on level sectors, the norm for least braking pressure is 25 tf per 100 tons of train weight.

Analytical dependencies of the fundamental specific resistance on start-off and in motion were established for the various types of rolling stock as a function

of axle load and speed on the basis of results from the experimental trips. It must be noted that the resistance to start-off and movement for cars in use throughout the railroad network, when set on 1067 mm bogies, is approximately 30 percent greater as compared with the wide gauge track.

When analyzing the processes of starting off, operating the train and braking, we determined the specific conditions under which the cohesive force between wheel and rail are achieved. These are linked with the greater humidity, fog, the large number of tunnels and small-radius curves, as well as the crew section of the locomotives and the track condition. These coefficients of cohesion of wheel to rail during the start-off and in the initial stage of movement (at speeds of 5-10 kilometers per hour) turned out to be lower than on the wide gauge.

The standards which the scientists obtained for resistance to movement, brakes, and wheel-rail cohesion are included in the new Rules for Traction Calculations. Recommendations for the efficient utilization of the tractive and coupling features of the TG16 diesel locomotives and a more precise specification of norms for train weight, line running time and fuel expenditure form the basis for further improvement of the transportation process on Sakhalin's railroads.

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## RAIL SYSTEMS

### NIZHNIY TAGIL RAILCAR WORKS SEEKS QUALITY IMPROVEMENTS

Moscow GUDOK in Russian 9 January 87 p 2

[Article by V. Kostromin, member of the Uralvagonzavod [Ural Railcar Plant] Association Party Committee under the rubric "Transport: Quality Criteria": "State Acceptance Is Evaluated"; first three paragraphs are GUDOK introduction]

[Text] Nizhniy Tagil -- It is no secret that our industry's products are not always of high quality. The rolling stock, which is delivered to machine-building enterprises, causes many justified complaints.

State acceptance began to be introduced on 1 January. It has been called upon to increase the reliability and quality of products and to bring them to the level of the best world models.

How did we prepare for it at Uralvagonzavod? What services had to operate so that there would be no interruptions in the technological chain for manufacturing railroad cars in a single sector? What new and future railroad cars is it planned to master? The published correspondence talks about this.

In Uralvagonzavod where they prepared in earnest to incorporate state acceptance, we had occasion to hear the following discussion between a product engineer and the workers:

"According to these production forms and records, you, my lads, must work during the new year so that quality will be ideal and the state acceptance representatives will not have any complaints."

The workers asked: "This is a new technical process?"

The product engineer replied: "No, it is not new. It is just that it must be followed accurately now."

"That means that it was not necessary to follow it before? Why did you not acquaint us with it right away? We would have always done as it required. Who needs rejects?"

The discussion was typical. Before, middle link commanders often did not get around to passing the instructions and production forms and records on to the worker. It was simpler to say: "Do this and this."

This demand for quality finally organized the worker. Indeed there were no special concerns about training and about learning the numbers and standard dimensions by heart. Sight -- by eye, and strike -- as the mood moves. You look -- you have failed to complete the winding by one twist and to screw completely by one thread. You think that the trouble is too much. Moreover, the technical control department will let it pass, and the Ministry of Railway inspectorate will accept it. The main thing is that your wages will be in good order. It turned out that it was more convenient and profitable for everyone to work with a lack of quality, but the state was worse off for it.

All told, the plant paid fines of approximately three million rubles for rejects during 1985 alone. Through the fault of foundry men alone, as many items as would fill 1,500 trucks became scrap during this time. This is what happens: When there is no quality, there is also no quantity, the material incentive fund grows scanty, and assets intended for the construction of housing, kindergartens and nurseries are hidden.

The words "state acceptance" have become for many people something similar to "Attention! great effort." Indeed, the work strain had noticeably risen long before the introduction of product control by State Committee for Standards organizations.

The plant designers in the country's leading chief designer department for building railroad cars began to review their drawings in June 1986 immediately after the organizing order for the enterprise to introduce state acceptance. More than half of them had to be reworked and brought into compliance with the requirements of the standards. The reworking and "polishing" of items is not a novelty for designers; they do this constantly. Changes are introduced into the next serially produced railroad car from the day it is placed on the production line and until the time that a new, more modern and more economical one comes to replace it. Thus, it was with the last model, The result -- the awarding of the Seal of Quality to a general-purpose railroad car with blank face walls in June of this year.

The developers of new large cargo railroad cars fully realize that the high quality of products is laid during the design stage. It is not without reason that they introduced an automated design system in the design department. Approximately two dozen tasks on a computer have already been solved with the help of the SAPR [automated design system]. This has reduced the time for calculations very much. Whereas before, for example, an economist with average qualifications spent a month on determining the economic effectiveness of a change in the load-carrying capacity or volume of a car body, the machine now provides the result in a moment. The engineer's thinking has been completely freed from routine work with the introduction of electronics.

During the 12th Five-Year Plan, it is planned to manufacture and test an experimental model of a four-axle, all-metal gondola car with a load-carrying capacity of 75 -80 tons which has blank face walls and hatches in the floor and a new two-axle bogie and automatic coupler for this railroad car. In a word, the designers -- as they say -- have no objections although they do have their own problems and quite a few of them. However, they have prepared good soil for the successful operation of state acceptance.

The task of the technological service is much more complicated. The existing drawings of the rigging, tools and technological processes, which the production workers have held on to, are -- to put it mildly -- not very punctual and, naturally, contain quite a few inaccuracies, readings and non-compliances with the requirements of the standards. Measuring tools are not sufficient at the work positions. Railroad car machine-tool operators and fitters performed many operations, frequently relying only on their own experience and the advice of their mentors. In preparing for state acceptance, the enterprise's industrial engineers refined and made more precise 494 manufacturing methods in accordance with which gondola car assembly and items are manufactured. All of the rigging was adjusted.

A procedure for conducting the incoming control of component items is being developed. Plant specialists have travelled to allied enterprises in order to eliminate the causes of disagreements and mutual claims on the spot.

The technical control service is being strengthened in the plant and is being staffed with knowledgeable specialists. The official pay rates for technical control department workers are being raised, and they are undergoing professional retraining. The main thing for us now is not simply to exercise control but to reveal the reasons for a reject in a timely fashion and to prevent it.

Like a powerful searchlight, state acceptance has illuminated all chronic unsolved problems and bottlenecks. It is now necessary to eliminate them with common efforts so that the enterprise's products -- general-purpose all-metal railroad cars -- will be better, more reliable and more durable.

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VL86F ELECTRIC LOCOMOTIVE WITH ASYNCHRONOUS MOTORS DETAILED

Moscow ZHELEZNODOROZHNYI TRANSPORT in Russian No 11, Nov 86 pp 37-40

[Article by Engineer P. Valtonen, Chief Designer of Plans and Specifications at VEINII [All-Union Scientific Research, Planning and Design, and Industrial Institute for Electric Locomotives] O. N. Zhulev, and VEINII Director and Candidate of Technical Sciences V. P. Yanov: "Electric Locomotive With Asynchronous Motors"]

[Text] Achievements in the area of semiconductor technology and control systems have created the necessary prerequisites for building electric locomotives with asynchronous traction motors. When the power, rotation rate and a number of other parameters are identical, the mass of a traction asynchronous short-circuited motor is 6-15 percent less than that of a direct current motor. The consumption of copper for an asynchronous motor is reduced by a factor of 2.0-2.5, the labor input in manufacturing it by approximately 20 percent, and maintenance and repair by 10-15 percent.

At the same time, the use of an asynchronous electric motor for traction also involves a number of shortcomings. First of all the necessity arises to have a complex and expensive static converter that first rectifies a single-phase alternating current and then converts it into a triple-phase one of the controlled frequency. Double conversion of total power will lead to a reduction in the k.p.d. [efficiency coefficient] in comparison with rectifying alternating current electric locomotives. The complexity of the power circuit and the control circuit also can cause some reduction in the reliability of an electric locomotive.

As a whole, the effectiveness of using an asynchronous drive for traction in many ways depends on the specific operating conditions. In this connection in 1985 an experimental 12-axle VL86F alternating current electric locomotive was built for verifying the accuracy of theoretical calculations and assessing the advisability of using an asynchronous drive under the rail conditions of the Soviet Union (Figure 1). It has the following basic technical data:

Table 1. Basic Technical Data of VL86F Alternating Current Electric Locomotive

| Item                                                                  | Value                                                 |
|-----------------------------------------------------------------------|-------------------------------------------------------|
| Undercarriage formula                                                 | 2 (2 <sub>0</sub> - 2 <sub>0</sub> - 2 <sub>0</sub> ) |
| Mass                                                                  | 300 tons                                              |
| Axle-to-rails load                                                    | 25 ton-force                                          |
| Design speed                                                          | 110 kilometers per hour                               |
| Hourly rating                                                         | 11,400 kilowatts                                      |
| Long-term rating                                                      | 10,800 kilowatts                                      |
| Maximum traction force when starting off                              | 120 ton-force                                         |
| Hourly rating traction force at a speed of 50 kilometers per hour     | 82 ton-force                                          |
| Long-term rating traction forces at a speed of 50 kilometers per hour | 78 ton-force                                          |
| Traction force at the design speed of 110 kilometers per hour         | 35 ton-force                                          |
| Wheel diameter along the rolling circle                               | 1,250 millimeters                                     |
| Type of electrical brake                                              | Regenerative                                          |
| Ambient air temperature range                                         | From +40° Centigrade to -60° Centigrade               |

The traction performance of the VL86F electric locomotive in comparison with the performance of the VL85 electric locomotive is cited in Figure 2.

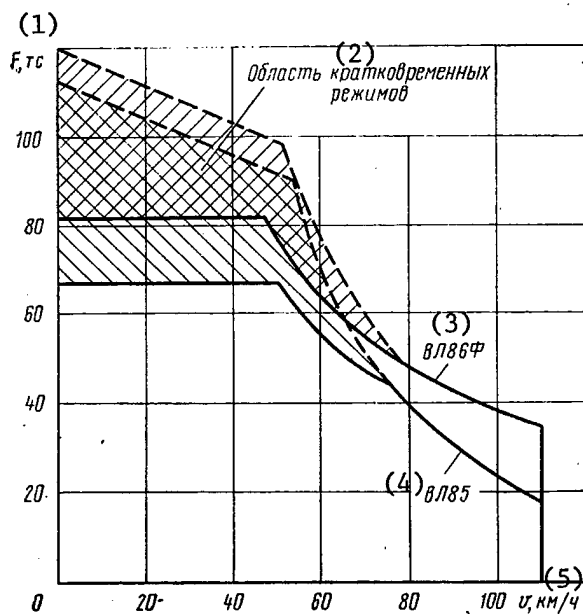


Figure 2. Traction Performance of VL86F and VL85 Electric Locomotives

Key:

- |                                  |                        |
|----------------------------------|------------------------|
| 1. Ton-force                     | 4. VL85                |
| 2. Area of transitory conditions | 5. Kilometers per hour |
| 3. VL86F                         |                        |

Work on creating the VL86F is being conducted by the VElNII [All-Union Scientific Research, Planning and Design, and Industrial Institute for Electric Locomotives] and the Novocherkassk Electric Locomotive Engineering Plant jointly with the Finnish firm "Stremberg," which developed and manufactured the power converter and the electronic control system.

The VL86F electric locomotive consists of two 6-axle sections. Each section has a complete set of equipment (Figure 3) that provides for operation of the electric locomotive under the conditions of traction and regenerative braking with automated control under both conditions. Operation according to a multi-unit system is provided by three or four sections with control from any cab of the railway engineer. The undercarriage is similar to the undercarriage of the VL85 electric locomotive. The voltage is fed to the traction transformer of each section through a current collector and the main switch.

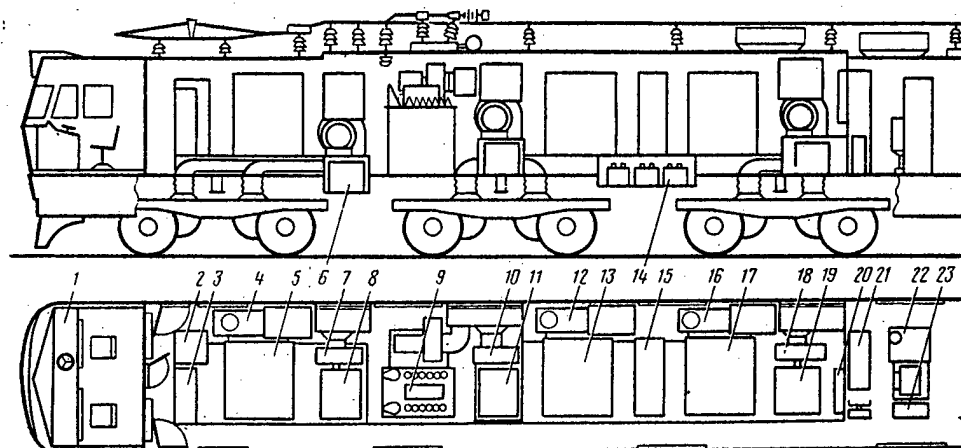


Figure 3. Complete Set of Equipment of VL86F Electric Locomotive

Key:

- |                                   |                                           |
|-----------------------------------|-------------------------------------------|
| 1. Console                        | 13. Static converter                      |
| 2. Power supply unit              | 14. Auxiliary machinery system capacitors |
| 3. Electronic control system unit | 15. Auxiliary equipment unit              |
| 4. Liquid cooling system unit     | 16. Liquid cooling system unit            |
| 5. Static converter               | 17. Static converter                      |
| 6. Network choke                  | 18. Centrifugal fan                       |
| 7. Centrifugal fan                | 19. Power equipment unit                  |
| 8. Power equipment unit           | 20. Low voltage equipment panel           |
| 9. Traction transformer           | 21. Pneumatic equipment unit              |
| 10. Centrifugal fan               | 22. Compressor motor                      |
| 11. Power equipment unit          | 23. Compressed air drying device          |
| 12. Liquid cooling system unit    |                                           |

The ONDTsE-10000/25-83UKhL2 type traction transformer has six traction windings for the power supply of the converters and one winding for its own needs. The rated voltage of each traction winding is 830 volts. The rated voltage of the winding for its own needs is 397 volts with sealing off at 216 volts.

NB-607 type asynchronous short-circuited six-terminal traction motors under long-term operating conditions have the following technical characteristics:

Table 2. Technical Characteristics of NB-607 Type Traction Motors

| <u>Item</u>              | <u>Value</u>               |
|--------------------------|----------------------------|
| Power                    | 900 kilowatts              |
| Voltage                  | 1300 volts                 |
| Stator current frequency | 45 hertz                   |
| Rotation rate            | 890 revolutions per minute |
| Torque                   | 9.66 kilonewton-meters     |
| Efficiency coefficient   | 0.94                       |

The winding connection of traction motors is a star without a neutral terminal, suspension is axle-bearing, ventilation is forced, and the cool air flow rate is 100 meters<sup>3</sup> per minute.

Cooling of the traction transformer is accomplished by an individual centrifugal fan installed in the transformer. The traction motors of each truck along with the network chokes are cooled by a centrifugal fan and the converters are cooled by an individual axial-flow fan included in the converter unit.

All auxiliary drive electric motors obtain their power supply according to a capacitor-splitting circuit from the transformer winding of its own needs. ANE-225 4UKhL2 type asynchronous short-circuited motors are used as the phase splitter and drive motors of transformer fans and traction motors, as well as the main compressor. The "Stremberg" firm's HXUP/SB 365A1 type asynchronous motors are used for the drive of the converter fans and oil pumps.

The basic circuit arrangement of the power circuits of traction motors for the middle truck of an electric locomotive section (the power circuit arrangements of traction motors for the other trucks are similar) is presented in Figure 4. The truck converters are connected to the transformer's T03 and T04 traction windings through the K3 and K4 line contactors and the L13 and L14 network chokes. The network chokes are designed for limiting the short-circuit current build-up rate of the converters. The choke has a closed magnetic circuit in which four coils are installed. The R2 charging resistor is connected in parallel to the K3 line contact by means of the K7 contactor. The charging contactors are engaged for preparing the converter for operation, and the filter capacitors of a constant voltage section are charged through the charging resistors and diode bridges of the rectifier portion of the converters. The line contactors are engaged automatically upon completion of the charge.

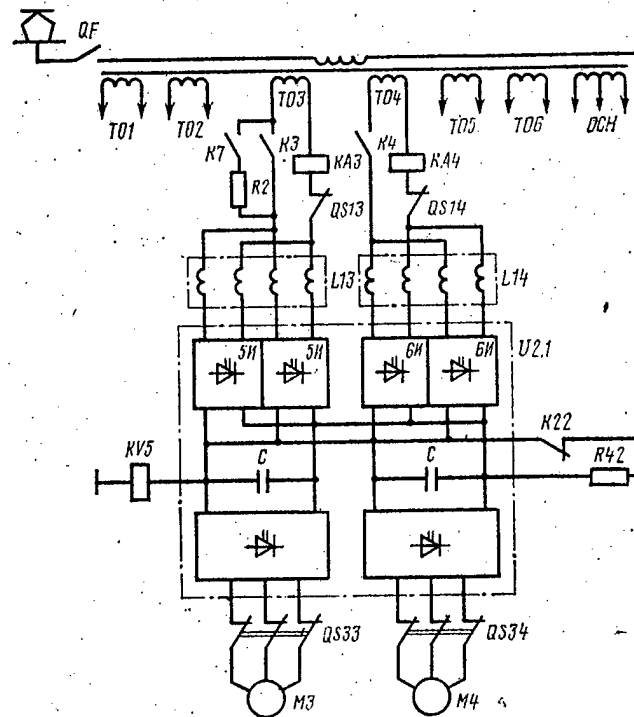


Figure 4. Basic Circuit Arrangement of the Power Circuits of Traction Motors for the Middle Truck of an Electric Locomotive Section (  $\nabla$  is a thyristor device with a forced current-suppression unit)

The R42 discharging resistor is connected to the buses of the converter's constant voltage section through the K22 contactor for ensuring personnel safety. When the current collector is lowered, this contactor closes. Discharging of the filter capacitors (C) is provided for a period of time of no more than 30 seconds.

Protection of the converter under emergency conditions is accomplished by disconnecting the main switch (QF). The converter's thyristors open simultaneously in a forced manner. The KA3 and KA4 peak current relays, the signal from which influences the main switch, are provided for in the circuit of the transformer's traction windings. The KV5 grounding relay is connected to the negative buses of the converters' constant voltage section for protection from "ground" shorts. Special protection of the traction motors from overloads in the electric locomotive's circuit is not provided for, since it is provided by a control system. A defective converter can be disconnected by the QS13 and QS14 disconnecting switches, and defective M3 and M4 traction motors by the QS33 and QS34 disconnecting switches.

A converter with an intermediate constant voltage section is used on the VL86F electric locomotive for converting the single-phase current of a commercial frequency into a triple-phase one of a controlled frequency and voltage. The converter consists of three basic parts: a single-phase rectifier, an intermediate constant voltage section, and a triple-phase self-contained inverter.

The inverter, the basic circuit arrangement of one phase of which is presented in Figure 5, is the main section of the converter. Each phase of the inverter consists of branches of the T1 and T2 main thyristors, branches of the D1 and D2 reverse diodes, and the T3 and T4 auxiliary (switching) thyristors. The C1 and C2 switching capacitors and the L1 and L2 switching chokes are common for all three phases of the inverter. In each of the 2 branches of main thyristors there are 3 12th class TB-253 instruments connected in series with a shutoff time of 40 microseconds. Fourteenth class TB-253 instruments with a shutoff time of 50 microseconds are used as auxiliary thyristors. Before installation in an electric locomotive the thyristors are specially selected in accordance with a number of additional parameters, particularly according to the residual recovery charge and the reverse current form factor. DCh-143 diodes, which also are connected in series in threes, are used in the branches of reverse diodes. The type of switching capacitors is the PZh-2.6/1.35-5.3KhL2.

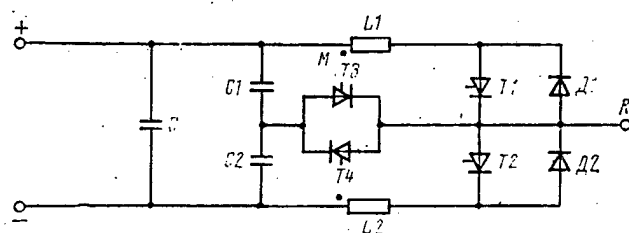


Figure 5. Basic Circuit Arrangement of One Phase of an Inverter

The main thyristors of each phase of the inverter are switched successively according to a particular algorithm--in accordance with the prescribed frequency of the current of the traction motor's stator and the phase repetition sequence--for converting the constant voltage into a triple-phase one. In this regard, the output line voltage remains unchanged. The effective value of its first harmonic is equal to approximately 0.78 of the voltage of the constant voltage section, which is equal to 1,670 volts. The half-cycle of voltage takes the form of a square pulse with amplitude .

The condition, when the voltage remains constant and the frequency (single-pulse operation) changes, is typical of the operation of an asynchronous traction motor with an attenuated field and frequency above the rated one (from 45 to 105 hertz), and that corresponds to the speed of an electric locomotive from 48 to 110 kilometers per hour. When the frequency is below the rated one, in order to maintain the motor's constant magnetic flux it is necessary to reduce the inverter's output voltage in proportion to the reduction in the frequency of the

current of the stator. This is achieved by reducing the pulse width (pulse-width control). However, a control method like this makes the harmonic composition of the inverter's output voltage worse and reduces the motor's k.p.d. because of an increase in losses in it.

For reducing the harmonic components the inverter's main thyristors in addition are switched over the course of each half-cycle of the basic frequency so that the half-cycle of the output voltage contains a series of pulses, the number of which increases in proportion to the reduction in the basic frequency. The switching frequency is equal to the product of the magnitude of the basic frequency (the frequency of the current of the stator) times the number of pulses per half-cycle. Accordingly, voltage control in the traction motor is accomplished by changing both the number and the width of the pulses (pulse-width modulation). The control conditions are selected on the basis of the conditions of providing an optimum ratio of losses in the motor and the inverter.

Closing the main thyristors during switching is accomplished by means of a special oscillatory circuit, which contains the C1 and C2 switching capacitors and the L1 and L2 chokes (see Figure 5). The energy that is necessary for suppression is stored in the capacitors during the period between switchings. The T3 and T4 thyristors impede discharging of the capacitors during the periods between switchings. The constant voltage intermediate section (C) (see Figures 4 and 5), which consists of an FZh-1.6-600 type filter capacitor bank, serves as an energy storage device that provides power independence at the traction motor shaft from fluctuations of power that is being selected from the contact system.

The rectifier performs according to the circuit of a reversing single-phase converter in which a thyristor bridge, which just as with the inverter is being controlled according to the pulse-width modulation method, is connected in counterparallel to the diode bridge. A rectifier of a type like this lets energy flux through from both the contact system to the traction motors and in an opposite direction. Thereby the regenerative braking of an electric locomotive is provided without additional equipment. In addition, due to a system like this the possibility emerges to eliminate the phase shift between the voltage and the current. As a result, the power factor of the electric locomotive both under traction and regenerative conditions can be close to one.

The rectifier for two traction motors of one truck consists of two pairs of bridges (two 5I and two 6I bridges, see Figure 4). Each pair of bridges of the same name receives its power supply from a separate traction winding of the transformer through network chokes. On the direct current side all the bridges are connected in parallel. The devices for forced switching of the thyristors of the rectifier bridges are similar to the corresponding devices of the inverter branches.

All the rectifier bridges are identical in terms of design. At the same time, they have somewhat different control algorithms for reducing the effect of higher harmonics of the network current on the electric power supply system. The half-cycle of the surge voltage that is generated by the 5I rectifier bridges consists of five pulses and the one that is generated by the 6I bridges

consists of six pulses. In terms of amplitude the pulses are equal to the constant voltage  $U_c$  and, as was noted, their width can be controlled. Thyristors, diodes and capacitors of the same type as in the inverter are used in the rectifier. A parallel connection of the bridges is used in view of the fact that the parameters of the thyristors being manufactured at the present time do not make it possible to create a single bridge of the required power, but a parallel connection of thyristors in the branch of the bridge would require the use of dividers, force making the demands on thyristors more rigid, and complicate the converter's circuit and design.

The filter capacitor banks of the converters of a truck's two traction motors are connected in parallel. Accordingly, each truck motor has its own inverter, but the constant voltage intermediate section is common. In terms of design the converter for the power supply of a truck's two traction motors is made in a single unit along with its own cooling system. Heat release from the semiconductor power devices and from the converter's RC circuits is accomplished by a special silicone fluid, which has good insulating properties and quite low viscosity at low temperatures--right down to  $-60^{\circ}$  Centigrade.

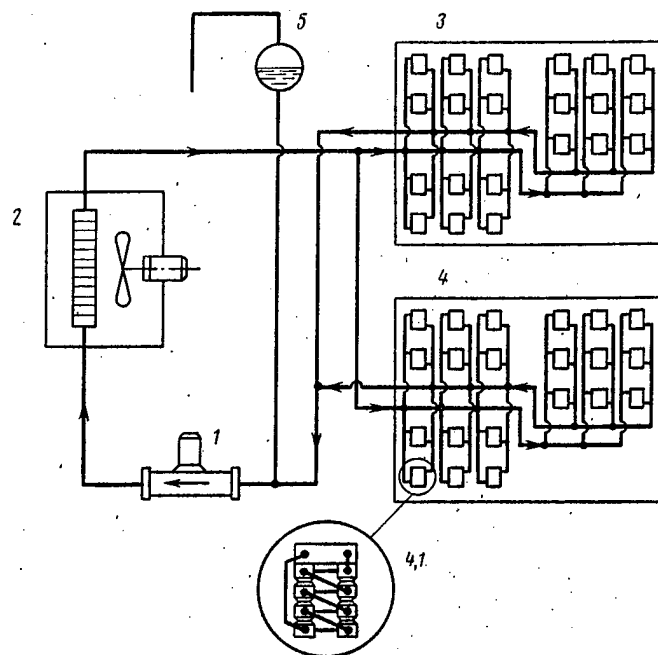


Figure 6. Block Diagram of the Liquid Cooling System of a Truck Converter

Key:

- |              |                   |
|--------------|-------------------|
| 1. Pump      | 4. Converter      |
| 2. Radiator  | 4.1. Coolers      |
| 3. Converter | 5. Auxiliary tank |

The converter of each truck has a self-contained liquid cooling system, a block diagram of which is presented in Figure 6. From the pump (1) the fluid enters the radiator (2) and then on to the converters (3 and 4). The heated fluid from the converters enters the oil pump inlet. Cooling of the fluid is provided by a two-stage axial-flow fan located under the radiator. The fan sucks the outside air in through the louvers on the lateral wall of the electric locomotive cab and expels it under the cab through the radiator. From the aspect of sucking in, an auxiliary tank (5), which impedes the generation of a discharge in the system and serves as an expansion tank when the volume of oil changes depending on the temperature, is connected to the oil pump. The expansion tank is connected with the atmosphere by a "breather" tube.

The converter's semiconductor devices are arranged in power modules--six devices apiece in each one. Each of the module's semiconductor devices is located between two hollow copper coolers. The coolers in the cooling fluid circulation diagram are connected in series (Figure 6, 4.1). The module itself is connected to the converter's cooling system by self-squegging quick-release connections, by which rapid replacement of the entire module's devices is provided without draining the fluid and losing it.

The cooling system is equipped with built-in temperature sensors. The fan is turned on at a fluid temperature above 50° Centigrade and turned off at a temperature of 35° Centigrade. This provides favorable temperature operating conditions for the semiconductor devices irrespective of the temperature of the environment. A warning light comes on when the temperature of the fluid in the control unit is 70° Centigrade, and the converter is automatically disconnected when the temperature is 73° Centigrade.

The electric locomotive's automatic control system maintains the traction force or the braking and speed prescribed by the railway engineer. A change in the direction of movement, as well as changing from traction conditions to regeneration conditions and back, is accomplished according to a command received from the railway engineer's control unit. The control system has three levels: an electric locomotive control subsystem, a truck control subsystem, and an axle control subsystem. An electric locomotive control unit, three truck control units and six axle control units are located in each section of the electric locomotive in a common control box.

A block diagram of the control system is presented in Figure 7. Information concerning the direction of movement (1), connection authorization (2), and the command for traction or braking (3) is received from the railway engineer's control unit. The prescribed load and speed values are received along channels 4 and 5. Units 6, 7 and 8 are included in the electric locomotive control subsystem. On the basis of data on the axle rotation rate, unit 6 generates its average value for the speed governor (7) and a signal for the skid-protection circuits (11). Unit 8 limits the load value depending on the speed.

Units 18 and 20-28 are included in the truck control subsystem. Authorization for connecting the rectifiers and inverters is generated in unit 18, and the prescribed value of current  $I_v$ , which is selected by a rectifier from the

network on the basis of a signal from the voltage regulator (20) and the inverter load sensor (22), is generated in unit 21. The prescribed value of the surge voltage for control pulses in the 5-pulse and 6-pulse rectifiers in units 25 and 26 is generated by means of phase interlocking (24) and a vector computer (23). Units 27 and 28 generate the ignition pulses.

Units 9-17 and 19 are included in the axle control subsystem. Units 9-13 generate the prescribed torque of the electric motor on the basis of the prescribed load. Unit 12 limits the torque when there is boxing up or skidding of the axles, and unit 13 limits it when there is a voltage reduction in the system. Unit 10 ensures the necessary speed for changing the prescribed moment value. Moment control is accomplished by unit 16, which transmits the prescribed frequency value to the logic unit (17) that generates the control pulses of the thyristors. Unit 19 generates pulses for turning on the thyristors.

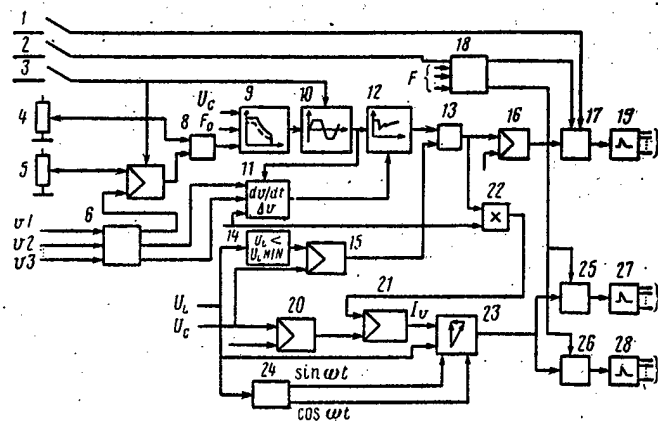


Figure 7. Block Diagram of the Electric Locomotive's Control System

Key:

- |                                |                          |
|--------------------------------|--------------------------|
| 1. Direction of movement       | 15. Unit 15              |
| 2. Connection authorization    | 16. Unit 16              |
| 3. Traction or braking command | 17. Logic unit           |
| 4. Channel 4                   | 18. Unit 18              |
| 5. Channel 5                   | 19. Unit 19              |
| 6. Unit 6                      | 20. Voltage regulator    |
| 7. Speed governor              | 21. Unit 21              |
| 8. Unit 8                      | 22. Inverter load sensor |
| 9. Unit 9                      | 23. Vector computer      |
| 10. Unit 10                    | 24. Phase interlocking   |
| 11. Skid-protection circuits   | 25. Unit 25              |
| 12. Unit 12                    | 26. Unit 26              |
| 13. Unit 13                    | 27. Unit 27              |
| 14. Unit 14                    | 28. Unit 28              |

The VL86F electric locomotive testing program provides for researching its traction and braking characteristics under various operating conditions and comparing them with similar characteristics of the VL85 electric locomotives with smooth voltage control.

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