A. ZVORYKIN

ENGINEERING PROGRESS IN THE U.S.S.R.

FOREIGN LANGUAGES PUBLISHING HOUSE

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CONTENTS

During the years of Soviet power Russia has undergone a basic transformation. Once a backward, agrarian country, technically and economically dependent on capitalist states, she is now a mighty industrial and collective-farm power with a first-class industry and the world's largest-scale agriculture, well-equipped with modern machines.

The Communist Party, having led the Great October Socialist Revolution to victory, saved Russia from national catastrophe to which she had been reduced by her capitalist and landlord rulers, and delivered her from the status of a semi-colonial country dependent on world imperialism. The great Communist Party, forged and steeled in battle by Lenin, the man of genius, took the Soviet people out to the high road of socialist transformations.

From its inception Soviet economy began to develop as a planned economy based on the objective economic laws of socialism that call for the continuous expansion and perfection of socialist production on the basis of higher techniques in order to satisfy to the maximum the material and cultural requirements of all the members of society.

When the Soviet state was still in its first years of existence, V. I. Lenin elaborated a scientific programme for the conversion of economically backward Russia into an advanced socialist power. Lenin's programme envisaged the socialist industrialization of the country, the all-out and immediate development of the heavy industry, and the country's electrification as the basis for the technical reconstruction of all the branches of the national economy. He worked

out a co-operative plan of remodelling agriculture along socialist lines, and outlined the path for a cultural revolution.

The magnificent effort exerted by the Soviet people carried them over the economic difficulties that ensued from pre-revolutionary Russia's backwardness and from the economic ruin brought about by the first world war and redoubled many times over by foreign military intervention and civil war. After the bloody battles in which it defended the dictatorship of the proletariat, the Communist Party of the Soviet Union directed the entire revolutionary energy of the broad masses towards restoring the national economy and achieved tremendous successes in an unprecedentedly short space of time.

With the laying of the first foundation stones for the edifice of socialism, the Communist Party devoted considerable attention to the development of science and engineering as powerful levers for raising the productive forces. V. I. Lenin said that the way to win communism was "to place the economy of the country, including agriculture, on a new technical basis, the technical basis of modern large-scale production."[1]

Our Party has been firmly and consistently implementing the programme of the technical revolution. At every stage of socialist construction it moved the decisive links to the fore, and by following them up it dragged out the entire chain of the country's technical reconstruction and the growth of her productive forces.

In March 1919, during the foreign military intervention and civil war, when devastation in the young Soviet land was most severe, the Eighth Party Congress adopted the programme of the R.C.P.(B.) in which it pointed out that the over-all expansion of the country's productive forces was the cardinal point determining the entire economic policy of the Soviet power.

[1] V. I. Lenin, *Works*, 4th Russ. ed., Vol. 31, p. 484.

The Ninth Party Congress (1920), which outlined the country's immediate economic tasks, paid particular attention to the question of a single economic plan. First and foremost that plan provided for the development of transport, fuel, and metallurgy. For this purpose priority was given to the problem of electrifying the whole national economy, on which basis the plan of the State Commission for the Electrification of Russia was subsequently drawn up. V. I. Lenin called this plan the second programme of the Party. The congress also pointed out that a single economic plan should rest on the latest achievements of engineering and required that in its realization particular attention should be paid to the broadest utilization of electric power.

When, through the efforts of the entire Soviet people, marked progress had been made in repairing the ruined economy, the Fourteenth Party Congress (1925) adopted its historic decision to industrialize the U.S.S.R. The prime task that the congress set the Party and the country was "to ensure the economic independence of the U.S.S.R., which would prevent the country's conversion into an appendage of capitalist world economy, by industrializing the country, developing the production of the means of production, and forming reserves for economic manoeuvring."[1]

The substantial headway made in concluding the period of restoration was noted with great satisfaction by the Fifteenth Party Congress (December 1927). By that time state industry had surpassed the pre-war level, the number of employed workers had increased, and productivity of labour had been raised.

The building of a large state industry was accompanied by a steady growth of the share of the production of the means of production. "The surpassing of the pre-war levels in industry," the decisions of the Fifteenth Party Congress pointed out, "the renewal of the fixed capital of socialist in-

[1] Resolutions and Decisions of C.P.S.U. Congresses, Conferences and Central Committee Plenums, Part II, pp. 196-97.

dustry, the beginning of basic technical and organizational transformations, notable progress in electrification, the creation and development of new branches of industry (machine-building, machine-tool building, automobile, turbine, aircraft, and chemical industries), the building of new plants, large construction works, and installations, and a fundamental re-equipment of the old plants—such were the material achievements of the Party and the working class along the path of industrializing the country as mapped out by the Fourteenth Party Congress."[1]

Towards the close of the period of restoration, the Soviet land began carrying out Lenin's slogan of "overtaking and surpassing" the technically developed capitalist countries. To that end the Party drew up the five-year plans of the development of the national economy of the U.S.S.R., and their implementation raised the country to an unprecedented level of economic and technical progress.

TECHNICAL REVOLUTION IN U.S.S.R. NATIONAL ECONOMY DURING THE PRE-WAR FIVE-YEAR PLAN PERIODS

In conformity with the Communist Party's policy of industrializing the country, the first five-year plan provided, in the first instance, for intensifying the production of the means of production so that the requirements of the heavy and light industries, transport and agriculture would, in the main, be satisfied by the home industry.

The entire Soviet people welcomed the first Five-Year Plan of the Development of the National Economy with tremendous enthusiasm. A mass socialist emulation movement was started in the country in response to the appeal of the Sixteenth All-Union Party Conference (1929). It was inspired by the militant call of the Communist Party to all

[1] *Ibid.*, pp. 436-37.

the working people to overtake and surpass the advanced capitalist countries technically and economically and to carry out the socialist reconstruction of the whole national economy in a relatively short space of time.

The Sixteenth Party Congress (1930) re-emphasized that the creation of a large-scale socialist industry was most important for the successful building of socialist society. The congress noted that the rapid rate of industrialization adopted by the Party was correct and demanded its further acceleration. At the same time the congress revealed a number of difficulties and concentrated the attention of the whole Party on overcoming them. The congress adopted a decision to consolidate and expand the power base to a point where it would ensure the uninterrupted extension of industry, of the whole national economy in all regions of the country; to increase the output of all kinds of fuel and for this purpose to speed up heading and the construction of large mines; to spur the output of tractors, agricultural machinery, and automobiles, and to develop the chemical industry to a size that would correspond to the demands of the rapidly developing industry and agriculture. The Communist Party and the Soviet Government carried out sweeping organizational measures for the construction of tractor-building plants in Stalingrad, Kharkov, and Chelyabinsk, of a harvester-combine plant in Zaporozhye, of auto works in Moscow and Gorky, etc.

The Sixteenth Party Congress considered it necessary to introduce chemistry in all branches of the national economy with undeviating consistence. To this end the country worked to achieve a faster rate of producing mineral fertilizers and agricultural pesticides, as well as a faster rate of producing artificial fibre, of developing forest chemistry, of processing slates, peat, and chemically valuable coals, and of producing synthetic oils and fuels, paints, building materials, and so on.

The technical reconstruction of all branches of the national economy was possible only on the basis of the ac-

celerated development of machine-building, especially heavy machine-building, which puts out equipment for the metallurgical and mining industries, and for the machine-tool building, electrical machine-building, boiler-and-turbine building, Diesel engine building, and other industries. Therefore, the Sixteenth Congress deemed it necessary to have the plan for the machine-building industry revised with a view to freeing industry and the whole of the national economy from dependence upon foreign countries once and for all and to satisfying the basic requirements of the national economy with the output of home machine-building.

Ferrous and non-ferrous metallurgy provides the foundation for the upsurge of machine-building and of all the other branches of industry. For that reason the Communist Party made a great effort to reconstruct old factories and plants and to build new ones such as the Magnitogorsk and Kuznetsk giants, the Zaporozhye plant in the Ukraine, the Nizhni-Tagil plant in the Urals, and others. As the industrialization of the country could no longer rest on the southern coal and metallurgical base alone, the Sixteenth Party Congress recognized the vital necessity of creating a second nationally important coal and metallurgical centre in the east of the U.S.S.R. by making use of the extremely rich coal and ore deposits in the Urals and Siberia.

The Party's economic policy, pursued in keeping with the basic interests of the Soviet people, has won vigorous support among the masses. The construction of the titans of socialist industry was started on an unparalleled scale. These were the auto works in Moscow and Gorky, the tractor plant in Kharkov, the first wing of the heavy machine-building plant in the Urals, the harvester-combine plant in Saratov, the copper smelting plant in the Urals, dozens of coal mines, oil refineries, and others. A stable industrial base, ensuring the further technical re-equipment of the national economy, including agriculture, was created through the commissioning of first-class machine-building plants.

The first five-year plan was fulfilled ahead of schedule in 1932, and in that period (1928-1932) the gross output of the heavy industry increased by 190 per cent.

The Communist Party followed up the successful first five-year plan by calling upon the entire Soviet people to carry out new tasks aimed at consummating the country's technical reconstruction. These great tasks were reflected in the decisions of the Seventeenth Party Congress (1934), which stated:

"...The final reconstruction of the entire national economy is the cardinal and decisive economic task of the second five-year plan. The determining prerequisite for completing the technical reconstruction of the national economy in the second five-year plan period must be the mastering of new machinery and new industries."[1]

In the second five-year plan period (1933-1937) the country's total industrial output and the output of the means of production increased by 120 and 140 per cent respectively; a particularly marked growth was achieved in the output of electric power, rolled stock, automobiles, tractors, harvester combines, and chemicals. Already by the end of the second five-year plan period the specific weight of industrial output in the national economy was 77.4 per cent, agriculture's share being only 22.6 per cent. (In 1913 industry provided only 42 per cent of the gross output in Russia; agriculture supplied the rest.)

The Soviet Union became Europe's biggest industrial producer already in 1935. The leading role in the country's technical reconstruction was played by newly created industries producing modern equipment and by the considerable expansion of the output of fuel, and ferrous, non-ferrous, and rare metals.

Tsarist Russia used to import almost half the machinery she needed, while the Soviet Union, already by the end

[1] Resolutions and Decisions of C.P.S.U. Congresses, Conferences and Central Committee Plenums, Part III, p. 203.

of the first five-year plan, reduced machinery imports to a tenth of her requirements in spite of the fact that these requirements had increased many times over. Towards the close of the second five-year plan period imports covered altogether only 0.9 per cent of the country's need for machines. The newly organized production of machines for all branches of the national economy was the deciding factor in the country's technical re-equipment.

The Soviet Union stepped into world leadership for the degree of saturation of industry with new, up-to-date machinery. At the Eighteenth Party Congress (1939) J. V. Stalin said: "There are no more or hardly any more old plants in our country, with their backward technique, and hardly any old peasant farms, with their antediluvian equipment. Our industry and agriculture are now based on new, up-to-date technique. It may be said without exaggeration that from the standpoint of technique of production, from the standpoint of the degree of saturation of industry and agriculture with new machinery, our country is more advanced than any other country, where the old machinery acts as a fetter on production and hampers the introduction of new techniques."[1]

Indeed, already in 1937 more than 80 per cent of the entire industrial output came from enterprises that were either new or had been completely reconstructed during the first and second five-year plan periods.

By 1938 the U.S.S.R. had become the world's biggest producer of agricultural machinery, locomotives, harvester combines, peat, and manganese ore, and the second biggest producer of lorries, tractors, oil, and iron ore. In Europe the Soviet Union held second place for the output of pig-iron, steel, and electric power.

In the course of the first and second five-year plan periods the U.S.S.R. developed a faster rate of industrial expansion than the leading capitalist countries. That steady

[1] J. Stalin, *Problems of Leninism*, Moscow 1953, p. 759.

growth continued during the third five-year plan period as well. In 1940 Soviet gross industrial output rose by 44 per cent over the 1937 level. In other words, it increased 12-fold compared with 1913.

The Eighteenth Party Congress (1939) set the country the new task of outstripping the capitalist states economically, i. e., in per capita output, for it had already overtaken and surpassed them in technique and in the rate of development.

These instructions of the Party formed the basis of the nation-wide effort to fulfil the third five-year plan, whose realization was cut short by the perfidious attack launched by Hitlerite Germany on June 22, 1941.

By the time the Great Patriotic War broke out the Soviet state had a powerful industry and a highly developed agriculture which was equipped in conformity with the last word in technique. A very profound technical revolution had transformed every branch of the industry and transport. New machinery replaced the old and was in its turn replaced by the most up-to-date equipment.

The economic map of the U.S.S.R. changed beyond recognition. A new giant coal and metallurgical base in the east—the Urals and Kuznetsk combine—was added to the old but completely reconstructed coal and metallurgical base in the Donbas. New large centres of the heavy industry sprang up in Western and Eastern Siberia, the Far Eastern territory, South, Central and North Urals, the north-western part of the U.S.S.R., Kazakhstan, the republics of Central Asia and the Transcaucasus. A new oil base, figuratively called the "Second Baku" by the Soviet people, was established in the heart of the country, between the Volga and the Urals. New centres of the textile industry came into being in Central Asia and in Siberia. A tremendous rate of over-all progress was achieved by different branches of the light and food industries; technical re-equipment embraced the cotton, silk, wool, leather and footwear, knitted fabrics, sugar, canning, confectionery, meat, dairy and other

industries directly satisfying the needs of the population in food and consumer goods.

Relying on the might of socialist industry, the Communist Party of the Soviet Union ensured the victory of the collective-farm system and carried into effect the socialist reconstruction of agriculture. Small and tiny individual farms with their primitive implements gave place to new and unprecedentedly large-scale collective farms based on the broadest employment of modern machinery and scientific agrobiology.

The implementation of the industrialization plan gave the Soviet Union colossal production capacities, which, during the Great Patriotic War, made possible the launching of an extensive war industry and supplying the Soviet Army with everything it required to fight the war and achieve victory.

Modern war is a war of engines. It is a test of all the forces of the belligerents, including their machines. The Soviet Union demonstrated the high class of its machinery by winning the war in single combat with Hitlerite Germany. Already at the very outset it became obvious that Soviet artillery, aircraft, and tanks were more than a match for the war machines of the German fascist army. The enemy's numerical superiority in certain kinds of weapons and equipment—tanks, mortars, submachine-guns—was nullified in the course of the war.

World War II showed the maturity of Soviet designers and the many-sided experience of the workers in the Soviet machine-building industry, who speedily organized the mass production of arms and ammunition and proved able quickly to put out new models and types of aircraft, tanks, ordnance of various kinds, mortars (including rocket-launchers), machine-guns, submachine-guns, bombs, and so on. The transition from one type of machine to another and the modernization of military equipment was carried out without stopping production. Technological improvements and the introduction of line production ensured the rapid

development of the individual output of the first models of new machines into serial and then into mass production.

The weapons produced by our industry won military fame and the confidence of Soviet troops. Soviet KV and T-34 tanks had better armour and greater fire power than the German mass T-3 and T-4 tanks as well as the Tigers and Ferdinands put out in the middle of the war and advertised by the Hitlerites as "new, peerless weapons." The best German tank, the Panther, was produced by drawing upon the main constructional merits of the Soviet T-34. Soviet anti-tank guns and self-propelled artillery were a formidable force in the struggle against the enemy. Soviet Yakovlev and Lavochkin fighters, Ilyushin stormoviks, and Tupolev and Petlyakov bombers were technically far superior to the German Messerschmitts, Focke-Wulfs, and Heinkels.

U.S.S.R. supremacy in military equipment was an expression of the colossal upsurge of Soviet science and technique, the result of the technical revolution carried out during the pre-war five-year plan periods, and of the technical advance that proceeded at an accelerated rate during the war as well.

POST-WAR RESTORATION AND DEVELOPMENT OF U.S.S.R. NATIONAL ECONOMY ON A NEW TECHNICAL BASIS

After the victorious termination of the war the Soviet Union set about restoring her national economy on territory that had been temporarily occupied. In spite of the tremendous destruction caused by the fascists, the Soviet people rapidly restored their economy and advanced it at a still faster pace. The assignments of the Fourth Five-Year Plan of Rehabilitation and Development of the National Economy of the U.S.S.R. for 1946-1950 were overfulfilled. Gross industrial output in the last year of the five-year plan (1950) was 73 per cent higher than in pre-war 1940 and over 19 times greater than in 1913.

Industry was restored on a new technical basis. The overfulfilment of the first post-war five-year plan was preconditioned by the perfection of technological processes and the utilization of the latest achievements of science.

Technique cannot remain and never remains at a standstill. It improves all the time. The specific features of technical progress in the U.S.S.R. are an unceasing effort to renew technique, a systematic modernization of equipment, and an enterprising application of advanced technology. In the current (fifth) five-year plan period these features are manifesting themselves in a most telling manner.

The impressive programme of economic construction and technical progress in the fifth five-year plan period was predetermined by the directives of the Nineteenth Congress of the Communist Party for the plan of U.S.S.R. development in 1951-1955. These directives precisely outlined the technical policy for every branch of the national economy and pointed out scientifically substantiated ways of advancing engineering practice.

In conformity with the plan to further industrial output, the Nineteenth Party Congress suggested increasing state capital investments in 1951-55 by approximately 100 per cent over the 1946-50 investments. In addition to the commissioning of new enterprises and aggregates, the congress proposed that "the output capacity of already operating enterprises must be increased by their reconstruction, by the installation of new equipment, by the mechanization and intensification of production, and by the improvement of technological processes."[1] Thus the Communist Party concentrated the whole country's attention on such most important problems of technical progress as the introduction of new machinery and engineering methods, mechanization, intensification, and improvement of technology.

[1] Directives of the Nineteenth Party Congress for the Fifth Five-Year Plan of the Development of the U.S.S.R. in 1951-1955, Moscow 1952, p. 7.

In regard to the engineering progress of separate branches of industry the directives of the Nineteenth Congress called mainly:

Ferrous metallurgy—to activate further the existing capacities of iron and steel plants; to intensify metallurgical processes on a bigger scale; to automatize and mechanize metallurgical units and labour-consuming work.

Non-ferrous metallurgy—to mechanize mining and labour-consuming work; to automatize and intensify production processes; to intensify the complex extraction of metals from ore; to further the output of highest grade metals; considerably to augment and to make better use of the capacities of existing plants.

Electric power stations—to automatize production processes on a large scale; to fully mechanize district power stations; to introduce remote control in power systems.

Coal industry—to improve methods of exploiting coal deposits; to introduce the most up-to-date mining machines for the over-all mechanization and further technical re-equipment of the coal industry and to ensure the growth of labour productivity; to develop the over-all mechanization of the most arduous mining processes, principally clean-up work at the face, and the loading of coal and rock in development workings: to introduce mechanized methods of shaft walling.

Engineering industry—considerably to increase the output of equipment for all branches of the national economy; adequately to supply up-to-date first-class equipment to power stations, ferrous and non-ferrous metallurgical plants, construction sites of oil refineries and synthetic liquid fuel plants, and the chemical industry; to develop in necessary quantities the output of hydraulic and steam turbines, generators, high-voltage apparatuses, and various control instruments for large hydraulic and steampower stations, metallurgical plants, oil refineries, and other plants; greatly to increase the output of rolled stock, big machine-tools and high-precision machine-tools, heavy forge and pressing equipment, control and checking instruments,

automatic and remote control machinery, and chemical equipment; substantially to increase the output of large Diesel lorries as well as gas-generator automobiles, hoisting and hauling equipment, machines for the mechanization of arduous labour, complete sets of equipment for the production of building materials, and automatic equipment for various branches of the light and food industries; to put out high-capacity machinery and equipment for the timber-cutting, pulp and paper milling, sawing, and wood-working industries; to design new machines with consideration for lightness and improved quality.

Chemization of industry—broadly to introduce oxygen into the technological processes of different branches of industry, particularly in ferrous and non-ferrous metallurgy, in the production of coal gas, and in the pulp and cement industries.

Output of consumer goods—extensively to automatize and mechanize food and consumer goods production processes.

Construction work—widely to introduce industrial methods, to complete the mechanization of the main construction processes, and to secure a transition from the mechanization of separate processes to the over-all mechanization of construction work.

Agriculture—to complete the mechanization of the main field work in collective farms; to mechanize arduous labour in livestock breeding, vegetable growing, and gardening, in transporting, loading and unloading agricultural produce, in irrigation work, in reclaiming marshland and cultivating new land. In 1955 the level of mechanization must be: ploughing, sowing grain, technical and fodder crops—up to 90-95 per cent; harvesting grain and sunflower seeds with combines—up to 80-90 per cent; picking cotton with cotton-picking machines—up to 60-70 per cent; sowing and harvesting flax-fibre—up to 80-90 per cent; sowing, row cultivating and harvesting potatoes—up to 55-60 per cent; mowing and siloing—up to 70-80 per cent.

Railway transport—to lengthen by the end of the five-year plan period the stretches of line equipped with automatic blocking by approximately 80 per cent compared with 1950 and supply them with not less than 2.5 times more auto-stops; to increase the number of electric interlock switches by approximately 2.3 times; to employ centralized dispatching on a much larger scale; to further the mechanization of marshalling yards; to introduce wireless to control train movements and shunting operations.

These directives show the care and the scientific penetration the Party is exercising in elaborating problems of developing and perfecting engineering methods and equipment. The decisions adopted by the congress demonstrate over and over again the C.P.S.U.'s tremendous importance as the leader and organizer of the progress of Soviet technique.

The directives of the Nineteenth Party Congress have placed the further rise of industrial output at approximately 70 per cent above the level of the fourth five-year plan period with a mean annual growth rate of about 12 per cent for the gross industrial output. Implementation of these instructions is proceeding successfully. Compared with 1940, gross industrial output increased by 102 per cent in 1951 and by 130 per cent in 1952. The industry producing the means of production exceeded the pre-war level by 100 per cent in 1950, by almost 140 per cent in 1951, and by approximately 170 per cent in 1952. In the aggregate, the volume of industrial output in 1953, the third year of the fifth five-year plan, was 150 per cent higher than in pre-war 1940.

In the third year of the fifth five-year plan period the Soviet Union produced:

steel—38 million tons, or over 100 per cent more than in 1940;

coal—320 million tons, or 93 per cent more than in 1940;

oil—over 52 million tons, or almost 70 per cent more than in 1940;

cement—over 16 million tons, or almost 200 per cent more than in 1940;

electric power—133,000 million kilowatt-hours, or 180 per cent more than in 1940;

cotton fabrics—5,300 million metres, or 34 per cent more than in 1940;

woollen fabrics—over 200 million metres, or approximately 70 per cent more than in 1940;

silk fabrics—over 400 million metres, or over 400 per cent more than in 1940;

sugar—3.6 million tons, or almost 70 per cent more than in 1940;

butter—400,000 tons, or almost 80 per cent more than in 1940.

These figures furnish additional proof of the great advantages of the socialist system, of the triumph of the policy of industrialization, and of the tremendous headway made by Soviet science and engineering.

The achievements of Soviet science and technique form the foundation for the growth and perfection of socialist industry. Soviet machine-building plants are putting out hundreds of new types of machines which further the engineering progress of the national economy.

Every year sees advances in the mechanization of production in all branches of the national economy: in coal mines, the timber industry, the main timber-cutting, loading and unloading processes the railway and water transport.

Perfected technology is being successfully introduced in all branches of industry. Processes of pig-iron and steel smelting have been intensified. In the oil industry turbine drilling now has a greater specific weight in the total volume of sinking operations. Turbine and double-shaft drilling are being successfully placed on a forced time-table, thanks to which the speed of drilling has been accelerated and the time necessary for mounting reduced. New sorts of modified pig-iron, a substitute for steel and rolled sections, are

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being used on an increasing scale in machine-building. Advanced methods of high-speed metal-working have been further developed. New production lines are being installed for the output of machine parts and for the assembly of machines, apparatuses, and instruments. Thermal and heating furnaces are getting more automatic equipment and more automatic and semi-automatic machines are being used in different technological processes.

In all branches of the national economy there has been a marked increase in the number of inventions and rationalization suggestions from the working people. In 1953 alone industry, transport, and enterprises engaged in construction work made use of 850,000 inventions, technical improvements and rationalization suggestions. A truly remarkable figure!

The Soviet Union's notable achievements in developing industry and in technically reconstructing all the branches of the national economy become particularly striking when contrasted with the state of industry in the capitalist countries in the period between the two world wars, as well as after World War II.

In Britain the level of industrial output between the two wars rarely rose above the 1913 mark; generally it was lower.

After World War I industry in the United States of America experienced a series of depressions and was finally hit by the unprecedented crisis of 1929-1932; the aftermaths of this crisis were liquidated only on the eve of World War II thanks to the "favourable" conjuncture. By 1951, owing to the feverish armaments race, the U.S. barely doubled its industrial output compared with 1929; during this time Britain increased her industrial output by 60 per cent, Italy—by 34 per cent, and France—by 4 per cent. In the U.S.S.R., on the other hand, 1951 saw the 1929 level of output exceeded 13 times.

In spite of the intensified marshallization and flow of dollars for the restoration of Western Germany's war

potential, some of the branches of that country's industry have as yet not attained their pre-war level.

In capitalist countries technique develops sporadically, by fits and starts. In their drive for maximum profits the monopolies artificially hinder technical development if it does not bring them big profits. They make their profits by robbing the peoples in dependent countries, by intensifying the exploitation of the proletariat, by employing cheap labour, by organizing wars, and by militarizing the national economy.

The antipodes to this is the successful industrial development in the People's Democracies, which have taken the path of socialism. Poland, Czechoslovakia, Rumania, Hungary, Bulgaria, and Albania have scored great achievements in industrial development.

In 1952 industrial production in these six countries registered an increase of 20 per cent, while in six West-European countries—France, Belgium, Austria, Holland, Greece, and Luxemburg—the increase was only 0.8 per cent. By the end of that same year the level of industrial production in the above six People's Democracies exceeded the pre-war level by almost 200 per cent; in the six West-European countries the pre-war level was surpassed by only 31 per cent.

Thus we see that steady industrial progress is possible only under the socialist system of economy. People's China has made tremendous advances, too. She has completed the restoration of her national economy and has launched upon the fulfilment of her first five-year plan of socialist construction. Wherever the capitalist system holds sway the situation is dominated either by catastrophic crises, stagnation, or an armaments race that exhausts and drains the economy.

The technical reconstruction of the U.S.S.R. was carried out with the employment of the latest achievements of modern science and engineering. Planned socialist economy gave unlimited scope to the development of the main lines

of modern technical progress—electrification and motorization, mechanization of labour-consuming work, automation of operation and production control, telemechanics, and the widespread introduction of chemistry.

The rate at which Soviet economy has gained ground provides ample proof of the absolute superiority of the socialist system over the capitalist system. The feudal system required about 200 years to show its superiority over the slave-owning system of economy. About 100 years were needed by the capitalist system to prove its superiority over feudalism. When as far back as 1926 J. V. Stalin took the advantages of the socialist system of economy as his point of departure to expose the perfidious and defeatist position taken up by Trotsky, who sought to prove that 50 or even 100 years were required to consolidate the socialist system, he said that "to hold out here a perspective of fifty or a hundred years means to suffer from the superstitious faith of the scared petty bourgeois in the almighty power of the capitalist system of economy."[1]

The Communist Party clearly showed the Soviet people the way the country could be technically re-equipped in the shortest possible period, and it took only about 13 years (from 1928, the first year of the first five-year plan period, to 1941, the second last year of the third five-year plan period, which was cut short by the war) to transform the Soviet Union from an agrarian country into a leading industrial power with a well-equipped first-class industry, a mechanized agriculture, and technically perfected forms of transport and communication.

This historic victory was won by the Soviet people because they are led by the glorious Communist Party of the Soviet Union, the great inspirer and organizer of their achievements in all spheres of socialist construction.

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[1] J. Stalin, *Works*, Vol. 9, Moscow 1954, p. 142.

MACHINE-BUILDING— FOUNDATION OF TECHNICAL PROGRESS

The engineering industry is the prime source for the technical re-equipment of the national economy of the U.S.S.R. It was called upon to reconstruct industry, the transport system, and agriculture on a new technical basis.

In the U.S.S.R. the engineering industry began to develop rapidly already during the first five-year plan period. By the end of that time the output of this branch of industry was approximately 10 times greater than in 1913, while towards the close of the second five-year plan period the increase was 30-fold. As a result of this the Soviet Union has firmly become Europe's largest builder of machines.

The Soviet engineering industry continued to develop steadily during the third five-year plan period as well. In 1940 its gross output was more than 50 times greater than in 1913.

In the course of the pre-war five-year plan periods, the U.S.S.R., as we have already mentioned, began to produce automobiles, aircraft, tractors, complex agricultural machinery, power units, equipment for ferrous and non-ferrous metallurgy, for the coal and oil industries, for the railways, and for the light and food industries, equipment for chemical plants, for the precision-tool industry, for a number of the most important branches of the engineering industry, and for the tool- and instrument-making industries.

Hundreds of giant, splendidly-equipped machine-building plants were built during the years of the five-year plans. These include the Urals and Novo-Kramatorsk heavy machine-building plants, ball-bearing factories, automobile works, tractor, machine-tool building, turbine, and harvester-combine plants.

Soviet machine-building developed both quantitatively and qualitatively. The output of the most up-to-date machines increased from year to year.

The machine-tool industry, which supplies machines for

the production of machines, is the core of machine-building. In 1913 Russia produced altogether only 1,490 machine-tools. In 1932 the U.S.S.R. put out 19,700 machine-tools, in 1937 the figure was 48,500 and in 1939—55,000. At the same time the range of machine-tools changed, their capacity and productivity swelled, and the specific weight of the more complex and improved models increased. On the eve of the Great Patriotic War the level of the Soviet machine-tool building industry was so high that it allowed the country to produce any type of equipment.

Soviet machine-tool builders mastered and began the production of first-class types of highly-productive metal-cutting machine-tools, forge and pressing equipment, tools and abrasives, universal gear-cutting semi-automatic vertical and horizontal high-speed millers, aggregate multiple cutter machine-tools, electric duplicators, special tools for electric spark treatment, and for spark-welding carbide alloy cutting edges on tools.

Advanced technological processes such as pressure, centrifugal, and precision casting, cold stamping, automatic welding under flux, high-speed cutting, and the thermal treatment of parts with high-frequency currents have become very widespread in the machine-building industry. Automation is being introduced on a growing scale.

A new complex branch of science—the technology of machine-building—has been created in the U.S.S.R. The most advanced forms of organizing production are being implemented. At the Ford plants in the U.S.A., for instance, a transition to a new car model entails a full stoppage of production from five to six weeks and a three months' loss of productivity. But at the Stalin Auto Works in Moscow, a transition to a new lorry model was carried out without any stoppage of production and almost without loss in the fulfilment of the plan. The men responsible for this daring initiative have been awarded Stalin Prizes.

The conditions created in our country permit developing new technique continuously. With this purpose in view the

fourth (first post-war) five-year plan (1946-1950) provided for the production of a large quantity of equipment to facilitate the further technical re-equipment of the entire national economy. That task has been successfully carried out. In a number of branches 50-60 per cent of the machines have been modernized. Industry was saturated with high-capacity machines, and the most advanced technological processes and line production methods of production were introduced.

In 1950 the output of the machine-building and metal-working industries advanced beyond the pre-war 1940 level by 130 per cent.

The directives of the Nineteenth Party Congress for the fifth five-year plan envisage doubling the output of the engineering industry. This means that in 1955 the country will be putting out 250 times more machines, machine-tools, tools and instruments than in 1913.

After the war all branches of the engineering industry revised their output range, and mastered the production of thousands of new special-purpose and aggregate machine-tools, automatic machines, hammers, presses, instruments, apparatuses, appliances and other types of equipment. In 1953 alone the U.S.S.R. engineering industry produced about 700 new types and models of machines (including more than 100 new types of highly-productive machines for the light and food industries) that are ensuring the further technical progress of the national economy. New types of equipment have been supplied to our power stations, metallurgical, chemical, and other plants. We already have machine-tools for building giant turbines, blooming mills, and other machine units for ferrous metallurgy, and powerful excavators for our construction works. New models of powerful scrapers, bulldozers, and excavating machinery have been put out. Agriculture has received a whole series of splendidly designed machines and implements.

The heavy machine-building plant in Kolomna has begun the serial production of ten types of heavy machine-

tools, including gear-cutting lathes for gears with a diameter of up to 5 metres. The plant also puts out vertical boring and turning machines for parts with diameters ranging from 2.5 to 5 metres. In 1953 the plant originated a powerful vertical boring and turning machine for parts with a diameter of 9-13 metres. This machine, which has 42 electric motors of different capacities (from 0.25 to 150 kilowatts), is operated by pushbuttons; it is very easily handled, completely automatic and needs only one operator at the main control desk. The fact that a whole train is required to transport the parts gives an idea of its size.

In the post-war years the milling-machine plant in Gorky created a unique and highly complex miller (17 metres long, 9.5 metres wide, and 5.5 metres high), which is set in motion by 22 electric motors and mills 12.5-metre shafts with diameters of up to 2.8 metres. All the mechanisms of the machine are automatically controlled and it needs only one operator to run it.

In recent years the Soviet machine-building industry produced a series of unique machine-tools for iron and steel plants. The rolling mills fashioned by our designers are technically superior to similar machine-tools produced abroad. Such, for example, are the rail and girder mill built at the Urals Machine-Building Plant, the standard blooming mill, the model 140 pipe-rolling mill, the mill for the production of spiral-seam welded pipes, and others.

The Novo-Kramatorsk Plant also mastered the production of a new type of electric hoist for mines. These machines have a hoisting speed of up to 16 metres per second and a drive capacity of more than 2,000 kilowatts. Such a hoist can raise more than a million tons of coal annually from deep mines in the Donbas.

Since the war the Soviet automobile and tractor industry has been putting out new types of automobiles and tractors. Most of the tractors now produced are of the caterpillar type. Formerly the majority of Soviet-made lorries had a load capacity of 1.5 and 3 tons, but the trucks made at

present carry a load of 2.5 and 4 tons. The automobile works in Minsk is producing lorries with capacities ranging from 7 to 25 tons.

The Pobeda passenger car is being improved. It will have a 65-70 h. p. motor with a lower fuel consumption, and a new and more graceful and comfortable body. Modernization is also embracing the low-powered Moskvich car.

Soviet machine-builders are indefatigably supplying our agriculture with new machines. In 1952 they created a self-propelled pneumatic cotton-picking machine, a fodder harvester combine, a high capacity mower, an anti-pest machine, and others. More than 80 models of different types of agricultural machines, ensuring the further mechanization of agricultural processes, were put out in 1953.

The Soviet engineering industry is called upon to supply all branches of industry with new machines. In the fifth five-year plan period, for example, it put out new paper-manufacturing machines. Technological processes such as smoothing paper and making it dense and glossy are very important in the paper industry and are carried out by special machines called calenders and supercalenders. The Second Five-Year Plan Works in Leningrad is producing 12-roller supercalenders with a capacity of up to 400 metres of 2,520-mm-wide paper per minute. Soviet designers have originated machines that form, press, dry, and smooth paper in a single, uninterrupted process.

Soviet machine-builders have also designed and built a high-capacity automatic plate-glass grinding and polishing conveyer. Installed at the Dzerzhinsky Glass Factory in Gus Khrustalny, this unit, which is 185 metres long and 9 metres wide, does the work of 300 grinding and polishing machines.

The machine-building industry in the U.S.S.R. is the foundation of the new and rapid technical advance in all branches of the Soviet national economy and it is creditably carrying out that role.

THE SUCCESSES OF ELECTRIFICATION IN THE U.S.S.R.

Power is the most important factor in the process of technically re-equipping the national economy. The significance of electrification is defined by Lenin's classical formula that "Communism is the Soviet power plus the electrification of the whole country."

The plan drawn up by the State Commission for the Electrification of Russia (December 1920) called for the building in 10-15 years of electric power stations with a total capacity of 1,500,000 kilowatts. By 1935 that plan was overfulfilled 2.5 times. The capacity of the power stations in the U.S.S.R. grew from 1,100,000 kilowatts in 1913 to 8,100,000 kilowatts in 1937.

In 1952 the U.S.S.R. produced 117,000,000,000 kilowatt-hours of electric power or almost 60 times more than in 1913, while in 1953, as already mentioned above, the output was 133,000,000,000 kilowatt-hours.

In the U.S.S.R. special attention is devoted to the construction of hydropower stations, which not only save fuel but also, because of the character of their production processes, most vividly embody the latest engineering techniques. Pre-revolutionary Russia had not a single hydropower station of any considerable size. But in Soviet years, such big power stations have been launched as the Dnieper (now fully restored after its destruction by the fascists), Volkhov, Svir, Rion, Zemo-Avchal, Ivankovo, Chirchik, and others.

In the pre-war five-year plan periods work was begun to carry out a far-reaching plan of reconstructing the Volga. That plan was partially realized before the war; hydropower developments were built at Shcherbakov (Rybinsk) and at Uglich. The construction of the world's biggest hydropower stations—at Kuibyshev and at Stalingrad—was started on a large scale after the war. The size of these stations may be judged from the fact that at their established total capacity

of 3,700,000 kilowatts they will annually produce 20,000,000,000 kilowatt-hours of cheap power.

The construction of two other powerful stations—on the Volga at Gorky and on the Kama (a tributary of the Volga) at Molotov—is nearing completion. The first units of the Molotov Hydropower Station have already been commissioned and are producing electricity for the industry.

The Kakhovka Hydropower Station on the Dnieper is going up rapidly. It will be launched a year ahead of schedule, i.e., in 1955 instead of 1956.

A huge hydropower station is going up on the Angara, marking the beginning of the work to utilize the energy of that river to develop the aluminium, chemical, mining, and other industries on the basis of cheap electric power and local raw material resources.

The fifth five-year plan has already witnessed the completion and launching of the Tsimlyanskaya Hydropower Station on the Don, the Ust-Kamenogorsk Hydropower Station on the Irtysh, the first wing of the Mingechaur Hydropower Station on the Kura, and the Gyumush Hydropower Station, a cascade station on the River Razdan in Armenia.

In addition to the big stations, thousands of small and medium power stations have been built for villages, workers' townships, and towns. There is now a nation-wide movement for the construction of collective-farm power stations to promote the electrification of production processes in agriculture and to bring more culture into the life of the peasant. Already in 1950 there were more than 75,000 electric motors with a total capacity of 400,000 kilowatts in operation in rural localities. Compared with 1940 the capacity of rural power stations had increased 4-fold by 1953. Agriculture is beginning to employ the more efficient electric tractor. The Korsun-Shevchenkovsky Machine-and-Tractor Station pioneered electric ploughing in the Ukraine in 1949. In 1952 the collective farms serviced by this machine-and-tractor station raised a much bigger crop on electrically ploughed fields than on fields cultivated by fuel-driven tractors.

The fifth five-year plan provides for a substantial growth of the capacities of district and factory fuel power stations in the most important industrial areas of the U.S.S.R.—in the south, in the Urals, in the Kuzbas, and in the Baltic Union Republics.

Electricity has penetrated deep into the national economy. It is not only the carrier of energy and the source of light, but is also the direct participant in a number of technological processes: in electro-metallurgical furnaces, in the electric welding of metals, in electrolyte baths, in electrical precipitation, in electro-chemical reactions, in the electric spark treatment of metals, in the broad use of high frequency currents (radio, television, multi-channel wire communications, thermal treatment of metals, heating metals before forging and rolling, drying timber, the canning industry, wireless electric transport, etc.), and automatics, in municipal economy, in transport and communications, in agriculture, and so on.

Electronics—the employment of electricity in gas mediums and in vacuums—a comparatively new branch of electrical engineering, has attained an unusually high level of development in the U.S.S.R. This refers to the wide use of electronic tubes for the most diverse purposes, principally in radio-engineering automatics and telemechanics, signalization, and so on.

Soviet power resources are extending on the basis of the technical progress of the electrical engineering industry. Uniflow steam boilers, producing steam at a pressure of 100 atmospheres with a temperature of 510°C. have been invented and are being used in the U.S.S.R. Powerful steam and hydraulic turbines are being produced. Soon after the termination of the Great Patriotic War, Soviet engineers constructed a high speed (3,000 r.p.m.) steam turbine with a capacity of 100,000 kilowatts; it works under a steam pressure of 90 atmospheres with a temperature of up to 480-500°C. Compared with a turbine of a similar capacity but working under a steam pressure of 29 atmospheres (the pro-

duction of such turbines was mastered in 1939-40), the new unit yields a 15-18 per cent fuel saving.

A new step along the road of technical progress was made with the building of a steam turbine with a capacity of 150,000 kilowatts and working under a steam pressure of 170 atmospheres; this is the most powerful and technically most perfect unit in the world and it is serviced by two huge steam boilers producing steam superheated up to 580°C.

Besides steam turbines the U.S.S.R. is producing gigantic hydroturbines.

The Soviet-made hydroturbines installed at the Lenin Hydropower Station on the Dnieper are the most powerful in Europe and among the most powerful in the world. They develop a capacity of up to 80,000 kilowatts while their efficiency is more than 0.93; the external diameter of the rotor is 6 metres and its height is 3.4 metres.

Hydroturbines and generators with capacities of more than 100,000 kilowatts and still higher efficiencies are being made for the Kuibyshev and Stalingrad hydropower stations.

The Stalin Metal Works in Leningrad has built a new type of uniflow hydroturbine featuring pivoting blades. The new turbine lets through the stream of water without changing the latter's direction, thereby achieving a higher power index. The rotor-generator, in deviation from the usual practice, is mounted on the rim of the rotor. The new machine may be mounted directly into the body of a spillway, thus obviating the necessity of building special premises for a hydropower station.

Soviet industrial enterprises have designed and constructed original high-voltage apparatuses: unique transformers, mercury and ionic electric current rectifiers, converters, switches, safety and compensating devices for 400,000-volt transmission lines. Engineers have elaborated and experimentally tested devices which ensure the stability of power systems with long transmission lines (Kuibyshev to Moscow—850 kilometres; Stalingrad to Moscow—up to 1,000 kilometres). Soviet scientists and engineers are making the world's first attempt to solve the problem of uninterruptedly exploiting a single high-voltage network, uniting the power systems on a huge territory in the European part of the U.S.S.R.

Important advances have been made in the sphere of engine-building. Internal combustion engines play a very important role both in the peaceful branches of the national economy and in the branches ensuring the country's defence. In the U.S.S.R. the output of internal combustion engines for automobiles, tractors, tanks, aircraft, ships, and for other machines and installations has multiplied several hundred times during the years of the five-year plans.

Thanks to the socialist system of economy and state planning, the science of energetics, created in the Soviet Union, allows for the complex and rational utilization of all power resources: fuel, hydraulic, and others.

TECHNICAL RE-EQUIPMENT OF THE MINING INDUSTRY

The complete transformation of the mining industry was made possible by the quantitative growth and technical improvement of Soviet machine-building. Prior to the Great October Socialist Revolution the mining industry was made up chiefly of a network of small mines where the predominant feature was manual labour and primitive tools—the pick, for example. Today the Soviet mining industry consists of large mechanized coal fields which are implementing the over-all mechanization of labour-consuming work by employing electric power and pneumatic tools, mining combines, coal cutters and heading machines. Hydraulic methods have been mastered in coal and manganese ore mining. Soviet-made excavators are extracting apatite, phosphorite, asbestos, and lignite.

At the time that it was successfully liquidating the aftermaths of the war in territory that had been temporarily occupied by the German fascist invaders, the Soviet coal in-

dustry exceeded the five-year plan target for 1950 already in the last quarter of 1949. The Donbas, totally destroyed by the fascist invaders, was restored on a new technical basis. The mines in that coal basin are now equipped with better machinery than before the Great Patriotic War and are yielding considerably more coal than in 1940. A colossal volume of work had to be done to achieve that: more than 600,000,000 cubic metres of water was pumped out of flooded mines; up to 230 of the major mines were restored and commissioned; 1,300 kilometres of mine workings have been either newly opened or restored.

Parallel with the restoration of the Donbas the post-war years have been marked by a steady rise in the output of coal and lignite in all the other coal basins of the U.S.S.R.: Kuznetsk, Karaganda, Moscow Region, the Urals, Eastern Siberia, and the Far East. New coal deposits are being developed.

The increase in coal output is principally due to large-scale mechanization. In U.S.S.R. mines such processes as cutting, hewing, underground loading, hauling, hoisting, and railway-car loading have been fully mechanized. The Soviet Union was the first in the history of mining engineering to design combination cutting and loading machines to mechanize labour. These machines, which are now being produced serially, cut, break off, and load coal onto the conveyer. Most widespread among them is the Donbas cutter-loader, the use of which increases the coal yield from the wall by 25 per cent and raises the labour efficiency of the miners by 50 per cent. In addition to the Donbas machine, Soviet engineers have created machines to mechanize coal breaking and loading in thin flat seams. These are the UKT-1, Gornyak, and UKMG-1 combined cutter-loaders. A combination cutting and loading machine—the KKP-1—for edge seams was produced in 1952.

Miners have been exerting a great effort to mechanize support setting and the first positive results have been already achieved; a mechanized portable lining set, the MPK-1,

has been invented in the Donbas, and engineers in the Moscow Coal Basin have invented the SHCH-50 shield-type lining set.

The loading of coal and rock in development workings is particularly hard work, and to mechanize it four types of loading machines have been produced. By the middle of 1953 such machines performed 40 per cent of the drifting in major horizontal development workings. The country is creating heading and drifting machines to mechanize drifting operations in mines.

In the fifth five-year plan the coal output will increase by 43 per cent compared with 1950. Further improvements are being introduced into mining technology: engineers are initiating remote and automatic control of machinery operating underground as well as the automation and line organization of all the processes of mining and transporting coal from the face to railway cars. By the end of 1952 about 2,000 cutters and cutter-loaders and more than 1,600 conveyer lines were being operated by remote control.

Great advances have been made in mechanizing the Soviet mining industry. In the Krivoi Rog Basin, for example, 1953 witnessed the complete mechanization of all drilling processes. That year the percentage of mechanization of other processes was: transportation—93; hauling—94; loading at the face in the development workings—almost 52.

These new machines are changing the character of underground labour. Mines are becoming underground factories. In Soviet mines, the labour of the miner, formerly the hardest, is now approaching that of the industrial worker, who relies on modern machines.

GROWTH OF SOVIET METALLURGY

In pre-revolutionary Russia the iron and steel industry had been made up almost entirely of small blast-furnaces and manually-fed open-hearth furnaces; the methods of rolling metal had likewise been primitive. The technical recon-

struction of the Soviet ferrous metal industry began with the building of a number of giant iron and steel works on the basis of the latest achievements of science and engineering, with increasing the capacity of operating metallurgical furnaces and rolling mills and with the mechanization of the labour-consuming work of feeding and preparing raw materials and of clearing the ready product and production waste.

In the pre-war five-year plan periods the country built the Magnitogorsk and Kuznetsk iron and steel works, the Azovstal, Zaporozhstal, Krivoi Rog, Kerch, Novo-Tagil, Chelyabinsk, Transbaikal, Amur, and other plants. At the same time the over-all reconstruction was undertaken of the old iron and steel works—the Makeyevka, Stalino, Dniepropetrovsk, Dnieprodzerzhinsk, and Alchevsk works, the Red October Works in Stalingrad, the Hammer and Sickle Works in Moscow, and many others. Soviet iron and steel works lead the world in the sphere of technical equipment and in rationally organizing technological processes.

Immediately after the termination of the war, the Communist Party and the Soviet Government set iron and steel workers the task of raising in the next 10-15 years the annual output of pig-iron to 50,000,000 tons and of steel to 60,000,000 tons. This task is being carried out successfully. The fourth five-year plan had provided for a 35 per cent rise in ferrous metal output in 1950 as compared with 1940, but the figure actually attained was 45 per cent.

The fifth five-year plan envisaged a substantial rise in the output of metal. In 1955 pig-iron output must exceed the 1950 level by 76 per cent, steel—by 62 per cent, and rolled stock—by 64 per cent. Moreover, the range and production of rolled stock in short supply is expanding; in particular, production of thick-sheet steel will increase by 80 per cent, of small-bar steel and rolled wire—by 110 per cent, and of stainless sheet-steel—by 210 per cent; there is to be a considerable increase in the production of economical types and profiles of rolled metal and of special steels and alloys for machine-building requirements.

Large-scale new construction work is continuing in the fifth five-year plan period. Compared with the fourth five-year plan period the production capacities to be launched will register the following increases: pig-iron—approximately 32 per cent; steel—42 per cent; rolled metals—not less than 100 per cent. While carrying out the socialist principles of proportionately distributing industry throughout the country, iron and steel workers are called upon to ensure the further development of the iron and steel industry in the Transcaucasus and to prospect for iron ore in the Karelo-Finnish Republic. Open-hearth plants will also be built within the local industry system.

Special materials are required to produce many modern types of equipment that operate under high stress: extra-durable corrosion-proof sorts of steel and alloys that do not lose their mechanical properties under high (or low) temperatures and high pressures. All this is produced by Soviet metallurgy. The U.S.S.R. has created a powerful metallurgical industry that puts out high quality equipment and organized the production of ferro-alloys as well as special purpose alloys—for electric bulbs, radio equipment, uniflow steam boilers, gas turbines, jet and internal combustion engines.

One of the most important achievements of the Soviet metal industry in post-war years was the output of heat-resisting alloys; parts made of such alloys operate at high temperatures and are not affected by corrosion when in contact with acids, alkalis, and the products of fuel combustion.

The Soviet iron and steel industry has the most powerful blast-furnaces. The automation of blast- and open-hearth furnaces is developing on a broad front. Already in 1951 a total of 90 per cent of all the pig-iron smelted in the U.S.S.R. was put out by blast-furnaces with automatically-heated blasts and about 95 per cent of all the steel was smelted in open-hearth furnaces with automatic heat regimes.

In 1953 more than half of the country's pig-iron was smelted in huge blast-furnaces with useful capacities of

1,000 cubic metres and over. Greater blast-furnace productivity has been attained through improved methods of preparing the charge and perfecting the operational regime of the furnaces (employing constant moisture blasting, high gas pressures, etc.).

Soviet open-hearth furnaces are the biggest in the world and have the highest thermal capacities, while the operators lead the world for the speed at which they carry out steel-smelting processes.

Extensive work is being done to automatize the manufacture of rolled metals. Automatic rolling mills attain the extraordinary output speed of up to 1.5 kilometres per minute and substitute heavy manual labour, reducing it to the adjustment of equipment.

Compared with 1913 the output of non-ferrous metals has grown many tens of times. In the course of the fifth five-year plan the country will be producing 90 per cent more refined copper than in 1950, 170 per cent more lead, 160 per cent more aluminium, 150 per cent more zinc, 53 per cent more nickel, and 80 per cent more tin. Electrothermal and electrochemical methods of producing aluminium, magnesium, sodium, and potassium, as well as rare metals are being successfully developed.

Powder metallurgy, first invented in the Soviet Union, has unusually great prospects for development. This method permits manufacturing high-precision machine parts from non-ferrous and light metals, iron, steel, and the most refractory alloys.

ACHIEVEMENTS OF THE CHEMICAL INDUSTRY

Some 75-80 years ago Karl Marx suggested with remarkable foresight that mechanical processing would yield more and more to chemical influence in proportion to the progress mankind made in mastering chemical methods and reactions.

The chemical industry is a comparatively young branch of our socialist national economy. Under the guidance of the

Communist Party the chemical industry was created anew in the U.S.S.R., as in tsarist Russia it had been very insignificant. The real burgeoning of the chemical industry began in the pre-war five-year plan periods. The nitrogen, coke-chemical, aniline dye, forest chemistry, potassium, and apatite branches were set up already in the years of the first five-year plan; at the same time the foundation was laid for the synthetic rubber, synthetic fibre, plastics, and imitation leather industries.

After the war the chemical industry advanced by leaps and bounds: in 1950 the pre-war output level was surpassed by 80 per cent, the production of nitrogen, phosphate, and potassium fertilizers increasing by 120, 90, and 40 per cent respectively.

Electrochemistry, chiefly electrolysis, is widely employed in the U.S.S.R., and this has permitted organizing many new industries such as the caustic alkali, chlorine, and other industries. Electrochemical methods of plating metals against corrosion (chrome plating, nickel plating, silver plating, and tinning) have also become very widespread. A sharp increase has been registered in the output of aluminium, magnesium, and a number of electrochemical products.

During the fifth five-year plan period the output of synthetic rubber will increase by 82 per cent over the 1950 level, soda ash—by 84 per cent, caustic soda—by 79 per cent, and mineral fertilizers—by 88 per cent. There will be more anti-pest chemicals, artificial fibre, dyes, and more pharmaceutical preparations (sulphidin, penicillin, streptomycin, etc.).

Year by year Soviet chemists are steadily expanding the technological possibilities of complexly utilizing raw materials and producing new synthetic compounds from the simplest raw materials. New branches of organic synthesis have been set up on the basis of processing coals and the by-products of oil refining. Soviet technique has mastered a method of splitting and compounding hydrocarbon mole-

cules which permits producing thousands of new compounds with anticipated properties.

Advanced technological processes have been introduced at Soviet chemical factories: chemical reactions in gas phases, catalysis under high temperatures and pressures, utilization of oxygen and hydrogen in oxidation and reduction reactions, development of electrochemical and electrothermal methods, employment of biochemical processes.

Chemical processing methods have made it possible rationally to utilize industrial waste (pyrite cinders, ammonia sulphate, sludge), to speed up technological processes (for example, hydrometallurgical), and to ensure their continuity and automation.

A very important trend in the employment of chemistry in the U.S.S.R. national economy is the all-sided combination of chemistry with all other branches of industry and agriculture. As a result broad use is now being made of the production waste of metallurgical and coke plants, oil refineries, etc.

THE TECHNICAL RECONSTRUCTION OF AGRICULTURE

The collectivization of agriculture, indivisibly linked with its transition to the lines of the most up-to-date technique, was of historic importance for the destinies of the revolution, for the complete liquidation in our country of the roots of capitalism, and for the victory of the socialist system. This unprecedented reconstruction of the social and technical foundations of agriculture was inspired and organized by the Communist Party.

V. I. Lenin dreamed of the day when the Soviet state would be able to send 100,000 tractors into the field and provide them with fuel and drivers. Then, V. I. Lenin said, the peasant would vote for communism. This dream of V. I. Lenin's was realized a long time ago. In 1940 the collective and state farms in the Soviet Union were served

by 523,000 tractors (in terms of 15 h.p. units), 182,000 harvester combines, and 228,000 lorries.

Besides tractors, Soviet agriculture is making wide use of other types of machinery. These include electric, petrol, gas-generator, wind, and hydraulic engines, steam locomobiles, etc.

U.S.S.R. agriculture has long ago become the most mechanized agriculture in the world. Nevertheless, the socialist industry continues indefatigably to supply agriculture with new machines. Self-propelled harvester combines, northern combines (adapted for work in north-west U.S.S.R.), special harvester combines for beet-roots, cotton, flax, sunflower seed, potatoes, hemp, maize, and hay have made their appearance in the Soviet Union.

More and more new types of agricultural machines are being systematically introduced in the course of the current five-year plan period, and in order to give an idea of the speed at which the design of agricultural machines is being improved it may be pointed out that a considerable part of the entire output of the agricultural machine-building industry in 1950 was made up of machines that had first been designed and built during the fourth five-year plan period.

At the beginning of 1954 Soviet agriculture had 1,260,000 tractors (in terms of 15 h.p. units) or more than twice as many as in 1940, and 326,000 harvester combines or almost twice as many as before the war.

In 1952 the level of mechanization in collective farms was: grain sowing—87 per cent as against 59 per cent in 1940; harvesting grain with combines—70 per cent as against 43 per cent in 1940; ploughing fallow land—96 per cent as against 82 per cent in 1940; cultivating ploughing—97 per cent as against 71 per cent in 1940; planting cotton—98 per cent; planting sugar beet—96 per cent.

The rapid growth of the Soviet agricultural machine-building industry is making it possible to extend the range of agricultural processes carried out with the help of modern machinery. For instance, before the war the fleet of MTS

machines permitted mechanizing about 90 processes on collective farms, but in 1952 the machine-and-tractor stations carried out more than 170 different processes.

Collectivization has provided the requisites for the broad application of advanced agrobiology to overcome soil exhaustion and to transform nature herself in the direction required by man. Increasing mechanization and the organizational and economic consolidation of collective farms is leading to a systematic rise of harvest yields. In 1952 the gross grain crop was 128,000,000 tons.

The directives of the Nineteenth Congress of the Communist Party for the fifth five-year plan envisage a further increase in gross agricultural output: 40-50 per cent more grain (55-65 per cent more wheat), 55-65 per cent more cotton, 40-50 per cent more flax fibre, 65-70 per cent more sugar beets, 50-60 per cent more sunflower seeds, 40-45 per cent more potatoes, and approximately 100-200 per cent more feed crops.

Widespread mechanization has caused a sharp rise in the productivity of agricultural labour. In 1922-23 individual peasant households spent an average of 32 man-days to produce one ton of grain, in 1937 the collective farms produced the same amount by spending 10 man-days, while in 1948 this was reduced to only eight man-days. On leading state-farms labour expenditure was even lower—five man-days per ton of grain. This shows that under socialist conditions fewer people, supplied with machines and carrying on their work on a scientific basis, ensure a much larger output of agricultural produce.

In recent years more and more machinery has been used in different branches of agriculture, including livestock breeding, where labour is particularly arduous. Soviet industry is putting out machines to mechanize all the processes of feeding and keeping livestock (water-supply and automatic watering, preparing feeds, mechanized milking, electro-shearing, clearing and transporting manure, etc.).

Automatic watering increases the milk yield of cows by

10-15 per cent. Electric shearing gives 8-13 per cent more wool (at the expense of a closer and more even cut).

In its decision "On Measures for the Further Development of Agriculture in the U.S.S.R." the plenary session of the Central Committee of the Communist Party of the Soviet Union held in September 1953 noted the successes scored in technically re-equipping agriculture.

At the same time the plenary session brought to light shortcomings in the development of agricultural mechanization and pointed out that the powerful machinery supplied by the socialist state was being utilized unsatisfactorily. Whereas the mechanization of grain crop, sugar-beet, and cotton cultivation had reached a high level, the mechanization of such important branches of the national economy as livestock breeding and the cultivation of potatoes and other vegetables, flax and other crops was allowed to lag behind.

In spite of the enormous strides made by the agricultural machine-building industry, by 1953 there was still no system of machines that could ensure the all-round mechanization of crop cultivation with consideration for the diverse natural and economic conditions of the different zones of the country. Even in grain cultivation, where the highest level of mechanization has been achieved in ploughing, sowing, and harvesting, the mechanization of many processes remains unsatisfactory. This concerns arduous labour required to treat grain on threshing floors, to gather and stack chaff and straw, to introduce organic and mineral fertilizers into the soil. While mowing has been mechanized to a considerable extent, hardly anything has been done to mechanize the very important subsequent work of stacking hay.

The plenary session drew up a detailed programme providing for a tremendous upsurge of agriculture in the next few years and mapped out the path leading to a further development of agricultural production, of the lagging branches in particular.

The Central Committee of the Communist Party and the Soviet Government have worked out a whole series of

measures to strengthen the technical base of machine-and-tractor stations, which are being called upon to take an increasingly greater part in implementing the great tasks of further enhancing agriculture, particularly livestock breeding and the cultivation of potatoes and other vegetables, and of further raising the harvest yield of all agricultural crops.

Besides steadily increasing in numbers, the machines that the machine-and-tractor stations have been receiving in the post-war period are being improved all the time. Wheel tractors predominated in machine-and-tractor stations before the war, but in the post-war years Diesel caterpillar tractors have become very widespread in agriculture. Compared with 1940 their number has multiplied 14 times. New types of cultivating machines—the Belarus, KDP-35, and HTZ-7 tractors—are being put out, the production of pendent machines and implements has been mastered, and the output of cotton-picking machines, sugar-beet combines and other machines has increased.

A far-reaching programme for the further saturation of agriculture with machines has been outlined. Between 1954 and 1957 agriculture will receive 250,000 cultivating tractors, not less than 500,000 general-purpose tractors (in terms of 15 h. p. units), and many other machines.

At the same time measures have been taken to provide for greater mechanization of all processes in the production of potatoes and other vegetables. The squarepocket planting method will be used to improve the cultivation of potato fields. With this method it is possible to mechanize lateral and traverse cultivation and to make successful use of potato-harvesters, thus reducing the amount of manual labour needed and increasing the harvest yield. In 1955 machines will be planting 80-90 and 95 per cent of the potatoes in collective and state farms respectively. Row cultivation and harvesting will have the same level of mechanization.

Provision has been made to build machines such as potato-planters, potato-harvesters, seeders, and cultivators. The 1954-55 output will include 45,000 potato-planters for

square-pocket planting, 40,000 potato-harvesters, 16,500 seedling-planters, and many other machines.

Soviet engineers have recently designed a new potato-harvester, the KKR-2, which, in contrast to the usual KOK-2 harvester, also operates on difficult and damp soils. The KKR-2 is drawn by a caterpillar tractor which puts into operation all its mechanisms. As it moves, its share digs up two rows of potatoes; these are automatically conveyed to the elevator, following which the machinery separates the tubers from the soil and leaves. The KKR-2 harvests a 4-5 hectare potato field per day, freeing dozens of farmers from heavy manual labour. This machine will help fully to mechanize potato cultivation.

The immediate task of agriculture in the U.S.S.R. is to increase the production of grain—the basis of all agricultural production. In addition to calling for a rise in the grain yield in all areas, the Communist Party and the Soviet Government recognized that the implementation of this task would require the opening up of 13,000,000 hectares of virgin and long-fallow land, chiefly in the eastern regions of the country. In 1955 this measure will bring the country an additional quantity of more than 16,000,000 tons of grain. By August 10, 1954 U.S.S.R. collective and state farms raised more than 14,000,000 hectares of very fertile virgin and long-fallow land. Taking account of the successes scored in opening up new and of the possibility of bringing more virgin and long-fallow land under cultivation the Central Committee of the Communist Party of the Soviet Union and the Council of Ministers of the U.S.S.R. adopted a decision in August 1954 to enlarge by 1956 the area under grain and other agricultural crops on newly-opened land to 28,000,000-30,000,000 hectares. Equipped as it is with first-class machines, socialist agriculture has all the possibilities of carrying out such a large-scale task in so short a time. Already in 1954 the machine-and-tractor stations and state farms engaged in opening new land received 120,000 tractors (in terms of 15 h.p. units) and many other machines.

The Party has given our country a programme providing for a steep rise in agricultural production, a programme of struggle for rapidly ensuring the entire population an abundance of foodstuffs by introducing and mastering new technique and agrotechnical methods in agriculture.

NEW SOVIET TRANSPORT MACHINES

The territory of the Union of Soviet Socialist Republics spreads over a sixth of the surface of the globe, with 12 seas and three oceans washing its shores. This clearly shows the significance of all forms of transport, which link the numerous regions and districts of our country.

The railway transport is of decisive importance for the existence and development of such a vast country as the Soviet Union, for without an efficient railway system it would have been impossible to develop our national economy.

The technical reconstruction of the railway transport was started already in the years of the first five-year plan, by electrifying the railways, introducing powerful rolling stock—steam, electric, and oil engine locomotives, 50-60-ton carriages—automatic coupling, automatic brakes, automatic block systems, reconstructing the surface structure of the lines, re-equipping the haulage gear, the water-supply, and communications systems, mechanizing loading and unloading processes, etc.

During the Great Patriotic War the railway transport magnificently coped with the difficult task of ensuring the transportation of troops and military supplies, as well as of goods for the national economy.

In the post-war years the railway transport has not only been restored, but compared with pre-war it has been considerably augmented. In 1952 the goods turnover was approximately 80 per cent greater than in 1940. The traffic capacity of the most important trunk lines has been increased,

new types of heavy rails laid, the total length of railway sidings extended, automatic blocking increased, and new railway lines built. The busiest lines are being rapidly electrified. The fleet of steam, electric and Diesel locomotives, as well as of high-capacity cars and all-metal passenger carriages has been considerably enlarged. Preparations are being made to transfer the rolling stock to roller bearings. Automatic centralization of hump yards is being introduced at marshalling stations. Radio communication with the drivers of shunting and traffic locomotives is being employed on a growing scale.

The fifth five-year plan provides for a 35-40 per cent greater goods turnover of the railway transport, but this target will be substantially surpassed as already in 1953 the freight turnover registered an increase of 32.5 per cent. In the course of the fifth five-year plan period about two and a half times more railway lines will be built and opened to traffic than in 1946-50; sectors equipped with automatic blocking and auto-stops will be lengthened. Centralized dispatching will be considerably extended.

The growth of the railway transport in the U.S.S.R. has required the perfection of the fleet of locomotives. The powerful L series freight locomotive, produced during the fourth five-year plan period, has been modernized through the joint efforts of workers and scientists with the result that it now has a 15-16 per cent greater capacity and consumes much less fuel. At the same time the Kuibyshev Locomotive Works in Kolomna produced a new type of passenger train locomotive, the 2-4-2 (two supporting axles in front, four engaging axles, and two supporting axles in the rear). It has a powerful steam supperheater and for that reason it consumes considerably less coal than similar type locomotives. Its rated speed is 125 kilometres per hour. It can haul trains over sectors where ordinarily two SU-type engines were needed. The chief technical advantage of the new locomotive is that though much heavier, its wheels exert the same pressure on the rails as the wheels of the SU. This has

been achieved by rationally distributing the weight of the engine on the axles.

In the very near future Soviet plants will begin supplying the railways with powerful locomotives for trains weighing 3,000-4,000 tons.

All other forms of transport—water, automobile, and air—are being successfully developed and technically perfected parallel with the expansion of the railways.

In 1951 the inland waterways were 23,000 kilometres longer than in 1940. The launching of the Lenin Volga-Don Canal has lengthened them still further. In the fifth five-year plan period the river and marine transport will have a 75-80 and 55-60 per cent greater freight turnover respectively than in 1950.

The marine and river transport is annually receiving a growing quantity of technical equipment. New passenger vessels and tugboats are being built for the river transport with the broad use of special ship metal, electric welding, sectional assembly and the most efficient engines, including turbo-electric engines. The marine has received splendid passenger vessels, freighters, and refrigerator ships; numerous freighters have been built for long ocean runs.

The traffic capacity of the river ports in Stalingrad, Saratov, Kuibyshev, Ulyanovsk, Kazan, Gorky, Yaroslavl, Molotov, Omsk, Novosibirsk, Khabarovsk, and Rostov-on-Don has been greatly increased. These ports are being equipped with efficient machinery. The sea ports in Leningrad, Odessa, Zhdanov, Novorossiisk, Makhach-Kala, Murmansk, Naryan-Mar, and the Far Eastern and Baltic (Riga, Klaipeda) ports, are being enlarged and reconstructed.

The automobile transport is growing year by year through the development of the Soviet automobile industry.

Prior to the Revolution Russia had a very small fleet of cars consisting entirely of imported models. The first Soviet automobiles (one and a half ton lorries) were produced in 1924. The following year the Yaroslavl auto works began the production of three-ton lorries. In 1929 the

U.S.S.R. built only 1,546 automobiles, but 1932 saw the output of 25,000 automobiles, a figure which increased to 200,000 in 1937.

The U.S.S.R. now holds first place in Europe and second place in the world for the output of lorries.

By 1940 the average capacity of Soviet lorries was 2.4 tons or 50 per cent higher than the average capacity of lorries in the U.S.A. In 1950 Soviet lorries had an average capacity of 3 tons.

The importance of the automobile transport as a means of carrying goods rose with the growth of the fleet of cars. In 1937 automobiles carried 569,000,000 tons of goods, and in 1940 the turnover was 859,000,000 tons. In 1950 automobiles transported 150 per cent more goods than the railways.

In the fifth five-year plan period the goods turnover of the automobile transport will be 80-85 per cent greater than in 1950.

A high rate of development has been achieved by the air transport—passenger and goods. Air lines now link all the most important industrial and administrative centres of the U.S.S.R. In 1952 the goods turnover of the civil air service was 820 per cent greater than in 1940, while in the fifth five-year plan period it will increase by no less than 100 per cent.

THE BUILDING INDUSTRY

The sweeping economic plans implemented by the Soviet state have required a tremendous rate of construction development in industry, agriculture, and the transport, and in the municipal economy. The building of dwelling houses and cultural establishments has proceeded on an exceedingly large scale. All this has required the mechanization and industrialization of construction work.

In the course of the fifth five-year plan period the building industry will receive a large amount of new equipment:

the number of excavators will increase by approximately 150 per cent, scrapers and bulldozers—by 200-300 per cent, and travelling cranes—by 300-400 per cent.

The problem of laying out huge sites for the construction of metallurgical and machine-building plants, hydropower stations, and so on has been solved; large block assembly of structures is now being practised; technically perfect methods such as hydraulic excavation, the use of reinforced concrete assemblies, heating concrete with electricity, and special technological methods allowing construction work to be carried on in winter, etc., have become widespread.

A vivid indication of the degree of mechanization of labour-consuming construction work is provided by the new machines employed for the construction of the Lenin Volga-Don Shipping Canal and of the hydropower stations at Kuibyshev, Stalingrad, and Kakhovka.

On the Volga-Don Canal 98 per cent of the earthwork was mechanized. Besides the large-scale mechanization of assembly, loading and unloading processes, machines did all the work of mining, treating, and transporting stone, crushed stone, gravel, and sand.

The building of completely automatized concrete-making plants, where all the work is done by machines and automatic equipment, was a very important achievement of Soviet engineering, an achievement which brilliantly proved itself during the construction of the Volga-Don Canal. A plant of this type, which produces up to 5,000 cubic metres of concrete per day, requires only 17 operators.

A still more perfect automatic continuous type of concrete-mixing plant was built on the site of the Kuibyshev hydropower development. At this plant the mixing, transportation, and laying of concrete are carried out as a single uninterrupted process, by the production line method. The entire personnel, including the adjusters on duty, consists of eight men.

Our construction works are supplied with the best walking, caterpillar, and other excavators, floating suction

dredges, high-capacity tip-up cars, tractors, scrapers, bulldozers, etc.

While the suction dredges used for the construction of the Volga-Don Canal had capacities of 300-500 cubic metres of earth per hour and displacement ranges of 2-3 kilometres, the suction dredge working at the construction of the Kuibyshev hydropower development removes 1,000 cubic metres of earth per hour to a distance of up to 4 kilometres.

In June 1953 the Urals Heavy Machine-Building Plant built a new walking excavator, the ESH-20/65. This machine can remove up to 15,000 cubic metres of rock per day. More than 100 railway flatcars were required to transport the new excavator to its working site.

A new powerful scraper with a 15-cubic-metre bucket was produced by the Kolyushchenko Works in Chelyabinsk. The bucket capacities on the old models were 6.8 and 10 cubic metres.

The Osipenko Building and Road Machine Works is putting out the D-264 skimmer with a 3-metre plough. The earth turned up by this plough is directed to a conveyer and from there to a dump bridge, which dumps it at a distance of more than 45 metres from the plough. This machine can excavate and remove 1,500 cubic metres of earth per hour.

A new branch of industry—factory production of reinforced concrete articles and parts—which is very important for speeding up construction work, especially the construction of buildings, is being organized in the fifth five-year plan period. We are building factories capable of producing ready-made building parts measuring 28 square metres and weighing up to 5 tons. With these highly mechanized and technically equipped factories the Soviet Union has ushered in a new stage in world civil engineering.

A high-capacity factory producing reinforced concrete parts was built in Lyubertsi, near Moscow, in the first years of the fifth five-year plan period. Based on the production line method this factory puts out wall panels, floors and ceilings, flights of stairs, and other parts for house build-

ing. Operated from an automatic control desk, the factory has self-propelled cranes, powerful manipulators, and automatic reinforcement and welding units. Another factory of the same type is being built in Moscow. The annual output of these two factories alone will be 240,000 cubic metres of reinforced concrete parts, which is enough to build 700,000 square metres of dwelling space.

THE TECHNICAL BASE FOR EXPANDING THE OUTPUT OF CONSUMER GOODS

The light and food industries of the U.S.S.R. have been radically reconstructed during the years of the five-year plans. First-class factories, supplied with modern efficient equipment, have replaced the poorly equipped enterprises.

After the war the restoration and extension of the light industries has been carried out on a new technical basis. Obsolete inefficient equipment has been replaced with better designed machines and units. In 1946-52 the light industries were supplied with more than 170,000 new machine-tools and machines. A systematic saving of labour per unit of output is being achieved by further mechanizing and automatizing production processes, by installing conveyers, and by reducing the number of operations.

Not so long ago the textile industry had been employing low-capacity and technically-backward mules, but now they have been replaced with new highly efficient spinning machines. Compared with mules these machines take up four times less space and the productivity of the spindles is 60-65 per cent greater. New equipment has reduced the number of main machine operations at spinning mills from 12 to 6. At weaving mills automatic machines are replacing the old mechanical equipment, thus increasing the labour productivity of the weavers by 50-100 per cent.

A new technology has been worked out for the production of artificial fibre, as a result of which in 1952 the output of fibre increased by 350 per cent over the 1940 level.

Most of the enterprises of the footwear, sewing, knitted wear, fur, and leather haberdashery industries are now using the conveyer and production line system. At reconstructed factories of the footwear, fur, and sewing industries labour productivity has risen 20, 40, and 30 per cent respectively.

The Soviet textile industry has considerably surpassed the technical level of the British textile industry, the oldest in the world. There 70 per cent of the equipment is made up of old inefficient mules, that have been completely done away with in the Soviet industry.

Scientific-research institutes are doing much to make the light industries technically perfect. For instance, the Scientific-Research Institute of the Textile Industry in Ivanovo has designed a new drawing frame which raises the quality of semi-manufactured goods and yarn. This machine is coming into use at many Soviet mills. Jointly with engineers of the Krasnaya Talka Mill, a group of workers of the institute has worked out a method of processing artificial staple fibre on a carder of redoubled productivity. This method is now being recommended for all mills. The institute has also invented a line steam bleaching unit which ensures the high-quality processing of a wide range of materials and requires only 2-2.5 hours for the work instead of the usual two days.

In October 1953 the Council of Ministers of the U.S.S.R. and the Central Committee of the Communist Party of the Soviet Union adopted a decision to accelerate the development of the light and food industries in order to secure in two or three years a much greater abundance of foodstuffs and consumer goods for the population. Soviet economy has been set the task of organizing a steep rise in the output of consumer goods. The fact that the U.S.S.R. has a powerful and technically perfect heavy industry, which ensures the rapid development of the socialist national economy without depending on capitalist countries, makes the implementation of this task possible. The programme providing for a sharp increase in the output of consumer goods is being steadily

put into effect. About 300 new factories for the light and food industries have been built and launched in 1953 alone. The old factories are being expanded and supplied with the latest equipment.

Important tasks have been placed before the chemical industry, which is called upon to achieve a higher technical level and a faster development of the production of indigo, bright-coloured sulphur dyes for the textile industry, mordant dyes for wool and cotton, nitro-dyes for leather, colouring pigments for finishing materials, acrylic emulsions, polychlorvinyl resins and plasticizers for them, and other chemical materials that go to improve the quality of the articles put out by the light industries and to widen their range.

The machine-building industry has the task of organizing the output of leather and footwear equipment, high-class knitted-wear machines for the production of quality stockings, special sewing machines, as well as equipment for the textile industry.

The country's interests demand the raising of the technical level of the textile industry. In particular, it is necessary to provide finishing factories with special machinery for the shrink-proof finishing of staple fibre fabrics; the finishing and dyeing of woollens, must be improved; the wet sponging of all pure-wool coat and suit fabrics must be organized; the factories must be equipped with installations for water-proofing coat fabrics; impregnation of pure-wool fabrics against damage by moths, dressing of all pure-wool, worsted suit and coat fabrics, and hydraulic pressing of all pure-wool, worsted, and broadcloth fabrics must be introduced.

These and other technical measures are being undertaken in all branches of the consumer goods industry with the purpose of increasing the quantity of goods and improving their quality.

A characteristic feature of the development of the Soviet food industry is the accelerated expansion of the output of the more valuable foodstuffs, which fully meets with the continuously growing requirements of the Soviet people. The

output of such items as meat, dairy products, fish, vegetables, fruit, sugar, and so on, is increasing rapidly. The development of technique in the food industry follows the double aim of intensifying production and of considerably improving the quality and brand of the products.

A fast rate of growth has been developed by factory baking. While in 1936 the baking industry supplied bread to 353 cities, in 1952 it was already supplying 1,104 cities. Mechanization and automation cover 78-98 per cent of the main processes in this industry.

Modern potato and vegetable dehydrating factories are being built to provide distant and northern districts with an uninterrupted supply of potatoes and other vegetables irrespective of the season.

The output of frozen vegetables and fruit is being increased.

The Soviet fish industry has been technically re-equipped. Sailing boats and fishing nets are being replaced to an increasing extent by modern sea-going vessels equipped with latest fishing tackle. Mechanized fish-processing plants have been built and bases have been set up on shore to serve the fishing fleet.

The food industry is getting more and more refrigeration machinery. In 1952 the capacity of the refrigerators in the food industry more than doubled compared with 1940. The fleet of refrigerator ships, chiefly for the transport of fish, has increased by more than 100 per cent in 1952, while by the end of the fifth five-year plan it will have three times as many vessels as before the war. In 1952 there were 40 per cent more refrigerator railway cars than in 1940.

Household refrigerators contribute immensely towards preserving the quality of foodstuffs. Soviet factories have mastered the production of three types of household electric refrigerators; their output doubled in 1952 compared with the preceding year, and will increase many times over in 1955. The development of refrigeration in a consecutive chain (from the industrial enterprise—to the transport, from

storehouses and shops—to the homes of consumers) is ensuring the Soviet people with a supply of wholesome and delicious food.

The complete mechanization of all the aspects of food (meat, fish, etc.) production technology with the widespread employment of automatic machines and conveyers is on the order of the day for the achievement of a further development of all the branches of the food industry. Creameries must make use of continuous extraction methods and of continuous-action automatic presses. An improvement in the quality of foodstuffs will be achieved by the extensive use of methods providing for continuous-flow refining and deodorization of fats at high temperatures and vacuums, followed by flavouring and vitaminization. The far-reaching programme earmarked for the output of canned food and food concentrates is based on the over-all mechanization of technology and on its further improvement through the application at large factories of continuous sulphitation (preliminary preservation) of half-finished fruit products, and the employment of automatic parcelling and packing machines.

Considerable attention is being devoted to advance refrigeration engineering. Rapid freezing apparatuses and effective and highly-efficient refrigerating-chamber coolers will be introduced. It is planned to automatize the control of cold storage plants and to use automatic control and measuring instruments, cold meters, and air ozonizing installations in storage chambers. Machine-builders have been set the task of mastering the output of modernized refrigerator two-step compressors, automatic freon units, equipment for the production of dry ice, absorption installations, refrigerators for the rapid freezing of sausages, fats, milk, wine, and non-alcoholic drinks, and automatic control and adjustment instruments and apparatuses for cold storage plants.

The measures taken by the Communist Party and the Soviet Government are creating still more favourable conditions for the technical advance of the food and consumer goods industries.

The fifth five-year plan calls for the production in 1955 of approximately 65 per cent more consumer goods than in 1950.

The accelerated development of the light and food industries is ensuring a far greater output of consumer goods than envisaged by the fifth five-year plan.

MECHANIZATION AND AUTOMATION

The vast experience of developing the Soviet national economy shows that under socialism the main lines of technical advance are mechanization, automation, electrification, and the widespread employment of chemistry. This is confirmed by the data we have given above on the achievements of engineering in various branches of industry, transport, and agriculture.

The mechanization of the most arduous production processes is being carried out chiefly on the basis of electrification and the development of the machine-building industry, which supplies the necessary machines to replace manual labour.

The progress of mechanization has become particularly manifest in the extracting industries. Machines used to perform a bare 1.7 per cent of the mining in the Russian coal industry in 1913, but in 1952 they put out 99 per cent of all the coal in the U.S.S.R., a figure no other country has reached; in Germany it is 85 per cent, in Britain—65 per cent, in the U.S.A.—84 per cent, and in France—76 per cent. Mechanization of oil extraction in Russia in 1913 was at a level of 6 per cent, but beginning with 1937 machines have been doing all the oil extracting in the U.S.S.R. where perfected methods are being applied for the exploitation of oil deposits: turbine drilling, inclined drilling, the maximum utilization of the hydraulic capacities of oil deposits, etc.

The U.S.S.R. now has a tremendously large number of the most diverse machines to do the physical labour of the worker and the collective farmer in the most arduous fields

of production: in mining, construction, road building, loading and unloading, lumbering, and agriculture. More machines are being produced to lighten the difficult work of drifters and hewers in mines. And there is a growing output of highly productive single-bucket and multi-bucket excavators, bulldozers, special road-building machines, tower and bridge cranes, automatic loaders, stackers, trailer tractors, electric saws, and planting and harvesting machines.

For many years the timber industry was among the most backward as far as mechanization was concerned. But this branch, too, has achieved notable successes, especially after the war. More and more machines are being used at lumber camps, particularly for dressing timber. By the beginning of 1954 machines were doing 78 per cent of the felling, 57 per cent of the transportation, and 71 per cent of the removing.

Besides lumbering, the work of loading and unloading in transport and other branches of the national economy is one of the forms of the most arduous labour. Efficient machines, making this work easier and faster, have been built in this field in recent years and they include cranes, bunker trestles, tractor loaders, multi-bucket, rotor and automatic loaders, excavators, and transport installations. For example, unloading machines and installations unload loose freight from a railway car 10-20 times faster and require 7-10 times less labour than if the work were done manually. The unloading of piece freight by cranes and automatic machines reduces heavy manual labour 4-7 times.

In capitalist countries mechanization of production processes intensifies labour to an extent where it exhausts the worker and wears down his health, increases unemployment, and makes the worker uncertain of what the morrow will bring. Under capitalism, where the aim of production is to extract the maximum profits by intensifying the exploitation of labour, the worker regards the machine as an alien force dominating him.

In socialist society the continuous growth and perfection of production on the basis of the highest technique seeks to satisfy to the maximum the material and cultural requirements of the working people. Under socialism the worker regards the machine as an implement that lightens his labour, and inasmuch as there is no unemployment in the U.S.S.R. the worker very willingly utilizes the machine in the national economy.

High parametres—speed, temperature, and pressure—have come to form a characteristic feature of modern Soviet engineering practice.

High-speed open-hearth smelting is a regular practice at such enterprises as the Hammer and Sickle Plant in Moscow, the iron and steel works in Magnitogorsk and Kuznetsk, the Zaporozhstal Works, and others. Soviet steel-makers hold the world's record for the amount of steel produced per square metre of hearth.

Only recently lathe operators in the metal-working industry were machining steel parts at a rate of 70-80 metres per minute, but today G. Bortkevich, N. Ugolkov, P. Bykov, B. Kulagin, and many other high-speed turners are putting out similar details at a rate of more than 3,000 metres per minute.

The employment of high pressures (600-800 and even 1,000 atmospheres) and high temperatures (around 800° C.) in the chemical industry has made it possible considerably to accelerate production processes and to increase output.

The use of high-pressure steam in new, powerful, high-speed steam turbines is yielding a 15-18 per cent fuel saving; each of the 100,000 kilowatt turbines (operating under a steam pressure of 90 atmospheres) installed at the Stalinogorsk State District Power Station annually saves not less than 100,000 tons of Moscow Basin coal in comparison with a similar capacity turbine operating under a steam pressure of 29 atmospheres, while a new 150,000-kilowatt turbine saves an additional 12-15 per cent of fuel, i.e., a whole trainload per day.

In order to expedite technological processes many Soviet enterprises have reduced the number of process phases and are making use of new and more productive operations.

Many machine-building plants have installed multi-tool machines designed to perform several operations simultaneously, for example, drilling, counter-boring, grinding, etc.

In certain cases electric treatment has substituted mechanical treatment: an electric-spark treatment method, invented in the U.S.S.R., is now employed to remove shavings, a process formerly carried out by a tool made from special high-speed steel or from a super-hard alloy.

Acceleration of technological processes and mechanization of the main and auxiliary operations have called forth the necessity of introducing automatic machinery to control machine units and check the quality of the finished products. Automation of production is the highest stage of mechanization.

Already before the Great Patriotic War the Soviet Union began putting out the most diverse automatic machines, machine-tools, apparatuses, and instruments.

On the initiative of Inochkin, a foreman at the Stalingrad Tractor Plant, the first automatic machine-tool production line in the U.S.S.R. was built in 1940. During and, particularly, after the war, automatic production lines of machine-tool units were installed at a number of leading Soviet plants. The following example shows the efficacy of such a line. The Ordjonikidze Machine-Tool Building Plant installed an automatic machine-tool line to machine the cylinder block of the ZIS-150 lorry. Controlled from a central control desk equipped with signal lamps of different colours, all the 16 machine-tools (4 vertical, 6 horizontal, and 6 inclined drilling and boring and thread-generating machines) in the line as well as the transportation devices between them are actuated by 20 electric motors with an aggregate capacity of 85 kilowatts.

The machine-tools stand in pairs in a line in the shop; between them is a rail conveyer. The following sequence is observed in the process: the operator at the control board

presses the starting button, the automatic electric device, controlling the movement of the conveyer, switches on, and the conveyer belt feeds the cylinder block casting to the machine line. Clamp fingers automatically seize the casting at the first pair of horizontal machines and hold it firmly in a strictly-fixed position. That same instant more than 30 different instruments—cutters and drills—drive into the casting from two sides, and complete the necessary technological processes in two minutes.

An electric instrument automatically releases the clamps and the conveyer again goes into action, carefully moving the casting to the second pair of machines, where it is automatically turned 180° by a special mechanism and clamps index it in front of a new series of tools. While this is going on the first pair of machines receive a fresh casting.

It takes 15 minutes for a combination of automatic instruments, without evident human interference, to move the casting down the entire line, where 224 spindles with 504 cutting instruments operate simultaneously.

The ZIS-150 cylinder block receives 91 holes along this line of machines; the operations include drilling, counterboring, boring, grinding, threading, etc. Every two minutes the line puts out a finished ready-to-be-assembled cylinder block. A labourer picks the block off the end of the line and puts it on the conveyer dolly.

Wiring connects the control desk with all the machines on the line. The operator can make adjustments in the automatic process without leaving his place. The sensitive machinery of the control desk follows the movement of the casting down the line and the operator always knows when an operation starts and ends at each pair of machine-tools.

The following data show the economic advantages of the line: the technological process formerly applied required 56 special machine-tools, taking up an industrial space of about 500 square metres to machine a cylinder block. The time necessary for all the machine operations was 195 minutes and in order to satisfy the needs of the

plant this section had to be tended by 180 workers and foremen working in three shifts.

The automatic production line occupies less than 200 square metres of industrial floor space and fully meets the plant's requirements in one shift; it is tended by three workers.

A similar line has been built by the Stankokonstruktsiya Plant for machining cylinder blocks for the Moskvich car. A number of automatic production lines have been installed at the Kharkov, Chelyabinsk, and Stalingrad tractor plants, at carriage and locomotive building plants, at aircraft factories, and others.

From the automation of individual machine-tools, Soviet industry is passing to the automation of whole sections (for instance, the rolling mill at the iron and steel works in Magnitogorsk, the automation of which was marked by the award of a Stalin Prize), shops (producing spark plugs for internal combustion engines), and whole complex units (the hydropower stations on the Moscow Canal).

The first fully automatic factory for the production of aluminium pistons for internal combustion engines was built in Moscow after the war. At this unique factory all the production processes have been automatized—from the feeding of raw materials, fuel, and metal to the foundry, to the packing of the finished article. Compared with other piston-producing shops, the automatic factory requires three times less industrial floor space and five times less workers to put out the same number of pistons. Here productivity of labour is nine times higher and the cost of the pistons three times lower.

The automation of the main equipment requires more rational forms of organizing production. Leading Soviet factories and plants are using the line conveyer method not only for the assembly of articles, but also in other production and auxiliary shops, for instance, for the thermal treatment of machine parts, particularly, for surface hardening, heating before forging, stamping, rolling, and so on. The

combination of all these operations into a single flow ensures an uninterrupted and very productive technological process and the release of high-quality goods, and yields an extraordinary saving of raw materials and semi-manufactured goods.

The U.S.S.R. was the first to employ a conveyer in the building of locomotives, carriages, river vessels, machine-tools, etc.

An interesting forge has been built on essentially new lines at a Soviet factory. Here the usual rumble of hammers has been eliminated and there is neither smoke nor soot. Electricity plays the chief role. Steam hammers have been replaced by noiseless hydraulic presses, and mazut furnaces—by high-frequency induction heaters. The appearance of the worker, too, has changed; the place of the smith and the hammerman with soot-blackened faces has been taken by an operator dressed in a white gown.

V. I. Lenin said that technical progress under socialism "... will make the conditions of labour more hygienic, will relieve millions of workers of smoke, dust, and dirt, and accelerate the transformation of dirty, repulsive workshops into clean and well-lit laboratories worthy of human beings." These words are coming true.

Automation has been particularly successful at electric and especially at hydropower stations. Here the turbines are started, regulated, and controlled from one and the same point. Recently there has been an increase in the number of remote-control hydropower stations, whose work is regulated from control rooms located many kilometres away. Everything is done automatically—control of the working regime of the machine units, oiling of the bearings, cooling of the generators, etc.

The hydropower stations on the Moscow Canal are under constant lock and key and have no staff of attendants. The work of the step-up and step-down substations along the electric transmission lines and of the lightning arresters is regulated automatically.

In the Soviet land the all-round mechanization and automation of production rests on the training of highly-skilled personnel. The man operating automatic machine units is a new type of worker who carries out the functions of an engineer or technician. Thus are gradually erased the essential distinctions between mental and physical labour in the U.S.S.R.

SOCIALIST EMULATION AND THE MASTERING OF NEW EQUIPMENT AND ENGINEERING METHODS

The greatest historic service rendered by the Communist Party of the Soviet Union is the creation of cadres, who form the treasure-store of the socialist state. The Communist Party has reared and trained an army of worker-innovators, advanced collective farmers, engineers and technicians—captains of production, business executives—captains of industry, and scientists, who are blazing new trails in science. Soviet science and technique, which are developing on a broad front, are the fruit of the unprecedented creative effort of Soviet scientists and men in industry.

Socialism has opened up unparalleled opportunities for releasing the working people's creative initiative, an initiative which has found its expression in socialist emulation.

Socialist emulation means demonstrating the enormous revolutionary energy of the people, engendered by the great purpose of building socialism.

In the U.S.S.R., the first country where socialism has triumphed, the working people have come forth as creators who are sharing most actively in directing production processes. This conscious activity of the working people and their new attitude towards labour comprise a tremendous factor in the development of the productive forces and create the conditions for a steady rise in labour productivity and for the improvement and perfection of engineering methods.

The growth of the creative initiative of the masses is a specific feature of the socialist system of society. Without

the activity and broad creative effort of the working masses, Soviet economy could not have developed at all. Inspiriting Soviet patriotism is strikingly embodied in the mass socialist emulation movement and in the display of folk initiative and creative activity. To Soviet people socialist emulation has become a vital necessity.

With his inherent genius V. I. Lenin revealed the sources of the basic change in people's outlook on labour—the transition of the means of production to the hands of the direct producers, the new position of the worker at factories and plants, and the possibility of carrying on production with the utilization of the latest achievements of science and technique. He said, "For the first time after centuries of working for others, of working in subjection for the exploiter, it has become possible *to work for oneself* and, moreover, to employ all the achievements of modern technique and culture in one's work."[1]

The equipment of the Soviet national economy with first-class machinery has brought to the fore the necessity of mastering and utilizing this machinery most effectively. The aspiration to utilize machinery most effectively was vividly demonstrated in socialist emulation, in the Stakhanovite movement. J. V. Stalin revealed the profound historical significance of the undertaking of the Stakhanovites when he called their movement "the most vital and irresistible movement of today."

The origin of the Stakhanovite movement is fundamentally linked with new technique. This movement, which has spread out in breadth and depth and acquired new forms, would have been inconceivable without the new, higher technique. Every day brings more evidence of the talents of production innovators—front-rank workers. These men and women are making an inexhaustible contribution towards the most effective utilization of new technique and its further development.

Already in the years of the pre-war five-year plans inno-

[1] V. I. Lenin, *Selected Works*, Vol. II, Moscow 1952, p. 368.

vators in production and leading workers had shown themselves to be people who had mastered the technique of their work, harnessed and advanced it. The striving to have a deeper knowledge of technique and to utilize it to the full has become a characteristic feature of the work of innovators, particularly after the war, thanks to the further rise of the cultural and technical level of the working class.

Advanced workers in industry are doing everything possible to increase output, to make the best use of available equipment and industrial space, and to employ to the maximum the latent reserves of factories and plants. Natalya Yarigina, a front-rank textile worker, started a socialist emulation movement aimed at utilizing machine-tools at their full capacity. Natalya Yarigina's initiative was taken up by tens of thousands of men and women workers in different branches of the national economy.

The construction of the main details of the warp-weaving machine at the Kosino Knitted Goods Mill, Moscow Region, was basically improved on the initiative of S. Mitin, shop manager at the mill. This considerably increased the speed of the machines and heightened the output capacity of the available equipment by more than 20 per cent. More high-quality goods are now being put out while comsumption of raw materials and down time have decreased drastically. This mill has substantially enhanced its output without additional equipment or industrial space.

N. Nazarova, a woman gear-cutting machine operator at the Stalin Auto Works in the Urals, started a movement aimed at prolonging the service of machine-tools and instruments through superior maintenance. Operating at first three and then five machine-tools, Nazarova regularly overfulfilled her monthly quota by 50-100 per cent, putting out high-quality products at the same time. The improved technology of machining gears, introduced by Nazarova, has freed four gear cutters, sharply reduced the time necessary to machine every part, ensured a greater durability of the instrument, and cut down the consumption of coolants.

The largely augmented production and technical efficiency of front-rank workers in the post-war period has made it possible to achieve remarkable successes in the struggle to fulfil and overfulfil progressive technical and economic norms. This is graphically illustrated by the work of Stalin Prize winners G. Bortkevich, P. Bykov, A. Markov, N. Ugolkov, and other workers, who pioneered high-speed methods of cutting metal. The movement inaugurated by these men is embracing many thousands of workers in machine-building plants throughout the country.

In 1952 Vasili Kolesov, turner at the Middle Volga Machine-Tool Building Plant, suggested a new high-speed method of cutting metal which he called the "power" method. Essentially this method consists in an accelerated feeding of the tool and an improvement of its cutting angle. Kolesov's method has contributed many new features not only to practice but also to the theory of cutting metals. In a short space of time Kolesov's experience was recognized and put into widespread practice in Soviet industry.

Acceleration of the technological processes of machining parts in the engineering industry brought innovator-fitters round to the idea of finding ways and means of speeding up the entire production cycle. At the Novo-Kramatorsk Heavy Machine-Building Plant (Donbas), S. Klimenko, senior foreman, I. Ogullo, foreman, and P. Gashchenko, foreman, started a movement in 1952 for reducing the machine-tool assembly cycle by changing the technology of the process. Formerly, all assembly operations followed a definite sequence—the installation of machine-tool sections, the alignment of all the main parts during assembly, the testing of the mechanisms, and so on. Innovators have organized the parallel assembly of main parts, using for this purpose a new device which lightened the work of the assemblymen and increased labour productivity. By mastering the new technology, the shop reduced by half the assembly cycle for a large unique machine-tool.

Steelmakers have set a splendid example in the struggle

for overfulfilment of average progressive technical and economic norms and for the over-all intensification of production. For instance, V. Zakharov, M. Zinurov, and I. Semyonov, steelmakers at the Stalin Iron and Steel Works in Magnitogorsk, as well as steelmakers at open-hearth shop No. 1 of the Dniepropetrovsk Iron and Steel Works, at the Hammer and Sickle Plant in Moscow, and at other plants are making wide use of new high-speed smelting methods and are putting out tens of thousands of tons of the best sort of metal over and above plan.

In the current fifth five-year plan period steelmakers are no longer satisfied with individual instances of high-speed smelting, but are working to employ high-speed methods all the time. S. Yakimenko, steelmaker at the Zaporozhstal Plant, is a pioneer in this respect. After profoundly analyzing their work and the experience of smelting metal in separate cases when high-speed methods were used, his team arrived at two important conclusions: firstly, that high-speed smelting can be made still faster and, secondly, that every smelting can be carried out at a high speed. The steelmakers achieved their goal. They ensured the maintenance of a definite heat regime in the open-hearth furnace at all stages of the smelting process and in the time between every smelting they kept the temperature at its highest possible level. The team reduced the time required to feed the furnace, to pour the pig-iron, to finish melting and to let out the metal. This gave the Zaporozhstal steelmakers an average saving of one hour, while in separate cases they saved from one and a half to two hours.

The experience of high-speed steelmakers stimulated the origination of high-speed methods in rolling shops as well. This valuable undertaking was launched at the Petrovsky Works in Dniepropetrovsk by F. Tsimbal, rail and girder shop foreman, Z. Klimenko, senior welder, V. Kukanov, senior blooming-mill operator, and V. Trikozenko, rolling-mill operator. They shortened the blooming-mill process for each ingot to 1.5 minutes; formerly it took 2-2.5 minutes.

This was achieved by reducing the intervals between the feeding of each ingot and between the time each ingot is passed through the rolls as well as by reducing the idling time of the blooming mill. By increasing the ingot heating temperature from 810°C. to 900°C. the innovators knocked an average of 30 minutes off the time required to heat each ingot. They improved on the method of changing rolls, thanks to which this process now takes up to 50 minutes instead of 1.5-2 hours. In seeking to employ high-speed metal-rolling methods, the workers of the rail and girder shop have surpassed the pre-war level of labour productivity by more than 100 per cent.

At the Stalin Iron and Steel Works in Kuznetsk a group of innovators suggested a technically daring method of reconstructing and assembling blast-furnaces at a high speed. The implementation of this method in the reconstruction of large blast-furnaces reduced the former extremely short time-table of 75 days by 12 days. This is unprecedented in the history of metallurgy.

High-speed methods have become widespread not only in machine-building and metallurgy but also in the extracting industries—coal and oil. In 1952 I. Poboka, leader of a team of drifters at Mine No. 1-2 in the Lisichanskugol Field, Donbas, initiated a high-speed method of drifting. That year his team drifted 1.5 kilometres of underground mine workings under difficult geological conditions. Using a loading machine, the team organized its work in a way that allowed one miner to substitute another. The men became very proficient with their machines and increased the drilling depth from 2.5 to 4 metres.

In the beginning of 1953 a Tuimazaburneft Trust team of drillers under the leadership of foreman Allayarov sank a 1,630-metre-deep oil well at a commercial speed of more than 1,000 metres per machine per month (the norm being 700 metres). This was achieved through the utilization of a new drilling technology, which entails fresh-water flushing of the face during sinking operations in spite of the fact

that this was prohibited by all formerly existing technical rules. These rules required the use of loamy paste for the sinking of wells. "Water was thought to be the enemy of drilling," foreman Allayarov said, and his team of innovators proved that in the conditions prevailing at the eastern oil-fields it is possible to use water instead of loamy paste in the sinking of wells. This has increased the mechanical speed of boring by 73 per cent.

New methods of sinking and exploiting oil wells are being employed by the Baku oil-workers, who are the most experienced in the Soviet oil industry. One of these new methods, calling for the multi-row sinking and exploitation of oil wells, consists in the following: two or three tap pipes are lowered into the well instead of one as had formerly been the practice. As a result, the combining of the construction and mounting operations into a single cycle allows for the sinking of two or three wells in the time usually required to sink one well. By this method one well opens up and taps several oil levels, lying one below the other. As a result oil is extracted from several levels at one and the same time.

While introducing and mastering new technique, leading Soviet enterprises are substantially speeding up output by raising labour productivity without increasing the number of workers. For example, in 1952 the Kaganovich First State Bearing Plant surpassed its 1951 output level by 13 per cent, almost 90 per cent of the increase being attained at the expense of greater labour productivity.

The colossal scale of the steadily growing industrial output in our country, the rapid technical progress in all branches of socialist industry, and the natural striving of the foremost worker-innovators to bring the laggers up to the level of the leading workers and to advance whole sectors, shops, and factories have given scientists, engineers, and technicians, new and more complicated problems to solve.

When the Stakhanovite movement was still in its early stages, foremen, technologists, shop managers, and designers came to the assistance of the innovators in production

by improving the organization of the work-benches and by equipping machine-tools with better tools and devices. This mutual assistance alone opened up tremendous possibility for the further development of technique and growth of labour productivity. But initially this support was not infrequently given only to individual foremost people in industry, who had become particularly prominent. The attainment of record indexes by foremost workers went on side by side with the non-fulfilment of norms by many workers.

The drive to raise labour productivity in sections, shops, and enterprises has confronted engineers and technicians with the complicated problem of considerably increasing labour productivity not of individual workers but of whole sections, shops, and enterprises. By carefully checking all the links in the technological chain and utilizing all the potentialities of their factories and plants, front-rank foremen, technologists and shop managers are creating a stable foundation for collective highly productive labour.

Leading technologists have come to have a deep understanding of the specific features of socialist emulation in the post-war period. This is vividly seen in the work of Stalin Prize winner Alexander Ivanov, a technologist at the Kirov Works in the Urals. By helping the workers and foremen correctly to utilize all the available equipment, to introduce advanced technology and to equip their machine-tools with highly-efficient devices, Ivanov added 75 per cent to the planned capacity of his sector and non-fulfilment of the norm by the workers has become a thing of the past.

The movement of engineers and technicians to introduce innovations in production has been further developed by the setting up of complex teams of engineers, foremen, and worker-inventors. In the most difficult sectors of industry these teams complexly solve problems of increasing output to the maximum through the utilization of the factory's inner reserves and the perfection of machines and methods. E. Savich, a milling-machine operator pioneered the organization of a complex creative co-operation team at the Kirov Works

in Leningrad. The team set up at his initiative was made up of worker-innovators—the foremost people in industry—as well as designer A. Fyodorov, assistant shop manager K. Rusinovich, technologist N. Vorobyov, and Docent of the Polytechnical Institute A. Shchegolev. Within the team every member was given a definite assignment—designing new models of cutting tools, planning technology, and so on—but all the most important questions were discussed collectively. The team helped the workers in the milling section radically to change machining methods and to reduce the amount of labour spent on putting out the article. High-speed methods were implemented in 160 of the 200 milling operations. Labour productivity rose to such a level that the shop was able to give the other sections 11 of its milling machines. The team's creative work has yielded a saving of more than 4,000,000 rubles.

It stands to reason that in the majority of cases the worker-innovators could not have solved such complicated problems as changing the technology of production by themselves, without the help of engineers. But it would be a mistake to regard the joint effort of engineers, technicians, and workers merely as engineers and technicians assisting and guiding the workers. In the post-war years there have been many instances of foremost workers revealing new technological potentialities and enriching science. Take, if only as an example, the movement of high-speed workers. It has greatly influenced the entire development of the machine-building industry, and demanded a revision of the existing designs of machine-tools and the working out of new designs.

The experience accumulated by high-speed turners has prompted the Sverdlov Machine-Tool Building Plant in Leningrad to work out the design of a powerful self-centering chuck for heavy roughing. This chuck reliably holds the workpiece in position.

On the basis of the successes achieved by the use of high-speed methods of metal cutting, factories, plants, and scientific-research institutes are conducting large-scale work

aimed at modernizing the existing machine-tools and designing new high-speed models. The Experimental Scientific-Research Institute of Metal-Cutting Machine-Tools, for instance, has designed and constructed a powerful high-speed vertical miller. The spindle of this lathe develops up to 1,500 revolutions per minute and permits milling at a cutting speed of 1,000 metres per minute. The Sverdlov Machine-Tool Building Plant has produced a 2,000 r. p. m. horizontal boring machine. The Krasny Proletary Works has put out a big lot of high-speed turning lathes. All this is ushering in a further technical advance in the Soviet machine-tool building industry. The creative co-operation of engineers, technicians, and workers is leading to the solution of problems of creating and implementing new, advanced technique.

The initiators of high-speed metal cutting have spurred not only the machine-tool building industry. The widespread employment of their methods has demanded the pulling up of many links in our industry: for example, the ball-bearing industry has to furnish our machine-tool builders with high quality bearings of greater precision and durability; the electrical engineering industry has to produce small high-capacity direct current motors with a wide control range; the tool-making industry has to increase its output of tools with hard-alloy edges in accordance with advanced modern technology, etc.

Worker-innovators are sharing creatively in the building of new machines. Quite often they come forward with constructive ideas and inventive initiative. Excavator operators, working on the construction of the Kuibyshev and Stalingrad hydropower stations have suggested a number of improvements in the design of their machines, which are facilitating their handling and increasing their productivity. Miners operating the Donbas coal cutter-loader have rendered its designers invaluable help in constructing machines for the all-round mechanization of long-wall mining.

Innovators in agriculture are not by any means lagging behind innovators in industry in the drive to perfect tech-

nique. E. Kompaniets, a harvester-combine operator at the Bozhedarovsk Machine-and-Tractor Station, has done some hard work to re-equip his machine and, as a result, he has ensured the mechanization of all maize-harvesting processes. Kompaniets' harvester cuts the stalk, separates the corn-cob, and converts the stalks into silage. The unit, tended by an operator, steersman, tractor driver, and three workers, does the work of 110 men. Its capacity is about 10 hectares per day.

The fight for technical progress in our day is providing numerous instances of rank-and-file workers achieving notable successes in introducing technical improvements on a par with technicians and engineers. For example, I. Kartashev, a fitter at the Ekonomizer Works in Leningrad, was very successful in simplifying and reducing the cost of the process of turning out toothed cutters, used for machining turbine parts. These high-precision cutters used to be made on special machine-tools, but Kartashev designed a simple optical device which permitted making them on an ordinary lathe. A special 20-fold magnifying screen showed the profile of the machined tooth, making it possible to see that the cutters get the necessary profile. Kartashev's device has speeded up the making of cutters several times, cut production costs 25-30 times, and is saving the Ekonomizer Works 700,000 rubles annually. That is the reason why worker-innovators rank with engineers and scientists when Stalin Prizes are awarded for achievements in perfecting technique and organizing production.

THE LINK BETWEEN SCIENCE AND INDUSTRY

The broad movement to draw scientists into the work of solving urgent production problems was started by the Stalin Auto Works in Moscow. While perfecting automobile engines, the works' engineers and technicians found it necessary to have the durability of the metal used for responsible parts greatly enhanced. Experimentation at the

works under the guidance of scientists resulted in the building of an automatic installation allowing for fast and high-quality hardening. The Stalin Auto Works was the first in the world to employ the high-frequency method of hardening crankshaft journals. Now the works is using high-frequency currents to process the surfaces not only of steel but also of cast-iron parts, giving the latter the hardness of steel.

The effective participation of scientists in deciding current practical problems of production is vividly seen on the example of the Kompressor Plant. Formerly this plant needed 75 hours to machine a forged steel shaft, most of the time being spent to convert a 160-kilogramme forging into a 67-kilogramme shaft. Almost 100 kilogrammes of steel was shaved off during the mechanical processing. After generalizing and utilizing the vast production experience of foremost workers, scientists of the Bauman Higher Technical School in Moscow and of the Scientific-Research Institute of Chemical Machine-Building, jointly with the engineers of the plant, decided to use a cast-iron shaft in the compressor instead of a steel one. The result was that the castings supplied to turners weighed 100 kilogrammes instead of the former 160, the mechanical processing took up 44 hours in place of 75, and not 100 but 30 kilogrammes of metal went into shavings. Thus, the transition to cast-iron shafts has reduced by half the technological cycle, released 50 per cent of the labour power formerly needed, and reduced costs by almost 300 per cent.

Industrial enterprises have become singular laboratories for many institutes. At the factories scientists and workers in production are jointly solving the tasks of introducing advanced methods of technology and production organization, and together they are achieving an increase in output. A typical example is the creative co-operation of G. Breikin, a turner at the Ordjonikidze Baltic Works, and I. Savin, a research worker at the Institute of Technology in Leningrad.

For many years G. Breikin had been turning 10-15-ton parts for ships. All technical instructions categorically forbade turning such large and responsible details at a speed of more than 8-10 metres per minute. When the high-speed movement started in factories and plants in Leningrad, G. Breikin increased the cutting speed of his machine-tool to 250-300 metres per minute. In some cases he worked at a speed of 500 metres per minute, but that put the tools out of commission. Breikin searched how to make tools that would speed up the process. At this very time I. Savin, who had designed universal high-speed tools with variable cutting angles, was looking for an opportunity of exhaustively verifying his experimental work under conditions of production.

That brought Breikin and Savin together and they concluded a socialist emulation contract, in which the turner undertook to fulfil his plan for the year in four months by employing high-speed regimes, and the scientist said he would investigate new methods of making tools with variable cutting angles and introduce them into production. By joint effort the emulators carried out the tasks they had set themselves.

The creative co-operation of scientists and workers in industry became particularly widespread after the Government had adopted a decision to build new hydropower stations on the Volga. The country's scientific centres and industrial laboratories, the most prominent scientists and factory engineers, academicians and innovators in production all pooled their efforts to work on problems that faced science and engineering for the first time in history.

The Kalinin Polytechnical Institute in Leningrad serves as an example of how the link between workers in science and industry grew and strengthened in practice. After the Government decision on the Volga hydropower stations was published, a group of scientific workers of the hydraulics chair at the institute began a series of investigations connected with the construction of locks for the Kuibyshev hydropower development. The chair of machine-building

technology helped the Stalin Metal Works to design new equipment for the hydropower station, and this co-operation of scientists and workers in industry resulted in the building of special machine units providing for the serial output of turbines. The chair of high tension did work connected with the construction of the Kuibyshev-Moscow high-tension line.

The fast link between science and industry, between scientists and worker-innovators is quite natural in our country, for it takes its beginning from the specific features of the Soviet social and state system. In socialist society advanced science is closely associated with practice. Jointly with workers in industry and agriculture, the Academy of Sciences of the U.S.S.R. in 1952 alone introduced more than 250 completed scientific works into the metallurgical, oil, and chemical industries, hydroconstruction, and so on.

Science permeates our entire social life; it arms the Soviet man in his struggle against nature and is a mighty force for transforming nature in the interests of man.

"Only socialism," V. I. Lenin said, "will free science from its bourgeois fetters, from its subjection to capital, from its slavery to filthy capitalist greed. Only socialism will provide the possibility of widely spreading and really subordinating common production and the distribution of products with scientific consideration of how to make the life of all the working people easier and bring them an opportunity to become prosperous."[1]

In the U.S.S.R. science has sunk deep folk roots, and this folk character manifests itself in the fact that the achievements of Soviet science are widely disseminated, are introduced into various branches of the national economy, and become the property of all Soviet people.

In capitalist countries the situation is different. There the capitalist system uses the fruits of science to enrich a handful of finance and industry magnates, to intensify the exploitation of the working people, and to prepare imperial-

[1] V. I. Lenin, *Works*, Vol. 27, 4th Russ. ed., p. 375.

ist wars of annihilation. In the capitalist world many scientific discoveries, which could lighten people's lives, are locked in the safes of the capitalist monopolies.

On the other hand, the very nature of the socialist social system opens an unlimited field for scientific creation and for the application of its results to production. Soviet science is emphatically breaking old traditions and norms, the natural sciences—physics, mechanics, and chemistry—have become closely linked with technique, while mathematics and geology have taken service with it. Soviet science is developing in the interests of the broad masses of the working people.

The concern of the Soviet state in the matter of developing science, training scientific and technical personnel, and giving wide scope to scientific-research work in the country is expressed in the creation of a huge army of new technical intelligentsia, which rose from the people and is serving the people. Cadres of the technical intelligentsia are growing out of the ranks of yesterday's workers and peasants, innovators in industry and farming.

Prior to the Great October Socialist Revolution there were approximately 3,000 people in Russia doing scientific work in the higher school and in research establishments; of these hardly more than a thousand had any genuine relation to scientific research in the real sense of the word. During Soviet years our country has reared a host of scientists, 160,000 strong, among whom there are more than a thousand academicians and corresponding members of the Union, Republican, and branch academies, 10,000 doctors of science and professors, and about 40,000 candidates of science and docents.

The U.S.S.R. has about 3,000 scientific-research institutes, experimental stations, laboratories, and other scientific establishments. There are more than 900 institutions of higher learning (including correspondence course institutes) in the country and in 1953 these had an aggregate body of 1,562,000 students. That year alone the higher and secondary special schools graduated more than half a million young

experts for different branches of the national economy. In 1952 there were about 5,500,000 experts with a higher or secondary education in the Soviet Union, i.e., 2.2 times more than before the war.

Solicitously reared by the Communist Party, scientists, engineers, technicians, and worker-innovators are waging a successful fight for technical progress.

A very vivid indicator of the progress of science and engineering in the U.S.S.R. is the quick discovery of the secret of producing and utilizing the nuclear energy of atoms. "The Soviet Union, which possesses practical possibilities for producing atomic energy, is deeply interested in having this new type of energy used for peaceful purposes, for the benefit of the people, for such employment of atomic energy expands beyond limit man's power over the elemental forces of nature and creates for mankind colossal opportunities of increasing the productive forces, promoting further technical and cultural progress and of multiplying social wealth."[1]

The "atom diplomats"—American enemies of peace, who lost their monopoly of the atom bomb long ago—have zealously spread the version that the U.S.A. possesses a weapon more formidable than the atom bomb and has a monopoly of the hydrogen bomb. But that is not so. In his speech at the Fifth Session of the Supreme Soviet of the U.S.S.R. on August 8, 1953, G. M. Malenkov, the head of the Soviet Government, declared: "The Government considers it necessary to inform the Supreme Soviet that the United States has no monopoly of the hydrogen bomb either."[2]

The achievements scored by science in the Soviet Union are graphically demonstrated by the launching of a Soviet atomic power station. By starting the exploitation of the first industrial atomic power station to supply electricity for

[1] G. M. Malenkov, *Report to the Nineteenth Party Congress on the Work of the Central Committee of the C.P.S.U.(B.)*, Moscow 1953, p. 54.

[2] G. M. Malenkov, *Speech at the Fifth Session of the Supreme Soviet of the U.S.S.R.*, Moscow 1953, p. 41.

industry and agriculture, the U.S.S.R. has taken a real step towards utilizing atomic energy for peaceful purposes.

The successes of Soviet science and engineering are a result of the advantages of the socialist system and of the mass character of scientific and technical creative work in the U.S.S.R.

The Soviet land owes all its great achievements to the heroic efforts of the people, to the selfless labour of workers, collective farmers, and the intelligentsia, and to the wise leadership of the Communist Party.

Soviet society is forging ahead along the path of gradual transition from socialism to communism. Communism is the system of the highest productivity of labour. The material basis of communism rests on the highest technique and on the unprecedented burgeoning of the talents and capabilities of all the members of society. In communist society technique will be the greatest source of economy, of lightening human labour, and of the steady growth of the material and cultural level of its members. It will be founded on the widest penetration of industry by science. Mankind will achieve its greatest triumphs in subjecting the forces of nature and in utilizing all the sources of power and natural raw materials. The material foundation of communist society is being built already today in Soviet factories and scientific institutions, in the fields and laboratories. The peaceful constructive labour of the Soviet people is inspired by the glorious Communist Party, which is confidently leading the Soviet people towards the complete victory of communism.