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Meeting of Experts/Decision Makers on Promotion
and Development of Machine Tool Industries in
Developing Countries of Asia and the Far East

Tbilisi, Georgia, USSR, 5 - 15 October 1974

TECHNICAL ASSISTANCE OF THE SOVIET UNION/
TO THE DEVELOPING COUNTRIES IN ORGANIZATION
OF PRODUCTION OF METAL-CUTTING AND METAL-WORKING
MACHINE TOOLS AND TOOLS ^{1/}

by

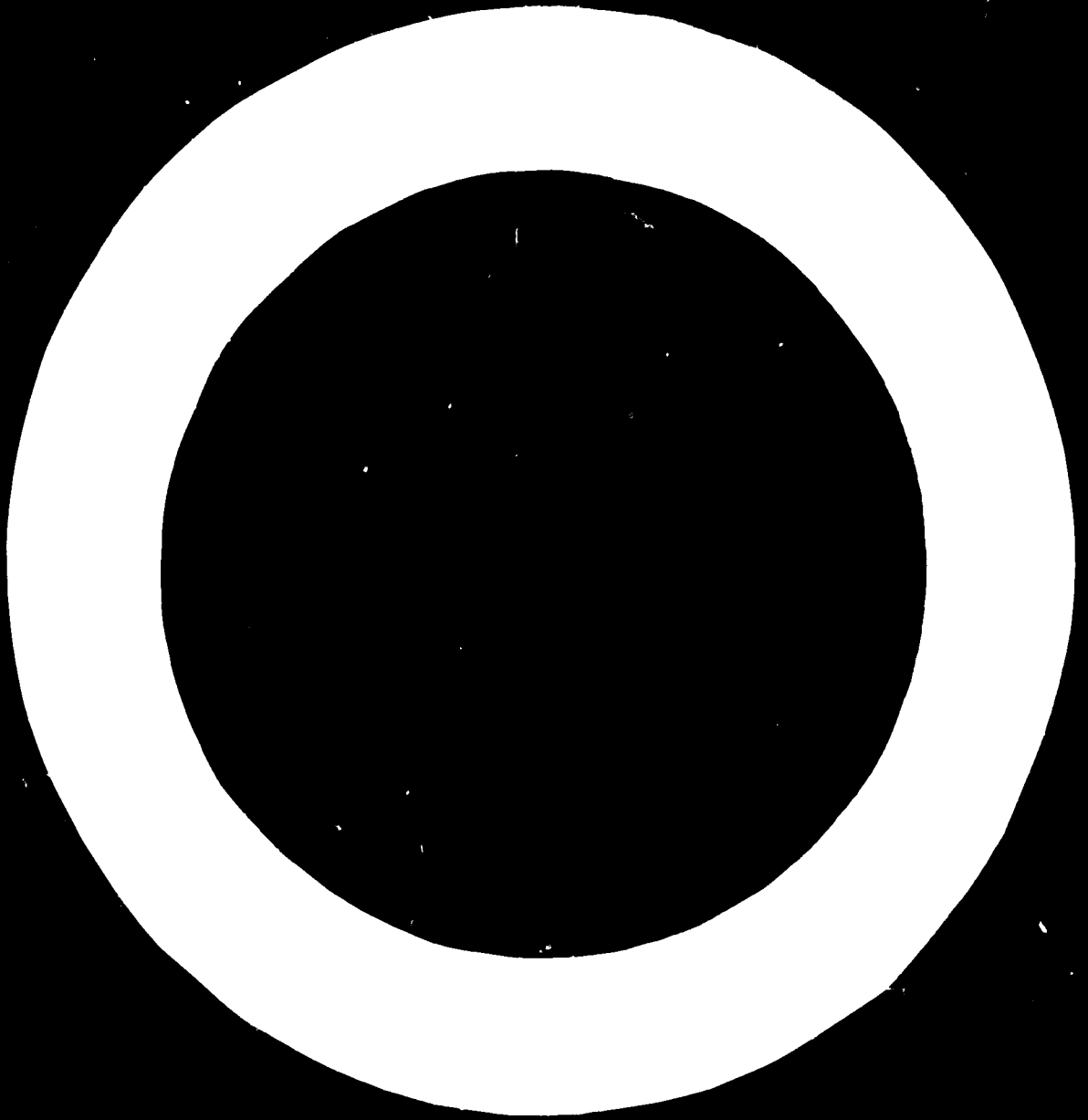
S. I. Eroshkin *

Machine Tool Industry

* Ministry of Machine Building of the USSR, Moscow

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The economic and technical co-operation between the USSR and developing countries is implemented, generally, on the grounds of intergovernmental agreements.

The co-operation is based on mutual benefit; it promotes development of the national economy in these countries and increase of the foreign trade of the Soviet Union.

The technical co-operation of the Soviet Union and the developing countries gained in scope in the field of creation of engineering and metal-working industries.

The USSR, in compliance with the agreements on economic and technical co-operation, renders its assistance in creation of 47 machine-tool and metal-working projects in these countries; of these, 37 were built and commissioned by the 1st of January, 1974, according to the State Committee of the Economic Relations.

For the purpose of development of machine-tool industry in the developing countries, 16 works of metal-cutting equipment and 3 works and shops of tools were built, or are at present under construction with technical assistance and help from the Soviet Union.

The Soviet Union assisted in projection, construction and mastering of production at the Helwan machine-tool factory with an output of 1620 machine-tools a year, inclusive of tool-room lathes, turret lathes, drilling and milling machines and shapers.

The annual program of the factory

Description	Model	Number	Annual prog-
		pcs	ram, tons
1	2	3	4
Tool-room lathes	1J611	200	112.0
	1A62	300	636.1
	1K62	300	656.2

1	2	3	4
Tool-room lathes	1M63	50	214.0
Turret lathes	1341	40	90.5
Drilling machines	HC-12A 2A125 2A135 2M55	280	250.8
Milling machines	6P80 6M82 6P13 6P83	350	907.0
Shaping machines	7B35 7A37	100	299.0
Total machine-tools		1620	3165.8
Machine-tool accessories			300.0
Pneumatic tools			16.0
Fixtures, dies			180.0
Grand Total		1620	3614.0

Composition, areas, equipment and employees of the factory

Shops and services	Area, Equipment, Employees			
	sq. m.	pcs	total	workers
1	2	3	4	5
Machine shops	14200	340	726	656
Assembly shops	7000	-	260	235

1	2	3	4	5
Stamping + welding shop	2270	47	46	39
Painting, packaging and storage of finished products	1950	-	50	35
Heat-treatment and electroplating department	1800	-	39	27
Tool room	2950	105	219	195
Machine-repair shop with construction-repair department	2100	56	147	130
Laboratories	4300	17	119	82
Store facilities	1680	-	13	6
Compressor room	330	-	3	3
Transformer substation and telephone exchange	110	-	23	14
Total	38690		1645	1422
Administration, engineering-laboratory building, welfare	3690		286	30
Grand Total	42380		1931	1452

Power Supply

The installed capacity of power consumers amounts to 10600 kW. Consumption of water by the production process amounts to 40 cu m per hour.

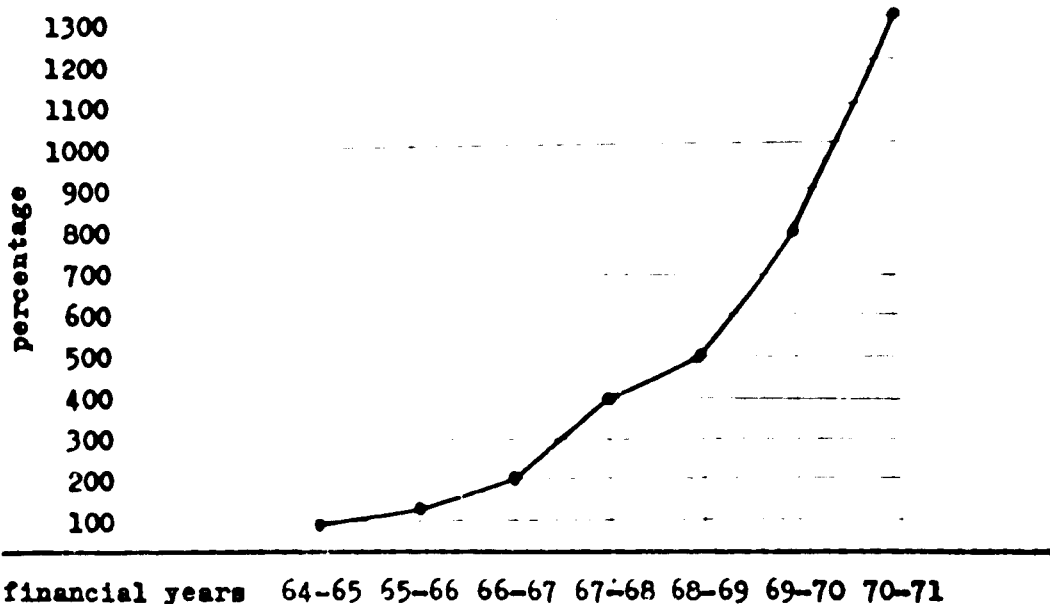
Figures 1 and 2 display the general view of the factory, location layout and scheme of general layout. The solution of the general layout clearly indicates the functional division of the site into the areas of main production, storage facilities, administration-welfare and engineering-laboratory facilities. Production buildings were designed as multi-bay single-storey construction with 18m-width bays of 10.8m height to structures. Natural lighting of the buildings, except for thermoconstant premises, is pro-

vided through the saw-tooth skylights of northern orientation. Window openings were provided only in the lower part of external walls for the sake of reduction of insolation.

Buildings of administration, engineering-laboratory premises and experimental shop make an integrate architectural design complex, located on the foreground at the entrance to the factory from Helwan. The complex is composed of two 4-storeyed buildings and a 1-storeyed experimental shop, which are connected with passages.

The production of lathes, drilling and milling machines has been mastered at the first phase of the Helwan machine-tool factory

The increase of the production output can be seen from the accompanied curve.



The factory is non-deficient, beginning from the year of 1969. It is noticable that 80 per cent of the machine-tools as produced at the factory are used in various branches of industry, 15 per cent in training centers of the Education Ministry and 5 per cent (lathes in particular) are in private sector.

With the technical assistance of the Soviet Union and using the Soviet projects, the ARE has constructed the factory of forgings and chains and the file plant with an output of 40,000 files a year.

In Hanoi, DRV, the mechanical plant has been constructed with the technical aid of the Soviet Union. The plant was designed as an integrate machine-building facility with a complete production cycle specialized for manufacture of tool-room lathes, shapers, cylindrical and surface grinders, vertical milling machines and radial drilling machines in a short-run and individual production.

The plant comprises the following buildings and constructions: main building, building of auxiliary shops, foundries, forging - preparation building, wood-working building, store building, administration and welfare buildings and other engineering-technical constructions.

Annual program of the plant

Description	Model or capacity	Number pcs	Annual program tons
1	2	3	4
Tool-room lathes	ref. to 1616	130	240.5
	ref. to 1K62	180	396.0
	ref. to T-630	50	200.0
Shaper	736	70	129.5
Universal cylindrical grinder	3A130	50	180.0
Surface grinder	372E	40	180.0

	1	2	3	4
Vertical milling machine		6H12П	100	320,0
Radial drilling machine		2A55	30	123,0
Boring machine		2620Б	30	360,0
Total			680	2129,0
Accessories				136,0
Spare parts				40,0
Parts for maintenance of equipment				105,0
Grand Total			680	2410,0

Composition, areas, equipment and employees
of the plant

Shops and services	Area sq m	Equipment pcs	Employees total workers	
			4	5
1	2	3	4	5
Forging - preparation shop	1130	9	49	42
Machine shops	5100	131	340	305
Assembly shop	3150	·	131	118
Painting shop with packaging room	970	·	18	15
Heat-treatment shop	540	·	19	14

	1	2	3	4	5
Tool room		800	42	116	103
Machine-repair shop		1000	24	101	87
Electroplating room		360	•	12	11
Iron foundry		3195	•	127	115
Steel foundry		2000	•	95	88
Wood-working shop		1386	•	60	54
Store facilities		2260	•	59	42
Welfare premises		4697	•	8	8
Head Office		4282	•	188	26
Laboratories and other services		4693	8	120	87
Total		35563	214	1437	1115

Power Supply

The installed capacity of power consumers amounts to 14100 kW. Consumption of water by the production amounts to 106,3 cu m per hour.

Figure No. 4 displays the general layout and the future development of the plant. The production buildings were designed and constructed in conformity with the technological requirements and with the provision of the maximum ventilation of the site and the minimum isolation of the production premises. Aeration of the production premises is done through window openings, louvers and skylights.

The new production buildings were designed with 18m-wide and 10.95m-high bays. At present, the reconstruction and expansion of the plant is in the phase of completion in compliance with the prepared Project Report.

As a rule, the necessity of creation of the national machine-building industry in the developing countries arises in consequence with the requirements of existing and expanding branches of industry, such as mining, food, construction materials, agriculture and transport. The most urgent are the problems of repair of the existing equipment, manufacture of spare parts, simple standardized machine-tools, various supporting equipment and metallic structures which are required to satisfy the current demands of the economy.

In Santo-Clara, Cuba, the mechanical plant has been constructed by the Soviet project with the assistance of the Soviet Union. The plant was designed as an integrate facility, comprising the machine - assembly shop, iron and steel foundry, forging - welding shop of forgings and welded structures and all necessary supporting and administration services.

Annual program of the plant

Products	annual program, tons	Notes
1	2	3
Spare parts by orders of other factories	1500	
Capital repair and restoration of mechanisms and equipment	700	
Manufacture and restoration of welded structures	1000	
Total	3200	

1	2	3
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Supply of castings without machining by orders of other factories:

iron castings	900
steel castings	1225
Total	2125

Composition, areas, equipment and employees of the plant

Shops and services	Area sq m	Equipment pcs	Employees total workers	
1	2	3	4	5
Foundry	6500	42	198	178
Forging shop	750	6	13	11
Shop of metallic structures	1500	29	52	47
Machine - assembly shop	5200	131	314	285
Heat-treatment shop with electroplating room	830	58	31	26
Tool room	750	43	73	65
Repair shop	430	18	31	26
Wood-working shop	650	23	42	37
Store facilities	2180	-	11	9
Head office, laboratories and other services	3470		80	
Total	22220		845	683

The plant operates in two shifts; the foundry operates in a sequential schedule.

Power Supply

The installed capacity of power consumers amounts to 7000 kW. Consumption of water by the production process amounts to 55 cu m per hour.

Figures 5, 6 and 7 give the layout solutions for the forging - preparation shop, foundry and machine - assembly shop. The general layout and the architecture-construction solutions are given in fig. 8. The buildings of the plant were designed in a simple style with the same width of the bays (18.0) in all premises and the same height in all two storeys of the buildings which entail wide unification of the construction elements. The plant was commissioned in 1968. At present, the technical assistance is being rendered in the development of the production.

The similar plant was projected for Ghana.

Wide technical co-operation is conducted with the Socialist Federal Republic of Yugoslavia within the bounds of COMECON.

In Blagoevgrad, People's Republic of Bulgaria, the plant of measuring tools has been built with the technical assistance of the Soviet Union. The list of products of the plant includes micrometering tools, gauges, master gauges and measuring tools. Annual output of the plant amounts to 1010000 pieces.

Annual program

Products	Thous. pcs	Annual program, tons
1	2	3
Micrometering tools	220	91.9
Gauges	639	211.0

	1	2	3
Flat-parallel length gauges and master gauges		87.5	95.1
Cast iron surface plates and scales		0.75	149.2
Measuring tools		62.75	112.5
Total		1010	660.0

Composition, areas, equipment and employees of the plant

Shops and services	Area sq m	Equipment pcs	Employees total workers	
			1	5
Machine - preparation shop	3354	117	180	161
Machine - assembly shop of micrometersing tools	1120	69	163	149
Machine shop of gauges	1130	51	154	141
Machine shop of length and master gauges	1100	39	186	173
Machine - assembly shop of measuring tools	1650	63	203	183
Heat-treatment shop	750		32	30
Plating shop	550		56	38
Tool room	660	35	85	75
Machine-repair shop	730	15	53	46
Stores	1350		19	7
Laboratories	900		60	

The installed capacity of power consumers amounts to 7100 kW. Consumption of water by the production process amounts to 40 cu m per hour.

Fig. 9 shows the general view of the plant. The solution of the general layout was made with reference to the technological process of production with account to the construction and production running. The plant comprises the following buildings: main building, block of supporting services, store of inflammable materials, water pumping station, spray pond, administration-engineering building, canteen, welfare premises. The main building, welfare premises, canteen and administration building are connected with the gallery. The main building has four single-storey bays of 18m each. The north-eastern portion of the building has two storeys. The height of the premises is 7.2m in the single-storey portion of the building and 6m in the two-storey portion. The single-storey portion accommodates the main production shops, while the two-storey portion is used for the temperature-controlled precision sections. The production bays are equipped with underslung beam-cranes with a capacity of 1 - 2 tons. There is a two-storey block in the middle of the single-storey portion to accommodate the auxiliary services, ventilation equipment and air conditioners. In 1972 the plant was fully commissioned; at present the Soviet Union is rendering its assistance in mastering and developing the production.

In Ihtiman, People's Republic of Bulgaria, the construction of the iron foundry is in the stage of completion, (fig. 10). The foundry is to produce castings for machine-tool industry and machine-building industry in amount of 60000 tons a year. The Soviet Union supplies about 50 per cent of the required equipment, apparatus and materials. The construction of the foundry is

being carried out in two stages. There is a territory reserved for future expansion. The first stage presumes the construction of buildings of medium and large iron castings with all supporting services, while the second includes the construction of building of small iron castings.

The location of the foundry on the site and the solution on the general layout follow the requirements of the technology, approaches of the transport ways and hydrogeological conditions. The main road of the foundry divides the site into two portions. The eastern part is assigned for the production buildings of large and medium iron castings and small castings, and the western part is for the building of auxiliary shops, storehouse of oils, chemicals and binders, and oxygen station.

The buildings are combined into the joint design composition by the building of welfares, which is connected by passages with all the buildings.

In the zone of the foundry buildings there are the general storehouse with the reception-distribution block, boiler house and fuel-oil store. Another line of construction is the garage, compressor room, water pumping station with the reservoir, water cooling tower, which are situated to the east of the foundry buildings. Site landscaping measures are provided to ensure good sanitary-hygienic conditions.

The start-up of the first stage is to be in 1975.

In Colo, Polish People's Republic, the abrasive plant was commissioned in 1969 to produce electrically-made corundum in lumps in amount of 20000 tons a year. At present, the reconstruction of the plant to manufacture abrasive tools in amount of 12000 tons a year is under consideration.

It is intended in Polish People's Republic to implement the following projects: the plant of fitting-erecting tools with an output of 10000 tons a year, the plant of twist drills with an output of 15000 pieces a year and the shop of milling heads.

Project offers were submitted to V/O "prommashexport" to conclude contracts for construction of the plant of fitting-erecting tools in Iran, the plant of hack-saws in India. The request of the Indian company "Hepres" for technical assistance in construction of the plant of hand tools is under consideration; also are under consideration the request of Iran for the plant of fooling, fixtures and dies, the request of the Turkish company "Dispisan Sanam Vi Tikare" for the complex facility of gears and the request of Cameroun for the file plant.

Summarizing the solutions of the layout, civil-engineering and technology, it is worthy of note that:

- not only technology was referred to in preparation of general layouts, but also climate conditions, the necessity of orientation of buildings according to the solar radiation, wind direction, etc;
- architecture of new buildings was developed with due regard for technological requirements, unification of construction solution, simplicity of shapes matching the production purpose of the building, maximum application of precast reinforced concrete and possibility of individual method of construction, the best conditions of natural lighting, aeration and protection of work-places from insulation;
- technological solutions were made with regard for short-run and individual production, program of production, the experience of the Soviet machine-tool factories and the initial stage of mastering the production in the developing countries.

It is provided that the machine-tool factories will receive painted castings. Such complex parts as beds and housings, are subject to accelerated aging; machining operations are divided into roughing and machining. Complex steel parts, after machining, are subject to accelerated aging or heat-treatment, depending on engineering specifications; machining operations on housing parts and beds are performed on planomilling machines and planing machines with subsequent grinding on surface grinders. Holes in headstocks and tailstocks, feed gearboxes and aprons are bored on horizontal boring machines with special fixtures and multi-edge cutting tools. Holes in the most important and precise parts are bored on jig boring machines.

Shafts and bushings are machined on turret lathes with subsequent grinding of surfaces to fits.

Technological layouts provide for location of the equipment in groups but with reference to flow sequences of technological process.

Assembly is divided into unit assembly and general assembly. Unit assembly is performed on work-benches and desks. General assembly, idle running and load running of machine-tools, capacity and accuracy test are performed on assembly stands.

Taking into consideration climate conditions, special attention is paid to electroplating. The provisions are made to chromeplating oxidation, zincplating, phosphatizing, nickelplating and photochemical engraving.

Projects provide for mechanization of transport and storage operation. Transport operations inside the shops are performed with the aid of travelling cranes, beam-cranes and electric loaders.

Transport operations between shops and buildings are performed with the aid of automotive transport and electric trucks. Stores are provided with electric stackers.

The technical co-operation with the developing countries brought up in recent years a certain practice.

Projection of plant in the developing countries begins with preparation of technical-economic estimations which contain analysis of demands for the products of the plant to be projected with due regard to the plans of future development of the country. In the course of the co-operation the Soviet projecting organizations take part in project-survey work, using available materials or doing engineering-geological surveys anew. As a rule, local engineers are invited for survey and project work, in particular for projecting outside conduits, water supply, signalling and power supply.

Preparation of project assignment is a further step. In selecting the nomenclature of machine-tools to be manufactured at plants under project in the developing countries, main attention is paid to satisfaction of the country's demand for universal machine-tools which are applied in various branches of industry, in agriculture, in transport, and with regard to possible export to the developing countries. Only those machine-tools are included into the program that have wide application due to their capacities and up-date standard technology.

Taking into consideration the level of development of the countries and their demand for metal-cutting equipment, the program of national plants and shops of mechanical specialization usually provides for simple in manufacture and standardized machine-tools and simple metallic structures which are not economical to be imported.

Project assignment, in addition to the nomenclature and the production output, determines specialization of the plant, production

and economic co-operation, range of capital investments, principle technoeconomic features as well as information of engineering surveys, prices of fuel, power sources and supporting materials and other data necessary for projection.

The next step is preparation of project report, or detail project report for small plants. This stage determines the stock of the equipment, develops specifications of the equipment and materials. In compliance with mutual agreement of the co-operating countries working project is prepared with respect to technological part, civil-engineering, electrical engineering and sanitary engineering.

Designing and rendering technical assistance in construction the General Supplier supplies equipment in complete sets and necessary materials for projects to be erected. In addition the General Supplier provides for spare parts during 10 years.

With rendering various technical assistance in construction of the plant, its putting into production and adjusting normal work of the enterprise the General Supplier develops measures for improvement of production-economic activity.

The Soviet enterprises undertake to help the corresponding by profile enterprises of the Developing Countries.

Rendering economical and technical assistance the Soviet Union in certain concrete cases gives the Developing Countries credit.

Training of Personnel

One of the most important problem of the Developing Countries is the elimination of the sharp shortage of skilled personnel.

" To create such personnel " - said A.N.Kosigin in his report at the XIII Congress of the CPSU - "is not less important thing than to construct enterprises of national industry" *).

The USSR renders the Developing Countries wide assistance in training the National personnel. The efficient system of periodical consultations and training of specialist at the Soviet plants, in designing organizations, universities, is established.

Recently the Soviet specialists trained about 900 machine-builders. The production training of specialists is being carried out at such machine-tool building plants as "Krasnii Proletarii", plant after S.Ordjonikidze in Moscow, Moscow Work of Grinding Machines, Rjazanskii Machine-tool Building Plant, Lipetskii, Sterlitamakskii Machine-tool Building Plants and other enterprises.

One of the existing form of preparation of the National personnel is their training by the Soviet specialists directly on construction jobs and in the process of putting the plants into production.

The construction sites are being turned into schools of mass training of workers and specialists.

For last 10 years more than 300 machine-tool builders have been going to the Developing countries for rendering technical

*) XIII Congress of the CPSU. Stenographical Report TPM, 1966, p.60

assistance and training national personnel.

The effective form of the USSR rendering in preparation of specialists is to organize in these Countries the own system of training the personnel, to create the national educational institutions beginning from general education and till higher educational establishments.

About 15 thousand of students from the Developing Countries are studying in the Soviet higher educational establishments.

The Soviet Union also renders assistance in solving a problem of training personnel in the course of the United Nations Organization. At the expense of the USSR payments 200 various seminars, symposiums and meetings were held and approximately 6500 grant-aided students of UNO from the Developing Countries were trained.

C O N C L U S I O N

1. Economical and technical co-operation with the Developing Countries has favourable perspectives. The main purpose remains the same at the present time that is to help these Countries to build and develop really independent national economy.

2. Creation of own metal working industry in the Developing Countries furthers the development of the whole industry and its supply with equipment.

3. At the period of the initial phases of creation of the machine engineering industry in the Developing Countries it is efficient to build machine-building plants of universal type, designed for repair and reconstruction of equipment, for production of spare parts, simple equipment, metal welded constructions

to satisfy the requirements of industry, transport and agriculture. Such enterprises shall be the centre of personnel training and the base for the future expansion of specialized machine-building industry, machine-tool manufacture including.

4. Machine-tool building plants be built for production of restricted amount of universal models of machine-tools, that can find wide use in various industries and be the articles for export. Equipment installed at the Plant should provide for the possibility of replacement of designed types by other models in the limit of size and precision parameters.

5. Machine-tool building plants should be developed as machining-assembling enterprises with wide co-operation as to supplying half-finished articles such as castings, forgings and stampings, purchased articles, standards and normals.

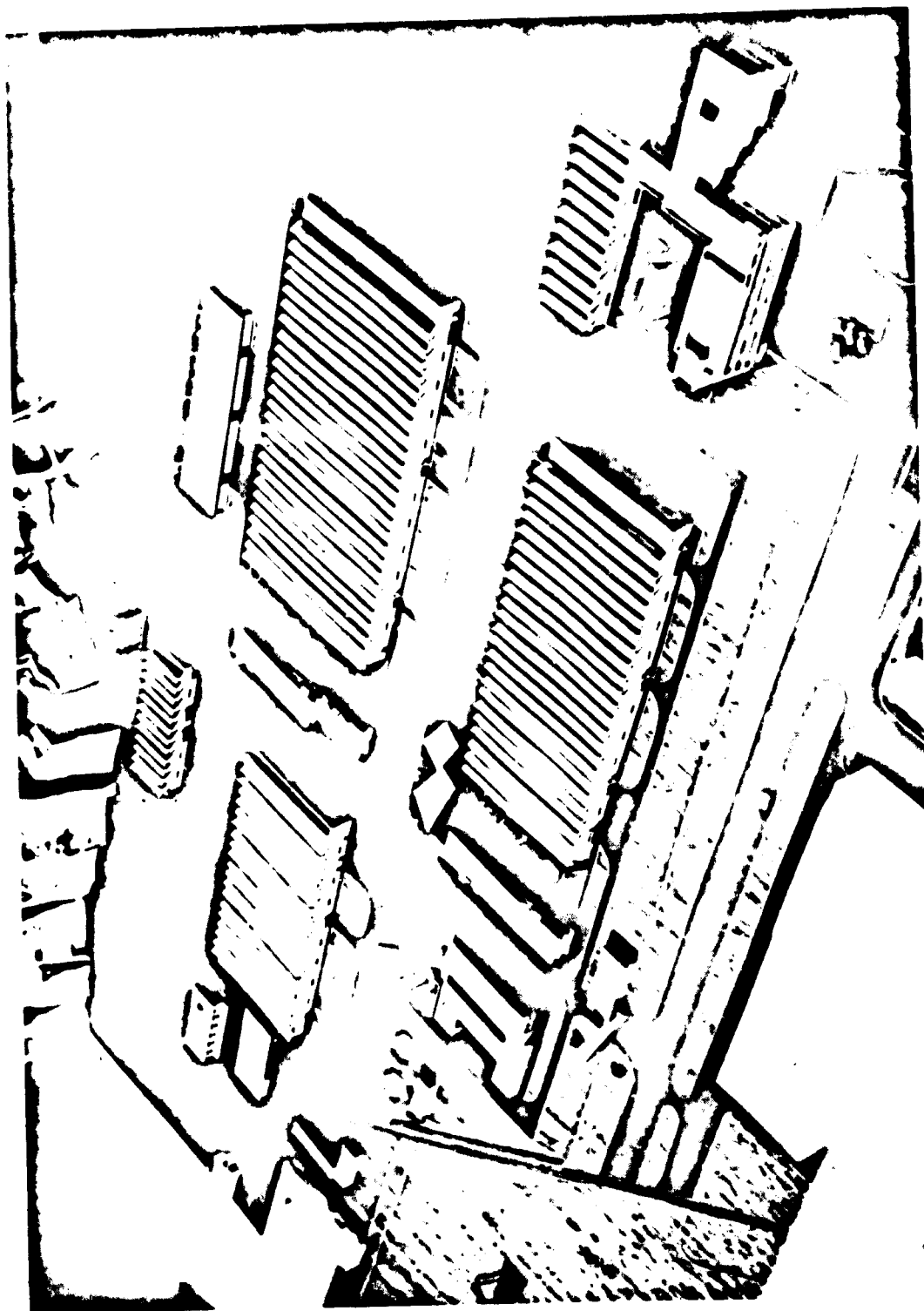
6. Modern principles of specialization and co-operation demands that the Developing Countries build plants and shops for production of castings, forgings and stampings to meet the demands of a number of machine-building enterprises.

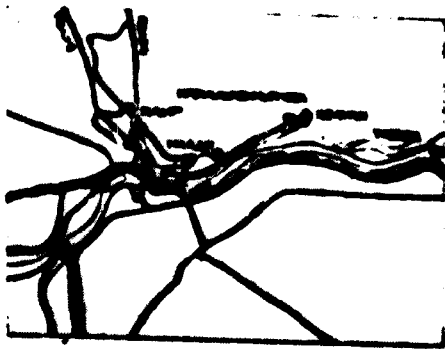
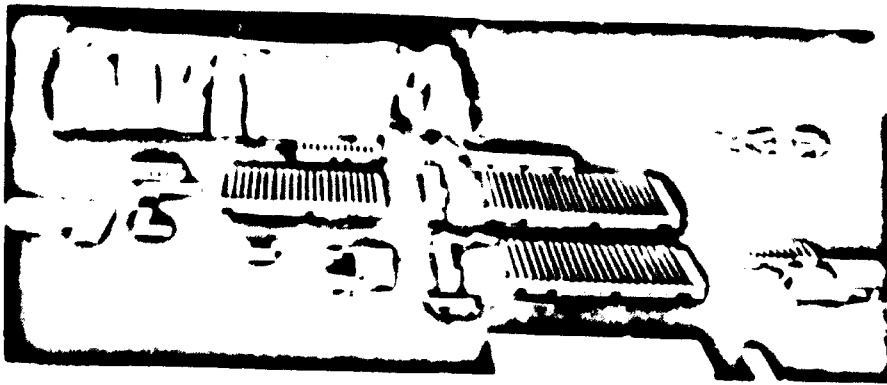
7. Together with construction of machine-tool building plants it is desirable to provide for production of tool. First it should be a small specialized plant for production of cutting tool such as cutters, drills, reamers, taps, screw-dies and saw blades.

8. To bring the finished plant to rated capacity in a short possible space of time it is important to carry out timely technological preparation of production processes, to design and

produce technological tooling, special tool and optional equipment.

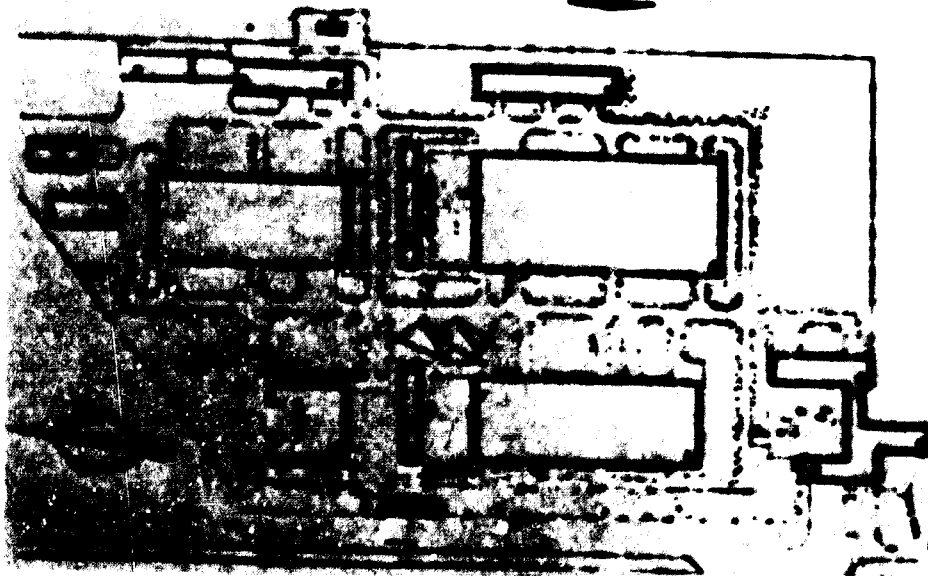
9. With the purpose of preparation the skilled personnel on the base of industrial enterprises it is advisable to establish centres for training the specialists. The centres should be supplied with all necessary equipment and training appliances.

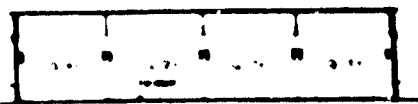
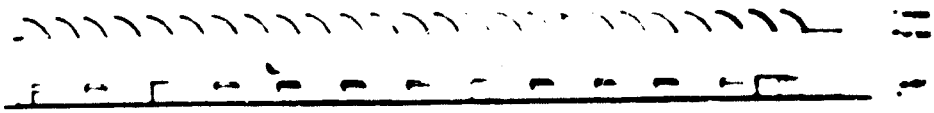




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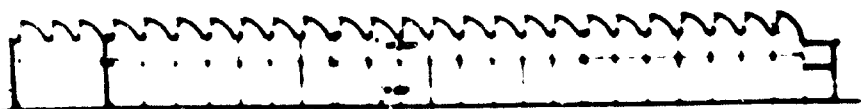
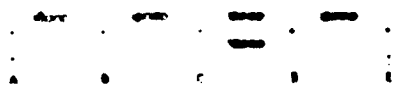
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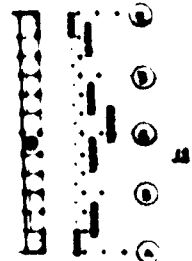
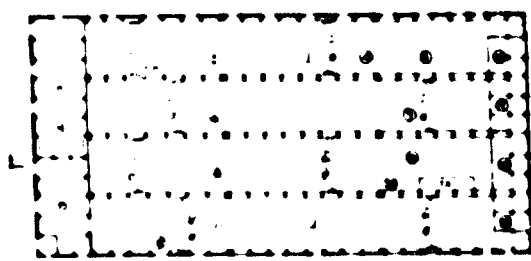


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РАЗРЕЗ 2-2



РАЗРЕЗ 1-1



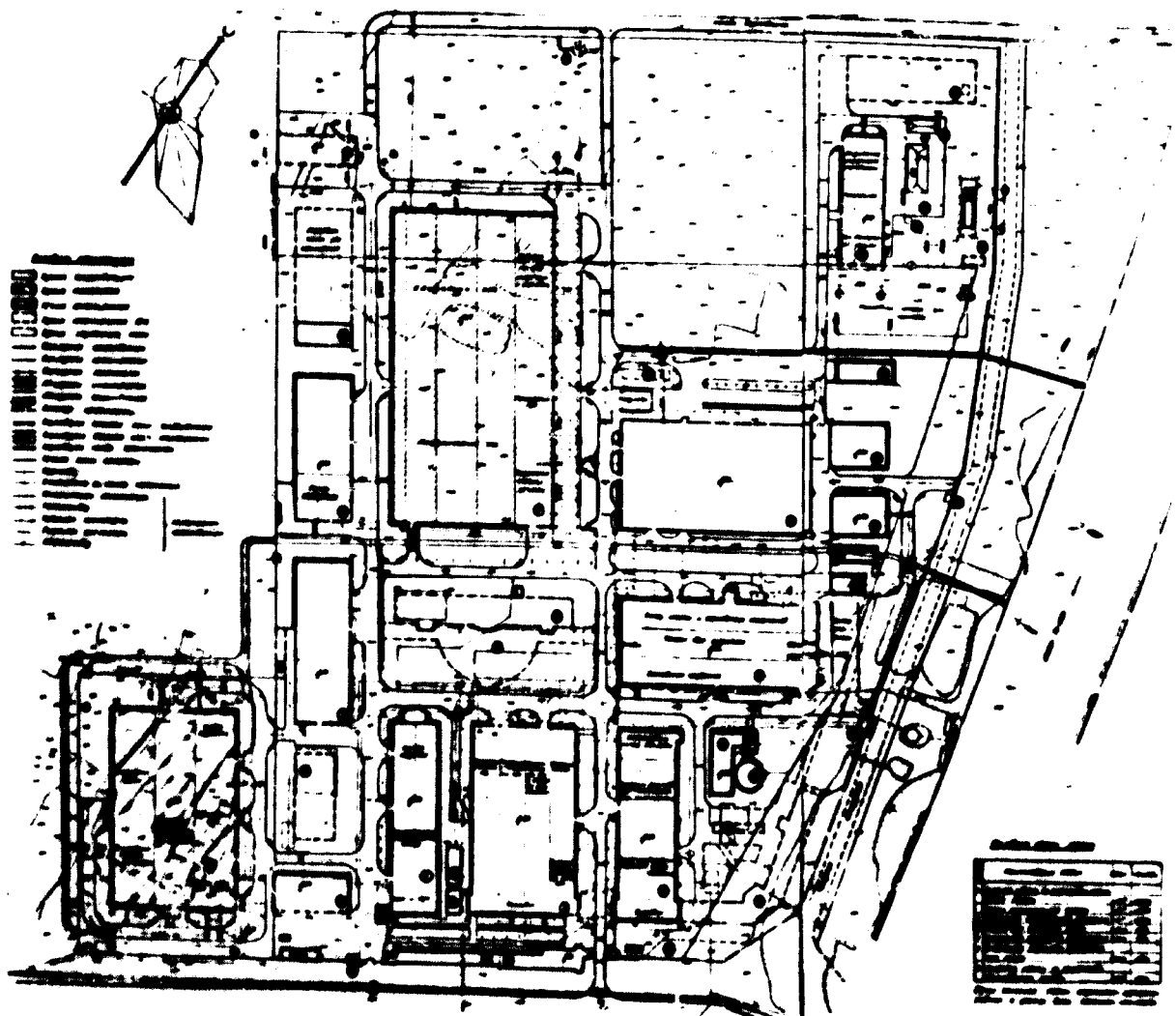
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ПЛАН НА ОУМ 1000

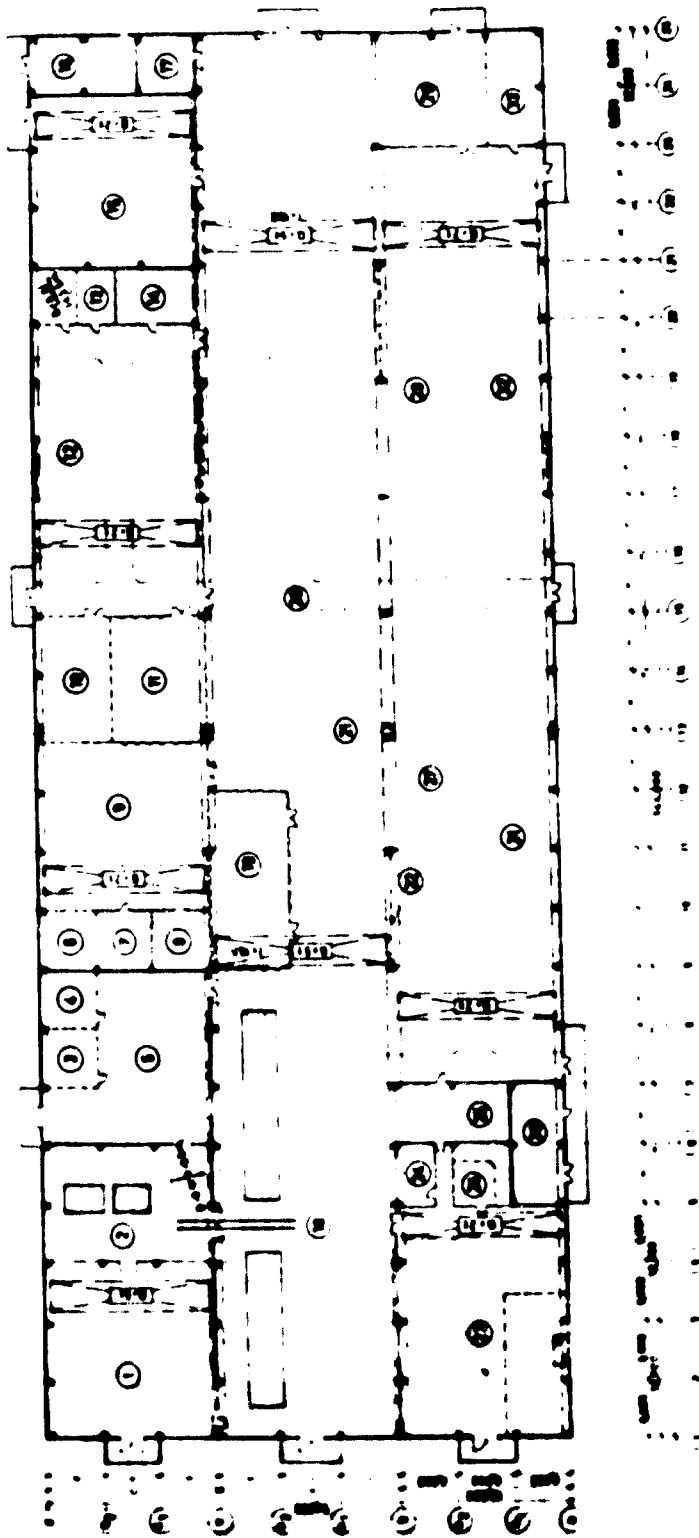
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ИНЖЕНЕРНО-ЛАБОРАТОРНЫЙ КОРПУС





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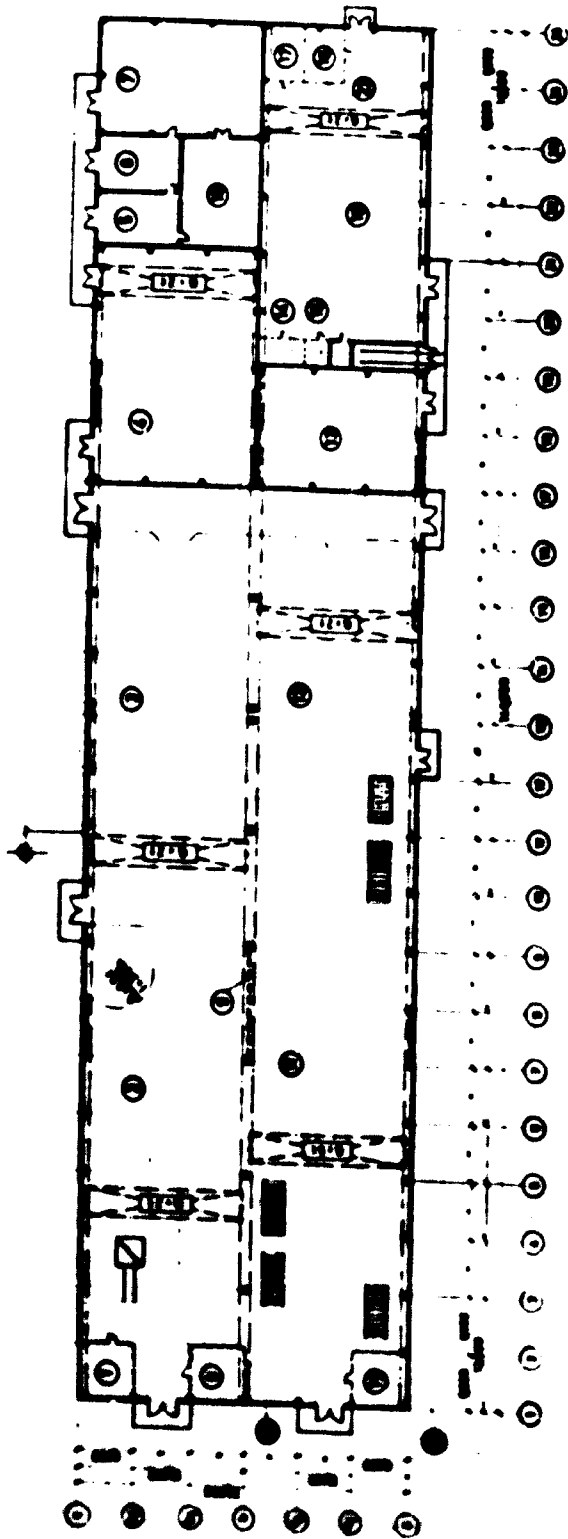
Key for symbols
 Solid walls
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Explanation of premises

- | | | | |
|----|--------------------------------|----|-----------------------------------|
| 1 | Painting section | 19 | Storehouse of finished parts |
| 2 | Section of tables production | 20 | Machine assembling shop |
| 3 | Grinding polishing section | 21 | Section of large parts |
| 4 | Electropolishing workshop | 22 | Vertical connections |
| 5 | Sealing drying section | 23 | Heat treatment shop |
| 6 | Testing station | 24 | Checking department |
| 7 | Store room | 25 | Intershop store room |
| 8 | Electric equipment repair shop | 26 | Cleaning section |
| 9 | Sharpening shop | 27 | Boiler section |
| 10 | Tool distributing store room | 28 | Section of medium and small parts |
| 11 | Tool room | 29 | Blanks storehouse |
| 12 | Intershop store room | 30 | Transformer substation |
| 13 | Central material | 31 | Section of shafts and bushings |
| 14 | Transformer substation | 32 | Section of standards |
| 15 | Emulsion workshop | 33 | Offices |
| 16 | Assembly department | | |

No 5

Figure 2
 MACHINE-ASSEMBLY BUILDING



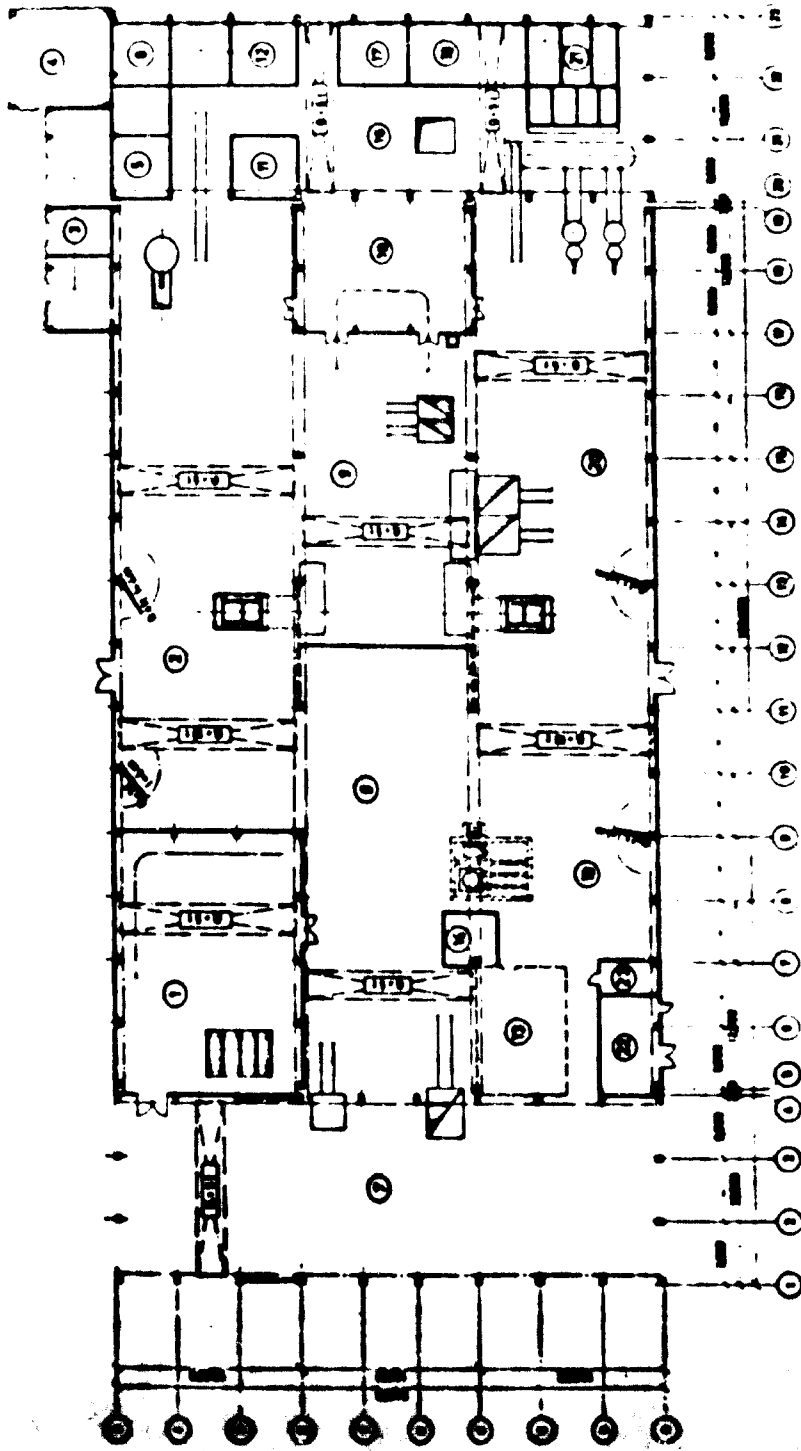
Designation of locations

- 1 Ventilation area
- 2 Pergo shop
- 3 Metal storehouse
- 4 Patterns storehouse
- 5 Transformer substation
- 6 Assorted stores market
- 7 Compressed air station
- 8 Spare parts store room
- 9 Vertical connections
- 10 Distribution panel
- 11 Metal structures shop
- 12 Metal storehouse
- 13 Boiler house

- 14 Store room
- 15 Office
- 16 Woodworking shop
- 17 Sharpening room
- 18 Pattern painting section
- 19 Auxiliary materials store room

- 20 Key for symbols:
- 21 Beams walls
- 22 Metal net partitions
- 23 Stained partitions

Figure 3
FABRICO-WILSONO BUILDING

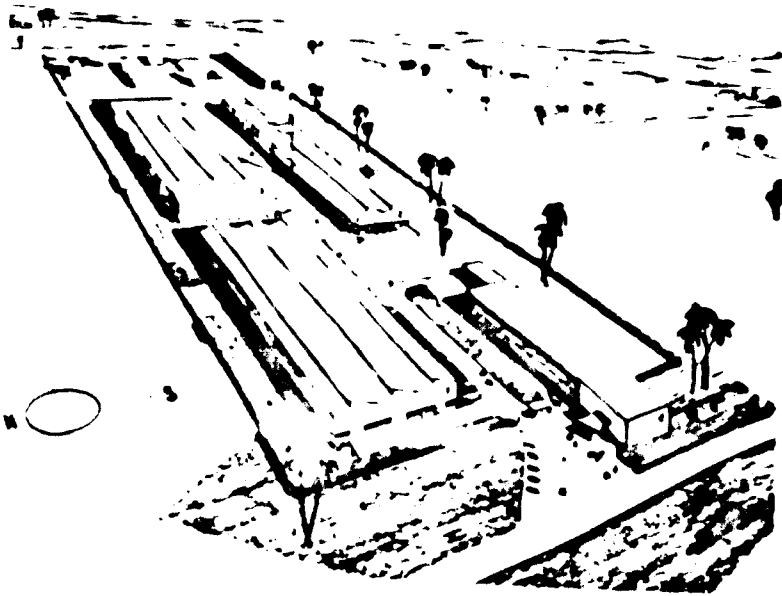


- Enumeration of premises**
- 1 Castings priming department
 - 2 Moulding department for steel castings
 - 3 Transformer substations
 - 4 Department of sand regeneration and water clarification
 - 5 Bin for regenerative
 - 6 Presses for castings and mould bases
 - 7 Moulding department
 - 8 Core department
 - 9 Sand preparation department
 - 10 Bin for metal charge
 - 11 Bin for sand
 - 12 Intermediate pattern storehouse
 - 13 Patterning station

- 15 Vertical connections
- 16 Storehouse for charge and moulding material
- 17 Bin for clay
- 18 Bin for coke
- 19 Non-ferrous coatings section
- 20 Moulding department for iron castings
- 21 Bin for metal charge
- 22 Transformer substation
- 23 Laboratory of proximate analysis

Key for symbols:
 Solid walls ———
 Metal net partitions - - - -
 Glassed partitions - - - - -

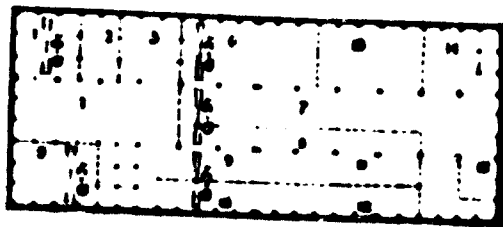
Figure 4
 FURNACE BUILDING



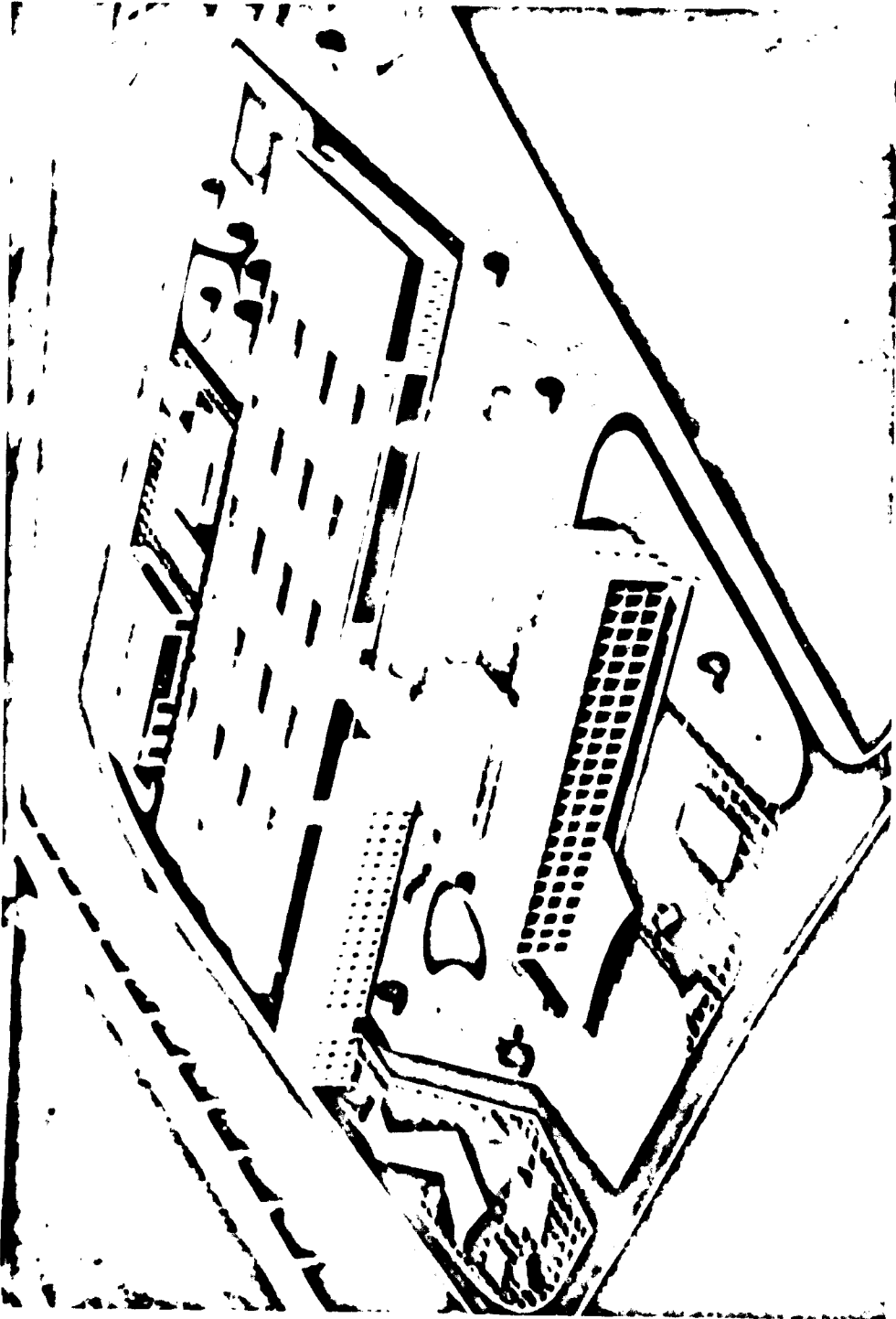
Виды почвы в поле

1. Низкооборотный пахотный слой
2. Кулинично-пахотный слой
3. Лесной пахотный слой
4. Архитектурный пахотный слой

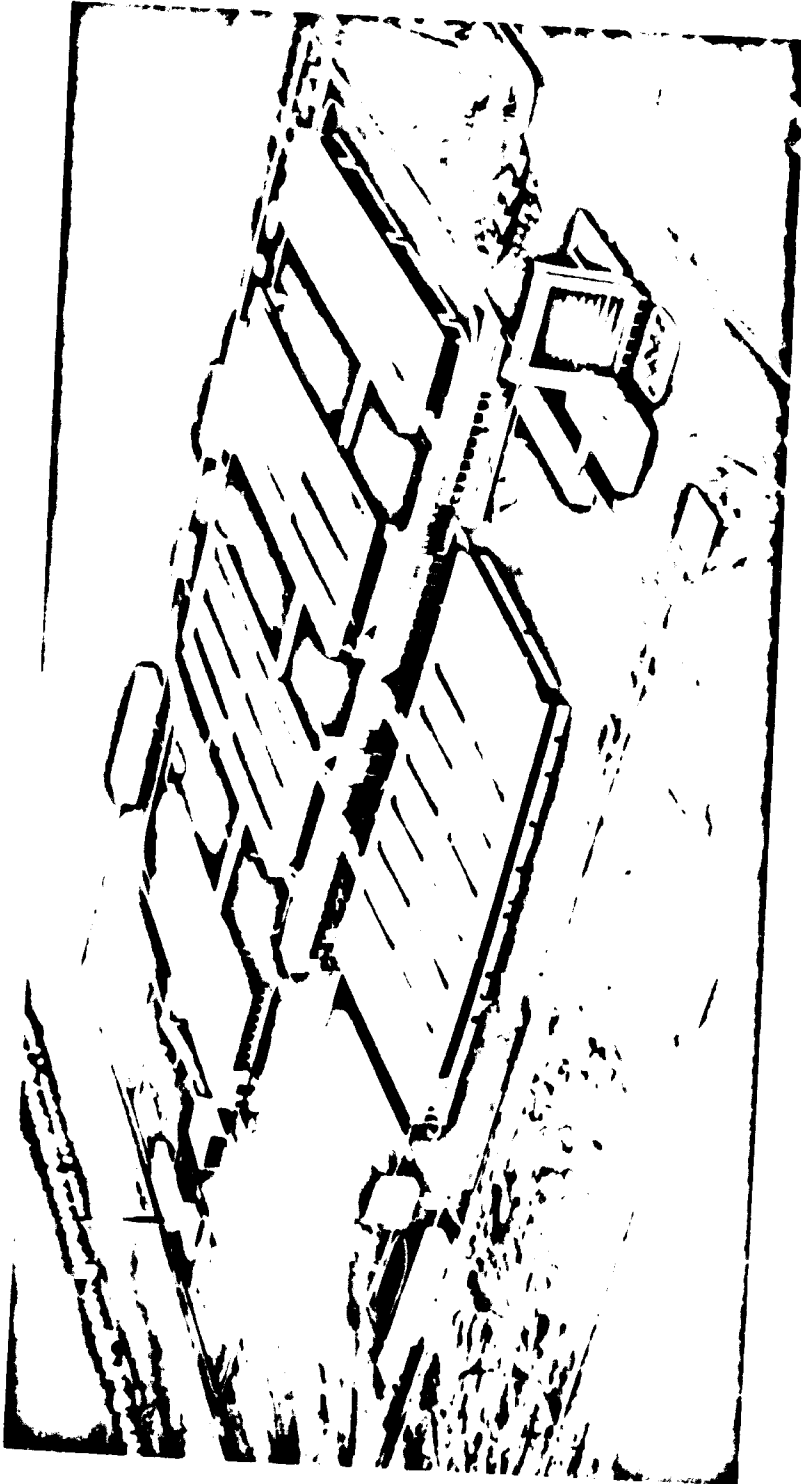
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