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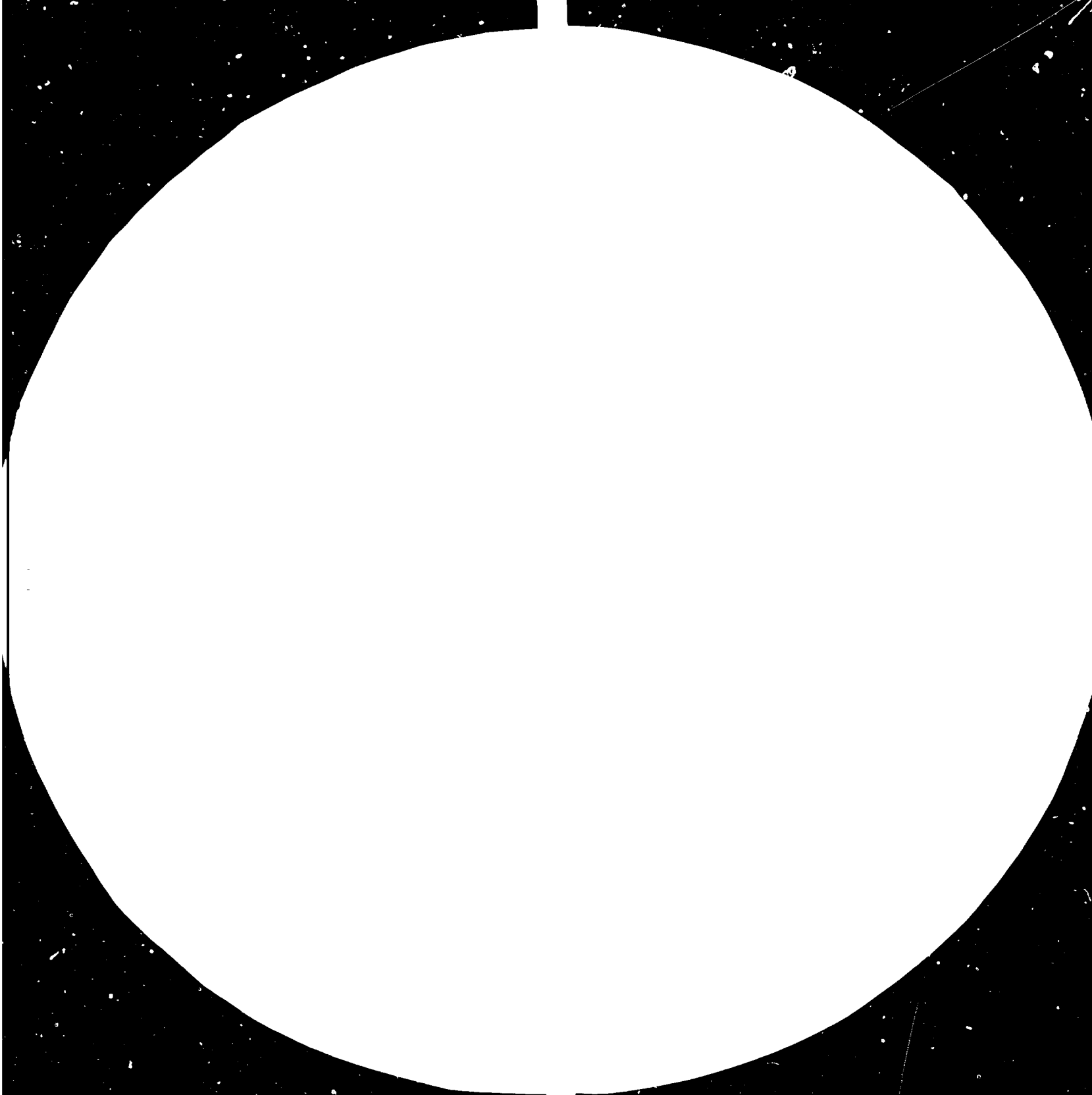

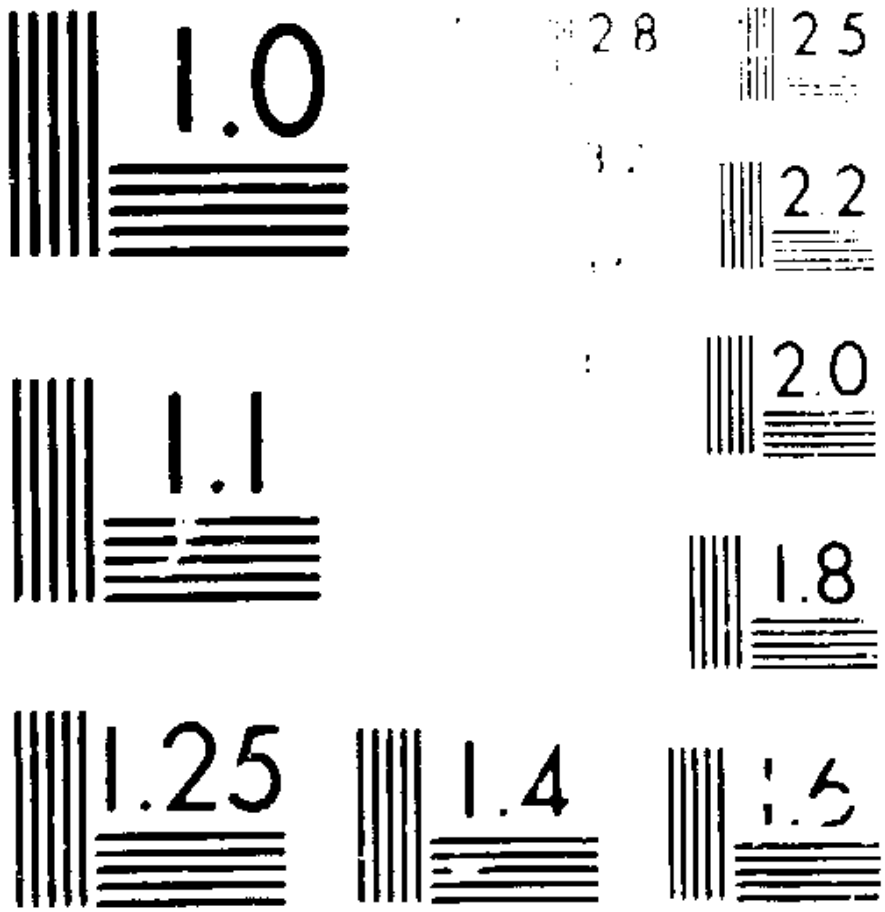
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C Z E C H O S L O V A K C E R A M I C W O R K S

THEIR DEVELOPMENT, STRUCTURE AND ENERGY MANAGEMENT

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Introduction

The most ancient ceramic products found in the territory of Czechoslovak state, have their origin in the later Stone age. They served as vessels to store or prepare food.

Early in our era, the Roman legions introduced in Middle Europe the production of bricks. The most ancient written reports from this period of Slav settlement regarding pottery date to the 14th century, stove tile making was reported in the 12th century and the manufacture of ceramic tubes for water-distributing started in Bohemia at the era of the 16th century. The most ancient refractory products are represented by metallurgical crucibles produced from refractory clays for melters in ancient Czech mining towns Kutná Hora and Příbram, famous in medieval Europe by silver ore extraction and silver production.

The porcelain production started at the end of 18th century. Original production in small ceramic workshops by private manufacturers outgrew gradually into industrial dimensions and its development enforced successively an increase of raw materials extraction. Thanks to high quality of domestic raw materials and to outstanding professional abilities of Czech ceramic specialists, the Czech ceramic products gained at the end of past century already an excellent reputation. Czech building ceramics have been applied for the construction of many public buildings all over the world. The best known are wall tiles, trade marks RAKO and HOB, further floor tiles, glazed-wall brick products and fireclay stones; in the industry of fine ceramics gained credit by the china ware from Karlovy Vary.

This more than centenary tradition in the industrial production of building and refractory ceramics was reassumed after the World War II by the Czechoslovak Ceramic Works. Their products - dressed raw materials as well as final products - are indispensable for many industrial branches. Raw materials mined and beneficiated by the Czechoslovak Ceramic Works are delivered not only to enterprises within the trust engaged in the manufacture of building refractory and insulating ceramics, sanitary ware, but al electroceramics, glass and porcelain industry. Valuable refractory and insulating products are supplied to metallurgical works, coke plants, foundry and forge plants, cement plan and heat producing units of all industrial branches inclusiv of heating and boiler plants. Building industry applies a large assortment of building ceramics produced in Czechoslovak Ceramic Works, namely wall and floor tiles as a functional element as well as design supplement of architectural works; in the construction of agricultural buildings stoneware products are used, and alkali-proof stoneware is indespensable for chemical industry, high-duty fillers based on refined kaolins are the basic semi-products for the production of high quality papers, and an important ingredient for the products of rubber production of plastics, pharmaceutical and cosmetic industries.

Czechoslovak Ceramic Works with about 20 000 employe and with their yearly production volume of about 4 billions Czechoslovak Crowns contribute directly by their production a smooth function of Czechoslovak national economy and take a significant part in Czechoslovak exports. Three quarters of the export tasks of the Czech Ministry for Building Industry are covered by this trust.

Inception and Development of Czechoslovak Ceramic Works

The inception and further development of the Czechoslovak ceramic industry has been fostered not only by a large abundance of ceramic raw materials, namely kaolins, clays, bentonite, quartzites, perlites, diatomites etc., but also by a high professionality and skill of all its employees. Its expansion has been provoked at the same time by steadily increasing needs to cover the demands of Czechoslovak building industry and of other industrial branches by domestic products to avoid imports. Ceramic works grew up namely in the areas of prime raw material deposits, i.e. in West Bohemi (Carlsbad and Pilsen Basins), white kaolins and clays deposistsin Northern Bohemia (Most area), in Southern Bohemia, in Central and Southern Moravia.

During the World War II the Czechoslovak national economy and the ceramic industry too, were heavily destroyed . After 1945 it was necessary to repair all damages in the shortiest time possible.

By The October Decree of the Czechoslovak Government on the nationalization of Czechoslovak industry all large industrial enterprises were nationalized. To manage the nationalized substances in the branch of ceramic and glass raw materials extraction of the production of ceramics, mortars, bricks, porcelain, fine ceramics and abrasives and of building enterprises, a central authority - the Czechoslovak Ceramic Works, Prague - was established on the 1st January 1946.

During the second stage of nationalization in 1948, further factories were incorporated. Thus the Czechoslovak Ceramic Works were entrusted with a historical role of the nationalization period to realize and to safeguard a success-

ful development of the whole building materials production together with all branches of the ceramic production, inclusive non-metallic minerals extraction. With regard to the outdated production and technical basis disordered by war considerably, it wasn't an easy task . Nevertheless, the ČKZ succeeded during the next years in the consolidation of all different branches in the framework of the newly established National Enterprises .

During the succeeding years Czechoslovak national economy has been getting successively through different organizational changes, which reflected of course in the ceramic industry, too.

/product mix

Production Assortment of the Czechoslovak Ceramic Works

The individual production branches have been successively delimited and have gained independence. The production programme of the Trust of national enterprises - Czechoslovak Ceramic Works - was stabilized in 1958 in 3 main groups of products:

1. Extracted and dressed non-metallic raw materials:

   The first group incompasses namely the extraction and beneficiation of kaolins for ceramic, paper, rubber industry and for other specialized branches, further on of shales, glass and foundry sands, porous, binding white-burning, refractory and other clays, feldspars, amorphous and crystalline quartzites, diatomite, perlite and other non-metallic minerals.

2. Building ceramics

   The second group includes the production of stoneware tub and shaped bricks, agricultural stoneware, chemical and

acid-proof stoneware, ceramic wall and floor tiles, mosaic for interior and exterior tilings, industrial pavings, stove tiles, production of large-scale tilings, shaped tiles for bathrooms etc.

3. Refractories

To the third group belongs the production of fireclay and silica bricks, mouldable refractories, heat-insulating materials, kiln furniture, chimney refractory liners, refractory binders etc.

Also other products are being contemporarily produced, e.g. building blocks, coloured crushed materials and sands, aggregates, fillers, non-fired masonry material, earthy colours, products for scant market needs, such as silk lustre, painter's coating masses, scant packed lining masses, etc.

Present organizational structure of the Czechoslovak Ceramic Works

From the point of view of their organization, the Czechoslovak Ceramic Works constitute the Trust of national enterprises, having their general management head quarter in Prague.

The Trust consists of 9 production enterprises:

Ceramic Works, Rakovník
CALOFRIG Works, Borovany
West Bohemia Ceramic Works, Horní Bříza
Ceramic Works, Chlumčany
Ceramic Glass Raw Materials, Karlovy Vary - Sedlec
North Bohemian Ceramic Works, Most
Ceramic Works, Břeclav - Poštorná

Moravian Fireclay and Shale Works, Velké Opatovice
Ceramic Works, Košice.

The Research Institute for Ceramics, Refractories and Non-Metallic Raw Materials in Plzeň is engaged in solving the science, research and technical development problems. and the Institute for Design and Construction in Prague in solving corresponding design targets.

Basic data on production capacities of the Czechoslovak Ceramic Works

In national enterprises incorporated into the Trust of Czechoslovak Ceramic Works, the total gross production volume increased since 1950 till now four times, the interannual increments being 7.5 % on the average. Namely since the 4th Five Year Plan, i.e. since 1965 - 1970, an intense increase of production and exportation was recorded. A short survey on the gross production volume increase can be seen in the Diagram 1.

An information on the participation of the respective production enterprises incorporated in the Trust of Czechoslovak Ceramic Works in the fulfilment of targets imposed upon the whole branch production for 1980 is represented by the Diagram 2.

This expressive production increase has been accompanied by high rates of labour productivity growth. During the 5th Five Year Plan e.g., that is in the year 1975 in comparison with 1970, an increase of 149,2 % in the production volume and of 137 % in the productivity of labour increase have been achieved. During the 6th Five Year Plan, terminated in 1980 further 34 % of the pro-

ductivity of labour increase have been reached as shown in Diagram 3.

Sales Activities of the Trust of Czechoslovak Ceramic Works

The sale of ceramic products produced by the Czechoslovak Ceramic Works is differentiated according to individual groups of production assortment. The sale of ceramic raw materials and refractories for the needs of Czechoslovak national economy is balanced and controlled from the level of the general management of the Trust. The sale of building ceramics is carried out through the National Enterprise STAVIVA (Building Materials) and through the Consumption Co-operative JEDNOTA (Unity) using their regional establishments.

Ceramic raw materials, refractories and building ceramics are exported through the Czechoslovak Foreign Trade Corporation "Czechoslovak Ceramics", Prague.

The distribution of basic production assortment groups in the total export volume results from the Diagram 4.

In comparing the exports of ceramics in the first years after the World War II with recent years, its present volume is estimated ten times higher . Since 1965 the exports to Socialist Countries have increased 7 times, to Non-socialist Countries 6 times (in franco-prices).

The growth of the export volume during the past years is shown in the Diagram 5.

The basic conception to fulfil increasing export targets of the branch consists in increasing gradually the building ceramic products share, later the refractories

share too; on the other hand, raw material exports will be decreased. Czechoslovakia is interested in an effective application and valorization of domestic raw materials. Therefore the technology of dressing and refining of non-metallic minerals is steadily being improved and the product's quality for Czechoslovak needs as well as for export is substantially increased. E.g., by means of application of electromagnetic separation or chemical bleaching of ceramic and paper kaolins a reduction of metallic impurities and higher whiteness can be achieved and thus a much higher valorization of original raw material.

A very important function have continuous innovations of the production assortment ensuing from steadily increasing competition on world market on the one hand and from the equilibrium between supply and demand existing on the Czechoslovak ceramic market so that the customers' claims on quality and a wider assortment are growing up.

Their demand will be shifted towards products with top quality, namely with regard to fashion colour choice, variety of surface finish of wall and floor tiles and modern design, form and size.

During the last years many very interesting technical novelties have been introduced in production aiming especially to energy savings in different spheres. E.g. expanded perlite being produced with the trade mark VAPEX adsorbs from water or working surfaces non-polar hydrocarbons, crude oil and its derivatives. 1 square meter of VAPEX is able to adsorb up to 500 l of crude oil or 300 l of fuel oil. An other new product of perlite being produced in the Ceramic Works at Košice (Eastern Slovakia) are insulating

plates for metallurgy. The West Bohemian Ceramic Works at Horní Bříza near Plzeň have introduced to market insulating shaped bricks PLASTIZOL HB as a very effective insulating material for industrial furnaces working at temperatures over 900 °C. The Moravian Fireclay and Shale Works at Velké Opatovice have introduced the production of stoppers for steel ladles with a capacity of 200 tons. Domestic raw materials have been used for their production. The quality of floor stoppers equals to foreign products imported until lately to Czechoslovakia.

In the building industry, the three-component chimneys being produced under Schiedel-licence proved to be perfect in their function with their high heat acid and thermal shock resistance . They ensure a higher gas tightness and fire security. The Ceramic Works at Poštorná (Southern Moravia) have contributed by their chemical instrument stoneware products to the innovation of sealers. and hyperboloid pumps, fans, cyclone stations and fume chambers.

Investment and layout activities

The production development in the field of ceramics has been supported by an extensive investment activity. A review of incurred investment costs in the respective Czechoslovak Five-Year-Plans is shown in the Diagram 6. On the average 58 % of all financial resources have been invested in machinery equipment and 42% in constructions. Thus the investment activities have been oriented in the first place to the modernization of factories and to the reconstruction of their technological equipment.

The production possibilities of the trust have been substantially enlarged by new factories being put into

service step by step and equipped by high-quality Czechoslovak and foreign technological equipment. As example can be mentioned new kaolin working plants at Kaznějov and Božičany in West Bohemia , feldspar extraction and dressing plant at Halámky in South Bohemia, new glass sands dressing plant at Střeleč in Central Bohemia, new floor tile plant at Chlumčany (West Bohemia) and Michalovce (East Slovakia), stoneware production plant at Borovany (South Bohemia), at Tomášovce (South Slovakia) and at Duchcov (North Bohemia), chemical stoneware production plant at Poltorná (South Moravia), wall-tiles production plant at Lubeneč (South Slovakia) and at Rakovník (Central Bohemia). The wall-tiles production plant at Horní Bříze (West Bohemia) has been reconstructed and modernized.

By the extensive investment activities the following production capacities have been put into operation:

wall tiles and tiling materials	8,300 000 m^2
ceramic floor tiles	4,200 000 m^2
stoneware	184 000 t
firecley	188 600 t
washed kaolin	315 000 t
shales	260 000 t
bentonite	135 000 t
expanded perlite	150 000 m^3

Important tasks in the investment activities are expected in the field of ceramics during the 7th Five-Year-Plan , i.e. in the years 1981-1985. The total investment programme includes obligatory targets such as the construction of a silica production plant at Svitavy (Central Moravia), quartzite dressing plant at Lahošť (North Bohemia) and shale dressing plant at Vyšehořovice

Further gasification of heat consuming units in the production plants and all environmental protection measures are being preferred.

To ensure an increased number of investments, reconstructions, modernizations and smaller constructions the Layou Planning Institute in the framework of the Czechoslovak Ceramic Works was established in Prague. Apart from layout planning, it is engaged in designing machinery for untraditional production processes. Some hundreds of different layout plans have been elaborated during its existence. The more important ones are e.g. the project of foamed fireclay production plant at Děčín (North Bohemia), "Fillers" Work of the national enterprise Calofrig at Borovany (South Bohemia), bentonite dressing plant at Želenice (North Bohemia), expanded perlite production plants, new building for the Research Institute for Ceramics, Refractories and Non-metallic Raw Materials at Karlovy Vary - Všeborovice etc. The Layout Planning Institute worked out also different projects for the construction of social equipments, computer centres, railway sidings, transformer stations, training centres, kindergartens for the children of employees etc.

The setting-up of ceramic industry in Slovakia where building ceramics had not been produced formerly, belongs undisputedly among the most important achievements of the Czechoslovak Ceramic Works.Putting to use Czechoslovak and foreign experiences and modern technology, in Slovakia has been created during the past 20 years a new industry which is steadily developed and enlarged.

Science, Research and Technical Development

The scientific-technical development at the present stage of socialist construction in Czechoslovakia has a very important target: to ensure a high dynamism of the development of Czechoslovak national economy and to increase its effectivity and at the same time to limit the energy and material demands, namely as far as imported raw materials are concerned. That is why the technical development of the branch being carried out namely by the Research Institute for Ceramics, Refractories and Non-metallic Raw Materials at Plzeň, is oriented to the following main targets:

- to decrease energy demands in the production proper by introducing new technological processes, e.g. by one-layer firing or by one-fire technology, or by elaboration of new body recipes to achieve lower firing temperatures by keeping the values of product quality. In this connection also consistent exploitation of residual heat has to be applied. An extraordinary attention is paid to the technical development of refractories and insulating materials production aiming to enable the decrease of energy exigency of all heat consuming units, where this refractory material is to be used.
- to introduce automation means into the production process aiming to introduce separate and complex systems for automatic control of individual machines, production lines and whole factories to achieve manpower reduction and to increase the productivity of labour.

- to decrease with high economy the materials consumption imported from abroad and to verify the possibilities of substitution by materials of domestic production, such as e.g. dyes, spare parts of mechanical technological equipment etc.
- to seek for new possibilities of dressing and beneficiation of domestic raw materials and to achieve by new dressing methods their high quality and to exploit more effectively the dump or lower quality raw materials; this problem coheres with the complex exploitation of prime mineral sources and deposits.

A highly qualified scientific and research base of the Czechoslovak Ceramic Works consists in the Research Institute for Ceramics, Refratories and Non-metallic Raw Materials in Pilsen, established in 1951. It contributes substantially to the solution of all tasks of scientific - technical development. Successful results of research assignments solved in the last 30 years in the framework programmes of the Czechoslovak Government, Ministry for Construction and Building Materials, Czechoslovak Ceramic Works and their enterprises, and the results of further activities of the Institute, such as coordinator of research and development within the Trust and its all-state authorization for technical development of ceramics, create solid foundation of the whole Trust.

The experts of the Research Institute for Ceramics, Refractories and Non-metallic Raw Materials have acquired rich experience in extending technical assistance and consultancy abroad. Excellent results of their work geared to the development of local ceramic industry on the goodwill of their foreign partners and of the United Nations

Industrial Development Organization /UNIDO/. A long tradition of ceramic manufacture in Czechoslovakia and successful results in the work of the Institute for developing countries and the least developed countries induced in 1978 the establishment of the UNIDO-ČSSR Joint Programme for International Cooperation in the Field of Ceramics, Building Materials and Non-metallic Minerals Based Industries in Pilsen.

All these facts highlight the present purport and position of the Research Institute for Ceramics, Refractories and Non-metallic Materials in Pilsen not only in the framework of the Czechoslovak Ceramic Works but also withing the whole Czechoslovak national economy.

The Headquarters of the Institute are in Pilsen. They include also the Division for Technical and Research Assistance extending technical and engineering services and consultancy to foreign partners. The division is predominantly engaged in power-engineering related to heat consuming units applied in ceramic industry, diagnostic measurements of this equipment, intensification, optimation and economization of its operation.

The Research Division at Horní Bříza is specialized in the research of building ceramics /ceramic wall tiles and glazes, ceramic floor tiles, stoneware/ and the research of refractories /shaped dense and lighted materials, high alumina and special products, refractories for monolithic linings/. The research is concerned both with technological

processes and development of technological machinery, design, lay-out planning, mechanization and automation of ceramic manufacture.

The Research Division at Karlovy Vary pursues the research of winning and beneficiation of ceramic and glass raw materials (kaolin, clays, bentonite, diatomite, quartz sands, feldspars) and the development of laboratory equipment. One of the results of its research activities is the introduction of the up-to-date beneficiation process for non-metallic raw materials. The application of high intensity electromagnetic separation enables e.g. the industrial utilization of the kaolins that have been difficult to process till now, and prolongation of life time of deposits.

The Research Division at Rájec -Jestřebí is aimed at the development of special refractory bodies for metallurgy (spouts and nozzles from fused quartz, lubricating and separating agents for pressure casting of metals) and utilization of liquifiers and SiO_2 gel in ceramic industry. Also new deposits of refractory claystones from the region Moravian chalk are utilized. The research center is gaged, too, in the research and introduction of dense and high-duty silica based on crystalline quartzites and in the development and research of graphite products.

The research divisions of the Institute are equipped with modern instruments and machinery for laboratory tests and semi-industrial trials. They can simulate every type of technological processing in the ceramic production. The Institute being engaged in energy savings in ceramic industry possesses a modern diagnostic unit by means of which diagnostic measurements of heat-consuming units are taken in the ceramic industry in ČSSR and abroad .

Due to the fact that these problems are going to be dealt during this Technical Workshop, I take it for indispensable to deal it more in detail in a special chapter on energy management and on its relevancy and level of care for heat consuming units in the whole trust of Czechoslovak Ceramic Works.

Long-years professional experience of the Institute and its technical outfit qualifies the Research Institute for Ceramics, Refractories and Non-metallic Raw Materials in Pilsen to offer its technical and research assistance and engineering services not only to Czechoslovak, but also to foreign production plants, central laboratories and specialized institutions. Many tens of industrialized and developing countries of all continents have taken advantage of them, such as: Algeria, Bangladesh, Bolivia, Botswana, Bulgaria+, Caribbean area+, China, Colombia, Egypt, Fiji+, Gambia, Great Britain, GDR, India, Iraq, Jordan, Kuwait, Lebanon, Libya, Lesotho, Malta, Mozambique+, Niger, Nigeria, New Guinea+, Surinam, Swaziland, Syria, Thailand, Tanzania, Turkey, Uganda, USSR, VSR, Zaire+ and Zambia.
Note: + through UNIDO - Czechoslovak Joint Programme.

The technical assistance afforded includes in the sphere of extraction and processing of raw materials:

- complex evaluation of non-metallic raw materials obtained through geological survey and prospection, assessment and determination of their potential applications
- investigations of new methods of extraction, dressing and refining
- dressing tests of all types of non-metallic raw materials with project of lines and plants for their treatment;

in the sphere of technological processes of production:

- research into and development of working masses, with elaboration of technological processes of manufacture of ceramic articles, such as facing tiles, floor tiles, sewerage and industrial stoneware, table ware,
- research and development of working masses with elaboration of technological processes of manufacture of refractory materials, such as fireclays or high-alumina products, silica of high density on the basis of crystalline quartzites for coke, metallurgical and glass industry, magnesites and others ;

in the sphere of mechanical and technological equipment:

- development and design of machines and equipment for mechanization and automation of technological processes in production of ceramic articles
- development and technical conception of instruments and apparatuses, e.g. automatic control of temperature in furnaces;

in the sphere of thermal power engineering:

- setting, optimation and intensification of operation of furnaces and kilns
- application of refractory solid and light-weight insulating materials in industrial furnaces ;

in the sphere of engineering activities and technical assistanc

- prognostic studies in the line of ceramic and glassmaking raw materials, of ceramic articles for building industry and of the refractories
- for capital investment projects involved in modernization of old and construction of new plants of ceramic industry
- assessment of projects of ceramic plants

- all kinds of consulting activities, training-in of experts and other kinds of technical assistance in the line of ceramics
- assistance afforded to developing countries during introduction of ceramic industries within the scope of activities of the Research Institute for Ceramics, Refractories and Non-Metallic Raw Materials in Pilsen and of the UNIDO-Czechoslovakia Joint Programme for International Cooperation in the Field of Ceramics, Building Materials and Non-Metallic Minerals Based Industries;

in the sphere of active licenses:

- affording of production licenses concerned with various ceramic and technological production processes, mechanical and technological equipment, checking and control instruments .

The era of 30 years has perfectly verified the abilities of the Research Institute for Ceramics, Refractories and Non-metallic Raw Materials in Pilsen. The implemented results of hundreds of solved research assignments have contributed substantially to the development of the technical level of manufacture in the production plants of the Czechoslovak Ceramic Works, to the successive innovation of equipment, the raise of production capacities and productivity, the extension of assortment, the high quality of products and last but not least to a considerable economization.

To further technical development of the trust contributes nevertheless by its activities not only the Research Institute, but also the Technical Development Sections in the respective production plants, event.

their bases for science and research, cooperating very closely with the Research Institute . This close cooperation originated in the past years some important solutions appreciated by Czechoslovak central authorities by the honorary title "Pioneer Work".

To ensure a steady technical progress in the field of ceramics high financial means are being expended every year. Nevertheless, the basic value consists in stimulative activity of scientific research base specialists and of all other workers of the trust - engineers, technicians, foremen and innovators.

Production assortment innovation.

The innovation programme related to the production assortment will continue during the next years in the framework of the Czechoslovak Five-Year-Plan. In the sphere of raw materials the continuous production of mixed kaolins will be started. They are characterized by elevated green strength and will help to solve the production of PE-fillers for rubber and plastics industry as substitutes for imported raw materials. An important measure consists in the introduction of TS 40 glass sands production. Their application shortens the glass melting times, so that valuable energy savings can be achieved and the melting aggregates capacity increased by 20 %.

In the sphere of refractories the innovation plan includes the light-weight construction materials and high-alumina refractories development of new gunite mortars, ramming and filling masses, refractory concrete and kiln furniture .With great interest is expected the production of corundum refractories for induction furnaces, silicon

carbide refractories for melting furnaces, ladle stoppers for manganese steel alloys castings etc.

The perspective orientation in the sphere of building ceramics, concerning the products decoration and surface finish innovation has been solved.

The rationalization of the tile setting calls for larger sizes in the production of floor and wall tiles. That is why their sizes of 15x20 cm, 20x20 cm, 20x30 cm and 30x40 cm will be verified.

Concurrently with building ceramics assortment innovation the cooperation between the production works and designers and architects is being intensified aiming to individual design of different representative buildings in Czechoslovakia, e.g. the INTERCONTINENTAL and PRAHA hotels in Prague, the attendance hall of the central railway station in Prague, some of the subway stations in Prague, the new Czechoslovak television building in Prague etc.

The sewerage stoneware assortment will be enriched with 200 cm tubes, dia.30 to 60 cm, the chemical stoneware with 200 cm tubes, dia to 120 cm.

Energy Management in the Czechoslovak Ceramic Industry

The present world situation regarding the energy problems and its negative phenomena have a great influence on the industrial development in all countries of the world. It is therefore imperative to rationalize to the need point the energy consumption in all spheres of mankinds activities.

By its very extensive production assortment the Czechoslovak ceramic industry represents an important component of

the national economy, nevertheless it is one of the biggest energy consumers.

The principle technological stages in the ceramic production are the drying and firing processes being applied on every type of body to achieve the desired technical properties. The exigency on energy of these thermal processes is very high due to the necessary time needed to fire exactly the product at high temperatures and with regard to the immense quantity of ceramic bodies representing millions of tons to be processed in the whole production cycle.

The contemporary energy consumption in the Czechoslovak ceramic industry represents every year about 400 000 tons of combustibles (in specific equivalent) that means, in conversion to primary fuel sources a daily consumption of about 3 500 tons of brown coal.

It has been ascertained by detailed analysis, that 86 % of this energy are consumed directly in technological processes of which 22 % for drying and 64 % for firing. Only 14 % of total is consumed for the so-called overhead consumption.

In the ceramic industry energy has the same importance as the raw materials used, in some cases even plays a quite decisive role. It is quite regular therefore, that the items "ceramics" and "energy" have a very close bearing and that recently an extraordinary attention is paid to their mutual dependence.

Nevertheless, the solution of this basic task in the ceramic industry is relatively complicated due to considerable production assortment extent, to the type and output unlike-

ness of the respective heat consuming units and their year of origin, to the variety of firing processes and to the types of combustibles applied. In spite of the exigency of questions mentioned above it is possible to determine three basic spheres in which the rationalization of energy management will be concentrated:

- modernization of the energy and combustible base
- rationalization of the existing heating units operation
- technology modernization according to the up-to--date research achievements.

First of all it is necessary to suppress stage by stage the utilization of generator gas for the firing ceramics. The low energetic efficiency of gas generator stations used for brown coal gasification influences negatively the energetic effectiveness of the production proper. At the same time the generator gas hinders with its character of combustion and the by-products the application of ne types of automatic heating systems or modern burners for gas furnaces. The transition to high-grade combustibles enabled in Czechoslovakia by their capacity increase and by a larger gas distribution network as well as the extension of natural gas sources represent therefore not only a momentous contribution to the production rationalization, but are at the same time one of the most significant preconditions for the modernization and rationalization of heat consuming units in Czechoslovak ceramic industry.

Another momentous task is the rationalization of existing thermal units operation. To solve it successfully it is necessary to start from a detailed technical diagnostic of the technological and thermal processes by means of the

mobile diagnostic unit being at disposal in the Research Institute for Ceramics, Refractories and Non-metallic Raw Materials in Pilsen, to determine conclusions for respective reconstruction in an economically suitable range and to optimize in that way the present stage and operation of the present heat consuming units at the energetically most appropriate conditions.

The third sphere is represented by research results, their realization and application in the production. It includes new technological processes aiming to the firing temperatures decrease, shortening of thermal cycles, introduction of one fire process of tiling materials, fluid firing of grained materials etc. New types of heat consuming units with a high thermal efficiency are being developed which are characterized by a perfect heat utilization in the own or following thermal process.

The solution of energy conservation problems in the production complex of Czechoslovak Ceramic Works aiming to decrease maximally the hitherto energy consumptions has been enabled only by means of constitution of the

complex system of energy management.

The complex system of energy management in the production plants of the Czechoslovak Ceramic Works has been constituted according to a profound analysis of the rationalization problems in the sphere of fuel and energy consumption based on many years experience in diagnostic measurements of thermal processes and equipment and with regard to successive development of the technology in ceramic production.

As the aim the introduction of a new management system was considered, which would be capable to realize with the knowledge of the existing state and all research

and development outputs regarding rationalization and optimization and being elaborated to a general programme - to realize perspectively the plan of energy consumption decrease in the field of ceramic industry.

The energy management board of the trust is represented by the General Director, his Advisory Board for Ener Management, composed of 15 specialized spheres of power engineering, the Production Director, his Chief Energy Engineer and the Trust Committee for Energy Problems and the staff of energy specialists in respective production enterprises and plants. Totally about 100 specialists and engineers are engaged in solving energetic rationalization.

In this system the team of 15 specialized research engineers of the Research Institute for Ceramics, Refractories and Non-metallic Raw Materials in Pilsen has an exceptional role through their activities. They ensure completely the sphere of energy research problems for the needs of the trust. Their activity consists in diagnostic measurements of heat consuming units. For that purpose the team is equipped with two Mobile Diagnostic Units furnished with appropriate measuring instruments. At present a new 2nd generation Mobile Diagnostic Unit is being prepared.

The organization of the system proper including the research and development sphere on the one hand and the realization sphere on the other is divided according to the Scheme 7.

The basic steps to constitute a general programme of energy management are
- analysis of the existing state

- expected outputs of research and development being in progress
- innovation programme.

According to them an optimum level of a rational solution of thermal processes and thermal units are derived, from the above indications:

- 1st stage - optimization (operation problems)
-2nd stage - optimization (reconstruction problems)
-3rd stage - innovation of the equipment .

The individual steps and the solution level are divided according to the Schemes 8 and 9.

The research and development programme is continously integrated and defined with more precision according to the recommendation of the advisory board of the general director.

The innovation programme can be seen in the Scheme 10.

From initial steps of the rationalization complex programme mentioned above the respective rationalization levels are derived according to the Schemes 11,12 and 13.

The output consists in summary of measures aiming to the optimization of heat unit operation in the sphere of its service modification.

Summary data for technical parameters and a conception solution of new heat consuming units to be installed are thus achieved. Their definition is based on complex research and development results regarding the technology as well as the thermal process and on results verified in the production practice.

The complex rationalization programme on fuel and energy consumption is concluded by the Trust Committee for Power Engineering in the form of a time schedule of individual rationalization measures being successively implemented.

The main task aimed at maximal fuel and energy savings involve in the technological sphere:

- new technologies with a decreased energy exigency enabling the application of non-tradionel raw materials - fluxing agents, which enable - in relation to the basic ceramic materials, kaolinite and quartzite - the reduction of firing temperatures
- one fire production technology enabling in the building ceramics production the glaze fusion at identical thermal conditions which are necessary to achieve the required properties of the body. The hitherto double firing technology is being replaced successively by the one fire technology due to substantial savings of consumed energy .

The check-up of designs of new production lines and plants from the energetic point of view is very important. Through this activity the planned values of energy consumption as well as the technical solution of heating systems, the control methods and the equipment of heat consuming units by a corresponding measuring and recording instruments are verified.

<u>in the sphere of thermal processes:</u>

- thermal diagnostic measurements have a big relevancy in appreciating the present level as well as in considering the necessary adjustments of all kinds. As a basic mean serves the Mobile Diagnostic Unit of the Research Institute

for Ceramics, Refractories and Non-metallic Raw Materials in Pilsen. It is completely equipped by measuring and evaluating apparatuses enabling to carry out thermal process analyse and thermal ballances of heat consuming units. At the same time other special instruments are being developed and a computer equipped measuring centre is applied.

- The intensification of kiln processes is based on the research of limiting firing conditions of the respective types of ceramic products, on semi-industrial trials and their application to the conditions of thermal units being in operation. The reduction of firing cycles enables a conspicuous reduction of energy consumption.

- Utilization of secondary heat sources from heat consuming units in operation in ceramic industry is focussed on energy recuperation from waste gases, from cooling air and dryer's outlets either directly in another thermal unit or indirectly by introducing heat exchangers into the cycle.

- Use of new types of burners in the heating systems with a higher rate of flow and of convection of heat by placing more burners into the sections controlled automatically.

- New methods of ceramic mass firing, especially by heat exchange application on a fluidized bed.

- Application of new types of heat insulating materials, light-weight fireclays, ceramic wool, and other products for furnace linings with reduced heat losses through accumulation and heat dissipation.

The complex system of energy management characterized by its main principles and schemes mentioned above and realized in the Trust of Czechoslovak Ceramic Works represents an optimum method how to ensure the tasks aiming to rationalize the energy and fuels consumption in the range of the trust .

From the point of view of the world level of technics it represents a quite new idea applied in the silicate industry where social and industrial interests in Czechoslovak conditions are fully in conformity.

An extraordinary significance of this system of energy management is emphasized by the fact, that the primary plan of the Czechoslovak Ceramic Works to decrease the energy consumption in 1980 by 3,5 % has been considerably surpassed, reaching the consumption reduction by 5,08 % that means a saving of 19 720 tons of specific combustibles or converted to brown coal, 52 000 tons.

Conclusion

In the sphere of every industry they are still no doubt considerable reserves not fully used. It is therefore one of the main tasks of the Czechoslovak ceramic industry as well as foreign silicate industry to contribute as much as possible to energy conservation programme by sparing existing energy world sources and participate thus in solving commonly this world problem.

You, dear Sirs, in the function of delegates represent the governments of less developed countries being at the start of industrial development. Allow me, please, to conclude my lecture by the following objective thesis: the greater will be the industrial development, the more energy the industry will consume and the more important will be the energy management.

That's why also this Technical Workshop has been organized by the UNIDO - ČSSR Joint Programme for International Co-operation in Pilsen. I hope that it will bring

to all participants many precious instructions and suggestions for their further work in one of the most sensible sectors of the modern industrial society - in the area of utilization of energy sources.

Allow me,please, to wish you much success in this work.

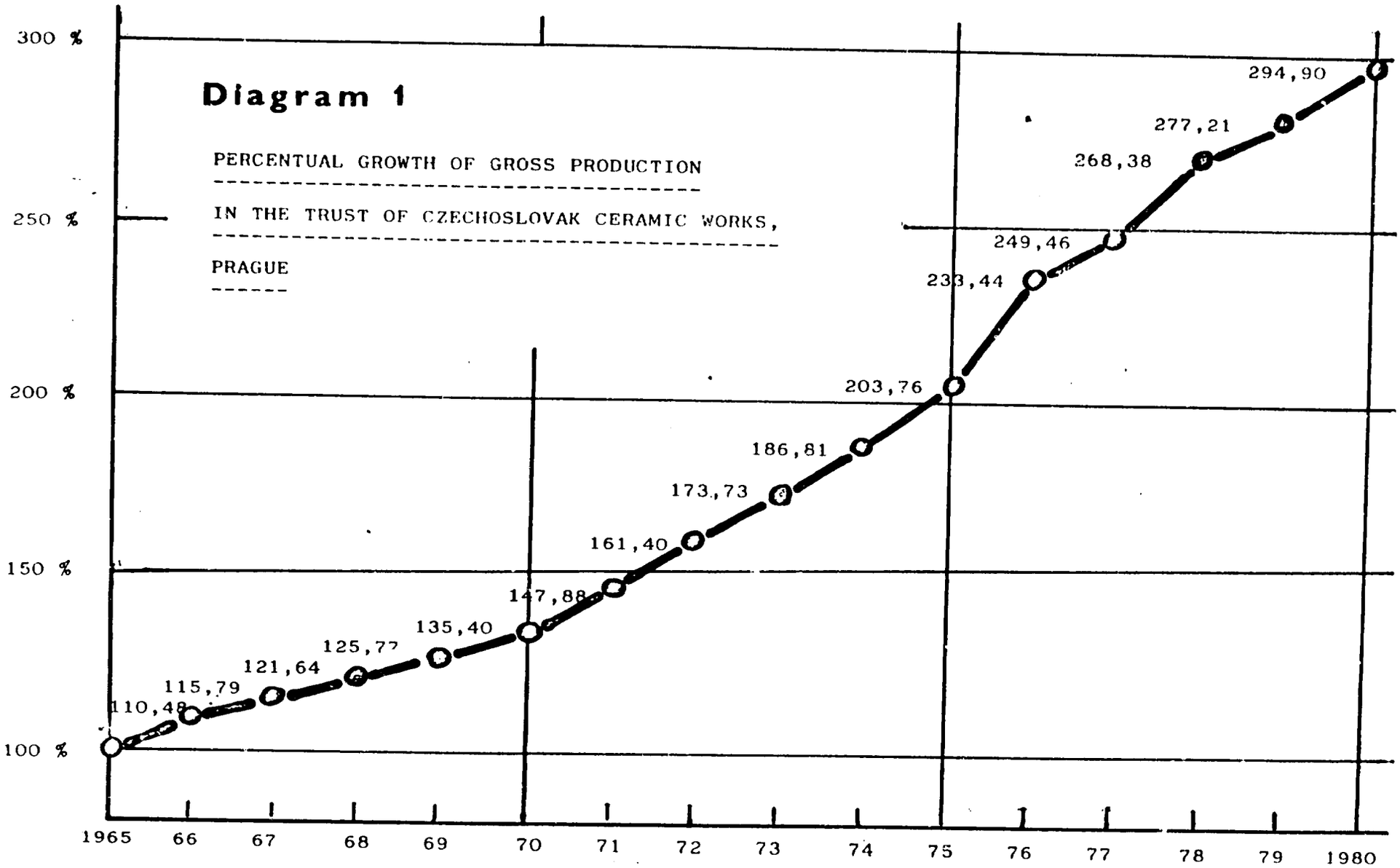
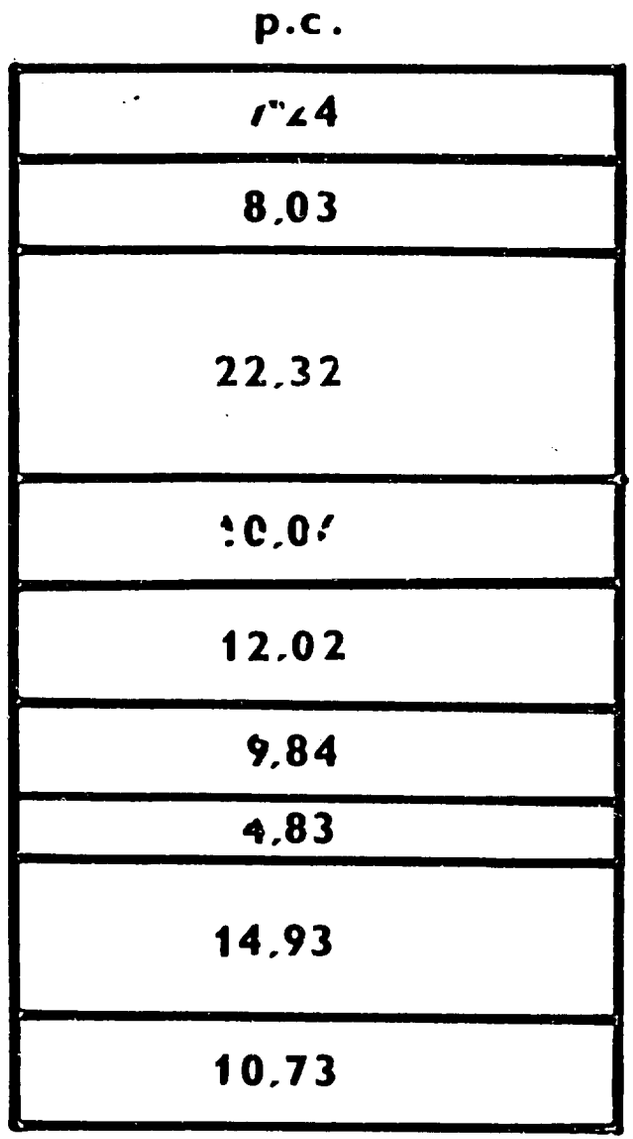


Diagram 1
PERCENTUAL GROWTH OF GROSS PRODUCTION
IN THE TRUST OF CZECHOSLOVAK CERAMIC WORKS,
PRAGUE
300 %
250 %
200 %
150 %
100 %
110,48
115,79
121,64
125,77
135,40
147,88
161,40
173,73
186,81
203,76
233,44
249,46
268,38
277,21
294,90
1965
66
67
68
69
70
71
72
73
74
75
76
77
78
79
1980

Diagram 2

PERCENTUAL CONTRIBUTION OF THE RESPECTIVE PRODUCTION PLANTS OF THE TRUST OF CZECHOSLOVAK CERAMIC WORKS, PRAGUE TO THE 1980 PLAN FULFILMENT



CERAMIC WORKS, RAKOVNÍK

CALOFRIG WORKS, BOROVANY

WEST BOHEMIAN CERAMIC WORKS, HORNÍ BŘÍZA

CERAMIC WORKS, CHLUMČANY

CERAMIC AND GLASS RAW MATERIALS, KARLOVY VARY - SEDLEC

NORTH BOHEMIAN CERAMIC WORKS, MOST

CERAMIC WORKS, BŘECLAV-POŠTORNÁ

MORAVIAN FIRECLAY AND SHALE WORKS, VELKÉ OPATOVICE

CERAMIC WORKS, KOŠICE

Diagram 3

PERCENTUAL GROWTH OF THE PRODUCTIVITY OF LABOUR

PER MAN IN THE TRUST OF CZECHOSLOVAK CERAMIC WORKS, PRAGUE

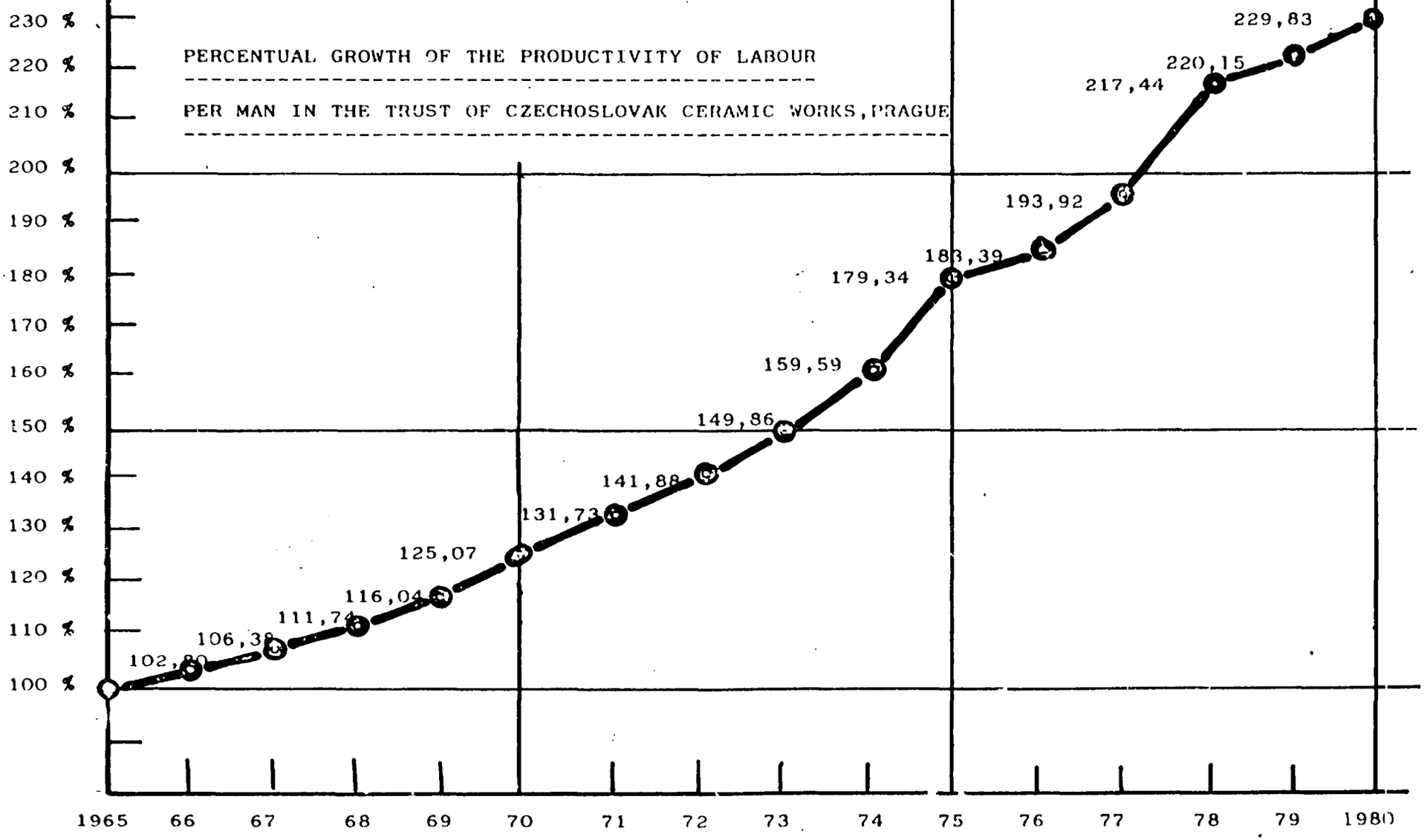
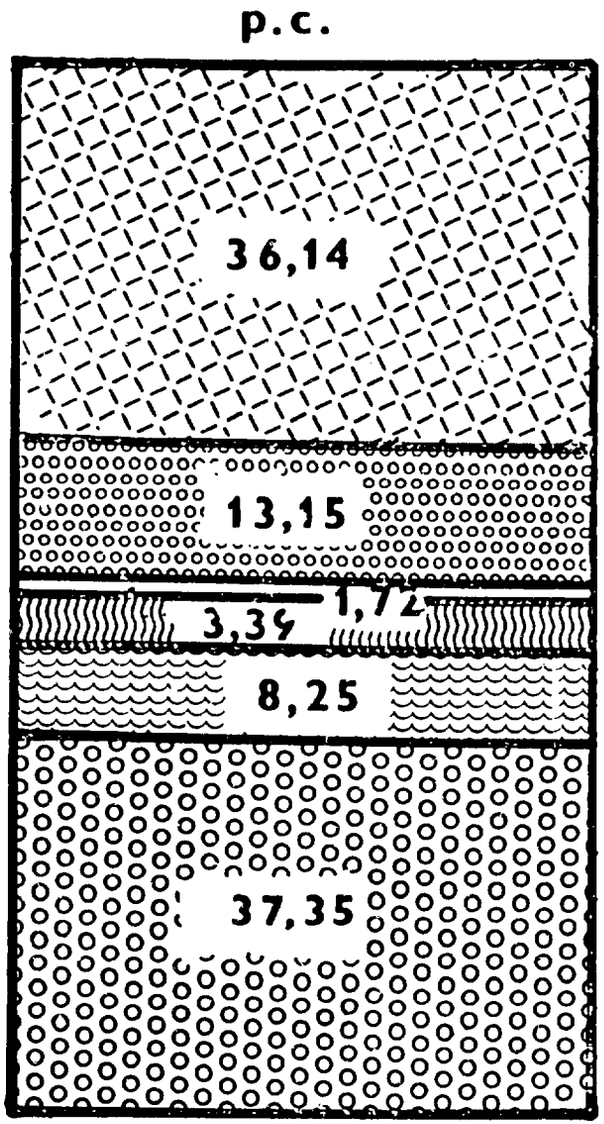


Diagram 4

DISTRIBUTION OF BASIC PRODUCTION ASSORTMENT IN THE TOTAL EXPORTS VOLUME OF THE TRUST OF CZECHOSLOVAK CERAMIC WORKS, PRAGUE



FLOOR TILES

WALL TILES

STONEWARE

FIRECLAY

SHALES

KAOLINS

Diagram 5

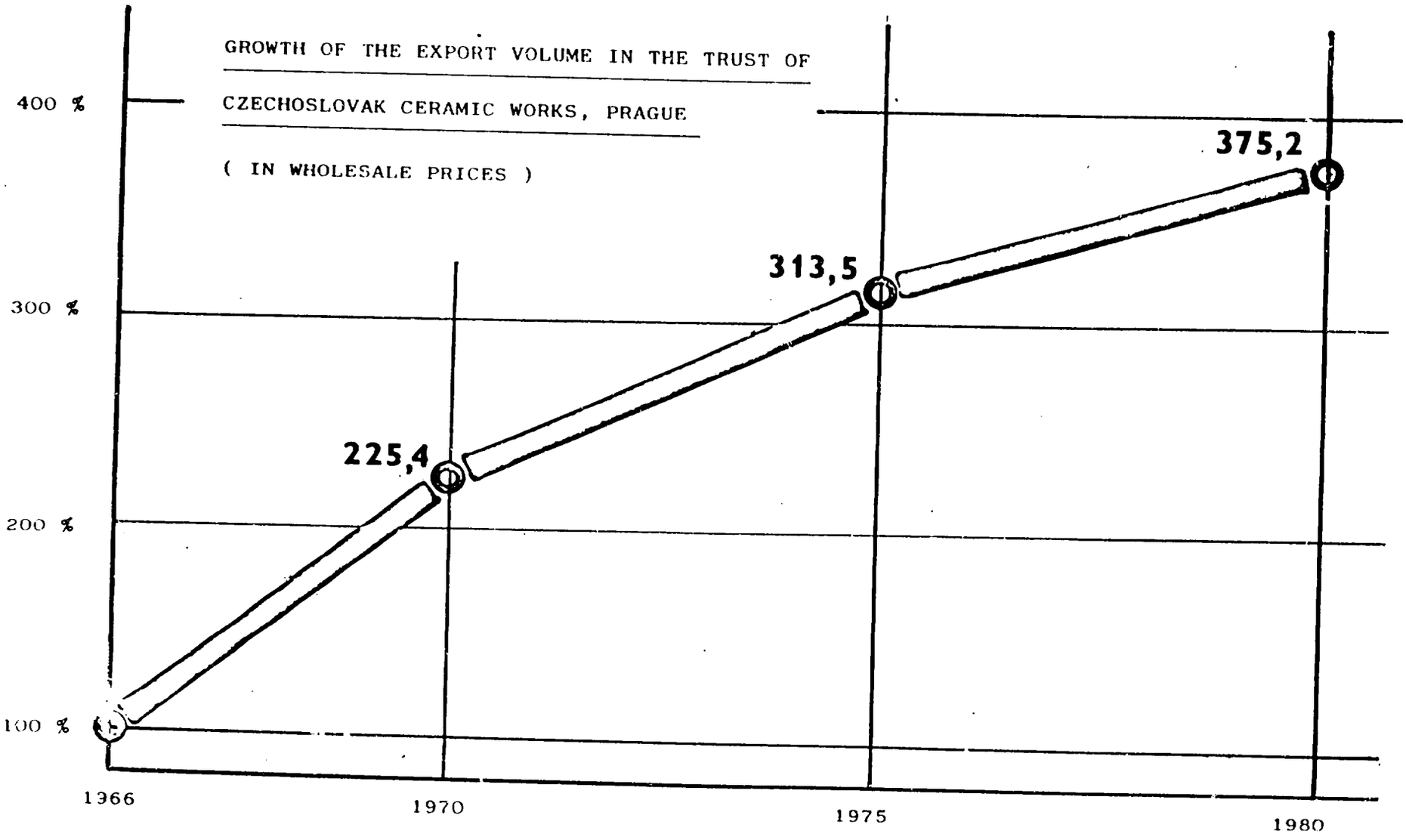
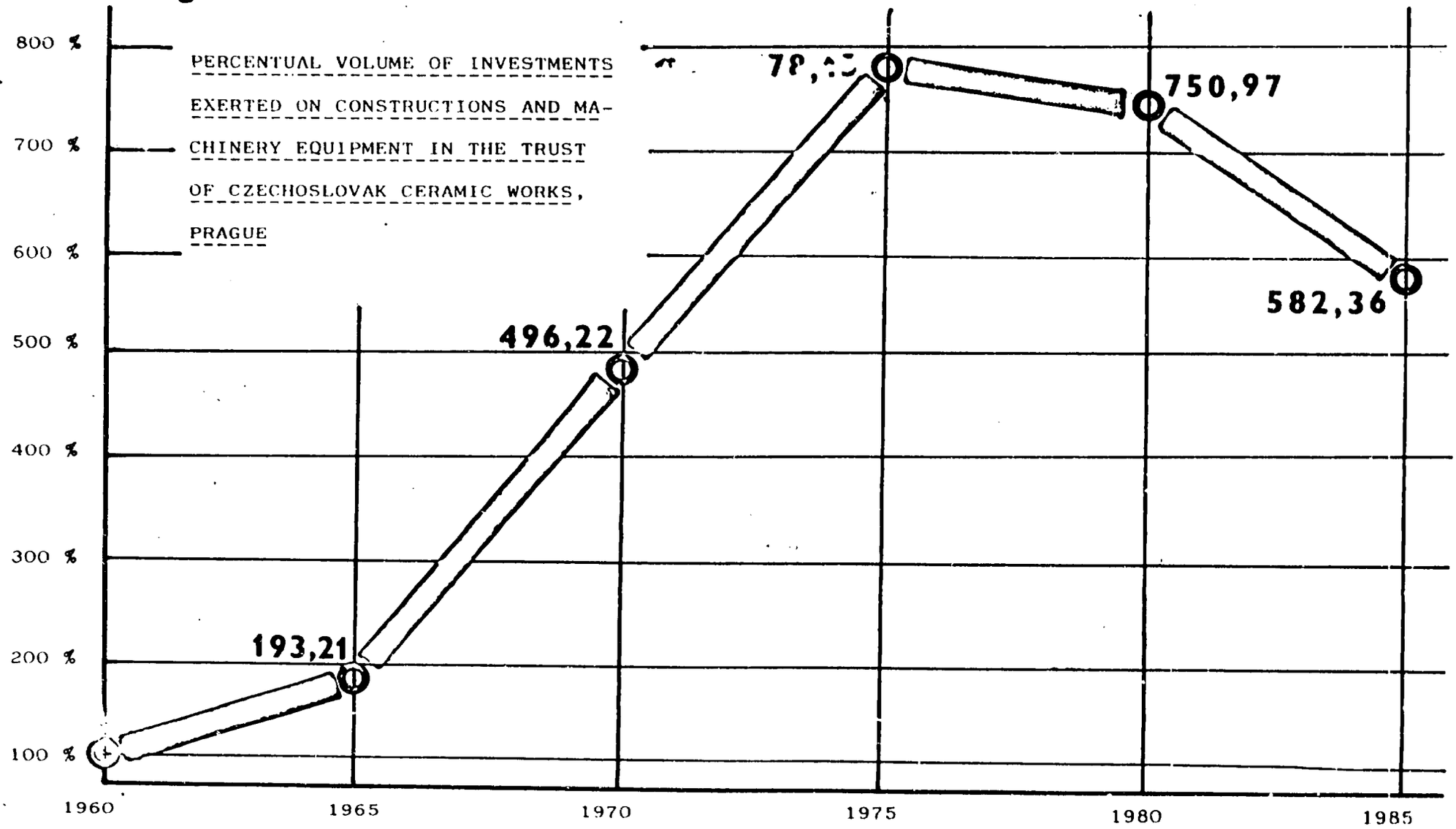
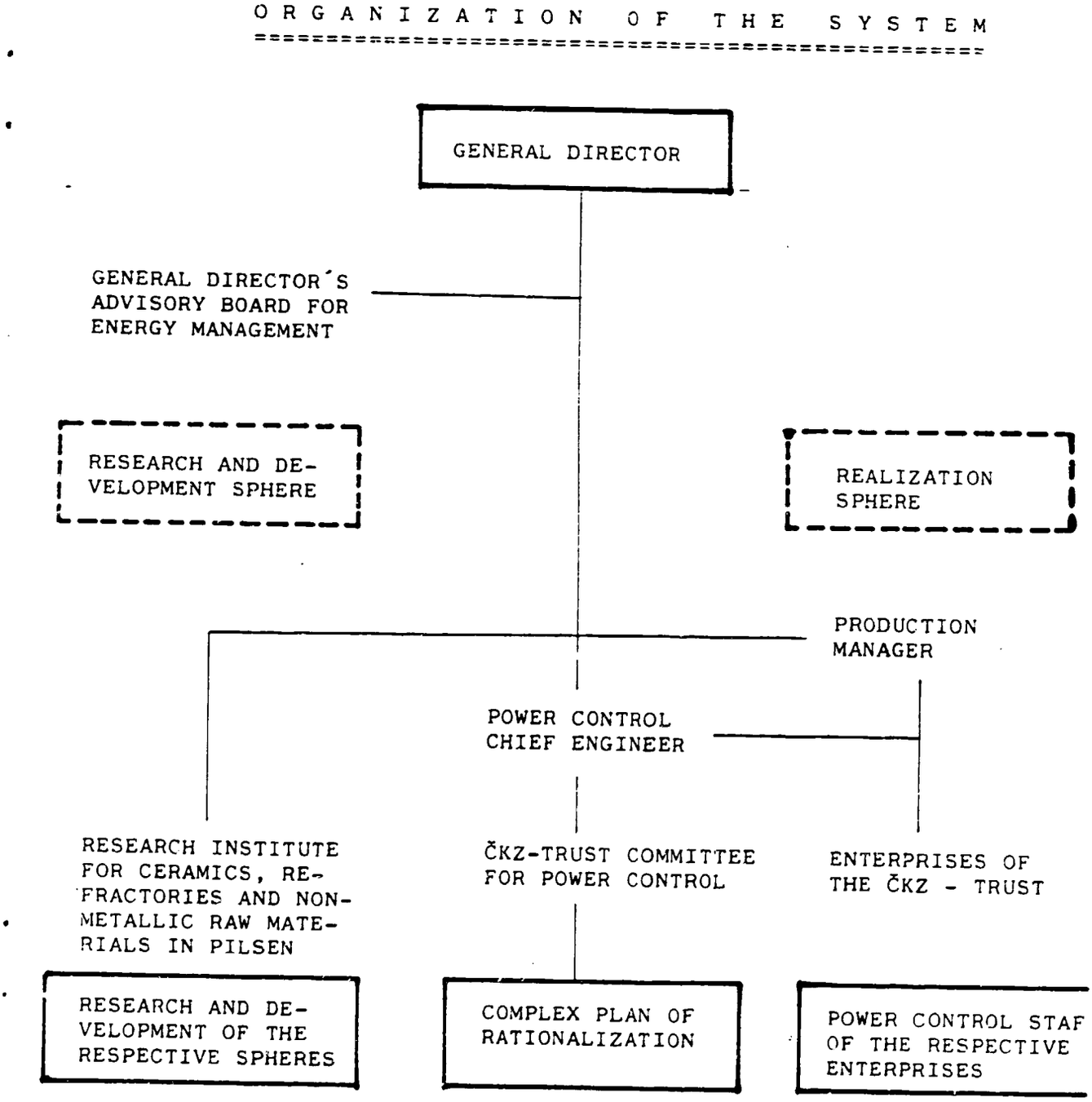

GROWTH OF THE EXPORT VOLUME IN THE TRUST OF
CZECHOSLOVAK CERAMIC WORKS, PRAGUE
(IN WHOLESALE PRICES)
400 %
300 %
200 %
100 %
225,4
313,5
375,2
1966
1970
1975
1980

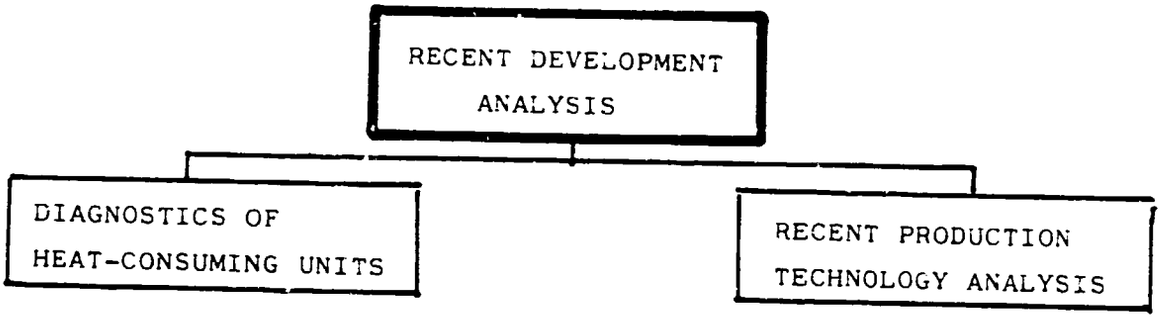
Diagram 6


PERCENTUAL VOLUME OF INVESTMENTS EXERTED ON CONSTRUCTIONS AND MACHINERY EQUIPMENT IN THE TRUST OF CZECHOSLOVAK CERAMIC WORKS, PRAGUE
800 %
700 %
600 %
500 %
400 %
300 %
200 %
100 %
193,21
496,22
750,97
582,36
1960
1965
1970
1975
1980
1985

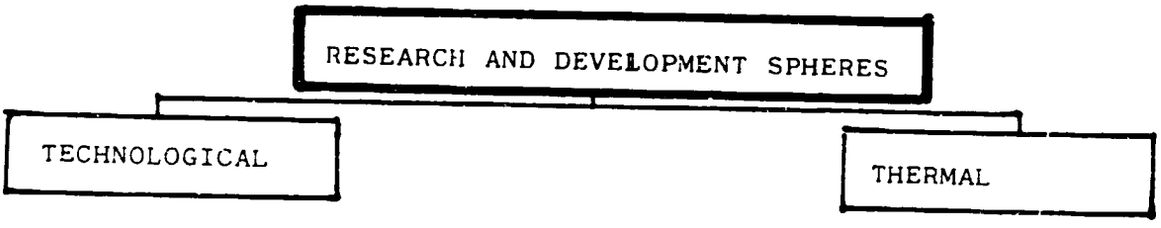
Scheme 7


ORGANIZATION OF THE SYSTEM
GENERAL DIRECTOR
GENERAL DIRECTOR´S ADVISORY BOARD FOR ENERGY MANAGEMENT
RESEARCH AND DEVELOPMENT SPHERE
REALIZATION SPHERE
PRODUCTION MANAGER
POWER CONTROL CHIEF ENGINEER
RESEARCH INSTITUTE FOR CERAMICS, REFRACTORIES AND NONMETALLIC RAW MATERIALS IN PILSEN
ČKZ-TRUST COMMITTEE FOR POWER CONTROL
ENTERPRISES OF THE ČKZ - TRUST
RESEARCH AND DEVELOPMENT OF THE RESPECTIVE SPHERES
COMPLEX PLAN OF RATIONALIZATION
POWER CONTROL STAF OF THE RESPECTIVE ENTERPRISES

Scheme 8

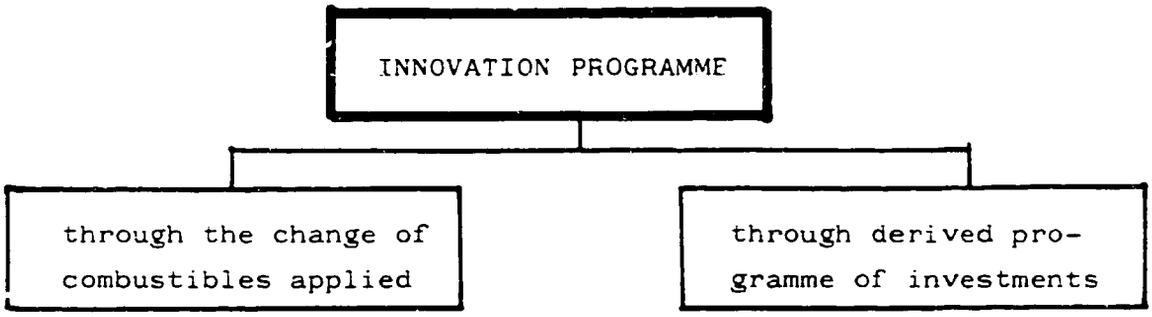


Scheme 9

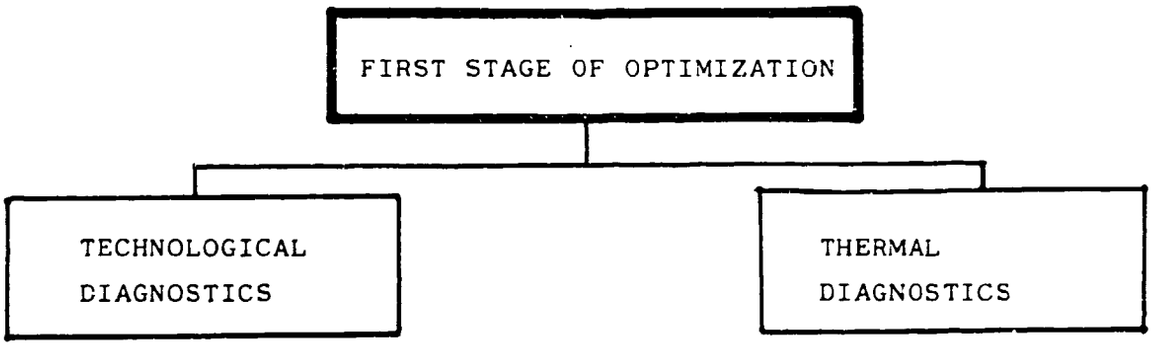


- RESEARCH OF TECHNOLOGIES WITH LOWER ENERGY EXIGENCIES
- DEVELOPMENT OF ONE-FIRE TECHNOLOGY
- NEW METHODS OF BODY PREPARATION
- OUTPUT OPTIMIZATION
- LIMITING CONDITIONS OF FIRIN(
- OPTIMIZATION OF ENERGY CONSUMPTION
- INTENSIFICATION OF PROCESSES
- UTILIZATION OF SECONDARY HEA1 SOURCES
- DECREASE OF HEAT LOSSES IN LININGS
- NEW HEATING SYSTEMS
- NEW FIRING METHODS

Scheme 10



Scheme 11

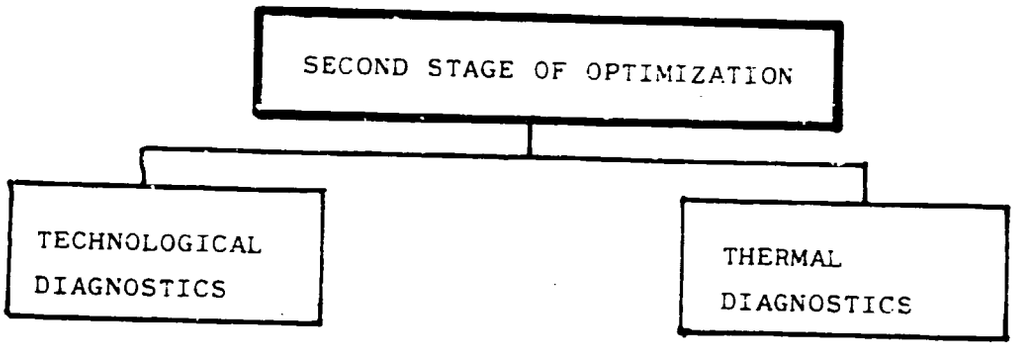


- OUTPUT INTENSIFICATION

- THERMAL INTENSIFICATION

- DIRECT UTILIZATION OF THE WASTE HEAT

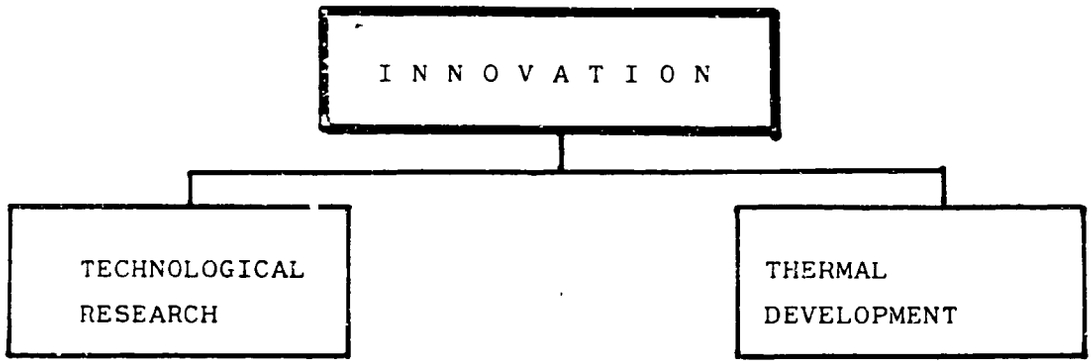
Scheme 12



- TECHNOLOGY WITH A DECREASED ENERGY EXIGENCY
- OUTPUT OPTIMIZATION

- THERMAL PROCESS INTENSIFICATION
- UTILIZATION OF SECONDARY HEAT SOURCES
- DECREASE OF AMBIENT THERMAL LOSSES
- NEW HEATING SYSTEM

Scheme 13



- NEW TECHNOLOGIES
- WITH A DECREASED EXIGENCY ON ENERGY
- WITH A DECREASED NUMBER OF FIRING PROCESSES

- OPTIMIZATION OF THERMAL PROCESSES
- NEW HEATING SYSTEMS
- CHANGES OF FUEL TYPES
- NEW FIRING METHODS
- INTERCONNECTION OF THE THERMAL CIRCUITS OF HEAT CONSUMPTION UNITS