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THE.MAL ELECTRIC POWER PLANTS
IN THE U.S.S.R.

Report No. 92

VOLUME I

COPY 2

THERMAL ELECTRIC POWER PLANTS OF THE U.S.S.R.

Report No. 92

VOLUME I

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PREFACE

This report is designed to provide the analyst with a brief but comprehensive account of the layout, structural design, and structural details of steam-powered electric power plants in the Soviet Union. Included are some plants producing both electric power and steam for heating.

The subject is extensive, and the time (3 months, including extensions) for preparing the work is limited. Seventy-five per cent of the electric power produced in the USSR comes from thermal plants. Reports on 45 Soviet hydroelectric installations made up nearly half of a two-year program completed by the Air Information Division in 1955. It was obvious from the outset that a strict limit must be placed on the coverage of the present work. The Structural Engineering Section therefore decided to exclude the following phases of the subject:

Small plants, especially those serving single industrial installations:
Design of the mechanical and electrical equipment of the plants, even of the boilers, turbines, and generators;
Water and fuel supply installations;
Layouts of electric systems;
Transformer and switch yards;
Transmission lines and substations;
Structure of cooling towers (views of several examples of these, however, appear in the plates).

Only large steam turbine power plants are included in the report.

The scanning of possibly useful periodicals, too, had to be cut off where the probable take was too thin to justify the expenditure of man-hours. The coverage exploited was still extensive, as may be seen from the Bibliography. A general list of titles explored (whether fruitfully or not) is on file with the SES copy of the report.

In the introduction, the general course of the Soviet electrification development is briefly outlined.

The first chapter deals with the layouts of different sections of the main power plant building. The four basic types of widely used plant design are described, and examples of some existing power plants typifying these different layouts of sections are shown.

The second chapter analyzes the structural details of the main plant building.

The third chapter deals with separate large Soviet thermal power plants giving for each all available and some estimated data and photographic illustrations.

A word of caution is in order concerning data on plants in those parts of the Soviet Union that were overrun by the Germans in World War II. All existing power stations in those regions were presumably demolished by the invaders. It is understood that most of the early reconstruction work was based on the original designs. This Section, however, has no information as to the total amount of new and updated design work that went into the reconstruction effort. It is therefore anybody's guess whether the data in this report on any plant in regions which were under German occupation represents what is there now, or whether it has been replaced by a more modern installation.

INTRODUCTION

The electrification of Soviet Russia went through several stages in the course of its development. The original electrification plan "Goelro" (State Commission for the Electrification of Russia) was approved in 1921 and the construction of electric power plants received first priority. The guiding principles of the "Goelro" plan were: the restoration and reconstruction of old power plants (part A of the Plan); the construction of 30 large regional power stations, mostly thermal (GRES), built in places where local low-grade fuel resources were available (peat, brown coal, anthracite culm, etc.); and connected with high-tension lines to form several main regional electric power grids (part B of the Plan).

Part A of "Goelro" plan was fulfilled by 1923, and part B around 1930. In the First Piatiletka (1928 - 1932) the original "Goelro" plan was extended, first by the increase of installed capacities in the already existing plants and secondly, by building 20 more power plants, almost all thermal. (See maps on Plates 1 and 2)

The main building of these power plants built up to the end of the first Piatiletka was usually a poured-in-place reinforced concrete frame structure with masonry curtain walls or brick panel walls and steel or wooden roof trusses. Columns were rigidly connected to poured-in-place pile-supported foundations and were entirely separate from the special pile-supported poured-in-place reinforced concrete foundations for the machinery.

Up to the end of the First Piatiletka very few hydroelectric stations were built. The main reason for this slow-down was that previously made geological surveys proved to be inadequate for the construction of dams and that more accurate surveys and plans were necessary.

Beginning with the Second Piatiletka (1933 - 1937) the construction of hydroelectric stations was started on a much larger scale.

The thermal power capacity was further expanded, mostly by additional installations in existing plants, and by building not only some new large power plants but also smaller local electrical stations which were switched into the steadily expanding regional grids. Larger new power plants were built, mostly in cities and around industrial centers. (See map on Plate 3).

The poured-in-place reinforced concrete type of construction was being gradually replaced by construction with precast reinforced concrete elements, such as columns, beams, and girders; the plant foundations and substructures, however, were still built of monolythic reinforced concrete.

This trend continued during the Third Piatiletka (1938 - 1941). During this time larger power and heat-and-power stations were built in the East, in the Ural Mountains, in Siberia, and in Central Asia; this building program in the East was especially intensified during the War.

During the War, precast reinforced concrete elements were not used in the construction of power stations because the precast fabricating plants were not operating.

After the War, during the Fourth Piatiletka (1946 - 1950) the first task was to rebuild the destroyed power plants. Next, rural electrification was greatly increased and extended whenever possible by the construction of small local hydroelectric plants. During the Fifth (1951 - 1955) and the present Sixth (1956 -) Piatiletkas large hydroelectric projects were carried out. The share of electrical energy produced by hydroelecrric plants rose to 25% of the total.

In the design and construction of new thermal power plants more standardization was attempted.

The power plants are under the Ministry of Electric Power Stations and plans for new stations are designed by the Institut Teploelektro-proyekt. The Institute prepares suggested master schemes for thermal plant construction. Precast reinforced concrete elements were prevailingly used in construction of plants; also rigid welded steel reinforcing skeletons which form the main reinforcement for the concrete frames of the building. Certain elements, usually roof beams, are of prestressed reinforced concrete. In the design of power plant foundations, instead of providing a separate foundation for each piece of auxiliary equipment, the design called for a basement with a heavy reinforced-concrete slab foundation. Only (1) the columns have separate footings, and (2) the boilers and turbogenerators rest on separate monolithic poured-in-place concrete blocks.

With boiler efficiencies increased so that a single boiler is sufficient to serve one turbogenerator, the design of thermal power plants has become simpler. The turbine hall is parallel to the boiler house, the turbogenerators are placed lengthwise to the turbine hall, and since one turbogenerator set longitudinally occupies the same space as its boilers, the condensing equipment being placed underneath in the basement, a block system boiler-turbine can be introduced. Instead of a central fuel preparation system (pulverizing for coal and milling for peat) at present each boiler has its own separate fuel preparation unit. Because boilers and turbogenerator sets are now (1956) larger and heavier, power plant construction has become stronger, foundations heavier, travelling bridge cranes of greater load-lifting capacities (100 - 200 m. tons), and consequently columns and girders stronger. The cross-section widths, however, of the boiler and turbine rooms can remain unchanged. One of the building's end walls is made as a temporary structure to be moved in case the plant is extended for the installation of new boiler-turbine block units. The unit capacities of these new boiler-turbogenerator sets have been increased. The boilers presently (1956) installed, work at higher pressures (up to 300 atm.) and higher temperatures (up to $650^{\circ}C = 1200^{\circ}F$), and turbogenerators can be installed at higher capacity ratings (up to 150,000 kw.)

MAP OF DISTRICT ELECTRIC POWER PLANTS

AT THE END OF THE PIATYLETKA (OCTOBER 1ST, 1933) INDICATING POWER PLANTS WORKING IN 1930, THOSE BEING ENLARGED AND OTHERS UNDER ERECTION

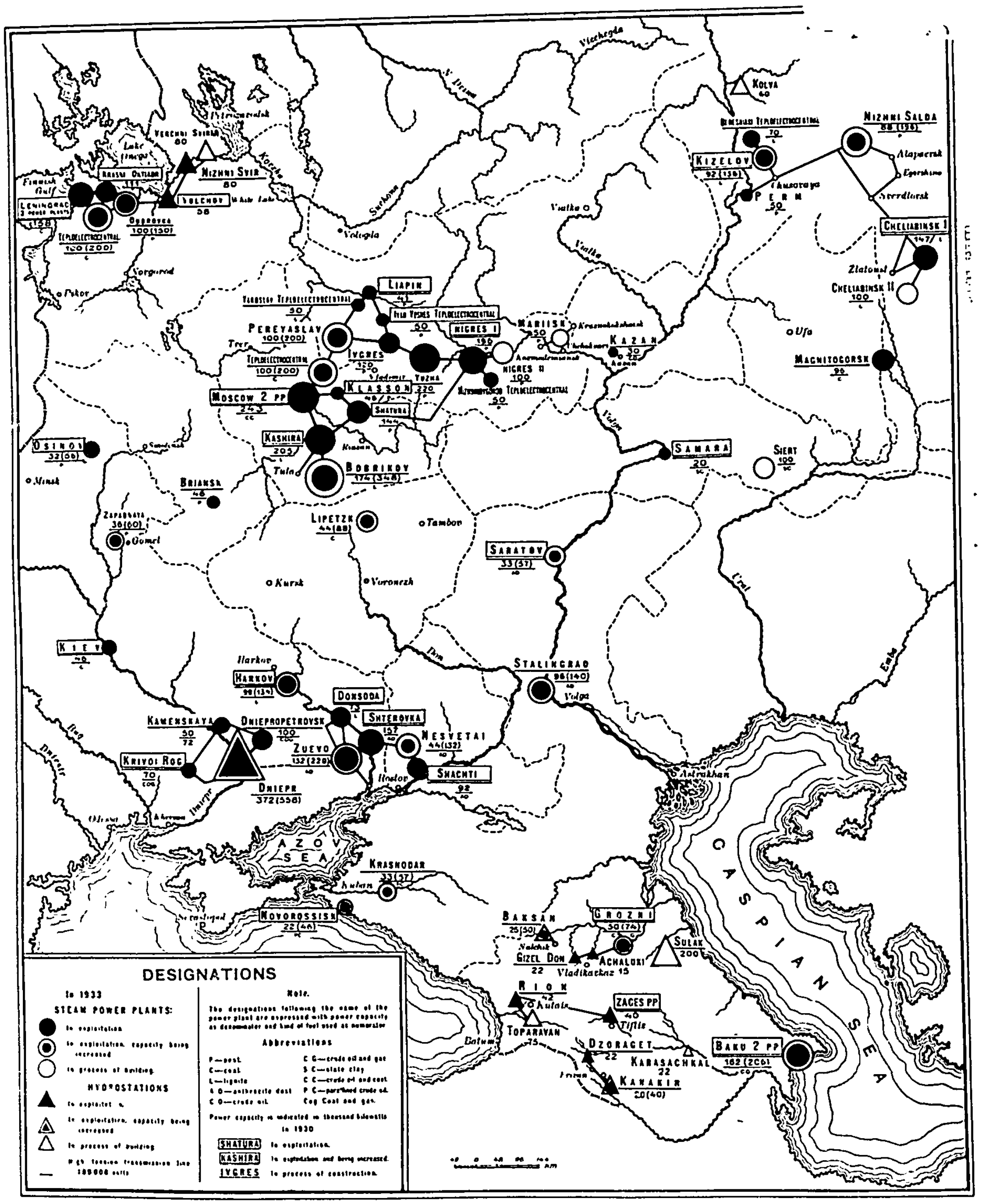
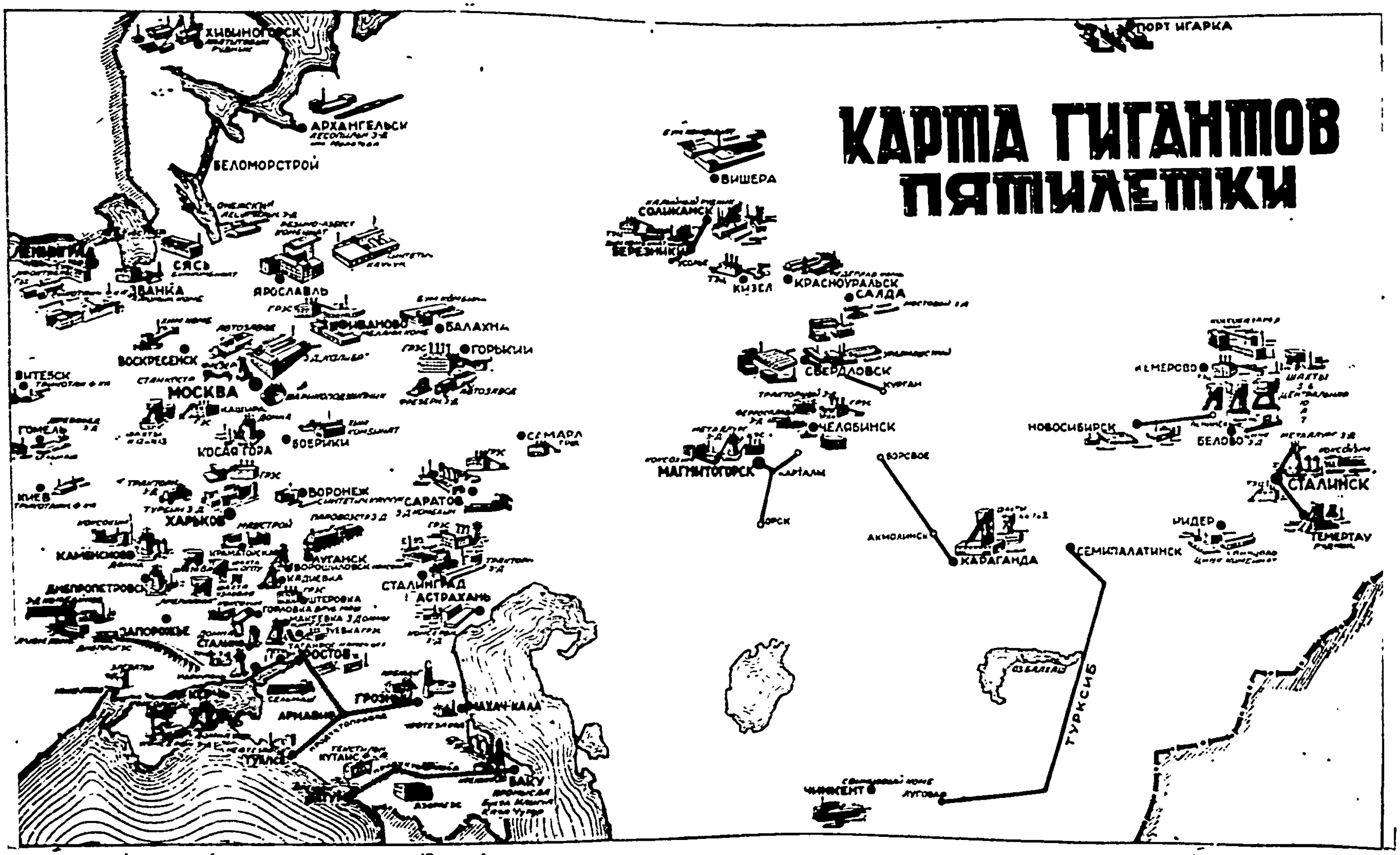


PLATE 1.



MAP SHOWING THE MAIN SOVIET POWER STATIONS AT THE END OF THE FIRST PIATILETKA IN PRINCIPAL INDUSTRIAL CENTERS.

Source: Prozhektor, 1933, No. 1, AP50.P76

PLATE 2.

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LIST OF REGIONAL ELECTRIC POWER STATIONS IN THE USSR IN 1936

POWER STATION	CAPACITY	POWER STATION	CAPACITY
1. NIVA HYDRO-ELECTRIC STATION	30,000 KW	30. OTHER CENTRAL POWER STATIONS OF THE DONBAS	45,000 KW
2. KONDOPOGA HYDRO-ELECTRIC STATION	4,500 "	31. NOVOROSSISK REGIONAL POWER STATION	20,000 "
3. LENINGRAD POWER STATIONS	378 000 "	32. GIZELDON HYDRO-ELECTRIC STATION	23,000 "
4. VOLKHOV HYDRO-ELECTRIC STATION	66,000 "	33. RION HYDRO-ELECTRIC STATION	48,000 "
5. LOWER SVIR HYDRO-ELECTRIC STATION	100,000 "	34. ZEMO-AVCHALI HYDRO-ELECTRIC STATION	25,000 "
6. MOSCOW POWER STATIONS	314,000 "	35. DZORAGET HYDRO-ELECTRIC STATION	22,500 "
7. SHATURA REGIONAL POWER STATION	180,000 "	36. BAKU REGIONAL POWER STATION	176,000 "
8. KASHIRA REGIONAL POWER STATION	186,000 "	37 KADYRYA HYDRO-ELECTRIC STATION	13,000 "
9. STALINOGORSK REGIONAL POWER STATION	100,000 "	38. BURJAR HYDRO-ELECTRIC STATION	3,300 "
10. KALININ POWER STATIONS	19,000 "	39. BOZ-SU HYDRO-ELECTRIC STATION	3,000 "
11. WHITE RUSSIAN REGIONAL POWER STATION	20,000 "	40. TASHKENT POWER STATION	3,500 "
12. VORONEZH REGIONAL POWER STATION	24,000 "	41. FERGANA REGIONAL POWER STATION	8,200 "
13. BRIANSK REGIONAL POWER STATION	22,000 "	42. NOVOSIBIRSK HEAT-AND-POWER STATION	35,500 "
14. KIEV POWER STATION	64,000 "	43. KEMEROVO REGIONAL POWER STATION	48,000 "
15. KHARKOV POWER STATIONS (TOGETHER WITH KRASNOZAVODSK HEAT-AND-POWER STATION)	98,000 "	44. CHELIABINSK REGIONAL POWER STATION	150,000 "
16. KRIVOI ROG REGIONAL POWER STATION	44,000 "	45. KIZEL REGIONAL POWER STATION	98,000 "
17. RYKOV POWER STATION	6,000 "	46. YEGORSHINO REGIONAL POWER STATION	24,500 "
18. KAMENSKOYE POWER STATION	48,000 "	47 SVERDLOV REGIONAL POWER STATION	11,000 "
19. DNIEPER HYDRO-ELECTRIC STATION	558,000 "	48. PERM REGIONAL POWER STATION	8,000 "
20. ODESSA POWER STATION	37,000 "	49. MIDDLE URALS REGIONAL POWER STATION	50,000 "
21. NIKOLAYEVSK POWER STATION	13,500 "	50. BEREZNIKI HEAT-AND-POWER STATION	93,000 "
22. SEVASTOPOL REGIONAL POWER STATIONS	8,000 "	51. KUIBYSHEV REGIONAL POWER STATION	27,000 "
23. SIMFEROPOL CITY POWER STATION	1,700 "	52. STALINGRAD REGIONAL POWER STATION	75,000 "
24. YALTA CITY POWER STATION	1,300 "	53. SARATOV POWER STATIONS	22,000 "
25. ROSTOV POWER STATIONS	128,000 "	54 KAZAN POWER STATION	24,000 "
26. KRASNODAR REGIONAL POWER STATION	10,000 "	55. GORKI REGIONAL POWER STATION	204,000 "
27. SHTEROVKA REGIONAL POWER STATION	152,000 "	56. IVANOVO POWER STATIONS	113,000 "
28. ZUYEVKA REGIONAL POWER STATION	200,000 "	57. VLADIMIR HEAT-AND-POWER STATION	3,500 "
29. NORTHERN DONETS REGIONAL POWER STATION	65,000 "	58. YAROSLAVL REGIONAL POWER STATION	36,000 "
		59. ARCHANGEL REGIONAL POWER STATION	16,000 "

(THE NUMBERS AGAINST THE STATIONS IN THIS LIST CORRESPOND TO THE NUMBERS SHOWN IN THE CHART)

CAPACITIES IN KW OF REGIONAL POWER STATIONS IN THE USSR IN 1936 SHOWN ON MAP, PLATE 2.

PLATE 3A.

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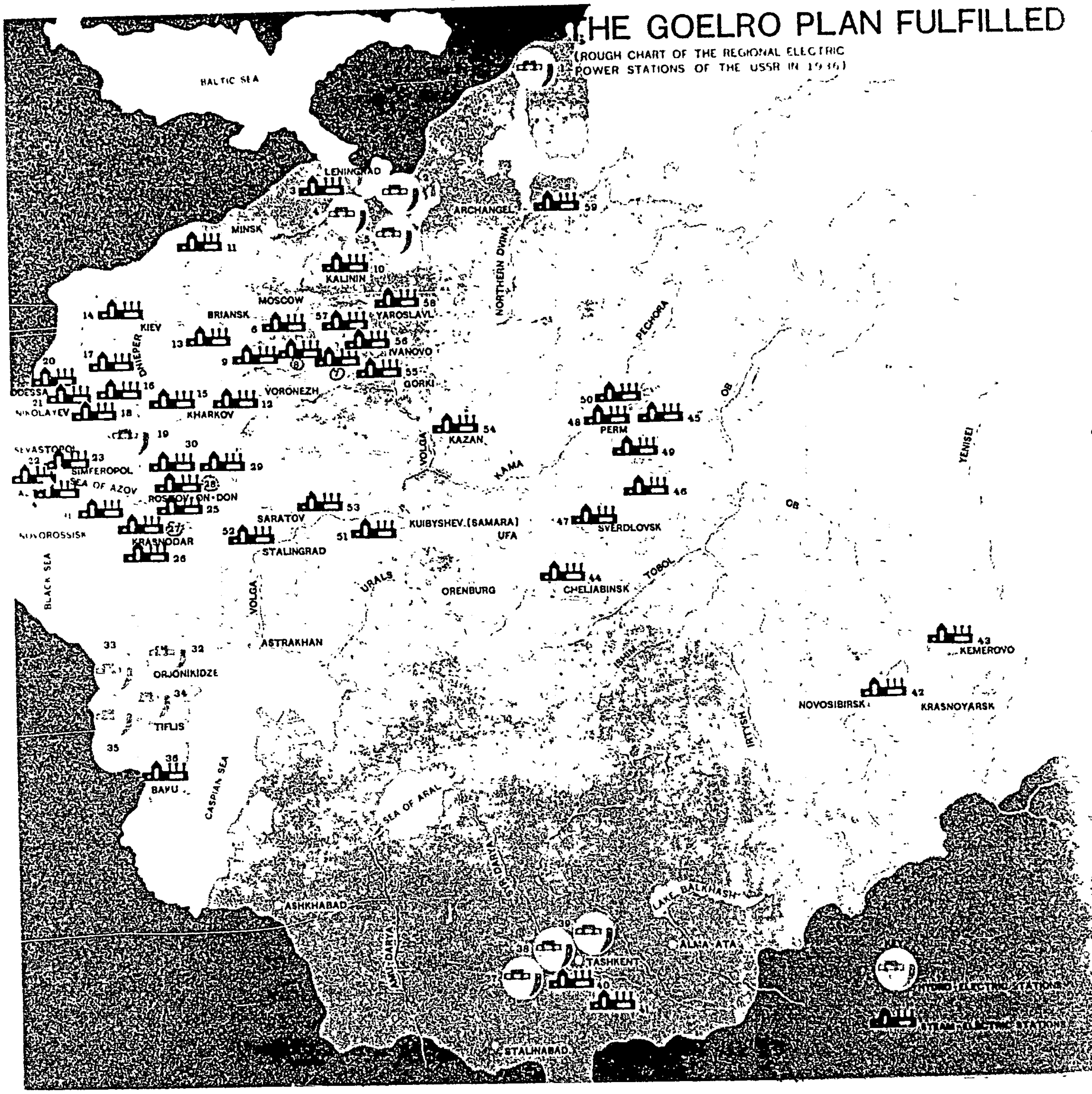

MAP OF REGIONAL POWER STATIONS IN THE USSR IN 1936

Source: USSR in construction, 1936, No. 6, DK267.A1U3

PLATE 3.

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CHAPTER I

GENERAL LAYOUT OF THE MAIN PLANT BUILDING

The larger thermal electric power plants in the USSR have steam turbines as primery movers. Steam piston engines have been completely discarded, gas turbines are still only in an experimental stage and Diesel motors are used in power plants of smaller capacity serving local needs. The layout of plants has been influenced principally by the kind, efficiency and size of equipment installed, by the kind of fuel fired, and also, to certain extent, by the type of the station, i.e. whether it is a condensing or a heat-and-power producing plant.

The general scheme of a plant layout is mainly centered on the proper placing of the boiler house as the most complex section of the plant and on the grouping of the turbine hall and other sections in relation to it.

When the steam turbine was introduced as the prime mover, the total capacity of several boilers was necessary to produce a sufficient amount of steam for one turbine. In the first peat-firing plants built in the twenties therefore, we find that either: 1/ the boiler rooms are placed at right angles to the turbine hall; or 2/ the turbine hall is placed parallel between two boiler rooms.

Examples of the first type of arrangement are: 1/ the first priority of the 204,000 kw. Gor'kiy GRES (see Plate 4, Fig. 1) which has three double-row boiler rooms, 6 boilers to a turbine; 2/ the first and second priorities of the 180,000 kw. Shatura GRES (see Plate 4. Fig. 2) which has three single-row boiler rooms, 6 boilers to a turbine.

An example of the second type of arrangement is the 100,000 kw. Dubrovka GRES where the turbine hall is placed between two boiler rooms and parallel to them (see Plate 5).

With the rapid advance of boiler engineering, the improved boiler-turbine ratio made it possible to lay out electric power stations with the turbine hall and one boiler house parallel. At first, when 2 boilers were still needed for one turbine, the boilers were arranged either in a double row, as in the 152,000 kw. Shterovka pulverized-coal GRES (Plate 6) or in a single row but with somewhat spread-out turbo-generator sets as in the peat-burning 120,000 kw. Ivanovo GRES (see Plate 7). Further increase in boiler capacities made it possible to design stations with one boiler installed per turbine.

The turbogenerator sets are arranged lengthwise to the axis of the turbine hall in all stations, with the exception of the first priority of the Shatura and the Dubrovka plants, where the turbogenerators are installed crosswise.

The main building of a thermal electric power (or heat-and-power) station is composed of the following sections:

1. The fuel bunker gallery section, in most cases with the peat-milling or coal-pulverizing installation (central or individual for each boiler);

2. The boiler house;

3. The smoke discharge section (smoke exhaust flues, induced-draft fans;)

4. The section of feedwater tanks, feedwater pumps, deaerators etc;

5. The turbogenerator hall and auxiliary equipment.

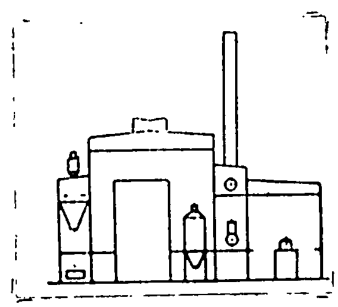
Those sections can be clearly identified on the model of a 5 x 50,000 kw. pulverized-coal station (see Plate 8) or on the model of a 200,000 kw. peat-firing power plant (see Plate 8a).

Different arrangements of these sections in relation to each other characterize the specific types of the main building design of thermal-electric power plants. The central point to be considered in a power plant design is the location of the boiler house as the most complex section of the plant.

The boiler house can have one or two free side walls - that is, walls that do not adjoin the turbine room or its auxiliary section. Outside a free side wall the designer can place the auxiliary sections of the boiler house, namely: 1. the bunker section (bringing and storing of fuel, and its preparation for burning, i.e. the milling or pulverizing equipment) and; 2. the smoke discharge section (smoke exhaust flues, induced-draft fans, smoke stacks).

According to the location of the boiler house, the main buildings of thermal-power and heat-and-power plants can be classified in four general groups.

First Group



In the first group, the boiler house has one free wall, outside of which is the fuel bunker section. In this group, the stacks are in or next to the boiler house; they and the induced-draft fans are set on a high specially-constructed frame, or on top of the frame that supports the feedwater tank, pump, and deaerator section.

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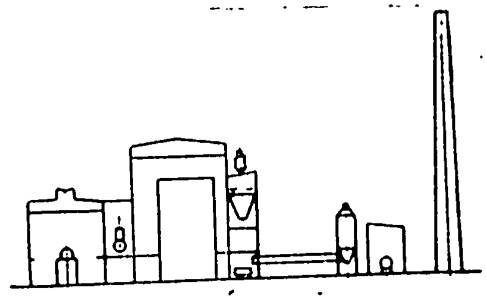
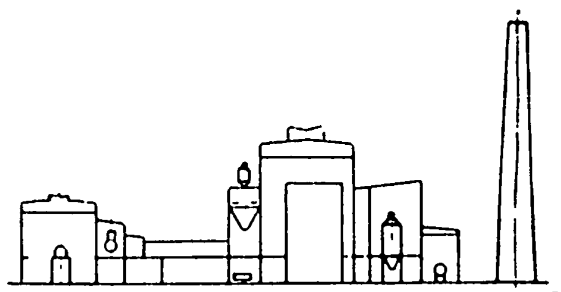
Second Group



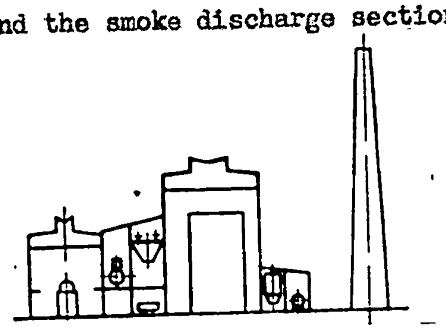
The Second Group includes power plants where the boiler house also has one free side wall, with the fuel bunker section adjoining; however, the smoke discharge installations are separated from the boiler house. Smoke flues are brought underneath the fuel bunker section, the induced-draft fans are placed low, on the ground floor, and the stacks are separated from the main building.

Third Group



In the Third Group, the boiler house has two free side walls, the fuel bunker section on one side and the smoke discharge section on the other.

Fourth Group



The fourth Group is like the Third in principle, but arranged more compactly, with the fuel bunker section set in a frame common to that of the turbine room.

The design of each of the groups is based on the general scheme of arrangement of the sections however, within the framework of one group some individual solutions in the design of the plant are feasible. The first group is the most common, especially in power plants built in the twenties and thirties.

Examples of the First Group arrangement are:

a. Zuyevka 96,000 kw. pulverized-coal GRES (see Plates 9 & 9a).

b. Kuznetsk 108,000 kw. pulverized-coal heat-and-power TETs. (see Plate 11)

c. Stalinogorsk pulverized coal GRES (see Plates 12 & 12a)

d. Ivanovo peat-burning GRES (see Plate 7)

e. Stalingrad pulverized-coal GRES (see Plate 10)

The layout of the First Group has the drawback that the smoke eliminating arrangement is located either totally or partially in the boiler house, and the induced-draft fans are placed at a high level, so that their draft capacity is reduced. In the Second Group design, this problem is solved by bringing the smoke exhaust flues to the lower level and placing the induced-draft fans and smoke stacks outside the boiler house. Examples of the Second Group are:

a. Nesvetay GRES (see Plate 13)

b. Stalinsk (Mosenergo #11) TETs in Moscow (see Plate 14)

The First and Second Groups form the "compact" groupings of the station sections. The Third Group is called the "disjointed design", the boiler house and the turbine hall being in different buildings. An example of this arrangement is the Orsk TETs (see Plate 15).

The Fourth Group arrangement is the latest design of the power plant building. Some power plants have already been built according to this arrangement, probably the Cherepet' GRES; also Mironovsk GRES and Slavyansk GRES.

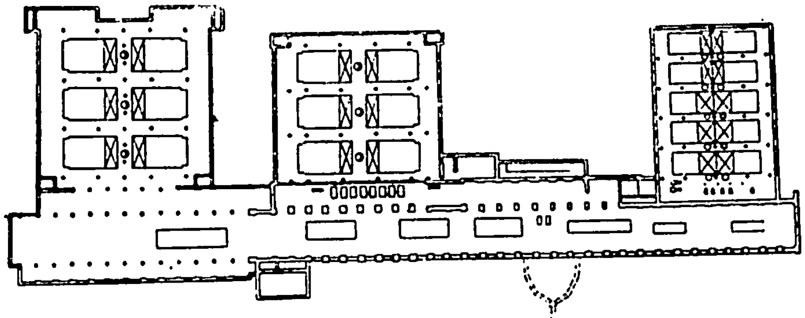


FIG. 37.—Gorki regional station (plan view).

Fig. 1 - Gor'kiy Peat-Firing GRES

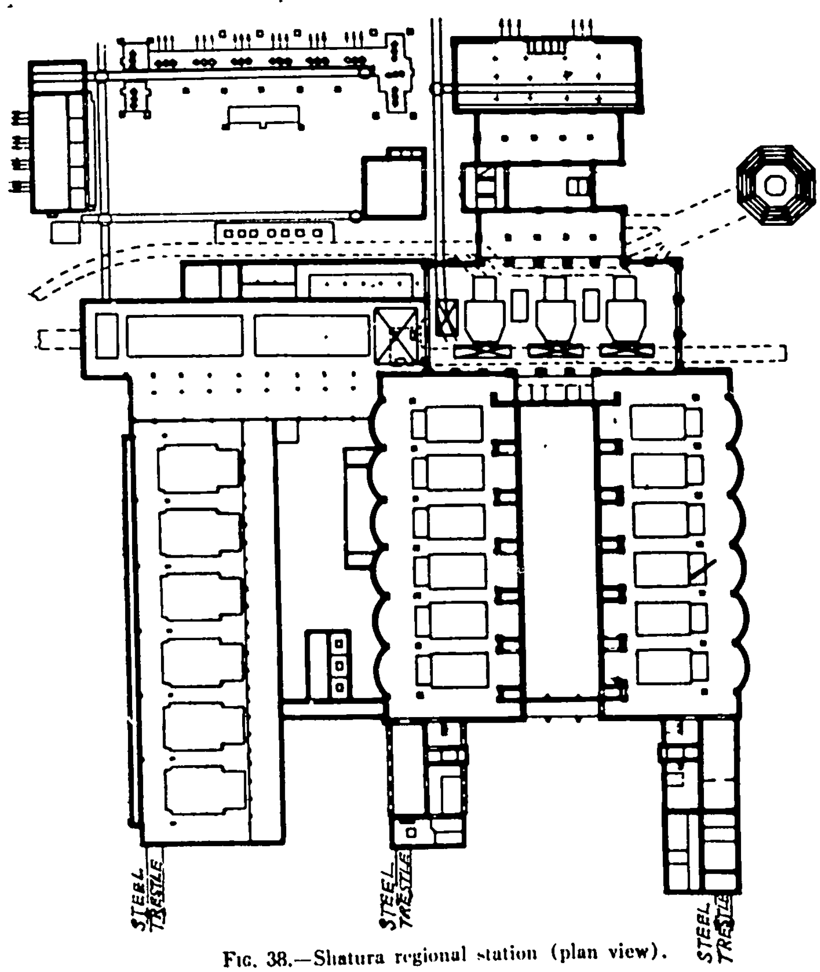


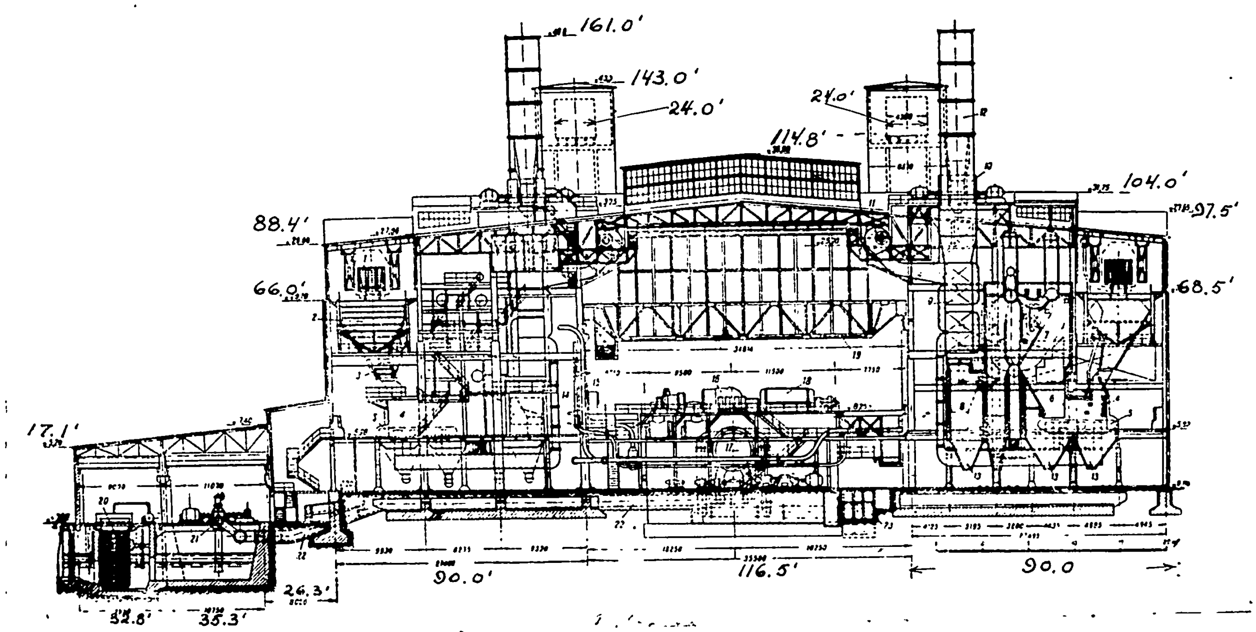
FIG. 38.—Shatura regional station (plan view).

Fig. 2 - Shatura Peat-Firing GRES

THERMAL POWER PLANTS WITH BOILER ROOMS AT RIGHT ANGLE TO TURBINE HALL.

Source: Weitz, 1. ed. Electric Power Development in the USSR, 1936. TK85.E6.

PLATE 4.

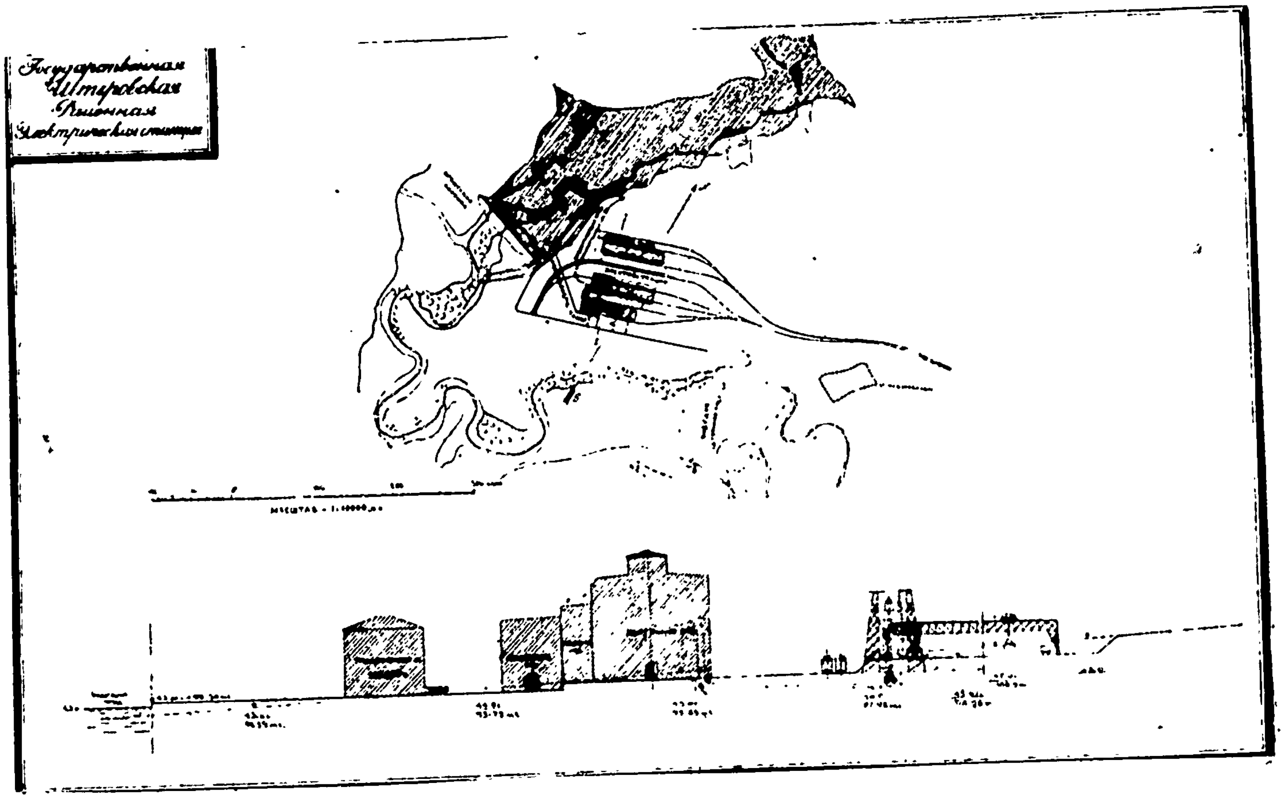


1 - Peat car; 2 - Steel peat bunker; 3 - Peat chute to the furnace well; 4 - Furnace well; 5 - Mechanical chain grate; 6 - Furnace; 7 - 3-drum water-tube boiler, capacity - 135/160 t./h.; 8 - Water economizer; 9 - Air preheater; 10 - Smoke-exhaust fan (induced draft); 11 - Forced draft fan; 12 - Stack; 13 - Ash and cinder bunkers; 14 - Feedwater pipeline; 15 - Steam pipeline; 16 - Steam turbine, capacity-50,000 kw.; 17 - Condenser; 18 - Three-phase generator; 19 - Crane bridge; 20 - Mechanical filter mesh; 21 - Circulation pumps; 22 - Water main; 23 - Drainage channel; 24 - Feedwater tanks.

DUBROVKA PEAT - FIRED GRES.

Source: Weitz, b. Electric Power Development 1936. TK85. E6, 1936.
Antipov, I. P. Arkhitektura elekrostantsiy, 1939. TH4581. A5.

PLATE 5.



Site plan and sections of main buildings

SHTEROVKA PULVERIZED COAL FIRING GRES (Capacity: 152,000 kw.)

Source: Stroitel'naya Promyshlennost' 1924, #4, p. 242.

PLATE 6A

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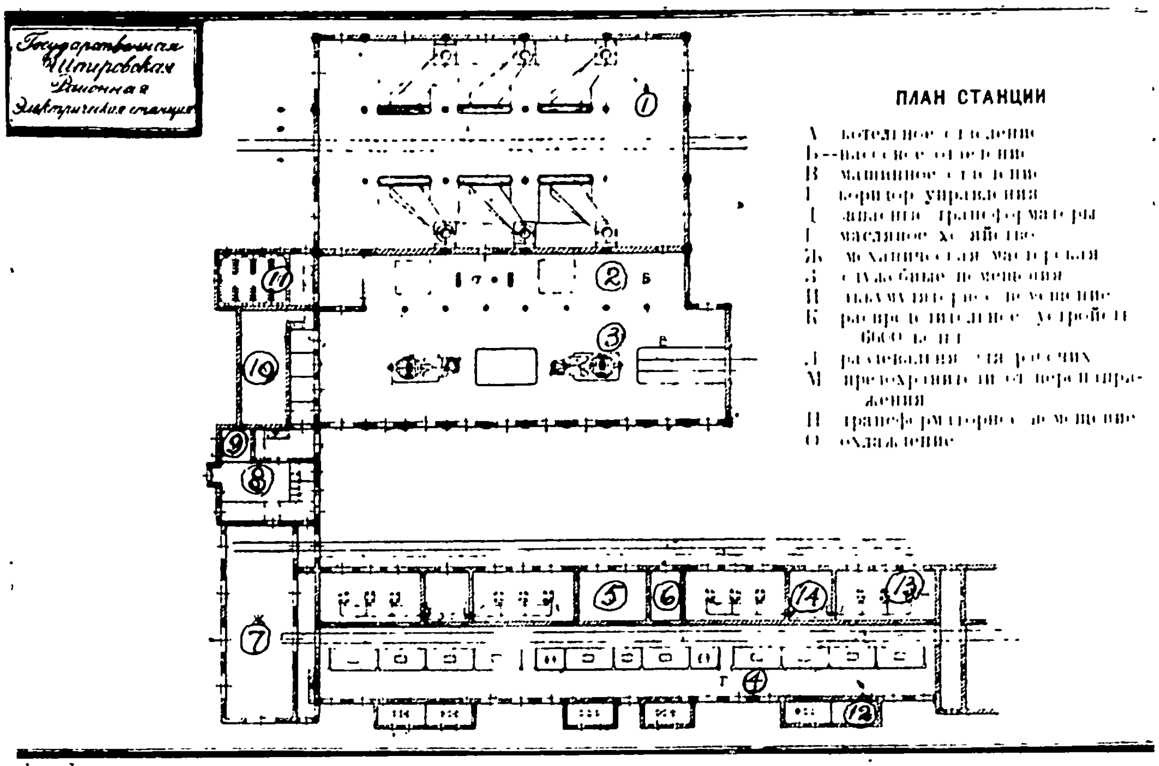


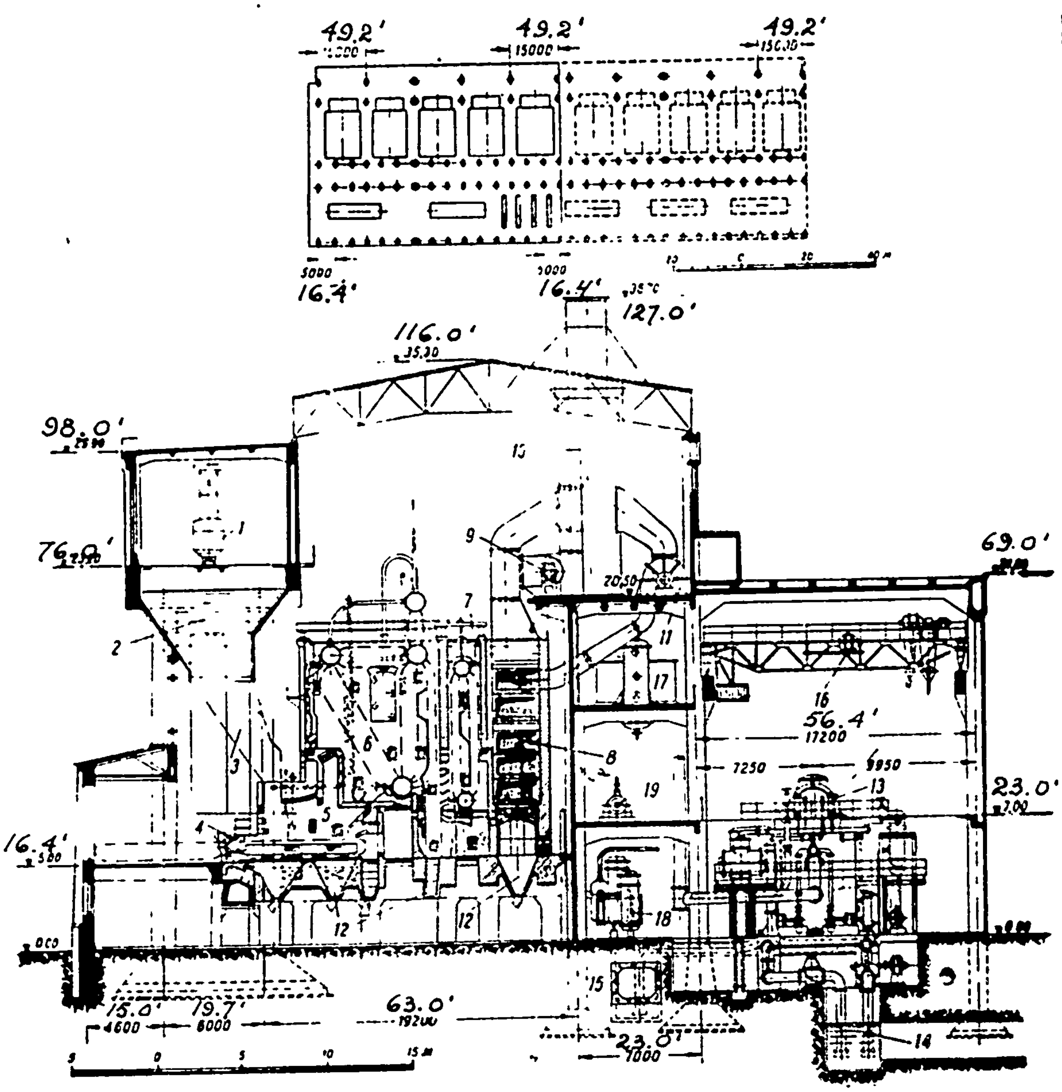
Plan of power plant.

1. Boiler house
2. Pump section
3. Turbine hall
4. Control section
5. Reserve transformers
6. Oil section
7. Work shop
8. Service quarters
9. Accumulator section
10. 6,600 Volt distributing installation
11. Locker room for workers
12. Circuit breakers
13. Transformer section
14. Cooling section

SHTEROVKA PULVERIZED COAL-FIRING GRES
(Capacity: 152,000 kw.)

Source: Stroitel'naya Promyshlennost', 1924, #4, p. 243.

PLATE 6



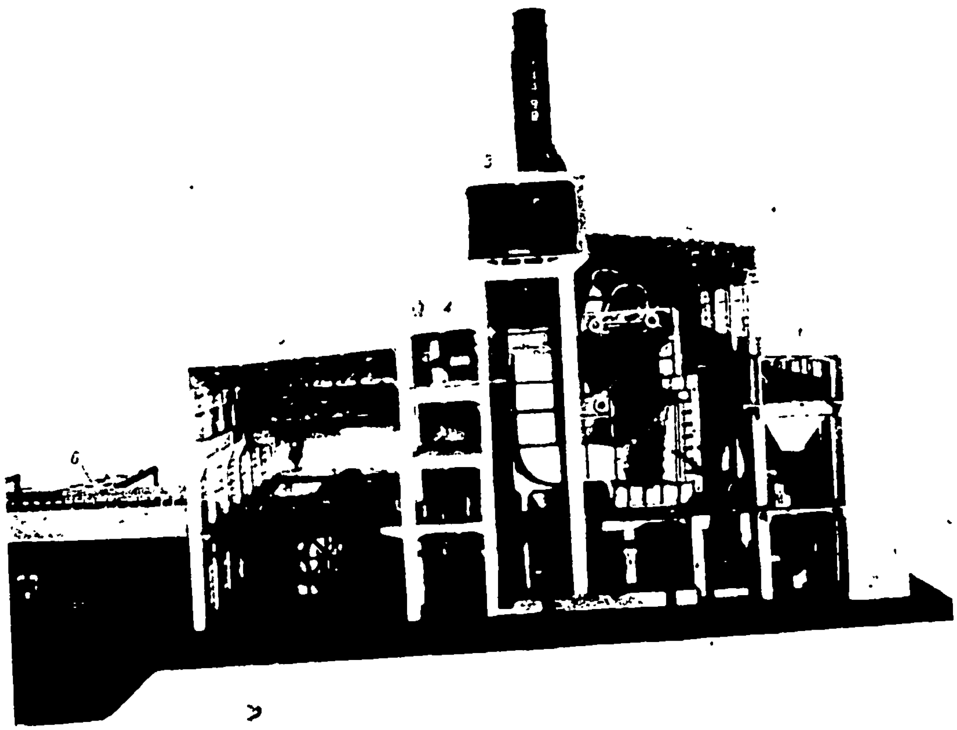
Main building, section and plan:

1 - Electric locomotive in the over-bunker gallery; 2 - Peat bunker; 3 - Peat chute to the furnace; 4 - Mechanical chain grate; 5 - Furnace; 6 - Boiler; 7 - Water economizer; 8 - Air preheater; 9 - Smoke-exhaust fan (induced draft); 10 - Stack; 11 - Forced-draft fan; 12 - Ash and cinder bunker; 13 - Turbogenerator, capacity - 24,000 kw.; 14 - Water channel and sump; circulation pumps; 15 - Drainage channel; 16 - Crane bridge; 17 - Feedwater tank; 18 - Feedwater preheaters; 19 - Boiler feedwater pumps.

IVANOVO PEAT-FIRING GRES

Source: Antipov, I. P. and S. S. Rakita. Arkhitektura elektrostantsiy, 1939, TH4581.A5.
Weitz, B. ed. Electric power development, TK85.E6 1936.

PLATE 7.

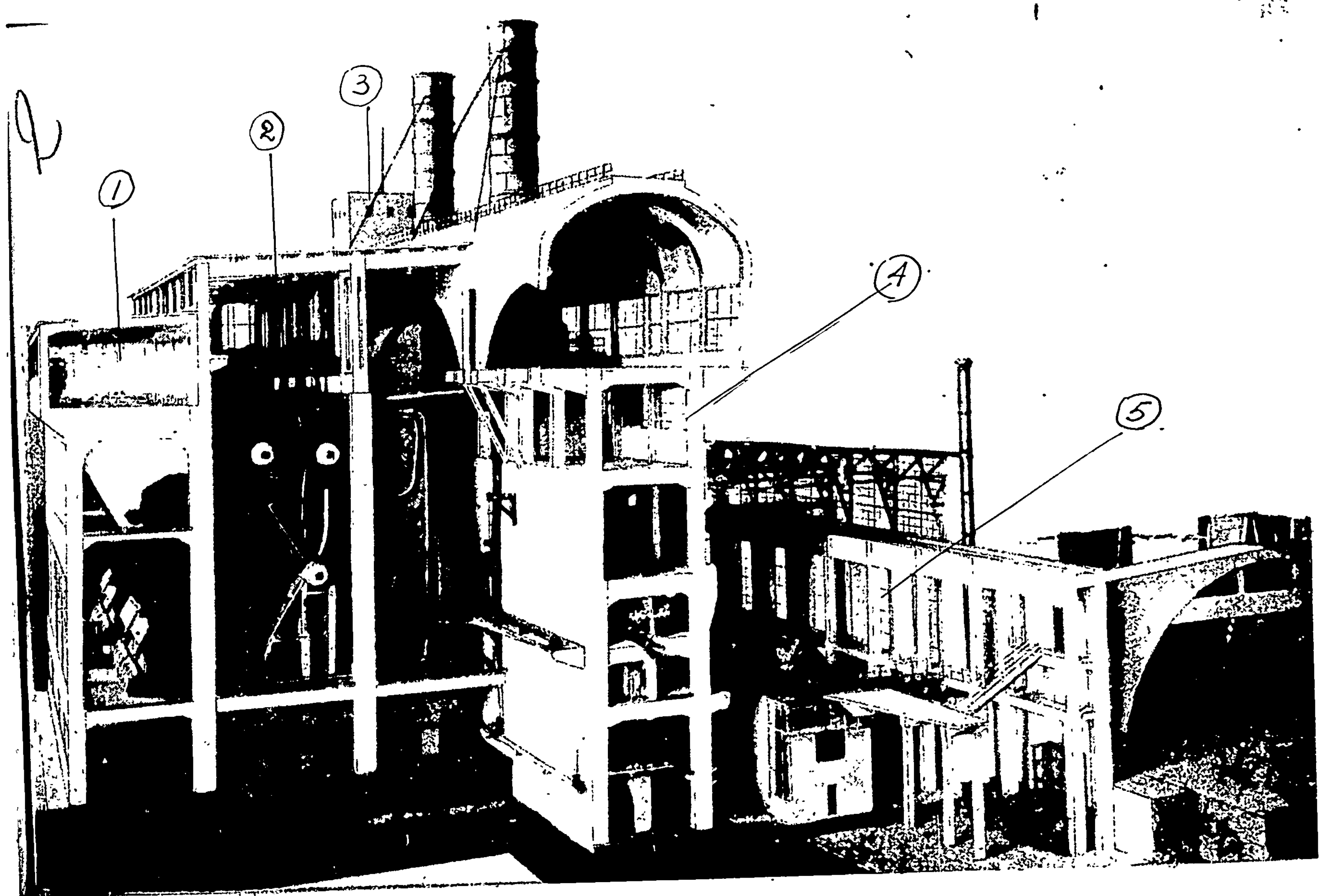


1. Bunker gallery
2. Boiler house
3. Induced draft fan gallery
4. Pump gallery
5. Turbine hall
6. Catwalk

MODEL OF A 5 x 50,000 kw. PULVERIZED-COAL-FIRING GRES.
(Section through the Main Power Plan Building.)

Source: Antipov, I. P. and S. S. Rakita, Arkhitektura Elektrostantsiy, 1939 TH.4581, A5.

PLATE 8.



1 - Bunker section with the peat pulverizing installation; 2 - Boiler house; 3 - Forced draft fans and smoke exhaust installation; 4 - Feedwater tanks, feedwater pumps, deaerators etc. bay; 5 - Turbine hall.

MODEL OF A 200,000 kw. PEAT-FIRING ELECTRIC POWER PLANT.

Source: Elektricheshiye Stantsii, 1932, No. 7, front cover TK4.E725.

PLATE 8.A.

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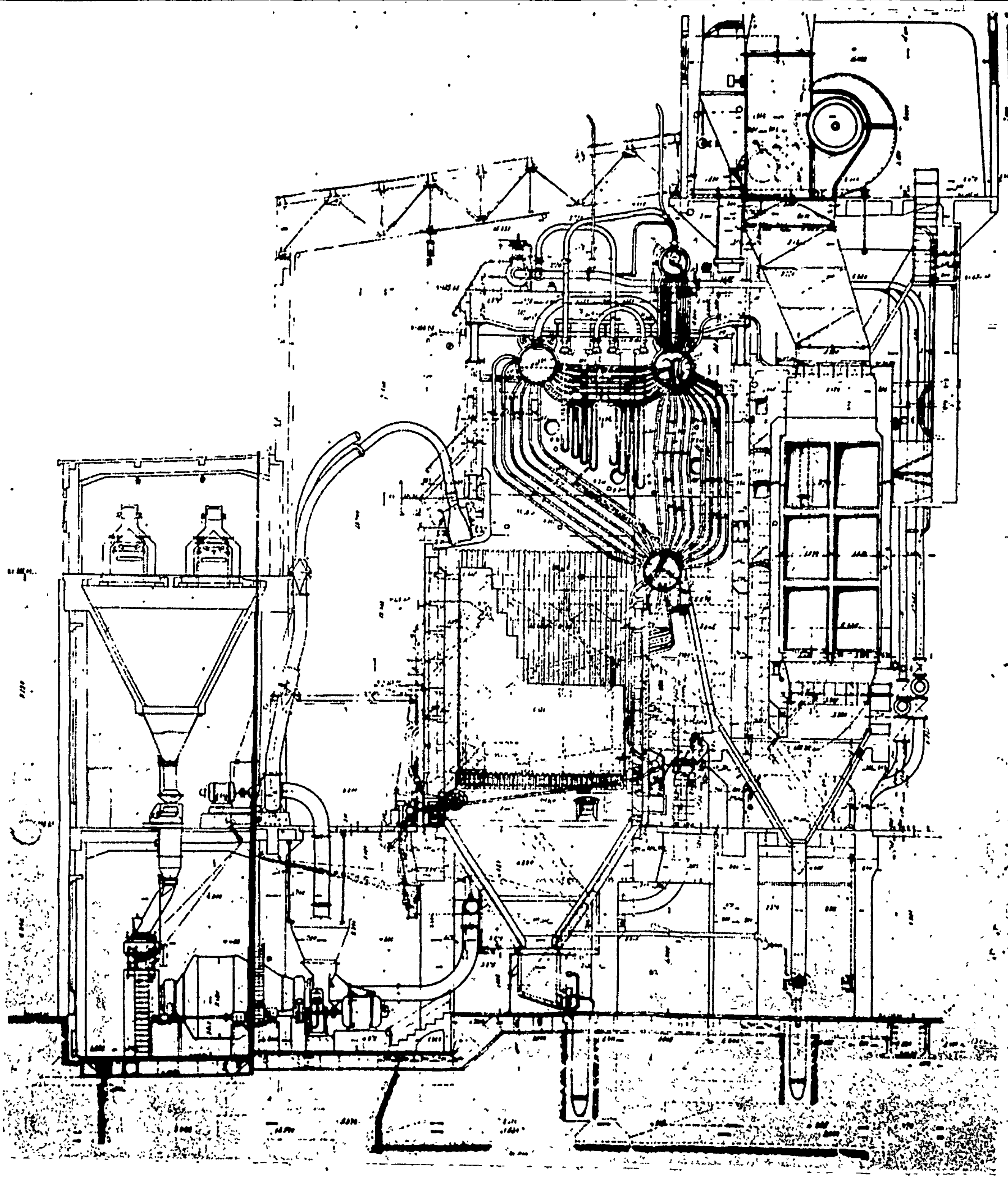
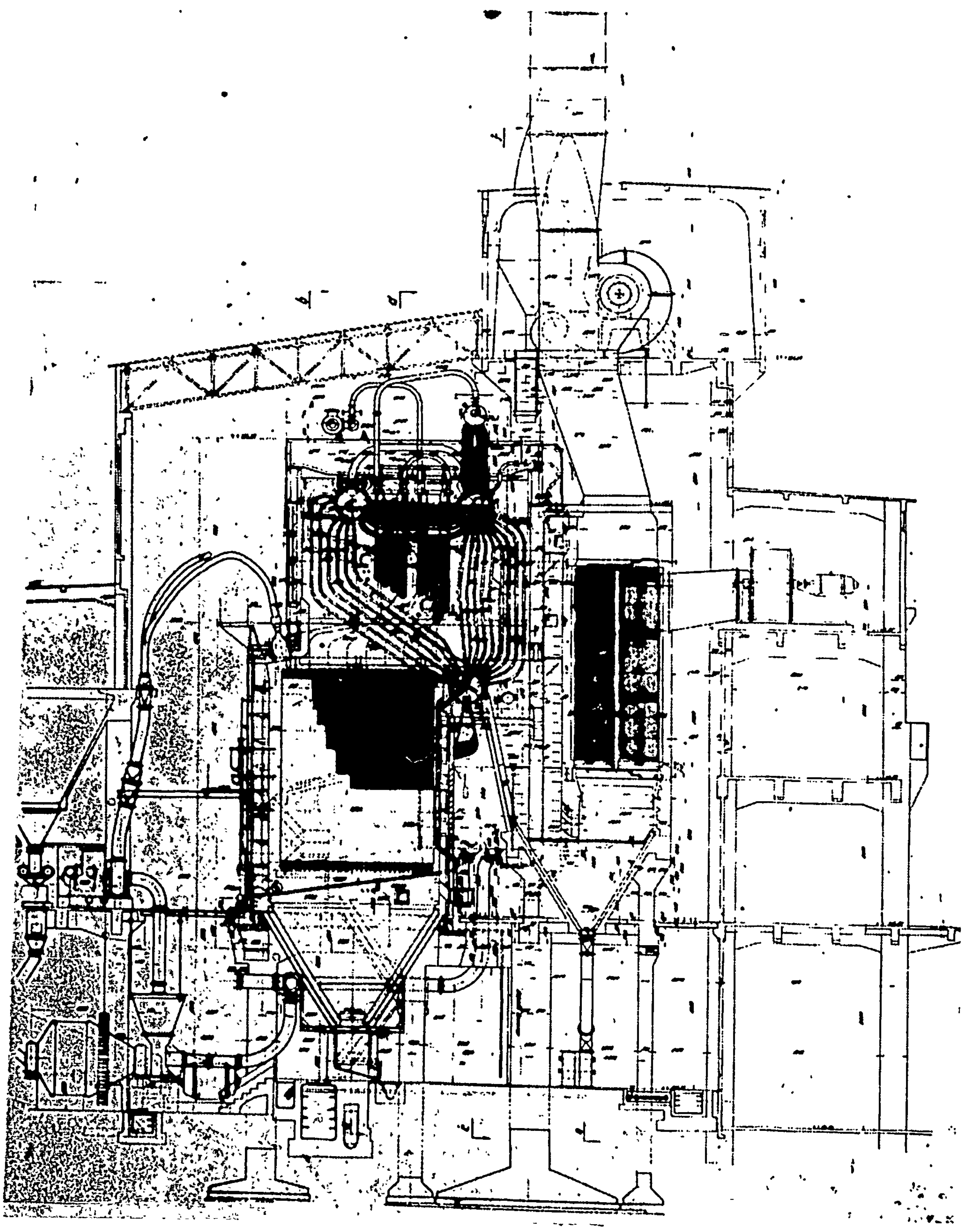


Cross section through the boiler house and the bunker gallery. The feed pump and tank section and the turbine hall are not shown - they adjoin the boiler house to the right.

ZUYEVKA 200,000 kw PULVERIZED-COAL GRES

Source: Elektroenergetika SSSR 1934 p. 68 TK 1193 R9 E4

PLATE 9.



Cross section through the boiler house and the feedwater pump and tank section. The bunker section is to the left of the boiler house and the turbine hall to the right of the feedwater pump and tank section.

ZUYEVKA 200,000 kw PULVERIZED-COAL GRES

Source: Elektroenergetika SSR 1934 p. 68, Tk 1193 R9 E4

PLATE 9A.

LEGEND: PLATE 10

1. Belt conveyers
2. Raw coal bunker
3. Automatic scales
4. Ball mills
5. Pulverized-coal injector
6. Pulverized-coal ducts
7. Pulverized-coal burners
8. Furnace chamber
9. Boiler
10. Air preheater
11. Smoke exhaust fan (induced draft fan)
12. Stack
13. Forced-draft fan
14. Cinder bunker
15. Ash bunker
16. Steam turbine, capacity 24,000 kw.
17. Boiler-feed pump
18. Feedwater tank

STALINGRAD PULVERIZED-COAL GRES

Source: Antipov, I. P. and S. S. Rakita, Arkhitektura Elektrostantsiy, 1939, TH.4581.A5
Weitz, B. Elektroenergetika SSR. v. 1, 1934, TK1193.R9E4.

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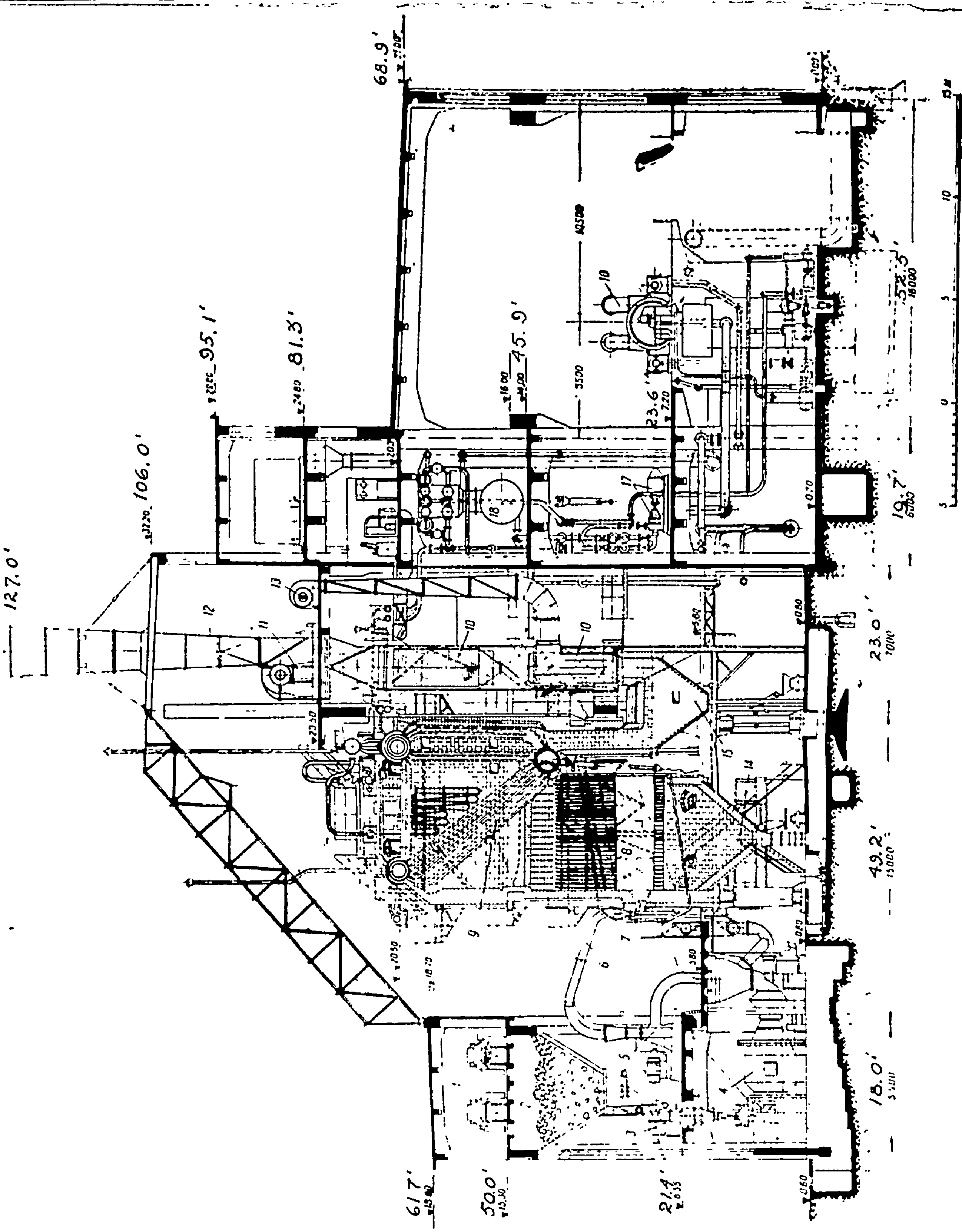
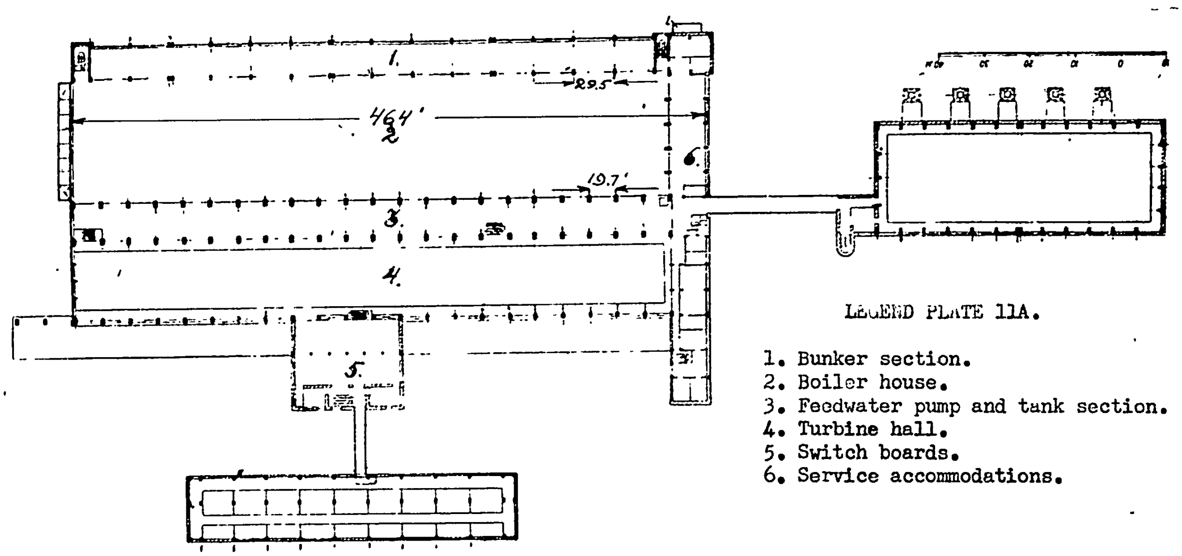


Section through the main power plant buildin. . Smoke-discharge section is part of boiler house with exhaust arrangement in upper part of structure.

STALINGRAD PULVERIZED-COAL GRES

PLATE 10.



LEGEND PLATE 11A.

1. Bunker section.
2. Boiler house.
3. Feedwater pump and tank section.
4. Turbine hall.
5. Switch boards.
6. Service accommodations.

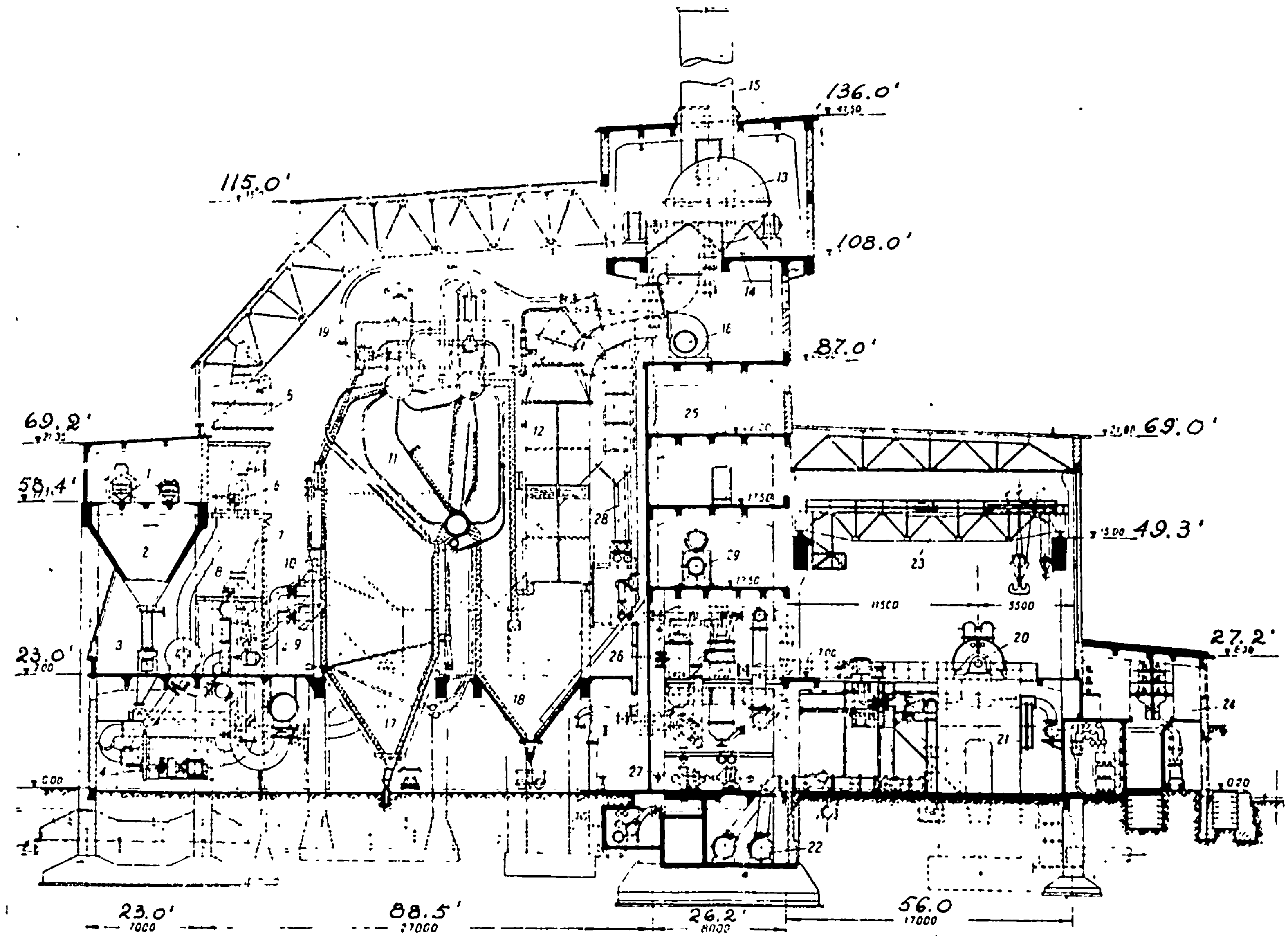
LEGEND: PLATE 11

1 - Belt conveyers; 2 - Raw coal bunker; 3 - Automatic scales; 4 - Ball mills; 5 - Dust remover conveyers; 6 - Worm dust conveyers; 7 - Pulverized-coal burners; 8 - Worm conveyer feeders; 9 - Pulverized-coal burners; 10 - Furnace; 11 - Boilers; 12 - Air preheater; 13 - Ash intercepting cyclone; 14 - Induced-draft fan; 15 - Stack; 16 - Forced-draft fan; 17 - Cinder bunker; 18 - Ash bunker; 19 - Steam line to the engine room; 20 - Steam turbine; capacity - 24,000 kw. 21 - Condenser; 22 - Water outlet lines; 23 - Crane bridge; 24 - Station distributor; 25 - Feedwater tanks; 26 - Feedwater preheaters; 27 - Boiler-feedwater pumps; 28 - Feedwater line; 29 - High pressure heaters.

KUZNETSK PULVERIZED-COAL TETs OF THE METALLURGICAL PLANT.

Source: Antipov, I. P. Arkhitektura Elektrostantsiy, 1939. p. 177. TH 4581.A5.

PLATE 11A.



Section through the main plant building.

KUZNETSK PULVERIZED-COAL HEAT-AND-POWER STATION TETs

PLATE 11.

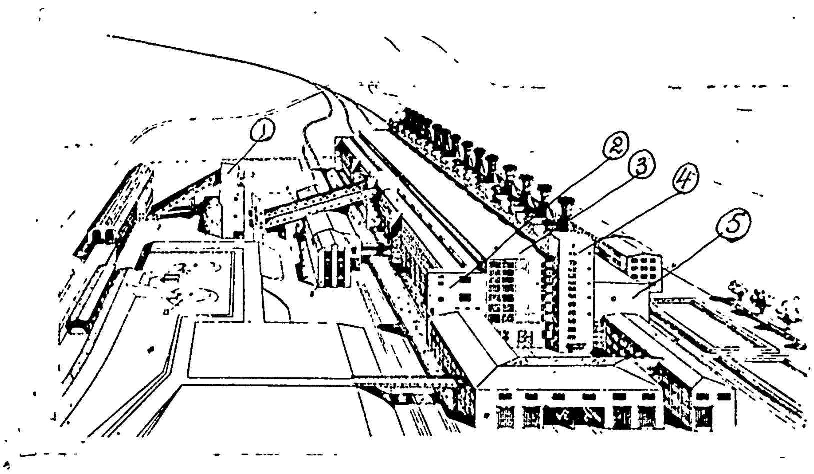


PLATE 12a: STALINOGORSK PULVERIZED-COAL GRES
General layout of the power plant building on the bunker side and coal conveying and crushing installations.

1 - Coal-crushing installation; 2 - Coal-bunker section; 3 - Boiler house; 4 - Water tank and pump section, with smoke exhausts and stacks are installed above; 5 - Turbine hall.

Source: Weitz, B., Electric Power Development in the USSR, 1936 TK85.E6, and Antipov, I. P. Arkhitektura elekrostantsiy, 1939. TH4581.A5

LENGEND: PLATE 12

6 - Ball mills; 7 - Pulverized-coal bunker; 10 - Boiler room; 11 - Boiler-feedwater pump; 12 - Switchboard; 13 - Water tanks; 15 - Induced-draft fan gallery; 18 - Steam turbine; 19 - Circulating pump; 21 - Control room; 22 - Switching and distributing installation.

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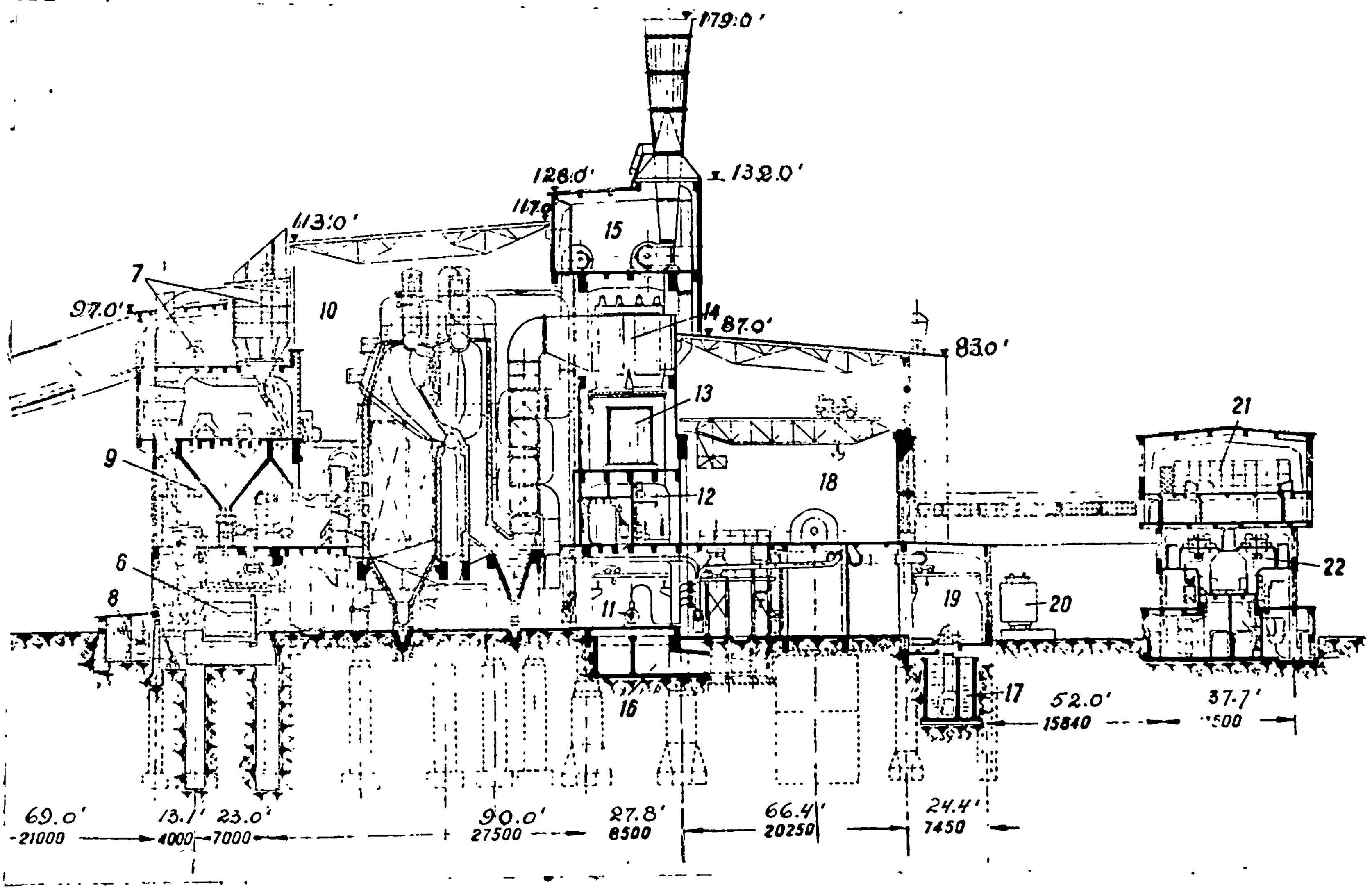

Cross section through the main power plant building.

STALINOGORSK PULVERIZED-COAL GRES

PLATE 12.

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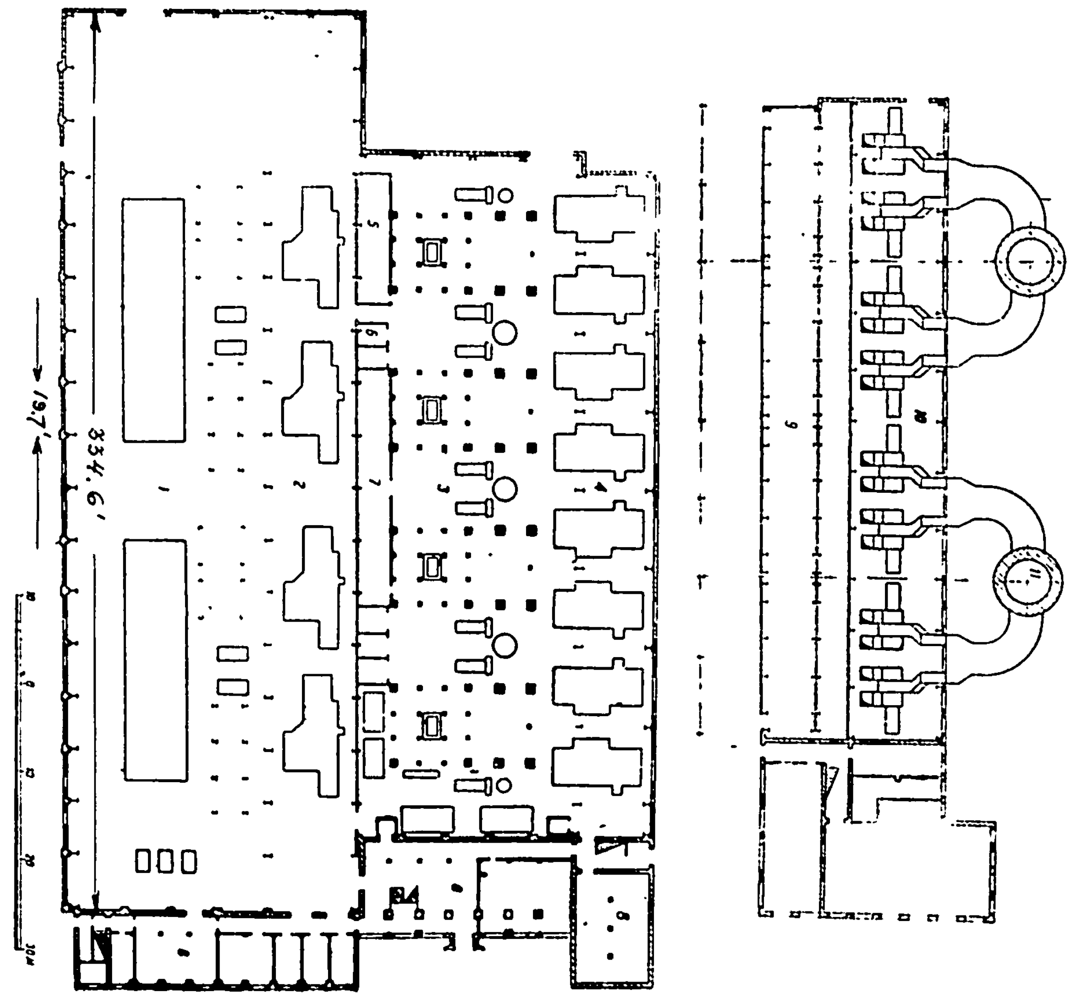
Legend To Plate 13a

1. Turbine hall
2. Feedwater-pump and tank section
3. Boiler house
4. Bunker section
5. Switchboard for lights
6. Transformers
7. Switchboard for 500 volts
8. Personnel accommodations
9. Electric filters.
10. Smoke eliminating section
11. Stacks.
12. Chemical water-cleaning installation



Plan of the first floor of the main building.

NESVETAY PULVERIZED COAL GRES.

PLATE 13A.

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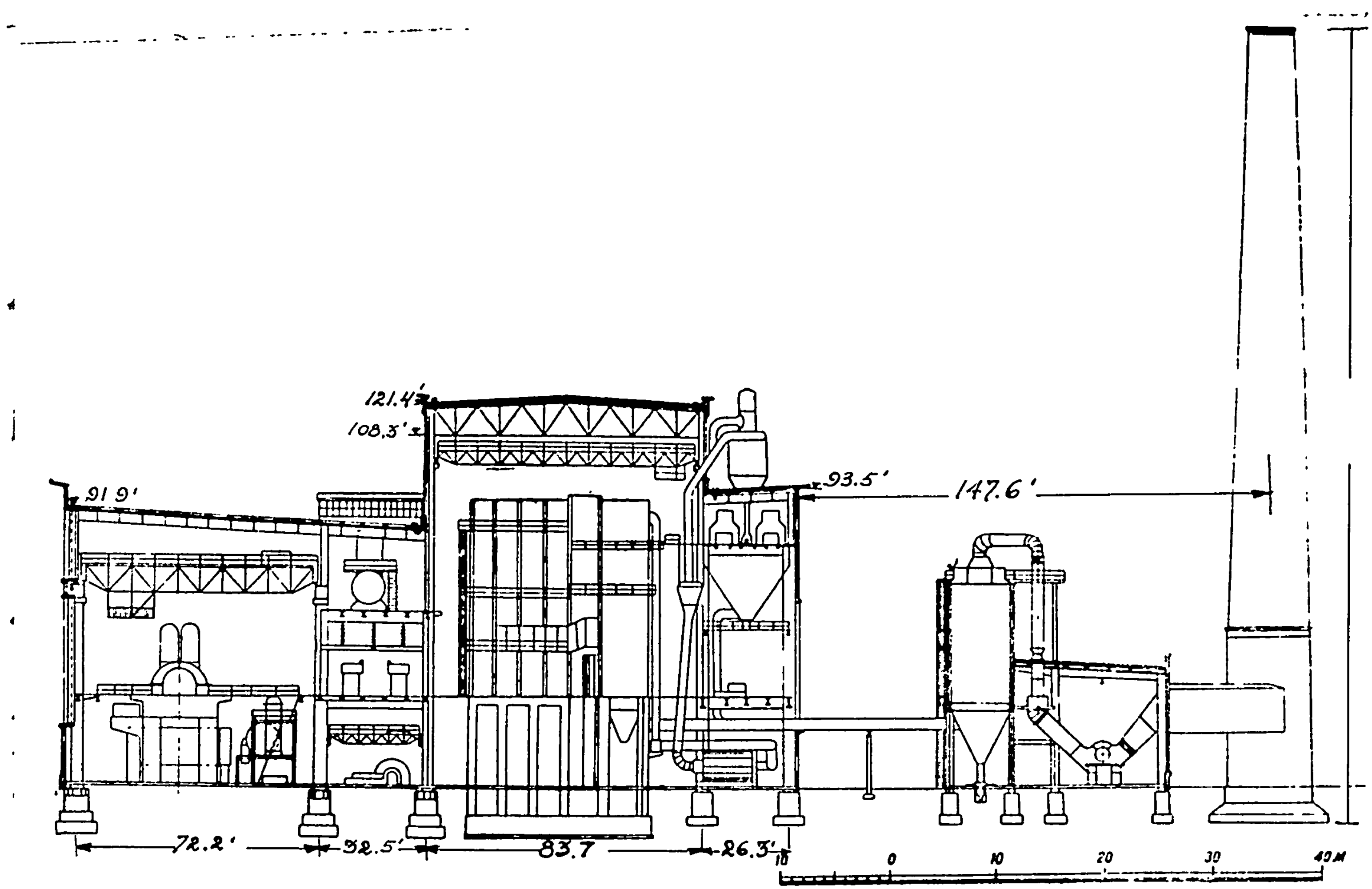

Section through the main building.

NESVETAY PULVERIZED-COAL GRES

Source: Antipov, I. P. Arkhitektura Elektrostantsiy, 1939, TH.4581.A5, and Elektricheskiye Stantsii, 1947, No. 5, TK4.E725.

PLATE 13.

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LEGEND: PLATE 14

1. Belt conveyers
2. Raw coal bunker
3. Duct
4. Automatic scales
5. Drying duct
6. Drying cyclone
7. Mills
8. Pulverized-coal separator
9. Pulverized-coal cyclone
10. Mill fan
11. Primary air fan
12. Primary air collector
13. Pulverized-coal worm conveyers
14. Pulverized-coal bunker
15. Pulverized-coal ducts
16. Pulverized-coal burners
17. Furnace chamber
18. Three-drum boiler; capacity 150-180 t./1.
19. Air heater
20. Electric filters
21. Induction fans
22. Forced-draft fans
23. Steam power and heat turbines; capacity - 25,000 kw.
24. Water heating apparatus for district heating lines
25. Deaerators
26. Feedwater tanks
27. Stations own - need switchboard

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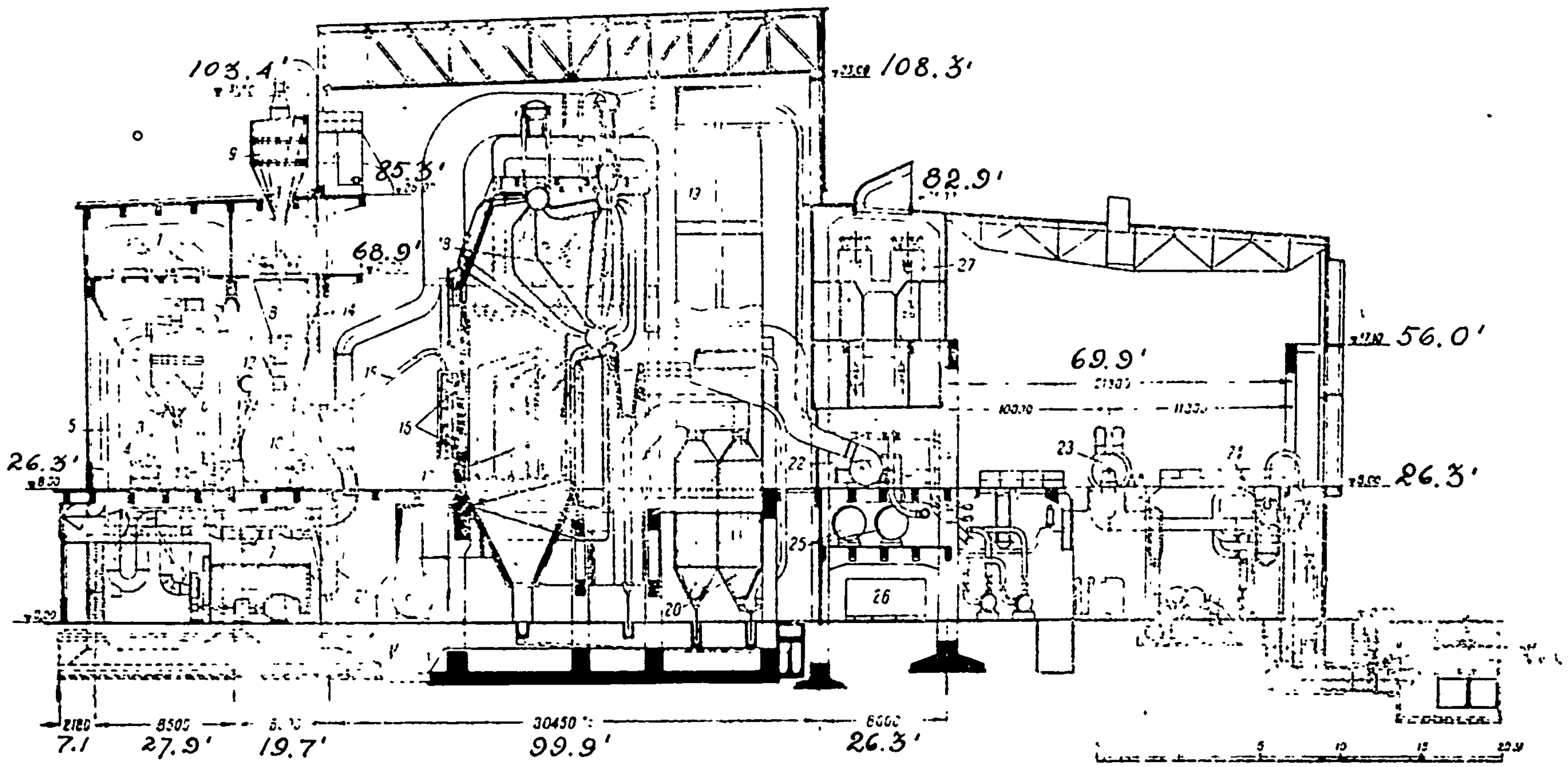

Section through the main building - Stacks located 40 m. apart from the building on side of the bunker section are not shown on the drawing.

STALINSK (MOSENERGO #11) PULVERIZED-COAL TETs IN MOSCOW

Source: Elektricheskiye Stantsii, 1947, #5 and #8, TK4.E725
Antipov, I. P. Arkhitektura Elektrostantsiy, 1939, TH4581.A5.

PLATE 14.

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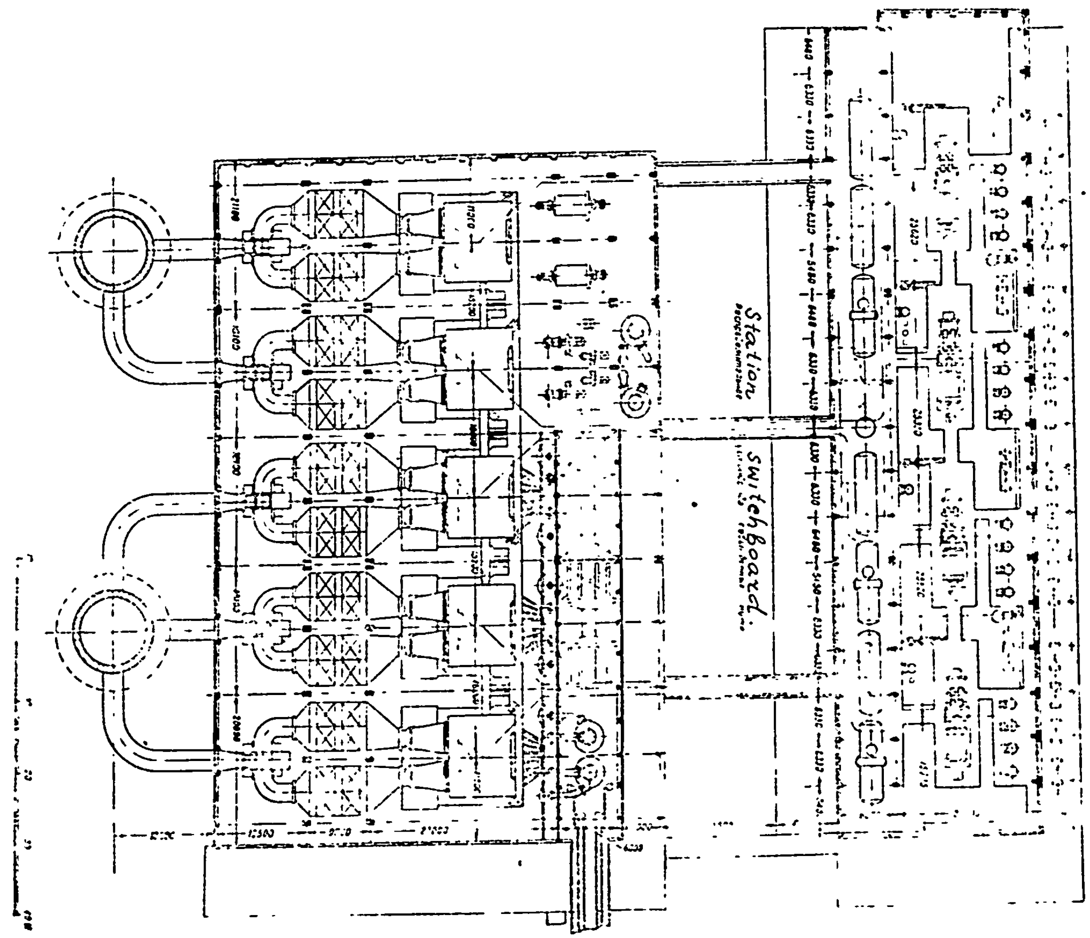
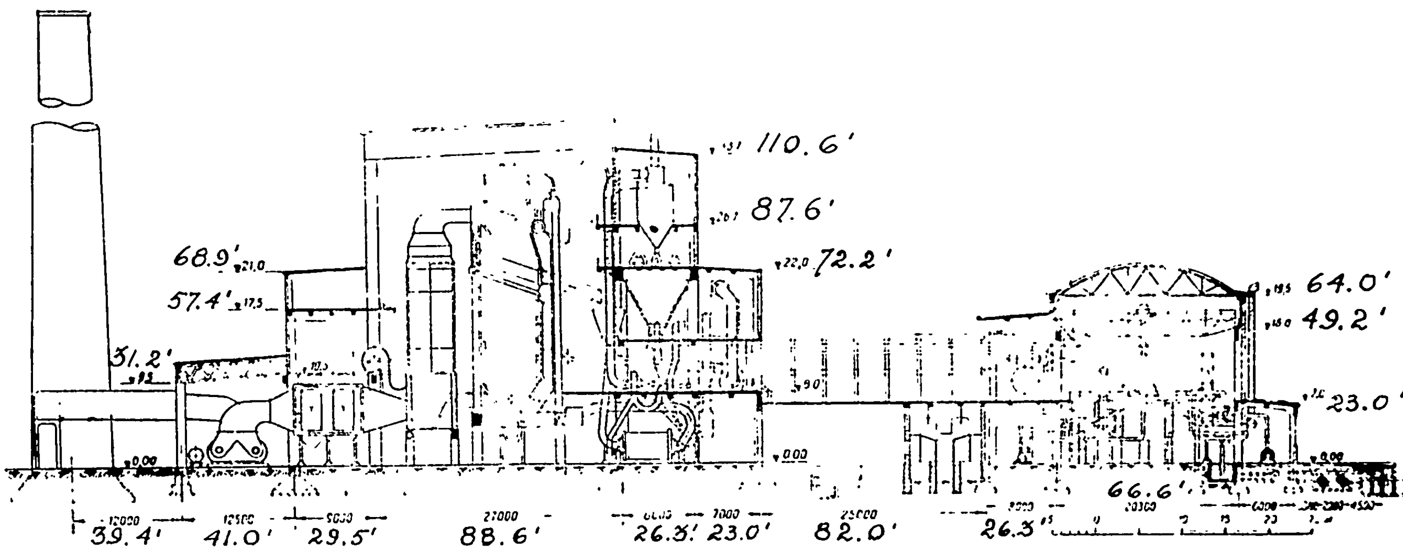


Plan of the main building of the station.

ORSK PULVERIZED-COAL TETs

Source: Weitz, b., Electric Power Development in the USSR, 1936, TK85. E6, Antipov, I. P. Arkhitektura elekrostantsiy, 1939, TH4581.A5.

PLATE 15A.



Type of "disjointed" design of station with low-set induced-draft fans and with the front of boilers facing the turbine hall.

ORSK PULVERIZED COAL TETs CROSS SECTION THROUGH THE MAIN PLANT BUILDING

Source: Weitz, B. Electric power Development in the USSR, 1936, TK.85. E6, Antipov, I. P. Arkhitektura elekrostantsiy, 1939, TH4581.A5.

PLATE 15.

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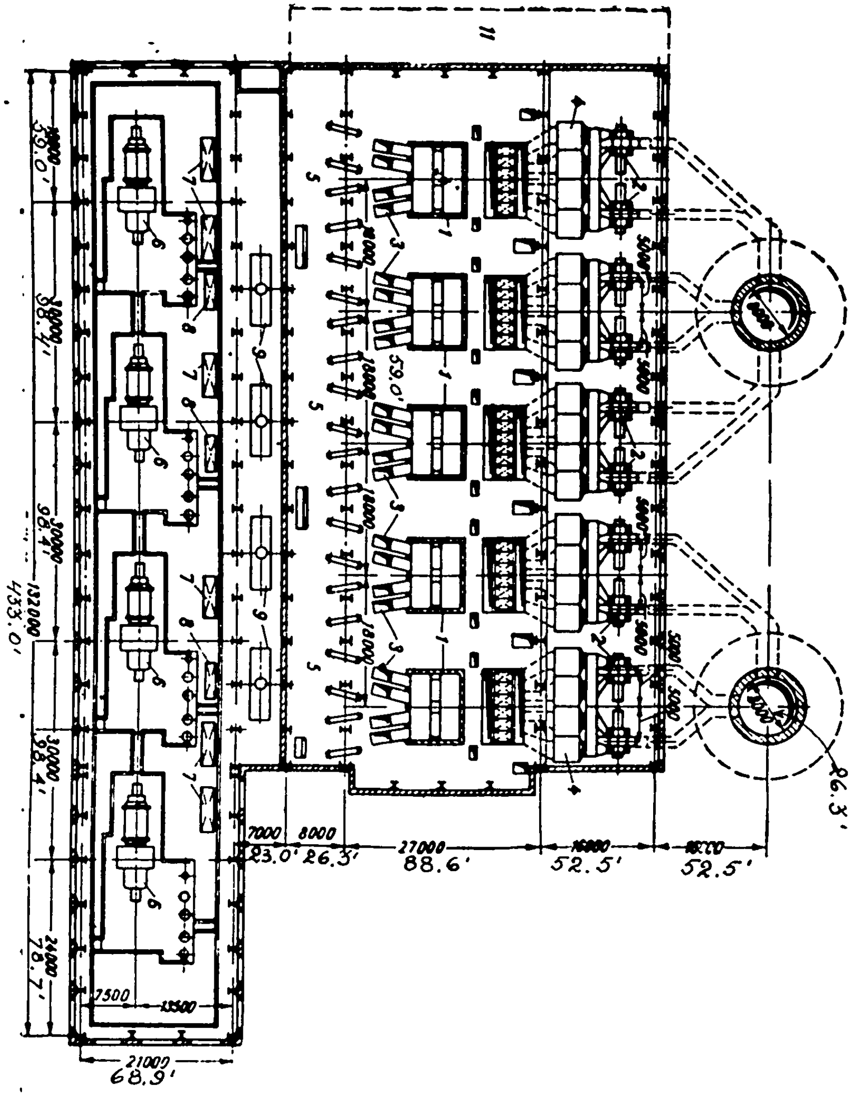

Plan of the main building.

CHEREPETS PULVERIZED-COAL HIGH PRESSURE GRES

Source: Elektrichevskiye Stantsii, 1947, No. 5, p. 11. TK4.E725.

PLATE 16A.

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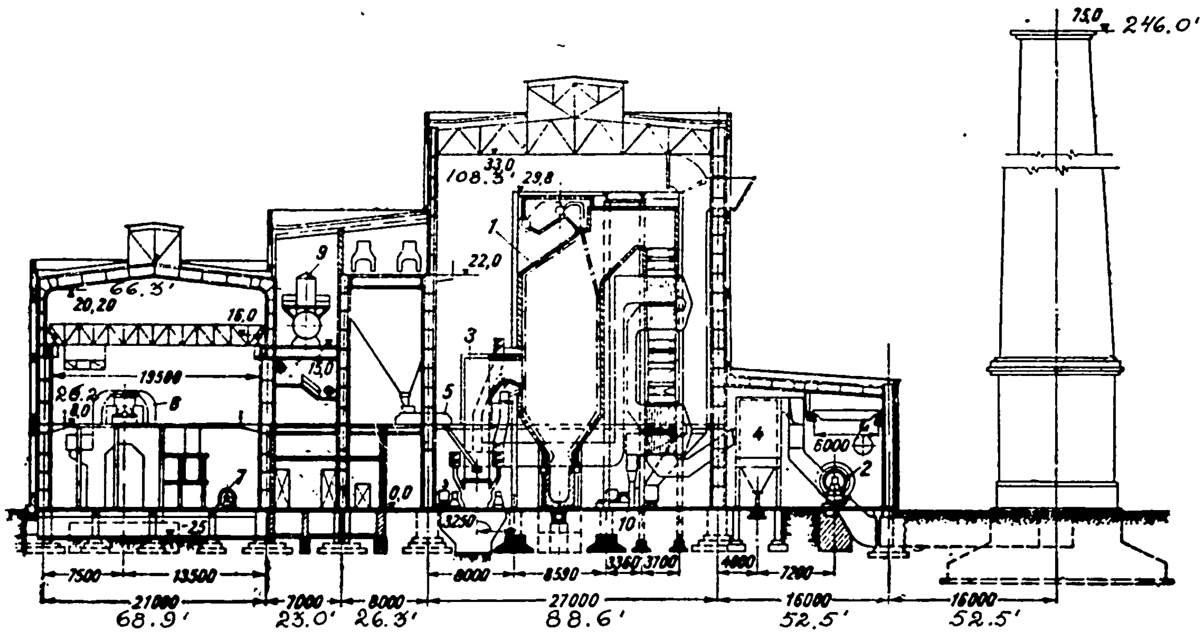

Cross section of the main building.

1 - Boiler; 2 - Induced-draft fan; 3 - Shaft mill; 4 - Cyclones; 5 - Belt feeder; 6 - Turbogenerator; 7 - Electric feed pump; 8 - Turboine-driven centrifugal feed pump; 9 - Deaerator; 10 - Forced-draft fan; 11 - Staff accommodation.

CHEREPET'S PULVERIZED-COAL HIGH-PRESSURE GRES

Source: Elektricheskiye Stantsii, 1947, No. 5, p. 11, TK4.E725.

PLATE 16.

CHAPTER II

CONSTRUCTION OF THE MAIN POWER PLANT BUILDING

1. BUILDING MATERIALS

The principal building materials used in the construction of the main power plant building and the switch house are the following:

a. Reinforced Concrete - monolithic poured-in-place (with either bar or rigid welded steel skeleton reinforcement) and precast (with bar or pre-stressed wire reinforcement). Reinforced concrete is used for frames, columns, beams, girders, floors, foundation blocks, slabs and mats, roof supporting beams, wall panels, roof covering slabs, and stacks;

b. Steel - used for frames, columns, beams, girders, roof trusses, open steel grid floorings, window sash, steel plate stacks (when the stacks are built on top of the building);

c. Brick - used for curtain walls braced to structural steel or reinforced concrete frames, also for stacks.*

d. Wood - now used very seldom in any part of the power plant building. In earlier plant construction wood was used for roof trusses (later replaced by steel trusses) and roof sheathing (later replaced by reinforced concrete slabs). At present wood is till used for roof trusses, roof sheathing, window sash, etc. in office and staff accommodation buildings.

2. A. CONSTRUCTION TREATMENTS OF THE MAIN POWER PLANT BUILDING

The construction of the main power plant building has received different kinds of treatment, depending mainly upon the time when the plant was built and the type of the plant layout.

---

* In older stations brick was used for wall-bearing construction, but now is very seldom used for the main power plant building.

Structural practice in the building of power plants has varied widely with time mainly in that the prevailing use at the outset of Soviet rule of poured-in-place reinforced concrete with bar reinforcing for the main supporting frames and elements of the building has been gradually shifting to the use of poured-in-place reinforced concrete with rigid welded steel skeleton reinforcement and precast reinforced concrete parts with reinforcement of bars and prestressed wire.

The type of the plant layout influenced its construction mainly because in the main power plant building the two-story wide-span and high-roof transverse frames of the boiler house and the turbine hall can be differently arranged with the multistory short-span frames of the bunker, smoke-eliminating and feed-water pump and tank sections, and with those different arrangements different parts of the building can serve as the principal structural supporting frames.

The first Soviet power plants (Shatura, Dubrovka, first part of the Gor'kiy plant) have special layout designs and are built in a different way from any others. The Shatura peat-firing plant (Plate 4, Fig. 2) had two and later three separate boiler houses with separate bunker sections built transversely to the turbine hall which connects them. Separate steel trestles for peat delivery are built for each boiler house. The main power plant building is therefore not one compact structure, but consists of four separate buildings (3 boiler houses and one connecting turbine hall). The buildings are constructed as separate reinforced concrete frames with brick curtain walls and steel roof trusses. The Dubrovka peat-firing power plant (Plate 5) has the turbine hall located between two boiler houses and its steel roof trusses are placed on brackets supported by the columns of the two adjoining boiler houses frames.

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These early power plant designs did not form any patterns to be followed in later built plants. The subsequent power plant layouts were of the four principal types described in Chapter One. Power plants built in the twenties and early thirties belong mostly to the First Type. In the second part of the thirties the design of the Second Type was introduced and became the prevailing pattern up to and after the war, when Type Four was designed. Type Three design did not become popular and there are few examples of this type of layout.

B. CONSTRUCTION OF THE MAIN POWER PLANT BUILDING OF THE FIRST TYPE DESIGN

The main structural features are:

Structural types: poured-in-place reinforced concrete frames or steel frames (in cases when the load-bearing capacity of the soil was low and there was danger of foundation settlement, or when the construction job had to be completed in a short period of time).

Wall coverings: brick curtain walls.

Roof construction: Steel trusses, and reinforced concrete roof beams.

Roof covering: wood sheathing boards, later changed to reinforced concrete slabs.

Floor construction: reinforced concrete slab, beam and girder construction and steel grids on steel stanchions.

Crane girders in the machine wall: steel, solid web.

Overhead bridge cranes: in the generator room.

Reinforced concrete columns of the outside wall of the generator room are built in four different ways;

1. Column of a rigid bent.
2. Stepped column.
3. Double column.
4. A-type column.

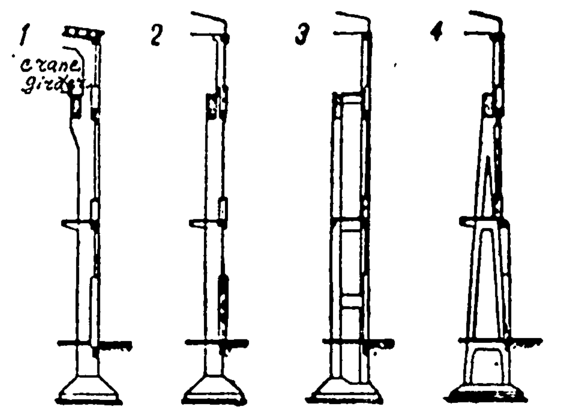

Fig. 5 - Reinforced concrete crane columns for generator room.

depending on the type of roof-supporting structures (steel trusses or reinforced concrete beams) and the load-lifting capacities of the overhead bridge cranes.

Foundations: poured-in-place reinforced concrete slab and mat footings (often on wood or concrete piling in lines or clusters) and separate monolithic reinforced concrete blocks for each boiler and each turbogenerator set. The reinforced concrete blocks for the turbogenerator sets have a special form in order to permit the installation of pipes and cables also the condenser. Typical reinforced concrete foundation block for a turbogenerator set of 50,000 kw. and 1,500 rpm. is shown on Plate 18a, Fig. 1. These foundations are set 4 m. (13 ft.) underground, and as a rule, are placed on clusters of wood or concrete piles.

Stacks: steel plate with an inside protective coating. They are placed on the roof of the main building extending 7-8 m. (23 - 26 ft.) above the roof top, 2.5 - 3.0 (8 -10 ft.) in diameter.

The Bay length: 5-6 m. (16-20 ft.) with the exception of the inner wall of the bunker section and the boiler room where the columns placed between boilers are spaced 15-18 m. (49-59 ft.)

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Frames supporting the smoke-eliminating installation

In some buildings of the first Group design the smoke-exhaust flues, induced-draft fans and stacks are placed on a special reinforced concrete frame built in the boiler house. This special frame is supported on one side by the columns of the feed pump and tank section frame and on the other side by reinforced concrete columns erected between boilers.

In other stations of this first Group the smoke discharge installations are placed directly on top of the upper floor multi-story frame of the feed pump and tank section.

Construction of some main power plant buildings of the First Group.

The Ivanovo 100,000 kw. peat-firing GRES is shown in Plate 7. The trusses of the boiler house rest on the reinforced concrete frames of the bunker section on one side and of the turbine hall on the other side. Inside the boiler house space the 3-story poured-in-place reinforced concrete frame of the feed pump and tank section is built, and on the top floor of this frame are placed the induced-draft fans and the steel stacks. In the frame for the turbine hall and feed pump and tank sections the columns are on 16.4 ft. centers; in the bunker section frame on 49.2 ft. centers. The roof of the boiler house is supported by Warren-type cambered steel trusses of 86 ft. span. In the bunker section and the turbine hall the roof is on reinforced concrete beams. The roof covering, originally of wood sheathing, was later replaced by reinforced concrete slabs covered with ruberoid. The outside walls are brick, of the curtain type.

In the Stalingrad pulverized-coal GRES (Plate 10) the smoke-eliminating installations are placed on a special monolithic reinforced concrete frame in the boiler house space; it rests on reinforced concrete columns placed between the boilers at one end and on reinforced concrete columns of the feed pump and tank section frame at the other. On top of this special frame short columns are placed, which support one end of the Warren-type parallel-chord steel roof trusses. The other ends of these rest on the reinforced concrete three-story bunker frame. The special frame for the smoke-eliminating section adjoins a 5-story reinforced concrete frame of the feed pump and tank section, which forms a part of the reinforced concrete frame of the turbine hall. The roofs of the bunker, feed pump and tank sections and the turbine hall are supported by reinforced concrete beams. The roofing is of ruberoid laid on reinforced concrete slabs.

The Zuyevka 200,000 kw. pulverized-coal GRES (Plate 9 and 9a) has a construction very similar to the Stalingrad GRES.

In the Kuznetsk pulverized-coal TETs (Plate 11 and 11a) and in the Stalinogorsk pulverized-coal GRES (Plate 12 and 12a) the smoke-eliminating section is placed directly on the monolithic reinforced multi-story frame of the feed water pump and tank section. In each plant the steel roof trusses of the boiler house are supported by the reinforced concrete frame of the bunker section at one end and by that of the feed water pump and tank section at the other. In both stations the frames of the building are of poured-in-place reinforced concrete with reinforced concrete roof beams, except in the boiler house and in the turbine hall, where the roof is supported by steel trusses. The roofing is of ruberoid laid on reinforced concrete slabs.

The construction of other power plants belonging to the First Type built in the twenties and thirties is similar to the one described above, but with some minor differences.

A postwar design of the First Type, also has main supporting frames of poured-in-place reinforced concrete, not with ordinary bar reinforcing but with welded rigid steel skeletons (see Plates 17a). This method has the advantage of eliminating the necessity of scaffoldings for the entire building to support the forms for the poured-in-place concrete; used instead are small portable forms suspended from the rigid welded steel skeleton. This rigid steel skeleton is strong enough to carry its own weight and also the weight of the suspended forms filled with fresh wet concrete. When the concrete hardens in one section, the portable forms are transferred to the next. The rigid welded steel skeleton, embedded in the poured concrete, acts as its reinforcing. On Plate 17a the two frames of the bunker and the feed-water pump and tank sections are shown. The roof trusses of the boiler house are supported by those two frames. The turbine hall, located to the left of the feed-water pump and tank section, is not shown on this diagram. Induced-draft smoke fans are placed directly on top of the feed-water pump and tank reinforced concrete frame which also supports the steel plate stack 14 m. (46 ft.) high, 4 m. (13 ft.) in diameter and weighing 26 m. tons.

The details of the load-bearing skeleton reinforcement are shown on Plate 17b. The welded steel skeleton of a column is composed of four laced angles. Supplementary reinforcing bars are placed at the outer edges

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of the section. Special supporting angles are provided for the assembly of rigid frames which consist of girders, beams and braces. The connection of column sections is made with the principal four angles and with the supplementary bar reinforcements.

C. STACKS

Main power plant buildings of the First Type design can easily be recognized as they are the only ones having stacks placed on the roof. The other three types have freestanding stacks outside the main building. Those stacks are of brick or reinforced concrete construction (Plate 19). They are located approximately 50 m. (164 ft.) from the main power house building, and are connected with it by 2-3 underground smoke flues. At the base of the stack the flues are brought to the surface and are connected with the stack shaft. The connection of the flue to the stack is reinforced with a cast iron ring 5 cm. (2 in.) thick.

At the bottom beside the flue connection two soot doors are provided. The stacks stand on reinforced concrete foundation mats supported by reinforced concrete piles. The height of stacks is determined by the fuel combustion draft requirements and also by the amount of sulphur in the smoke discharge. Some Soviet coals have a high sulphur content, and special smoke cleaning installations have been devised to eliminate injurious sulphuric gases from the smoke. Previously, without these cleaning installations, much higher stacks were needed than those built under current practice.

The brick masonry stack shown on Plate 19 Fig. 1 is 120 m. (394 ft.) high. Its foundation is a reinforced concrete mat supported by 252 reinforced

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concrete piles. Up to the 20 m. (66 ft.) level the stack is octagonal with an inside diameter of 9.95 m. (32 ft.) and an outside diameter of 13.20 m. (43 ft.). The shaft is straight vertical up to the 66 ft. level. Above 66 ft. the stack is round and conical with an outside diameter of 12 m. (39 ft.) at the bottom and 5.76 m. (18 ft.) at the top. The brick walls are 103 cm. (40 in.) thick at the bottom and gradually are reduced to a thickness of 0.38 m. (15 in.) at the top. Up to the 20 m. (66 ft.) level the shaft is lined with a fire brick lining 25 cm. (9.8 in.) thick, which is insulated from the structural brick masonry by a 10 cm. (4 in.) layer of tripoli. In the upper conical part of the shaft the fire brick lining is 12 cm. (4.8 in.) thick and the insulation tripoli layer is 5 cm. (2 in.) thick.

The monolithic reinforced concrete stack shown on Plate 19 Fig. 2 is 115 m. (377 ft.) high. It is divided into 7 sections, each section being of constant wall thickness decreasing from 1.05 m. (41.3 in.) in the bottom section to 0.8 m. (31.5 in.) in the top section. In order to protect the reinforced concrete from the corrosive effect of the sulphuric gases the stack has a fire brick lining 25 cm. (9.8 in.) thick in the first three lower sections and 12.5 cm. (4.9 in.) thick in the four upper sections. The outside diameter of the stack is 10 m. (32.8 ft.) at the base and 5 m. (16 ft.) at the top.

D. CONSTRUCTION OF THE MAIN POWER PLANT BUILDING OF THE SECOND TYPE DESIGN

Structurally the most important difference between the First and the Second Type design is the removal from the boiler house of the smoke-eliminating installations. The boiler house is located between the bunker section on one side and the feedwater pump and tank section on

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the other. These two multistory short-span frames and the outside wall of the turbine hall constitute the main load-bearing elements of the building. The columns of the bunker and of the feedwater pump sections adjacent to the boiler house have stepped extensions which support the roof trusses of the boiler house. The smoke flues at the back of boilers are laid on the ground floor of the bunker section, where the smoke-cleaning cyclones and induced-draft fans are also installed; sometimes they are placed outside the main building in a special small annex building which stands between the main building and the freestanding stacks.

Main structural features of the main building of the Second Type design are similar to those of the First Type design with some changes:

Structural type: reinforced concrete frames are built mostly of pre-cast structural members or complete structural parts of the frame. After the War, in 1946, a new method for reinforced concrete frames was designed by the Teploelektroproyekt, namely monolithic reinforced concrete frames with rigid load-bearing welded steel skeletons as reinforcement. This method was also applied to some power plant buildings of the First Type design built after the War.

Plates 20A - 20E show the details of this kind of construction. The steel welded skeletons are prefabricated in sections of one or a group of structural members, forming a part of the frame. Those prefabricated parts weighing 3 to 5 m. tons (depending on the lifting capacity of the assembly crane), with wood or steel forms attached to them are then lifted and welded to each other in the process of building erection, and the concrete is poured into these forms. Sometimes the monolithic parts are combined with some precast structural members as shown on Plate 20E fig. 8. Besides reinforced concrete frames steel frames are also used. (see Plate 21a).

(See Plate 21). The main steel frames are shown in Fig. 1 with the section of principal structural members. Figs. 2 and 3 give two different treatments of principal frame connections, the rigid-frame type (Fig. 2) and the later type with hinged frame connections (Fig. 3).

At present (1957) the construction design of steel frames is based on the following principles:

1. The transverse combined frame is composed of main supporting rigid frames and adjoining hinged structural members.

2. The number of rigid joints is kept at a minimum and they are executed in the form of connections between columns and trussed cross girders.

3. The transfer of transverse stresses in joint connections is accomplished through supporting plates and the connection between continuous girders and columns is made by flange joints.

4. The solid web column and continuous girder sections are made in I-form composed of three built-up plates.

Wall coverings: brick curtain walls for the turbine hall outside wall are 51 cm. (20 in.) thick; for the bunker section outside wall, 38 cm. (15 in.) thick.

Roof construction: steel trusses and reinforced concrete beams.

Roof covering: reinforced concrete slabs.

Roofing: ruberoid or corrugated steel sheets. (when roof supporting construction is of steel trusses with steel purlins.).

Floor construction: reinforced concrete slab, beam and girder construction and steel grids on steel stanchions.

Overhead bridge cranes: in the turbine hall and often in the boiler house.

Crane girders: steel.

Reinforced concrete columns: for the outside wall of the turbine hall - as in First Type design (see p. 39).

Foundations: the separate poured-in-place reinforced concrete foundation footings for each piece of auxiliary machinery has been replaced by a monolithic reinforced concrete basement floor mat on which all auxiliary machinery equipment and cables are laid. (See Plates 18B and 18C.) Separate poured-in-place reinforced concrete footings were still used for each column and for each boiler, and special reinforced concrete blocks, placed 4 m. (13 ft.) underground for each turbogenerator unit (see Plate 18A). In monolithic construction with rigid steel welded skeleton reinforcement the embedment of the column in its foundation footings is shown on Plate 20D, Fig. 5.

Stacks: are built outside the building as described above under C.

Examples of the Second Type design construction are: the power plants in Nesvetay (Plates 13 and 13A) with separate building for the smoke--eliminating section; and in Moscow, the Stalinsk TETs (Plate 14), where the smoke-eliminating installations (electric cyclone filters and induced--draft fans) are placed on the ground floor of the boiler house. The Nesvetay main power plant building, built in 1936-38, has steel frames, one for the bunker section, the other a combined transverse two-aisle frame for the feed-water pump section and the turbine hall with continoous two-span transverse girders. The steel roof trusses of the boiler house are supported by the stepped columns of the bunker section and of the feed-water pump section. The transverse frames of the machine hall and feed-water pump section are on 6 m. (20 ft.) centers and of the bunker section on 9 m. (30 ft.) centers. The smoke-eliminating section annex has transverse steel bents. The boiler house and the machine hall are equipped with overhead bridge cranes. The Kurakhovka GRES (47° 59' N, 37° 19' E) is similar to the power plant in Nesvetay.

The Stalinsk TETs in Moscow has reinforced concrete frames partly of precast structural members. The roof trusses in the turbine hall and the boiler house are of steel; the bunker and the feed-water pump sections have reinforced concrete roof beams. The boiler house has no overhead bridge crane. Of interest are the foundations of the boiler house, built as one monolithic reinforced concrete mat.

E. CONSTRUCTION OF THE MAIN POWER PLANT BUILDING OF THE THIRD TYPE DESIGN

Structurally the main difference between the Second and the Third Type design is the "disjointing" of the main power plant building into two separate buildings. One contains the boiler house, placed between the bunker section on one side and the smoke-eliminating section on the other. The other building contains the feedwater pump and tank section and the turbine hall; it is connected with the first building by an 80-100 ft. long gallery housing the switching installations. The main structural features do not differ from those described for the Second Type design. This type of construction has not been widely used, as it proved more expensive and required a wider area than other types. An example of this type if the Orsk TETs (plates 15 and 15A), built as reinforced concrete frames with reinforced concrete roof beams.

F. CONSTRUCTION OF THE MAIN POWER PLANT BUILDING OF THE FOURTH TYPE DESIGN

This type is the latest in Soviet power plant construction. It was designed by the Institut Teploelektroproyekt in 1947. At that time also new regulations were issued under the title "Principle Regulations Governing the Design of Electric Power Plants, Substations, and Heat and Power Distributing Systems." Main articles of these regulations relating specifically to the structural part of the main power plant building construction are annexed at the end of this chapter.

The Fourth Type design has been prevalent since 1950, in the Fifth and Sixth Piatiletkas; some power plants of the Second Type design, however, are still being built. The layout of the Fourth Type design is shown on p. 12. The main structural features are similar to those of the Second Type design (see p. 45).

The Fourth Type layout has been designed in steel, in monolithic reinforced concrete with rigid welded steel skeleton reinforcement and in precast reinforced concrete with some prestressed-wire-reinforced structural members.

The steel frame construction is shown on Plates 22A and 22B. The transverse frames of the building are on Fig. 1 with the main structural members given. (Allowable steel stresses 1400 kg/cm^2 - 19,900 lb/in^2). Figure 2 shows the boiler house and the turbine hall as rigid steel frames. The steel columns between the bunker and the feed water pump section are connected with those two frames by hinged structural members. All steel columns are rigidly connected with their foundation footings. The weight of steel required by this design is given in the table on Plate 22B. Plate 22C shows the details of the principal joints.

Another design of the Fourth Type in steel is shown on Plates 23A and 23B. Here two alternatives are considered. In the first scheme the combined frame of the bunker and feedwater pump sections is made the

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principal rigid supporting element of the whole building, with the two outside walls of the turbine hall and the boiler room attached to this central frame by hinged structural members.

In the second scheme the two other frames of the building, namely of the boiler house and of the turbine hall are made rigid; they are connected by hinged structural members to form the middle frame of the bunker and the feed-water pump section. The second scheme is considered more advantageous and easier in assembly, having a smaller number of rigid joints.

The construction of the Fourth Type in monolithic reinforced concrete with rigid welded steel skeleton reinforcement is shown on Plates 24A and 24B. The transverse frames of the building are shown on Fig. 1.

For this medium-size power plant the weight of equipment on one square meter of floor space is calculated to be 1 m. ton (20.48 lb./ft^2). The floor heights are 12-18 m. (39-59 ft.). The load on a column in the lower floor sections is calculated to be 400-600 m. tons.

The combined two-aisle multistory frame of the bunker and feed-water pump sections is built as a monolithic reinforced concrete frame with rigid welded steel skeleton reinforcement. It consists of a lattice of steel angles and round bars welded together. The frame of the outside wall of the turbine hall is of reinforced concrete. The frame of the boiler house (except the inside wall up to the 25 m. (82 ft.) level) with the upper floor of the bunker section, and the structural members supporting the roofs of the turbine hall and boiler house are of steel.

The inter-story floors in the bunker and the feed-water pump sections are of beam-and-slab monolithic reinforced concrete construction.

Details of the steel skeleton reinforcement of the monolithic reinforced concrete frame of the bunker and the feed-water pump sections are shown on Plates 24A and 24B. In the process of construction the rigid welded steel skeleton supports only its own weight and the weight of forms which are attached to it and filled with poured-in-place wet concrete for the height of one story.

When the building is finished the frame members must carry the complete dead load of the building and also of the equipment. This combined load is much greater than that during construction: for girders and beams 2-3 times greater, for columns in lower story sections 8-10 times greater. Thus the original rigid welded steel skeleton is not sufficient, as the final reinforcement and additional reinforcing steel round bars must be added. The steel skeleton is mounted in prefabricated sections of steel members for one floor together with attached wood or steel forms as shown on Fig. 7.

All columns are rigidly embedded in their reinforced concrete stepped footings. The erection of the rigid steel skeleton for the bunker section is shown on Plate 24B, Fig. 8.

In 1956 the Institut Teploelektroproyekt designed a uniform construction scheme of the main power plant building of the Fourth Type layout in precast reinforced concrete. (Plates 25A - 25D)

On Plate 25A, Fig. 1 the cross-section through the building is shown with the transverse precast reinforced concrete frames, and sections of their principal structural members. The suggested dimensions of the plant make it possible to install turbogenerators of various capacities (25,000, 50,000 and 100,000 kw.) and boilers of 160 to 220 t./hr. steam producing capacities without changing the aisle span or the bay length of the structural frames. In case some additional units should be installed the building need only be extended lengthwise.

According to this design a TETs of 150,000 kw. capacity will have 26 bays each 6 m. (19.7 ft.) long making the total length of the building 156 m. (512 ft.). The two-aisle multistory rigid frame - Plate 25a, fig. 1 (rows B, C, D) of the bunker and feed water pump sections ensure the transverse stability of the building. The outside columns of the turbine hall (row A) and of the boiler house (row E) are connected to the central rigid frame by hinged roof beams. The longitudinal stability of the building is ensured by longitudinal girders connecting the transverse frames and columns in the outside rows. All the elements of the building superstructure (columns, girders, beams, floor and roof panels) are of precast reinforced concrete. Wall coverings are of reinforced foam concrete panels.

For columns, concrete "300" is used (with a compressive strength of 300 kg./cm^2 = 426 lb./in^2); for all other members concrete "200" is used (with a compressive strength of 200 kg./cm^2 = 284 lb./in^2.)

The cross sections of the columns have a uniform width of 0.6 m. (24 in.) and depths of 2, 1, 0.8 and 0.6 m. (78, 39, 31 and 24 in.).

For the inter-story floor covering a uniform type of panel is selected (Fig. 2). These panels have two longitudinal and five transverse ribs. The panels are 5.35, 5.55, 5.65, 5.97 m. (17.6, 18.2, 18.6, 19.6 ft.) long and 1.49 m. (4.9 ft.) wide. Rebates 60 x 70 mm. (2.36 x 2.76 in.) are provided along the longitudinal ribs of the panels for setting flat cover plates for floor openings. The openings between panels are obtained by moving apart the panels for the necessary distance.

The bunkers are designed in the form of two longitudinal partitions made up of precast reinforced concrete ribbed panels which are supported by beams resting on the cross girders of the frame. The transverse partition walls of the bunker also serve as cross-girders of the bunker section frame; on them rest the floor panels at floor level 23.00 m. (76 ft.). The bunker feed hoppers are of steel.

The roof beams of the turbine hall (span 27 m. = 88.6 ft.) of the boiler house (span 24 m. = 78.7 ft.) are of precast reinforced concrete with pre-stressed wire reinforcement. They support large reinforced concrete roof panels.

The precast structural elements are fabricated in sections weighing not more than 15 m. tons. At the building site the prefabricated sections of the columns are joined together to form sections weighing up to 40 m. tons, if they are to be assembled in places where the crane beam can lift such a load. Thus most columns are erected completely assembled, with the exception of the outside wall of the boiler house, where the assembly jib crane beam is most extended and can lift only shorter sections, which must be connected in the process of erection.

The column sections are connected on the ground by welding the protruding bars of their reinforcement and then pouring concrete over the joint to make it monolithic (Fig. 3). The connection of column sections in the process of erection (field joints) along row D is accomplished by welding the reinforcing bars of these sections, but without pouring concrete over the joint, because of the considerable height at which the work must be done (Fig. 4). These joints are provided with central steel plates for better transfer of vertical forces, and with steel side plates welded to steel hoops, to fasten the two connecting column elements so as to withstand any bending moment which might occur in the column joint (Fig. 4). The ends of column elements to be connected are reinforced with steel mesh which increases the strength of the concrete in the area of local compression. To align the two connecting column elements assembly bolts are provided. After adjustment, the side plates are welded and the assembly bolts and supporting angles are cut off. Then the joint is cemented. Such a column joint can withstand a vertical force of 250 m. tons and a moment of 200 ton-meters (1400 ft. kips). When the building has a basement and a floor above it at gound level 0.0 the joint of the column with the foundation is formed by embedding the column in a recess in the foundation footing (Fig. 5); the floor cover then rests on the top edge of the foundation footing.

To ensure the transfer of vertical loads to the foundation footing, the end of the column is provided with a pin, thus providing for filling the space under the base of the column with concrete.

The column is adjusted and fixed by means of wedges. The foundation recess is provided with an opening for cleaning and flushing. The vertical force transferred by such a column joint can reach 600 m. tons and the bending moment 50 m. ton meters (360 ft. kips).

When the building has no basement and no floor at gound level 0.0, the joint of the column with the foundation is formed by welding the projecting reinforcing bars of the foundation and the column (Fig. 6). While the column is being set up the vertical load is transferred through a steel pipe. The bending moments can be transferred by the reinforcing bars only after welding. The welding of the four corner reinforcing bars ensures the necessary stability to the column in the process of erection. After all reinforcing bars are welded and the joint poured with concrete, all the live load is transferred from the column to the foundation.

The joint of a cross girder with a column shown on fig. 7 is formed by welding the projecting upper and lower reinforcing bars of the two members with the aid of steel insertion rods. Welding is done by the submerged-arc method. Concrete is then poured into the joint to make it monolithic, in order to provide compressive strength. Wall coverings are of reinforced foam concrete panels (see fig. 8). On the outside the panels are covered with a 35 mm. (1.4 in.) rough-finished layer of heavy concrete "200". The foam concrete is of the mark 75 (with a compressive strength of 75 kg./cm^2 = 1066 lb./in^2.) and a volume weight of 900 kg./m^3 = 55 lb./ft^3.

The fastening of panels to the columns is flexible, with bolts, so that the panel load is not transmitted to the columns. The substructure of the main power plant building is usually built in the form of a great number of separate foundation slabs for various units of equipment, tunnels, channels, etc. placed at different levels. In this project, one basement floor is designed, under the turbine hall, bunker, and feed water pump sections (see plates 18B and 18C). Foundations for auxiliary equipment are placed in the basement at level 0.0. The basement floor is of flat precast reinforced concrete slabs with prestressed wire reinforcement 3 m. x 3 m. (10 ft. x 10 ft.) and 0.25 m. (10 in.) thick. The slabs rest at their corners on precast reinforced concrete columns with caps. This construction has the necessary height to accomodate all the auxiliary equipment.

Column foundation footings, supporting walls, and other structural elements in the substructure are of prestressed reinforced concrete. The foundation slab under the building, and the foundations blocks under the turbogenerator and boiler are of monolithic reinforced concrete. In special cases when ground water is high, the basement floor is placed on a continuous monolithic ribbed reinforced concrete mat. The amount of reinforced concrete necessary for the new-design of basement floor is 1.2 m^3/m^2 (0.146 yd^3/ft^2) of

TABLE I

LIST OF PRECAST REINFORCED CONCRETE STRUCTURAL MEMBERS OF THE MAIN POWER PLANT BUILDING UNIFIED FOURTH TYPE LAYOUT DESIGN OF A TETS 150,000 KW CAPACITY.

Name of the structural member	Number of sizes of each type	Weight of each structural member m. tons	Number of units	Volume of re-inforced concrete m^3	Volume of re-inforced concrete yd^3
A. Superstructure	~~24~~	~~3.5 - 15.6~~	~~549~~	~~2,400~~	~~3,110~~
Columns	24	3.5 - 15.6	549	2,400	3,110
Cross girders	13	6.5 - 10.3	228	778	1,010
Roof supporting beams	2	17.5 - 21.0	60	462	600
Floor beams	6	0.5 - 3.4	721	540	700
Floor and roof panels	2	114 - 2.6	1943	1,579	2,020
Bunker members	5	1.1 - 6.2	360	5566	740
Various members (flat panels monitors etc.)	-	———	—	375	490
Total				6,700	8,700
B. Substructure					
Column foundation footings and shoes	9	2.0 - 14.5	270	1,174	1,520
Columns	3	1.0 - 3.0	480	428	560
Concrete blocks	4	0.4 - 1.2	922	434	565
Supporting walls	1	1.7	86	146	190
Flat slabs and panels for floors and ceilings	6	0.07 - 5.6	1,046	1,138	1,480
Beams, ducts, passage tunnels cable support blocks	8	0.07 - 1.8	1,414	213	277
Various elements	-	-	-	87	117
Total				3,620	4,720
C. Reinforced foam concrete wall panels	21	0.31 - 2.3	1,930	2,480	3,230

Source: Stroitel'naya Promyshlennost', 1956, No. 6, page 24, 57 floor space as compared to the required volume of 1.35 m^3/m^2 (0.164 yd^3/ft^2) of reinforced concrete for the previous method of separate foundations for auxiliary equipment.

The list of precast reinforced concrete structural members for the construction of the main power plant building is given on table 1.

The total volume of reinforced concrete for the superstructure of the main building amounts to 7100 m^3 (250,000 ft^3) of which 95% or 6700 m^3 (236,000 ft^3) consists of precast members.

In the substructure (together with the foundations for the turbo-generators) the total volume of reinforced concrete amounts to 15,020 m^3 (530,000 ft^3), of which 24% or 3620 m^3 (128,000 ft^3) consists of precast members. The monolithic reinforced concrete in the substructure is used for the continuous foundation mat and for foundation blocks for the turbo-generators and boilers.

A photo showing a main power plant building in erection according to the above design is shown on Plate 25, fig. 9.

The latest regulations, issued in 1947, concerning the design of thermal power plants recommend instead of a building frame entirely in reinforced concrete (Plate 25e, fig. 2) a mixed type construction for the main building, (Plate 25e, fig. 1). The recommended scheme consists of precast reinforced concrete for the main structural frame and for its heavily loaded members and steel for lightly loaded members; for members placed at high levels, such as the upper part of the turbine hall wall above the crane girder, the upper floor frame of the bunker and feed water pump sections, the upper parts of the boiler house inside wall above the roof of the bunker section; and for crane girders.

TABLE 2

1947 STANDARD MIXED-TYPE CONSTRUCTION

COMPARISON OF QUANTITIES OF STEEL AND CONCRETE FOR 18 m. (59 ft.) OF BUILDING

Upper structural members of the building frame built either in steel or in reinforced concrete.	Mixed-type construction design (Table 25e, fig. 1). Weight of required steel.	All-reinforced-concrete construction design (Table 25e, fig. 2). Volume of required reinforced concrete.	
	m. tons	m^3	yd^3
Members of the upper part of the turbine hall outside wall (above crane girders).	5.94	6.3	8.2
Members of the upper floor frame of the bunker and feed-water pump section.	17.2	57.0	74.2
Members of the upper part of the boiler house inside wall (Above the roof of the bunker section).	8.7	8.4	11.0

Source: Elektricheskiye Stantsii, 1947, No. 7, page 10, The amount of material (steel or reinforced concrete) required for the construction of the upper structural members for 18 m. (59 ft.) length of building (width of one boiler unit) - see Plate 18a - according to the two alternative treatments (Plate 25e, fig. 1 and 2) is shown on table 2.

The total amount of material (steel and reinforced concrete) required for the construction of the entire frame for 18 m. (59 ft.) according to those two alternatives is:

	Alternative 1 (fig. 1)	Alternative 2 (fig. 2)
Reinforced concrete	451 m^3 (590 yd^3)	553 m^3 (720 yd^3)
Steel construction	107 m.tons	67 m.tons

Examples of the Fourth Type design

The 3 large newly built thermal power plants, the Mironovskaya 400,000 kw. coal-fired GRES near Artemovsk in Stalinskaya oblast', the Slavyanskaya GRES, and the Cherepet' GRES (projected capacity 600,000 kw.) are probably built according to the Fourth-Type layout design (see also plate 16 and 16a). There may be only small differences in their transverse dimensions; the length of the buildings will change with the number of installed boiler and turbo-generator units.

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APPENDIX

"PRINCIPAL REGULATIONS GOVERNING THE DESIGN OF ELECTRIC POWER PLANTS, SUBSTATIONS, HEAT AND POWER DISTRIBUTING SYSTEMS" ISSUED BY THE MINISTRY OF ELECTRIC POWER STATIONS USSR IN 1947.

PARAGRAPHS RELATING TO THE CONSTRUCTION OF THE MAIN POWER PLANT BUILDING AND THE DISTRIBUTING INSTALLATIONS.

Construction of the Main Power Plant Building

317. The bay length in the main buildings should be uniform and a multiple of the width of the boiler unit.

318. Deformation joints are provided in the main building at the end of a boiler unit.

Settlement joints are provided in places where any structure adjoins the main building.

Deformation joints in the principal frame of the main building are built in the form of double columns.

319a. Stiffness and stability of the building are achieved by means of rigid frames, both transverse and longitudinal.

321. In the case where the skeleton of the main building is of steel, the construction is as follows:

rigid bents with columns rigidly connected with the foundations;

hinged members between the bents;

continuous welded members;

field joints on erection bolts.

322. In cases where the skeleton of the main building is of reinforced concrete, the structural members carrying heavy loads are of reinforced concrete. Steel is used for the lightly loaded elements, which for the most part carry their own load and that of the facing; steel is also used for long-span members subject to bending.

323. The crane girders in the turbine hall are of steel as a rule.

324. Bunkers, as a rule, are wholly of steel.

325. The boiler and engine room end walls (permanent and temporary) should be built on a steel frame.

326. A temporary end wall must be built so that the work in the part of the building which is to be expanded may proceed without dismantling of the wall; construction of an end wall should also be such that the wall can be moved to form a new end wall.

327. Concrete "140" (2,000 lb./in^2) should be used in the main reinforced concrete construction of the main building.

328. Steel "3" (23,000 lb./in^2) is to be used for the steel construction of the main building skeleton.

329. The following construction is adopted for the load-bearing roof members of the engine and boiler room in both reinforced concrete and steel structures with 6-7 m. (19.7 - 23.0 ft.) bays:

a) with span up to 24 m. (78.7 ft.): steel frames with solid web beams;

b) with span over 24 m (78.7 ft.): frames with latticed beams or roof trusses.

330. The inside walls separating the boiler room from other compartments (engine room, service quarters, bunker gallery) are made of fireproof material; the thickness of the walls is:

a) not less than 25 cm. (9.8 in.) for brick walls;

b) not less than 20 cm. (7.9 in.) for walls of block material (ceramic blocks, slag-concrete blocks, etc.).

331. The wall covering for the main building frame is to be of fireproof and frost- and humidity-resisting construction.

332. The outside walls (brick construction) of the boiler room above the boiler servicing level are to be half a brick (one brick, American notation) in thickness for any climatic conditions.

333. Walls thicker than one and a half brick (three bricks American) (in steel frame constructions) should be self-supporting.

334. The use of reinforced concrete walls and partitions is not allowed as a rule.

335. Compartment partitions of plant-service distributing installations with small-size oil or air circuit breakers consist of steel skeleton and gypsum or asbestos-cement panels.

336. Roof covering load-bearing members are of fire-resistant or semi-fire resistant materials.

337. The roofing of the main building consists of three layers: a layer of ruberoid over two layers of artificial parchment paper with mastic adhesive.

338. A special basement is provided under the engine room and the deaerator compartment to accommodate the underground communications.

Auxiliary equipment and platform supports are installed directly on the reinforced concrete floor above the basement.

339. The underground communication lines of the engine room are laid in ducts and tunnels in cases where the ground water level is high.

340. The boiler room underground communication lines are laid as a rule in ducts and channels.

341. The foundations of the turbogenerator units are of reinforced concrete (for any unit capacity), or steel (for unit capacity up to 25,000 kw.).

342. The boiler foundations are of reinforced concrete in the substructure and of steel in the superstructure; this is achieved by extending the steel skeleton to the ash compartment floor or by building individual steel foundations.

343. Ball mill foundations are built, as a rule, as separate reinforced concrete bases - (under the bearings, the electric motor and the reduction gear) which are located on the solid foundation slab of the bunker section.

344. Induced-draft fan foundations and the foundations for similar large size auxiliary equipment are built of lightly reinforced concrete on undisturbed ground.

345. Floors of service quarters and ceilings are of reinforced concrete or wood; floors and ceilings in toilets, showers and washrooms, laboratories, workshops, and archives are made of reinforced concrete exclusively. The partitions in the above-mentioned rooms are of brick, half a brick (one brick American notation) in thickness.

Main Distributing Installations and Switch Panel

346. Whenever the control panel and main distribution installation are located in a structure outside the main building, a heated passage should be provided to connect these two buildings.

347. The building housing the main distribution installation with small size or non-oil circuit breakers is designed to have load-bearing walls, and floors and ceilings; the partitions are not included in the number of load-bearing structural elements of the building. Partitions of compartments are assembled from precast gypsum or similar panels, which are set in steel frames. Light steel frames joined to the main skeleton of the building are provided for the panel erection.

348. Low walls and racks in bus-bar construction are also made of gypsum or similar panels which are fastened to a frame.

349. The thickness of outside brick walls of the main distribution installation are not to exceed 38 cm. (15 in.) irrespective of the climatic conditions.

350. Floors, ceilings and roofs are to be of reinforced concrete laid on steel beams.

351. The roofing of the main distribution installation and that of the control panel should consist of three layers: a layer of ruberoid over two layers of artificial parchment paper with mastic adhesive.

352. No windows are provided in the building of the main distribution installation. Natural lighting is to be provided in the control panel building. Window casings and sash are to be of wood.

(Source: Elektricheskiye Stantsii, 1947).

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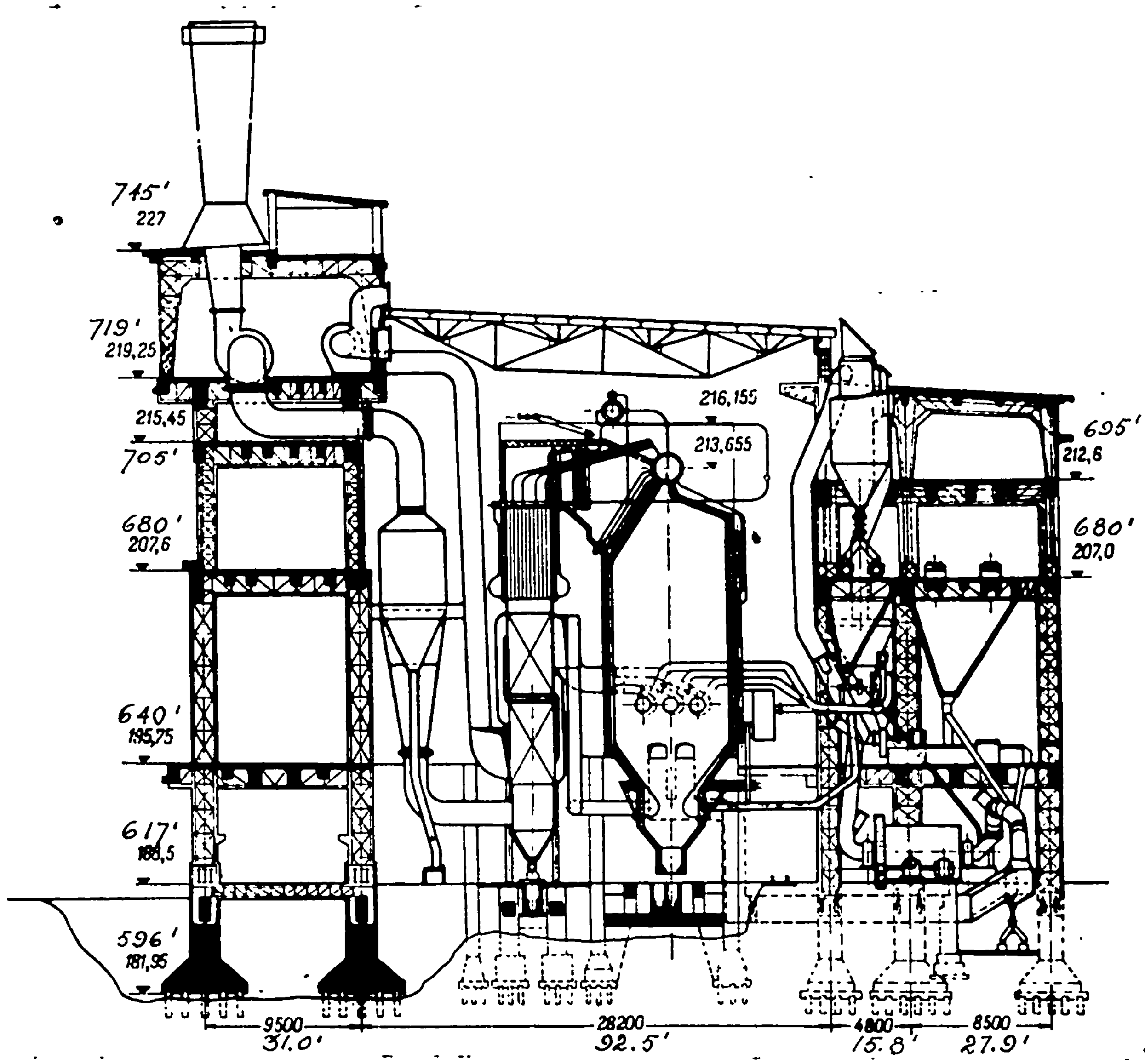

Monolithic reinforced concrete frame construction with rigid welded steel skeleton reinforcement. The turbine hall is to the right of the feed-water pump and tank section (not shown on this diagram)

SECTION THROUGH THE MAIN POWER PLANT BUILDING OF THE FIRST-TYPE DESIGN

Source: Elektricheskiye Stantsii, 1949, #1, p. 28, TK4.E725

PLATE 17A.

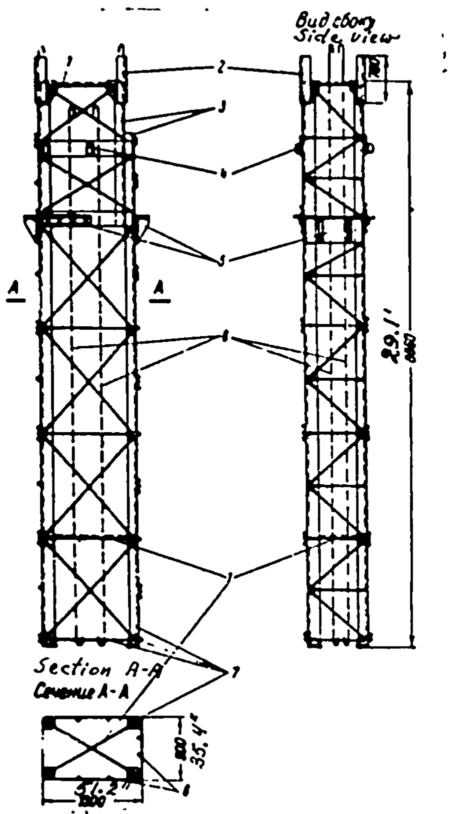

Fig. 1 - Rigid Welded Steel Skeleton Reinforcement of a Column.

Fig. 1 - Legend

1. Stiffening Cross bars.
2. Joint connecting angles of the load-bearing reinforcement.
3. Reduction of the column to a smaller cross section.
4. Plates for adjusting connecting lattices.
5. Erection supports.
6. Bar reinforcement.
7. Rigid welded steel skeleton reinforcement.

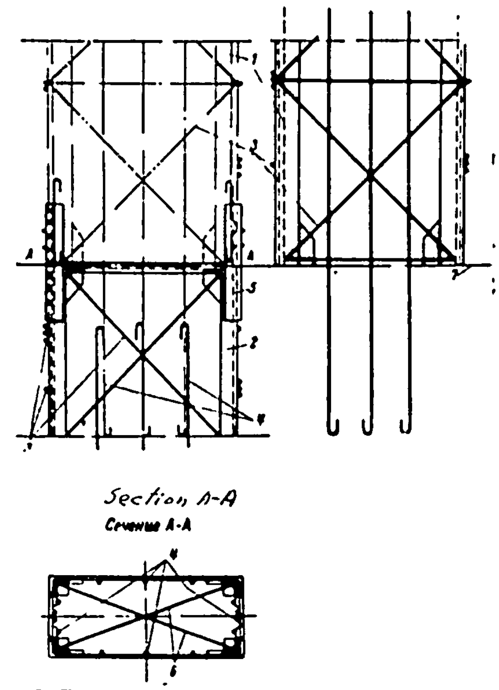

Fig. 2 - Details of a Joint of the Column Sections

1. Upper column section.
2. Lower column section.
3. Reinforcement of the skeleton lattice of the column.
4. Bar reinforcement of the column.
5. Joint angle.
6. Stiffening cross bars of the column.

Fig. 3 - Legend

1. Bar reinforcement of the beam.
2. Bar reinforcement of the beam-column joint.
3. Rigid welded steel skeleton reinforcement of the beam.
4. Plates for adjusting connecting lattices.
5. Erection supports.
6. Erection angles.

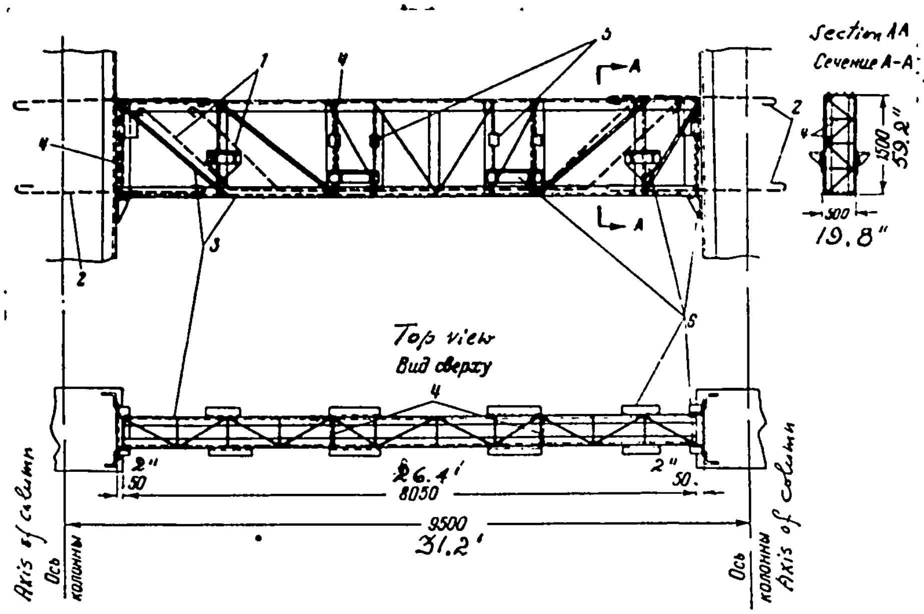

Fig. 3 - Rigid Welded Steel Reinforcement of a Cross Girder.

DETAILS OF THE RIGID WELDED STEEL SKELETON REINFORCEMENT FOR REINFORCED CONCRETE FRAMES SHOWN ON PLATE 17A.

Source: Elektricheskiye Stantsii, 1948, #6, p. 14, TK4.E725

PLATE 17B.

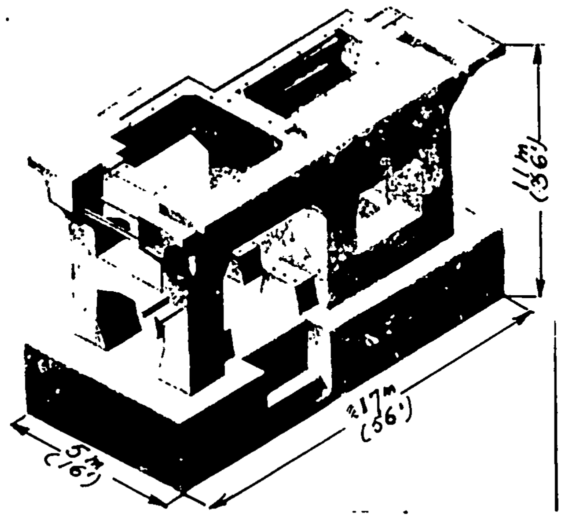

Fig. 1

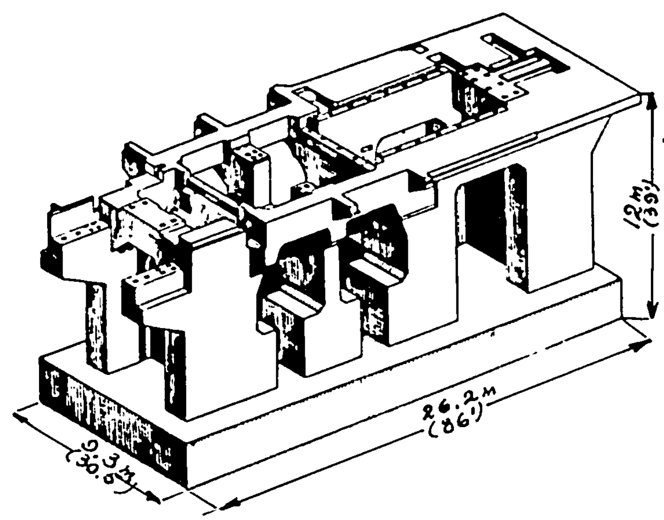

Fig. 2

Monolithic reinforced concrete foundations of turbogenerator units.

**Source: Antipov, I. P. Arkhitektura elektrostantsiy, 1939. (TH 4581.A5)
Elektricheskiye stantsii, 1954, No. 9, p. 22 (TK4.E725).**

PLATE 18A.

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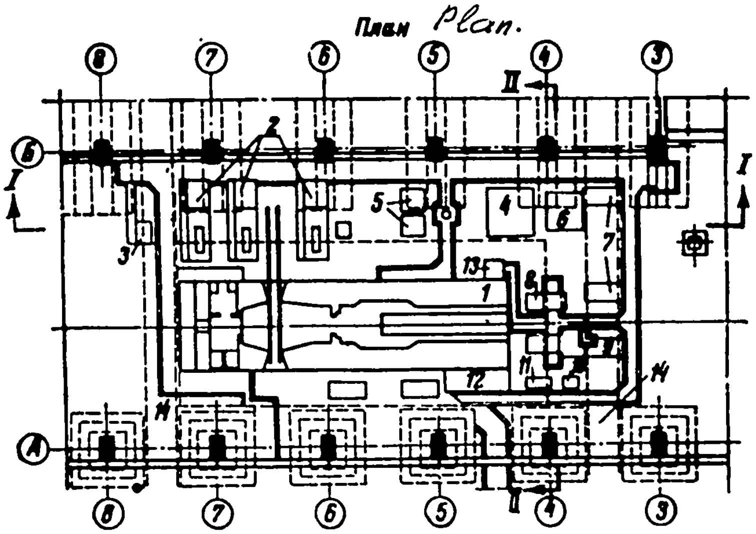
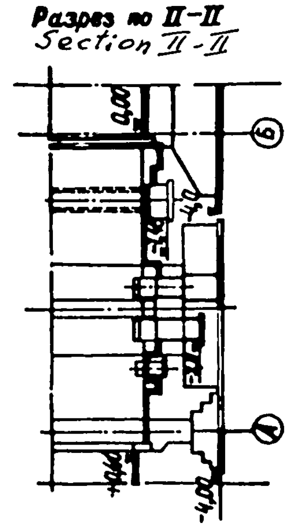
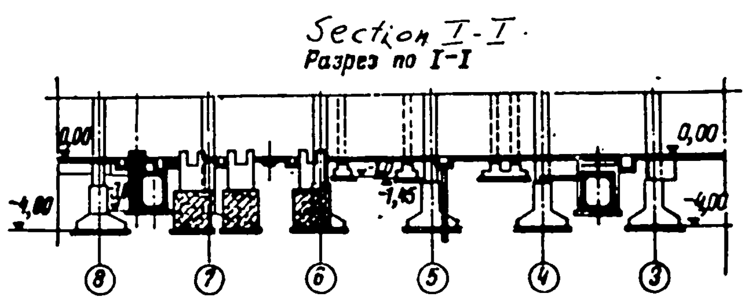






Legend

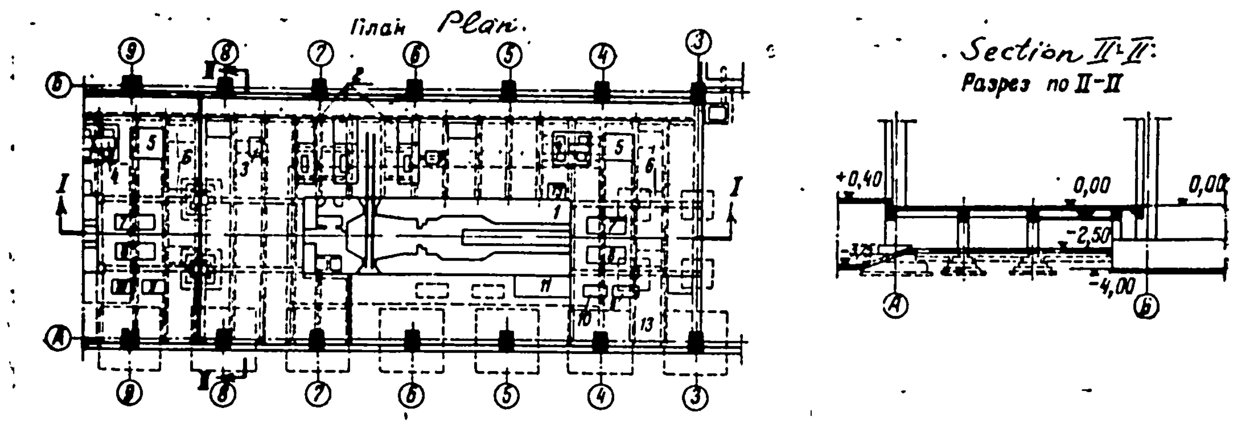
1. Foundation under the turbogenerator;
2. Foundations under the electric feed pumps;
3. Foundation under the turbine feed pump;
4. Foundation under the overflow pump and platforms;
5. Foundation under the platforms;
6. Foundation under the separator;
7. Foundations under the platforms;
8. Foundation under the electric condenser pump;
9. Foundation under the condenser turbo-pump;
10. Foundation under the lubricating turbo-pump;
11. Foundation under the electric lubricating pump;
12. Foundation under the lubrication-oil cooler;
13. Foundation under the overflow tank;
14. Cable tunnel.

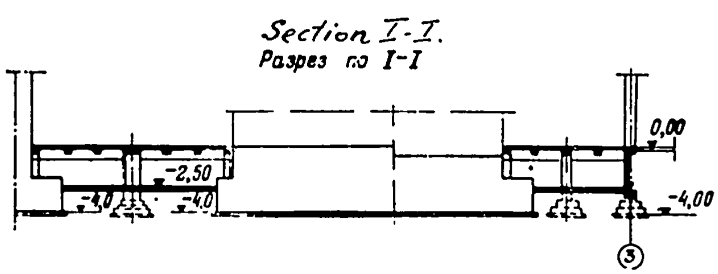
Foundations of a turbogenerator unit and of its auxiliary equipment underneath the machine hall.

TYPE OF CONSTRUCTION WITH INDIVIDUAL FOUNDATIONS.

Source: Elektricheskiye stantsii, 1947, #7, p. 11

PLATE 18B.





Legend

1. Foundation under the turbogenerator;
2. Electric feed pumps;
3. Turbine feed pump;
4. Overflow pump and platforms;
5. Separator;
6. Posts under platforms;
7. Electric condensing pump;
8. Condensing turbo-pump;
9. Lubricating oil turbo-pump;
10. Electric lubricating oil pump;
11. Lubricating oil cooler;
12. Overflow tank.

Foundations of a turbogenerator unit and of its auxiliary equipment underneath the machine hall.

TYPE OF CONSTRUCTION WITH A BASEMENT FLOOR PLACED ON A MONOLITHIC REINFORCED CONCRETE MAT.

Source: Elektricheskiye stantsii, 1947, No. 7, p. 12.

PLATE 18C.

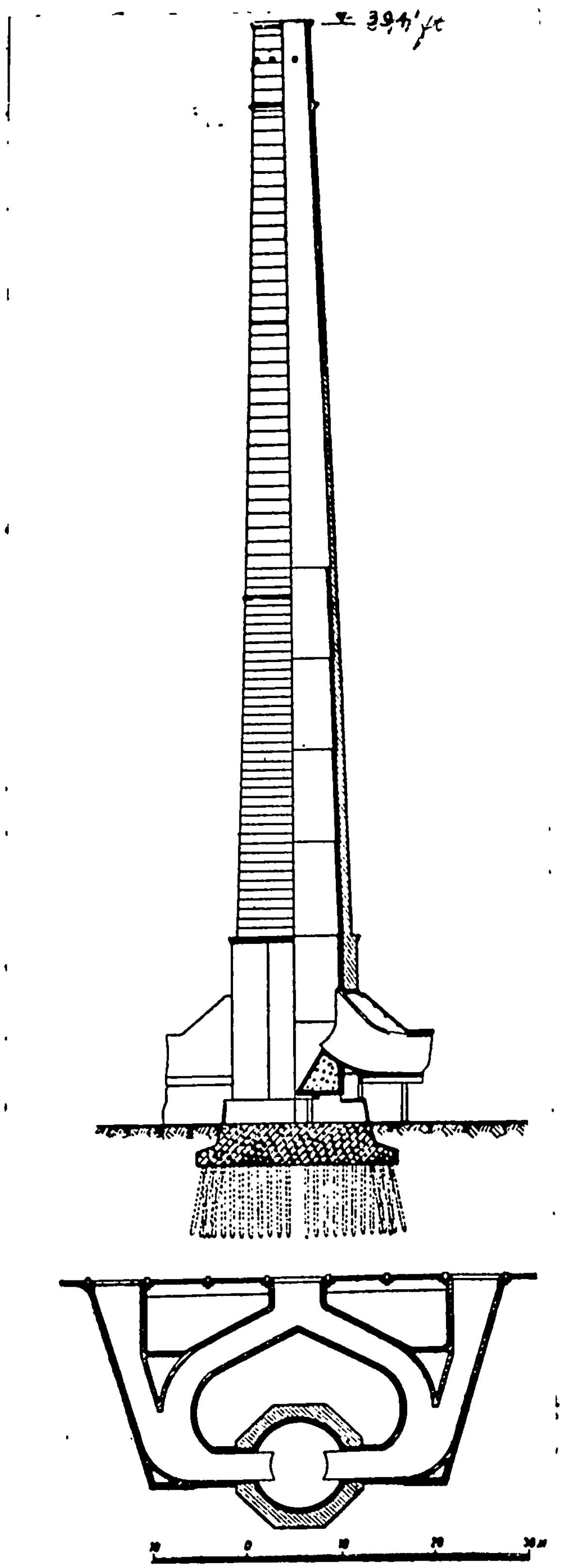


Fig. 1 - Brick Stack.

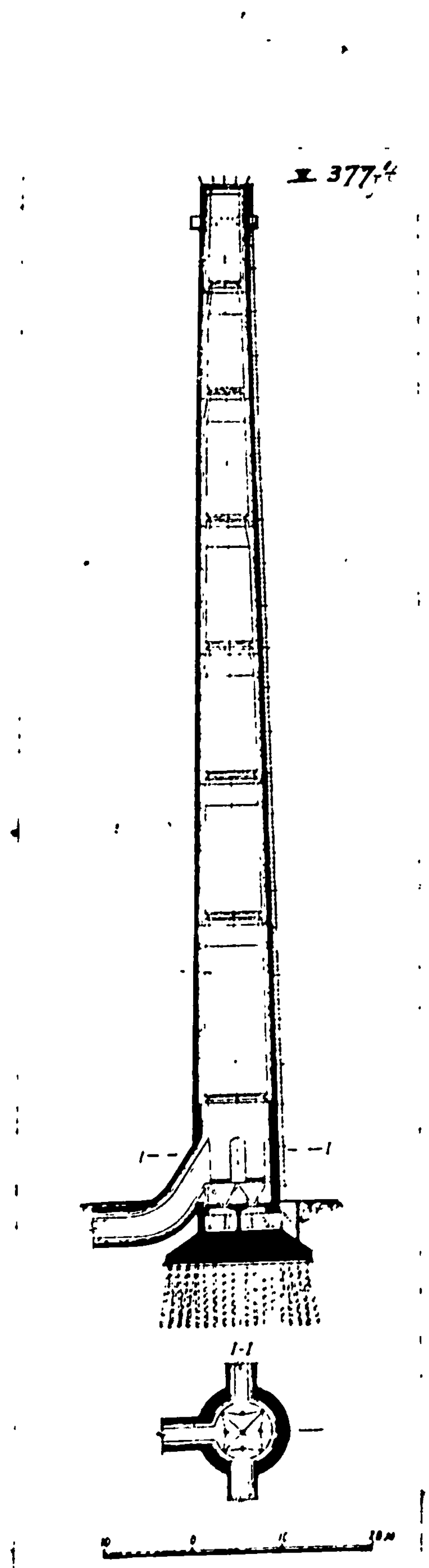
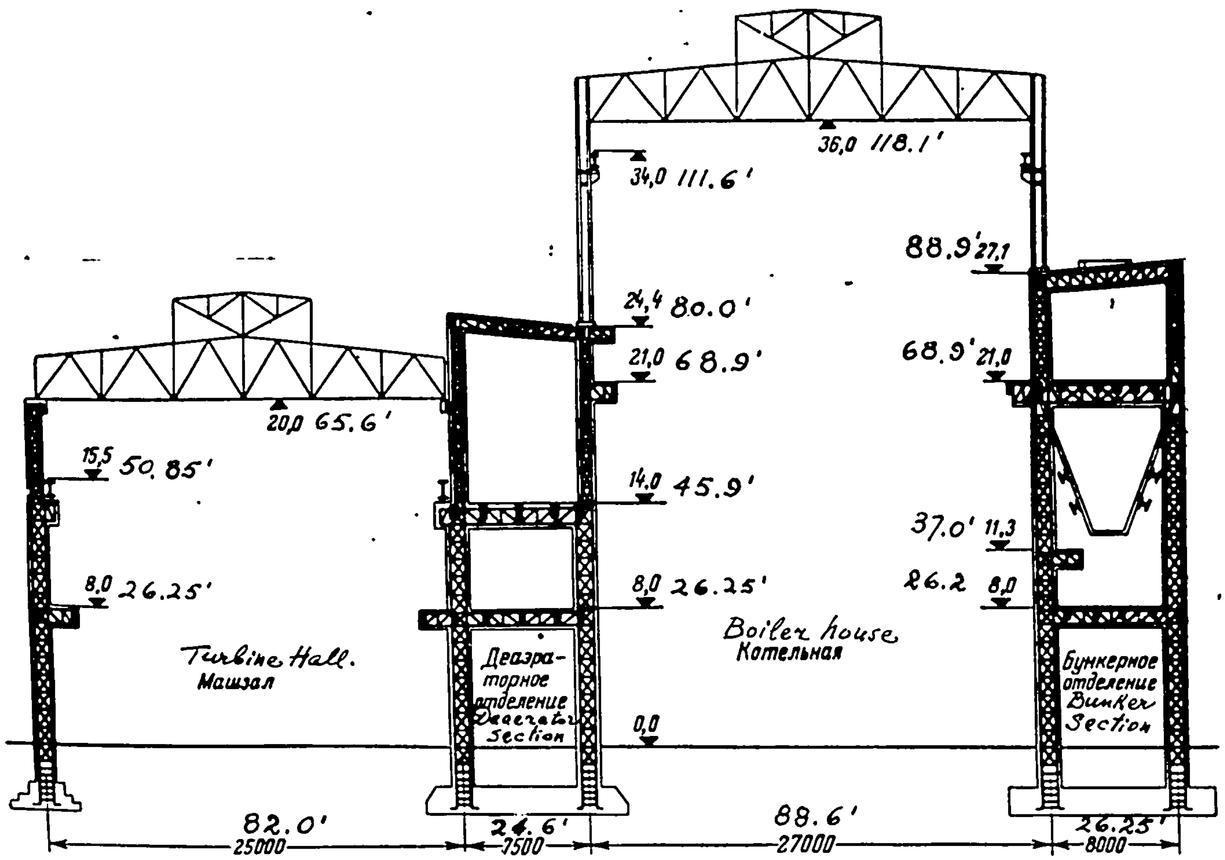


Fig. 2 - 1. Reinforced Concrete Stack.

STACKS

Source: Antipov, I. P. Arkhitektura elektrostantsii, 1939 (TH.4581.A5)

PLATE 19.



The separate frames of the bunker, the deaerator sections and the outside wall of the turbine hall have rigid steel welded skeleton reinforcement.

THE LOAD BEARING MONOLITHIC REINFORCED CONCRETE TRANSVERSE FRAMES OF THE MAIN POWER PLANT BUILDING OF THE SECOND-TYPE DESIGN

Source: Elektricheskiye Stantsii, 1952, #2, p. 25. (TK4.E725)

PLATE 20A.

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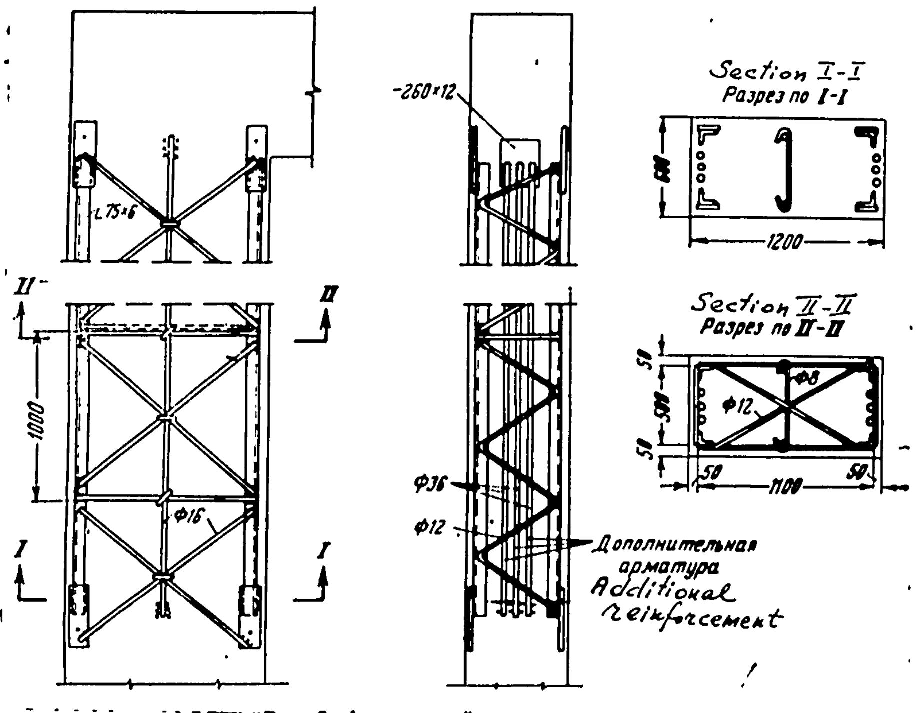

Fig. 1 – Reinforcing skeleton of the column.

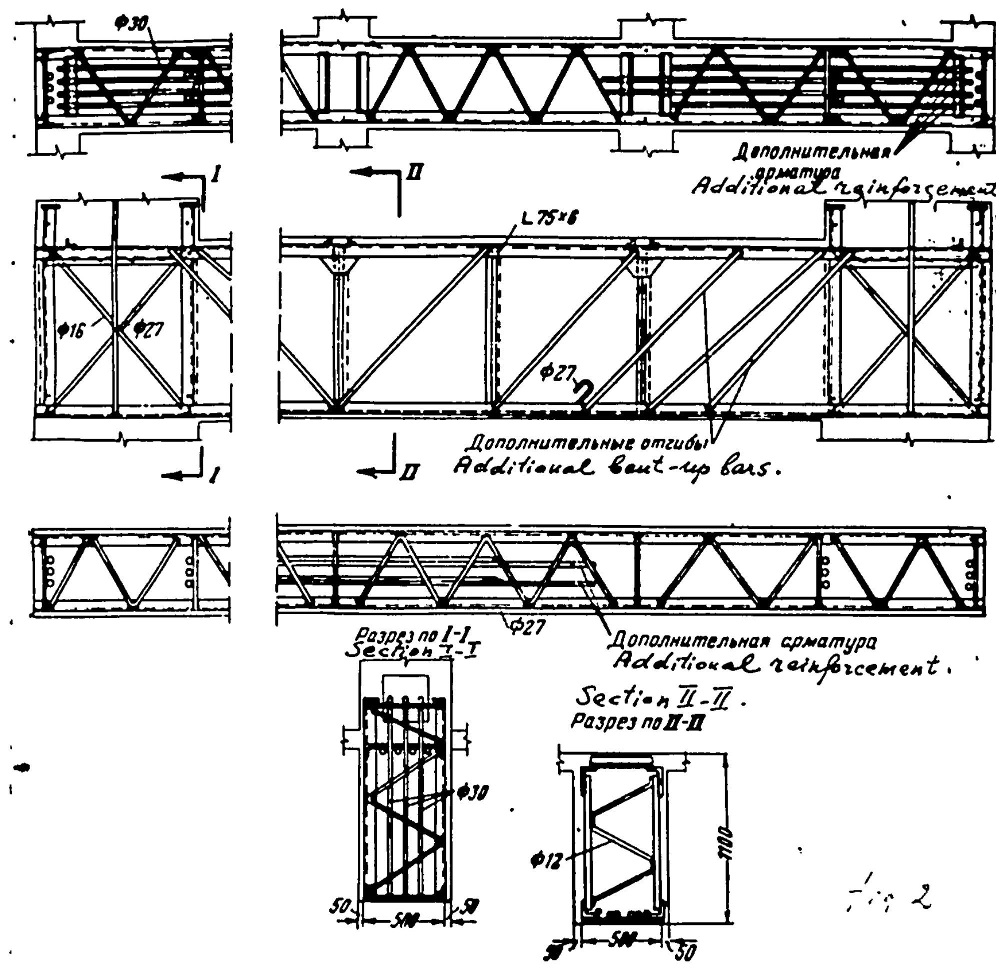

Fig. 2 – Reinforcing skeleton of the cross girder

DETAILS OF THE RIGID STEEL WELDED SKELETON REINFORCEMENT OF THE MONOLITHIC REINFORCED CONCRETE FRAMES SHOWN ON PLATE 20A.

Source: Elektricheskiye Stantsii, 1952, #2 p. 23–26.

PLATE 20B.

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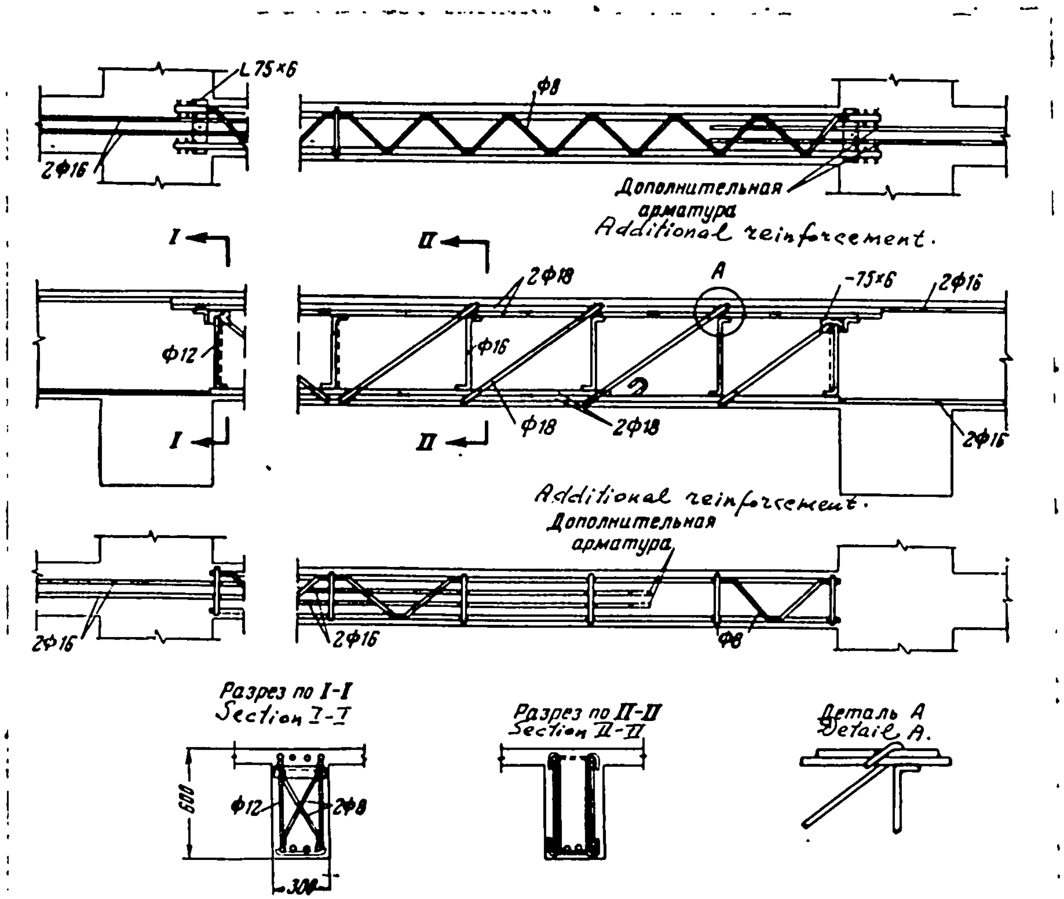

Fig. 3 - Reinforcing skeleton of the beam

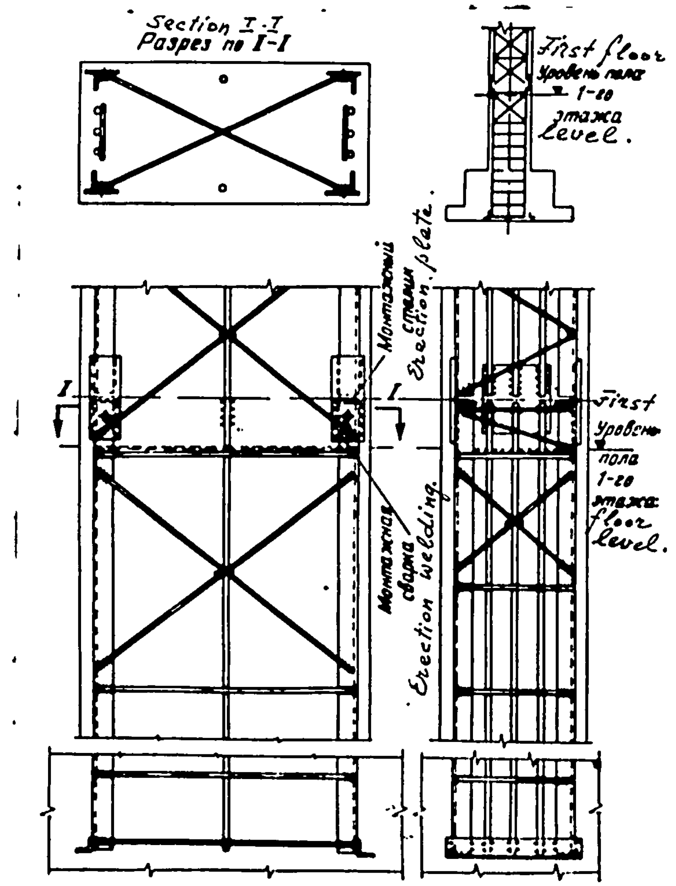

Fig. 4 - Connection of the skeletons of the column and the foundation footing at the level of the floor of the first story.

DETAILS OF THE RIGID STEEL WELDED REINFORCEMENT OF THE MONOLITIC REINFORCED CONCRETE FRAMES SHOWN ON PLATE 20A.

Source: Elektricheskiye Stantsii, 1952 No. 2, p. 24

PLATE 20C.

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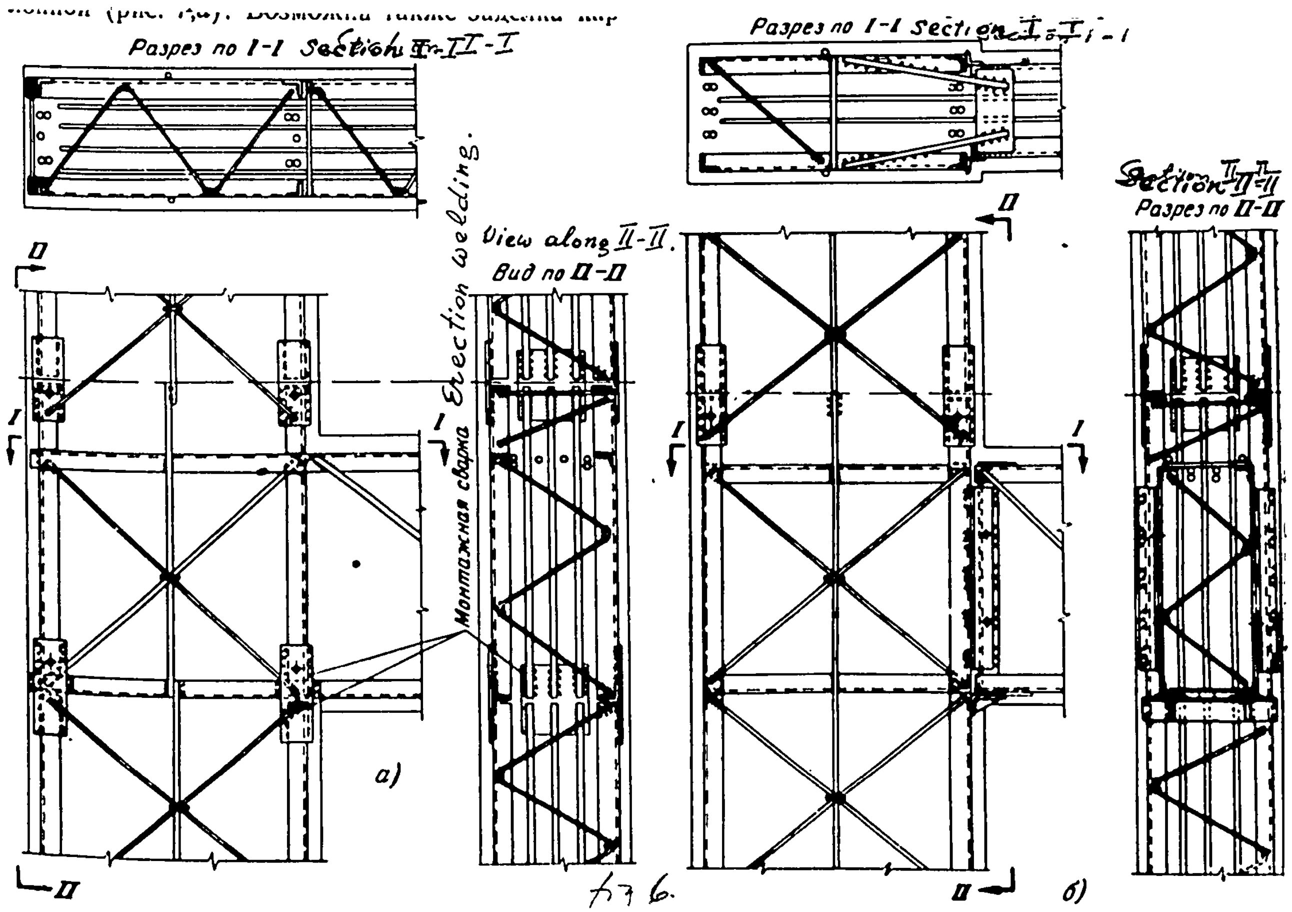

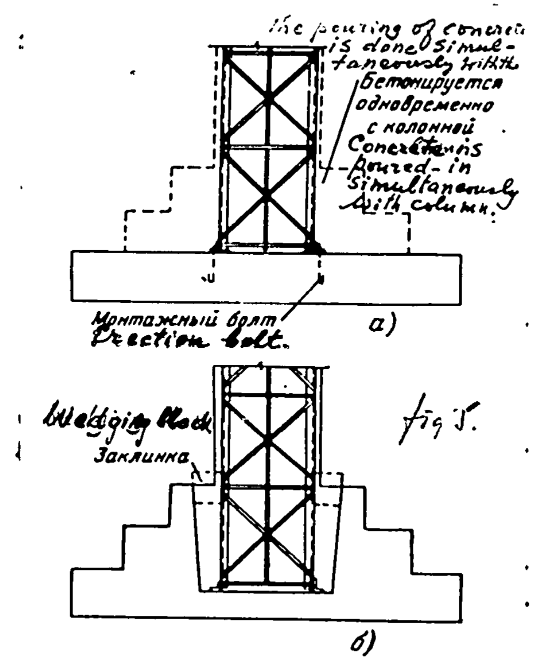

Fig. 5 - Embedment of the column skeleton in the foundation footing.

a. Attachment of the skeleton to the foundation plate
b. Embedment of the skeleton in the foundation well.

Fig. 6 - Connection of the skeletons of the column and the cross girder.

a. When the girder crosses the column
b. When the girder ends at the column.

DETAILS OF THE RIGID STEEL WELDED REINFORCEMENT OF THE MONOLITHICS REINFORCED CONCRETE FRAMES SHOWN ON PLATE 20A.

Source: Elektricheskiye Stantsii, 1952, No. 2, p. 25

PLATE 20D.

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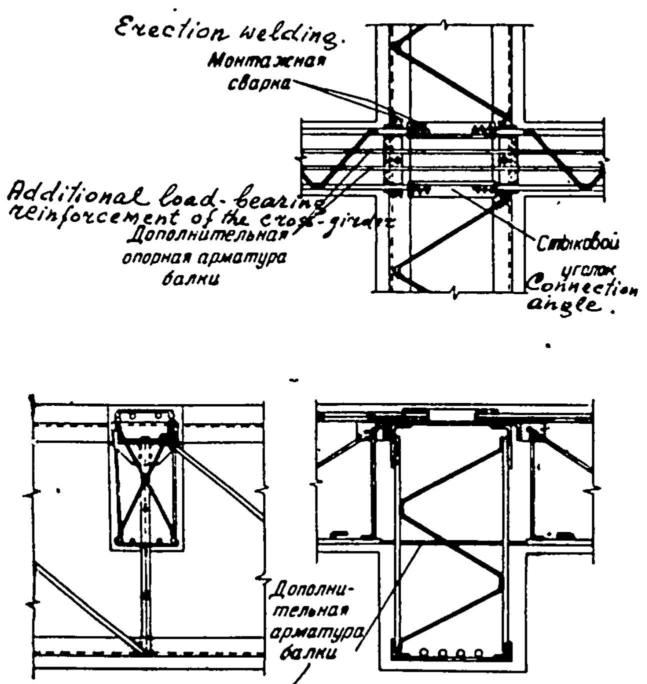

Fig. 7 – Connection of the skeletons of the girder to the beam.

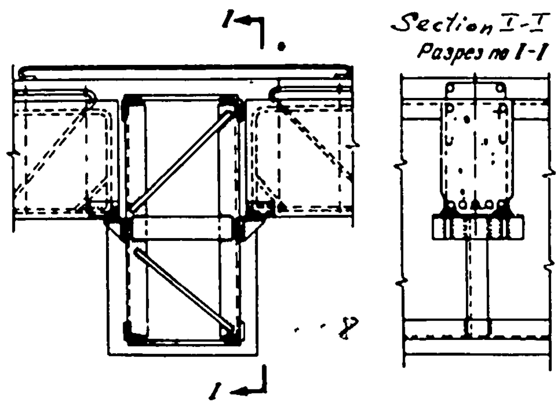

Fig. 8 – Connection of the precast reinforced concrete beam to the skeleton of the transverse girder.

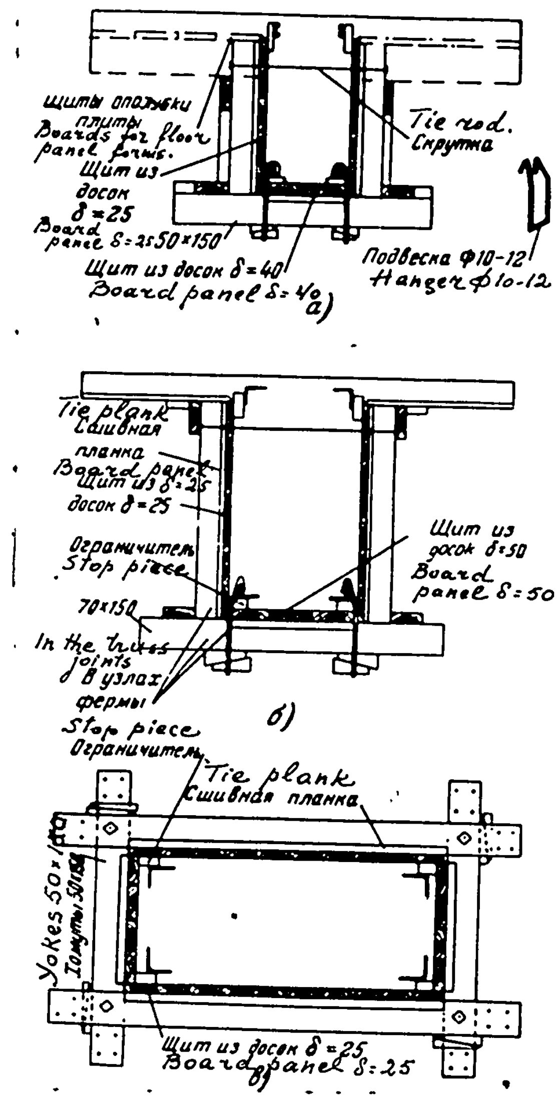

Fig. 9

Fig. 9 – Legend

Fastenings of the form to the skeleton

a. Construction of the fastening of plank forms for the beams.
b. Construction of the fastening of plank forms for the girders.
c. Construction of the fastening of plank forms for the column.

DETAILS OF THE RIGID STEEL WELDED REINFORCEMENT OF THE MONOLITH REINFORCED CONCRETE FRAMES SHOW ON PLATE 20A

Source: Elektricheskiye Stantsii, 1952, #2, p. 26

PLATE 20E.

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Weight of Steel: for 18 m. (59 ft.) of building length (boiler unit).
(Allowable Steel stresses 1400 kg/cm² (19,900 lbs/in²)

	Scheme No. 1			Scheme No. 2		
	Total Weight m tons	Weight of steel kg/m³	lb/ft³	Total Weight m tons	Weight of steel kg/m³	lb/ft³
Roof-supporting members	60.5	1.81	0.112	87.1	3.87	0.240
Columns	172.2	5.20	0.323	137.6	6.04	0.374
Crane girders	16.8	0.4	0.0249	9.8	0.43	0.0266
Inter-story floor-supporting members of the feed water pump section	40.5	1.20	0.0745	33.7	1.70	0.1055
Inter-story floor supporting members of the bunker section	58.5	1.76	0.109	38.16	1.69	0.1049
Bunkers	41.3	1.24	0.077	29.3	1.30	0.0805
Longitudinal frame members	40.0	1.20	0.0745	28.44	1.27	0.0788
Total	429.3	12.9	0.800	369.0	16.3	1.01

mm.	in.
100/12	= 3.94/0.472
120/16	= 4.72/0.630
120/18	= 4.72/0.709
150/10	= 5.91/0.394
300/14	= 11.8/0.551
400/16	= 15.8/0.630
480/14	= 18.9/0.551
500/12	= 19.7/0.472
500/16	= 19.7/0.630
500/18	= 19.7/0.709
900/12	= 35.4/0.472
1100/10	= 43.3/0.394
1100/12	= 43.3/0.472

Conversion figures for steel sections on Plate 21A, Fig. 1

PLATE 21B.

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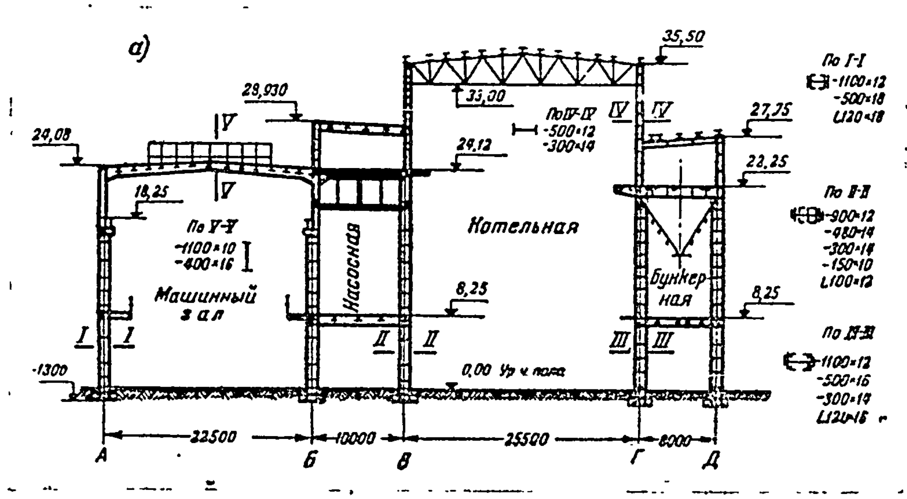

Fig. 1. Transverse steel frames of the main power plant building with steel sections for a rigid-frame connection design (as per scheme 1 - fig. 2).

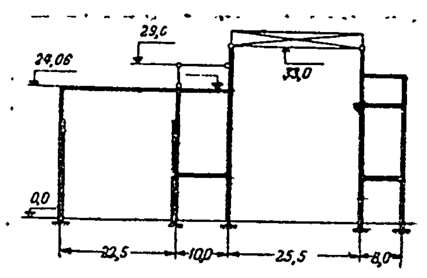

Fig. 2. Scheme 1 - The multi-story four-aisle combined transverse steel frame is rigidly connected.

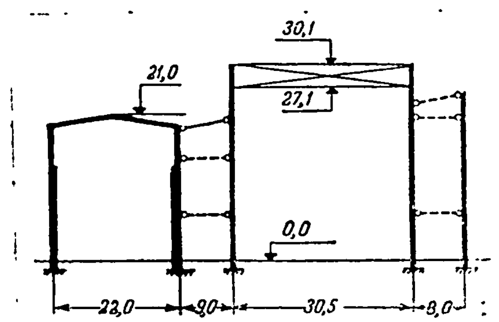

Fig. 3. Scheme 2. The steel rigid frames of the boiler house, of the turbine hall and the outside wall of the bunker section are interconnected by hinged steel members.

CONSTRUCTION OF THE MAIN POWER PLANT BUILDING OF THE SECOND-TYPE DESIGN IN STEEL.

Source: Elekricheskiye Stantsii, 1948, #9.

PLATE 21A

Weight of Steel: for 18 m(59') bldg. length (boiler unit) (Allowable steel stresses 1400 kg/cm^2 - 19,900 lb/in^2 -)			
	Total Weight m tons	Weight of steel	
		kg/m^3	lb/ft^3
Roof-supporting members	81.8	3.10	0.1920
Columns	121.6	4.61	0.2860
Crane Girders	8.5	0.32	0.01984
Inter-story floor-supporting members of the feed water pump section	17.4	0.66	0.0410
Inter-story floor supporting members of the bunker section	65.6	2.49	0.1545
Bunkers	35.0	1.32	0.0820
Longitudinal frame members	29.5	1.10	0.0682
Total	359.4	13.6	0.8450

⅃L 75/8 = 2.95/0.315
⅃L 150/12 = 5.91/0.472
⅃L 150/16 = 5.91/0.630

100/10 = 3.94/0.394
300/20 = 11.8/0.787
350/12 = 13.8/0.472
350/16 = 13.8/0.630
350/30 = 13.8/1.18
400/20 = 15.8/0.787
500/10 = 19.7/0.394
500/18 = 19.7/0.709
500/20 = 19.7/0.787
500/30 = 19.7/1.18
750/8 = 29.5/0.315
750/10 = 29.5/0.394
750/13 = 29.5/0.472
750/14 = 29.5/0.551
1000/10 = 39.4/0.394
1000/14 = 39.4/0.551
1000/20 = 39.4/0.787
1200/12 = 47.2/0.472
1800/14 = 70.9/0.551

Conversion figures on steel sections on Plate 22A, Fig. 1

PLATE 22B.

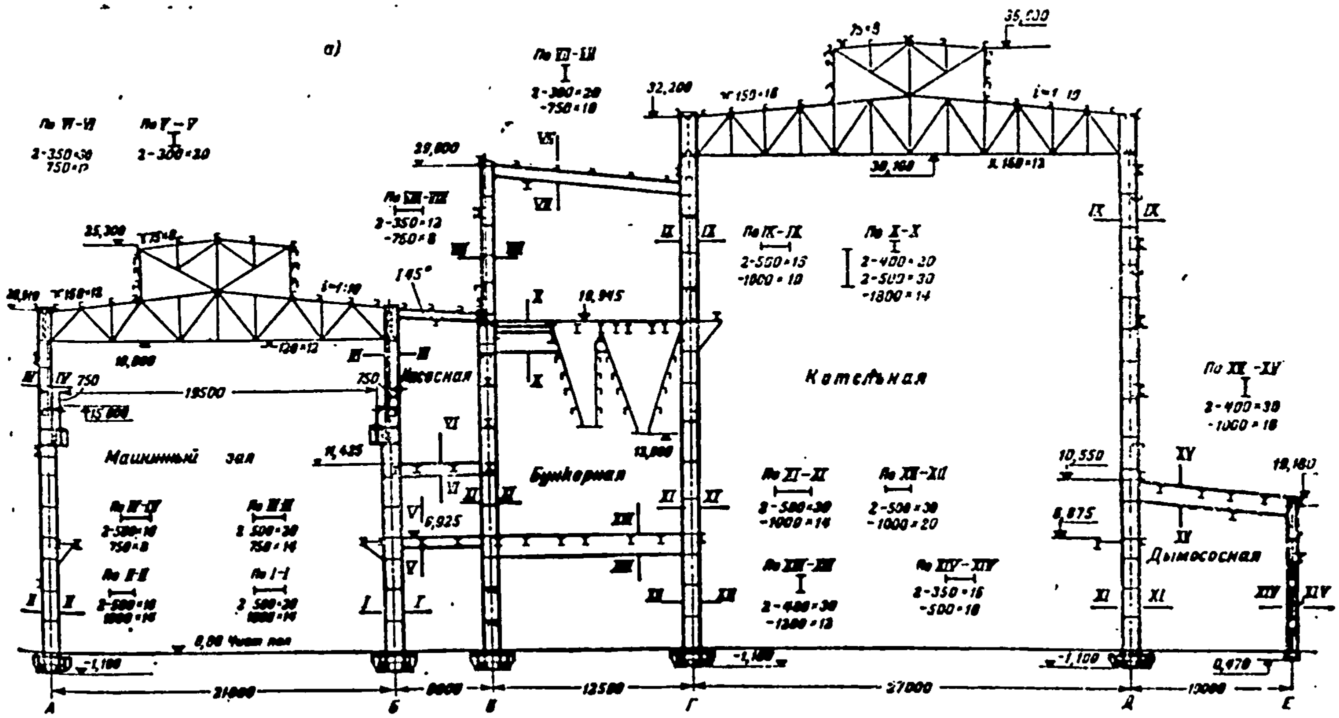

Fig. 1 - Transverse steel frames of the main power plant building.

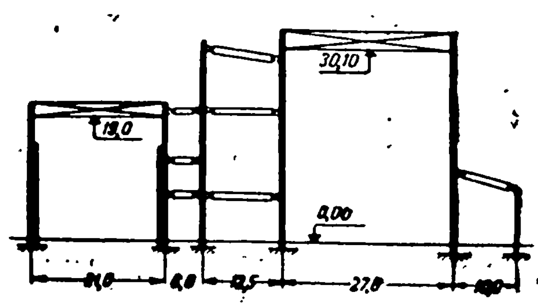

Fig. 2 - Construction scheme of the main building steel frame connections.

CONSTRUCTION OF THE MAIN POWER PLANT BUILDING OF THE FOURTH-TYPE DESIGN IN STEEL

Source: Elektricheskiye stantsii, 1948, No. 9 (TK4.E725).

PLATE 22A.

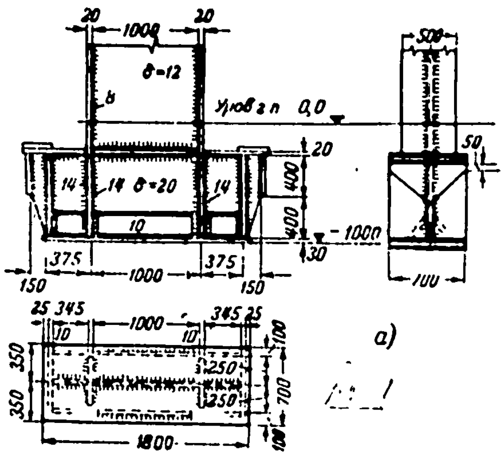

Fig. 1 - Base of a column

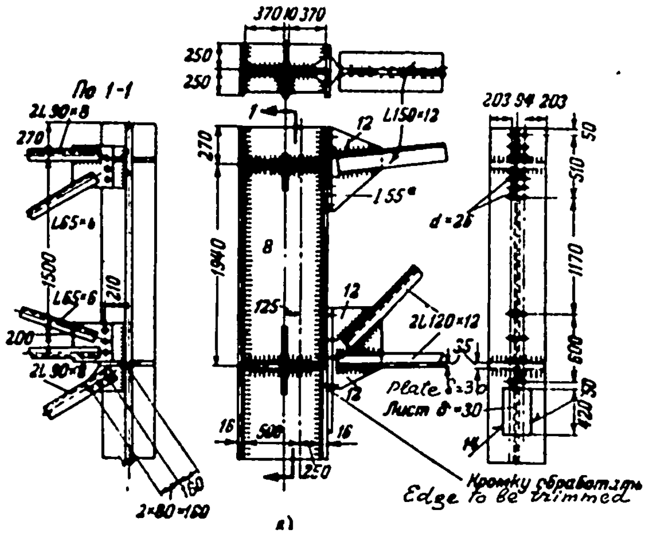

Fig. 3 - Connection between truss members and a column.

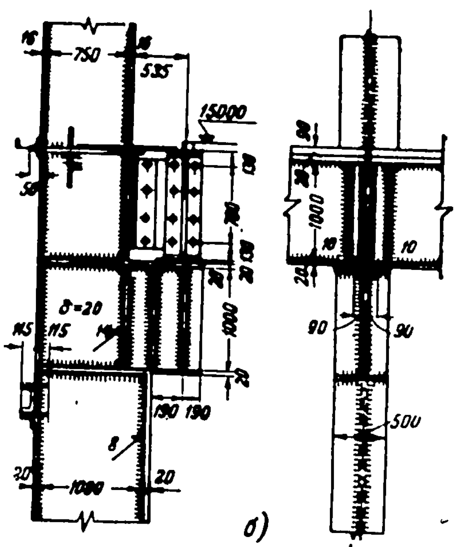

Fig. 2 - Connection of a crane girder and a frame girder to a column.

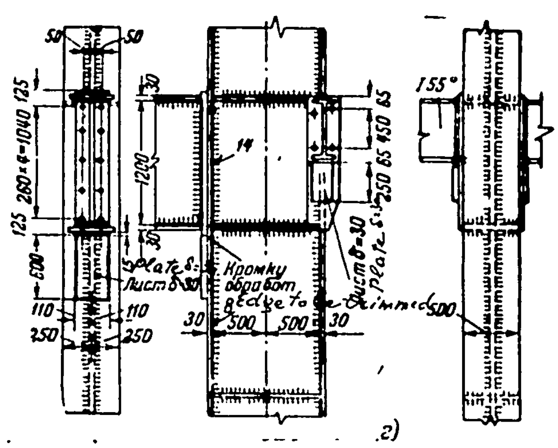

Fig. 4 - Connection between a column, a girder and a beam

DETAILS OF THE PRINCIPAL JOINTS OF THE STEEL FRAME IN THE MAIN POWER PLANT BUILDING

Source: Elektricheskiye Stantsii, 1948, #9 (TK4.E725)

PLATE 22C.

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Scheme I

The combined rigid steel frame of the bunker and feed-water pump section is connected with the outside walls of the turbine hall and the boiler house by hinged structural members

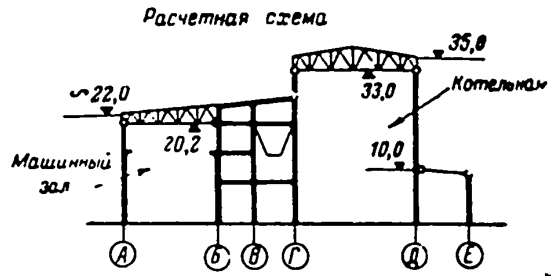

Fig. 1 - Design scheme 1

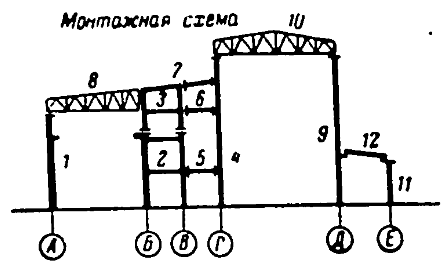

Fig. 2 - Erection scheme 1

Scheme 2

The rigid frames of the boiler house and the turbine hall are connected by hinged structural members forming the middle hinged combined frame of the bunkerand feed-water pump stations.

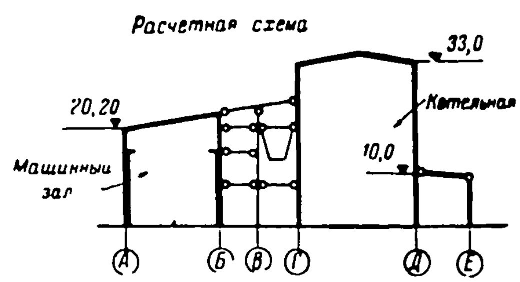

Fig. 3 - Design scheme 2

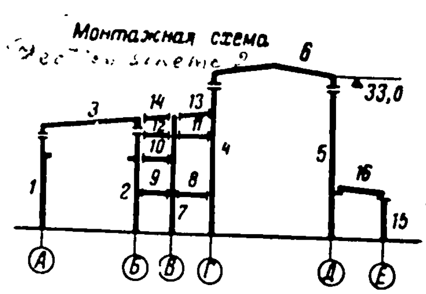

Fig. 4 - Erection scheme 2

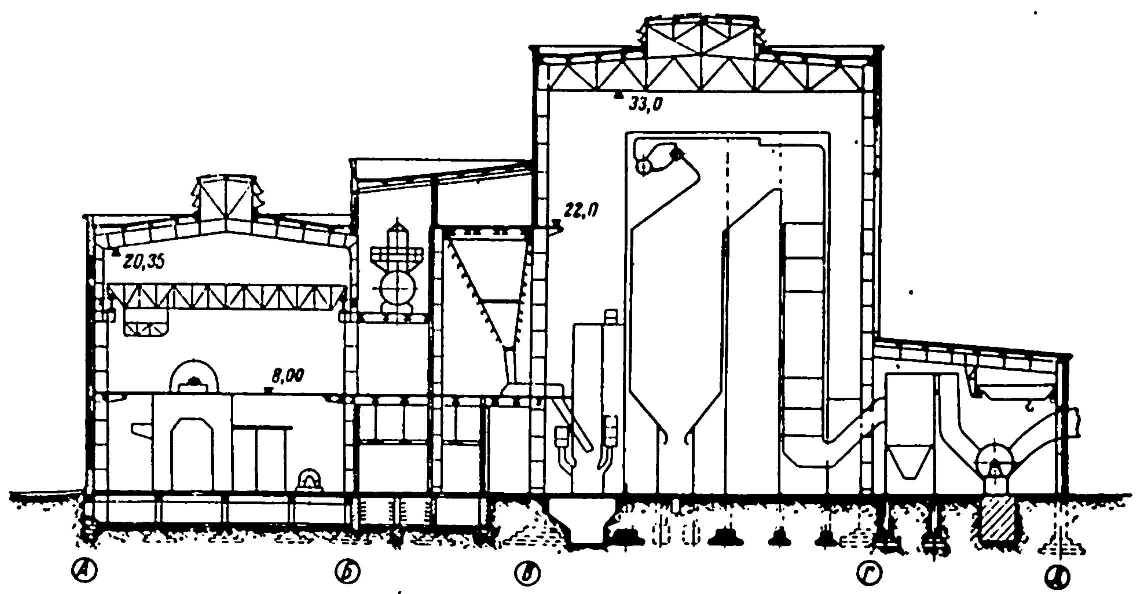

Fig. 1 - Main transverse steel frames of the building.

CONSTRUCTION OF THE MAIN POWER PLANT BUILDING OF THE FOURTH-TYPE DESIGN IN STEEL

Source: Elektricheskiye Stantsii, 1947, #7.

PLATE 23A.

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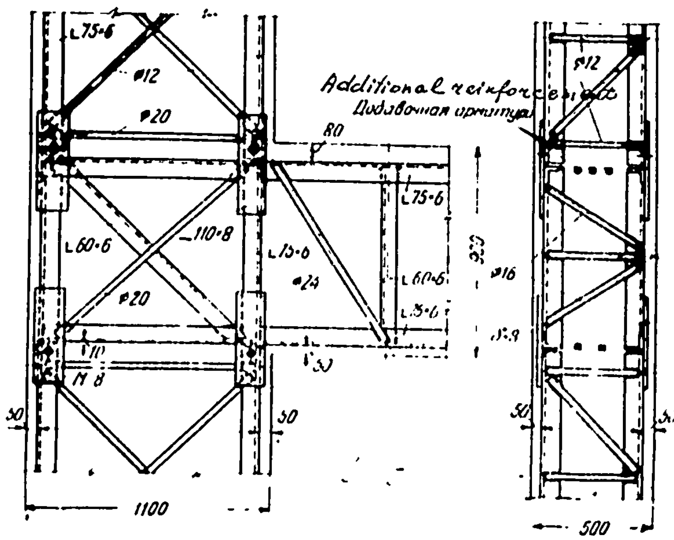

Fig. 5 - Connection between the steel welded skeletons of a cross girder and a column.

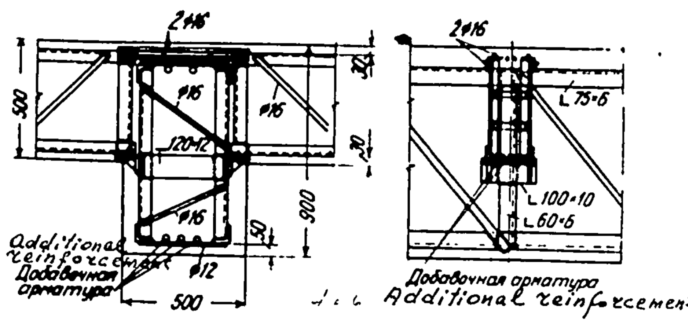

Fig. 6 - Connection between the steel welded skeleton of a girder and a beam.

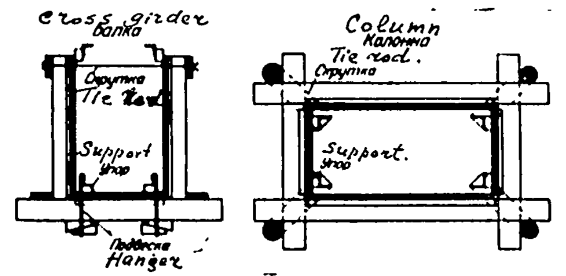

Fig. 7 - Fastening of the concrete forms to the welded steel skeleton of a girder and of a column.

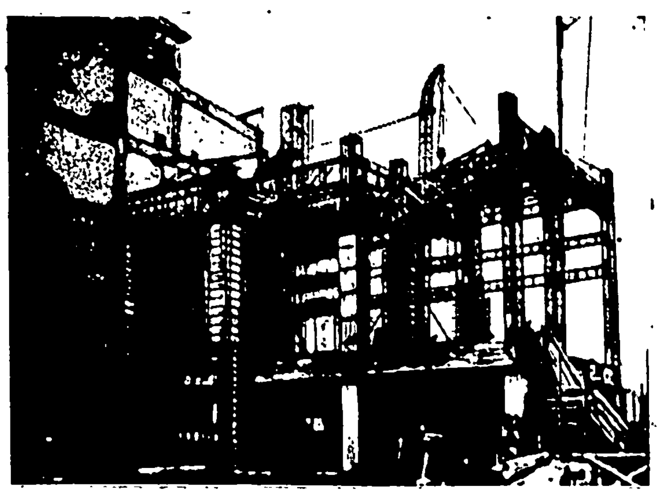

Fig. 8 - Assembly of welded steel reinforcing skeleton parts for the bunker section frame by means of a swing jib crane.

PLATE 24B.

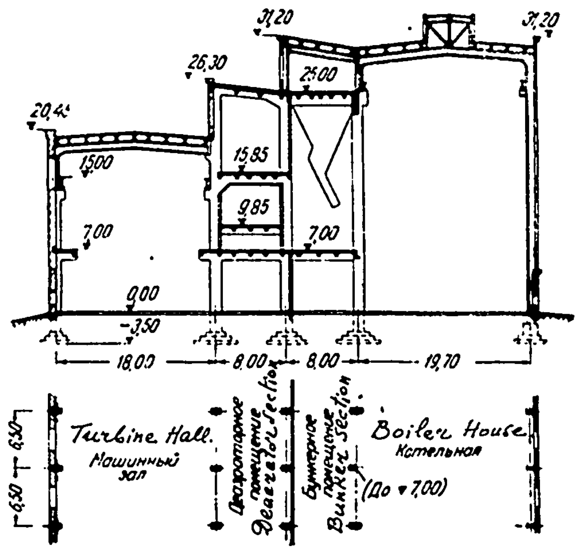

Fig. 1 - Principal transverse frames and partial plant showing the bay lengths of the main power plant building.

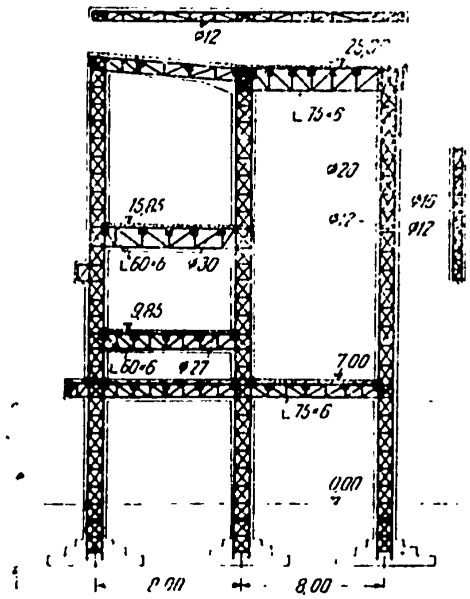

Fig. 2 - Welded rigid steel skeleton of the monolithic frame of the bunker and feed-water tank sections.

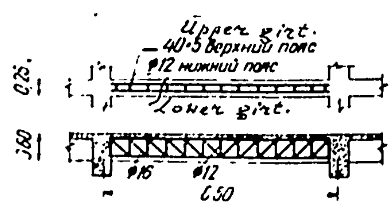

Fig. 3 - Rigid steel welded skeleton of the floor supporting beam.

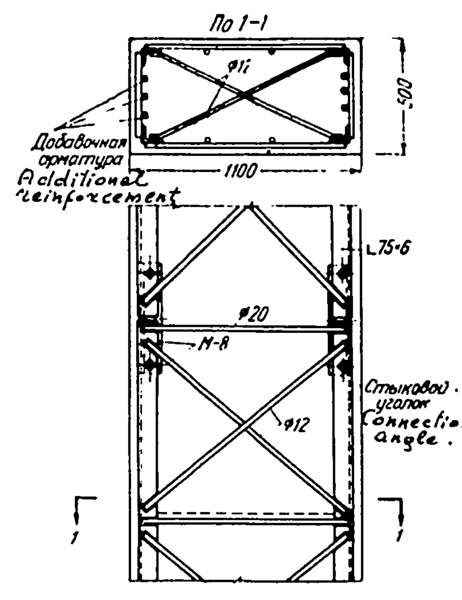

Fig. 4 - Joint of the welded steel skeleton of a column.

CONSTRUCTION OF THE MAIN POWER PLANT BUILDING IN MONOLITHIC REINFORCED CONCRETE WITH WELDED RIGID STEEL SKELETON REINFORCEMENT

Source: Stroitel'naya promyshlennost', 1950, No. 4.

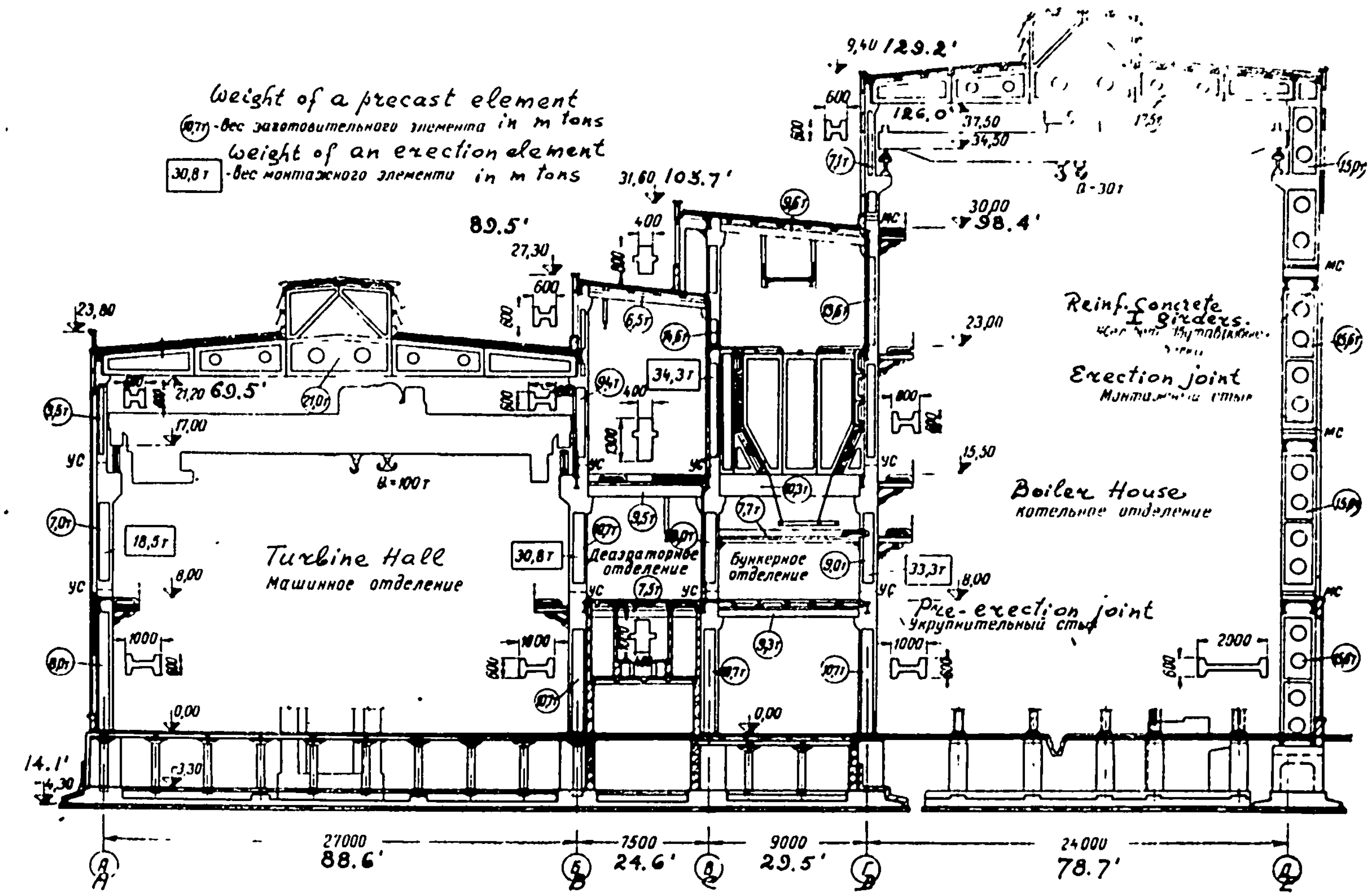

Fig. 1 – Transverse precast reinforced concrete frames of the main power plant building. The sections of the principal structural members are shown. In small circles are given the weights of the prefabricate members, and in small squares are the weights of members pre-assembled at the building site.

CONSTRUCTION OF THE MAIN POWER PLANT BUILDING OF THE FOURTH TYPE LAYOUT DESIGNED IN PRECAST REINFORCED CONCRETE

Source: Stroitel'naya Promyshlennost' 1956, #6.

PLATE 25A

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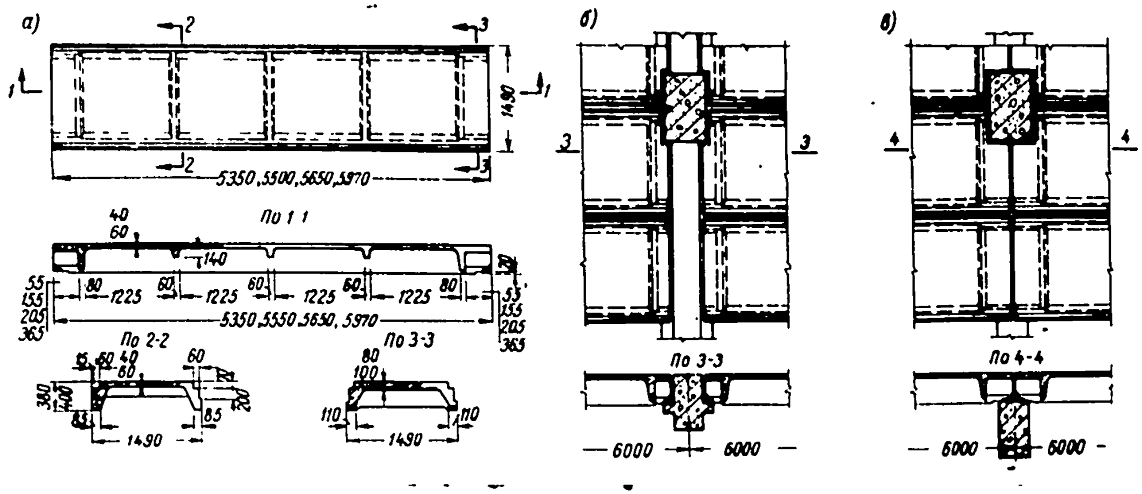

Fig. 2 - Inter-story floor panels

Legend Fig. 2

a. Geometric dimensions
b. Panels resting on brackets of the cross girder.
c. Panels resting on top of the cross girders.

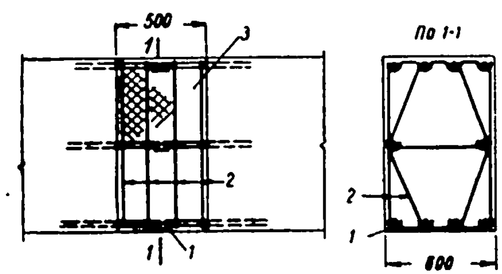

Fig. 3 - Preassembly joint of a column

Legend Fig. 3

1. Welding of reinforcing bars by submerged method.
2. Stirrups
3. Concrete joint filling

CONSTRUCTION OF THE MAIN POWER PLANT BUILDING OF THE FOURTH-TYPE LAYOUT, DESIGNED IN PRECAST REINFORCED CONCRETE

Source: Stroitel'naya Promyshlennost' 1956, #6.

PLATE 25B

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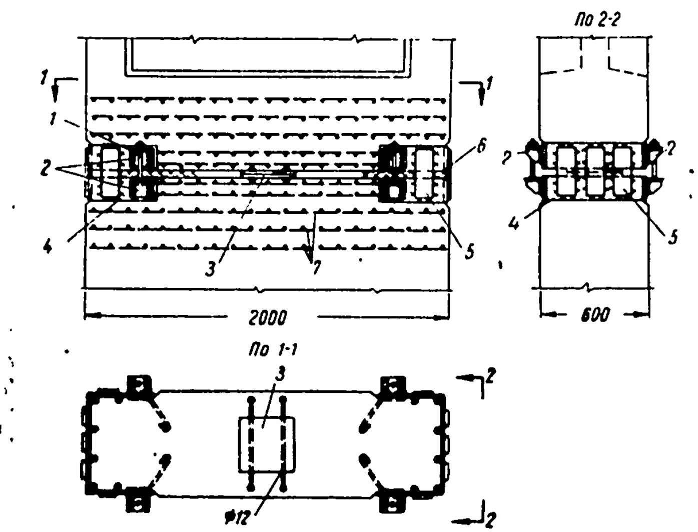

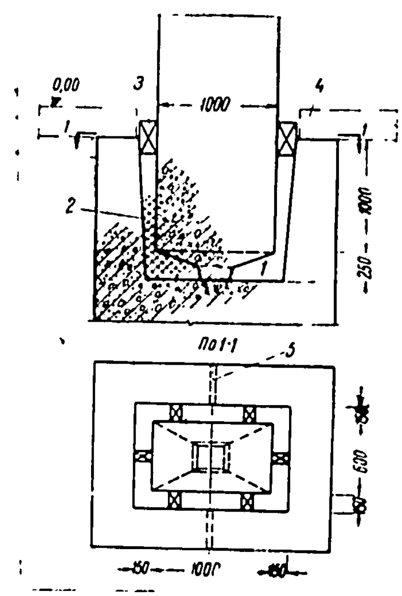

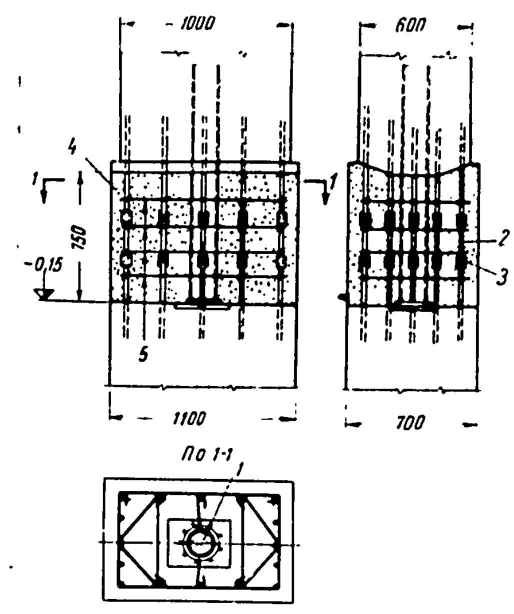

Legend Fig. 4.

Erection joint of a column

1. Erection adjustment belt.
2. Erection angles ∠ 120x10 mm.
3. Steel plates 300 x 200 x 16 mm.
4. Steel hoops placed around the column joint, 140 mm. x 10 mm.
5. Side steel plates 100 x 280 x 16 mm.
6. Cement plaster applied around the column joint.
7. Horizontal steel mesh set in the column (indirect reinforcing.)

Legend Fig. 5

Joint of a column with its foundation footing in case a basement is built.

1. Pin in the column of the butt.
2. Concrete filling
3. Wedges.
4. Floor covering.
5. Scupper 50 mm (2 in.)

Legend Fig. 6

Joint of a column with its foundation

1. Pipe 160/10 mm (10.2/0.4 in.) filled with concrete for adjustment of the column.
2. Insertion of reinforcing bar pieces.
3. Welding of ends of the reinforcing bars by the submerged arc method.
4. Filling with concrete.
5. Column stirrups.

CONSTRUCTION OF THE MAIN POWER PLANT BUILDING OF THE FOURTH TYPE LAYOUT DESIGNED IN PRECAST REINFORCED CONCRETE

Source: Stroitel'naya Promyshlennost' 1956, #6.

PLATE 25C

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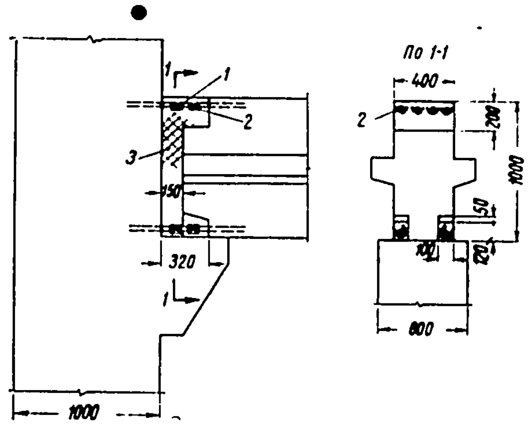

Fig. 7 - Legend

Joint of a transverse girder with a column

1. Insertion of pieces of reinforcing bars
2. Welding of ends of the reinforcing bars by the submerged arc method.
3. Concrete filling.

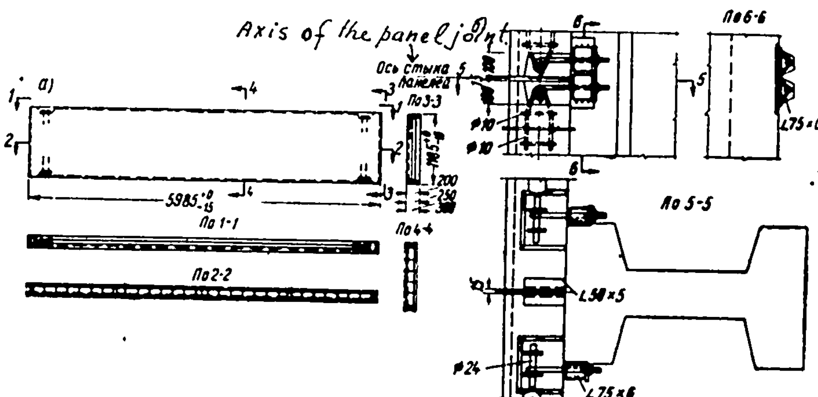

Fig. 8

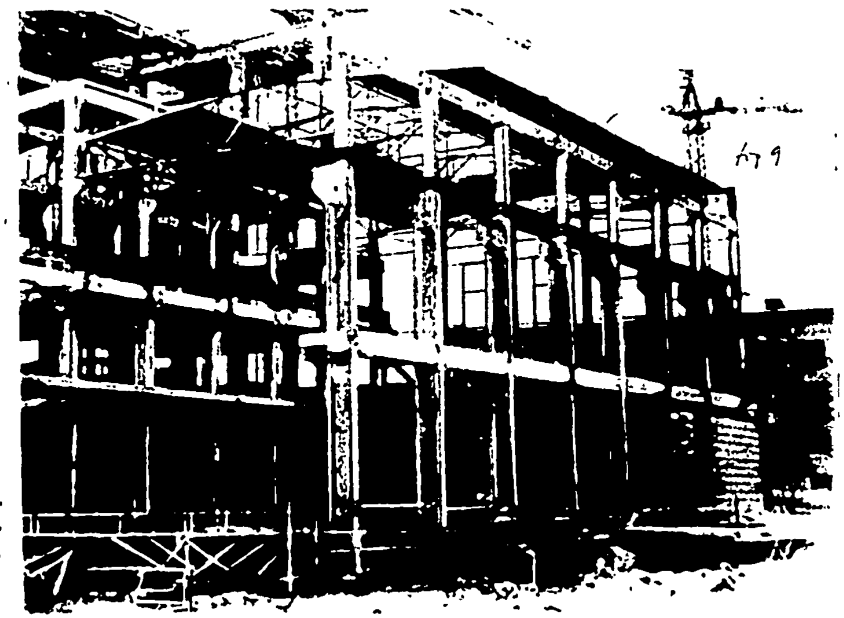

Fig. 9 - Legend

Construction of the frames of a TETs in precast concrete

Fig. 8 - Legend

Reinforced foam-concrete wall panels.

a. Geometrical dimensions.

b. Details of the attaching of panels to a column.

CONSTRUCTION OF THE MAIN POWER PLANT BUILDING OF THE FOURTH TYPE LAYOUT, DESIGNED IN PRECAST REINFORCED CONCRETE

Source: Stroitel'naya Promyshlennost' 1956, #6

PLATE 25D

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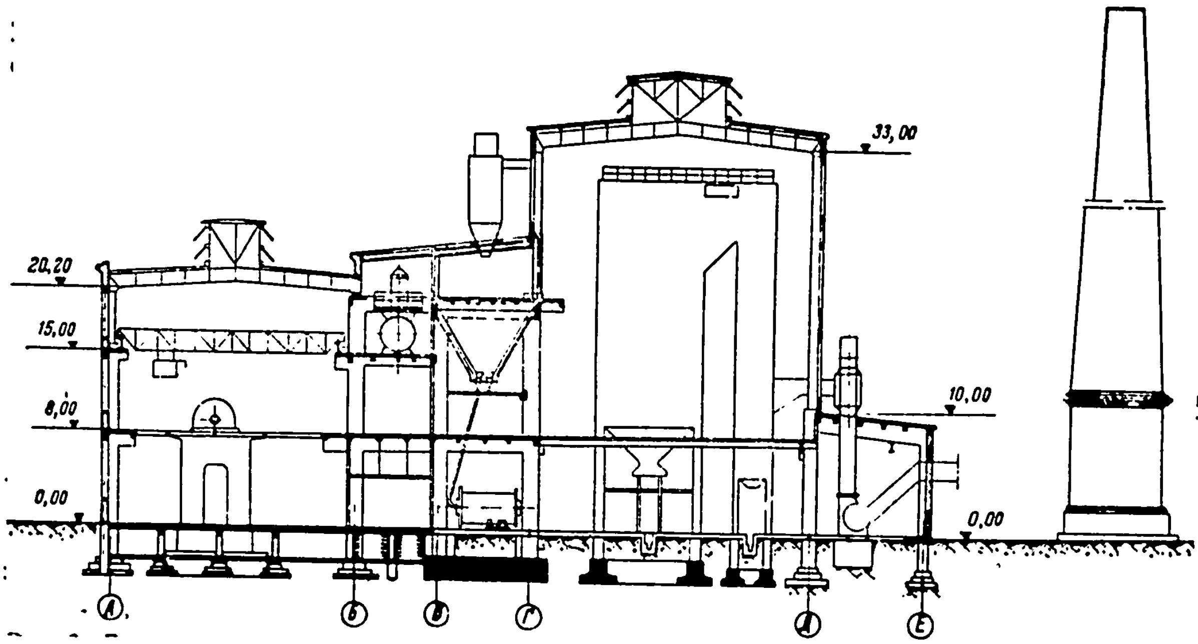

Fig. 1 - Frame construction in precast reinforced concrete and steel.

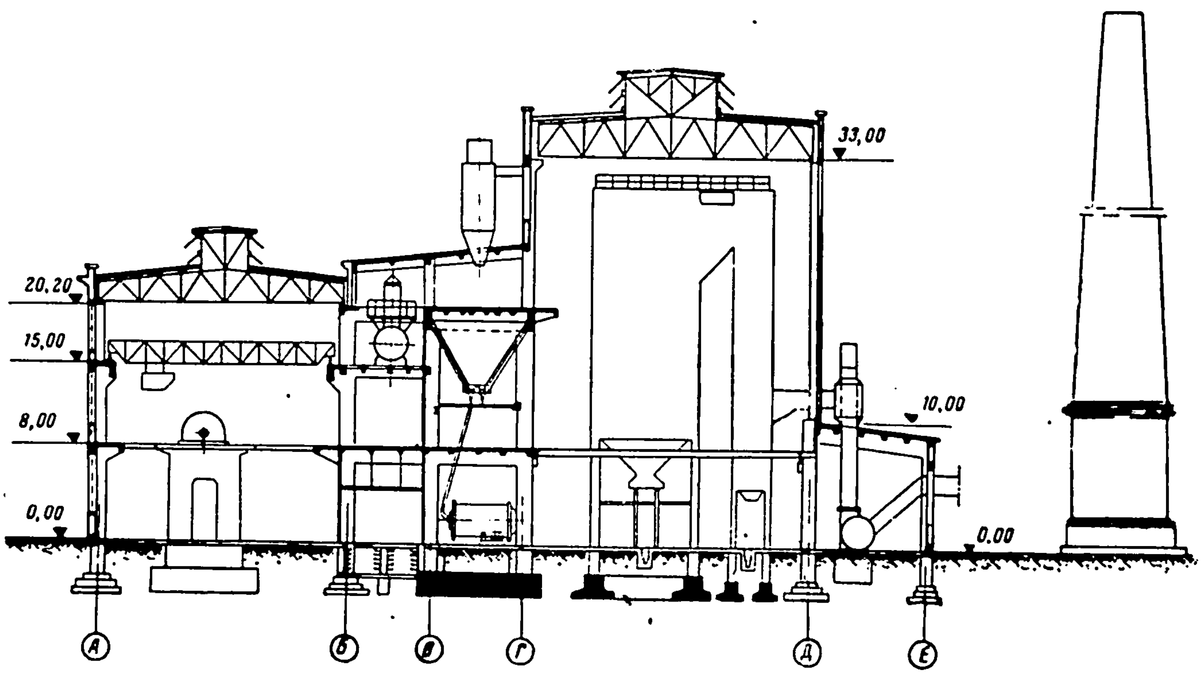

Fig. 2 - Frame construction entirely in precast reinforced concrete.

Two Alternatives in Construction.

MAIN POWER PLANT BUILDING

Source: Elektricheskiye Stantsii 1947, #7.

THERMAL ELECTRIC POWER PLANTS IN THE U.S.S.R.

Report No. 92

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Report No. 92

VOLUME II

Information Prepared
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Library of Congress

For
United States Air Force
September 1957

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CHAPTER III

Some of the Principal Soviet Thermal Power Plants.

Data (available and estimated) and photographs.

Abbreviations used:

GRES - State Regional Electric Power Plant.

GES - State Electrical Power Plant.

TETs - Heat-and-Power Electric Plant.

List of Plants

Name of the Plant	Plates	Pages
Shatura GRES	4, fig. 2; 26 - 26F.	14; 92-99
Dubrovka GRES	5; 27-27C.	15; 100-104
Gor'kiy GRES	4, fig. 1; 28 - 28C.	14; 105-109
Kashira GRES	29 - 29H.	110-119
Shterovka GRES	6, 6A; 30 - 30G.	16-17; 120-128
Zuyevka GRES	9, 9A; 31-31B.	21-22; 129-132
Ivanovo GRES	7; 32 - 32E.	18; 133-139
Stalinogorsk GRES	12, 12A; 33 - 33E.	26-27; 140-146
Stalingrad GRES	10; 34 - 34B.	23; 147-150
Stalingrad TETs	34C.	151-152
White Russian GRES	35 - 35D.	153-158
Berezniki TETs	36 - 36C	159-163
Solikamsk GES	37	164-165
Kuznetsk TETs	11, 11a; 38 - 38D.	24-25; 166-171
Chelyabinsk GRES	39, 39A.	172-174
Magnitogorsk GES	40 - 40B.	175-178
Kramatorsk GES	41, 41A	179-181
Kemerovo TETs	42	182-183

List of Plants (Cont'd)

Name of the Plant	Plates	Pages
Sverdlovsk TETs	43, 43A.	184-186
Voroshilovsk GES	44	187-188
Saratov GRES	45 - 45E	189-195
Yaroslavl' GRES	46	196-197
Yaroslavl' TETs	46A	198-199
Baku GRES	47, 47A	200-202
Baku GES	47B	203-204
Novorossiysk GRES	48	205-206
Voronezh GRES	49	207-208
Kazan' TETs	50, 50A	209-211
Moskva TETs "Stalin"	51, 51a	212-214
Moskva GES "Smidovich"	51A-51D	215-219
Moskva High Pressure TETs	51E	220-221
Elektrogorsk GES "Klasson"	51F	222-223
Artem GRES	52, 52A	224-226
Mironovskaya GRES	53	227-228
Slavyansk GRES	54, 54A.	229-231
Cherepet' GRES	55-55B	232-235

SHATURA PEAT-FIRING GRES

(Plates: 4, fig. 2; 26, 26A, 26B, 26C, 26D, 26E, 26F)

Location: Shatura, near Moscow.

Coordinates: 55° 35' N, 39° 36' E.

Date of construction: 1925, enlarged in 1933.

Layout type: Of special design, three separate boiler house buildings placed crosswise to the turbine hall (see Plate 4, fig. 2, also description on page)

Installed capacity: 180,000 kw. (1933)

Dimensions: Overall: L. - 180 ft.; W. - 82 ft.; H. - 44 ft.

Structural type: Poured-in-place reinforced concrete frame.

Wall covering: Brick curtain or panel walls.

Roof construction: Steel roof trusses.

Roofing: Ruberoid on wooden later changed to reinforced concrete sheathing.

Window sash: Steel.

Cranes: In the turbine hall, cap. 75/15 m tons (estimate).

Crane girders: Steel.

Stacks: Steel on the roof of the boiler house.

Trestles for peat delivery: Steel.

Substation: Open-air, adjoining the power plant building.

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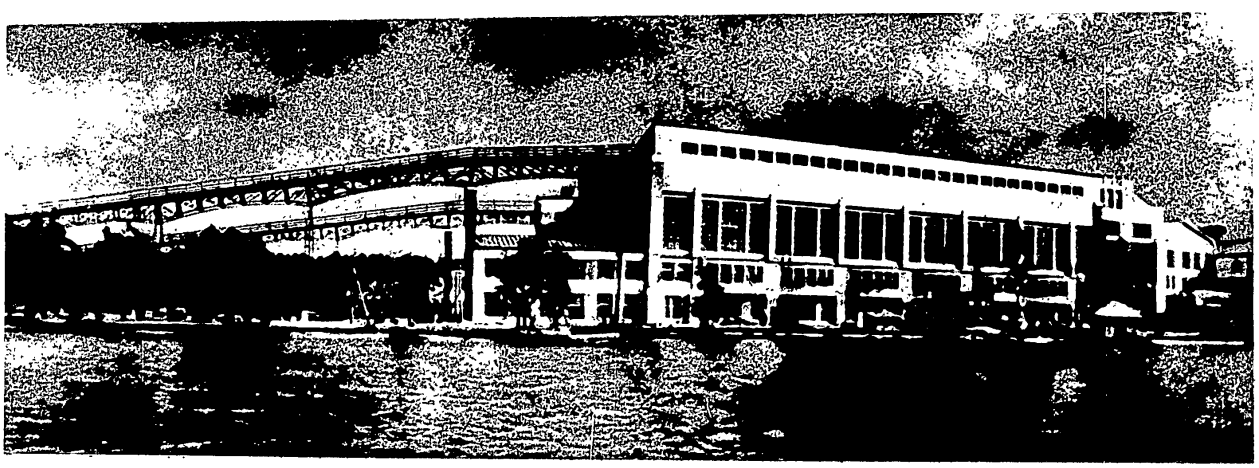

Side view of the GRES and peat delivery trestles.

SHATURA PEAT-FIRING GRES
(Capacity: 180,000 kw.)

Source: USSR in Construction 1930, #3, p. 8 top

PLATE 26

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<u>View from the turbine hall side.</u>

SHATURA PEAT-FIRING GRES
(Capacity: 180,000 kw.)

Source: Elektrotechnische Zeitschrift, 1930, p. 387 bottom (TK3.E8).

PLATE 26A

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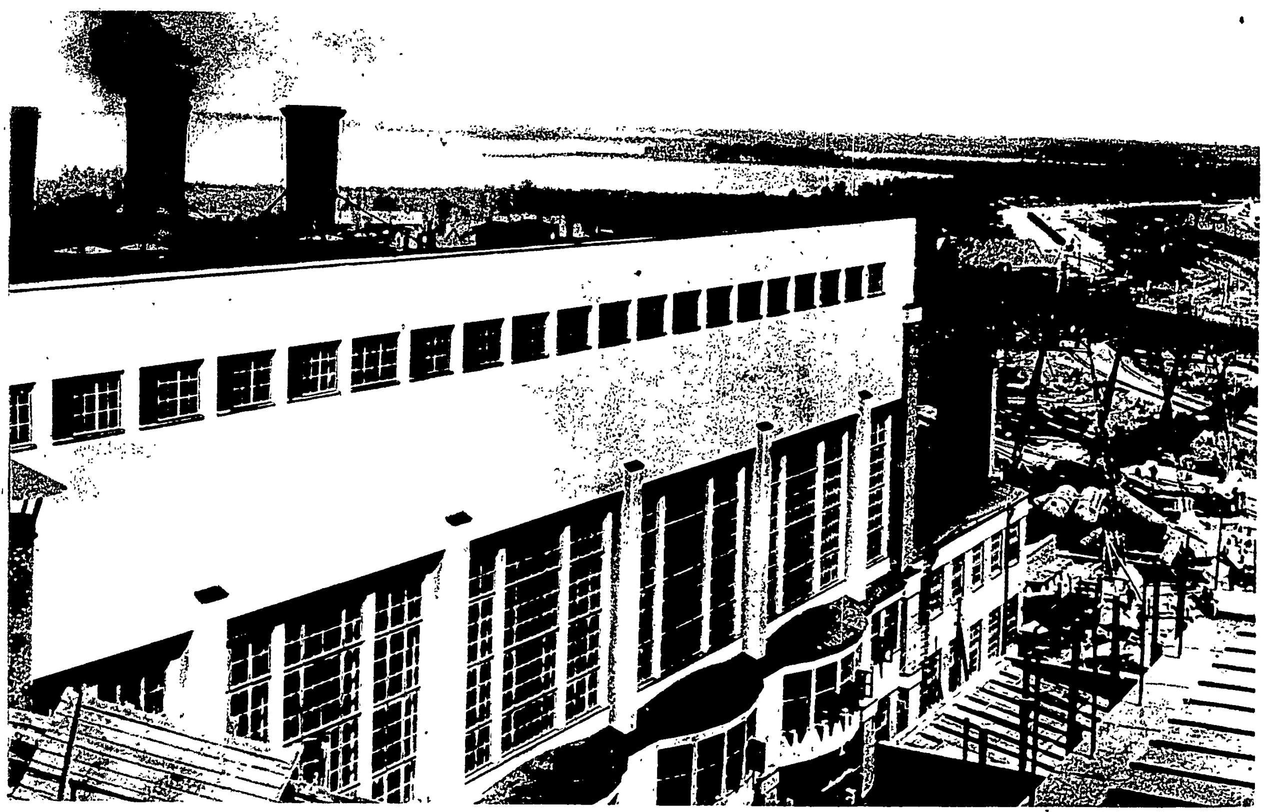
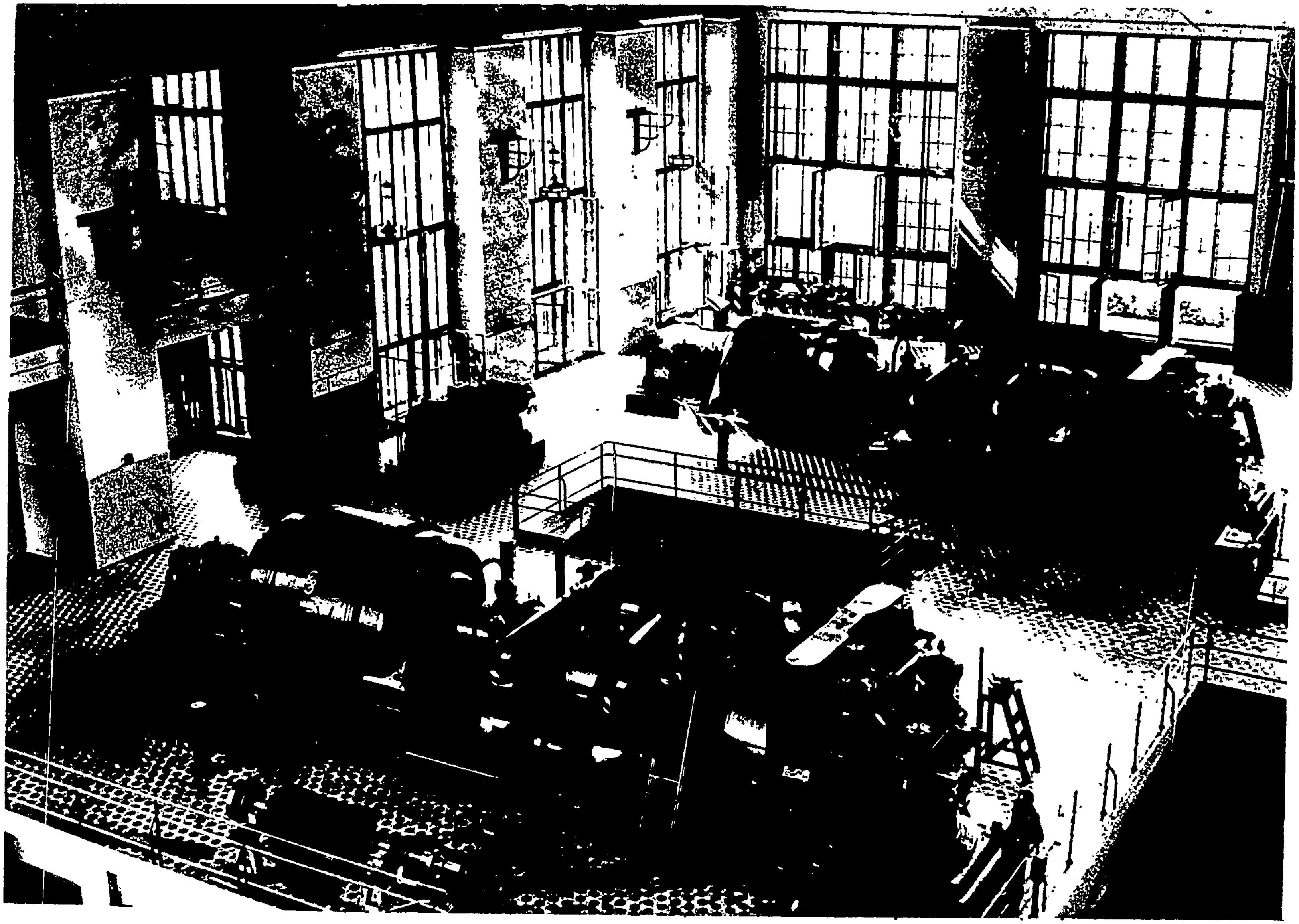


Partial view of the boiler house #2.

SHATURA PEAT-FIRING GRES (Capacity: 180,000 kw.)

Source: USSR in Construction 1930, #3, p. 9 top

PLATE 26B



Partial view of a turbogenerator hall.

SHATURA PEAT-FIRING GRES (Capacity: 180,000 kw.)

Source: USSR in Construction 1930, #3, p. 9 bottom

PLATE 26C

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Partial view of second section of the turbogenerator hall.

SHATURA PEAT-FIRING GRES
(Capacity: 180,000 kw.)

Source: Economic Review of the Soviet Union 1931, #8, p. 178.

PLATE 26D

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Partial view of the transformer bank.

SHATURA PEAT-FIRING GRES
(Capacity: 180,000 kw.)

Source: Economic Review of the Soviet Union 1929, #11, front cover

PLATE 26E

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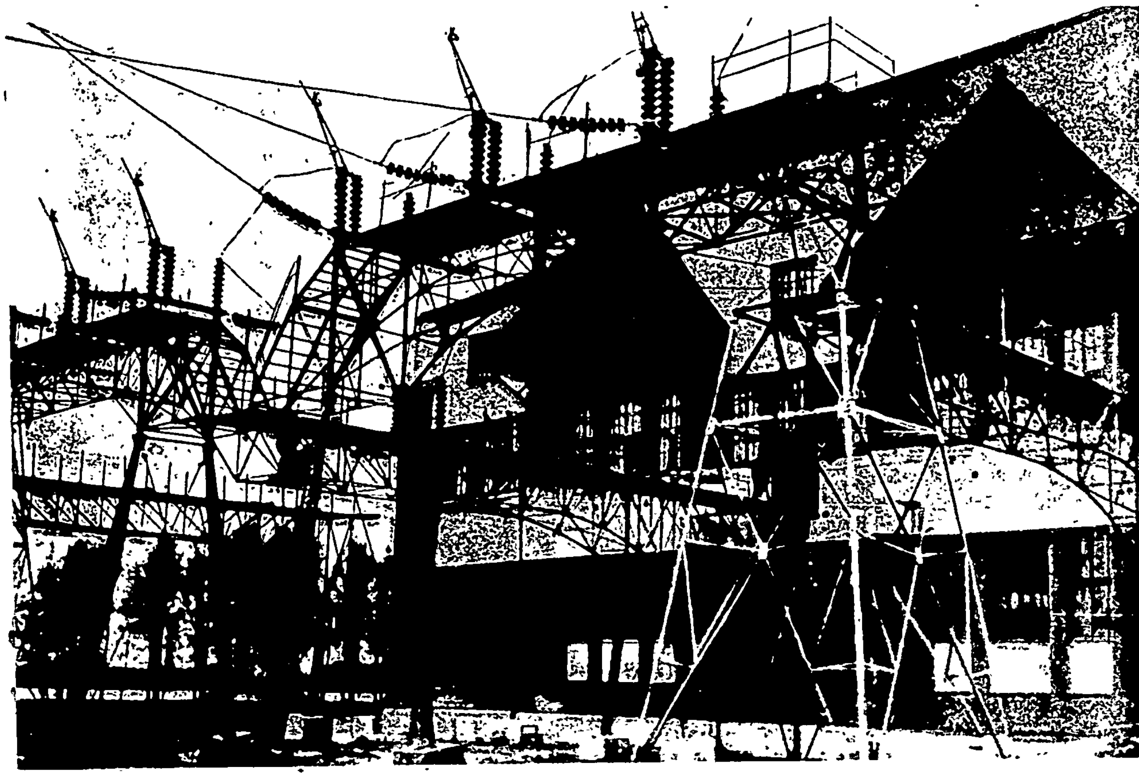


Partial exterior view of a sub-station and steel structures carrying high tension wires.

SHATURA PEAT-FIRING GRES
(Capacity: 180,000 kw.).

Source: Prozhektor 1925, #20, p. 8 bottom

PLATE 26F

DUBROVKA PEAT-FIRING GRES

(Plates: 5; 27, 27A, 27B, 27C)

Location: Village on the Neva River near Leningrad

Coordinates: 59° 50' N, 31° 00' E.

Layout type: Of special design, two boiler houses, between them the turbine hall (see Plate 5, also description p.).

Date of Construction: Built in 1933, reconstructed in 1946.

Installed capacity: 200,000 kw (1946)

Structural type: Steel frame (probably)

Outside dimensions: L. ; W. 297 ft.

Wall covering: Originally brick curtain walls, reconstructed - reinforced concrete panels.

Roof construction: Steel trusses.

Roofing: Ruberoid on reinforced concrete sheathing (prob.).

Boiler house: W. - 59 ft; Height to roof truss: 69 ft. (est).

Bunker sect.: W. - 31 ft.

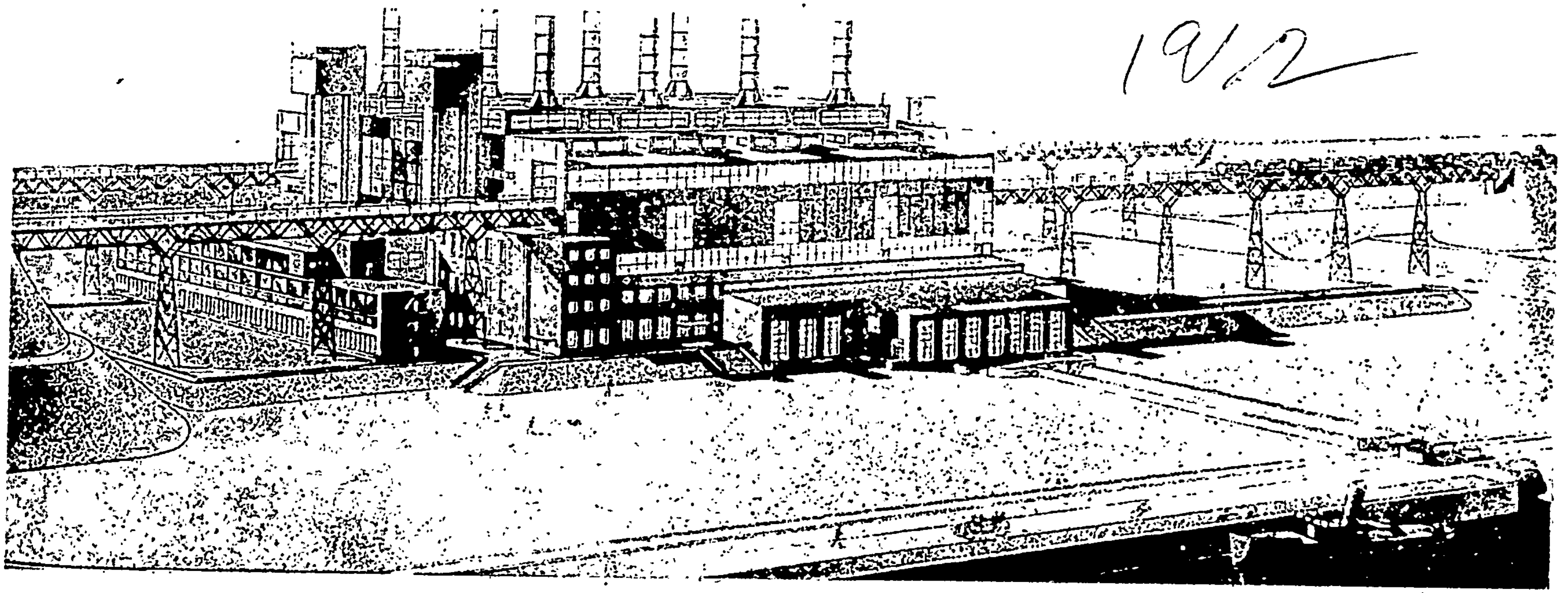
Turbine Hall: W. - 116 ft; Height to roof truss: 79 ft (est).

Cranes: In the turbine hall, cap. 75/15 m tons (est).

Crane girders: Steel

Stacks: Steel 2 rows of 4, on roof of turbine houses.
Height above roof 18 ft., ∅ 12 ft.

Trestles for peat delivery: Steel.



General view

DUBROVKA PEAT-FIRING GRES
(Capacity: 200,000 kw.)

Source: Elektricheskiye Stantsii 1932, #3, front cover, (TK4.E725).

PLATE 27

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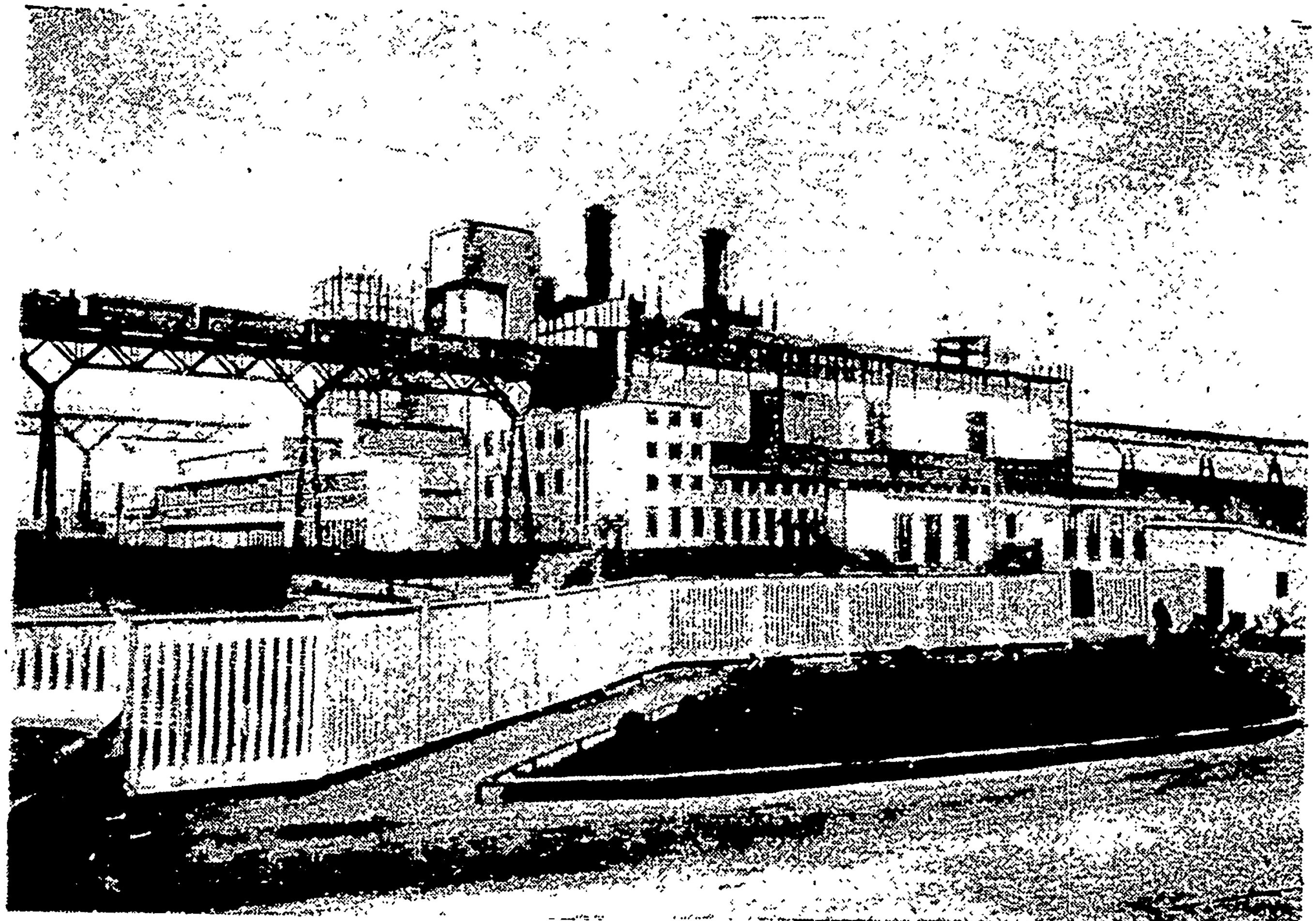
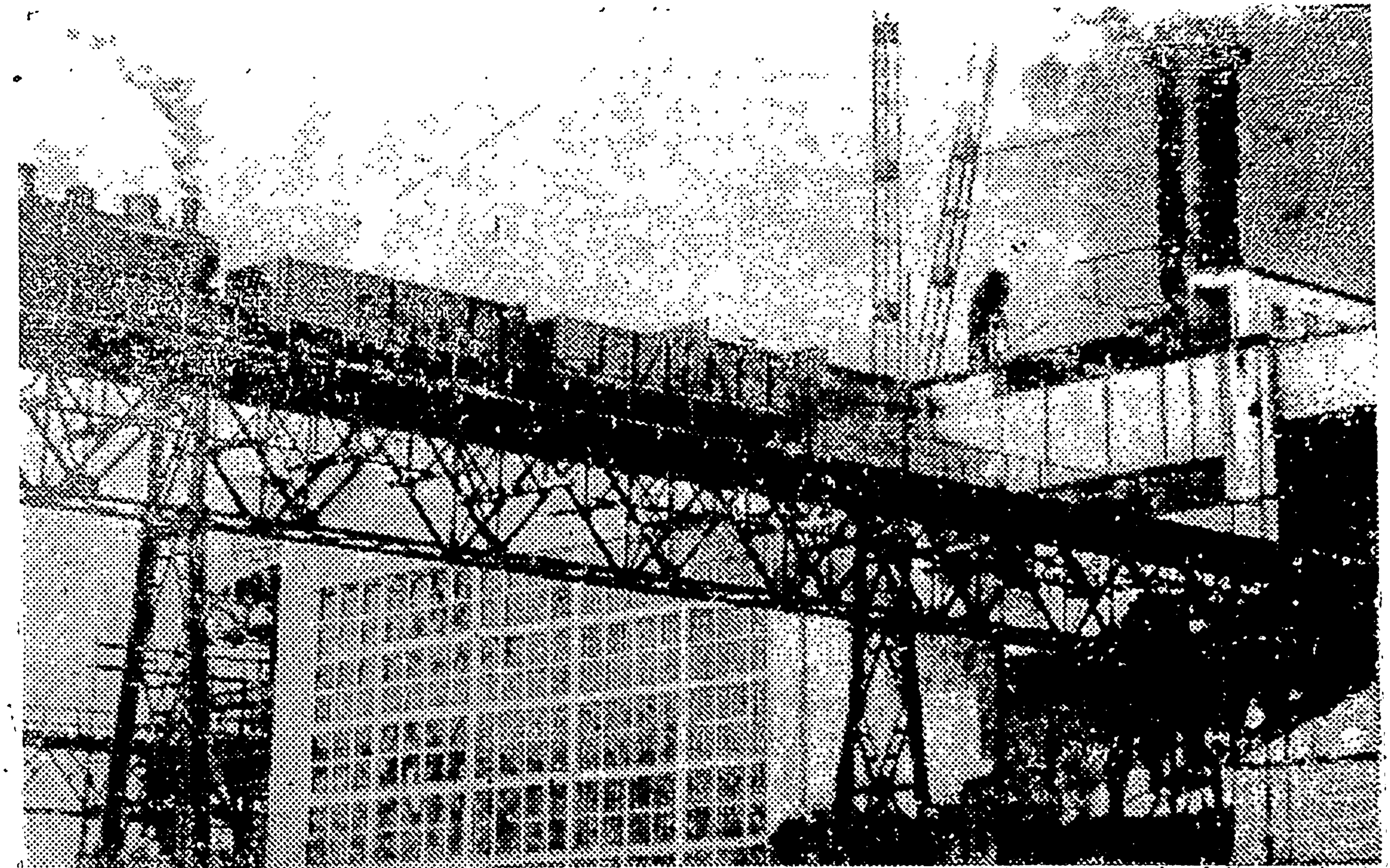


Side view of the plant showing steel trestles for peat delivery and a boiler house.

DUBROVKA PEAT-FIRING GRES
(Capacity: 200,000 kw.)

Source: Pyatnadsat' let leninskogo plana elektrifikatsii 1936 p. 69 (TK85.D6)

PLATE 27A



Partial view of the GRES showing steel trestles for peat delivery.

(during the reconstruction in 1946)

DUBROVKA PEAT-FIRING GRES
(Capacity: 200,000 kw.)

Source: Leningradskaya Pravda 1947, #14, p. 4.

PLATE 27B

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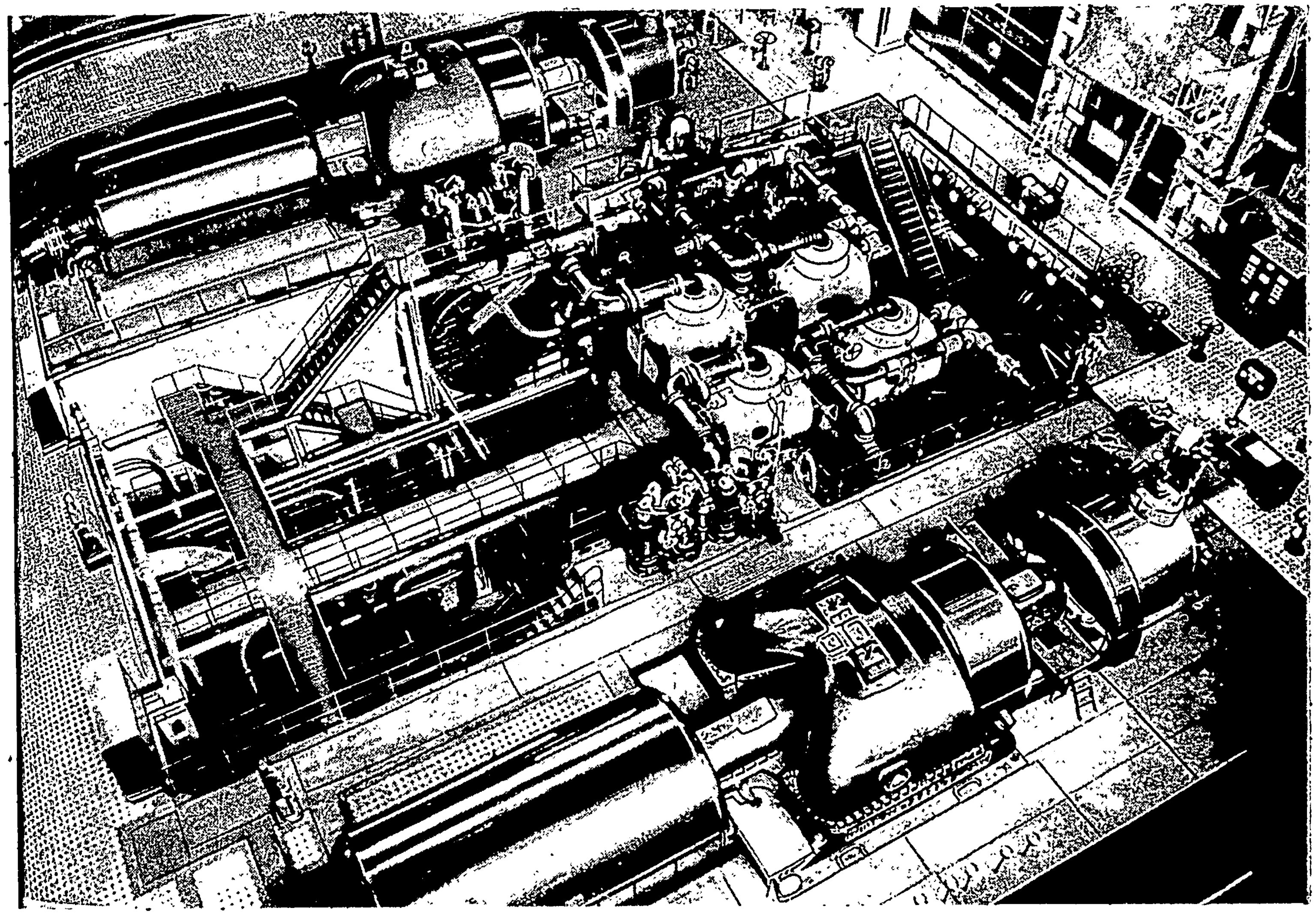


Partial view of the turbine hall.

DUBROVKA PEAT-FIRING GRES (Capacity: 200,000 kw.)

Source: Elektricheskiye Stantsii 1937, #10, front cover, (TK4.E725).

PLATE 27C

GOR'KIY GRES (Mixed Fuel: Peat and Coal Firing)

(Plates: 4, fig. 1; 28, 28A, 28B, 28C)

Location: Town of Balakhna on the banks of theVolga River, 33 klm from the city of Gor'kiy.

Coordinates: 56° 20' N, 44° 00' E.

Date of Construction: First part - 1930.
Second part - 1933.

Layout type: First part - First type design.
Second part - Second type design (prob).

Installed capacity: 204,000 kw (1933).

Structural type: Poured-in-place reinforced concrete frame

Wall covering: Brick curtain walls.

Roof construction: Monolithic reinforced concrete beams.

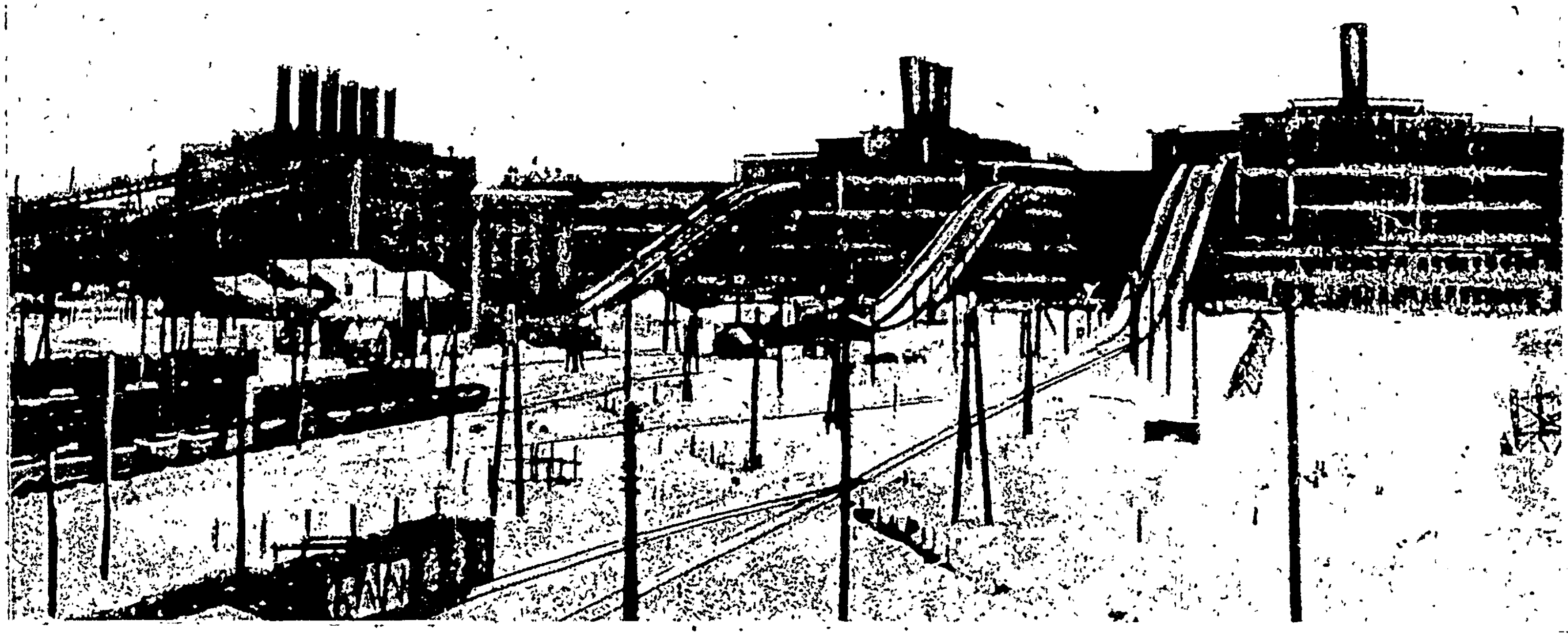
Roofing: Ruberoid.

Cranes: In the turbine hall.

Crane girders: Reinforced concrete.

Floor construction in the turbine hall: Steel grid on steel stanchions.

Stacks: Steel on roofs of boiler houses.



General view of two boiler houses - first part of construction.

GOR'KIY GRES (mixed peat and coal firing)
(Capacity: 204,000 kw.)

Source: Elektricheskiye Stantsii 1934, #4, front cover (TK4.E725).

PLATE 28

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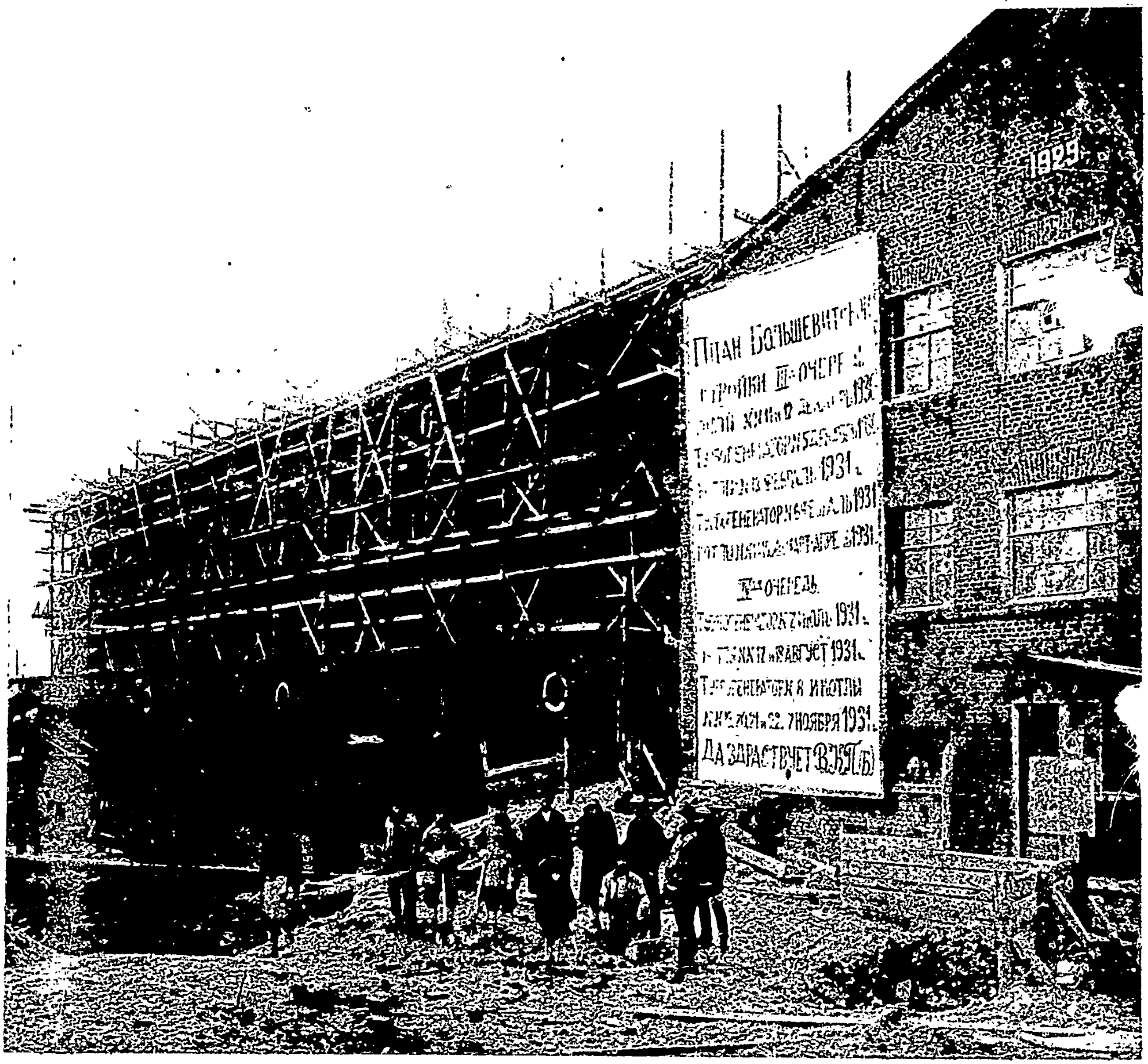

One of the GRES buildings under construction.

GOR'KIY PEAT AND COAL-FIRING GRES
(Capacity: 204,000 kw.)

Source: Prozhektor, 1930, #34, p. 9.

PLATE 28A

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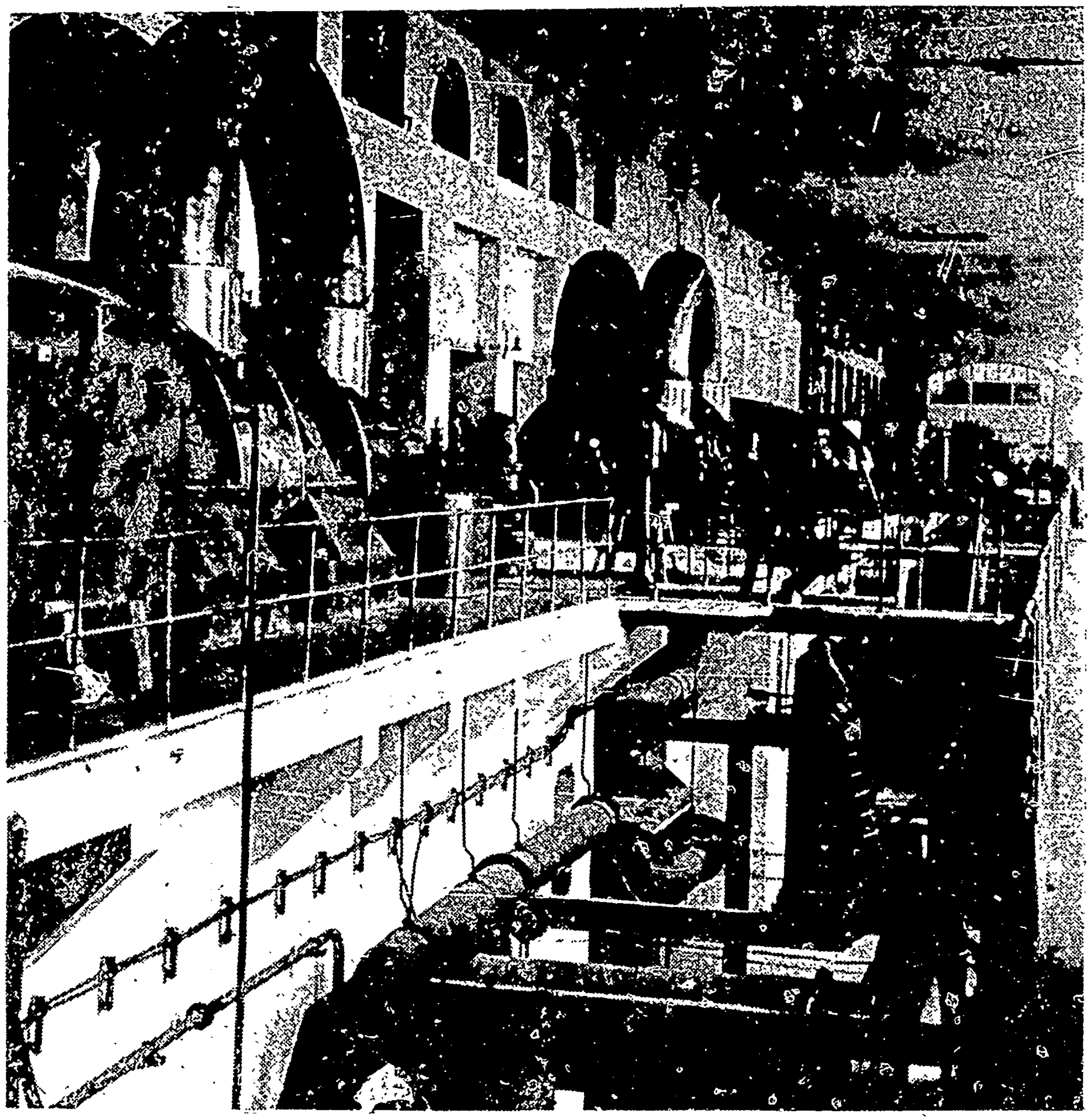

Partial view of the turbine hall.

GOR'KII GRES (mixed peat and coal firing)
(Capacity: 204,000 kw.)

Source: Economic Review of the Soviet Union 1932, #7, p. 164.

PLATE 28B

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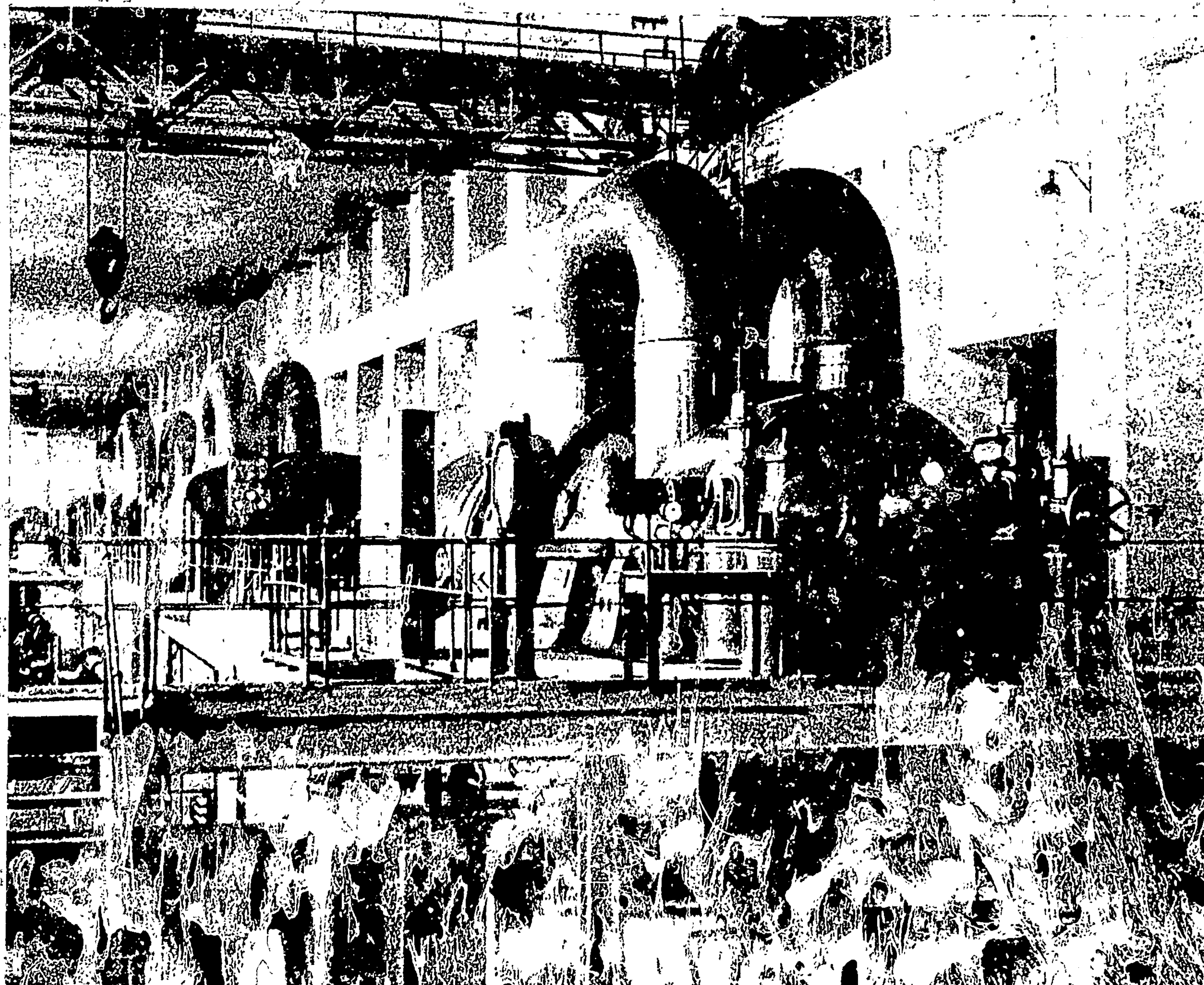


Partial interior view of the [illegible] all.

GOR'KIY PEAT AND COAL-FIRING [illegible]
(Capacity: [illegible] kw.)

Source: [illegible] in Construction [illegible] 33, #3, p. 12 middle

PHOTO 28[illegible]

KASHIRA PULVERIZED COAL GRES

(Plates: 29, 29A, 29B, 29C, 29D, 29E, 29F, 29G, 29H)

Location: Kashira, town in Moscow Region.

Coordinates: 54° 50' N, 38° 12' E.

Date of construction: First built in 1923, extended in 1931 and 1932.

Layout type: First type design.

Installed capacity: 186,000 kw (1932).

Structural type: Poured-in-place reinforced concrete frame.

Wall covering: Brick curtain walls ; wall section around the coal bunkers finished with hollow concrete blocks.

Roof construction: Steel trusses and reinforced concrete beams.

Roofing: Metal sheets and ruberoid.

Cranes: In the turbine hall, originally 35 m. tons capacity later propably increased to 75/15 m tons.

Crane girders: Steel.

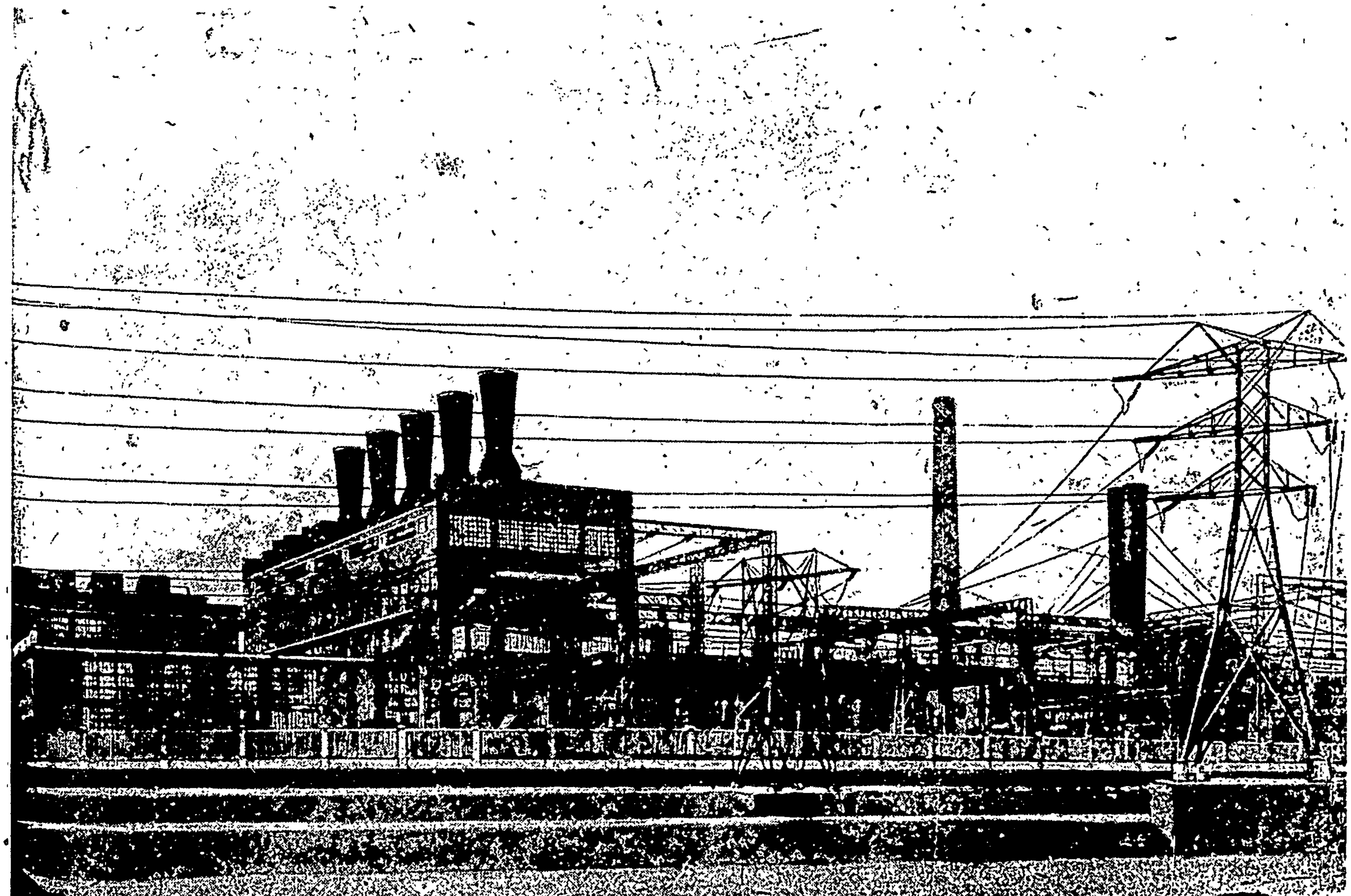
Turbine hall floor: Steel frame on steel stanchions, covered with tile.

Coal bunkers: Reinforced concrete.

The general power distribution control panel is located in the continuation of the turbine hall section.

Stacks: Steel on roof of building.

Substations: Steel frames - outdoor.

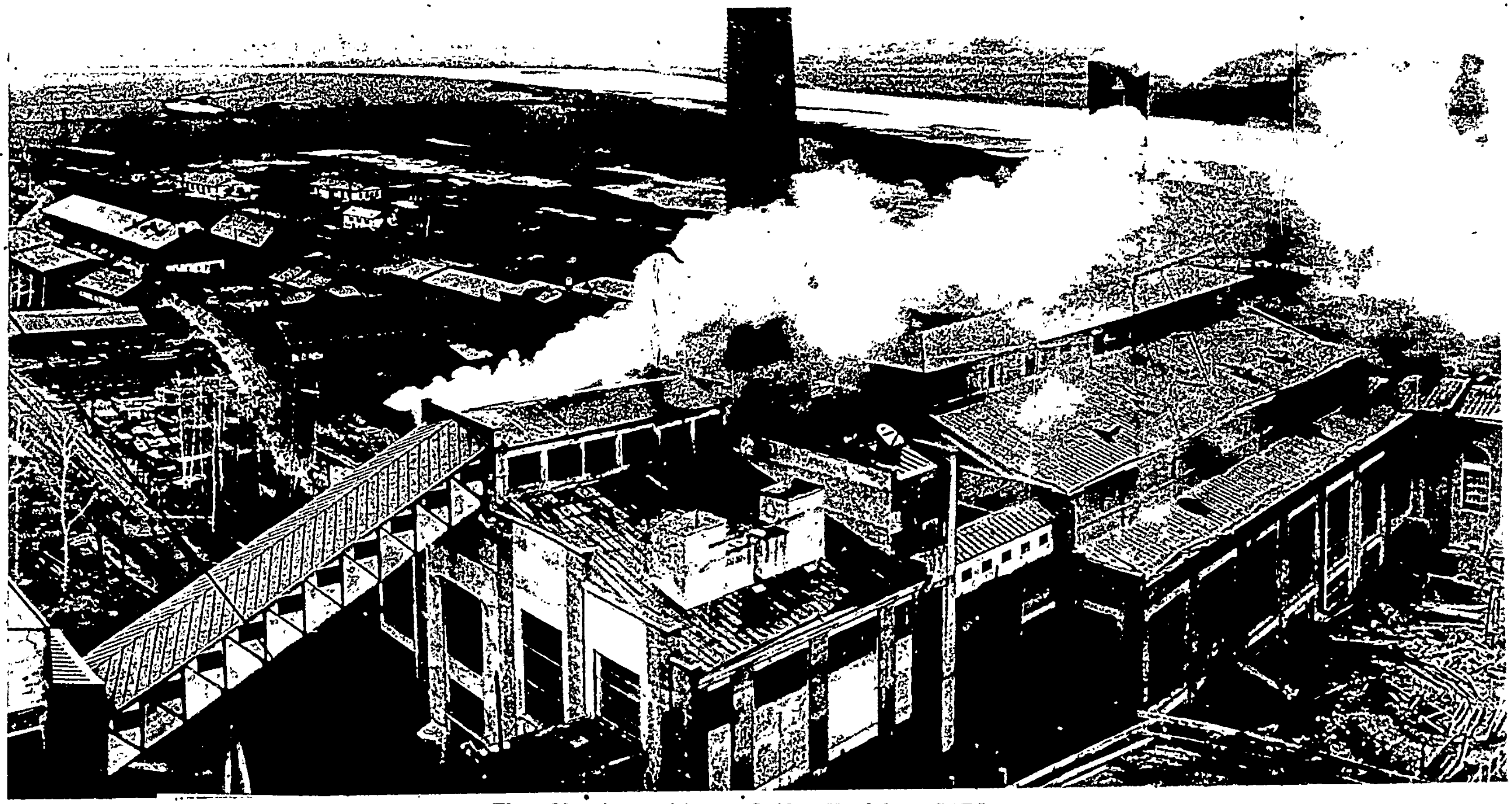


General view of the boiler house and the open-air sub-station.

KASHIRA PULVERIZED COAL-FIRING GRES. (Capacity: 186,000 kw.)

Source: Elektricheskiye Stantsii 1933, #5, front cover ($T^{K}4$.E725)

PLATE 29



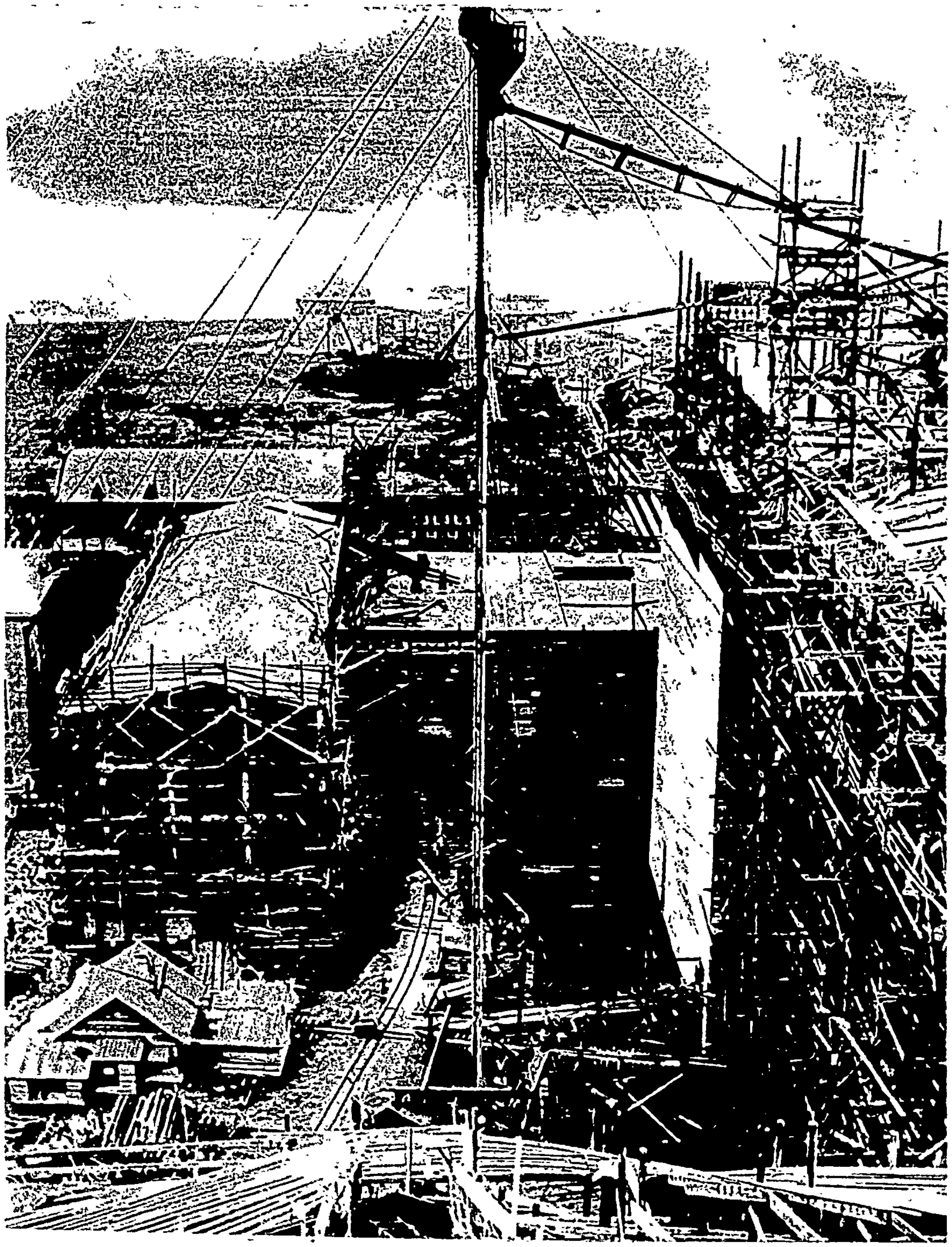
<u>The first section of the Kashira GRES</u>

KASHIRA PULVERIZED COAL-FIRING GRES
(Capacity: 186,000 kw.)

Source: USSR in Construction 1930, #3, top p. 6

PLATE 29A

Declassified in Part - Sanitized Copy Approved for Release @ 50-Yr 2013/09/03 : CIA-RDP81-01043R002500170001-1

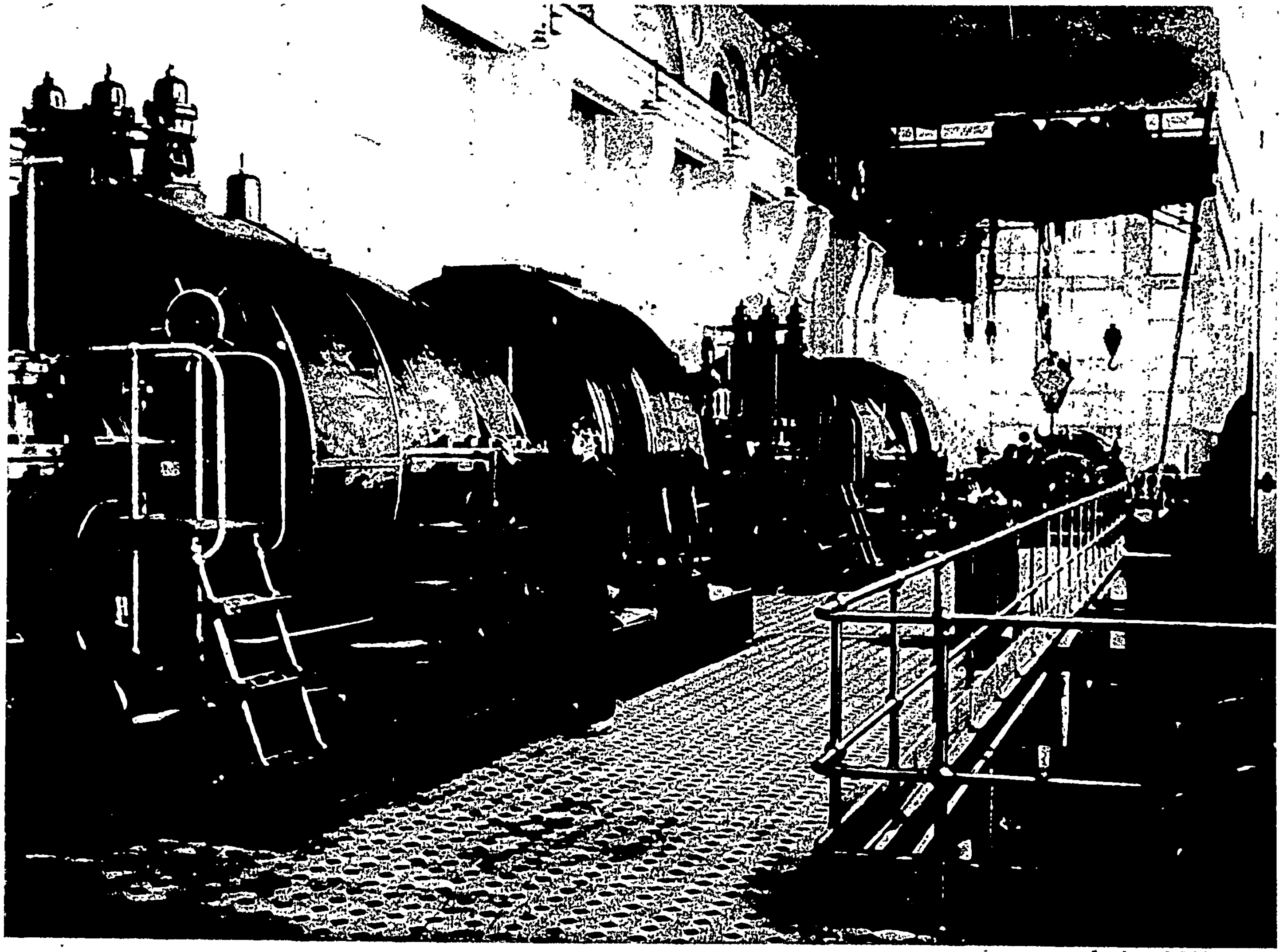


The second section of the Kashira GRES under construction

KASHIRA PULVERIZED COAL-FIRING GRES (Capacity: 186,000 kw.)

Source: USSR in Construction 1930, #3, p. 7, bottom.

PLATE 29B



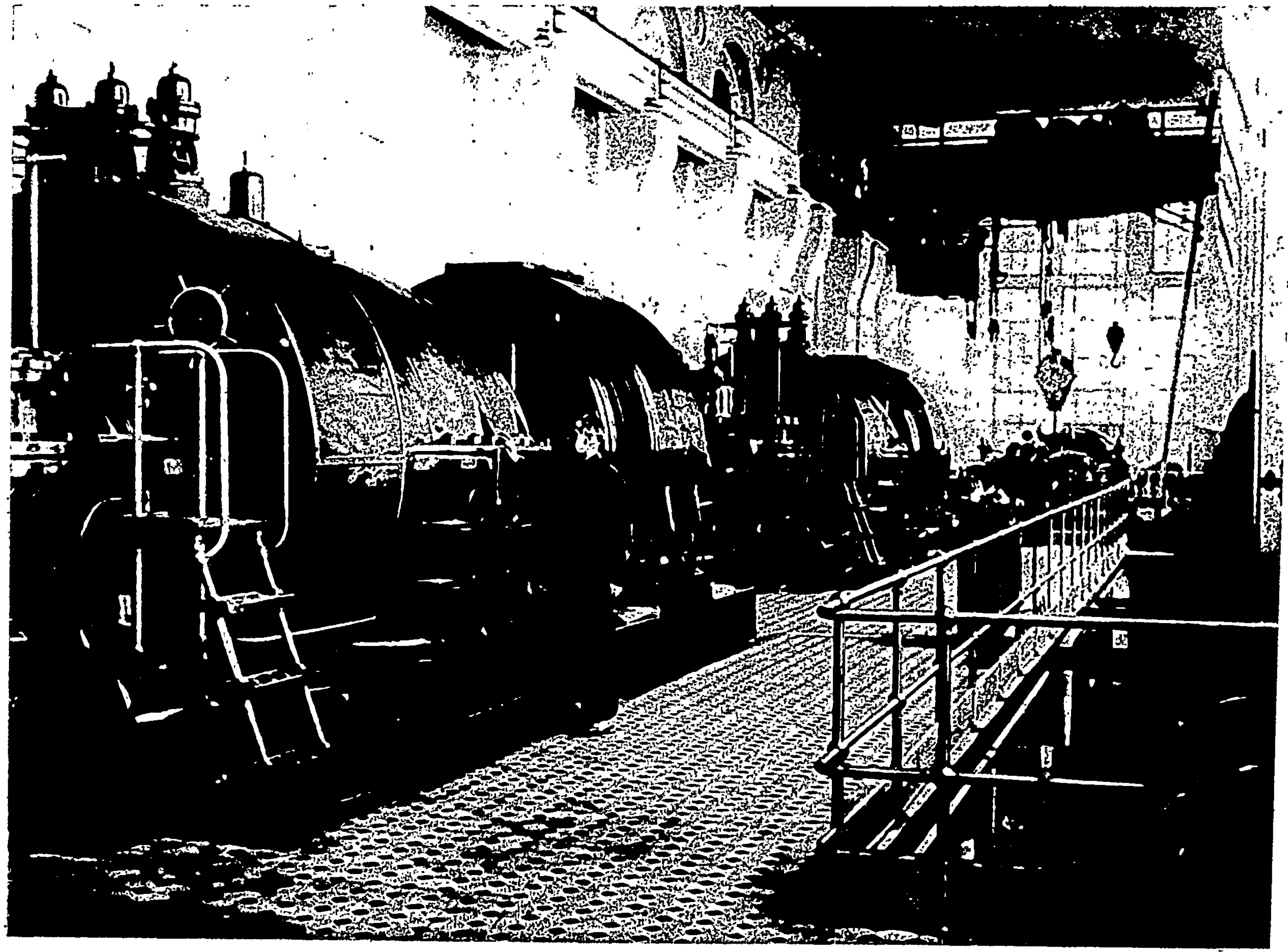
A 50,000 kw. turbogenerator built by the "Elektrosila" Plant.

KASHIRA PULVERIZED COAL-FIRING GRES (Capacity: 186,000 kw.)

Source: Elektricheskiye Stantsii, 1933, #6, front cover (TK4.E725)

PLATE 29C

Declassified in Part - Sanitized Copy Approved for Release @ 50-Yr 2013/09/03 : CIA-RDP81-01043R002500170001-1



<u>Partial view of the turbine hall</u>.

KASHIRA PULVERIZED COAL-FIRING GRES (Capacity: 186,000 kw.)

Source: USSR in Construction 1930, #3, bottom p. 6.

PLATE 29D

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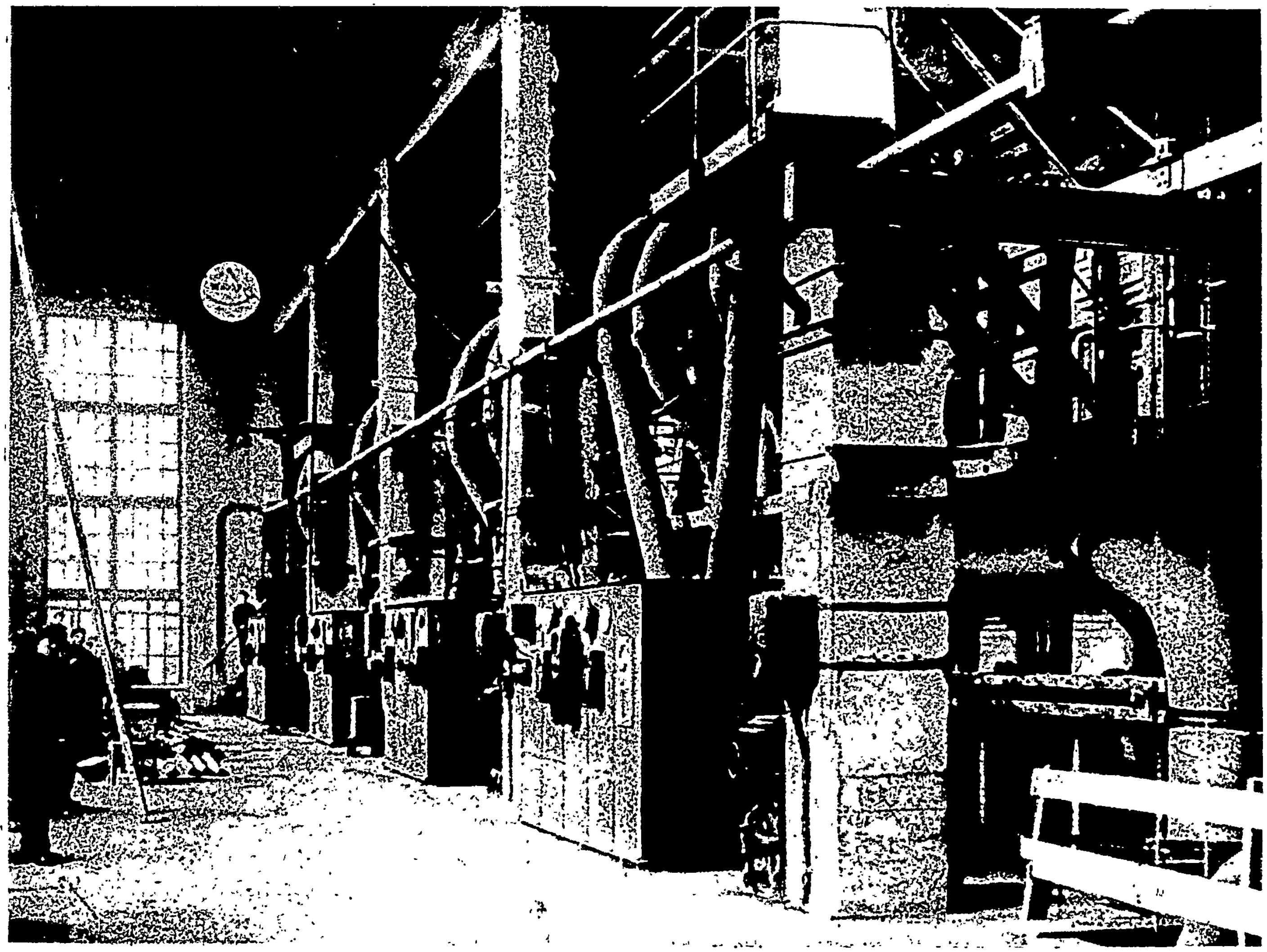

Coal pulverizing equipment

KASHIRA PULVERIZED COAL-FIRING GRES (Capacity 186,000 kw.)

Source: USSR in Construction 1930, #3, p. 7, top right.

PLATE 29E

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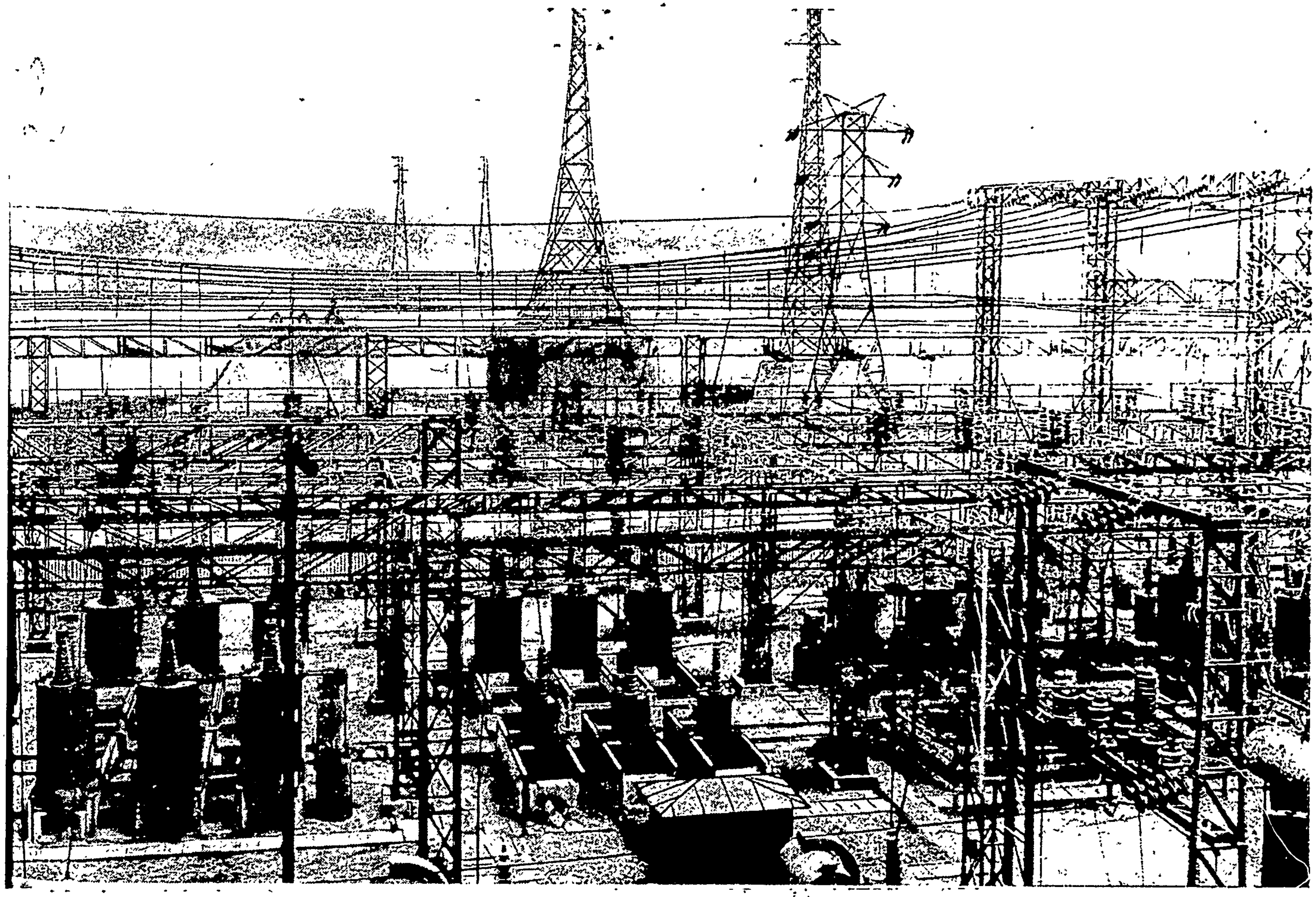


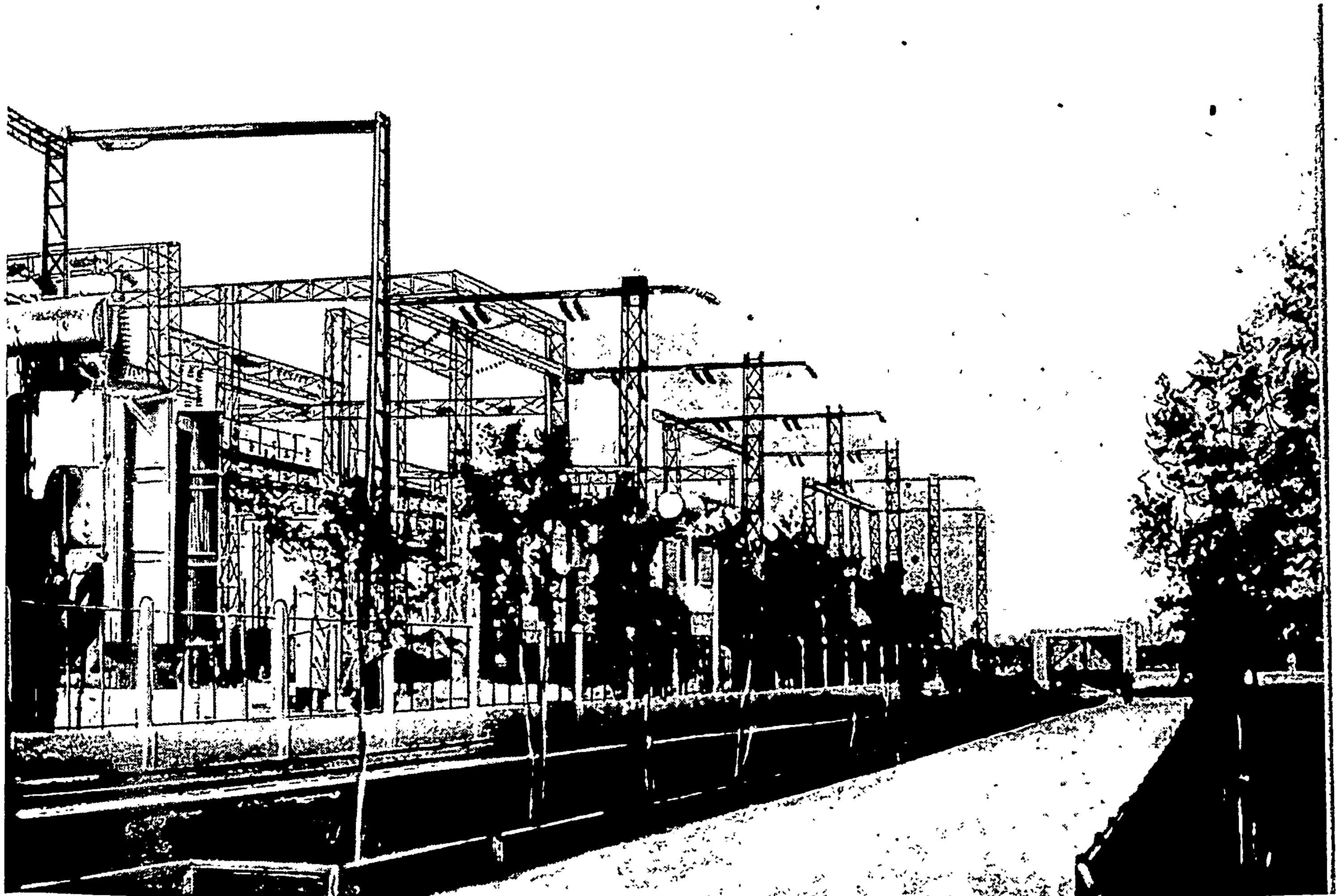
Partial view of an outdoor sub-station.

KASHIRA PULVERIZED-COAL FIRING GRES (Capacity: 186,000 kw.)

Source: Elektricheskiye Stantsii 1933, #7, front cover, (TK4.#725)

PLATE 29F

Declassified in Part - Sanitized Copy Approved for Release @ 50-Yr 2013/09/03 : CIA-RDP81-01043R002500170001-1



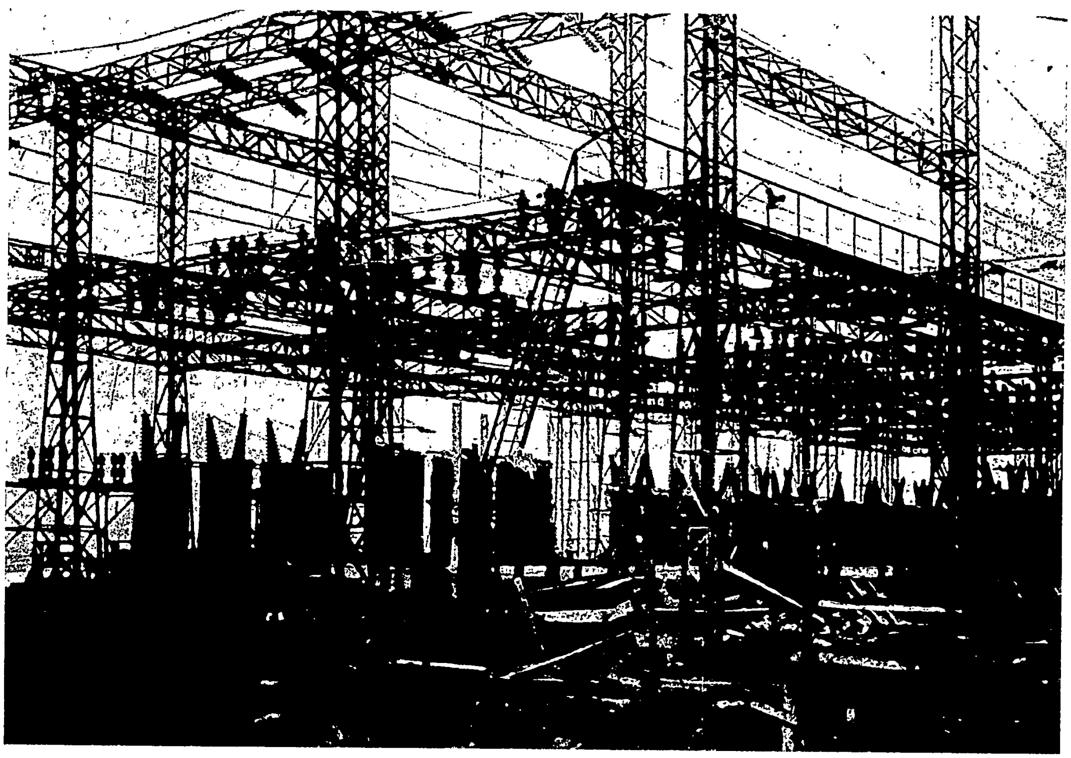
Partial view of the 115 kw. outdoor sub-station.

KASHIRA PULVERIZED COAL-FIRING GRES (Capacity: 186,000 kw.)

Source: Elektricheskiye Stantsii, 1937, #6, front cover (TK4.E725)

PLATE 29G

Declassified in Part - Sanitized Copy Approved for Release @ 50-Yr 2013/09/03 : CIA-RDP81-01043R002500170001-1



Step-up transformer bank.

KASHIRA PULVERIZED COAL-FIRING GRES
(Capacity: 186,000 kw.)

Source: USSR in Construction 1930, #3, p. 27, top left.

PLATE 29H

Declassified in Part - Sanitized Copy Approved for Release @ 50-Yr 2013/09/03 : CIA-RDP81-01043R002500170001-1

SHTEROVKA PULVERIZED COAL GRES

(Plates: 30, 30A, 30B, 30C, 30D, 30E, 30F, 30G)

Location: Shterovka in the Ukranian Donbass.

Coordinates: 48° 05' N, 38° 55' E.

Date of construction: Built in 1926, extended in 1930 and 1931. Reconstructed after the war.

Layout type: First type design

Installed capacity: 152,000 kw. (1931)

Dimensions: Turbine hall: Length - 115 ft.; Width 50 ft.; Height - 65 ft.
Feedwater pump section: Length - 98 ft.; Width 23 ft.; Height 67ft.
Boiler house: Length - 164 ft.; Width 98 ft.; Height - 93 ft.

Structural type: Poured-in-place reinforced concrete frame.

Wall covering: First construction - brick curtain wall, later extensions, reinforced concrete panels.

Roof construction: Steel trusses (prob).

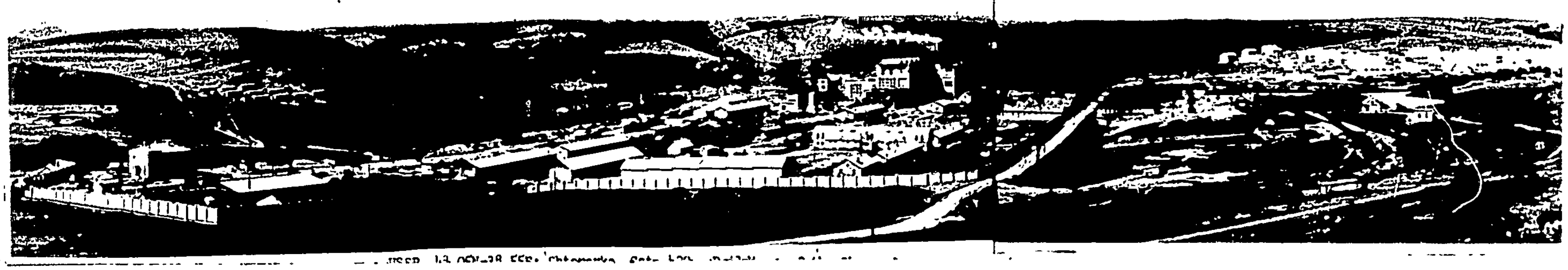
Roofing: Ruberoid (prob).

Cranes: In the turbine hall - cap. 75/15 (est).

Crane girders: Reinforced concrete.

Turbine hall floor: Steel frame on steel stanchions tile floor cover.

Stacks: Steel on roof of building.



General view of the plant.

SHTEROVKA PULVERIZED COAL FIRING GRES (Capacity: 152,000 kw.)

Source: USSR in Construction 1930, #3 top. pp. 10-11.

PLATE 30

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View of the main structure from the south.

SHTEROVKA PULVERIZED COAL-FIRING GRES
(Capacity: 152,000 kw.)

Source: USSR in Construction 1930, #3, p. 10 middle.

PLATE 30A

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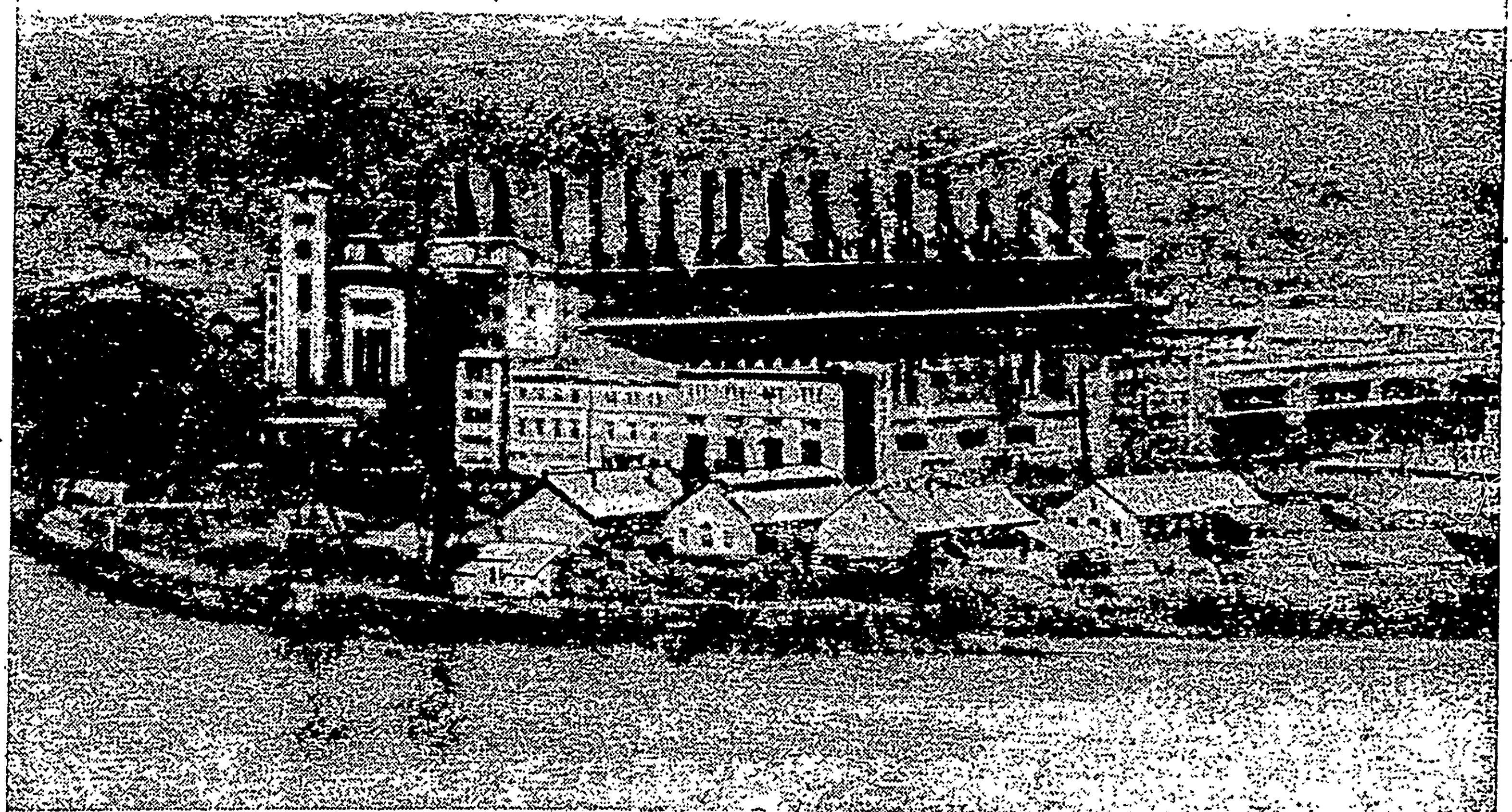


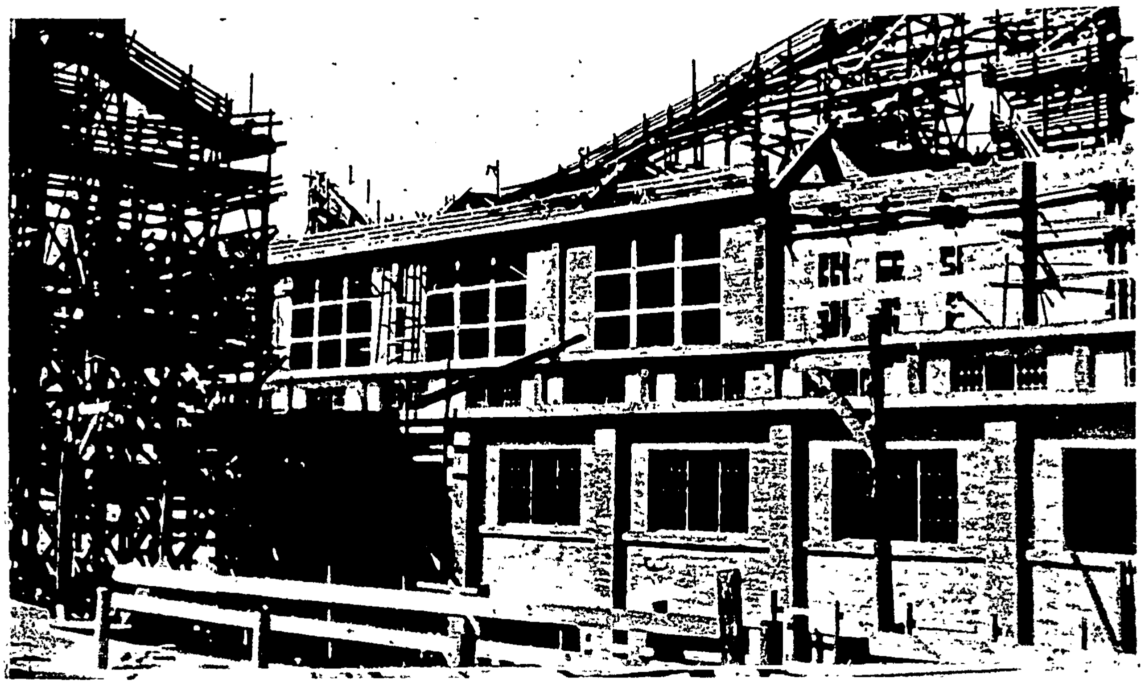
General view of the GRES.

SHTEROVKA PULVERIZED COAL-FIRING GRES (Capacity: 152,000 kw.)

Source: Elektricheskiye Stantsii 1936, #1, p. 9 (TK4.E725)

PLATE 30B

Declassified in Part - Sanitized Copy Approved for Release @ 50-Yr 2013/09/03 : CIA-RDP81-01043R002500170001-1

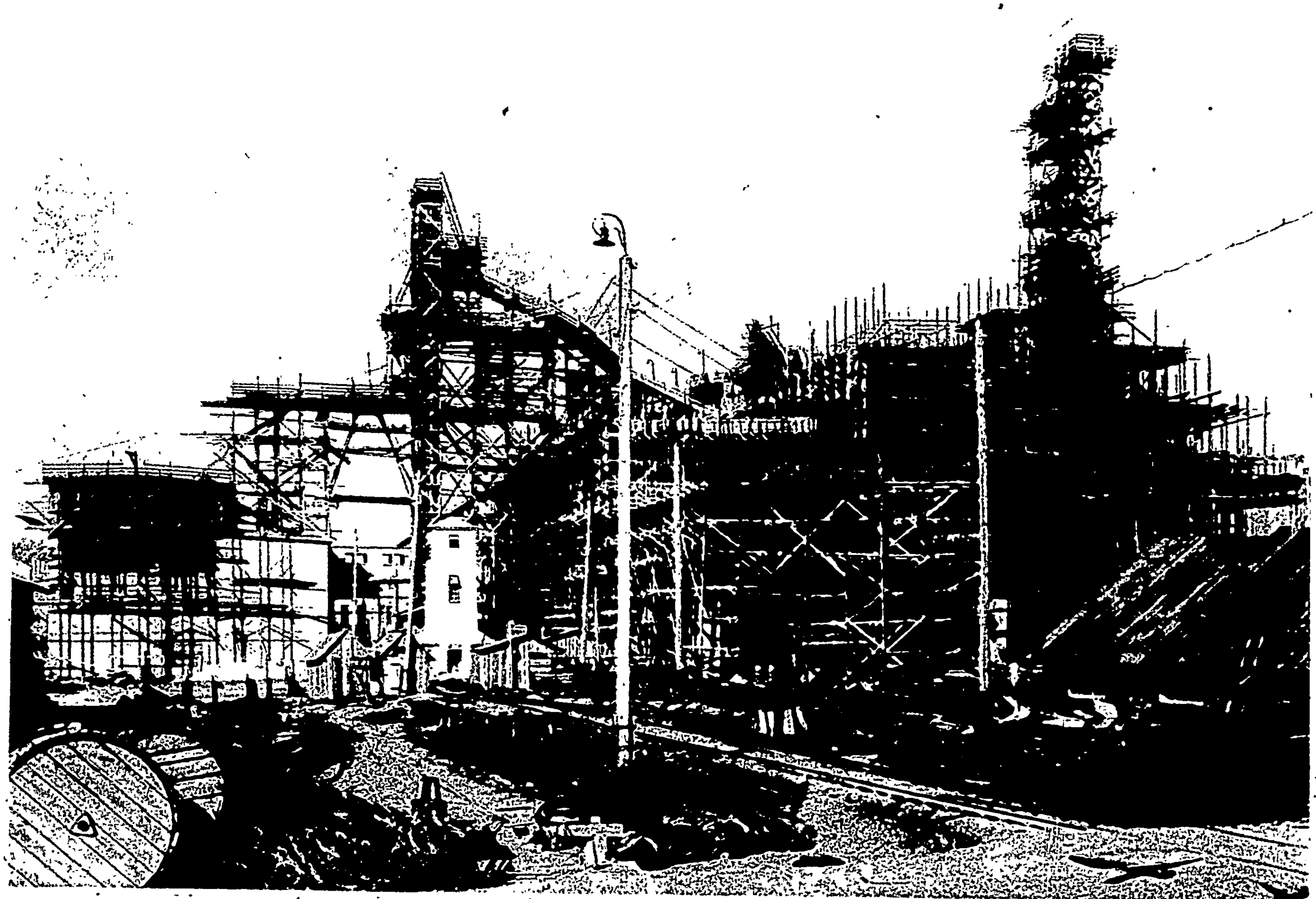


Boiler room under construction.

SHTEROVKA PULVERIZED COAL-FIRING GRES
(Capacity: 152,000 kw.)

Source: Prozhektor, 1930, #16, p. 29.

PLATE 30C



The third section of the plant under construction.

SHTEROVAKA PULVERIZED COAL-FIRING GRES
(Capacity: 152,000 kw.)

Source: USSR in Construction 1930, #3, p. 10 bottom.

PLATE 30D

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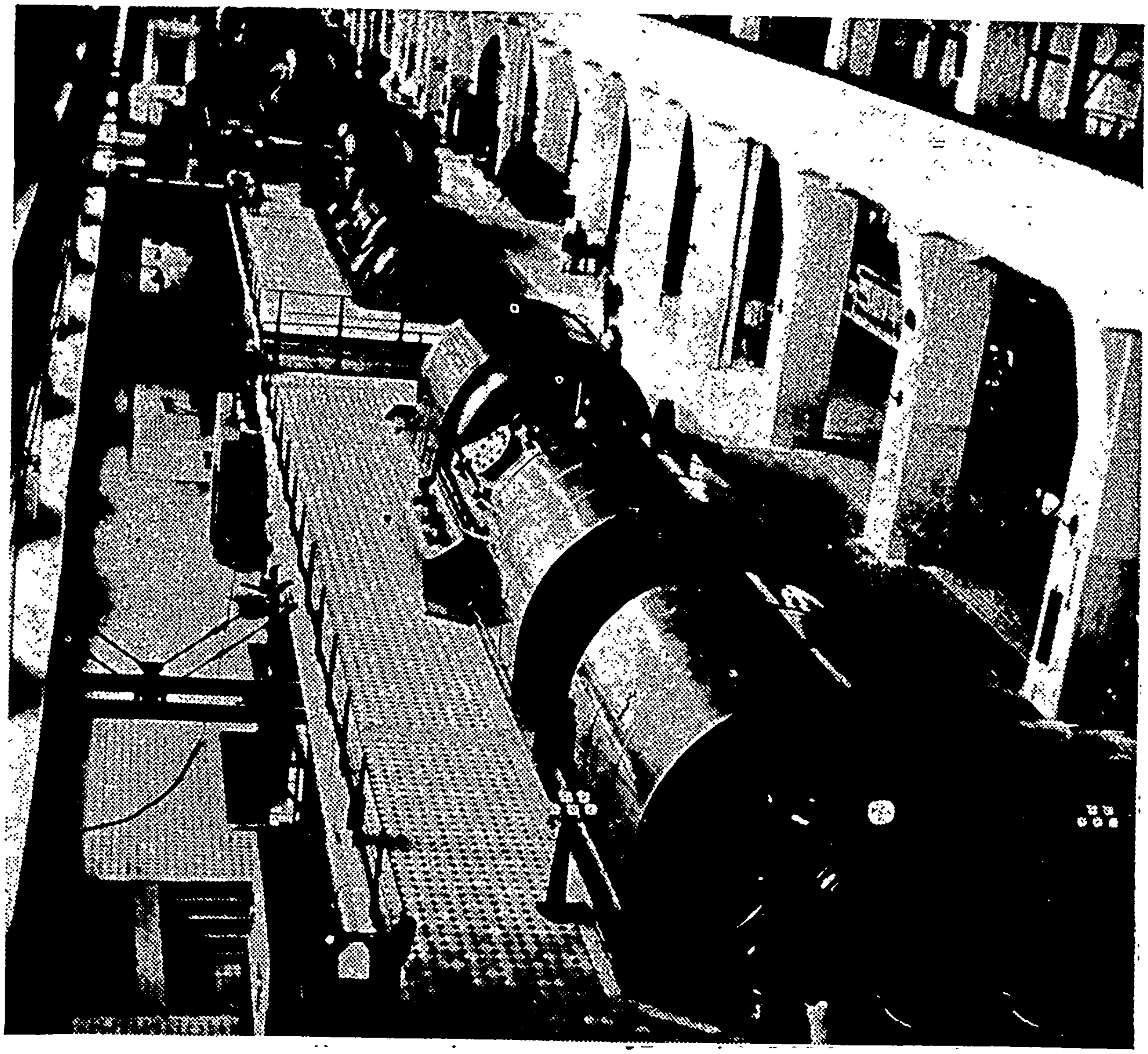
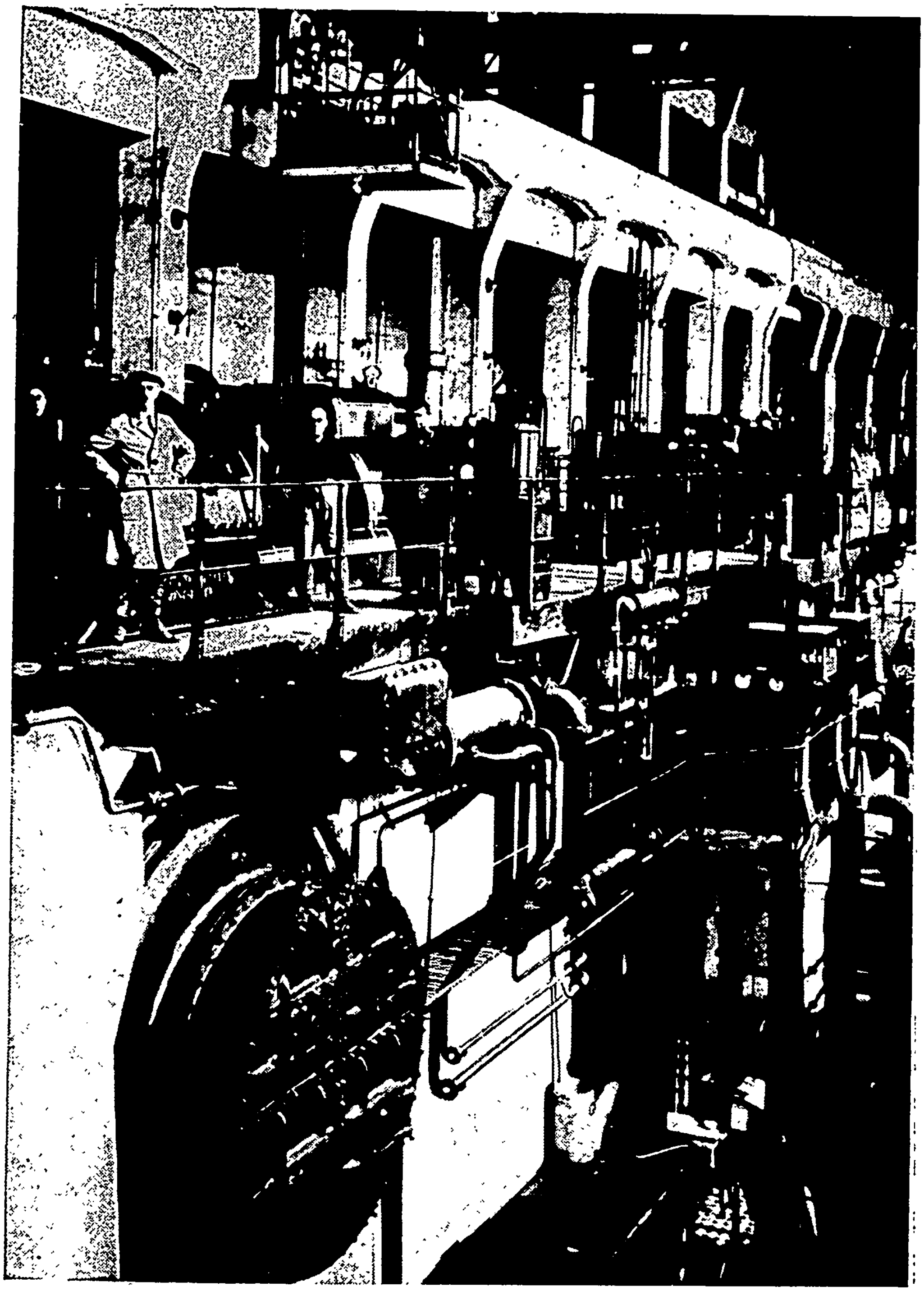


Partial view of the turbo-generator hall.

SHTEROVKA PULVERIZED COAL-FIRING GRES
(Capacity: 152,000 kw.)

Source: Economic Review of the Soviet Union 1932, #13-14, p. 294.

PLATE 30E



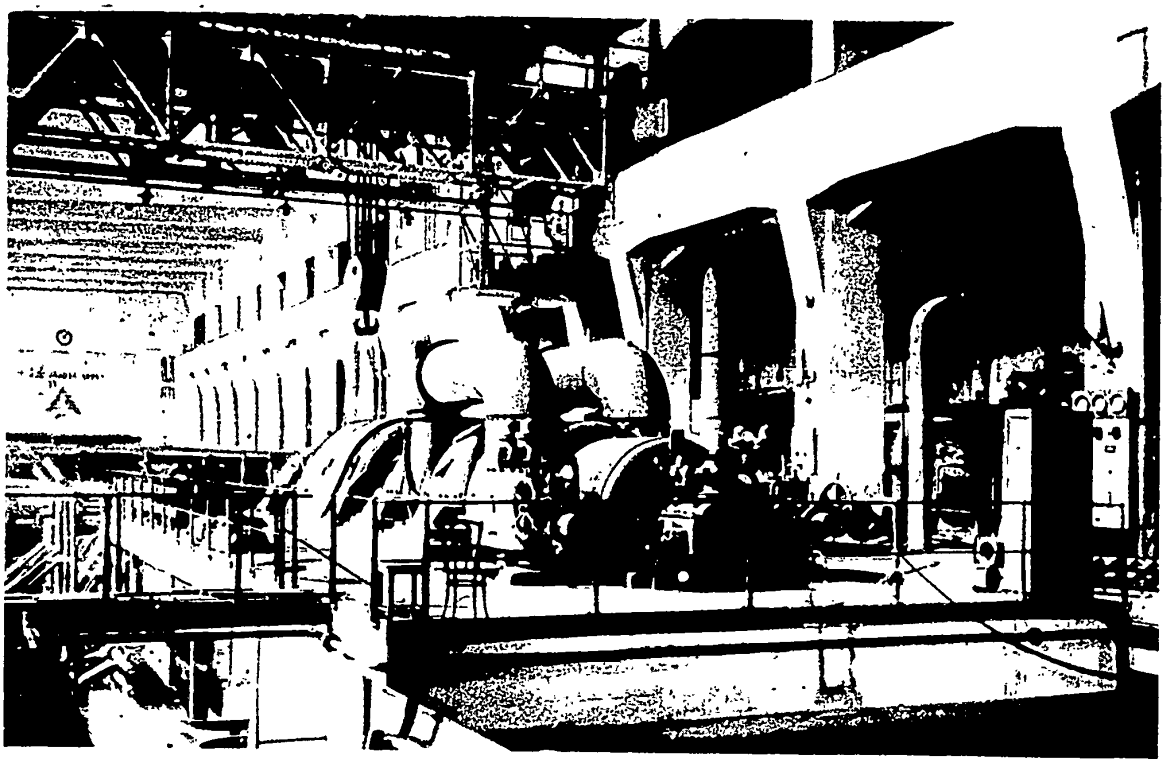
Side view of the generator hall.

SHTEROVKA PULVERIZED COAL-FIRING GRES
(Capacity: 152,000 kw.)

Source: Economic Review of the Soviet Union 1931, #3, p. 57.

PLATE 30F

Declassified in Part - Sanitized Copy Approved for Release @ 50-Yr 2013/09/03 : CIA-RDP81-01043R002500170001-1



Partial interior view of the turbine hall, second section.

SHTEROVKA PULVERIZED COAL-FIRING GRES
(Capacity: 152,000 kw.)

Source: USSR in Construction 1930, #3, p. 11 middle.

PLATE 30G

ZUYEVKA PULVERIZED-COAL GRES

(Plates: 9, 9A; 31, 31A, 31B)

Location: In the Ukranian Donbass.

Coordinates: 48° 04' N, 38° 15' E.

Date of construction: Built in 1931, extended in 1935,and 1939, reconstructed after the war in 1949.

Layout type: First type design.

Installed capacity: 200,000 kw (1935).

Dimensions: Boiler house: W - 86 ft; H. to bot. of truss - 98 ft.
Feedwater pump section: W. - 24.6 ft; Total Height - 90 ft.
Bunker section: W - 29 ft. (est); Total Height - 94 ft. (est).

Structural type: Poured-in-place reinforced concrete frame.

Wall covering: Reinforced concrete panels (prob).

Window sash: Steel.

Roof construction: Steel trusses.

Roofing: Ruberoid (prob).

Cranes: In the turbine hall cap. 75/15 (prob).

Crane girders: Steel

Stacks: Eight steel on the roof of the building.

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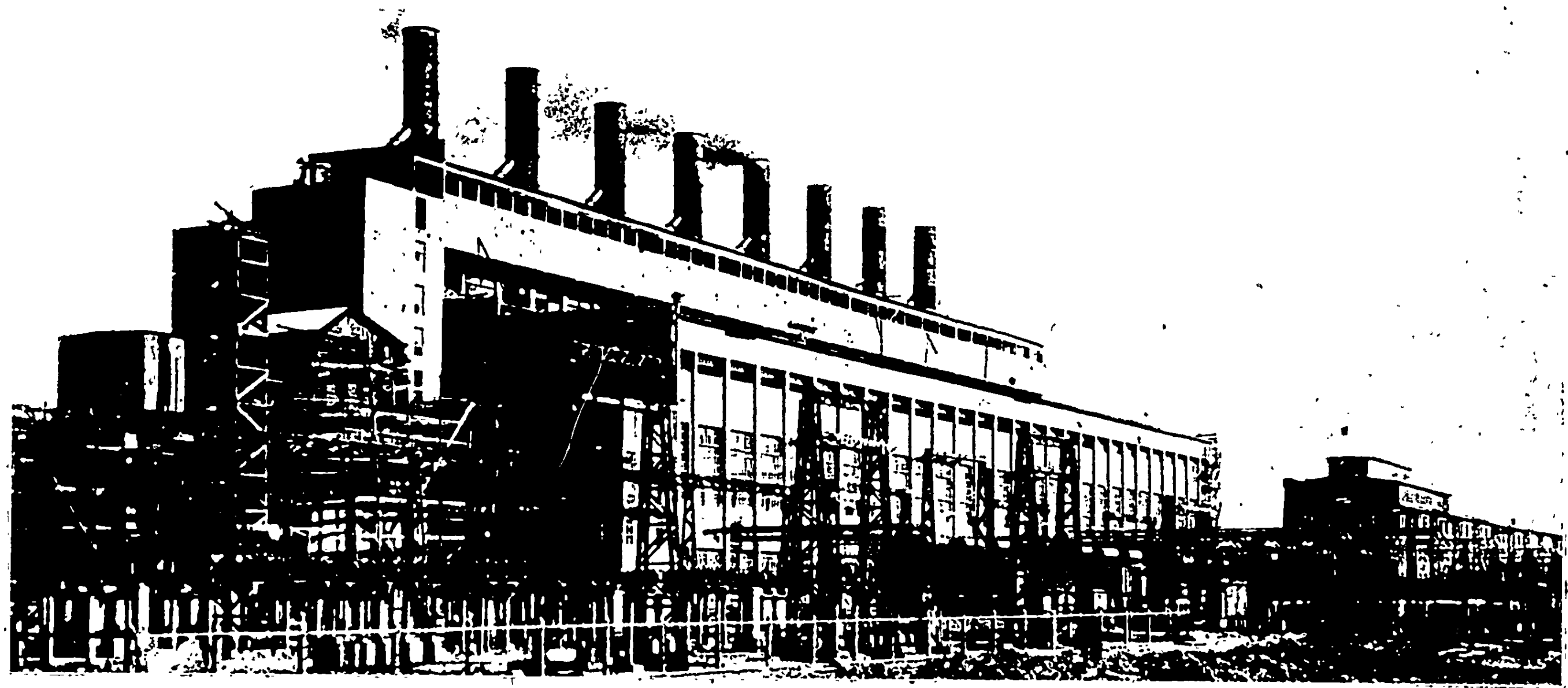
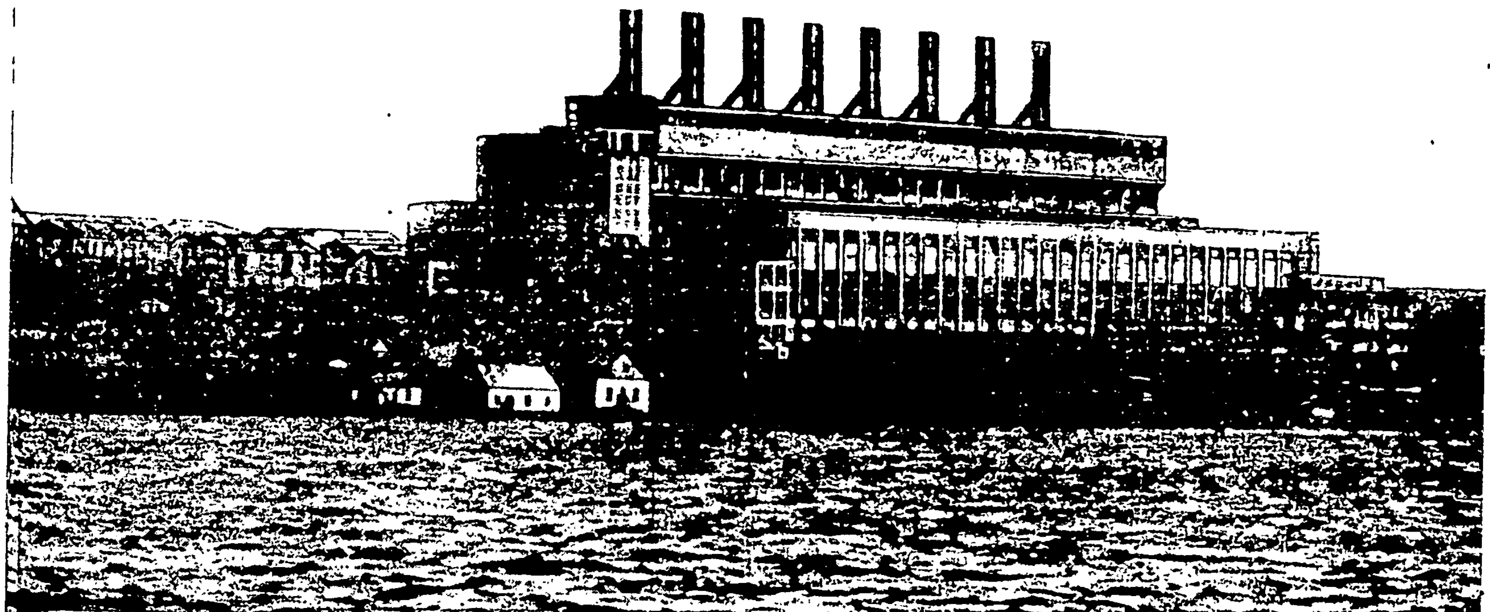


View of the GRES and open air sub-station.

ZUYEVKA PULVERIZED COAL-FIRING GRES
(Capacity: 200,000 kw.)

Source: Arkhitektura SSSR 1933, #3-4, p. 30 top, (NA6.A74)

PLATE 31



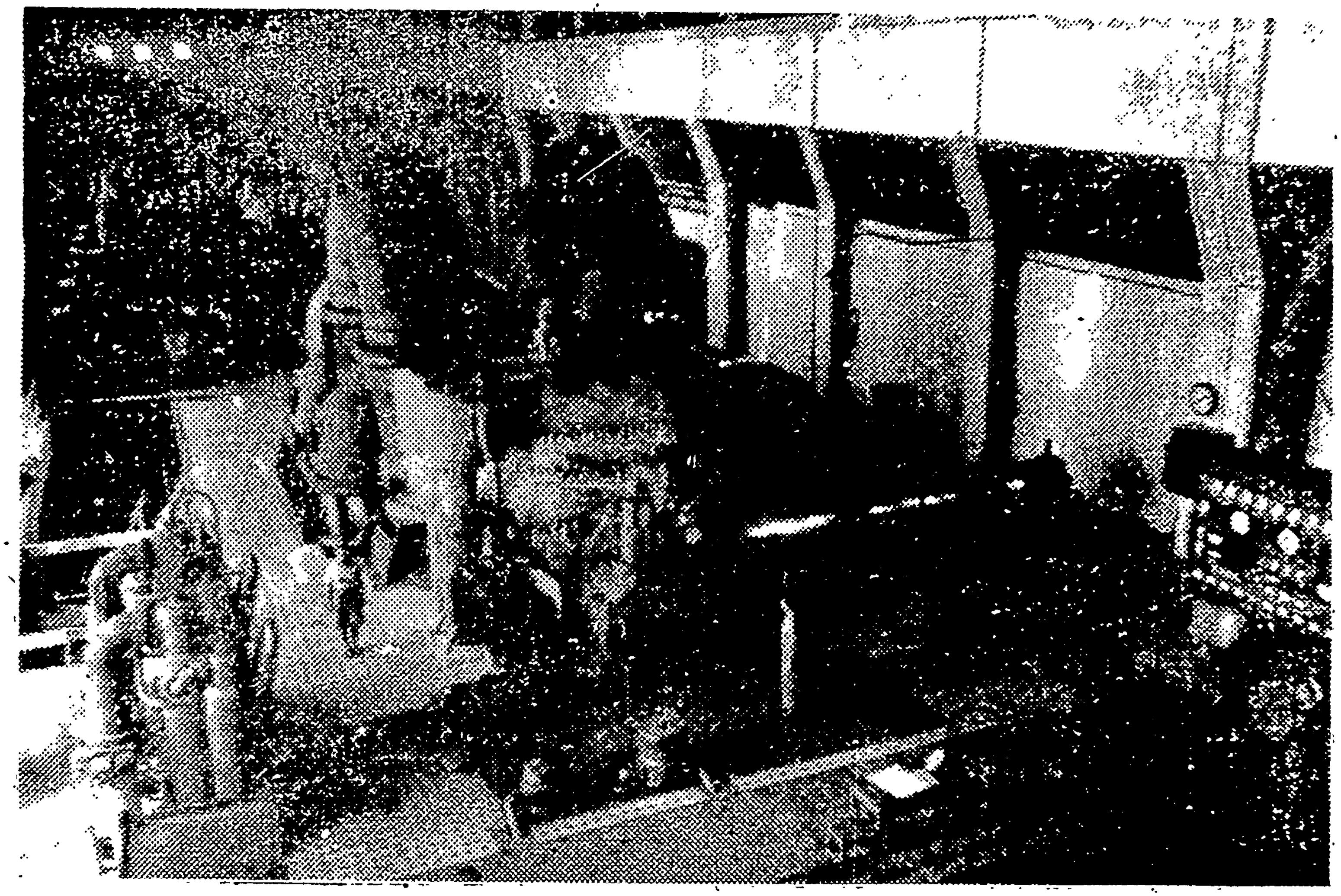
General view.

ZUYEVKA PULVERIZED COAL-FIRING GRES
(Capacity: 200,000 kw.)

Source: Elektricheskiye Stantsii 1933, #3, front cover, (TK4.E725)

PLATE 31A

Declassified in Part - Sanitized Copy Approved for Release @ 50-Yr 2013/09/03 : CIA-RDP81-01043R002500170001-1



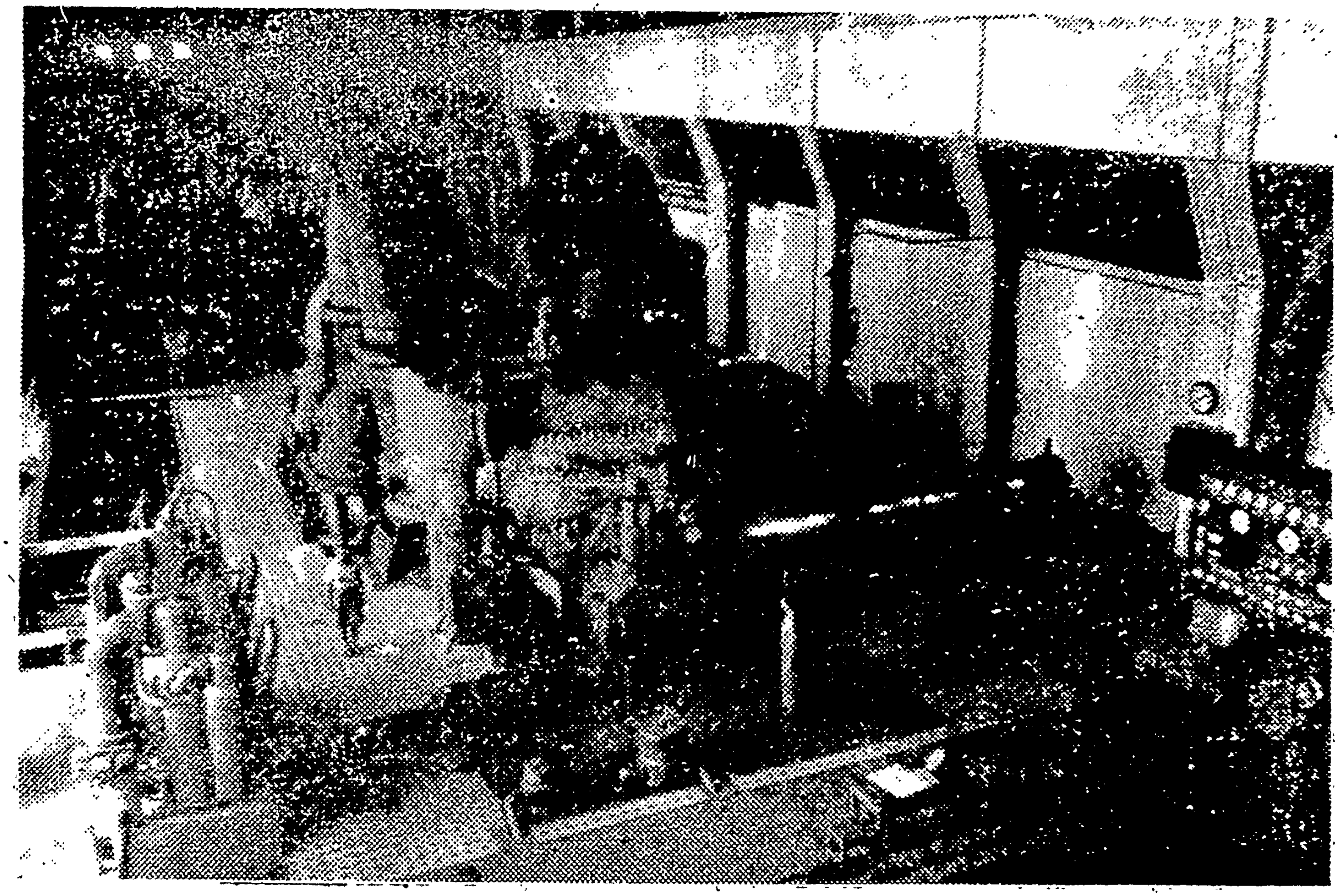
100,000 kw. Turbo-generator at the partially reconstructed Zuyevka GRES.

ZUYEVKA PULVERIZED COAL-FIRING GRES
(Capacity: 200,000 kw.)

Source: Trybuna Ludu 1950, #52, p. 6 center.

PLATE 31B

Declassified in Part - Sanitized Copy Approved for Release @ 50-Yr 2013/09/03 : CIA-RDP81-01043R002500170001-1



100,000 kw. Turbo-generator at the partially reconstructed Zuyevka GRES.

ZUYEVKA PULVERIZED COAL-FIRING GRES
(Capacity: 200,000 kw.)

Source: Trybuna Ludu 1950, #52, p. 6 center.

PLATE 31B

Declassified in Part - Sanitized Copy Approved for Release @ 50-Yr 2013/09/03 : CIA-RDP81-01043R002500170001-1

IVANOVO (formerly IVANOVO-VOZNESENSK) PEAT-FIRING GRES

Plates: (7, 32, 32A, 32B, 32C, 32D, 32E).

Location: City of Ivanovo (previously Ivanovo-Voznesensk) industrial center

Coordinates: 57° 00' N, 40° 59' E.

Date of construction: 1931.

Installed capacity: 113,000 kw.

Layout type: First type

Dimensions: Overall L - 490 ft, W - 177 ft., H - 116 ft.

Structural type: Reinforced concrete.

Wall covering: Brick curtain or panel wall.

Roof construction: Boiler room - steel trusses; bunker, feed-water pump and turbine sections - reinforced concrete beams and panels.

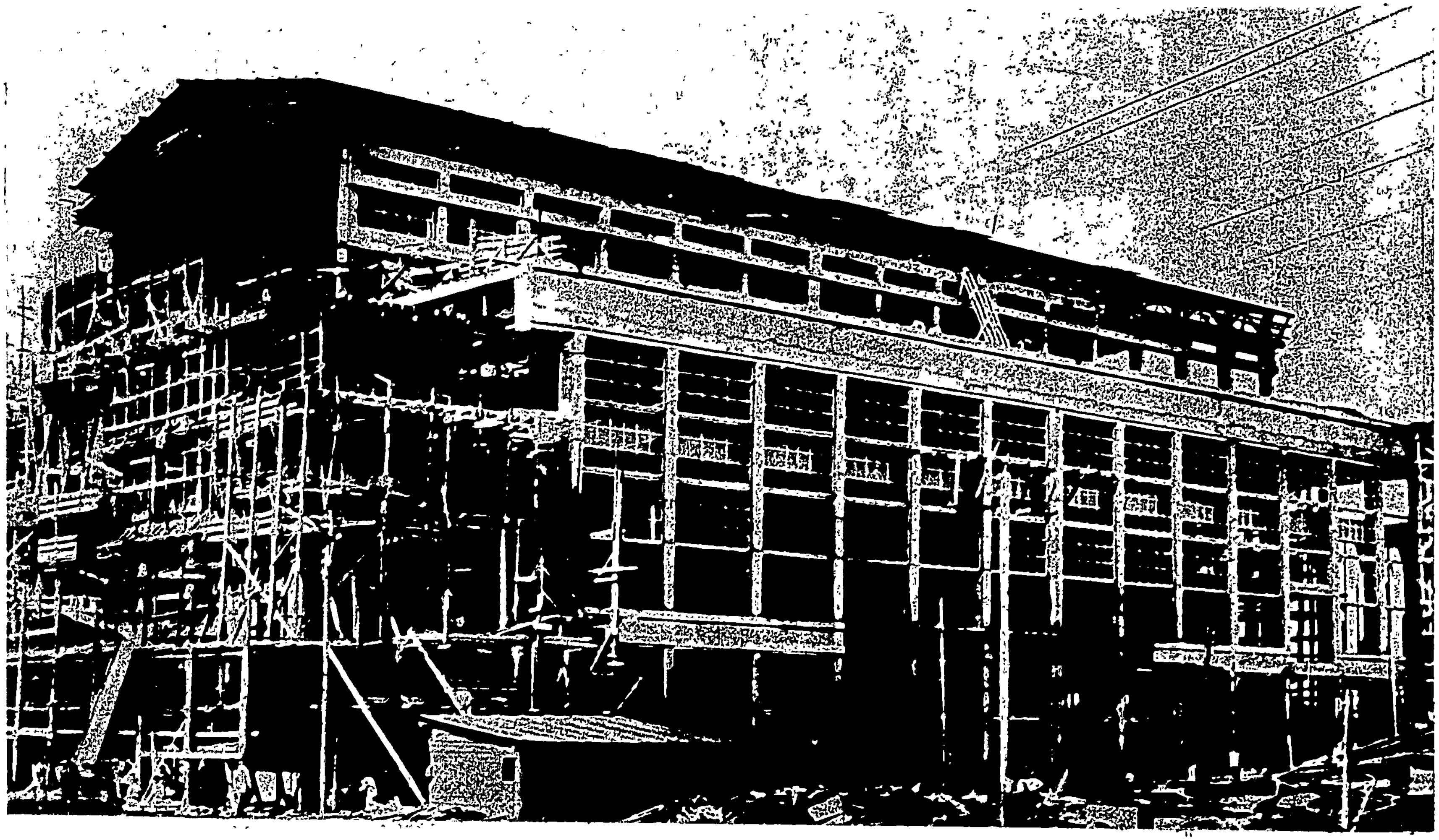
Roofing:

Cranes: In the turbine hall.

Crane girders: Reinforced concrete.

Stacks: Steel, located on the roof.

Fuel delivery: Over steel trestle



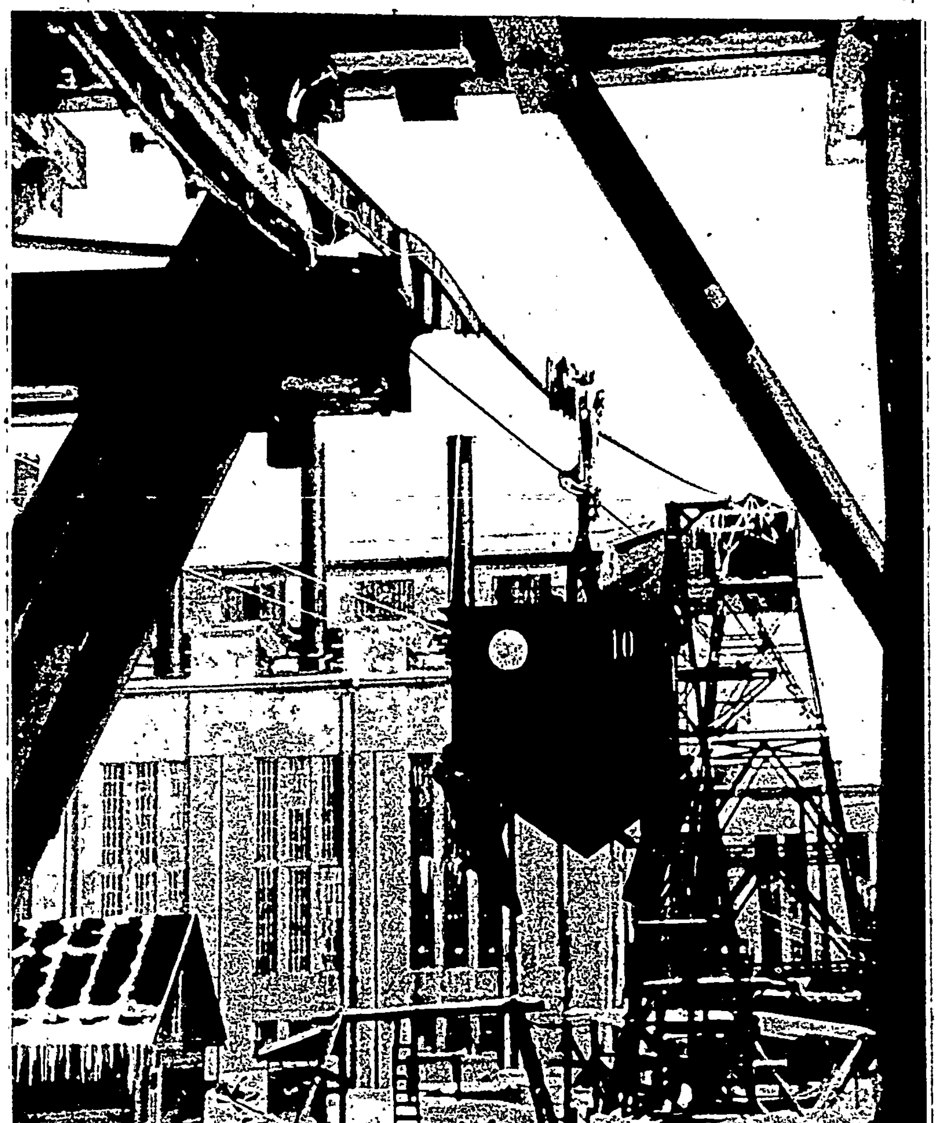
<u>Side view of the main building under construction.</u>

IVANOVO (formerly Ivanovo-Voznesensk) PEAT-FIRING GRES (Capacity: 113,000 kw.)

Source: USSR in Construction 1930, #2, p. 13 middle

PLATE 32

Declassified in Part - Sanitized Copy Approved for Release @ 50-Yr 2013/09/03 : CIA-RDP81-01043R002500170001-1

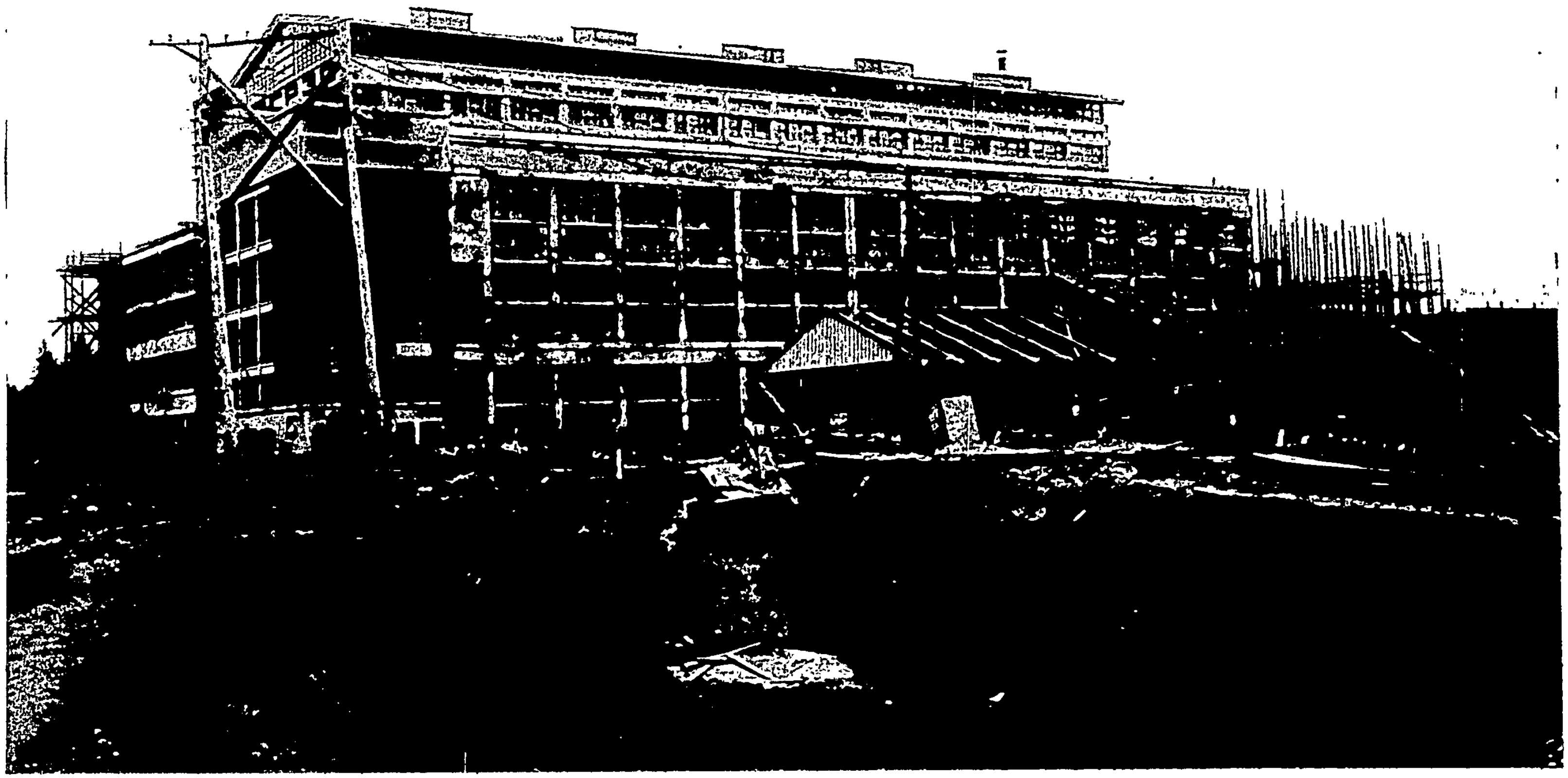


Construction work at the GRES .

IVANOVO (formerly Ivanovo-Voznesensk) PEAT-FIRING GRES
(Capacity: 113,000 kw.)

Source: Fünfzehn Eiserne Schritte, Berlin 1932, p. 61.

PLATE 32A

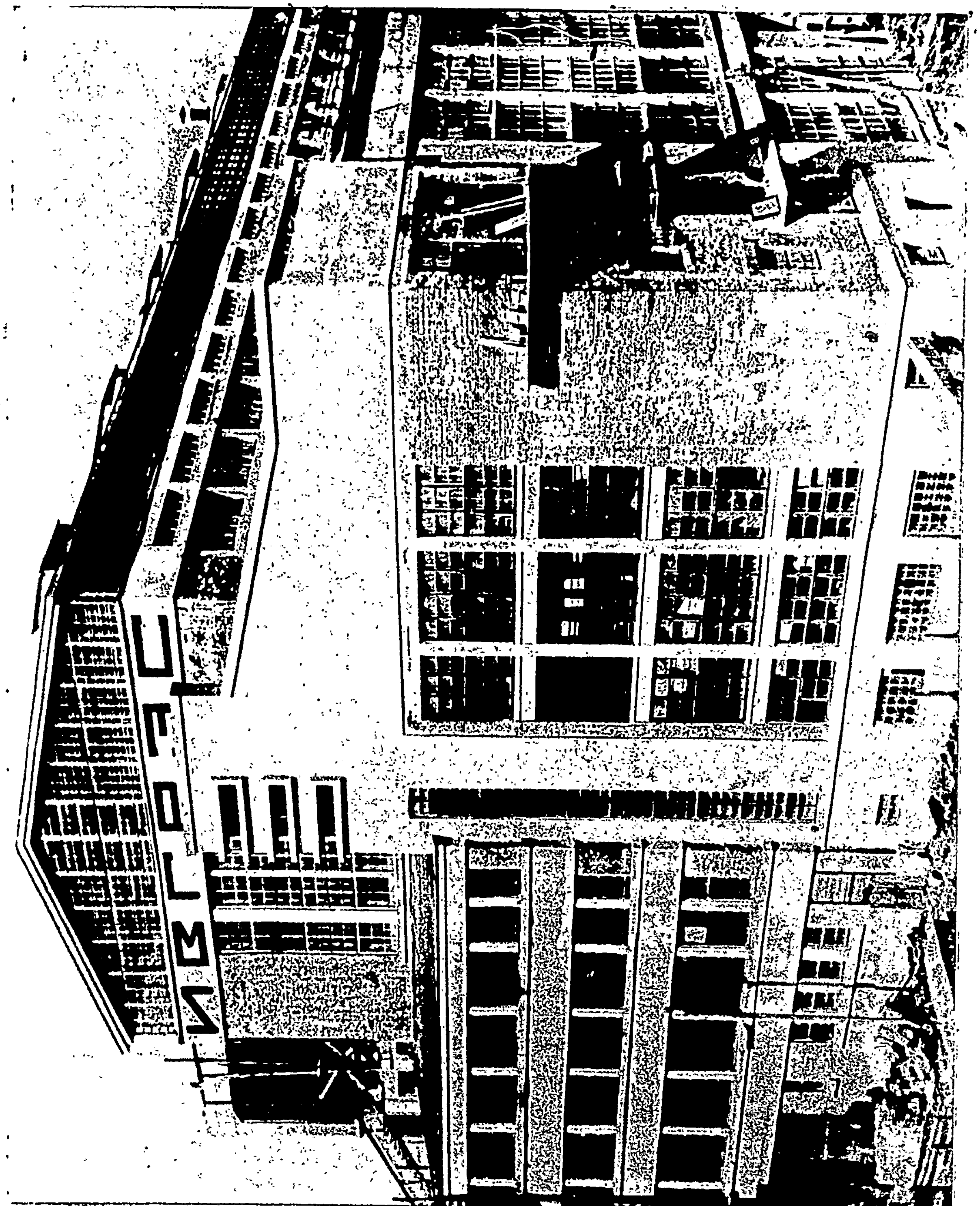


<u>Main structure in the advanced stage of construction.</u>

IVANOVO (formerly Ivanovo-Voznesensk) PEAT-FIRING GRES
(Capacity: 113,000 kw.)

Source: USSR in Construction 1930, #3, p. 20 center.

PLATE 32B

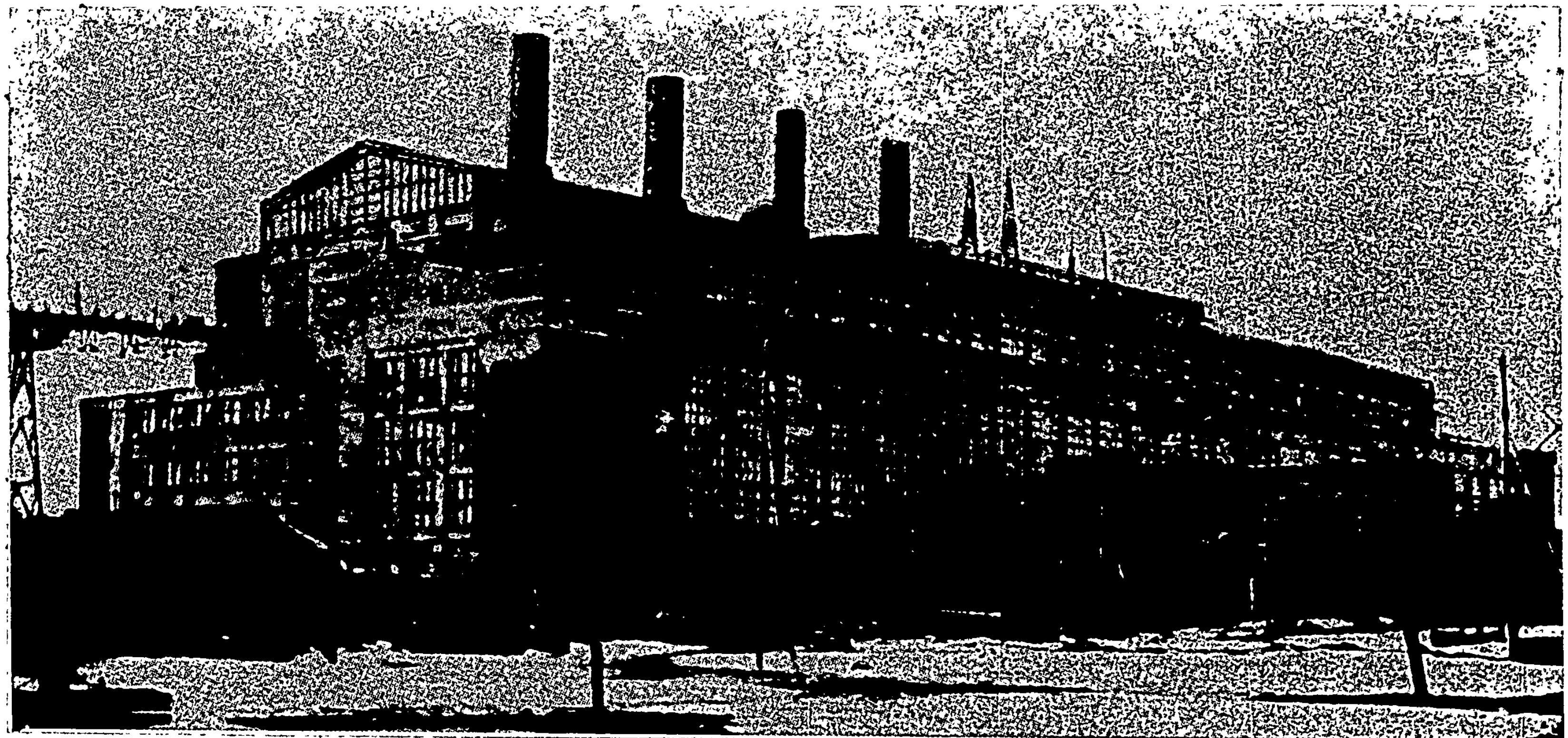


GRES under construction.

IVANOVO (formerly Ivanovo-Voznesensk) PEAT-FIRING GRES (Capacity: 113,000 kw.)

Source: Prozhektor 1930, #17, p. 26.

PLATE 32C



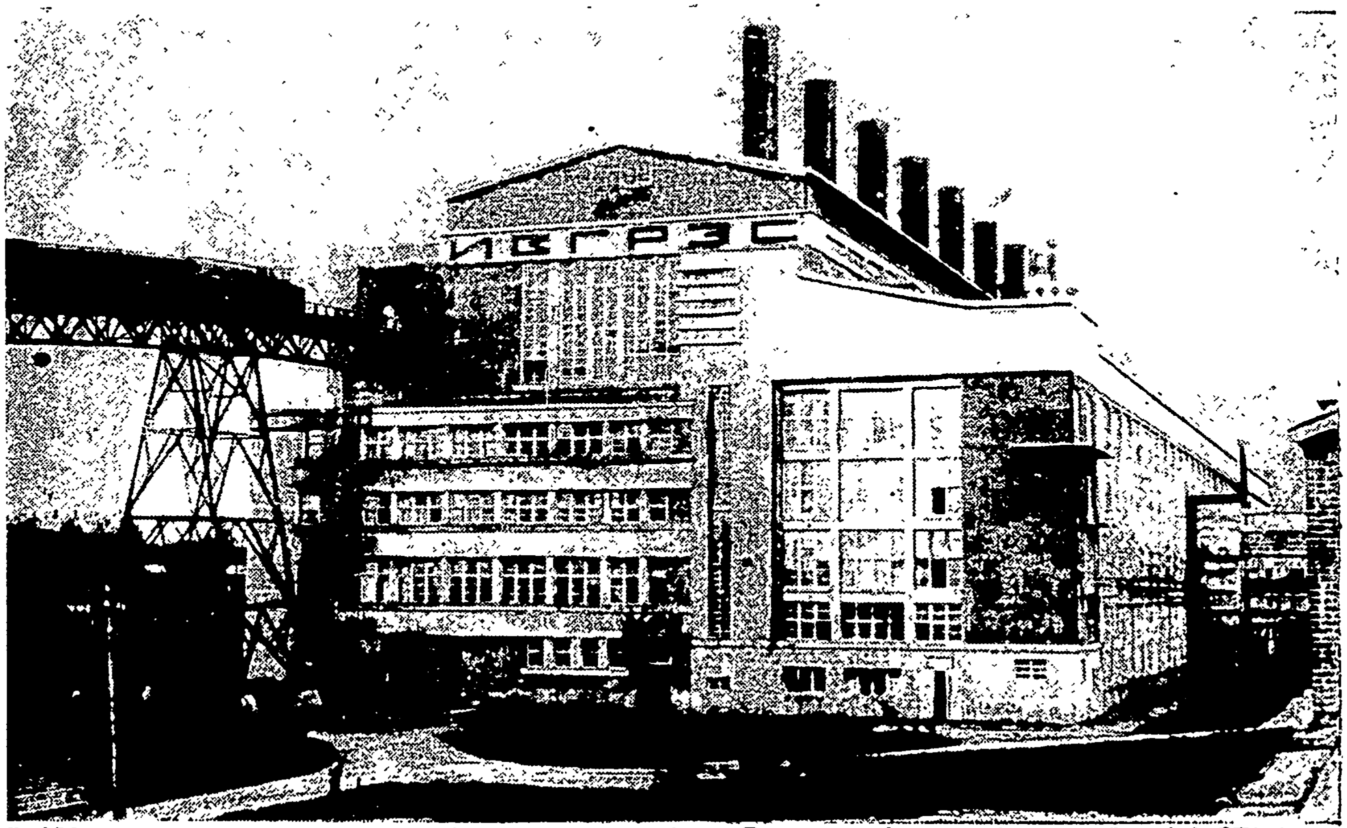
Side View.

IVANOVO (formerly Ivanovo-Voznesensk) PEAT-FIRING GRES
(Capacity: 113,000 kw.)

Source: Arkhitektura elektrostantsiy 1939, p. 168 bottom, (TH4581.A5)

PLATE 32D

Declassified in Part - Sanitized Copy Approved for Release @ 50-Yr 2013/09/03 : CIA-RDP81-01043R002500170001-1



View of the main building and the fuel delivery steel trestle

IVANOVO (formerly Ivanovo-Voznesensk) PEAT-FIRING GRES
(Capacity: 113,000 kw.)

Source: Pyatnadsat' let leninskogo plana elektrifikatsii 1936, p. 57
(TK85.D6)

PLATE 32E

Declassified in Part - Sanitized Copy Approved for Release @ 50-Yr 2013/09/03 : CIA-RDP81-01043R002500170001-1

STALINOGORSK COAL-FIRING GRES

(Plates: 12, 12A, 33, 33A, 33B, 33C, 33D, 33E)

Location: Stalinogorsk in Moscow Region.

Coordinates: 54° 05' N, 38° 14' E.

Date of construction: 1934 - expanded in 1936 (auxiliary building).

Installed capacity: 150,000 kw.

Dimensions: Overall: W. 220 ft.
Main building: Bunker section - W.36 ft.
Boiler house - W. 90 ft.
Feedwater tank section - W. 27.8 ft.
Turbine hall - W. 66.4 ft. H. to truss - 39 ft.(est).

Layout type: First type design.

Structural type: Poured-in-place reinforced concrete frame.

Wall covering: Brick curtain walls and reinforced concrete panels (est).

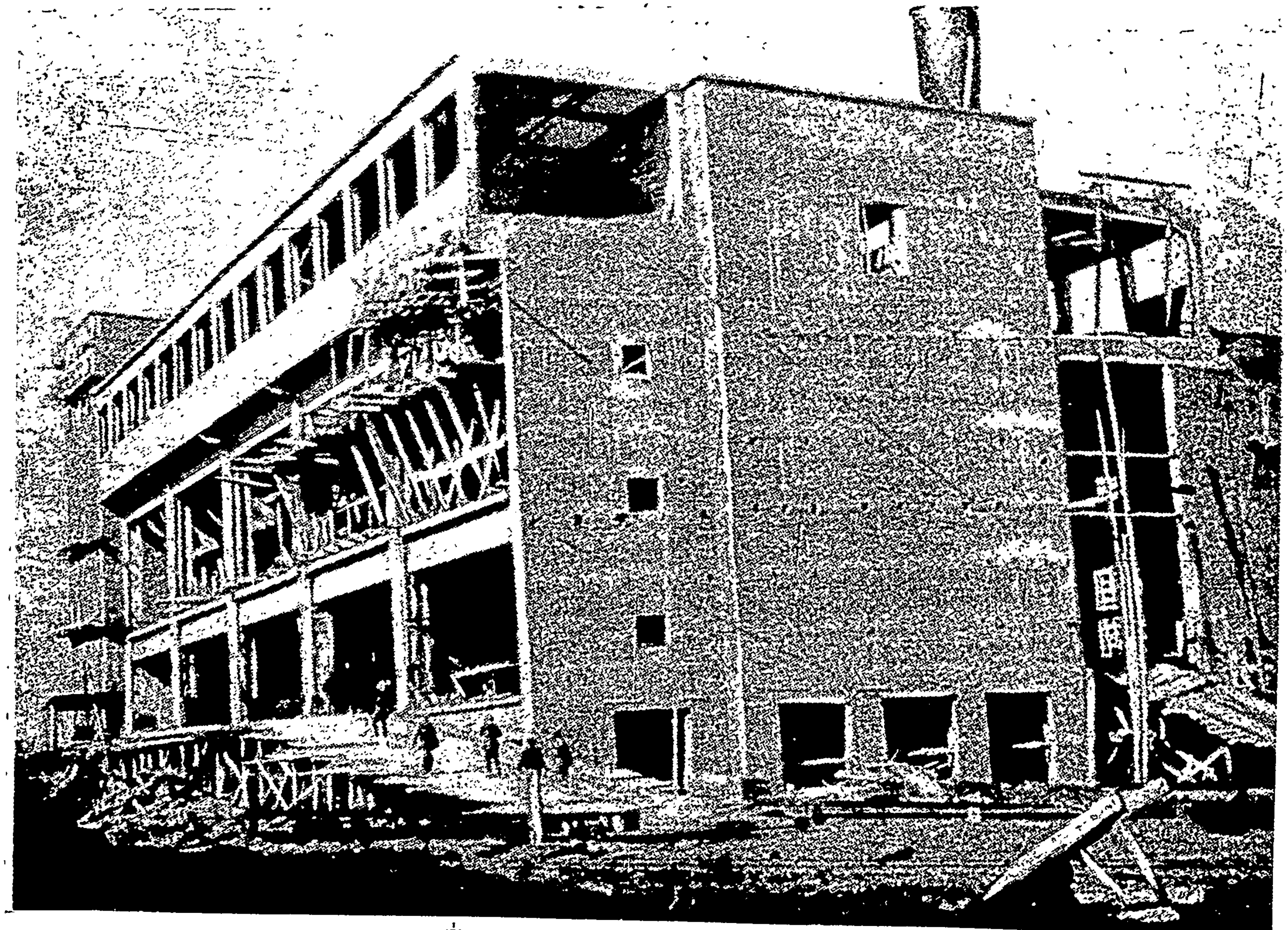
Roof construction: Steel trusses (boiler house and turbine hall); reinforced concrete beams (bunker section, feedwater tank section, switch house)

Roofing: Ruberoid (prob).

Cranes: In the turbine hall, cap. 75/15 (est).

Crane girders: Steel (est).

Stacks: Steel on the roof of the building.

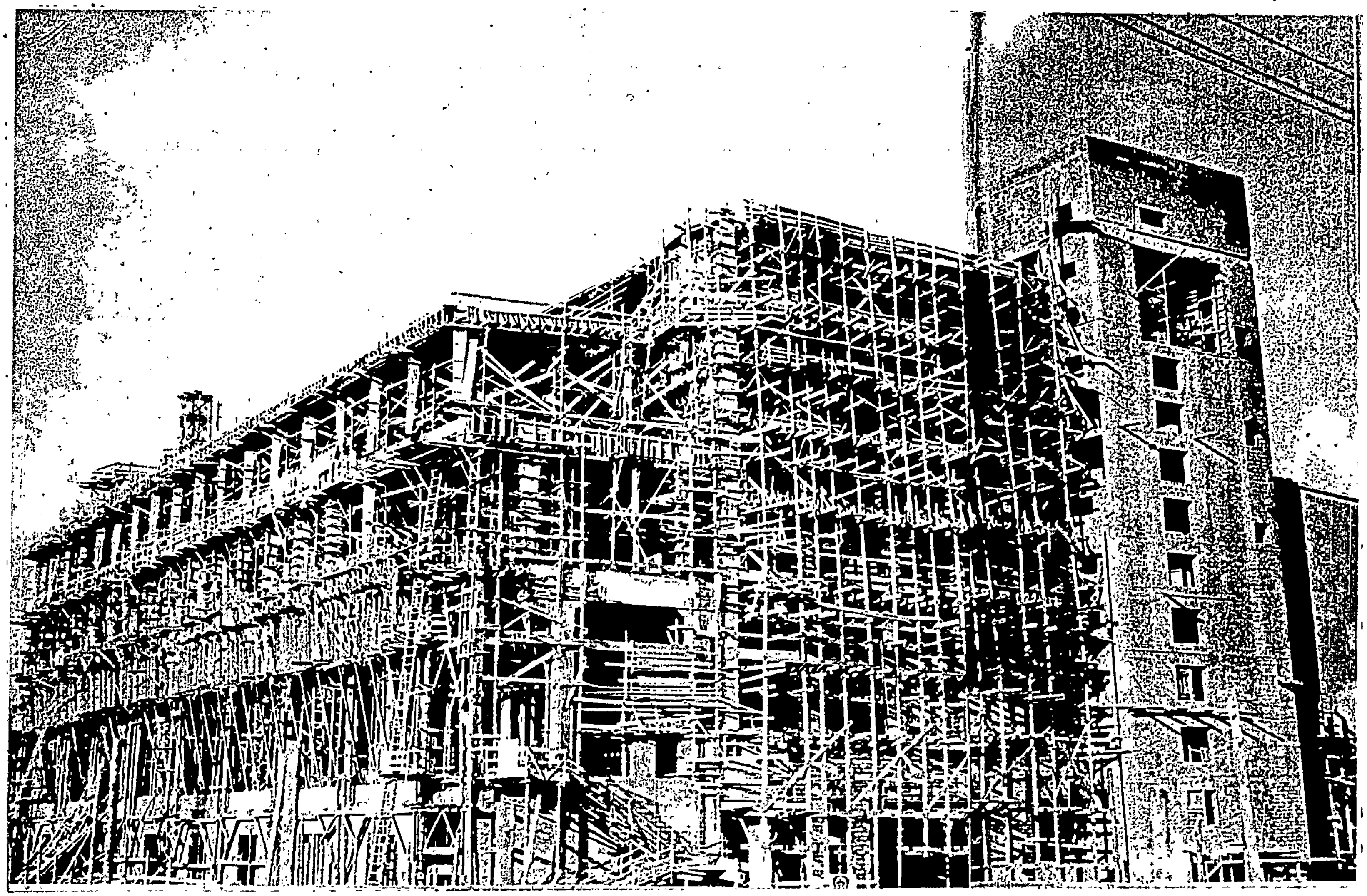


The GRES under construction.

STALINOGORSK COAL-FIRING GRES
(Capacity: 100,000 kw.)

Source: Aviatsiya i Khimiya 1931, #10-11, p. 33, (TL 504.Z3)

PLATE 33

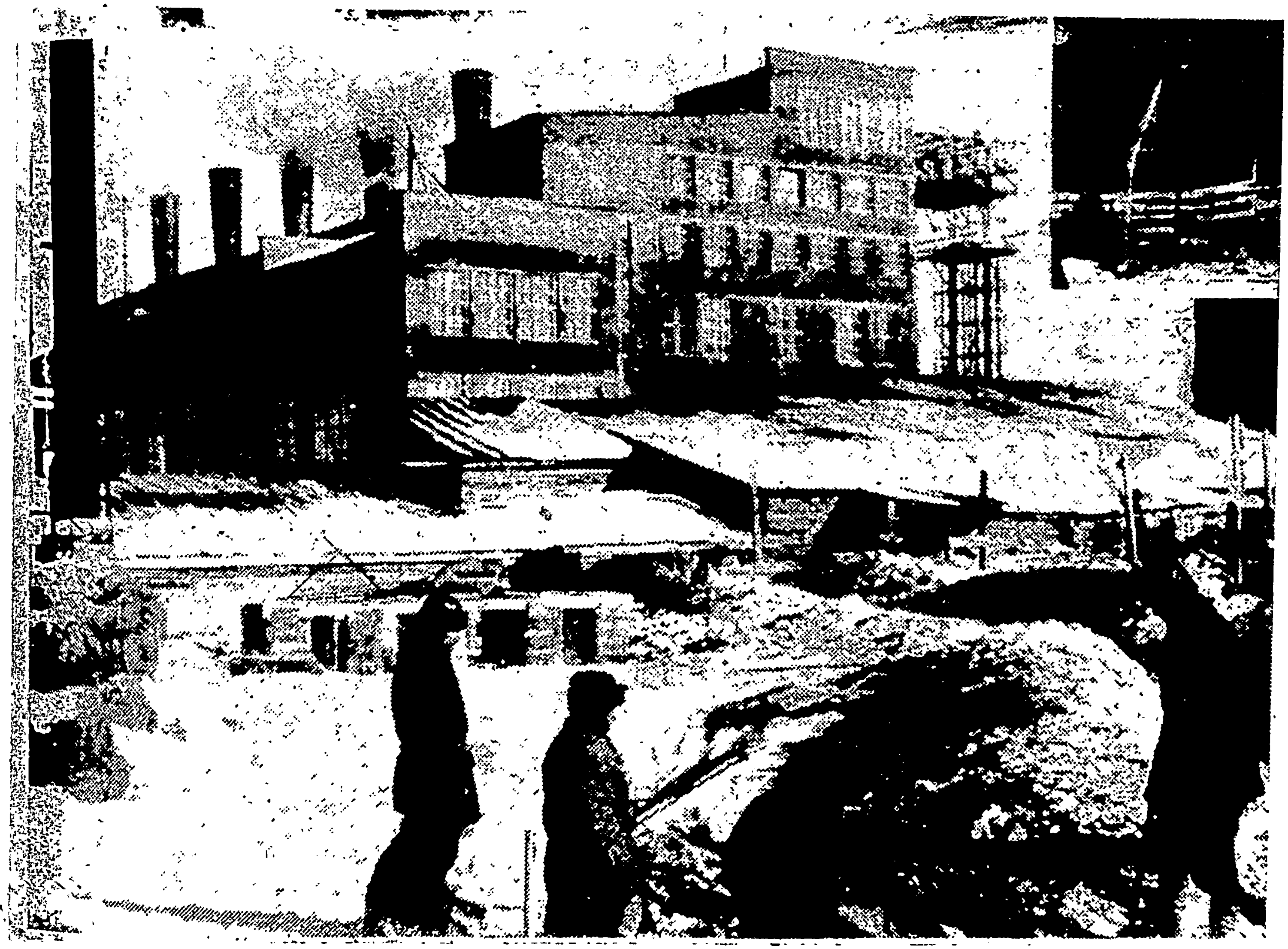


"Stalin" GRES under construction.
STALINOGORSK GRES "STALIN" (Coal-firing)
(Capacity: 100,000 kw.)

Source: USSR in Construction 1934, #1, p. 24 top.

PLATE 33A

Declassified in Part - Sanitized Copy Approved for Release @ 50-Yr 2013/09/03 : CIA-RDP81-01043R002500170001-1



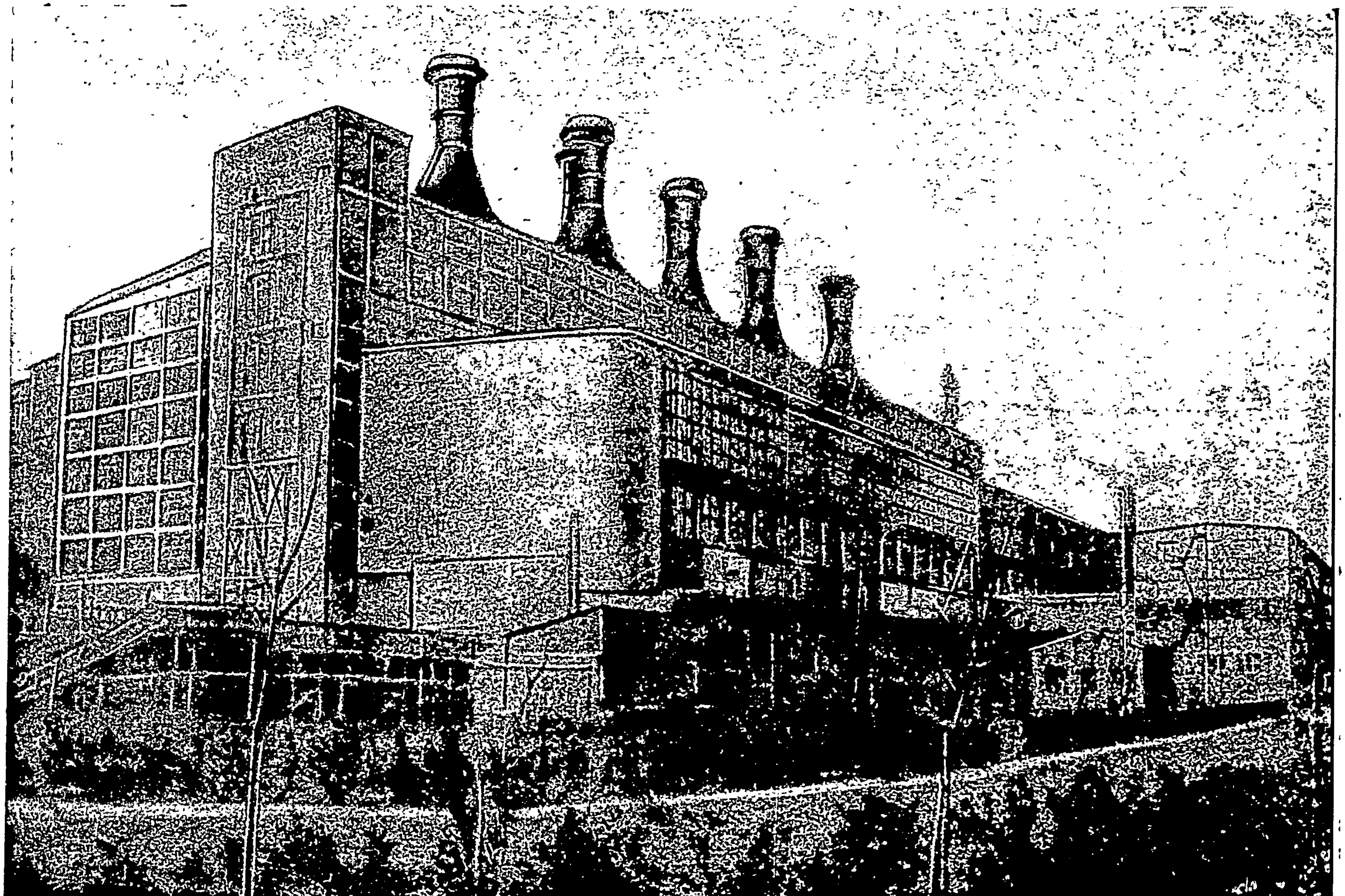
<u>Exterior view</u>.

STALINOGORSK COAL-FIRING GRES (Capacity: 100,000 kw.)

Source: Prozhektor 1932, #9-10, p. 33, left third from top.

PLATE 33B

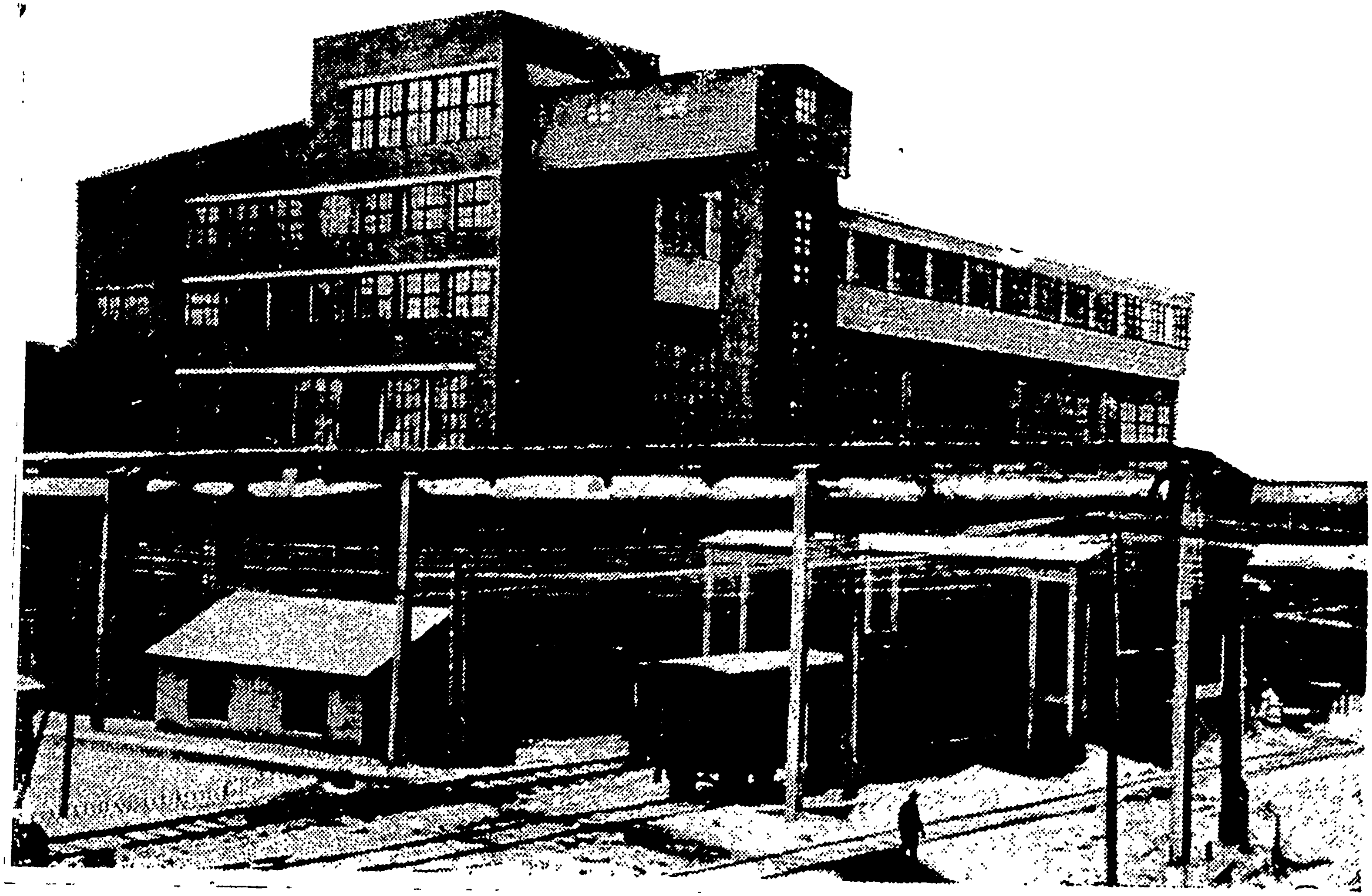
Declassified in Part - Sanitized Copy Approved for Release @ 50-Yr 2013/09/03 : CIA-RDP81-01043R002500170001-1



Exterior view.
STALINOGORSK COAL-FIRING GRES
(Capacity: 100,000 kw.)
Source: Elektricheskiye Stantsii 1936, #2, front cover, (TK4.E725)

PLATE 33C

Declassified in Part - Sanitized Copy Approved for Release @ 50-Yr 2013/09/03 : CIA-RDP81-01043R002500170001-1



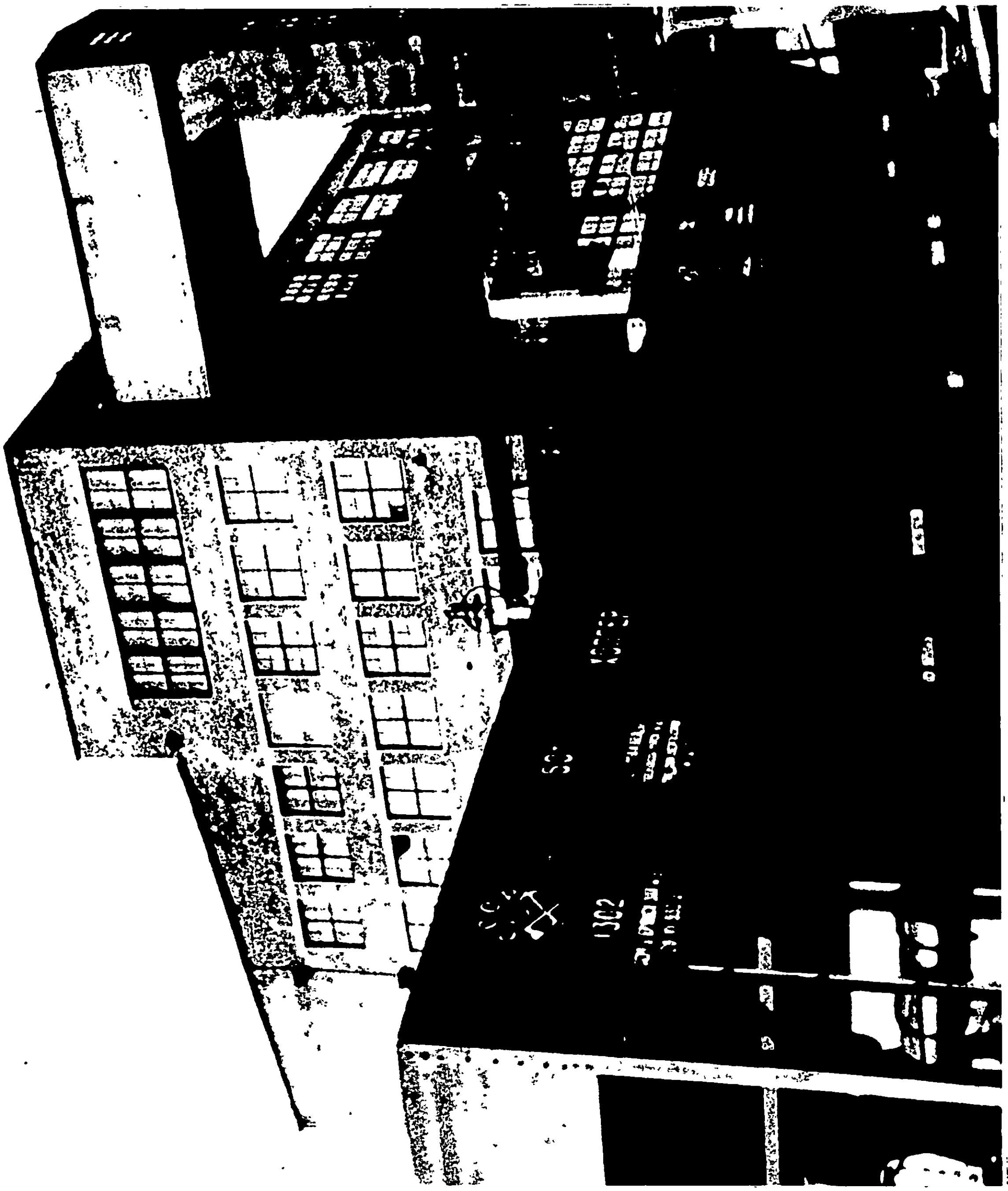
General view.

STALINOGORSK AUXILIARY POWER PLANT

Source: Pafos Osvoyenia, p. 83, (T26.R9M6)

PLATE 33D

Declassified in Part - Sanitized Copy Approved for Release @ 50-Yr 2013/09/03 : CIA-RDP81-01043R002500170001-1



Partial view of auxiliary power plant.

STALINOGORSK AUXILIARY POWER PLANT

Source: USSR in Construction 1934, No. 1, back cover.

PLATE 33E

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STALINGRAD PULVERIZED COAL-FIRING GRES

(Plates: 10, 34, 34A, 34B)

Location: City of Stalingrad on the bank of Volga River

Coordinates: 48° 42' N, 44° 30' E.

Date of construction: 1930

Installed capacity: 75,000 kw. (1934)

Layout type: First type.

Outside dimensions (available): W - 162.5 ft.; H - 106.0 ft.

Structural type: Reinforced concrete.

Wall covering:

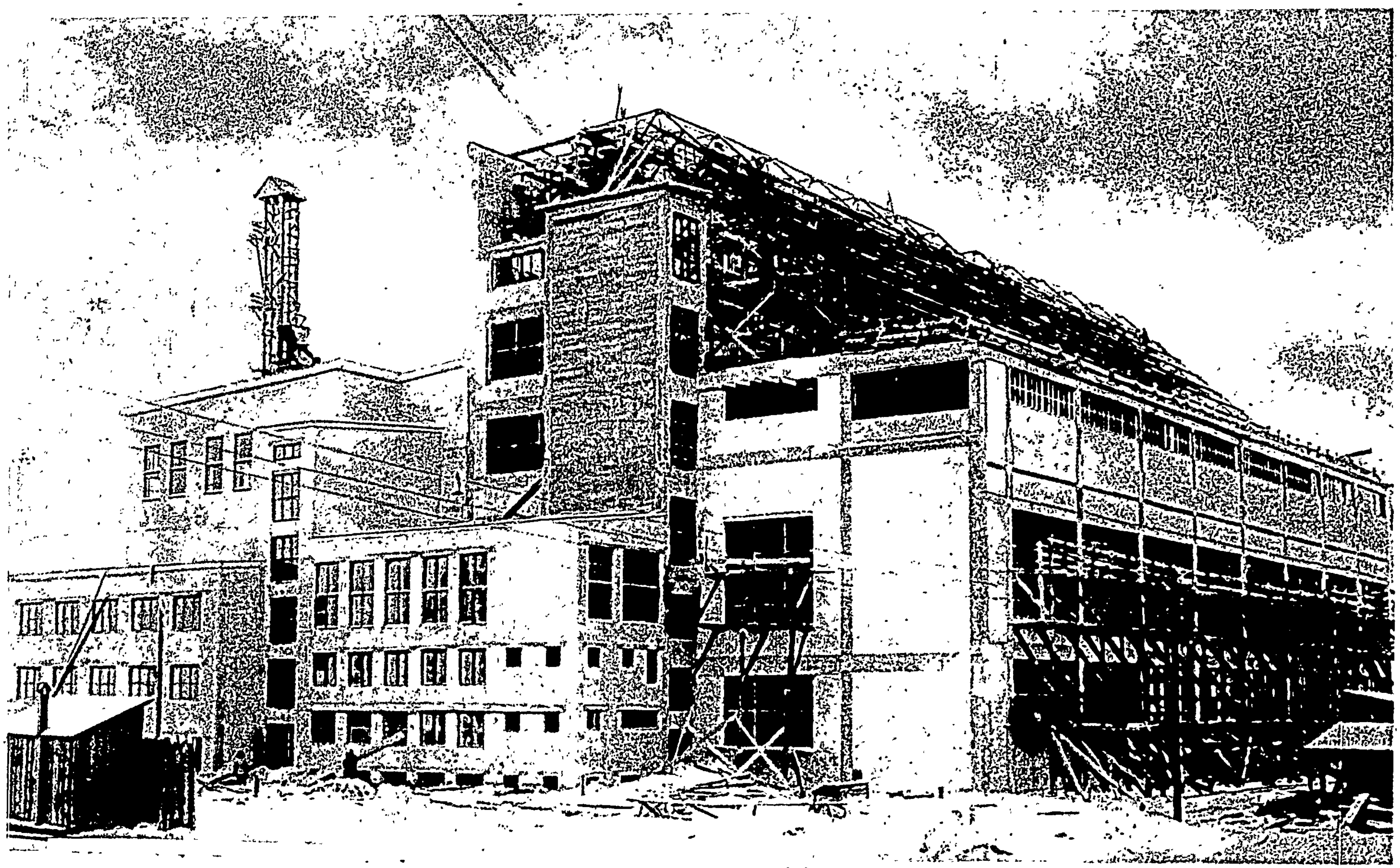
Roof construction: 1) Boiler room - Warren parallel chord steel trusses.
2) Bunker section, feed-water pump section and turbine hall - reinforced concrete beams and slabs.

Roofing: Presumably ruberoid.

Crane: In the turbine hall.

Crane girders: In the turbine hall - reinforced concrete

Stacks: Steel, located on the roof.



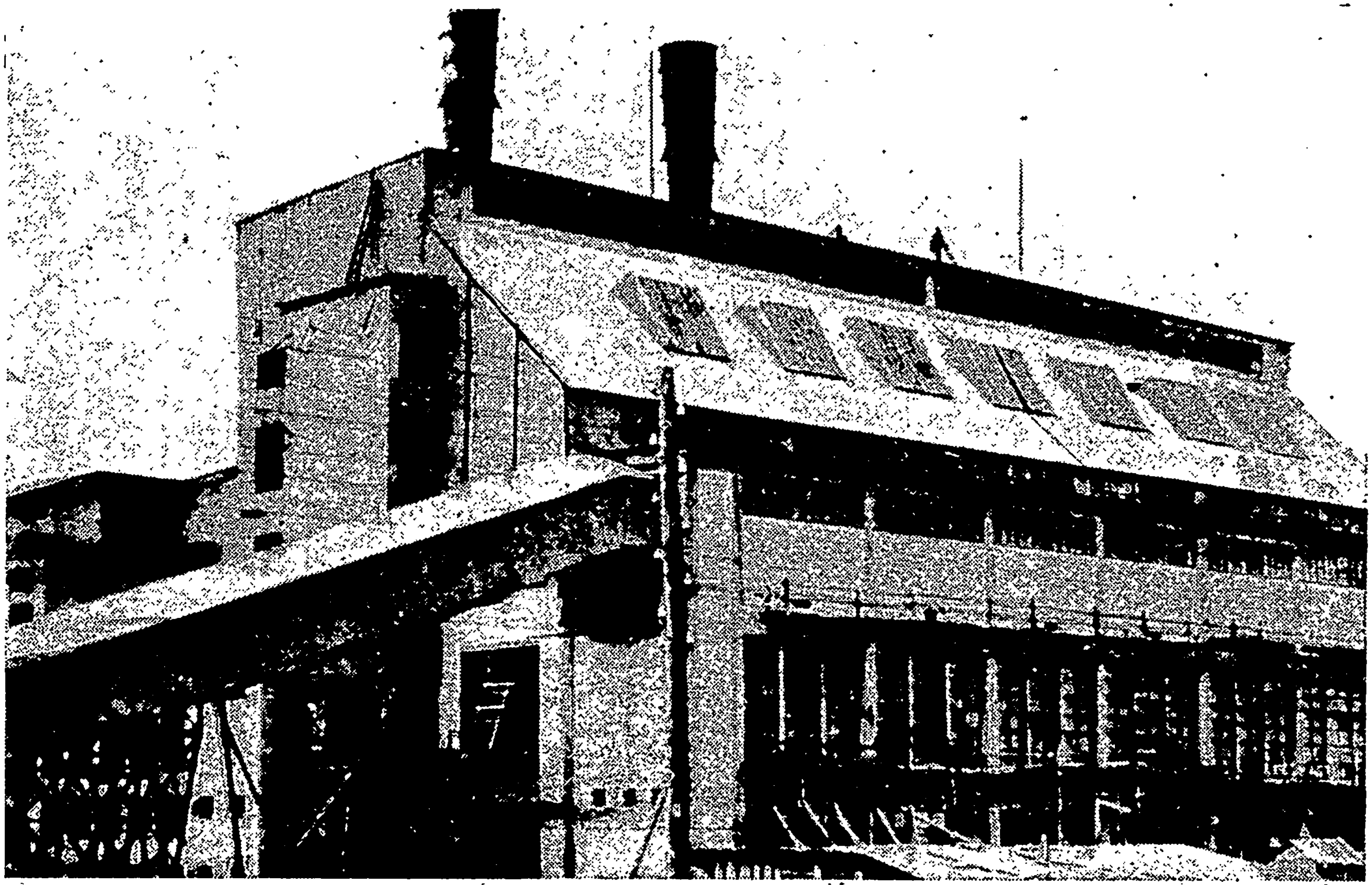
Main building under construction.

STALINGRAD PULVERIZED COAL-FIRING GRES
(Capacity: 75,000 kw.)

Source: USSR in Construction 1930, #3, p. 21 middle.

PLATE 34

Declassified in Part - Sanitized Copy Approved for Release @ 50-Yr 2013/09/03 : CIA-RDP81-01043R002500170001-1



Partial exterior view.

STALINGRAD PULVERIZED COAL-FIRING GRES
(Capacity: 75,000 kw.)

Source: Prozhektor 1930, #35, p. 6 bottom left.

PLATE 34A

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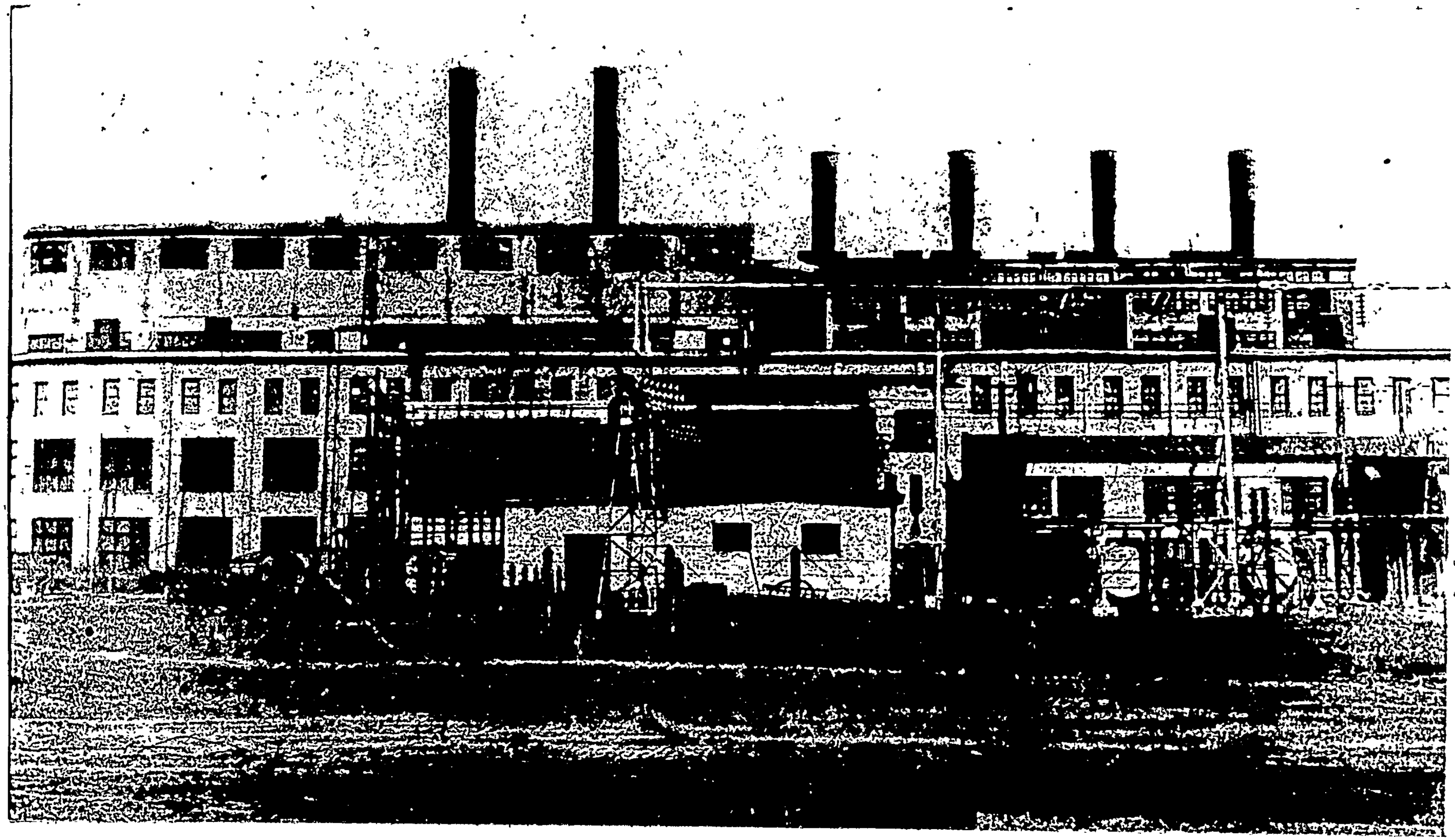

Exterior view.

STALINGRAD PULVERIZED COAL-FIRING GRES
(Capacity: 75,000 kw.)

Source: Elektricheskiye Stantsii 1936, #8, front cover, (TK4.E725)

PLATE 34B

STALINGRAD TRACTOR PLANT TETS

(Plates: 34C)

Location: In the northern part of the city of Stalingrad, on the bank of the Volga River

Coordinates: 48° 42' N, 44° 30' E.

Date of construction: Destroyed during the war, reconstructed during the Fouth Piatiletka (1946-1950)

Layout type: First type.

Installed capacity: 19,000 kw. (1936).

Dimensions:

Structural type: Appears to be a combination of steel and brick. Steel frame with continuous steel sash windows - for side walls. Brick wallbearing construction for front walls.

Wall covering:

Roof construction:

Roofing:

Cranes: In turbine hall

Crane girders: Steel

Stacks: Steel, located on the roof.

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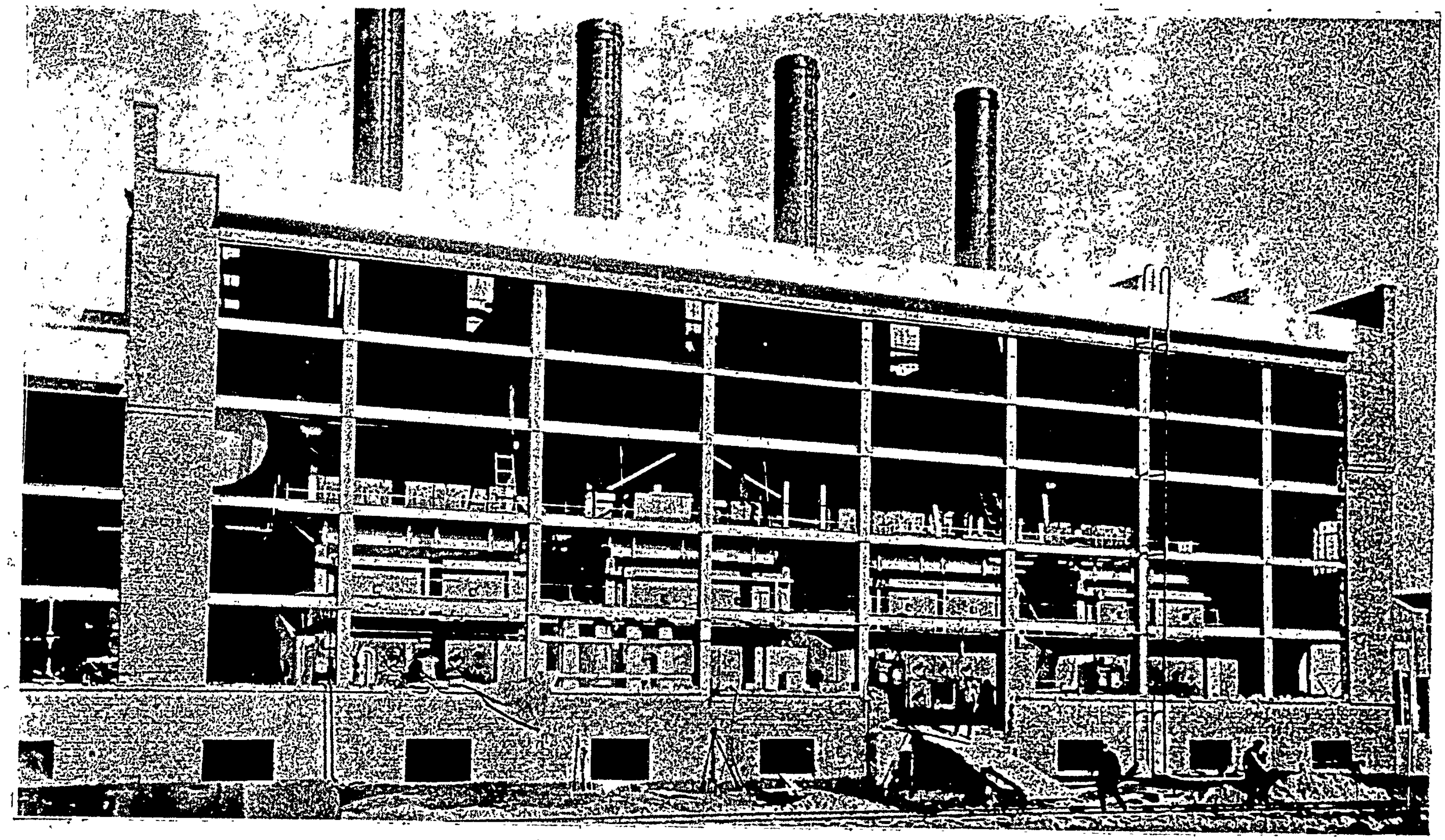


<u>View of the boiler room.</u>

STALINGRAD TRACTOR PLANT POWER STATION (pulverized coal-firing)
(Capacity: 19,000 kw.)

Source: Economic Review of the Soviet Union 1931, #17, p. 395.

PLATE 34C

WHITE RUSSIAN PEAT-FIRING GRES.

(Plates: 35, 35A, 35B, 35C, 35D)

Location: Near or in Orekhovsk, White Russia.

Coordinates: 54° 42' N, 30° 30' E.

Date of construction: 1930

Layout type: First type.

Installed capacity: 20,000 kw.

Dimensions:

Structural type: Reinforced concrete frame. Brick panel walls.

Wall covering:

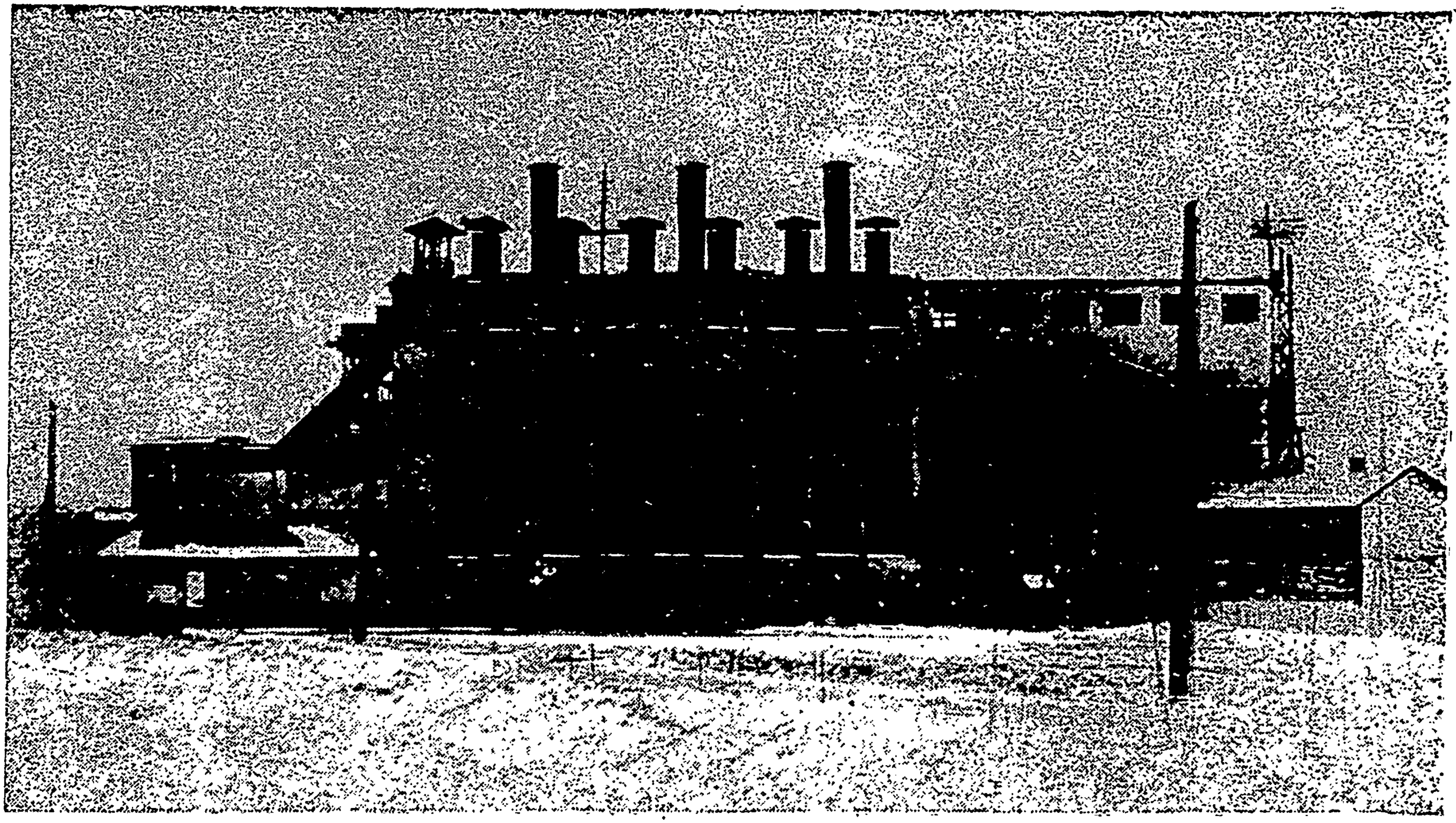
Roof construction:

Roofing:

Cranes:

Crane girders:

Stacks: Steel, located on the roof.



General view.

PEAT-FIRING GRES IN OR NEAR OREKHOVSK, WHITE RUSSIA
(Capacity: 20,000 kw. 1931)

Source: Elektricheskiye Stantsii 1936, #1, p. 19, (TK4.E725)

PLATE 35

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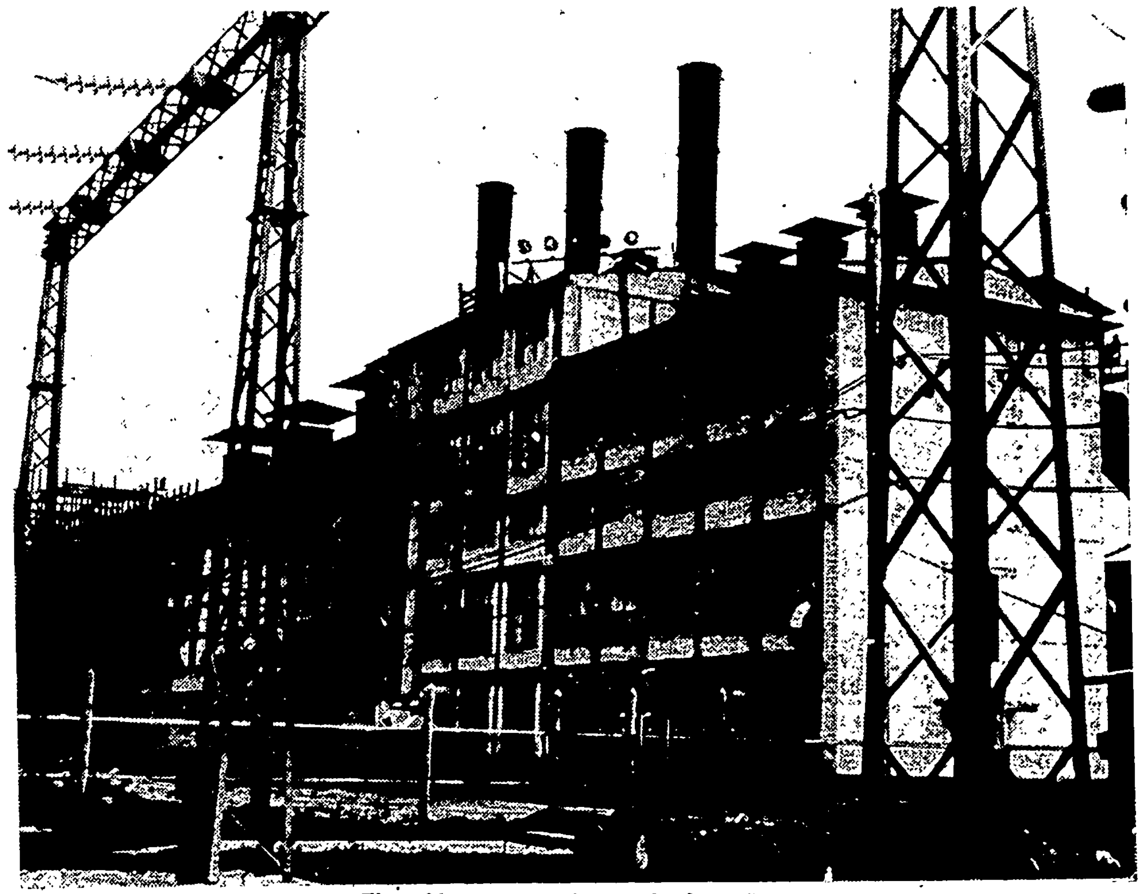

<u>The first section of the plant</u>.

PEAT-FIRING GRES IN OR NEAR OREKHOVSK, WHITE RUSSIA
(Capacity: 20,000 kw. - 1931)

Source: Economic review of the Soviet Union 1932, #7, p. 151

PLATE 35A

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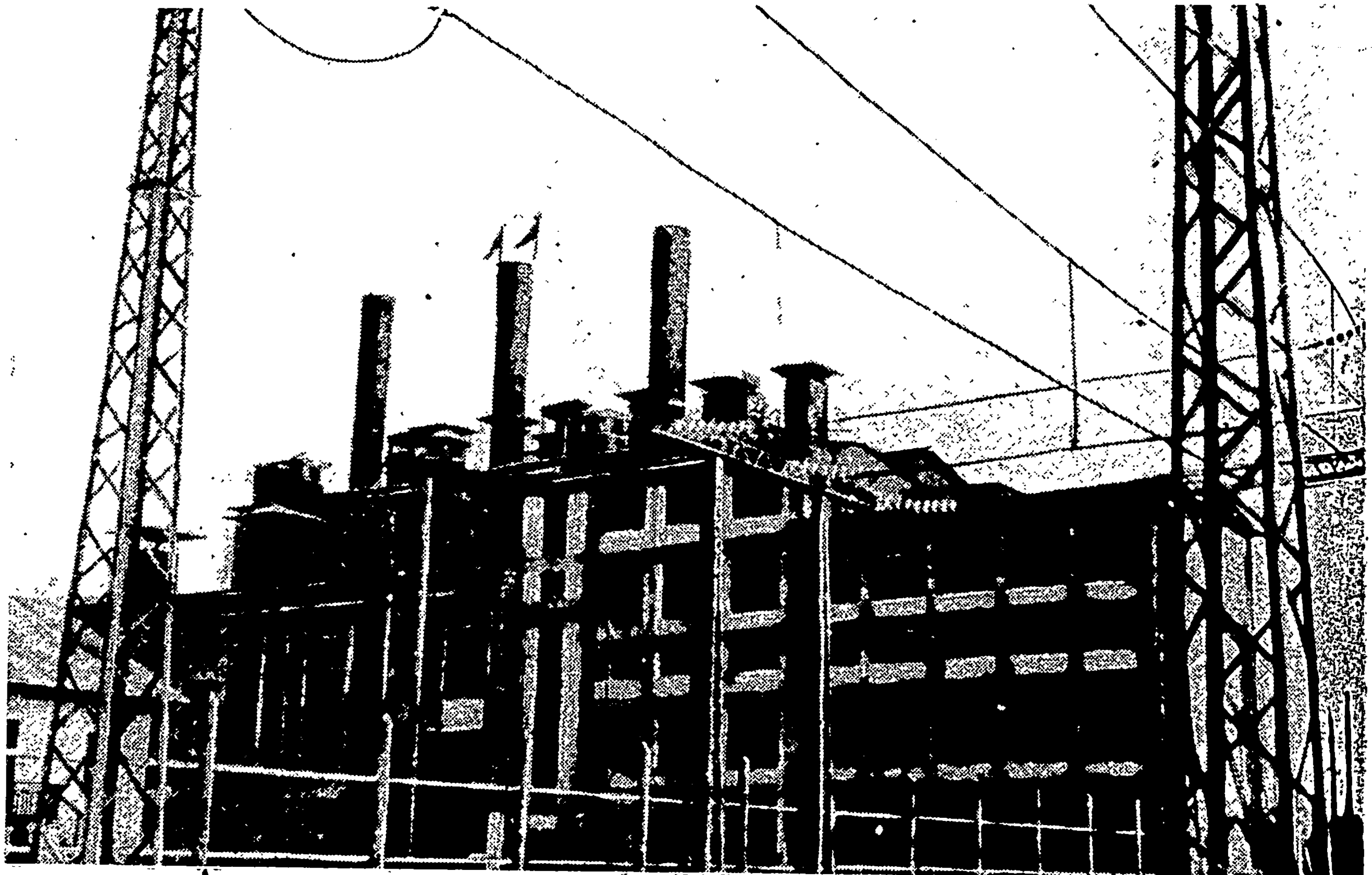

<u>Exterior view</u>.

PEAT-FIRING GRES IN OR NEAR OREKHOVSK, WHITE RUSSIA
(Capacity: 20,000 kw.)

Source: Prozhektor 1930, #35, p. 6 bottom right.

PLATE 35B

156

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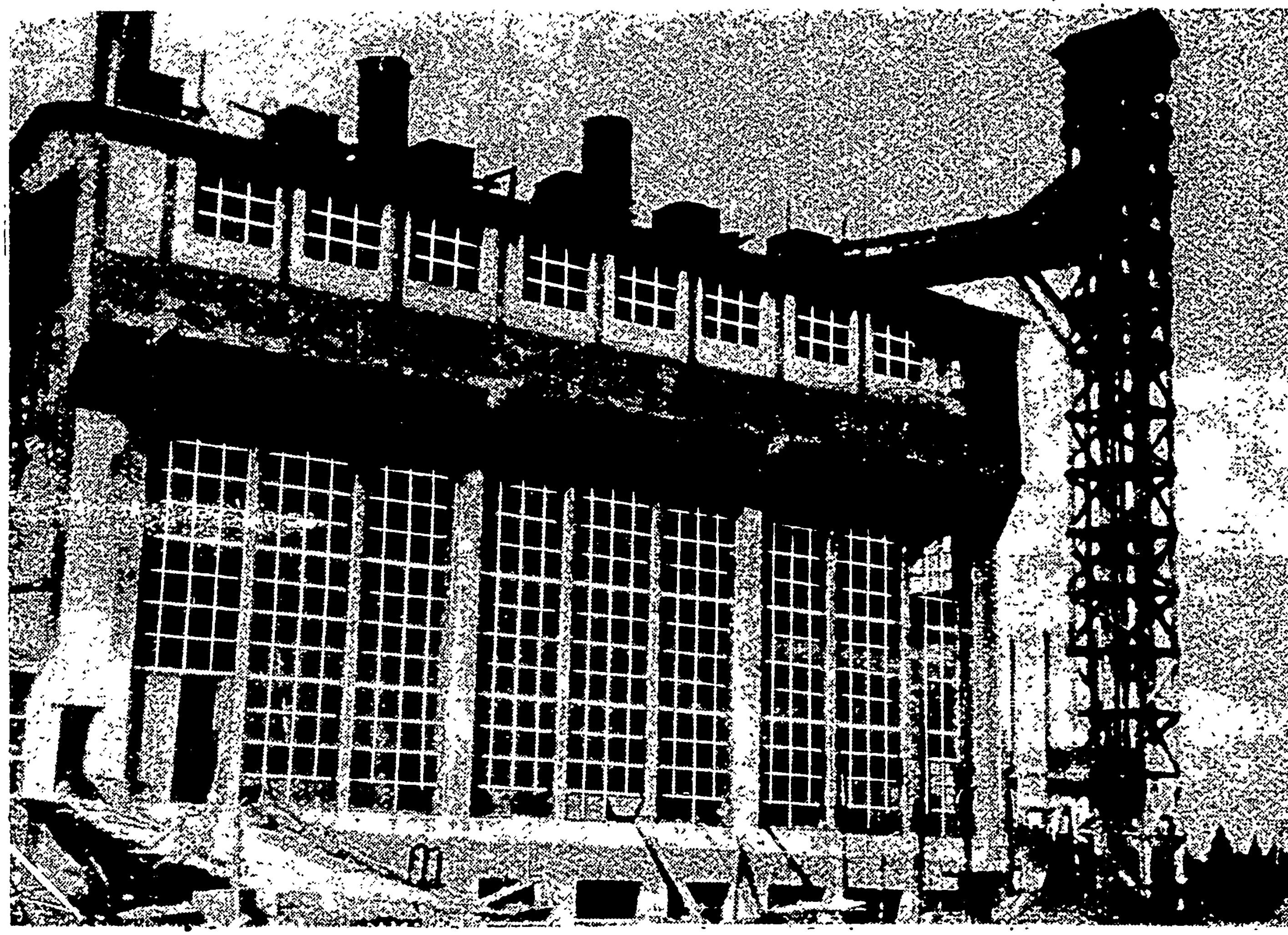

The GRES under construction.

PEAT-FIRING GRES IN OR NEAR OREKHOVSK, WHITE RUSSIA
(Capacity: 20,000 kw. - 1931)

Source: Prozhektor 1930, #26-27, p. 22 center left.

PLATE 35C

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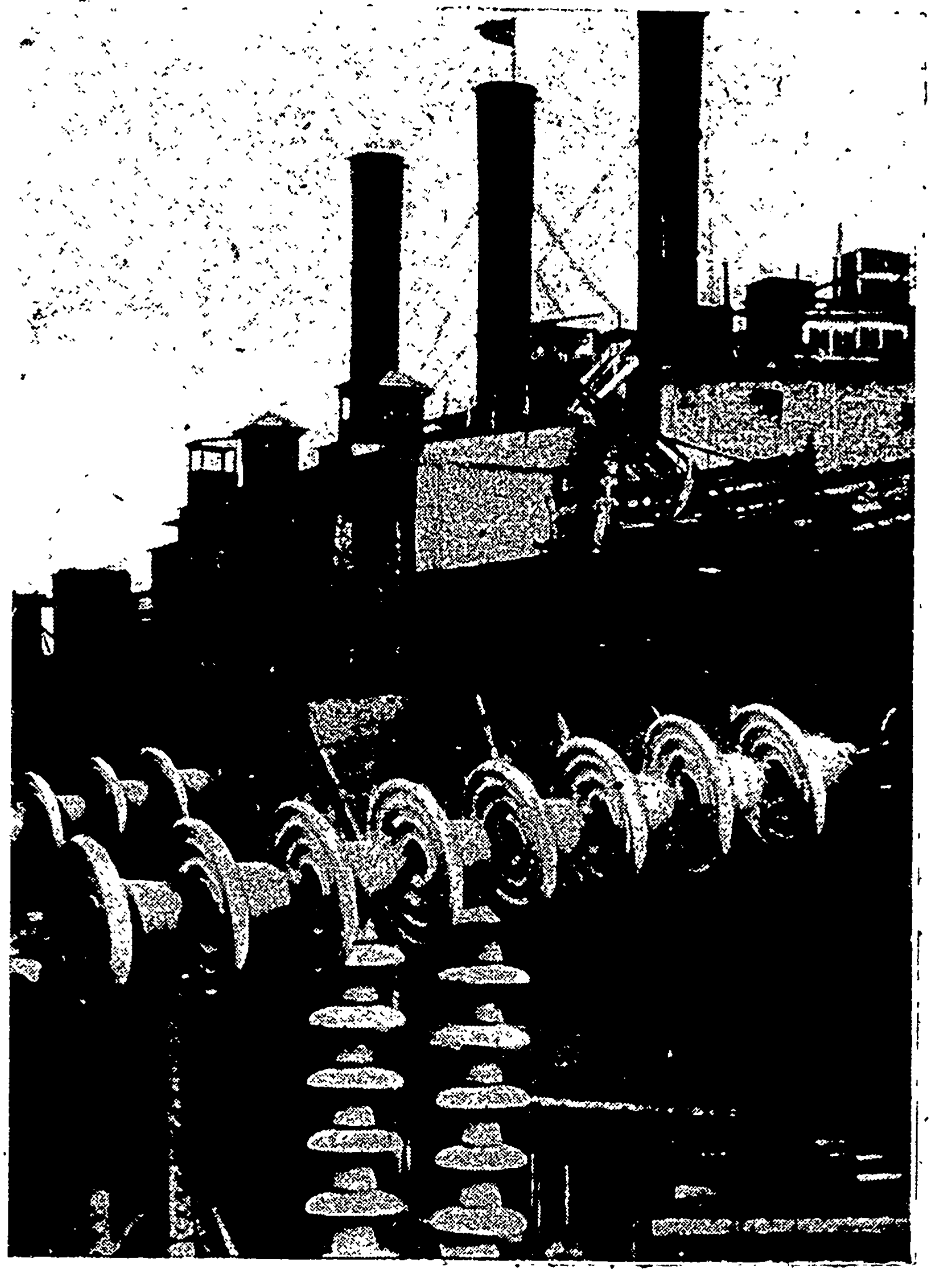

Partial view of the roof.

PEAT-FIRING GRES IN OR NEAR OREKHOVSK, WHITE RUSSIA
(Capacity: 20,000 kw.)

Source: Prozhektor #29, p. 30 top center.

PLATE 35D

BEREZNIKI PULVERIZED COAL-FIRING TETS

(Plates: 36, 36A, 36B, 36C)

Location: On the site of the Berezniki Chemical Works.

Coordinates: 59° 21' N, 56° 40' E.

Date of construction: 1931.

Layout type: First type.

Installed capacity: 93,000 kw.

Dimensions:

Structural type: Reinforced concrete and steel.

Wall covering: On the side wall - continuous sash windows and reinforced concrete panels

Roof construction: In turbine hall - steel trusses

Roofing:

Cranes: In the turbine hall

Crane girders: Reinforced concrete.

Stacks: Steel, located on the roof.

Trestles for fuel delivery: Steel

Remarks: Two 10,000 kva. step-up transformers are installed in the open air sub-station; the Berezniki TETS is thus connected with the Kizelovsk and Solikamsk power stations.

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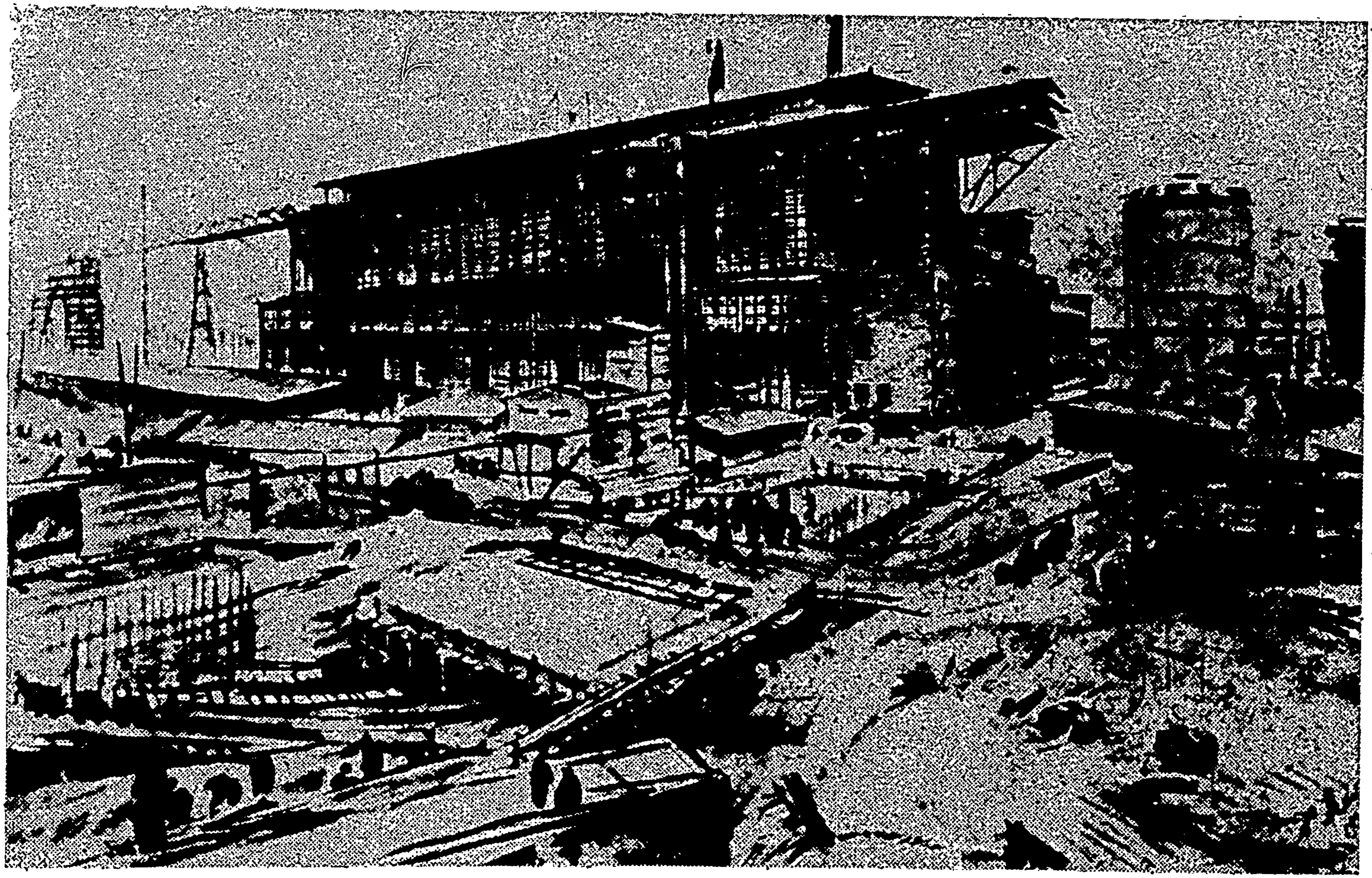

Berezniki TETs under construction.

BEREZNIKI PULVERIZED-COAL FIRING TETs
(Capacity: 93,000 kw.)
Source: Khimstroy 1932, #1, p. 1379, (TPl.K5)

PLATE 36

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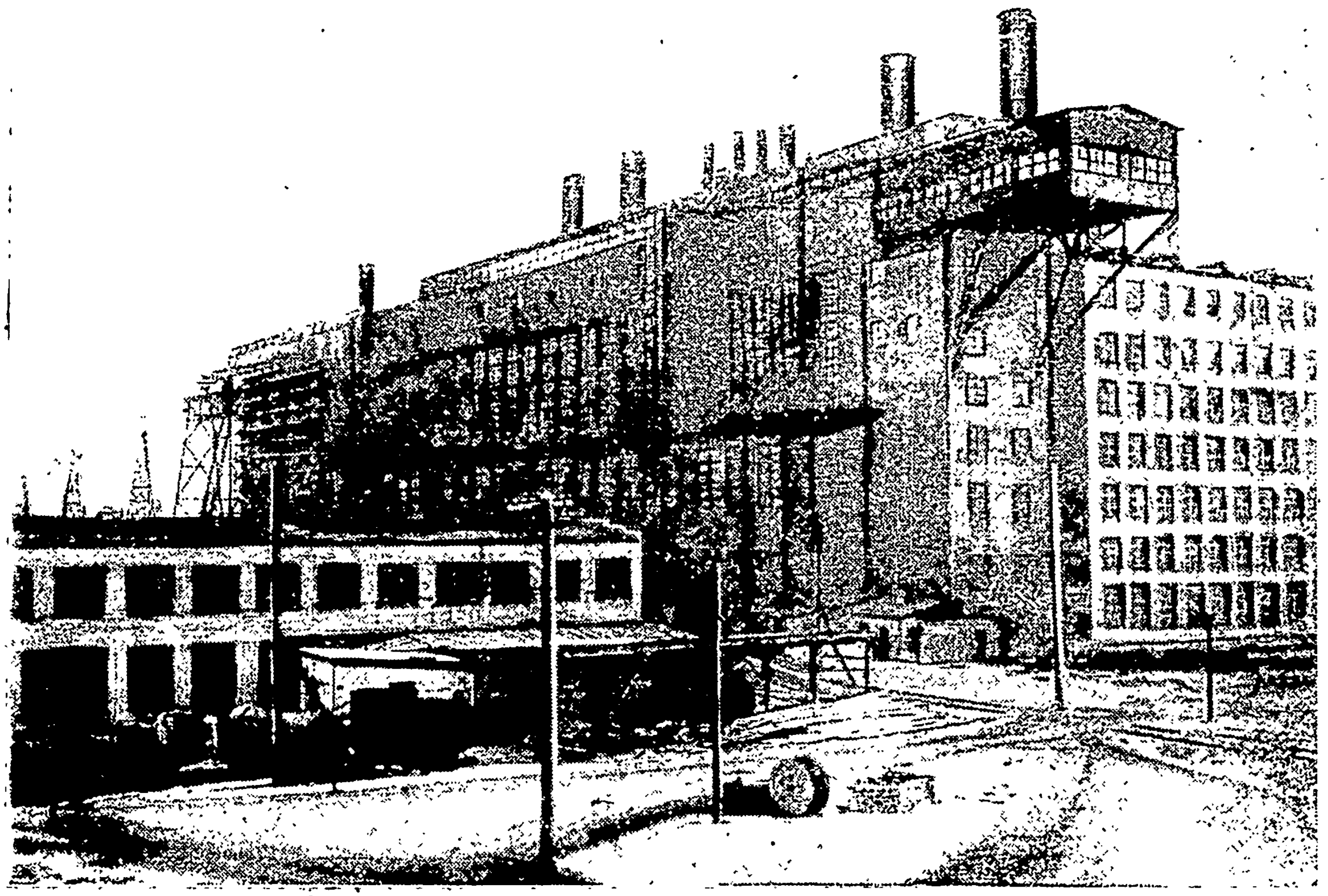

Partial exterior view of the TETs serving the Berezniki Chemical works.

BEREZNIKI TETs (pulverized coal-firing)
(Capacity: 93,000 kw.)

Source: Pyatnadsat' let leninskogo plana elektrifikatsii, 1936, p. 51, (TK85.D6)

PLATE 36A

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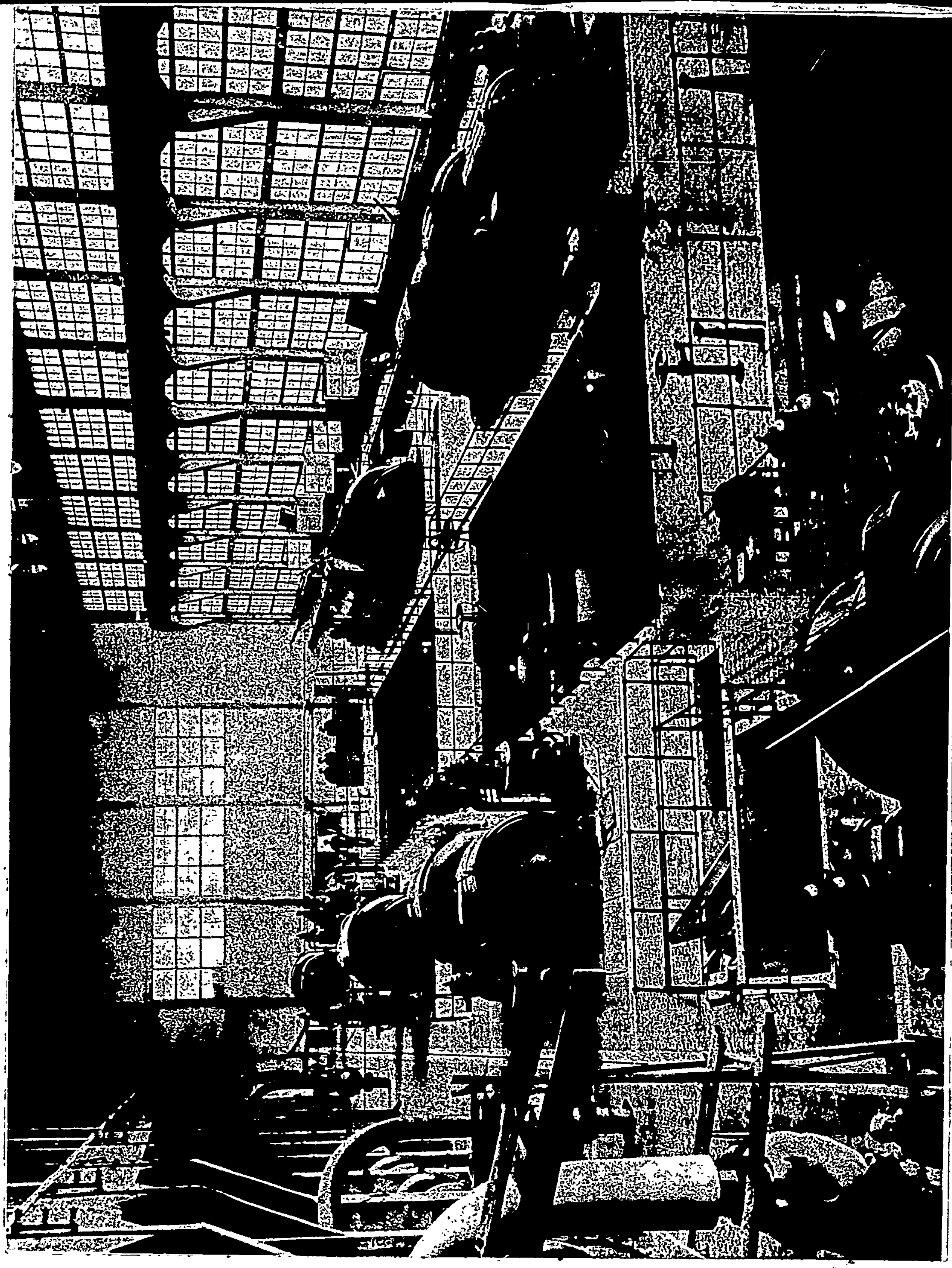
Exterior view of the TETs serving the Berezniki Chemical Works.

BEREZNIKI PULVERIZED COAL-FIRING TETs
(Capacity: 93,000 kw.)

Source: USSR in Construction 1932, #5, p. 26.

PLATE 36B



Turbogenerator hall.

BEREZNIKI TETs (pulverized coal-firing)
(Capacity: 93,000 kw.)

Source: DK267.A1U1, 1932, #5, p. 26.

PLATE 360

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SOLIKAMSK COAL-FIRING GES

(Plates: 37)

Location: Apparently on the site of the Solikamsk Chemical Plant.

Coordinates: 59° 38' N, 56° 47' E.

Date of construction: Prior to 1932.

Layout type: First type.

Installed capacity:

Dimensions:

Structural type: Reinforced concrete, poured-in-place.

Wall covering: Probably brick panel walls.

Roof construction:

Roofing: Sheet iron.

Cranes:

Crane girders:

Stacks: Steel, located on the roof.

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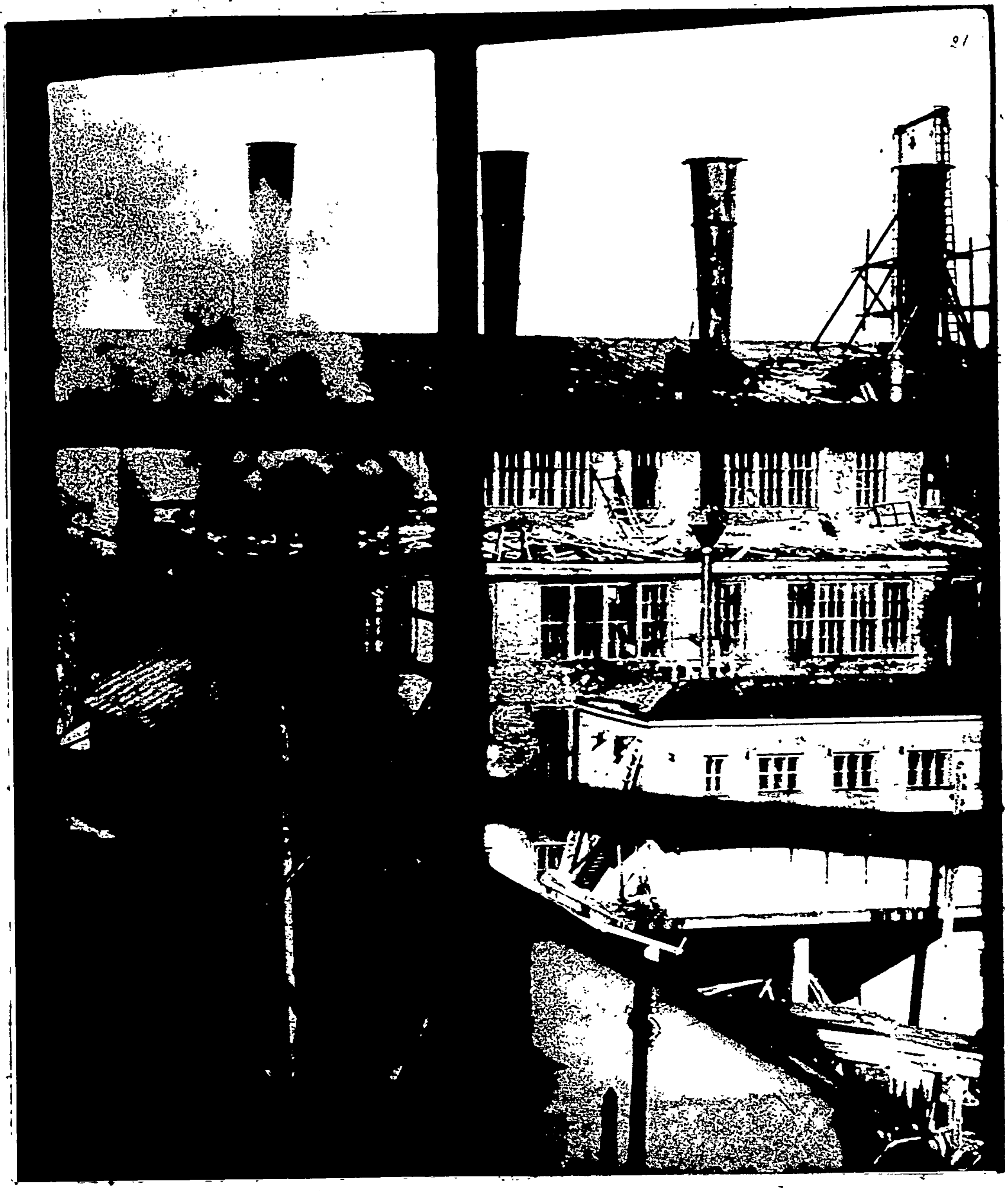

Partial view from the window of another building.

SOLIKAMSK COAL FIRING GES

Source: USSR in Construction, 1932, #5, p. 21.

PLATE 37

KUZNETSK COAL AND BLAST FURNACE GAS-FIRING GES

(Plates: 11, 11a, 38, 38A, 38B, 38C, 38D)

Location:

Coordinates: 55° 00' N, 85° 00' E. —— (approximate)

Date of construction: 1931.

Installed capacity: 109,000 kw.

Layout type: First type.

Dimensions: Overall - L. - 462.5 ft.; W. - 193.7 ft.; H. - 136.0 ft.

Structural type: Poured-in-place reinforced concrete.

Wall covering:

Roof construction: Steel trusses in the boiler house and turbine hall; reinforced conrete beams in bunker and feed water pump section.

Roofing: Presumably ruberoid.

Cranes: In the turbine hall; probable capacity - 75/15 tons.

Crane girders: Reinforced concrete.

Stacks: Steel, located on the roof.

Switch house: Reinforced concrete.

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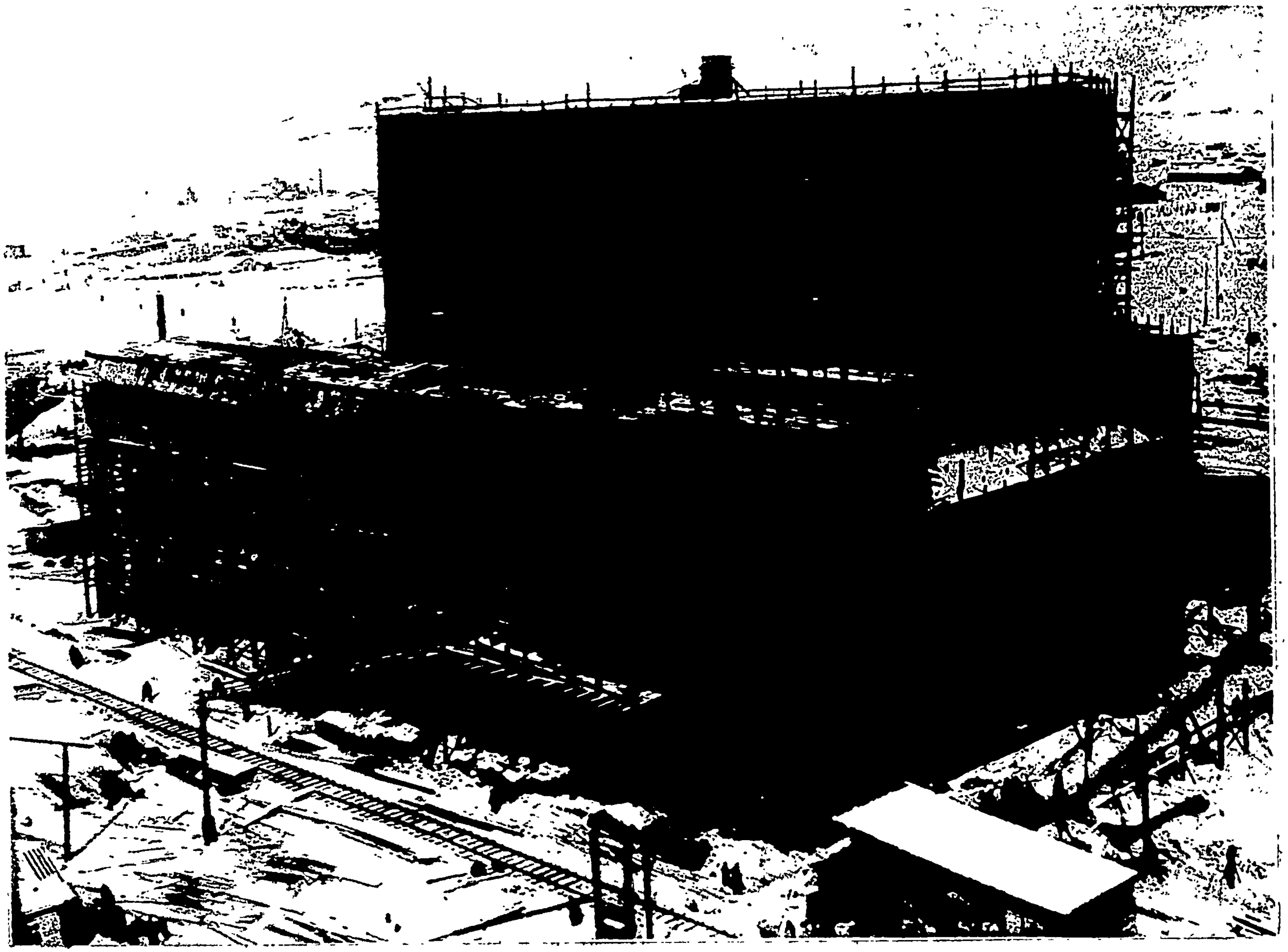

Central power station at the Metallurgical Plant in the process of construction.

KUZNETSK COAL AND BLAST FURNACE GAS FIRING TETs
(Capacity: 60,000 kw. - Projected 108,000 kw.)

Source: USSR in Construction 1932, #4, p. 19 bottom, (DK267.A1U3)
PLATE 38

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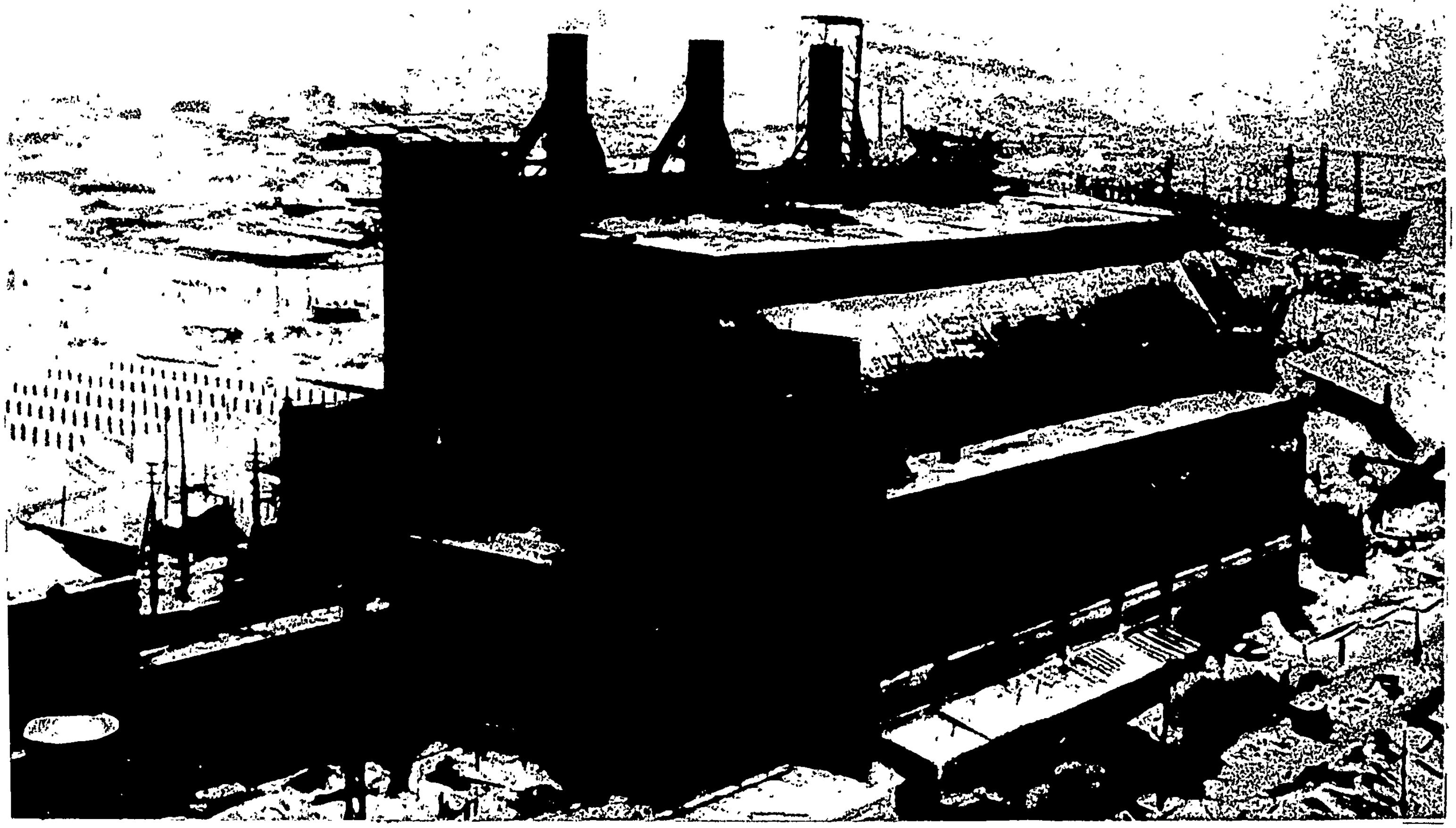


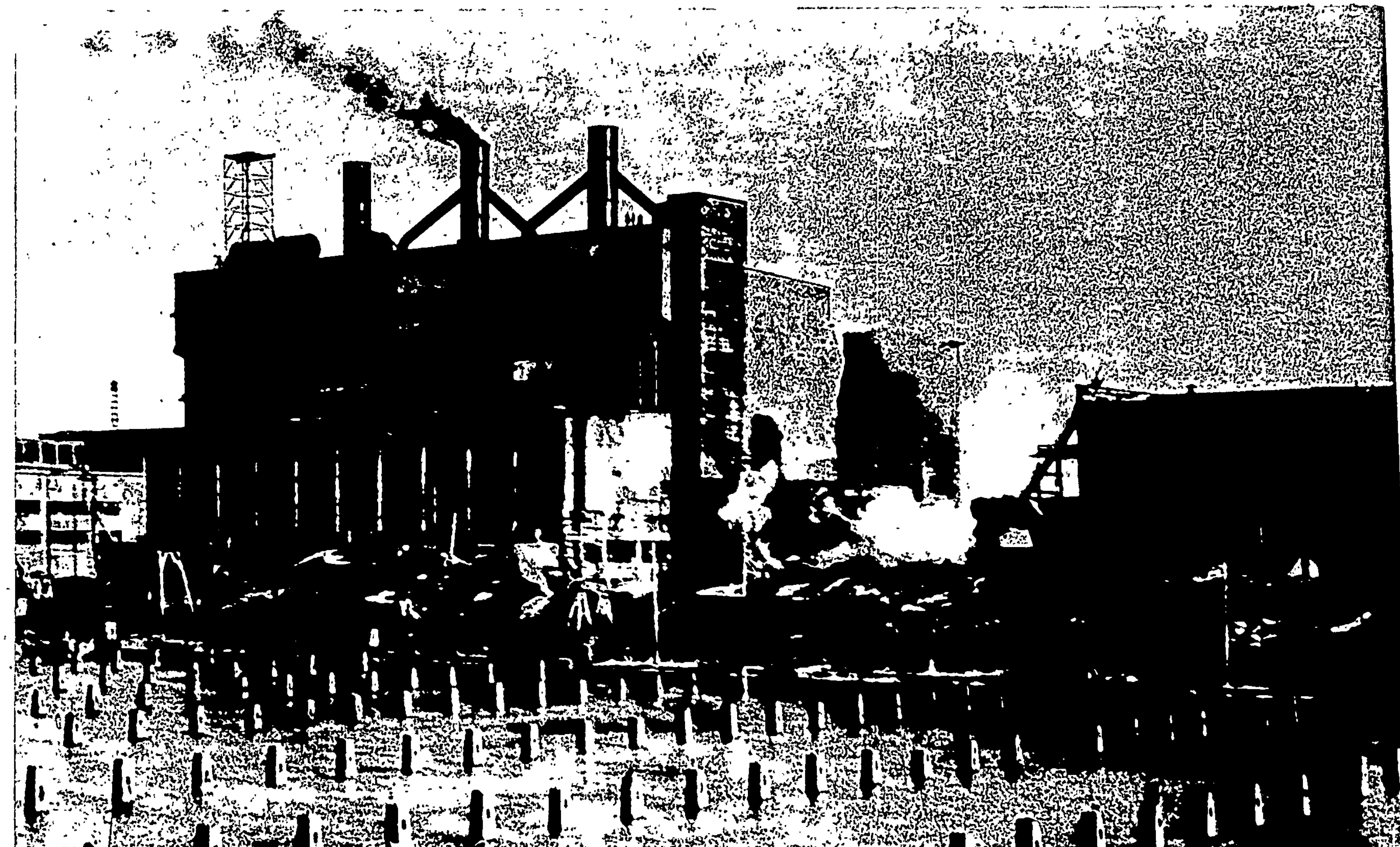
Central power station at the Metallurgical Works.

KUZNETSK COAL AND BLAST FURNACE GAS FIRING TETs
(Capacity: 60,000 kw. - Projected 109,000 kw.)

Source: USSR in Construction 1932, #4, p. 20 top, (DK267.A1U3)

PLATE 38A

Declassified in Part - Sanitized Copy Approved for Release @ 50-Yr 2013/09/03 : CIA-RDP81-01043R002500170001-1



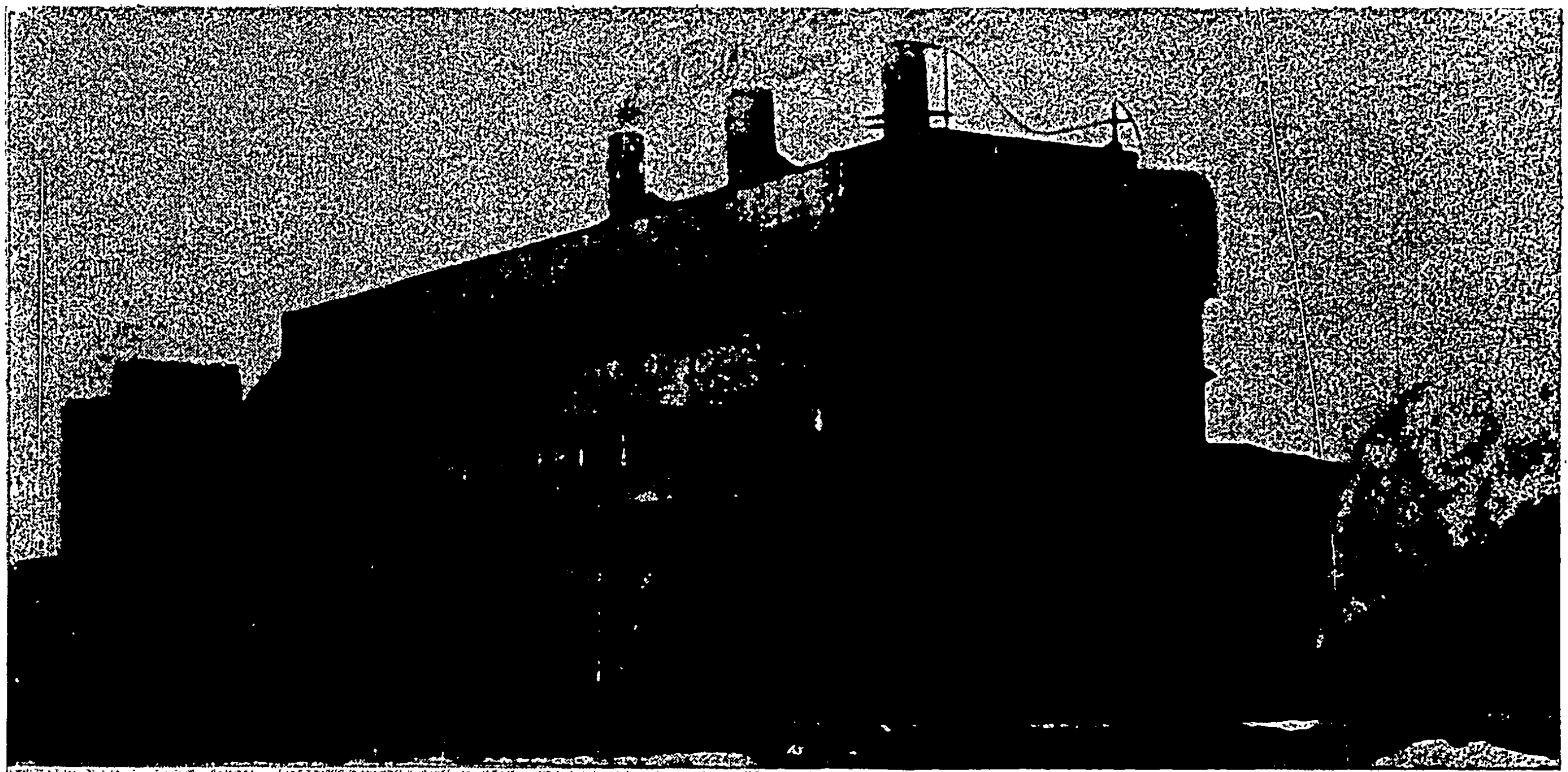
Central power station at the Metallurgical Plant.

KUZNETSK COAL AND BLAST FURNACE GAS FIRING TETs
(Capacity: 60,000 kw. - Projected 109,000 kw.)

Source: USSR in Construction 1932, #4, p. 10 bottom, (DK267.A1U3)

PLATE 38B

Declassified in Part - Sanitized Copy Approved for Release @ 50-Yr 2013/09/03 : CIA-RDP81-01043R002500170001-1



Partial view of the TETs

KUZNETSK COAL AND BLAST FURNACE GAS-FIRING TETs
(Capacity: 60,000 kw. - Projected 109,000 kw.)

Source: Arkhitektura elektrostantsiy 1939, p. 179, (TH4581.A5)

PLATE 38C

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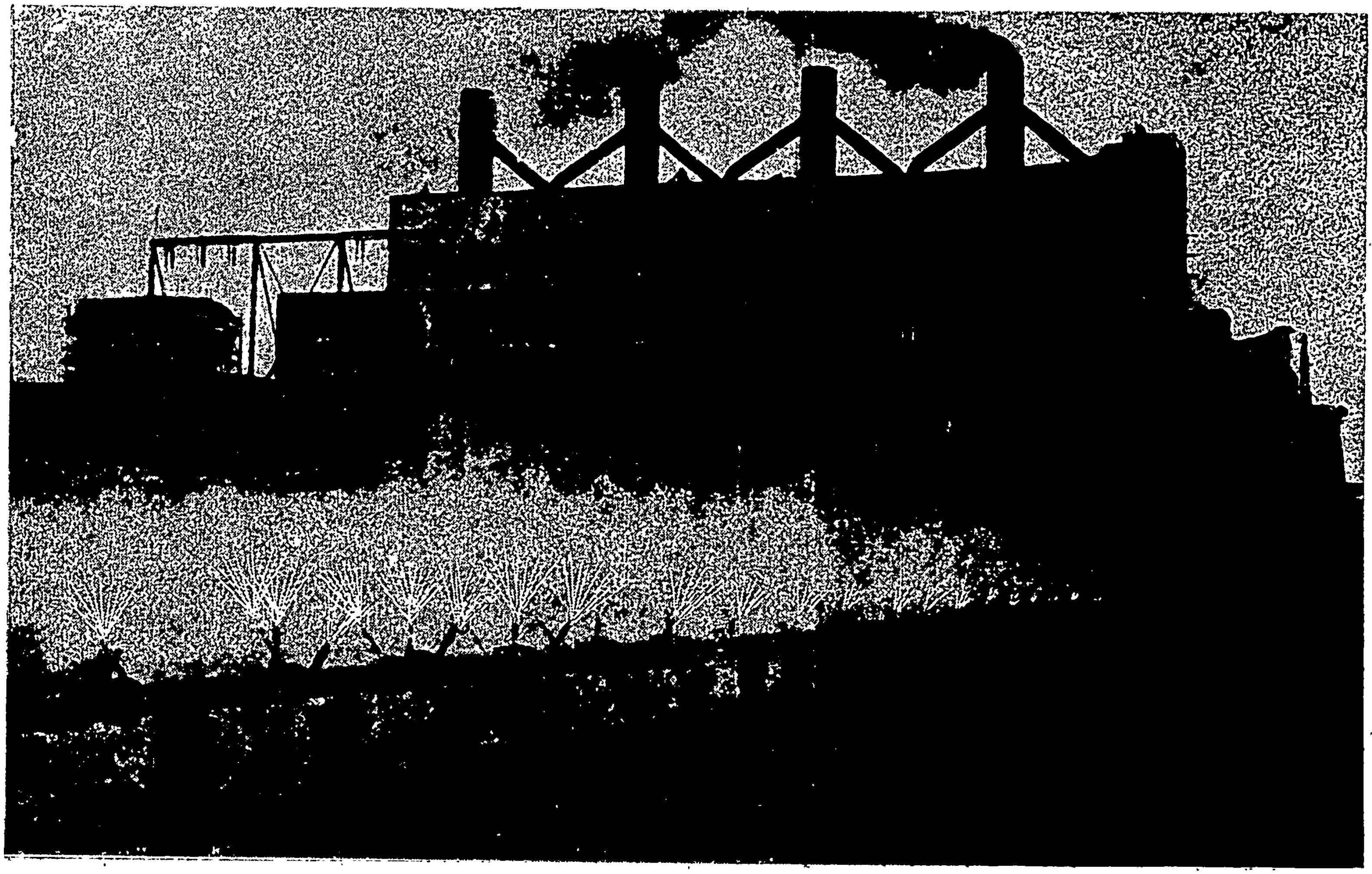


Partial view of the TETs showing the spray pond.

KUZNETSK COAL AND BLAST FURNACE GAS-FIRING TETs
(Capacity: 60,000 kw. - Projected 109,000 kw.)

Source: Arkhitektura elektrostantsiy 1939, p. 178, (TH4581.A5)

PLATE 38D

CHELYABINSK COAL-FIRING GRES

(Plates: 39, 39A)

Location: Chelyabinsk, industrial city in the Ural' Mountains

Coordinates: 55° 10' N, 61° 24' E.

Date of construction: 1930.

Layout type: First type.

Installed capacity: 150,000 kw.

Dimensions:

Structural type: Reinforced concrete frame

Wall covering: Reinforced concrete panels (prob.)

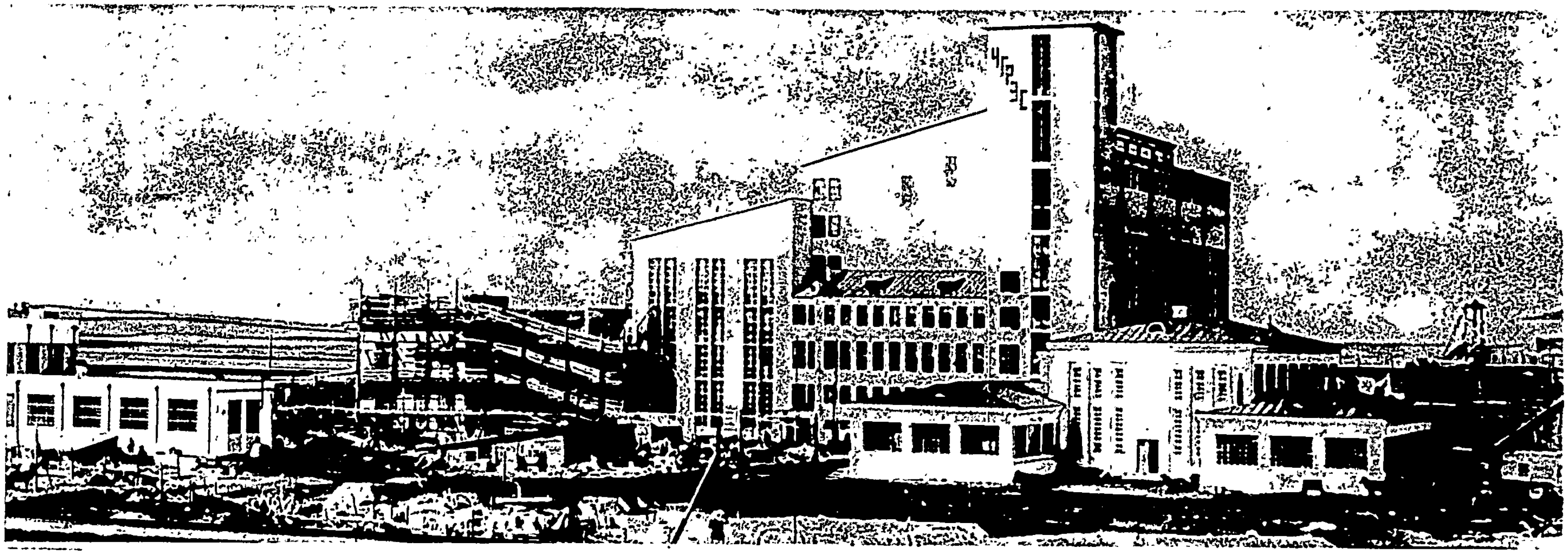
Roof construction:

Roofing: Ruberoid (prob.)

Cranes:

Crane girders:

Stacks: Steel, located on the roof.



GRES under construction.

CHELYABINSK COAL-FIRING GRES
(Capacity: 150,000 kw.)

Source: USSR in Construction 1930, #3, p. 20 bottom.

PLATE 39

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General view of the first section nearing completion.

CHELYABINSK COAL-FIRING GRES
(Capacity: 150,000 kw.)

Source: Elektricheskiye Stantsii 1932, #9, front cover, (TK4.E725)

PLATE 39A

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MAGNITOGORSK COAL AND BLAST FURNACE GAS-FIRING GES

(Plates: 40, 40A, 40B)

Location: Magnitogorsk Industrial city in Ural Mountains

Coordinates: 53° 27' N, 59° 04 E.

Date of construction: Before 1933.

Layout type: First type.

Installed capacity: 98,000 kw.

Dimensions:

Structural type: Cost-in-place reinforced concrete frame

Wall covering: Brick panel walls

Roof construction: Steel trusses, probably wood sheatting

Roofing: Probably tar and gravel

Cranes:

Crane girders:

Stacks: Steel, located on the roof.

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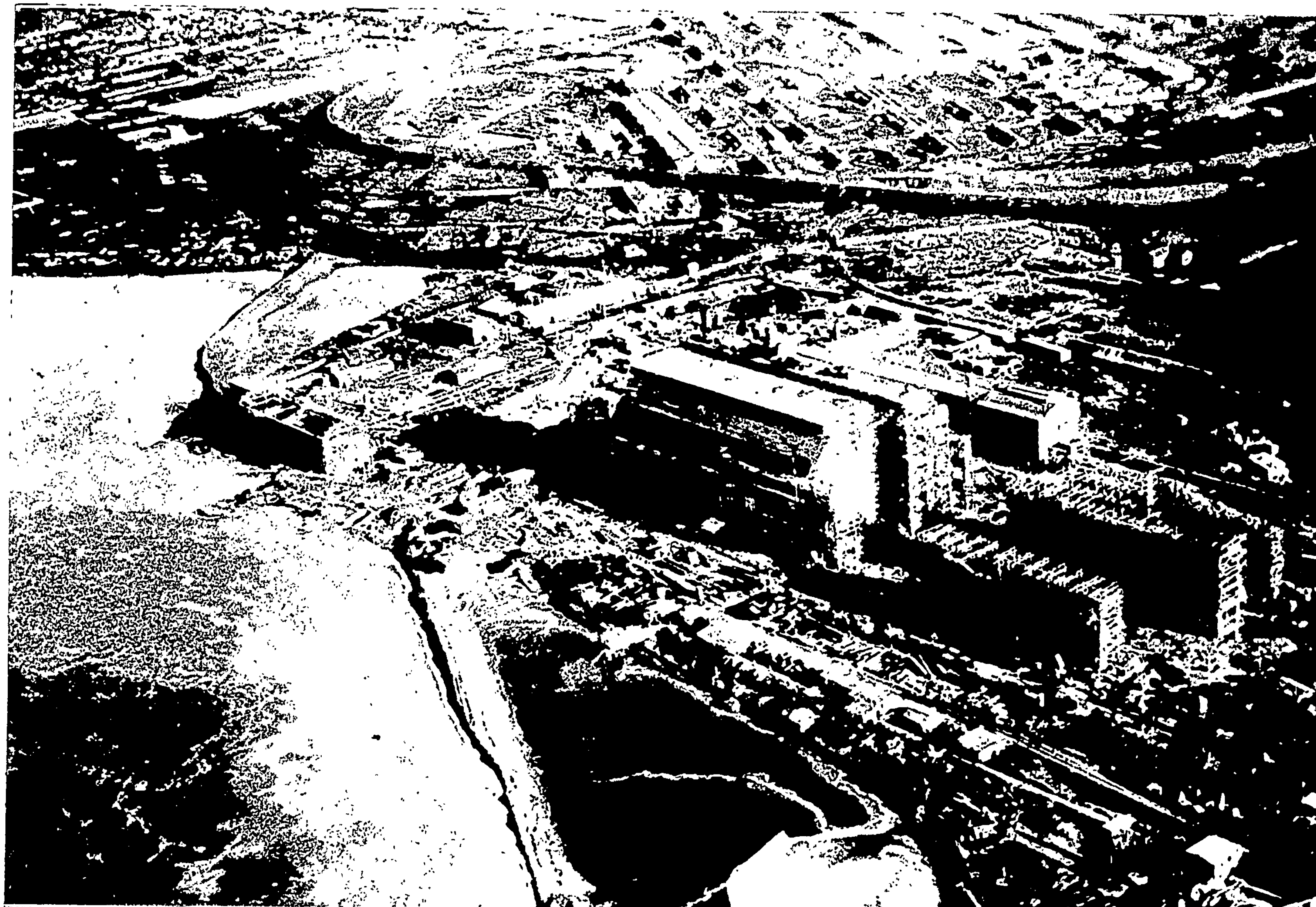
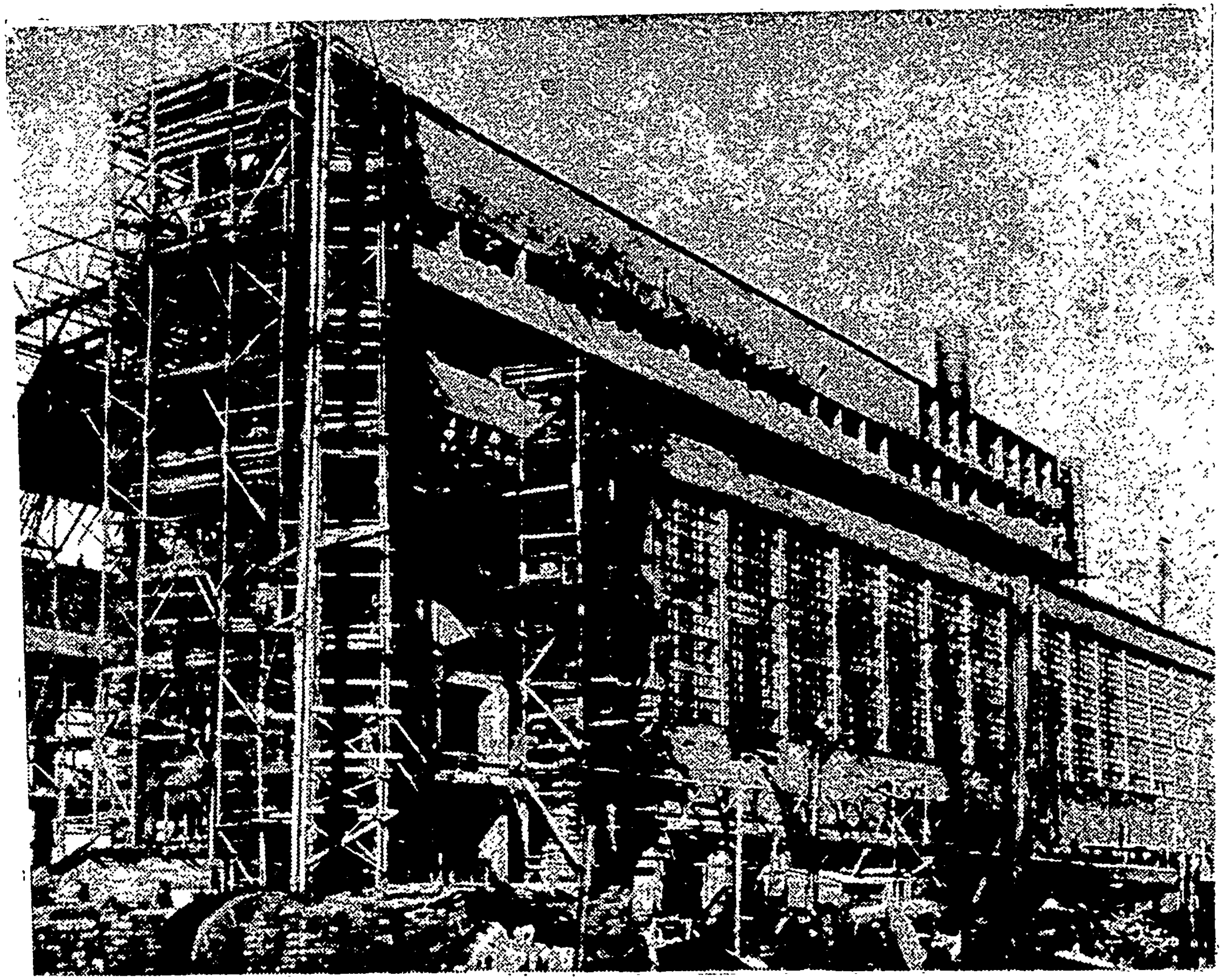


Aerial view. GES under construction.

MAGNITOGORSK COAL AND BLAST FURNACE GAS FIRING GES SERVING THE METALLURGICAL PLANT
(Capacity: 98,000 kw. - Projected 350,000 kw.)

Source: USSR in Construction 1932, #1, p. 32 bottom.

PLATE 40



GES under construction.

MAGNITEGORSK COAL AND BLAST FURNACE GAS FIRING GES
(Capacity: 98,000 kw. - Projected 350,000 kw.)

Source: Ogonek 1932, #18, p. 13 bottom right, (AP50.042)

PLATE 40A

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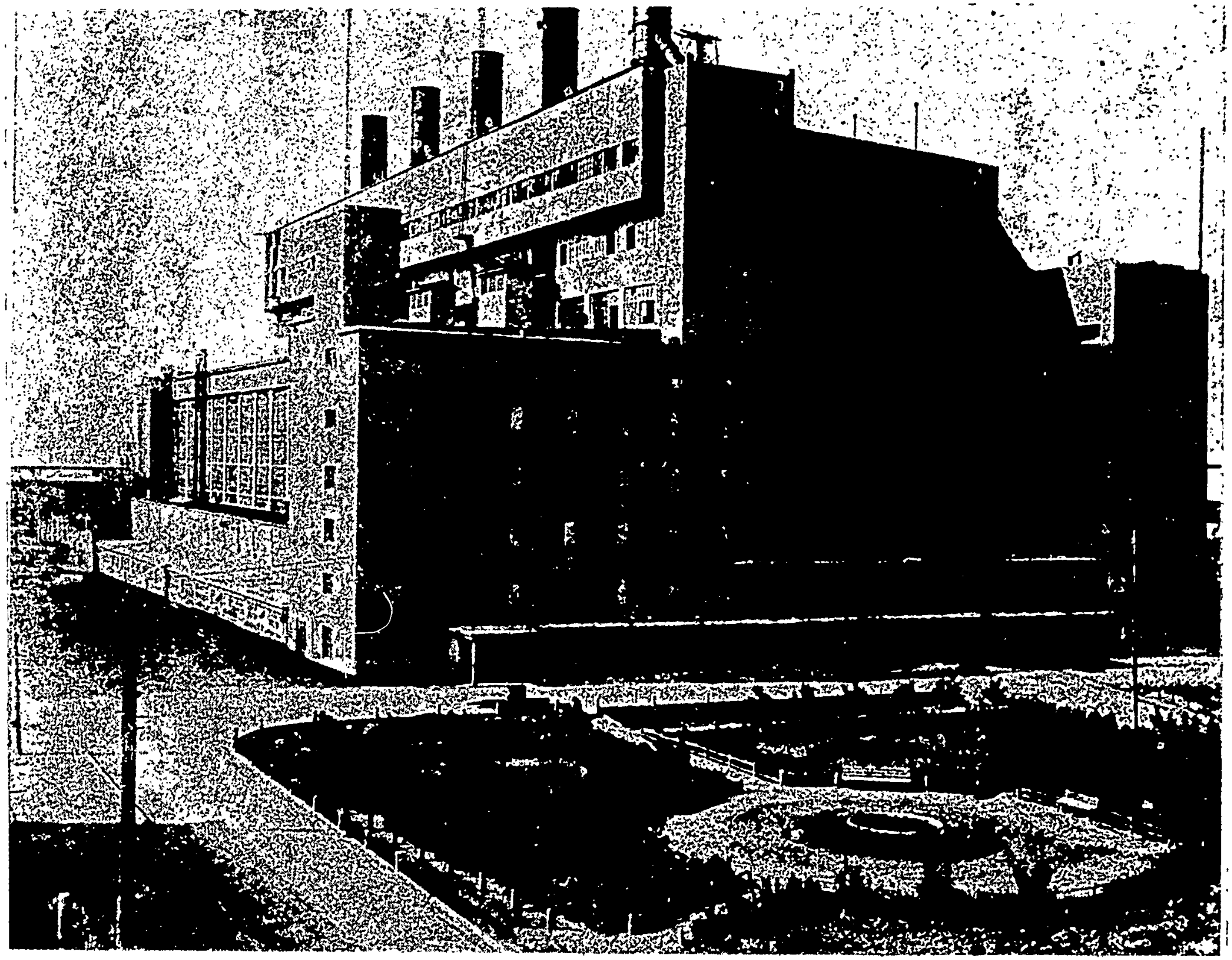


Partial exterior view.

MAGNITOGORSK COAL AND BLAST FURNACE GAS FIRING GES SERVING THE METALLURGICAL PLANT
(Capacity: 98,000 kw. - Projected 350,000 kw.)

Source: Arkhitektura elektrostantsiy 1939, p. 170, (TH4581.A5)

PLATE 40B

Declassified in Part - Sanitized Copy Approved for Release @ 50-Yr 2013/09/03 : CIA-RDP81-01043R002500170001-1

KRAMATORSK COAL AND BLAST FURNACE GAS FIRING POWER STATION

(Plates: 41, 41A)

Location: Don Basin (The power station serves the metallurgical plant)

Coordinates: 48° 43' N, 37° 33' E.

Date of construction: Before 1932.

Layout type: First type.

Installed capacity: 25,000 kw.

Dimensions:

Structural type: Appears to be reinforced concrete.

Wall covering:

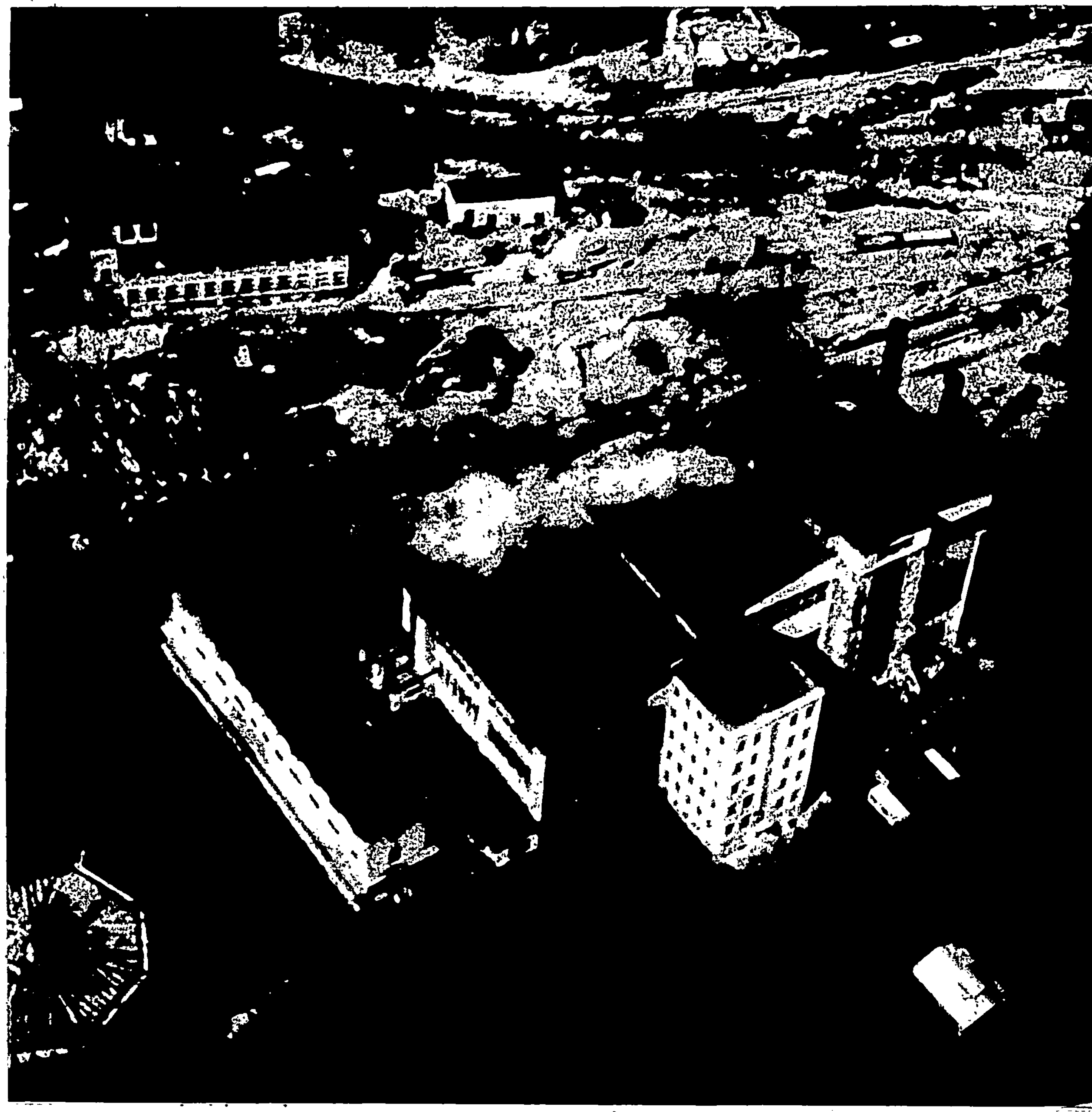
Roof construction:

Roofing: Sheet-iron.

Cranes:

Crane girders:

Stacks: Steel, located on the roof.



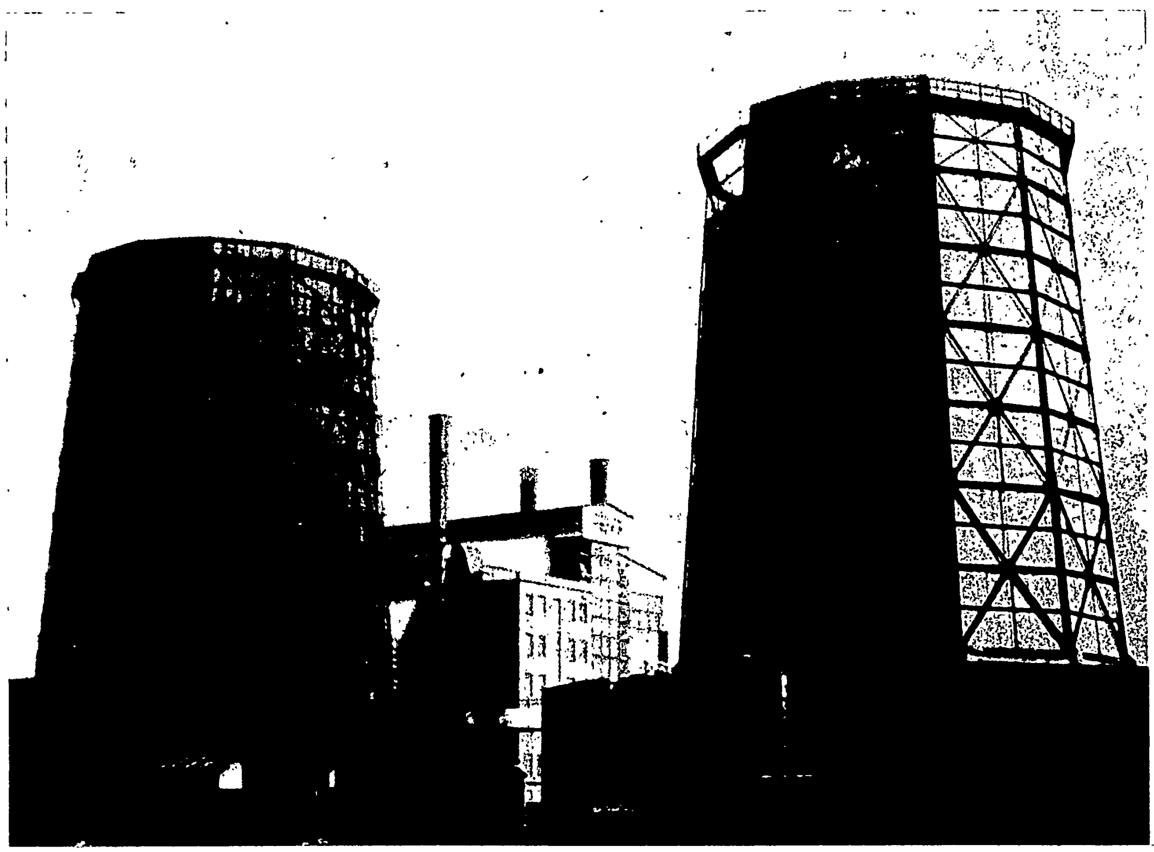
Aerial view.

KRAMATORSK COAL AND BLAST FURNACE GAS FIRING GES
(Capacity: 25,000 kw. - Projected 57,000 kw.)

Source: USSR in Construction 1932, #7, p. 8.

PLATE 41

-181-



Water cooling towers.

KRAMATORSK COAL AND BLAST FURNACE GAS FIRING GES
(Capacity: 25,000 kw. - Projected 57,000 kw.)

Source: USSR in Construction 1932, #7, p. 8 bottom

PLATE 41A

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KEMEROVO COAL-FIRING TETS

(Plates: 42)

Location: City in Kuznetsk Basin, central Siberia

Coordinates: 55° 20' N, 86° 05' E.

Date of construction: 1934.

Layout type: First type.

Installed capacity: 48,000 kw.

Dimensions:

Structural type: Reinforced concrete.

Wall covering:

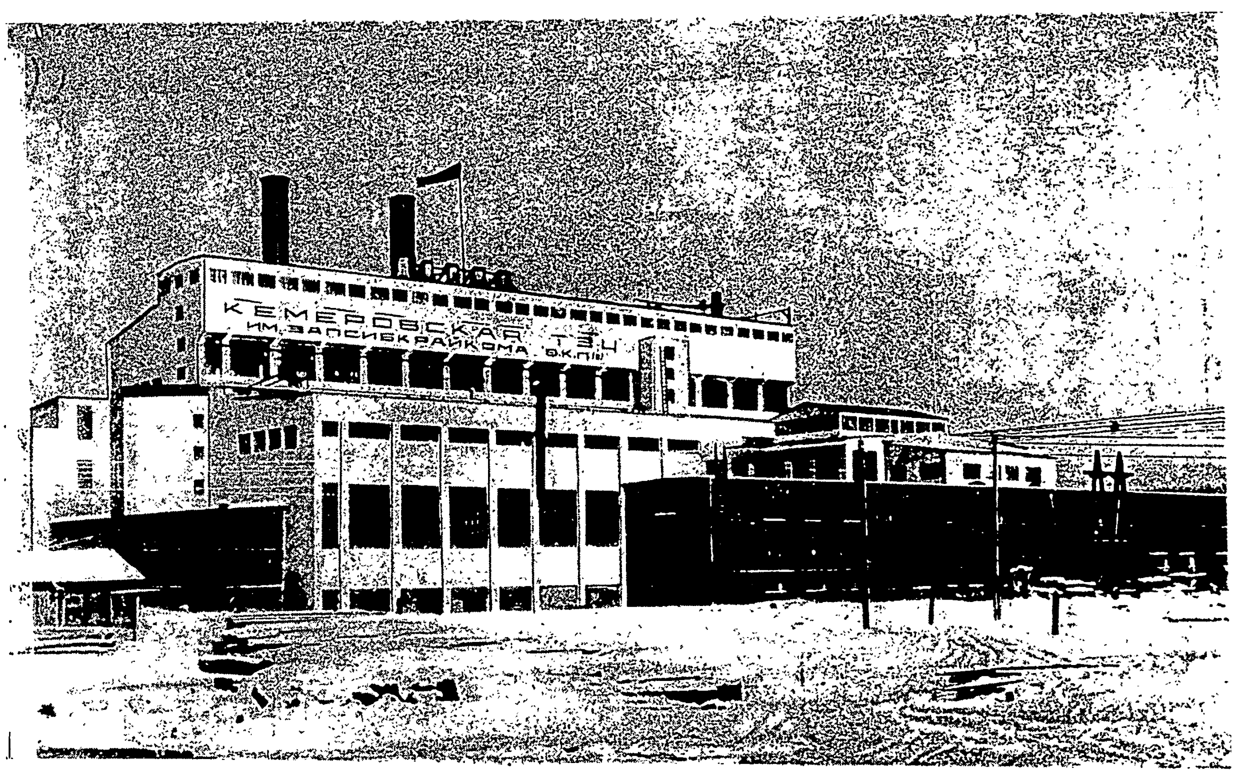
Roof construction:

Roofing: Probably sheet iron

Cranes:

Crane girders:

Stacks: Steel, located on the roof.



Partial exterior view.

KEMEROVO COAL-FIRING TETs
(Capacity: 48,000 kw.)

Source: Elektricheskiye Stantsii, 1934, #3, front cover, (TK4.E725)

PLATE 42

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SVERDLOVSK PEAT-FIRING TETS

(Plates: 43, 43A)

Location: City east of Urals, between Nizhniy Tagil and Chelyabinsk

Coordinates: 56° 50' N, 60° 38' E.

Date of construction:

Layout type: First type.

Installed capacity: 10,000 kw.

Dimensions:

Structural type: Reinforced concrete frame.

Wall covering: Brick panel walls.

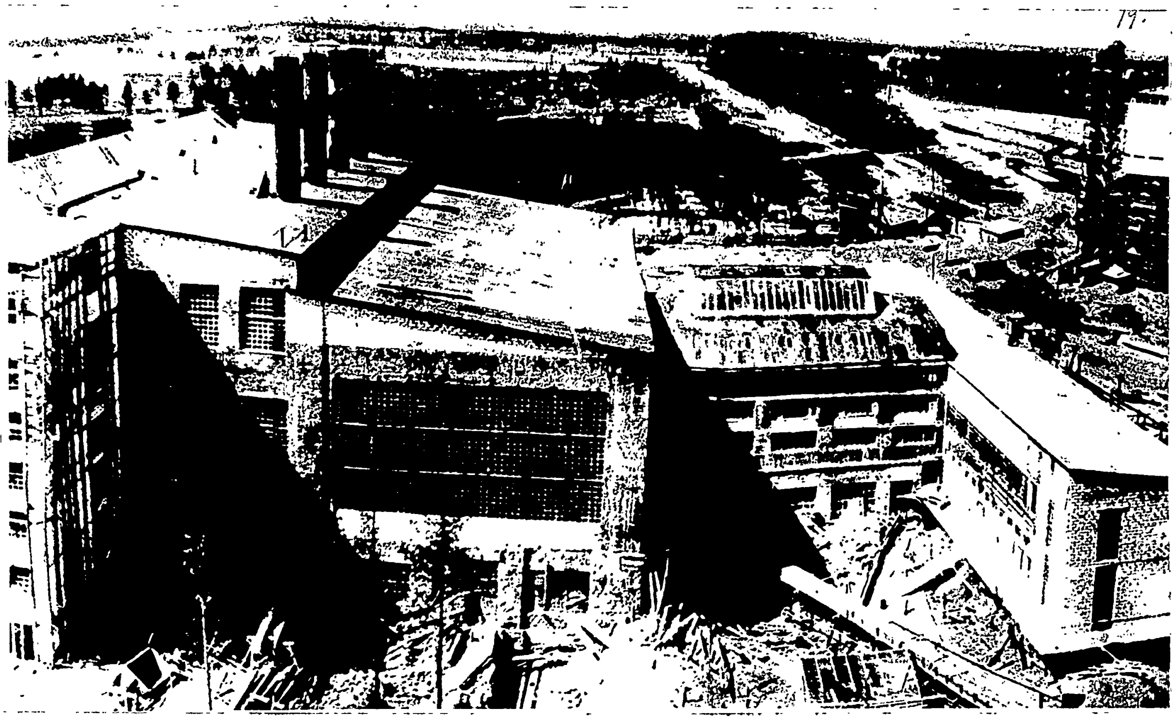
Roof construction:

Roofing: Sheet-iron on sloping part; tar & gravel on flat part.

Cranes:

Crane girders:

Stacks: Steel, located on the roof.

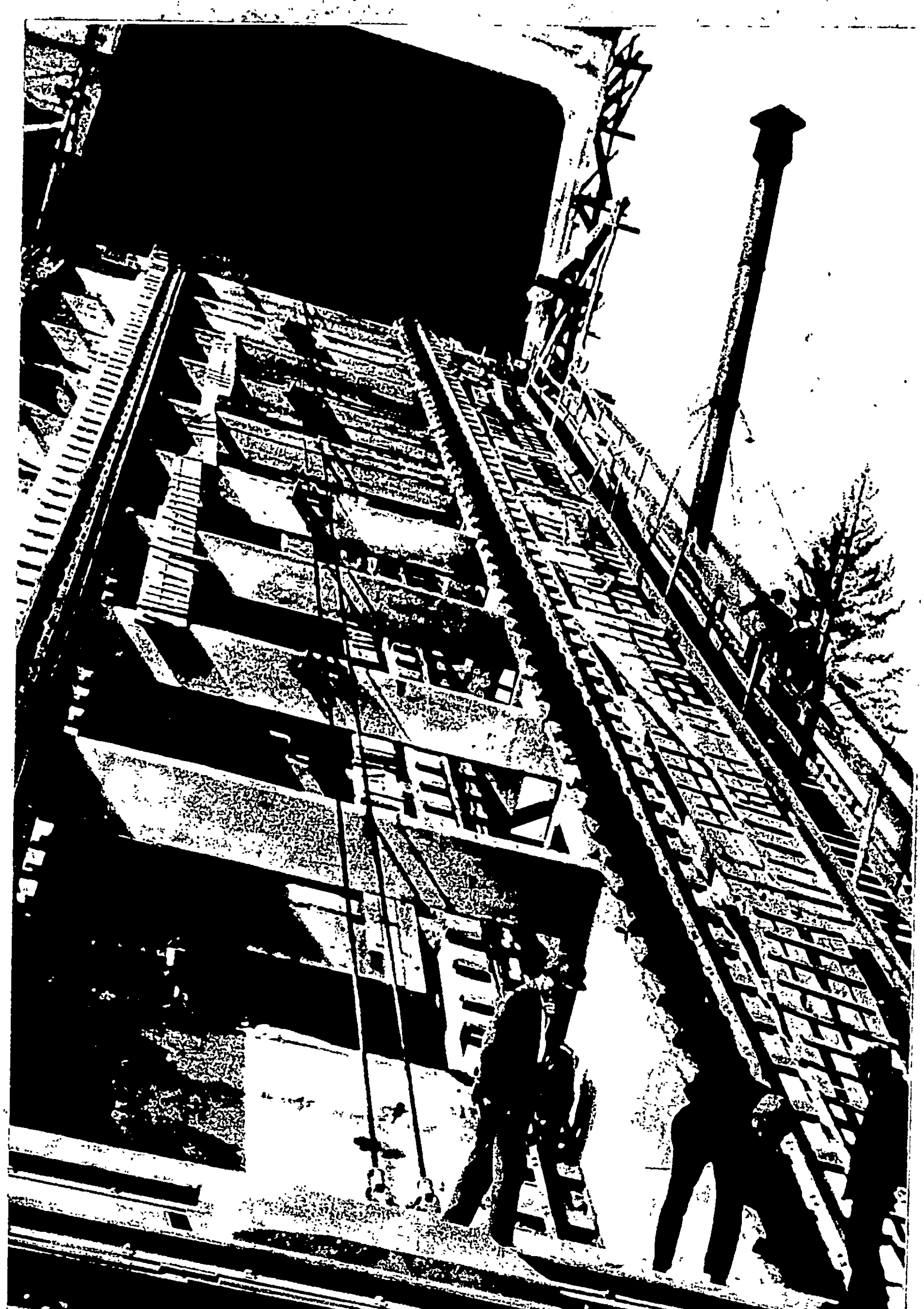


Partial exterior view of the TETs serving "Uralmashstroi" (Ural Machine Building Works)

SVERDLOVSK PEAT-FIRING TETs
(Capacity: 10,000 kw. - Projected 18,000 kw.)

Source: USSR in Construction 1932, #7, p. 19 top.

PLATE 43



Fuel supply trestle leading to the bunker gallery of the TETs.
(Serving "Uralmashstroi" - Ural Machine Building Works)

SVERDLOVSK PEAT-FIRING TETs
(Capacity: 10,000 kw. - Projected 18,000 kw.)

Source: USSR in Construction 1932, #7, p. 19 bottom.

PLATE 43A

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VOROSHILOVSK COAL AND BLAST FURNACE GAS FIRING POWER PLANT

(Plates: 44)

Location: City in Southern Donbass, Ukraine

Coordinates: 48° 30' N, 38° 47' E.

Date of construction: After 1936.

Layout type: First type.

Installed capacity: 24,000 kw.

Dimensions:

Structural type:

Wall covering:

Roof construction:

Roofing: Probably sheet iron

Cranes:

Crane girders:

Stacks: Appears to be steel, located on the roof.

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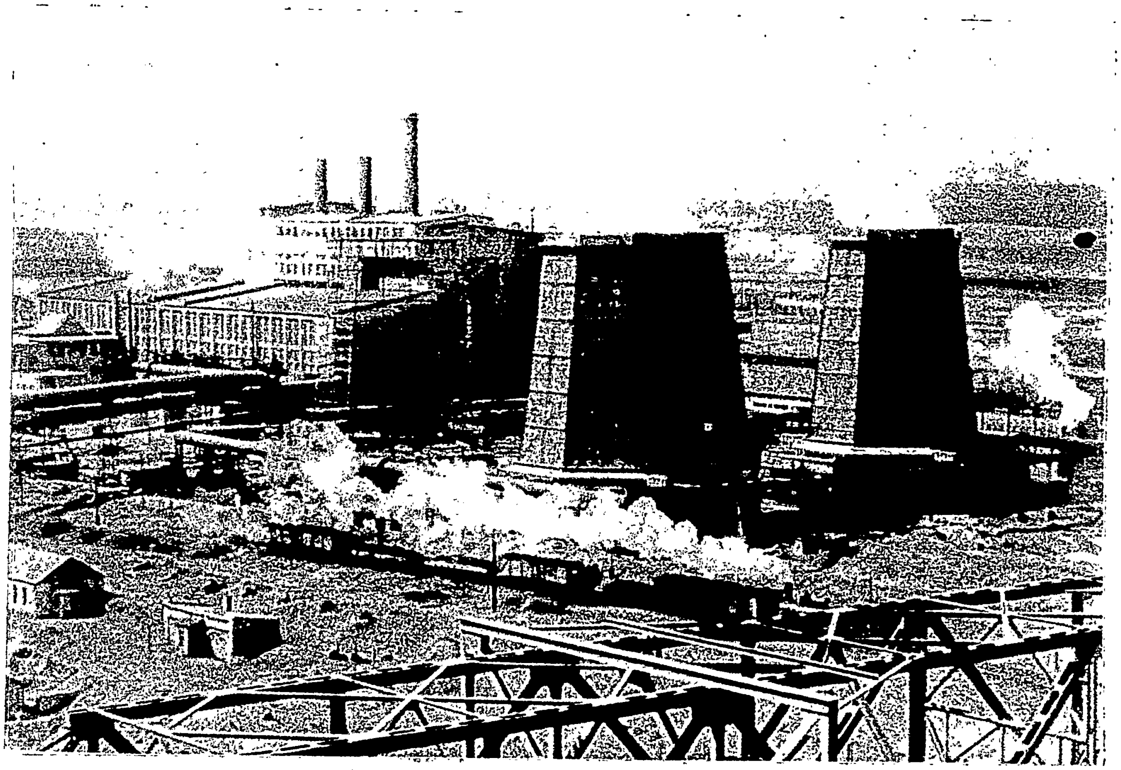

General view of the GES serving the Voroshilov Metallurgical Plants.

VOROSHILOVSK COAL AND BLAST FURNACE GAS-FIRING GES
(Capacity: 24,000 kw.)

Source: Ogonek 1947, December, p. 6 top right.

PLATE 44

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SARATOV COAL-FIRING GRES

9 (Plates: 45, 45A, 45B, 45C, 45 D, 45E.)

Location: On the shore of Volga in the city of Saratov

Coordinates: 51° 34' N; 46° 02' E

Date of construction: 1930

Installed capacity: 22,500 kw

Layout type: First type

Dimensions:

Structural type: Reinforced concrete frame

Wall covering:

Roof construction:

Roof covering:

Cranes:

Crane girders:

Stacks: Steel; located on the roof

Remarks: There is also a 12,000 kw TETs at Saratov.

The GRES under construction.

SARATOV COAL-FIRING GRES
(Capacity: 22,500 kw.)

Source: Prozhektor 1930, #9, p. 14 bottom left.

PLATE 45

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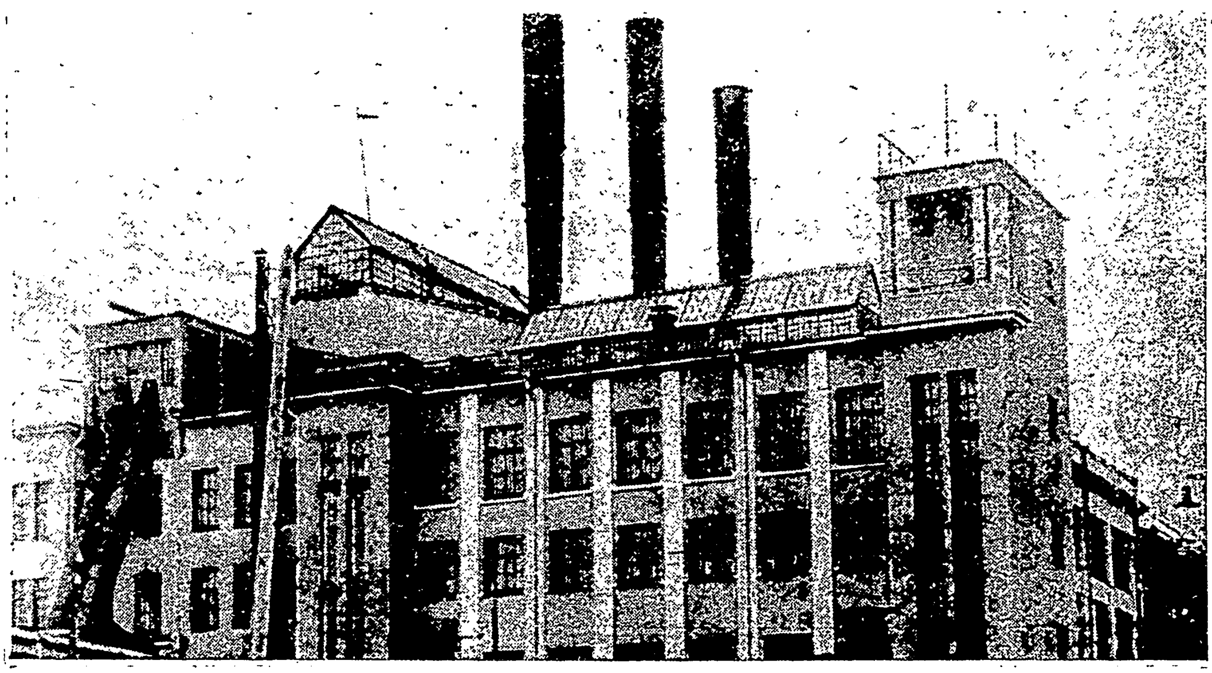
The GRES under construction.

SARATOV COAL-FIRING GRES
(Capacity: 22,500 kw.)

Source: Prozhektor 1930, #26-27, p. 24 bottom left.

PLATE 45A

-192-



Partial view of GRES under construction.

SARATOV COAL-FIRING GRES
(Capacity: 22,500 kw.)

Source: Prozhektor, 1930, #35, p. 9, bottom right.

PLATE 45B

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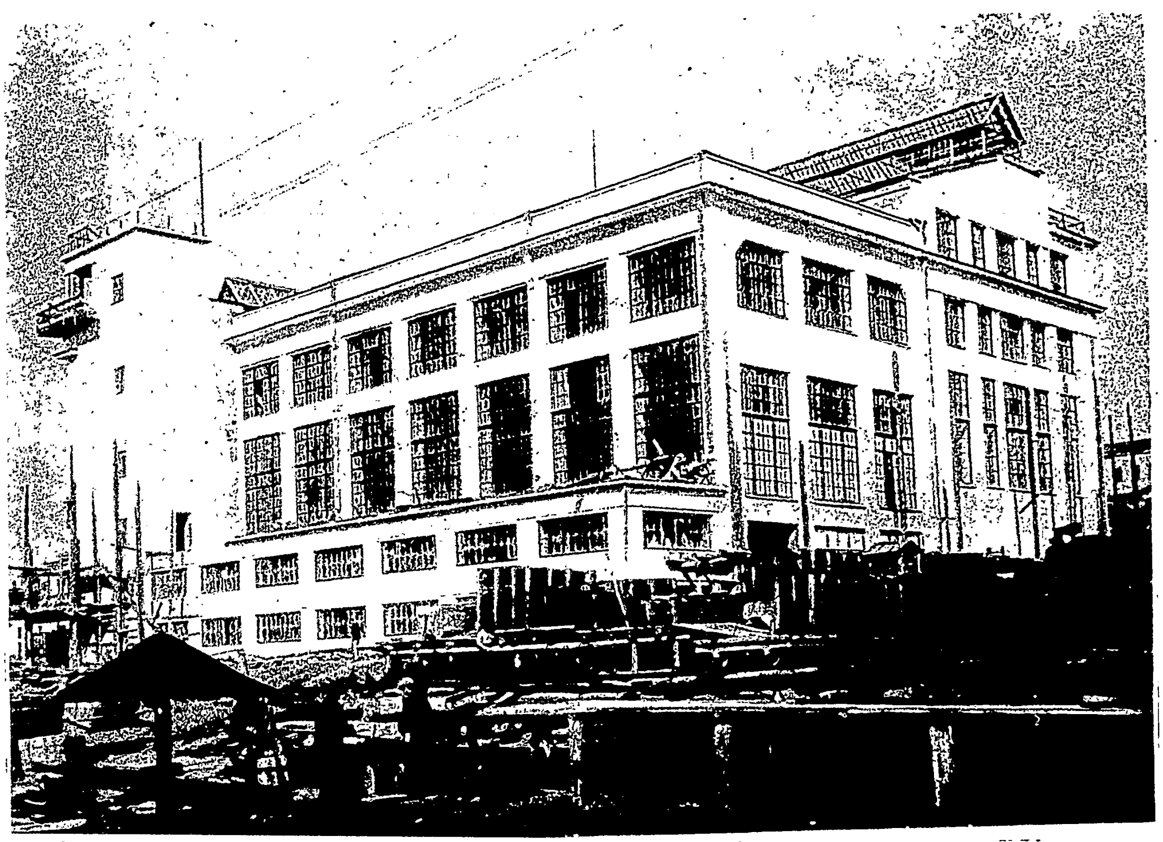
-193-

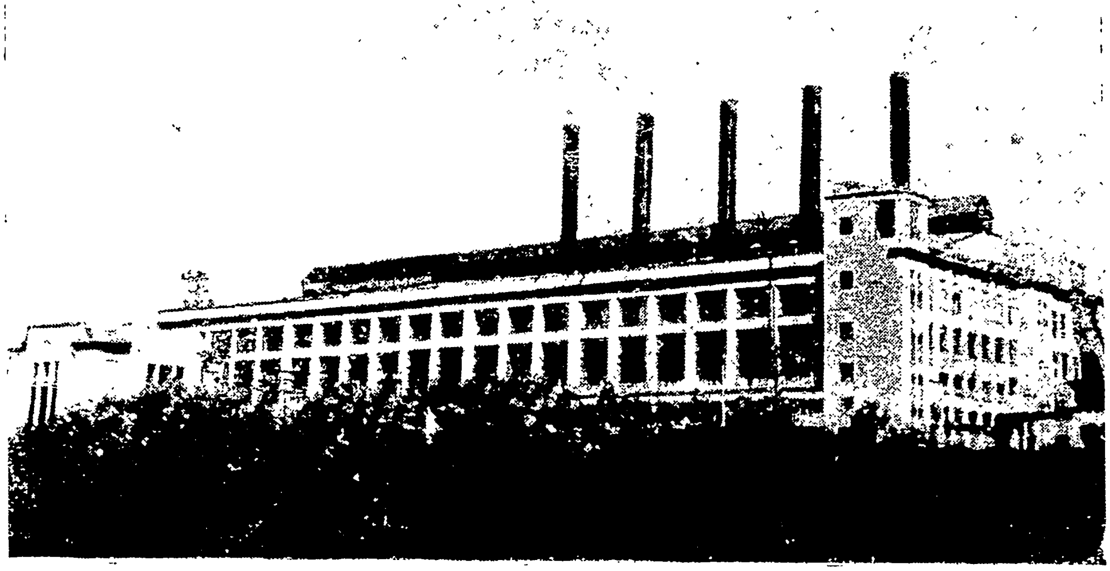


GRES under construction.

SARATOV COAL-FIRING GRES
(Capacity: 22,500 kw.)

Source: USSR in Construction 1930, #3, p. 21 top

PLATE 45C



<u>General view</u>:

SARATOV COAL-FIRING GRES
(Capacity: 22,500 kw.)

Source: Pyatnadtsat' let leninskogo plana elektrifikatsii, 1936, p. 43, (TK85.D6)

PLATE 45D

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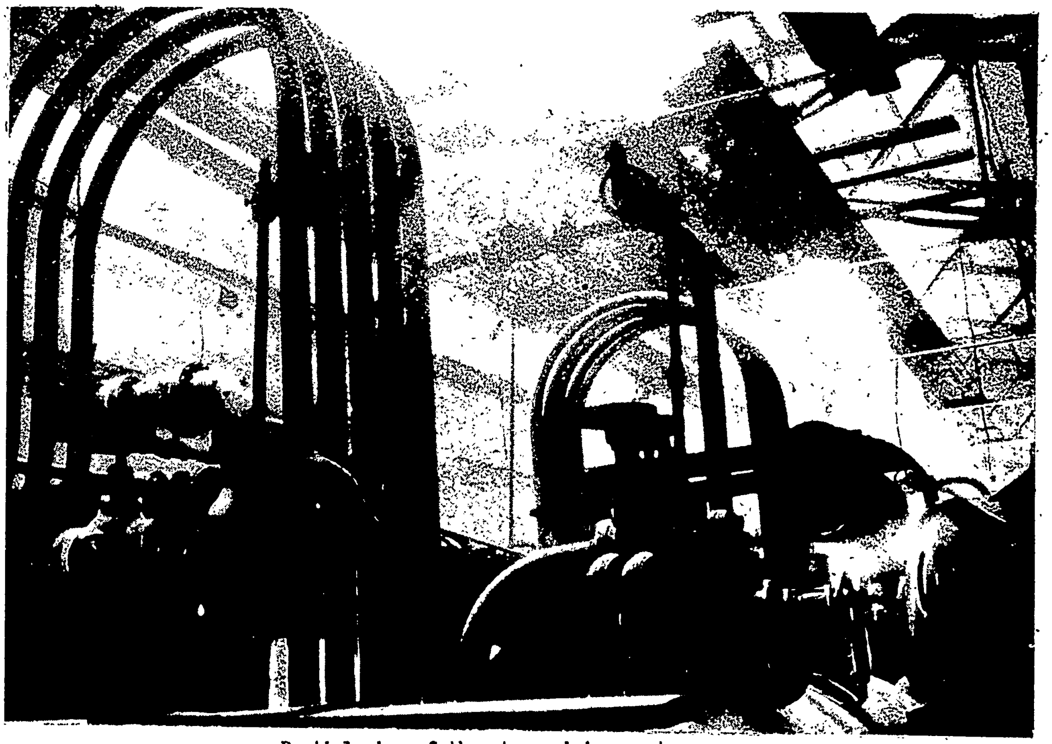

Partial view of the steam piping system.

SARATOV COAL-FIRING GRES
(Capacity: 22,500 kw.)

Source: Prozhektor 1930, #9, p. 14 bottom right.

PLATE 45E

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YAROSLAVL' PEAT-FIRING GRES

(Plates: 46)

Location: Left bank of the Volga River, near the city of Yaroslavl'

Coordinates: 57° 35' N; 39° 50' E.

Date of construction: 1931

Installed capacity: 41,000 kw

Layout type: First type

Dimensions:

Structural type: Reinforced concrete

Wall Covering: Brick, and block panel walls and curtain walls

Roof construction:

Roof covering:

Cranes:

Crane girders:

Stacks: Steel; located on the roof

Fuel delivery: Over steel trestles

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Side view of the boiler house.

YAROSLAVL' PEAT-FIRING GRES
(Capacity: 41,000 kw.)

Source: Elektricheskiye Stantsii, 1936, #6, front cover, (TK4.E725)

PLATE 46

YAROSLAVL' PEAT FIRING TETS

(Plates: 46A)

Location: Site of the Yaroslavl' Rubber and Asbestos Plant

Coordinates: 57° 35' N; 39° 50' E (approximately)

Date of construction: 1933

Installed capacity: 130,000 kw

Layout type: First type

Dimensions:

Structural type:

Wall covering: Brick

Roof construction:

Roof covering:

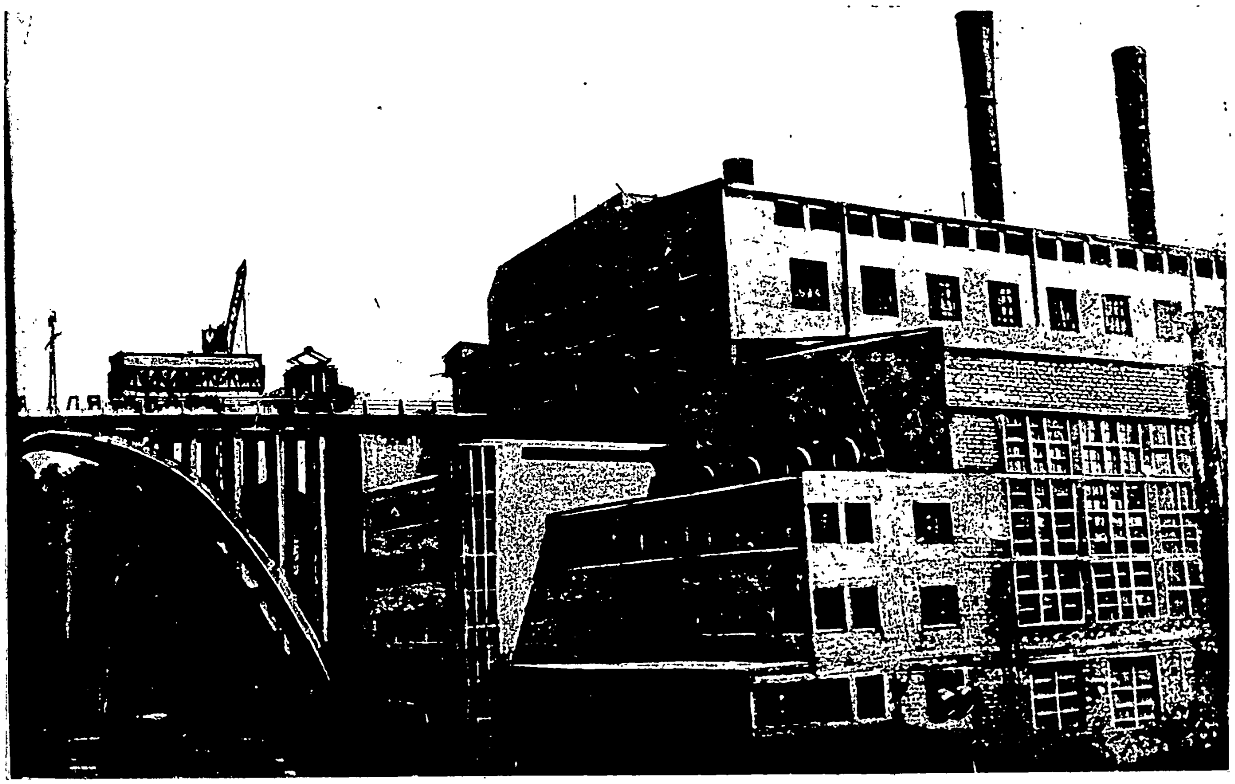
Cranes:

Crane girders:

Stacks: Steel; located on the roof

Fuel delivery: over a reinforced concrete trestle

-199-



Partial exterior view showing peat delivery reinforced concrete trestle.

YAROSLAVL' PEAT-FIRING TETs AT THE YAROSLAVL' RUBBER AND ASBESTOS PLANT
(Capacity: 130,000 kw.)

Source: Elektricheskiye Stantsii 1934, #7, front cover (TK.E725)

PLATE 46A

BAKU CRUDE OIL, GAS AND MAZUT (FUEL OIL) FIRING GRES "KRASNAYA ZVEZDA"

(Plates: 47, 47A)

Location: Baku, Azerbaydzhanskaya SSR, on east Caspian Sea

Coordinates: 40° 23' N; 49° 55' E.

Date of construction: Prior to the 1921 "GOELRO" plan; expanded since then

Installed capacity: 109,000 kw

Layout type: First type

Dimensions:

Structural type:

Wall covering:

Roof construction:

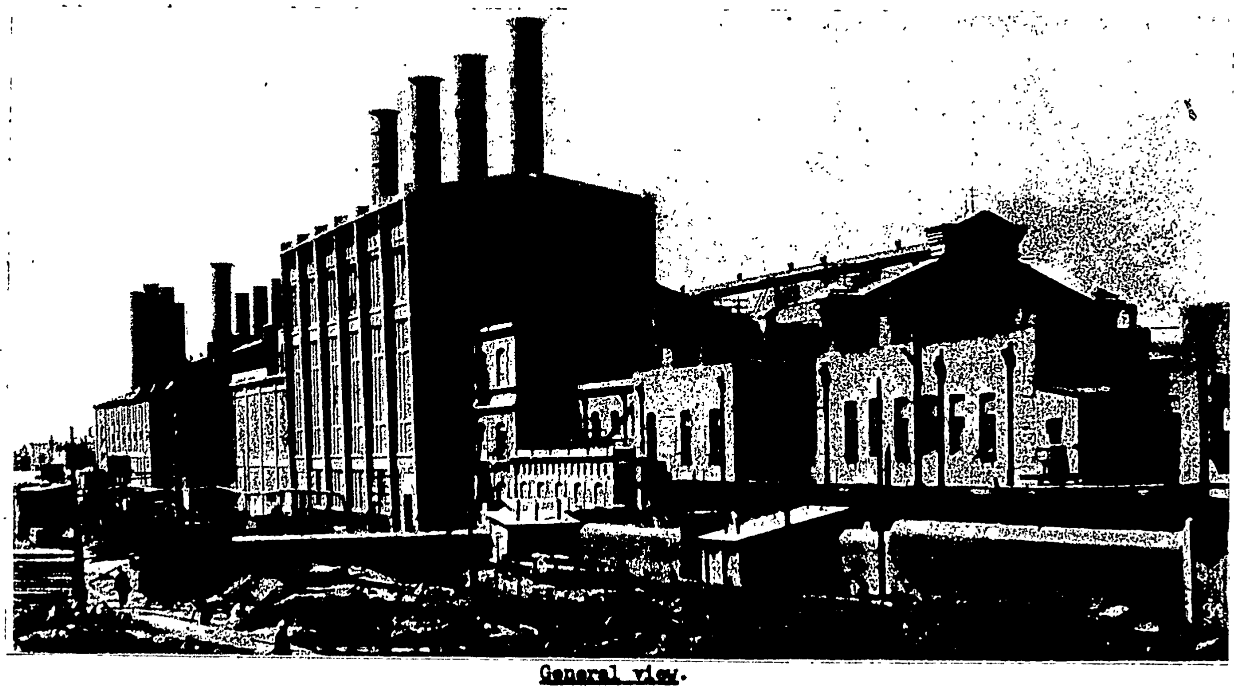
Roof covering:

Cranes:

Crane girders:

Stacks: Steel; located on the roof

-201-



General view.

BAKU "KRASNAYA ZVEZDA" CRUDE OIL, GAS AND MAZUT (fuel oil) FIRING GRES
(Capacity: 109,000 kw.)

Source: USSR in Construction 1932, #3, p. 25, center left.

PLATE 47

Side view.

BAKU CRUDE OIL, GAS AND MAZUT (fuel oil) FIRING GRES "KRASNAYA ZVEZDA".
(Capacity: 109,000 kw.)

Source: Elektricheskiye Stantsii 1936, p. 37, (TK4.E725)

PLATE 47A

BAKU OIL, GAS AND MAZUT (FUEL-OIL) FIRING GRES "KRASIN"

(Plates: 47B)

Location: Baku, Azerbaydzhanskaya SSR, on east Caspian Sea

Coordinates: 40° 23' N; 49° 55' E.

Date of construction: Prior to the 1921 "GOELRO" plan; expanded since then

Installed capacity: 67,000 kw

Layout type: First type

Dimensions:

Structural type:

Wall covering:

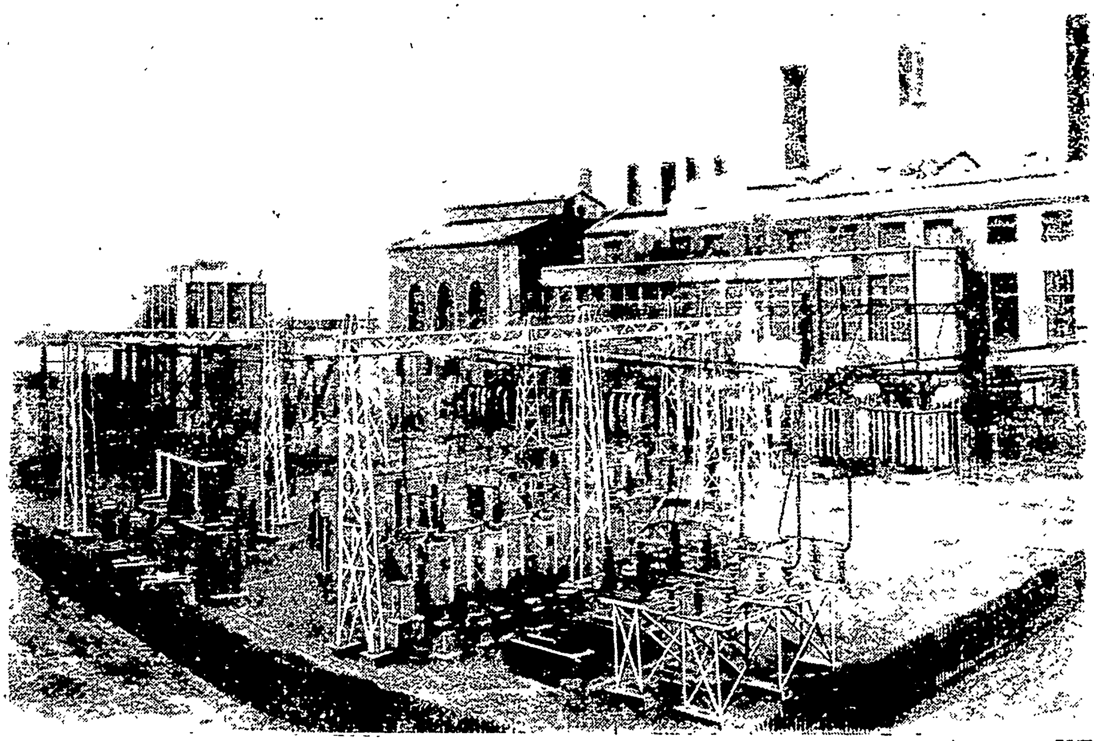
Roof construction:

Roof covering:

Cranes:

Crane girders:

Stacks: Steel, located on the roof



Partial view of the plant and 100 kv. open sub-station.

BAKU "KRASIN" OIL-GAS AND MAZUT (fuel oil) FIRING GES
(Capacity: 67,000 kw.)

Source: Pyatnadsat' let leninskogo plana elektrifikatsii 1936, p. 37, (TK85.D6)

PLATE 47B

NOVOROSSIYSK MAZUT (FUEL*OIL) FIRING GRES

(Plates: 48)

Location: Port on Black Sea, east of Sea of Azov

Coordinates: 44° 43' N; 37° 47' E

Date of construction: 1930

Installed capacity: 20,000 kw

Layout type: First type

Dimensions:

Structural type: Reinforced concrete

Wall covering:

Roof construction:

Roof covering:

Cranes:

Crane girders:

Stacks: Steel; located on the roof

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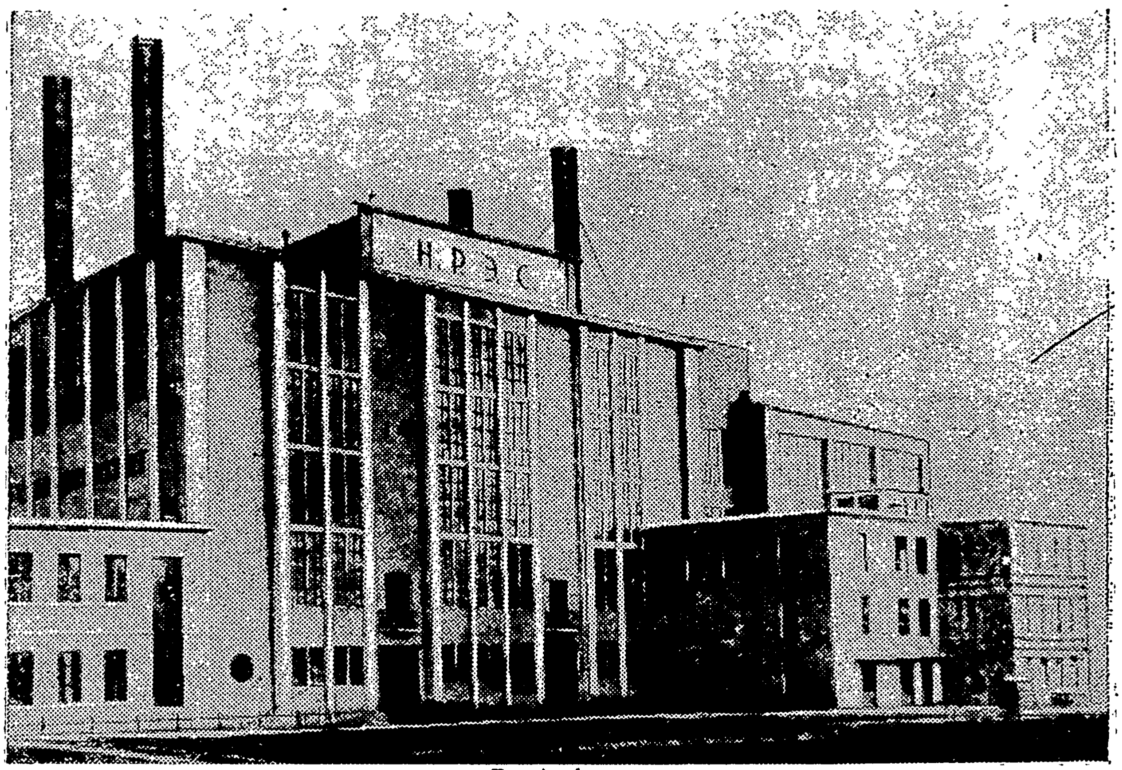

Front view.

NOVOROSSIYSK MAZUT (fuel-oil) FIRING GRES
(Capacity: 20,000 kw.)

Source: Elektricheskiye Stantsii 1936, #1, p. 41, (TK4.E725)

PLATE 48

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VORONEZH PULVERIZED COAL-FISHING GRES

(Plates: 49)

Location: City on Don River, 300 miles south of Moskva

Coordinates: 51° 38' N; 39° 12' E

Date of construction: 1934

Installed capacity: 24,000 kw (1934)

Layout type: First type

Dimensions:

Structural type: Reinforced concrete

Wall covering:

Roof construction:

Roof covering:

Cranes:

Crane girders:

Stacks: Steel; located on the roof

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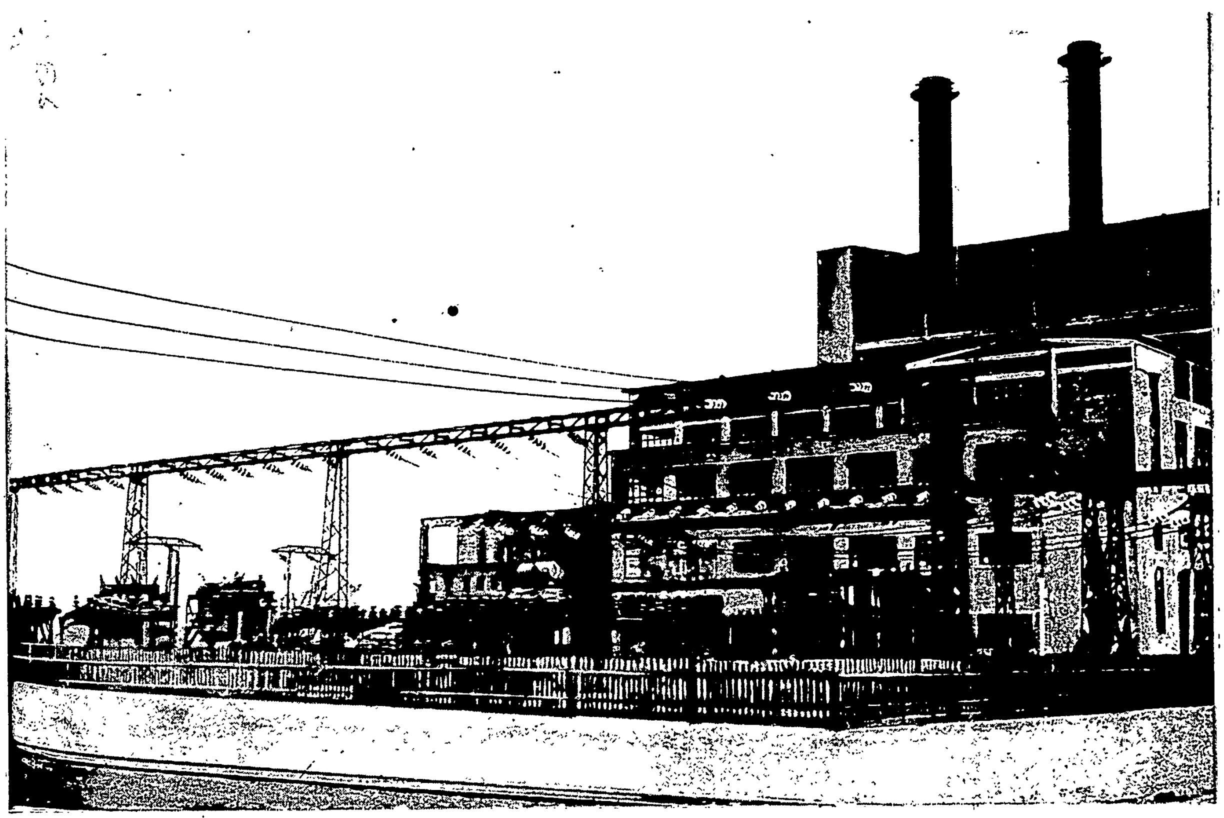


Partial view of the GRES and the open air sub-station.

VORONEZH PULVERIZED COAL-FIRING GRES
(Capacity: 24,000 kw.)

Source: Elektricheskiye Stantsii 1936, #11, front cover, (TK4.E725)

PLATE 49

KAZAN' COAL-FIRING TETS

(Plates: 50, 50A)

Location: City on Volga River, 440 miles east of Moskva

Coordinates: 55° 45' N; 49° 08' E

Date of construction: 1932

Installed capacity: 20,000 kw

Layout type: First type

Dimensions:

Structural type: Reinforced concrete

Wall covering:

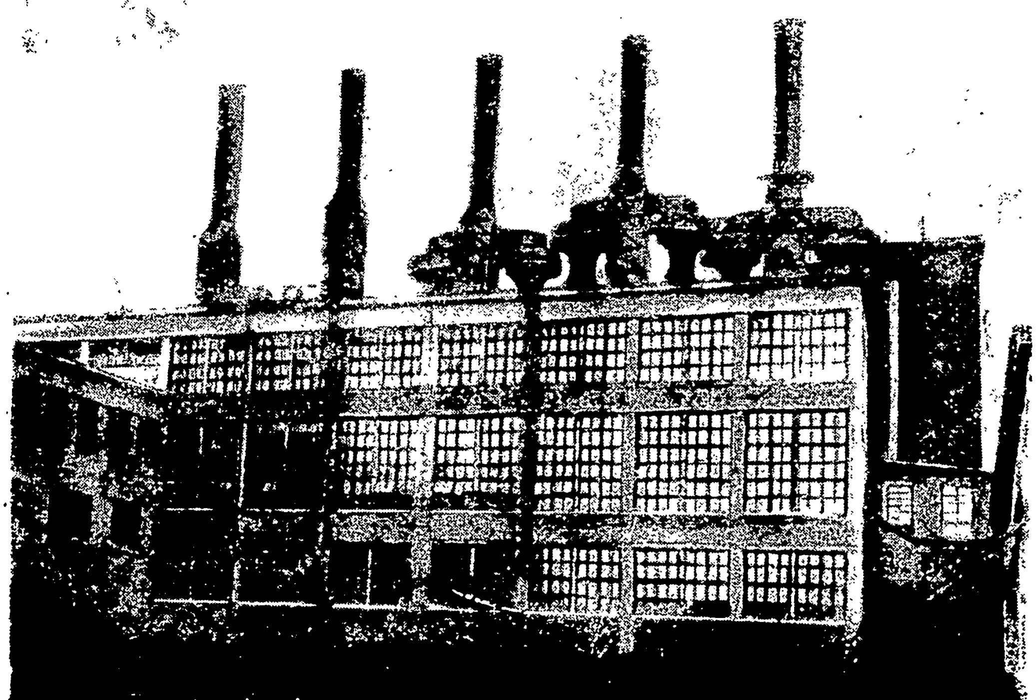
Roof construction:

Roof covering:

Cranes:

Crane girders:

Stacks: Steel; located on the roof

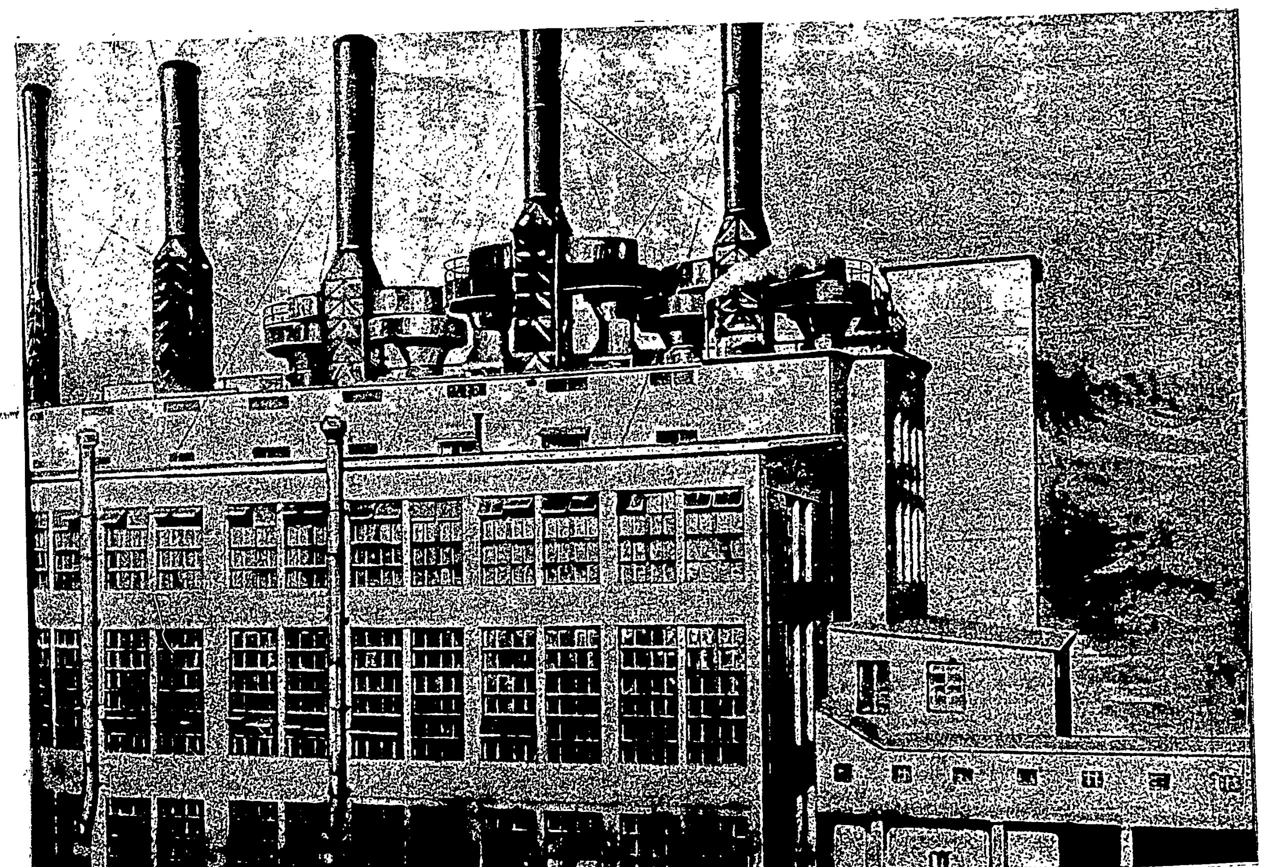


Partial exterior view.

KAZAN' COAL-FIRING TETs
(Capacity: 20,000 kw.)

Source: Piatnadsat'let leninskogo plana elektrifikatsii, 1936, p. 63, (TK85.D6)

PLATE 50



Partial exterior view.

KAZAN' COAL-FIRING TETs
(Capacity: 20,000 kw.)

Source: Elektricheskiye Stantsii 1936, #7, front cover (TK4.E275)
PLATE 50A

MOSKVA COAL-FIRING TETS "STALIN"

(Plates: 51) (51a)

Location: Moskva

Coordinates: 55° 45'; 37° 35' E

Date of construction: Between 1931 and 1935

Installed capacity: 25,000 kw (1936). Projected capacity: 100,000 kw

Layout type: Second type

Dimensions:

Structural type:

Wall covering: Probably brick panel walls

Roof construction:

Roof covering:

Cranes:

Crane girders:

Stacks: Appear to be separate from the building

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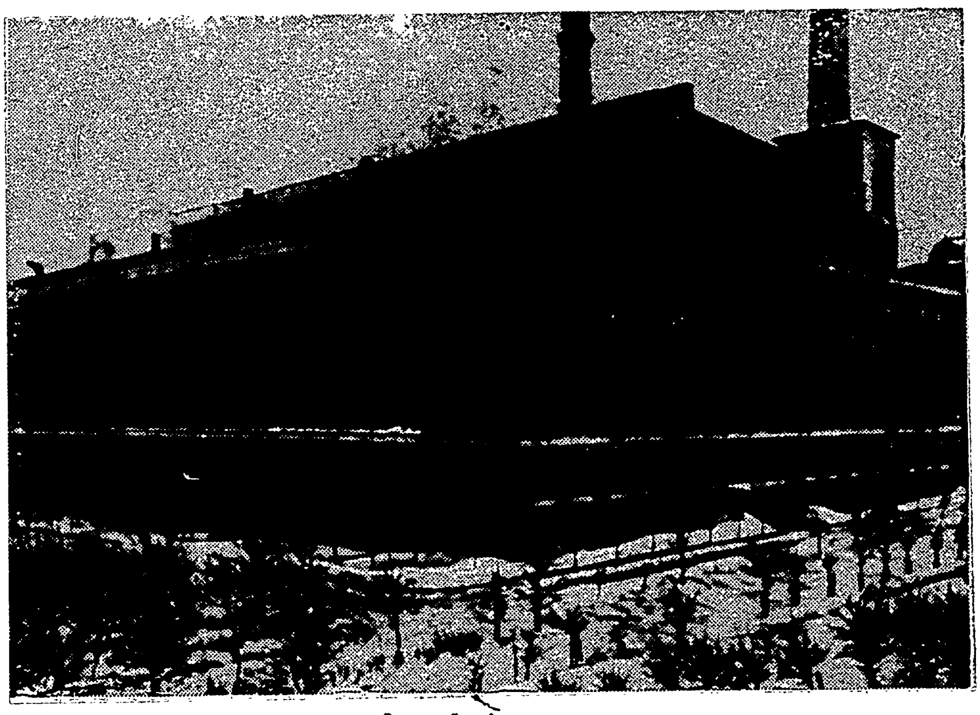

General view.

MOSKVA COAL-FIRING TETs "STALIN"
(Capacity: 25,000 kw.)

Source: Markin, A.B., Budushchyeye Elektrifikatsii SSSR, 1956, p. 22, (TK85.M3)

PLATE 51

View during construction

MOSKVA COAL-FIRING TETs "STALIN" (Capacity: 25,000 kw.)

Source: Elektricheskiye Stantsii 1936, No. 1, top p. 12.

PLATE 51a

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MOSKVA MAZUT (FUEL-OIL)-FIRING POWER STATION "SMIDOVICH"

(Plates: 51A, 51B, 51C, 51D)

Location: Moskva

Coordinates: 55° 45'; 37° 35' E

Date of construction: 1886; reconstructed several times; a 12,000 kw turbine added in 1933 for district heating

Installed capacity: 120,000 kw

Layout type: First type

Dimensions:

Structural type: Probably partly brick wall, partly reinforced concrete frame

Wall covering: Various; probably partly concrete, partly brick curtain walls

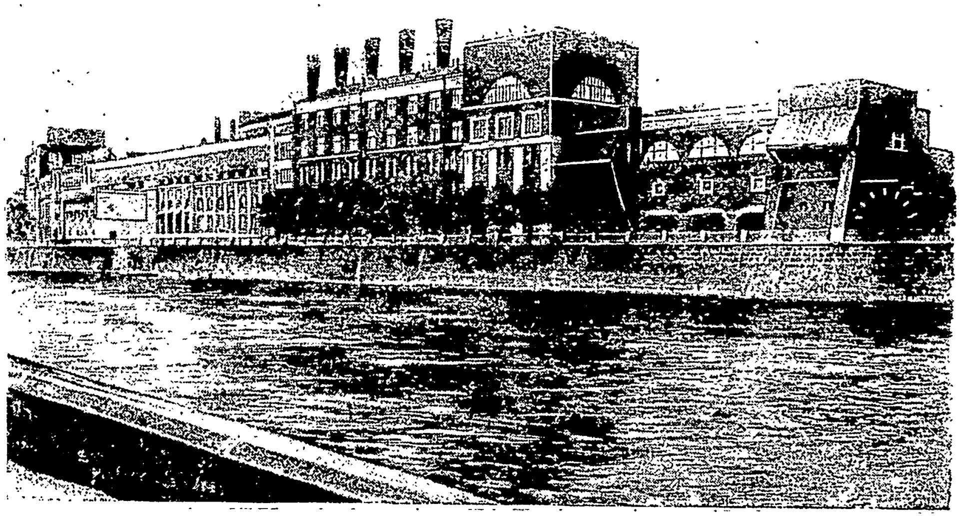
Roof construction:

Roof covering:

Cranes:

Crane girders:

Stacks: Steel; located on the roof



General view.

MOSKVA MAZUT (fuel-oil) FIRING GES "SMIDOVICH"
(Capacity: 120,000 kw.)

Source: Pyatnadsat' let leninskogo plana elektrifikatsii 1936, p. 31, (TK85.D6)

PLATE 51A

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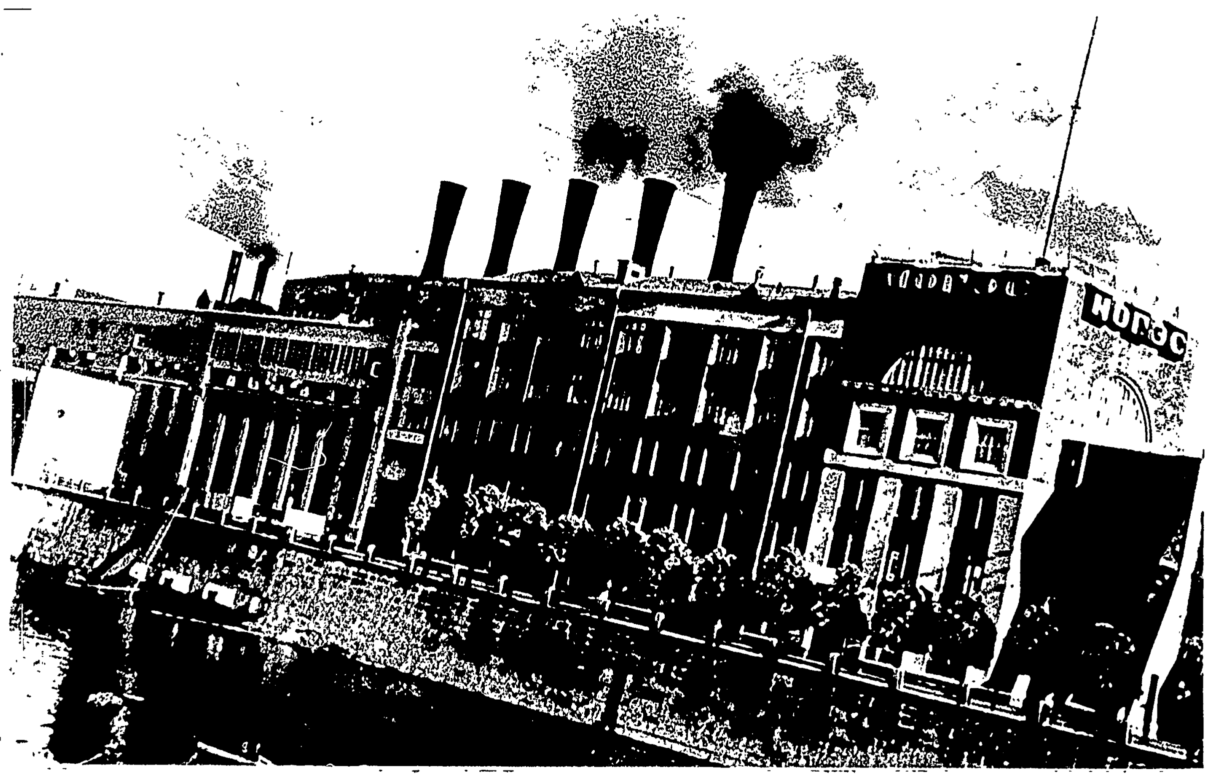

Side view.

MOSKVA MAZUT (fuel-oil) FIRING GES "SMIDOVICH"
(Capacity: 120,000 kw.)

Source: USSR in Construction 1931, #9, p. 27 middle.

PLATE 51B

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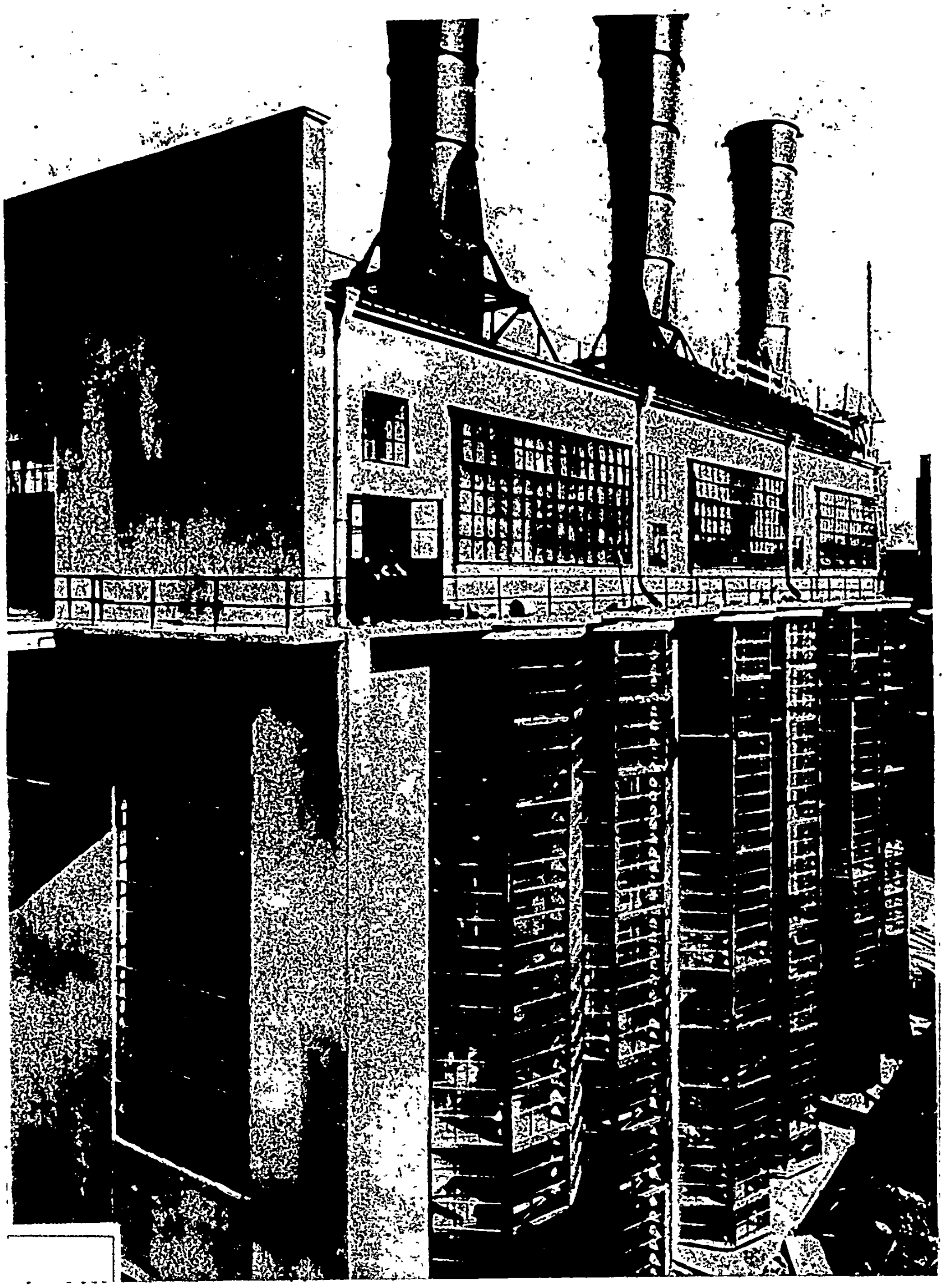

Exterior view of the boiler house.

MOSKVA MAZUT (fuel-oil) FIRING GES "SMIDOVICH"
(Capacity: 120,000 kw.)

Source: USSR in Construction 1930, #3, p. 19 top

PLATE 51C

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Construction detail.

MOSKVA MAZUT (fuel-oil) FIRING GES "SMIDOVICH"
(Capacity: 120,000 kw.)

Source: USSR in Construction 1931, #9, p. 27 top

PLATE 51D

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MOSCOW HIGH PRESSURE COAL-FIRING TETS (ENERGO)

(Plates: 51E)

Location: Site of the All-Union Heat Technical Institute in the suburbs of Moscow

Coordinates: 55° 45'; 37° 35' E

Date of construction: 1933

Installed capacity: 60,000 kw

Layout type: First type

Dimensions:

Structural type: Probably poured-in-place reinforced concrete frame

Wall covering: Probably brick panel walls

Roof construction:

Roof covering:

Cranes:

Crane girders:

Stacks: Steel; located on the roof

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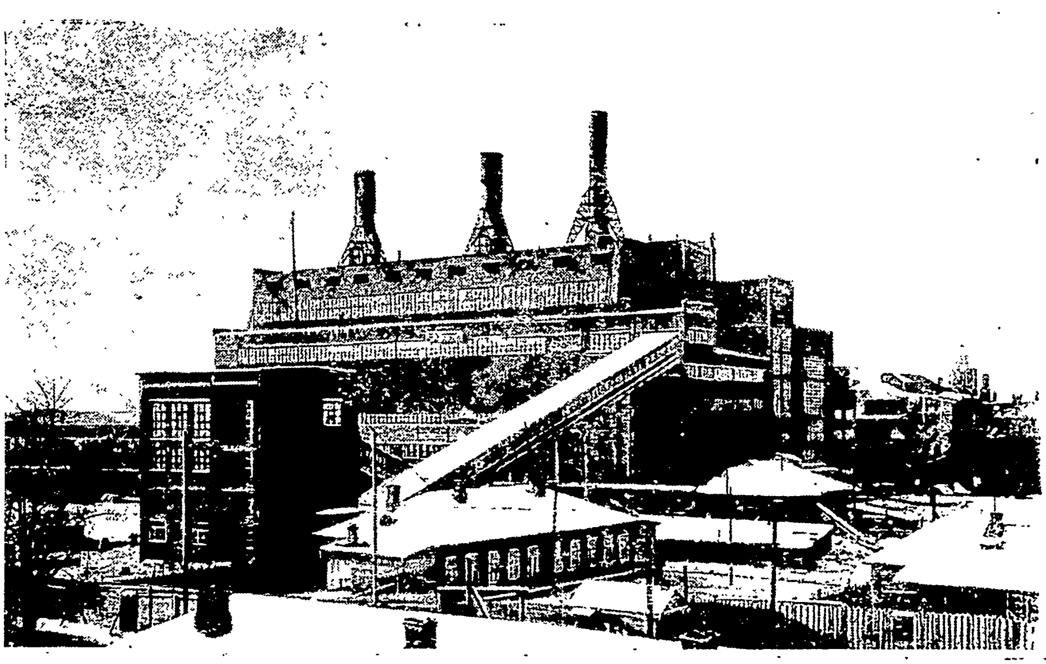


General view

MOSCOW HIGH PRESSURE COAL-FIRING TETs (ENERGO)
(Capacity: 60,000 kw.)

Source: Pyatnadsat' let leninskogo plana elektrifikatsii 1936, p. 67, (TK85.D6)

PLATE 51E

ELEKTROGORSK (FORMERLY ELEKTROPEZEDACHA) PEAT-FIRING PLANT "KLASSON", MOSENERGO GRES

(Plates: 51F)

Location: 12.5 miles from Noginsk, Moscow oblast'

Coordinates: 55° 53' N; 38° 47' E

Date of construction: Before 1930

Installed capacity: 46,000

Layout type: First type

Dimensions:

Structural type: Reinforced concrete frame

Wall covering: Presumably brick

Roof construction:

Roof covering:

Cranes:

Crane girders: Steel (prob.)

Stacks: Steel; located on the roof

Side view.

ELEKTROGORSK (formerly Elektroperedacha) "KLASSON", PEAT FIRING PLANT #3, MOSENERGO GES
(Capacity: 46,000 kw.)

Source: USSR in Construction 1930, #3, p. 19 middle.

PLATE 51F

COAL-FIRING ARTEM GRES "KIROV" IN PRIMORSKIY KRAY

(Plates: 52, 52A)

Location: Approximately 25 miles from Vladivostok on Suchanskaya Railroad.

Coordinates: 43° 22' N, 132° 19' E.

Date of construction: Apparently in 1936.

Installed capacity: 50,000 kw.

Layout type: First type.

Dimensions:

Structural type: Reinforced concrete frame.

Wall covering:

Roof construction:

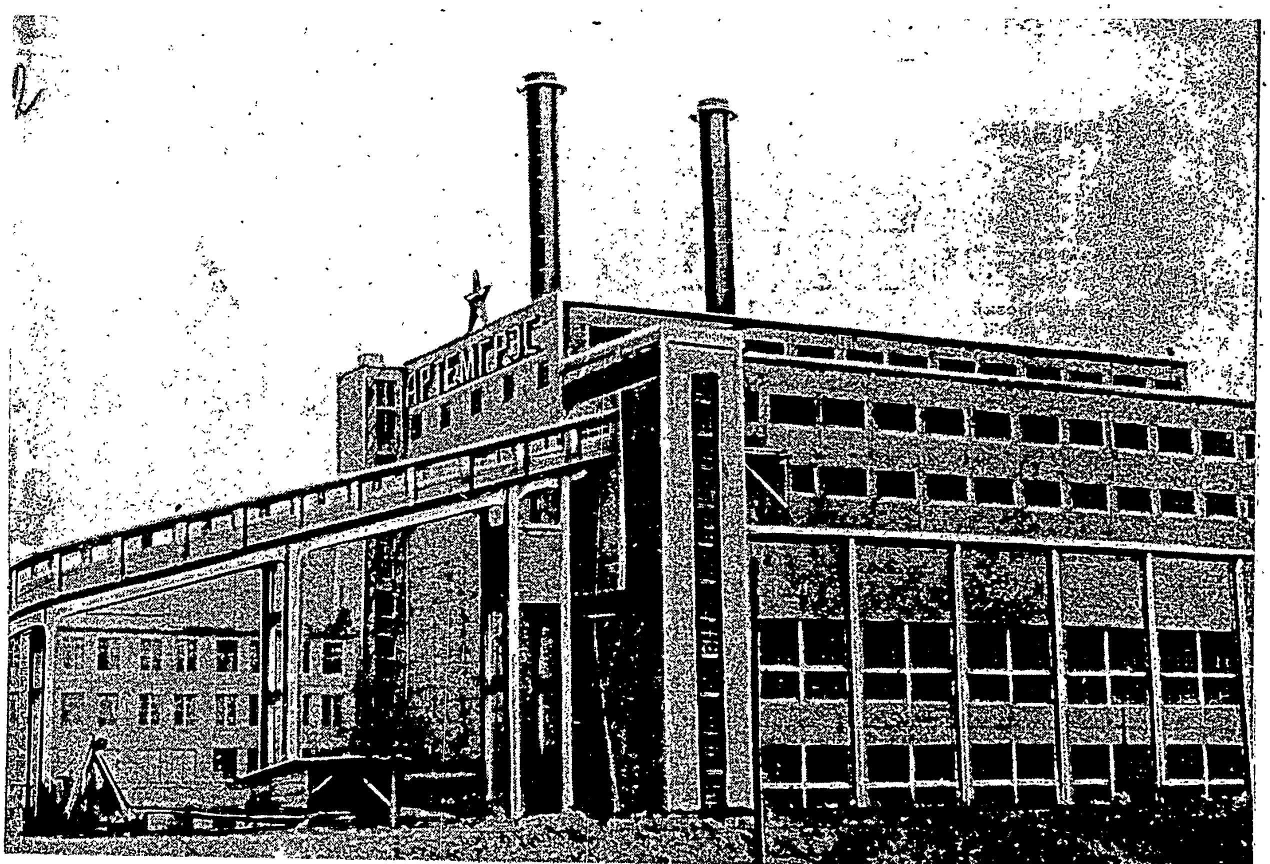
Roofing:

Cranes:

Crane girders:

Stacks: Steel, located on the roof.

Fuel delivery: Over a reinforced concrete trestle.



Side view of the GRES.

ARTEM GRES "KIROV" IN PRIMORSKIY KRAY (coal firing)
(Capacity: 50,000 kw.)

Source: Elektricheskiye Stantsii, 1937, #5, front cover (TK4.E725)

PLATE 52

General view.

ARTEM GRES "KIROV" (Primorskiy Kray) (coal firing)
(Capacity: 50,000 kw.)

Source: Krasnoye Znamya 1947, #10, p. 4.

PLATE 52A

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MIRONOVSKAYA COAL-FIRING GRES NEAR ARTEMOVSK (STALINSKAYA O.)

(Plates: 53)

Location: In Donbass, southern Ukraine

Coordinates: 48° 36' N, 38° 01' E.

Date of construction:

Installed capacity: 400,000 kw.

Layout type:

Dimensions:

Structural type:

Wall covering:

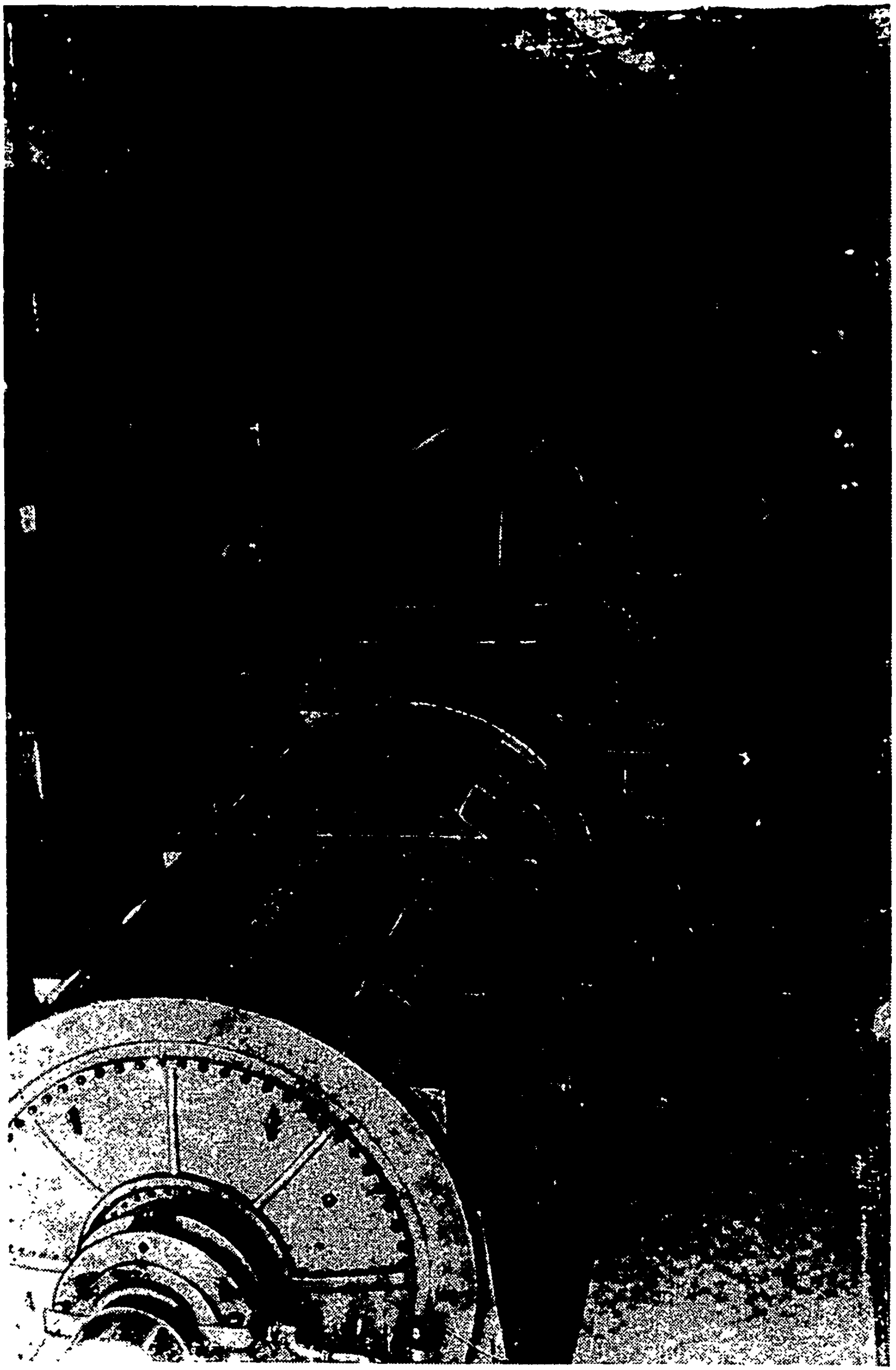
Roof construction: Turbine hall - longitudinal monitor, braced light steel trusses.

Roofing:

Cranes: In the turbine hall.

Crane girders:

Stacks:



Interior view of the turbine room.

MIRONOVSKAYA COAL-FIRING GRES NEAR ARTEMOVSK (Stalinskaya o.)
(Capacity: 400,000 kw.)

Source: Markin, A.B., Budushchyeye Elektrifikatsii SSR 1946, p. 21 (TK85.M3)

PLATE 53

SLAVYANSK GRES IN STALINSKAYA OBLAST'

(Plates: 54, 54A)

Location: Slavyansk, Stalinskaya Oblast', Ukrainskaya SSR.

Coordinates: 48° 52' N; 37° 36' E

Date of construction: 1951-1955.

Installed capacity: 200,000 kw (1955)

Layout type: Fourth type.

Dimensions: (est)

Structural type: (est) Lower part of building-reinforced concrete frame; upper part of building: steel members

Wall covering:

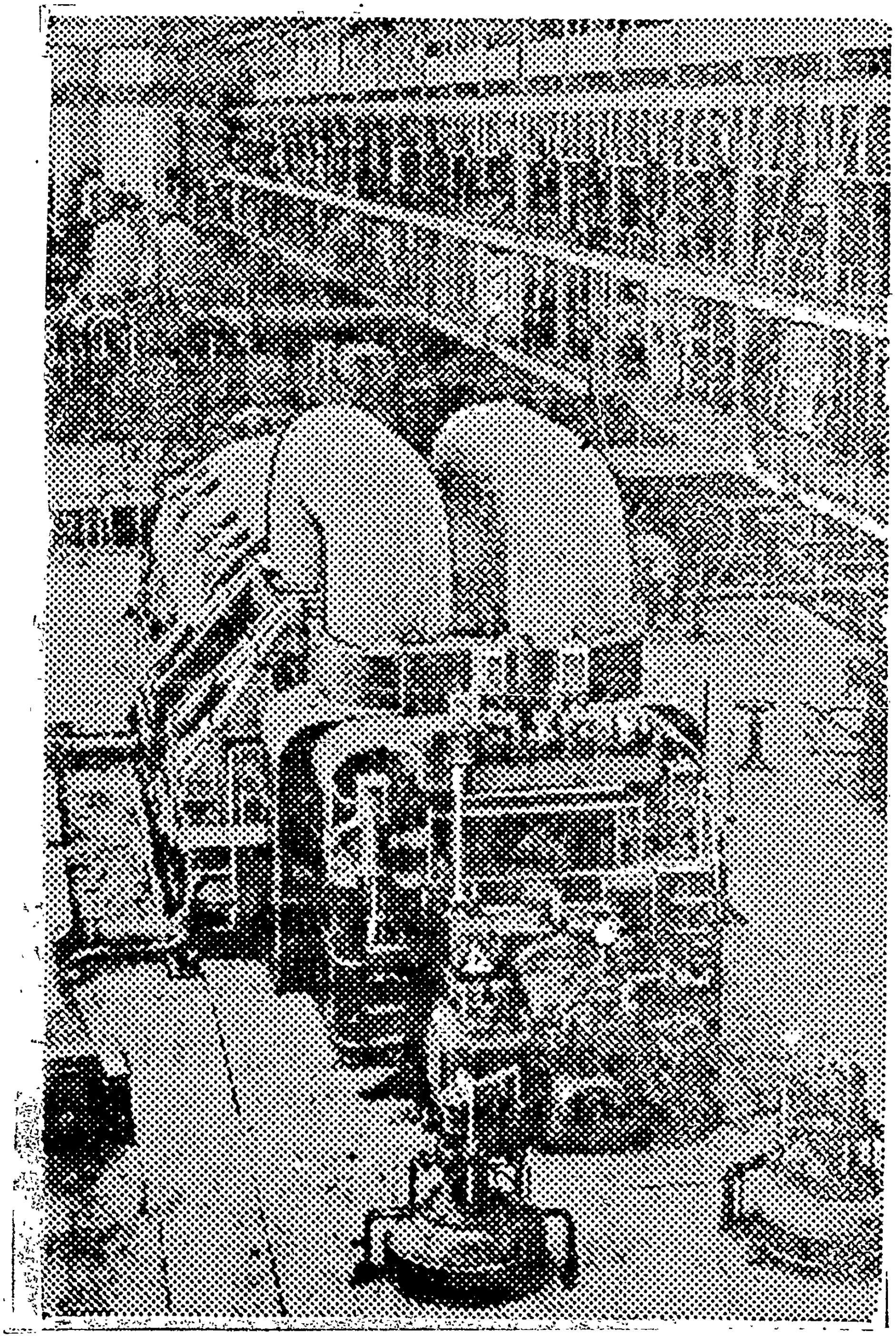
Roof construction:

Roof covering: Ruberoid over reinforced concrete slabs (est.)

Cranes: In turbine hall-est. cap. 150/30 m ton in boiler house

Crane girders: Steel solid web (est).

Stacks: Reinforced concrete (prob.)



Partial interior view of the turbine room.

SLAVYANSK GRES

Source: Zarya Vostoka 1955, 5 Oct., #236, p. 2, (AP50.Z3)

PLATE 54

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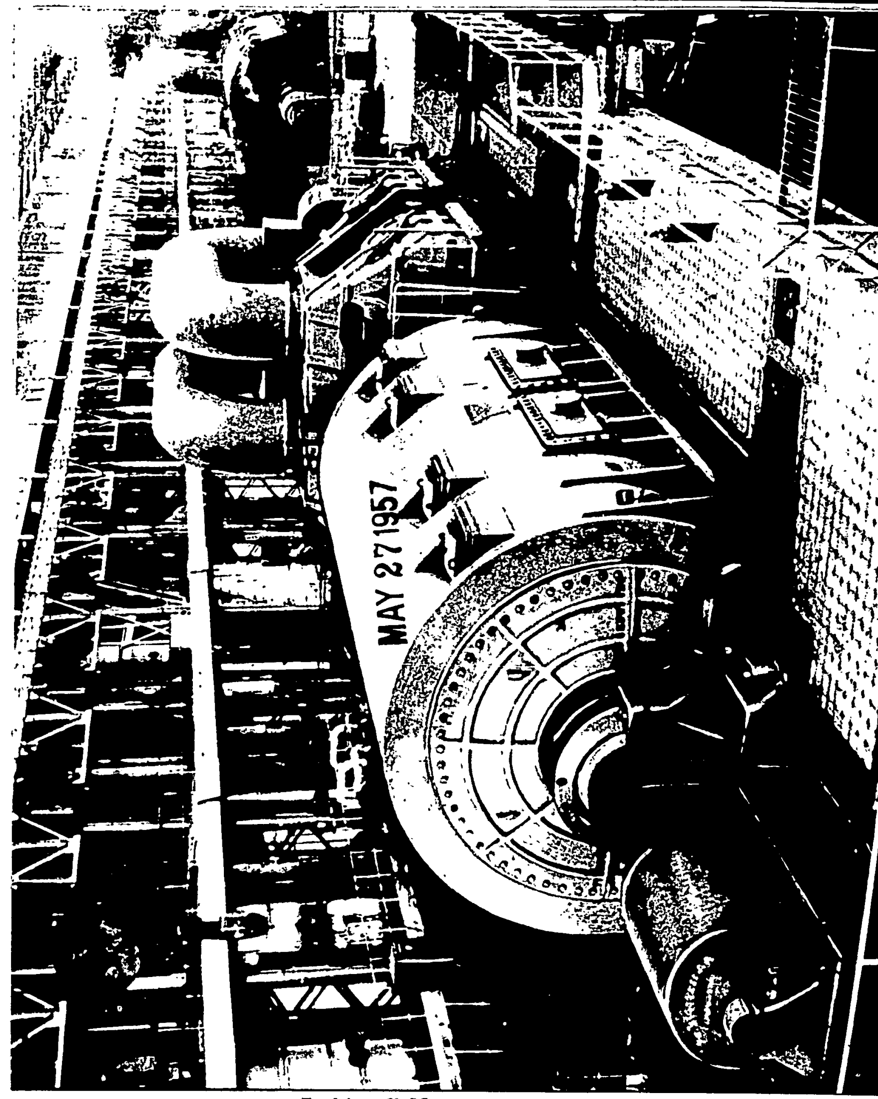


<u>Turbine Hall.</u>

SLAVYANSK GRES.

Source: Teploenergetika, 1957, #4, front cover

PLATE 54A.

CHEREPET' COAL-FIRING GRES IN TUL'SKAYA OBLAST'

(Plates: 16, 16A, 55, 55A, 55B)

Location: Town 160 miles south of Moskva

Coordinates: 54° 07' N, 36° 24' E.

Date of construction: 2nd section was under construction in 1956.

Installed capacity: 300,000 kw. in 1956; projected capacity - 600,000 kw. before 1960.

Layout type: Fourth type.

Dimensions: Overall - W. - 259.3 ft.; H. - 131.0 ft.; L - 433.0 ft.

Structural type: Steel frame.

Wall covering. Probably brick curtain walls.

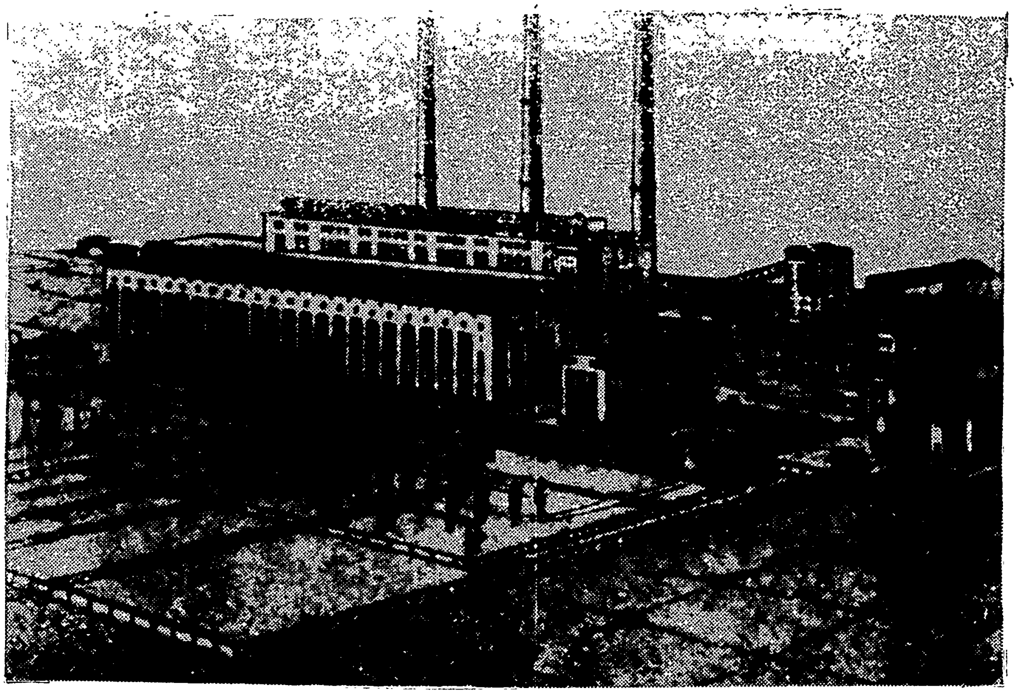
Roof construction: Boiler room - longitudinal monitor; braced light steel trusses.

Roofing:

Cranes:

Crane girders: Steel.

Stacks: 2 stacks presumably of reinforced concrete; located 52.5 ft. from the smoke exhaust installation.



General view.

CHEREPET' GRES
(Projected final capacity: 600,000 kw.)

Source: Markin, A.B., Budushchyeye Elektrifikatsii SSSR, 1956, p. 51, (TK85.M3)

PLATE 55

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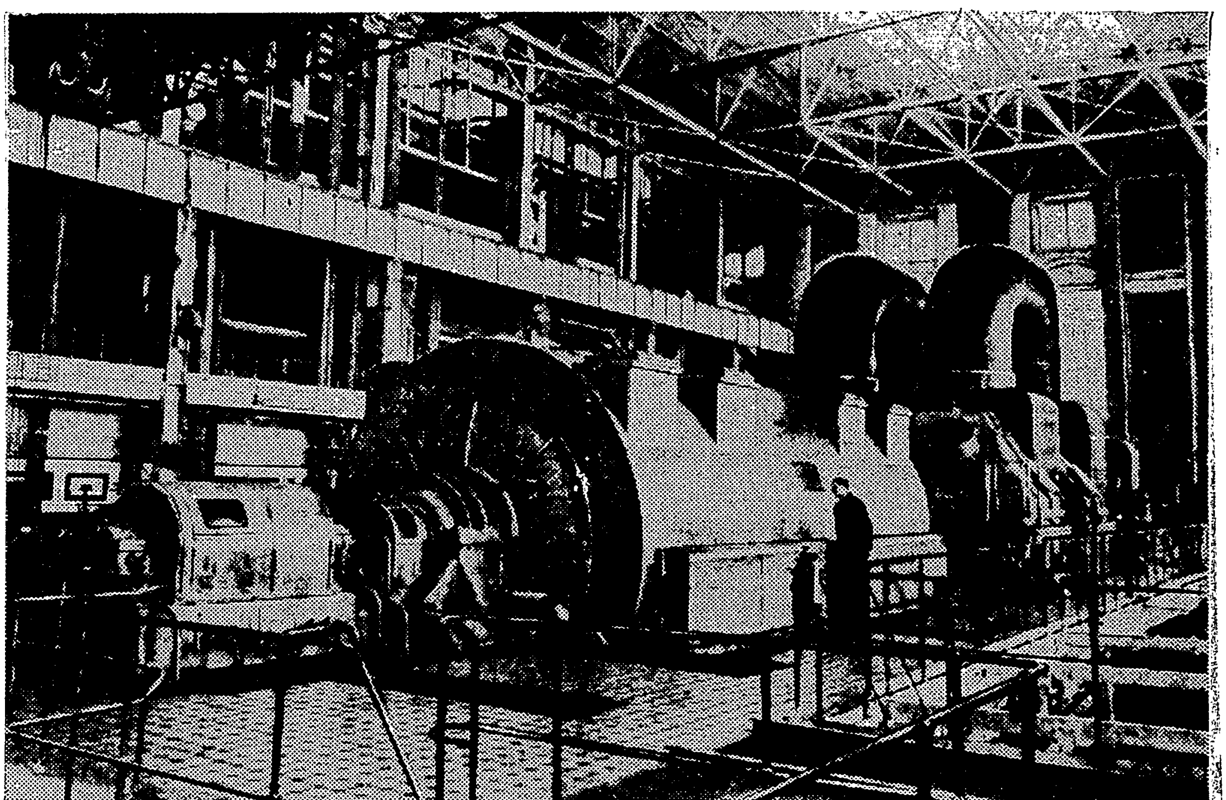

Partial interior view of the turbine room.

CHEREPET' GRES
(Projected final capacity: 600,000 kw.)

Source: Izvestiya 1956, #72, p. 1.

PLATE 55A

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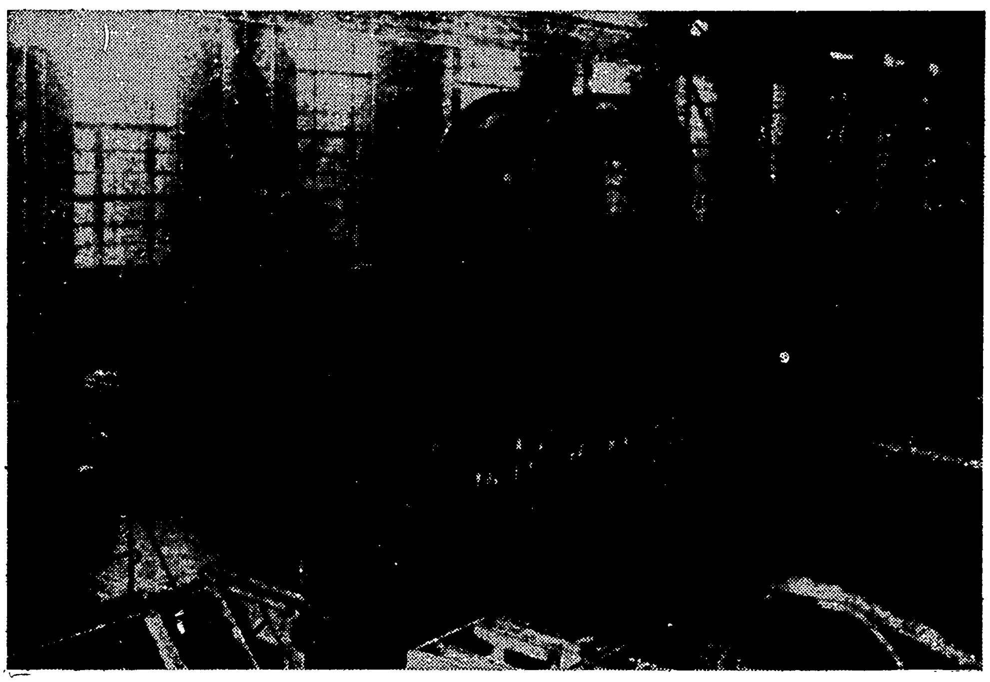

Turbine hall housing a 150,000 kw. turbine.

CHEREPET' GRES
(Projected final capacity: 600,000 kw.)

Source: Markin, A.b., Budushchyeye Elektrifikatsii SSR 1956, p. 53, (TK85.M3)

PLATE 55B