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DEPARTMENT OF JUSTICE
WAR DIVISION
ECONOMIC WARFARE SECTION

REPORT ON

TELEPHONIC AND OTHER COMMUNICATIONS

IN JAPAN AND JAPANESE CHINA

December 17, 1942

with Supplement (2371-A)

January 1, 1943

Submitted by: Victor H. Kramer
Economic Warfare Section
Department of Justice
Chicago, Illinois

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Economic Warfare Section
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Washington, D. C.

Confidential Report
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TELEPHONIC AND OTHER COMMUNICATIONS IN JAPAN AND JAPANESE CHINA

I. INTRODUCTION: SCOPE OF THE REPORT

This report seeks to outline the facilities for telephonic and telegraphic communications between and in the important cities of Japan, Manchukuo and occupied China, with special emphasis placed upon a few vital telephone exchanges. There is also a brief description of Japan's facilities for wireless broadcasting, and a final section on Japan's facilities for manufacturing new telephone and telegraph equipment. 1/

The report is incomplete. Although its scope is broad, its results are limited by the scope of the information available in Chicago. In part, its outline has been fitted to the limitations of the available information.

II. TELEPHONIC COMMUNICATION

A. Introduction

1. Importance of Telephone Exchange

All telephonic communication between two points must be routed through an exchange. Hence, the exchange is the nerve center of the telephonic communication system. It serves as the classic example of a bottleneck, vital not only in the economy of a people, but in practically all other phases of civilian and military life.

1/ Japan's facilities for manufacturing radio equipment have been discussed briefly in a preliminary report by Robert Wohlforth, Economic Warfare Section, New York, dated March 4, 1942. The Military Intelligence Service (G-2), Colonel F. W. Sharp, has located all producers of radio equipment on maps, and has elicited pertinent detailed military intelligence from the sources interviewed.

(over)

2. Vulnerability of Telephone Exchange

Because of the enormously complex mass of telephone wires leading into an exchange together with the complicated and delicate equipment selecting (in case of automatic equipment) or used in the selection (in the case of manual equipment) of any desired connection, destruction of or substantial damage to an exchange is very difficult to repair. In Japan, it would take at least eight months for partial recovery of an exchange, and two years for complete rehabilitation. 2/

Exchanges in Japan, other than those in Tokyo, have an added element of vulnerability, because the local supply of spare parts is also customarily stored in the exchange buildings. Usually, moreover, the exchanges, except in the larger cities, such as Tokyo, Yokohama, Osaka, Kobe, and perhaps Nagoya and Kyoto are located in the building which also houses the local Post Office and Telegraph office. Knowledge of this fact is of great value because it should facilitate location of the exchanges in all but a few major cities.

B. History and Ownership

Telephone and telegraph systems of the Japanese Empire are owned and operated by the Government, under the jurisdiction of the Department of Communications

As a result of the earthquake and ensuing fire of September, 1923, most of the telephone exchanges in and near Tokyo and Yokohama were destroyed. For their reconstruction, the Government decided to introduce automatic equipment successively in each of the various exchange offices.

2/ This is the most conservative estimate of those given by several engineers. That it is no idle estimate, is shown by the fact that following the 1923 earthquake and fire in Tokyo, it was a month before any exchanges were again offering partial service, over eight months before the toll lines were completely restored, more than two years before the new Marunouchi building was ready, and three years before all of the exchanges and stations (telephones) were completely restored. See the very interesting pamphlet by Dr. Inada: "A Brief Description of the Damages Done by the Earthquake to the Wired and Wireless Telegraph and Telephone Installation of Japan (December, 1925)". This is Selected Paper No. 9 from The Journal of the Institute of Electrical Engineers of Japan, and is printed, and was apparently written, in English.

C. Significant Peculiarities in Japanese Telephone System

1. Protection Against Earthquakes

In view of the analogy to be drawn between the effects of bombing (including incendiary) and of earthquakes (including resultant fires), it is of especial interest to note that the Japanese have constructed their telephone exchange buildings with special attention to protection against earthquakes and fires. Moreover, arrangements have also been made to safeguard the equipment itself against shock and fire.

All switchboards are specially designed against earthquakes and all boards and racks are tied together with angle iron to resist vibration due to earthquakes. The same care has been taken for battery equipment. Moreover, the exchange buildings are of double window construction and switching rooms have double doors to make them dust proof.

2. Protection Against Humidity 3/

In much of Japan and China there are periods of heavy rain and consequent high humidity. Most or all telephone exchanges are equipped with air-conditioning plants to protect the equipment from the damaging effects of excessive moisture. A product known as adsole is manufactured from acid earth found in the Echigo district of Japan. It strongly absorbs the moisture of air at ordinary temperature without any change in itself, and therefore can be used permanently. At 250° Fahrenheit or above, it expels the absorbed moisture and when cooled, it again becomes capable of absorbing moisture. Its absorbing power is over 15% of its own weight. The dried earth is then wetted, and thus is cooled through evaporation. This process enables the Japanese to obtain cool air, having proper humidity in summer.

In each plant, there are two adsole tanks, one for drying the air, while the other is subjected to hot air or steam treatment at about 390° Fahrenheit. The heating device used to dry the adsole in summer also heats the building in winter.

D. Principal Telephone Exchange Buildings

1. Marunouchi Exchange Building 4/

3/ Facts in this subsection are taken from a paper written in English in 1930 by Dr. Inada, Head of the Telegraph and Telephone Engineering Division of the Japanese Department of Communications. It was apparently written for some English or American scientific society. Hereinafter, it will be referred to as "Inada paper".

4/ Not to be confused with the Marunouchi Building a few blocks south.

a. General

Today this is the most important single structure in the telephonic communications system in the Orient.

It houses at least 8,000 lines of automatic telephone equipment, a long distance telephone switchboard from which over 325 long distance lines radiate to all parts of the Japanese Empire through submarine cables at Shimonoseki and elsewhere. 5/ Moreover, the building directly back of it is the terminus for all domestic and overseas telegraph cables. A picture of these two buildings (Marunouchi in the foreground) is attached (Appendix A).

b. Location

The building is located approximately three quarters of a mile east of the northeast corner of the Imperial Palace Grounds, as shown on the attached map of Tokyo (Appendix B). It is four stories in height and has dimensions of about 80 by 150 feet.

c. Floor Plan

In the basement are located several sets of storage batteries and motor generators producing 65 volts to charge the batteries, which are 50 volts, used to operate the automatic equipment, ring the bells, etc. The motor generators are driven by electricity from the city power system, but there is an auxiliary motor which is gasoline-driven for emergency use. It is customary to have two generators -- a small one for use when the load is low; a larger one for peak load periods. The air-conditioning plant is also located in the basement.

On the first floor are the terminal rooms, where the underground cables enter from the basement. Equipment consists of the main distributing frame 6/ equipped with lightning arrestors, and the manager's offices. A blue print of the floor plan of this floor is attached (Appendix C).

On the second and third floors, the automatic equipment is installed. Attached are the floor plans for these floors (Appendices D-1 and D-2, and E). Also attached are pictures of the switchroom, rotary line switches, 7/

5/ Submarine cables are discussed infra, section E.3., page 15.

6/ On one side of the main distributing frame, lightning arrestors are mounted. Outside cables terminate here and terminals going to the switchboard lines are on the other side of the frame.

7/ Inside telephone lines from the main distributing frame go directly to the rotary line switches. There is one for each station. (A station is a telephone).

repeater frames, 8/ automatic connector switches, 9/ and the telephone exchange room (Appendices F, G-1, G-2 and H).

On the fourth floor the long distance switchboard rooms are located. There are positions for at least 110 operators.

2. Other Tokyo Exchanges

Below is a table listing the automatic exchanges in Tokyo in 1928, and showing the types of equipment, the name of the manufacturer, the name of the exchange, and the number of lines in each. 10/

Table 1. NUMBER OF AUTOMATIC SUBSCRIBERS ACCORDING TO THEIR LOCATIONS AND TYPES OF EQUIPMENTS IN 1928

Name of Cities	Type of Equipment	Office Name	Equipped No. of Lines at the end of 1928	No. of Subs. Lines actually equipped end of 1928	Opened at the year of	Name of Manufacturer
Tokyo	6 digits with	Kyobashi	7,300	6,017	1925	A.T.M. 11/
"	Strowger type	Honjo	6,400	5,643	"	"
"	"	Shitaya	7,700	6,850	"	"
"	"	Kanda	4,200	3,061	"	"
"	"	Kayabacho	3,400	2,346	"	"
"	"	Kudan	3,600	3,300	1926	"
"	"	Otsuka	2,900	2,627	"	A.E.I. 12/

8/ Repeater frames are used to mount repeater switches which are used to connect calls made from a station located on one exchange to a station on another.

9/ Automatic connecter switches are the final switches in a chain of switches which joins the calling station to the called station.

10/ This table is taken from the Inada paper. It will also be found in an article by the same man in The Far Eastern Review for Oct. 1930, pp. 546-8, 566. This article is virtually a copy of that portion of the Inada paper which relates to telephones, with certain interesting pictures added, most of which have been reproduced in this report.

11/ Automatic Telephone Mfg. Co., Liverpool, England. It is an associate company of Automatic Electric Co., Chicago.

12/ Automatic Electric Co. Inc., Chicago.

Table 1. (cont'd.) NUMBER OF AUTOMATIC SUBSCRIBERS ACCORDING TO THEIR LOCATIONS AND TYPES OF EQUIPMENTS IN 1928

Name of Cities	Type of Equipment	Office Name	Equipped No. of Lines at the end of 1928	No. of Subs.Lines actually equipped end of 1928	Opened at the year of	Name of Manufacturer
Tokyo	6 digits with	Marunouchi	4,100	3,641	1927	A.E.I.
"	Strowger type	Nihonbashi	4,000	3,136	"	"
"	"	Shiba	4,000	2,671	"	"
"	"	Mita	----	842	1928	"
"	"	Asakusa	8,000	----	in instal-lation	"
"	"	Akasaka	2,000	----	"	"
Near Tokyo	4 digits with Strowger type	Nakano	2,800	----	in instal-lation	Nippon Electric Co.
"	"	Kawasaki	1,800	----	"	A.E.I.
"	"	Ebara	1,600	----	"	"
"	"	Senju	1,400	----	"	"

Since 1928, several (not more than seven, probably less) of the remaining manual exchanges have been switched over to automatic, but no further data is available.

The Nihonbashi Exchange is housed in the same building as Marunouchi. The Kyobashi Exchange is located on Appendix B. Approximate locations of the Mita, Shiba, and Kanda exchanges will also be found there. 13/ Also attached are the floor plans of the first and second floors of Shiba Exchange (Appendices I and J) the plans of the first, second, elevation and roof of Otsuka Exchange (Appendices K, L, M and N); and the plans of the first and second floors of Asakusa Exchange (Appendix O). In addition, there are attached pictures of exteriors of Otsuka, Shiba, and Kanda exchanges (Appendices P, Q and R). They illustrate the very sturdy construction of exchanges in Tokyo. Finally, there are attached pictures of the interior of Kyobashi Exchange (Appendices S and T), and a portion of the interior of Honjo Exchange (Appendix U).

Although each of the listed exchanges is essential to complete calls in Tokyo made to or from each of the respective districts served by each, all out-of-town calls (including even those to Yokohama) must go through Marunouchi.

13/ Though every effort was made to locate the other exchanges in Tokyo, no one was found here who could do so with any real degree of certainty.

3. Imperial Household Exchange

The Imperial household is equipped with a private branch automatic exchange which in turn has trunk line connections to Marunouchi, through which all long distance calls must be routed. It is located on the east side of the grounds, just inside the second wall, as shown on Appendix B. Pictures showing the entrance to the building housing the exchange and the switch room are attached (Appendices V and V-1). The exchange is equipped with at least 260 stations, with at least forty trunk lines to Marunouchi.

4. Telephone Exchanges in Yokohama, Osaka, Kobe, Nagoya and Kyoto

The principal or central telephone exchanges in Yokohama, Osaka, and Kobe are located on Appendices B and W. Relevant information concerning these exchanges and those of Nagoya and Kyoto are shown on the following table.

Table 2 14/ NUMBER OF AUTOMATIC SUBSCRIBERS ACCORDING TO THEIR LOCATIONS AND TYPES OF EQUIPMENTS IN 1928

Name of Cities	Type of Equipment	Office Name	Equipped No. of Lines at the end of 1928	No. of Subs. Lines actually equipped end of 1928	Opened at the year of	Name of Manufacture
Yokohama	5 digits with Strowger type	Honkyoku	6,000	5,149	1925	S.H. 15/
"		Chojamachi (Central)	6,000	5,381	"	"
Nagoya	"	Honkyoku	5,000	2,719	1928	A.E.I.
"	"	Naka	4,000	2,756	"	"
Kyoto	"	Honkyoku	7,000	5,123	"	"
"	"	Gion	4,800	2,618	"	"
Osaka	6 digits with S.H. type	Horikawa	2,000	1,527	1927	"
"		Tennoji	2,500	2,193	"	"
"	"	Fukushima	1,600	---	in installation	"
Near Osaka	4 digits with S.H. type	Tengachaya	2,300	1,694	1928	"
		Sumiyoski	1,600	1,257	"	"
Kobe	5 digits with S.H. type	Minatogawa	5,000	4,513	1927	"
"		Suma	1,700	---	in installation	"
Near Kobe	4 digits with S.B. type	Mikage	3,600	---	"	Siemens Br. Co., Eng.
		Ashiya	2,000	---	"	

14/ From the Inada paper.

15/ Siemens & Halske, Berlin.

(over)

The Yokohama Chojamachi (Central) exchange is thought to be of especial importance since it is a switching center for special submarine and aerial lines used in the supervision of the fortifications along the channel up from the ocean to Tokyo Bay.

5. Dairen

a. Functional Importance

Dairen is at the southern-most point of the Kwantung Peninsula and is twenty-five miles northeast of Port Arthur. It is the control point for all telephonic communications into Manchuria and Northern China, and is a switching center for wire and wireless communications.

b. Location and Equipment

The main telephone exchange (called Futo) was automatized on April 1, 1923, and was the first automatic exchange in the Empire. It is located in a large building which also houses the postal and telegraph services. It is equipped with from 6,500 to 9,000 lines of automatic equipment. Pictures of the exterior and interior of the exchange are attached (Appendices X and Y). There are two other exchanges known as Sakako (in a village about ten miles west of Dairen) with from 810-1000 lines and Bujum with from 625-800 lines. Equipment was made by Automatic Electric in the United States, and by Automatic Telephone Mfg. Co. in Liverpool.

6. Telephone Exchanges in Manchukuo

The automatic equipment in the telephone exchange at Harbin was manufactured by Automatic Electric. The number of lines is at least 3,000. Pictures of the interior and exterior of the exchange are attached (Appendix Z), as are pictures of pole lines and cable entrances (Appendices AA, BB and CC) indicating that much of Harbin's telephone wire system is above ground.

The Mukden equipment was manufactured by Siemens and Halske in Berlin, and is equipped for 4,000 lines.

7. Telephone Exchanges in Occupied China

a. Present Status: Speculative

The present status of the principal telephone exchanges in Jap-occupied China is speculative. The Chinese attempted to take inland as much of the removable equipment as was possible. In many instances they succeeded, but the Japanese may have replaced the removed equipment.

b. Shanghai

(1) Telephone Exchanges in International Settlement

(a) Survey

In the International Settlement of Shanghai, there are six exchanges owned and formerly operated by the Shanghai Telephone Company -- a subsidiary of International Telephone and Telegraph Company. This system has the following exchanges and numbers of lines: Central (10,000); Fokien (7,000); North (7,000); Wayside (3,000); Montigny (6,000); Pichon (7,000); West (6,000); Lucerne (3,000) and Hungjao (200). Lucerne and Hungjao exchanges are manual; all the others are automatic. Each of them is located on Appendix DD, which is a telephone map of Greater Shanghai, and on Appendix EE -- a street map. The old West Exchange -- located on these maps -- is now used as a warehouse for storing spare parts.

(b) Central or Main Exchange

This office is in a building 120 by 40 feet, of reinforced concrete. It is three stories in height. In the basement (only part of which is below ground level) are housed the motor generator and batteries. On the ground floor the general business offices are located. The second and third floors contain the automatic equipment, which was made by an International subsidiary in Antwerp. Long distance calls from Tokyo and elsewhere are handled on the manual board, which is located on the second or third floor.

(2) Chinese City

In the Chinese city of Shanghai, there are five exchanges owned and formerly operated by the Shanghai Telephone Administration of the Chinese Government. These exchanges, with the number of lines in each are as follows: Nantao (3,000). Chapei (1,500); Lunghwa (150); Civic Center (300); Pootung (160). Although there are a total of 5,110 lines of equipment, there were only 4,200 lines in use at the end of 1936. All the equipment was manufactured and installed by Automatic Electric Company, Chicago. Each of the exchanges is located on Appendices DD and EE. Blue prints of the floor plans of the Civic Center, Nantao and Chapei offices are attached (Appendices FF, GG, HH and II), as are pictures of the exteriors of Nantao (Appendix GG-1) and Chapei (Appendices II-2, II-3 and II-4).

(3) Long Distance and Intra-City Communication

Long distance calls from outside Shanghai are routed to the Central Exchange in the case of calls destined for stations in the International Settlement, and to the Chapei Exchange in the case of calls destined for stations in the Chinese City. A modification of this statement is necessary (1) in the case of calls destined for the International Settlement from a point on Chinese Government lines outside Shanghai, in which case the call would go to Chapei before going to Central; and (2) in the case of calls destined for the Chinese City from a point not served by Chinese Government lines in which case the call would go through the Central Exchange before going to the Chinese City.

(over)

A call from a station in the International Settlement to a station in the Chinese City, in every case, must be routed through Central in the Settlement and is a toll call. There are forty-five trunk lines from Central to Nantao; twenty-six from Central to Chapei, and twenty from Central to Pootung. A call from a station in the Chinese City to a station in the Settlement can be routed through Nantao, Chapei, or Pootung, but from any one of these, it must go to and through Central in the Settlement. There are fifty trunk lines from Nantao to Central; twenty-eight from Chapei to Central; and twenty-five from Pootung to Central.

c. Nanking

(1) Introduction

There are three exchanges in Nanking: Central, North and South. Their locations are shown on the attached map of Nanking (Appendix JJ). All equipment was manufactured and installed by Automatic Electric Company, Chicago.

(2) Central

This exchange has 3,000 lines of automatic equipment. It is housed in a three-story building. The cable vault or inlet for long distance lines is in the basement. Offices are on ground (or first) floor. Batteries and power equipment are on the second floor. On the top floor are located the toll board and the automatic equipment. The floor plan is attached (Appendix KK).

(3) North

This exchange is housed in a one-story building and contains 2,600 lines of automatic equipment. Its floor plan will be found in Appendix LL-1.

(4) South

This exchange is housed in a two-story building containing 2,300 lines of automatic equipment. The equipment is arranged as in the Central office except that there is no toll board. A floor plan is attached (Appendix LL-2). Pictures of the interior are attached (Appendices MM and NN).

d. Canton 16/

(1) Survey

On August 25, 1939, the Canton office was opened. The automatic exchange equipment is of the Standard Electric Rotary Machine Switching type manufactured

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16/ Material in this subsection is condensed from an article appearing in the October, 1929 issue of The Far Eastern Review, pages 468-9.

by a subsidiary of International Telephone and Telegraph in Antwerp. The system comprises two exchanges, a 4,000 line central unit with an ultimate capacity of 10,000 lines serving Canton proper and the foreign community of Shameen, and a branch exchange of 300 lines with an ultimate capacity of 800 lines located on the island of Honan. The exchanges are connected by a fifty pair submarine junction cable laid in the Pearl River.

(2) Main Exchange

The main exchange building, situated in Taiping Road, is of reinforced concrete construction, two stories high with a half basement. It was built in 1929. Pictures of the exterior and equipment are attached (Appendices OO and PP) All of the automatic equipment is located on the second floor in which there is ample room for an ultimate capacity of 10,000 lines. The main frame is directly below on the first floor. There is also on this floor, the necessary charging equipment, ringing machines, storage batteries and test desks.

The climate of Canton is severe with high humidity during many months of the year. This condition resulted in the installation of specially treated equipment throughout, including anti-rust treatment of all metal work, enamelled conductors, and impregnated insulation of all cables. In addition, air-conditioning equipment is installed which maintains a temperature of less than 80° Fahrenheit at a relative humidity of 60% under extreme conditions. This equipment is installed in the basement where there is also storage space and a cable vault through which all cables of the system enter the building.

The special service operators' positions, including long distance operators, are located at Central Exchange.

(3) Power Equipment

The power equipment at Central Exchange includes two forty-eight volt 960 ampere hour storage batteries with tank capacity of 3,360 ampere hours consisting of twenty-five cells each. The charging equipment consists of two motor driven compound wound generators with a capacity of 275 amperes at sixty volts. A picture of the power room is attached (Appendix TT).

(4) Underground Ducts

Over half of the outside plant is carried in concrete ducts laid underground. The underground duct system was laid almost entirely under the sidewalks. All ducts were laid on a concrete base three inches thick and at a depth to give a uniform coverage of eighteen inches. In crossing streets, the duct was completely boxed in with four inch concrete slabs. The majority of the manholes were five foot by five foot in area, with a concrete bottom and brick walls and with a reinforced concrete top. Double cast-iron covers with locks were provided for all manholes. Pictures of a special manhole and of the construction of the concrete ducts are attached (Appendices QQ and RR).

A total of 600 reinforced concrete poles manufactured locally were used on the project, a majority of which were forty feet long. The poles were set to a depth of five feet on a concrete base. Poles located at street corners or other points where they would be subject to damage from vehicles, were protected by a concrete collar up to a height of three feet above the ground.

c. Hongkong 17/

(1) Survey

The whole of the Hongkong telephone system, comprising 12,900 lines, was cut over to automatic service at midnight on May 3, 1930.

The network comprises three exchanges:

Exchange	Preselectors and multiple	Ultimate
Central	9,500	10,000
Kowloon	3,000	10,000
Peak	400	500

The Central and Kowloon exchanges were both installed in new buildings and all of the equipment including the main frames and power plant is accommodated on a single floor. Pictures of the interior and exterior of the Kowloon Exchange are attached (Appendices SS and TT).

In the case of the Central Exchange, there is also capacity on the same floor for a second unit of 10,000 lines.

The equipment at the Peak Exchange was installed in the old Magneto Telephone Exchange Building and the power plant accommodated in an adjacent building. The Central and Peak exchanges are on the same island, but the Kowloon Exchange is located across the bay, five miles from the Central Exchange and connected with it by submarine cable.

Junctions are provided between the Central and Kowloon exchanges, and between the Central and Peak exchanges, but direct junctions are not available between the Peak and Kowloon exchanges. Calls between these two exchanges are routed via the Central Exchange.

The toll board is located at the Central Exchange for furnishing long distance service.

17/ The material in this section is taken from an article in the magazine, Telephony, Vol. 100, No. 6, printed in 1930.

(2) Air-conditioning Equipment

The climatic conditions in Hongkong are exceptionally humid and generally of a tropical character. Having regard to the comfort of its staff, and in order to avoid equipment troubles under humid conditions, the Hongkong Telephone Company installed an air-conditioning plant for dehumidifying and cleaning the air in the apparatus rooms. The manufacturers have supplied all apparatus and iron-work with a special tropical finish.

(3) Power Equipment

In all cases, power for the equipment is provided by duplicate twenty-five cell batteries.

The Central and Kowloon exchanges are fitted with duplicate fifty volt booster batteries for metering, and with one counter E. M. F. battery.

The machines at the Central and Kowloon exchanges comprise two motor-generator sets to run off the public supply, and two ringing machines, one to run from the public supply, and the other from the exchange battery. At the Peak Exchange, one motor-generator set only is installed and duplicate ringing dynamotors to run from the exchange battery.

E. Long Distance Telephone Lines

1. Lines

The principal long distance telephone lines in existence in 1929 in Japan are shown in the following table. 18/

Table 3.

MAIN TELEPHONE CABLES

Section	Year Completed	Length (km.)	Underground or Aerial	No. of Pair of Cable	Loading Space (km.)
Osaka-Kobe	1922	37.2	underground	102	1.83
Tokyo-Yokohama	1923	33.6	"	"	"
Kyoto-Osaka 19/	1924	56.0	"	98 (armored)	2.00
Tokyo-Hino	1927	40.0	underground and aerial	186, 114 & 54	1.83
Tokyo-Kobe	1928	604.4	"	184 & 204	"
Tokyo-Utsunomiya	1929	118.4	"	204 & 108	"
Fukuoka-Kurume	1929	43.8	"	108	"
Moji-Fukuoka	1929	100.6	"	160 & 108	"
Niigata-Nagaoka	1929	71.3	"	114, 78 & 54	"
Sapporo-Otaru	1929	37.8	"	78	"

18/ From the Inada paper.

19/ Manufactured by Siemens and Halske.

(over)

Except for a short section between Osaka and Nagoya, the cables used in the lines listed in the above table were manufactured in Japan. Most of the loading coils 20/ in use then were of foreign manufacture.

The Tokyo-Kobe line is the longest and most important in Japan. It connects the cities of Tokyo, Yokohama, Nagoya, Kyoto, Osaka and Kobe, which have a combined population in excess of 13,500,000, and are equal to the combined populatio of New York, Chicago, Philadelphia and San Francisco.

Aerial cable is used except in those cities where it is thoroughly impracticable, and hence is underground. Thus, Tokyo has a complete underground cable system.

Appendices UU, VV, WW, XX, YY, ZZ, AAA, BBB, CCC and DDD are pictures of various devices used in the construction of long distance telephone lines in Japan.

2. Repeater Stations

A repeater station is a building housing a power system and many vacuum tube amplifiers through which impulses travel on long distance lines, and as a result of which the impulses are amplified. Because magnetic flux reduces the strength of the impulses as they travel over the wire, amplification is necessary at regular intervals in order to maintain sufficient volume. Power equipment in the stations is derived from storage batteries which are charged by generators operated from a power line.

Dotted throughout the principal islands of Japan, as shown on the map (Appendix EEE), are repeater stations. The location, spacing and number of telephone repeaters in the Tokyo-Kobe line in 1929 are shown in the following table. 21/

Table 4. REPEATER STATIONS AND REPEATERS (Nov. 1928)

Name of Repeater Station	Distance from Preceeding Station	Number of Repeaters Actually Installed		
		2-Wire	4-Wire	Total
Tokyo		--	46	46
Yokohama	34	49	--	49
Ashigara	56	25	44	69
Ejiri	92.2	26	44	70
Toyokawa	123.4	50	44	94
Kameyama	131.2	11	45	56
Osaka	140.1	161	223	384
Total	576.9			

20/ It is believed that most or all of the lines under construction, as shown on this map, have been completed.

21/ From the Inada paper.

Appendices FFF and GGG are pictures of the exteriors of the Ashigara and Ejiri repeater stations. 22/

Destruction of any repeater station would, of course, seriously effect long distance telephone communication. Destruction of all in a given line would render conversation impossible. But unless there is a shortage of the parts used -- vacuum tubes, for example, -- these stations should not prove as difficult to replace or repair as a telephone exchange.

3. Submarine Telephone Cables

The following table shows the principal continuous submarine telephone cables in Japan, 23/ in 1929.

Table 5. PRINCIPAL CONTINUOUS LOADED SUBMARINE TELEPHONE CABLES

	Year	Length km.	Kind of Cable	No. of Conductors	Dia. of Conductor mm.	Dia. & No. of Layers of Landing Wire
Bisan Strait	1922	10.8	Lead covered paper insulated	16	1.85	0.2x2
Tsugaru Strait (1)	1926	65.6	Balata "	4	2.47	0.3x2
Geiyo Strait	1927	34	Lead covered paper insulated	8	1.8	0.3x1
Bungo Strait	1927	48	G. P. "	4	1.85	0.3x2
Akashi Strait	1928	22	Lead covered paper insulated	28	1.3	0.3x1
Naruto Strait	1928	15	" "	28	1.3	0.3x1
Essa Strait	1928	38.8	Balata "	4	2.49*	0.3x2
Tsugaru Strait (11)	1928	64.4	" "	4	2.49*	0.3x2
Fukuoka-Iki	1928	33	Lead covered paper insulated	2	1.3	0.3x1
Fukuoka-Tsushima	1929	115	G. P. "	4	2.5	0.3x1

Note: Mark * made up of a 2.0 mm. copper round wire and 3 copper strips.

22/ Ashigara is probably near Odawara and Matsuda. Ejiri is on the west side of Suruga Bay, near and north of Shizuoka. Toyokawa is three or four miles north of Toyohashi, which is on Atsumi Bay. Kameyama is on the west side of Atsuta Bay, a few miles inland, thirty-five or forty miles southwest of Nagoya.

23/ From the Inada paper.

(over)

III. TELEGRAPH

A. General

The Tokyo and Osaka Central Telegraph offices, both having wireless stations are the centers of the Japanese telegraph networks in the east and west, respectively, and connect the principal inland cities.

The new Tokyo telegraph building was opened in July, 1926, and is adjacent to the Marunouchi telephone exchange (Appendix A), and is located on the Tokyo map (Appendix B). The Osaka Central Telegraph office was first occupied in October, 1928. Its location is shown on Appendix W. In both buildings, there is special fire protection equipment, presumably of the sprinkler type.

Telegraph wires in the principal cities and between Tokyo and Yokohama, between Nagoya and Kobe and perhaps elsewhere are underground.

The telegraph office in Shanghai is in Sassoon House, which is located on Appendix EE.

The numbers of telegraph instruments and certain other equipment in each of the two offices in 1929 is shown on the following table. 24/

Table 6. TELEGRAPH INSTRUMENTS

	Tokyo	Osaka
Telegraph printer for foreign language	2	3
Telegraph printer for Japanese "Kana"	10	8
Submarine Cable duplex	1	--
Wheatstone duplex	33	24
D.C.A.C. quadruplex (Morse sounder)	16	18
D.C.A.C. Simultaneous duplex (")	2	2
Duplex (")	69	68
Combined duplex and simplex (")	7	7
Simplex (")	188	97
Telephone	23	12
High frequency carrier current duplex	--	1
Automatic telegraph switching system	1	1
Telephone switchboard	1	1
Pneumatic tube	44	4

B. Long Distance Submarine Telegraph (Cables)

There are several direct telegraph circuits between the main island and Manchukuo and Korea. Examples are Tokyo-Dairen, Tokyo-Keijo (Korea), Osaka-Mukden, Shimonoseki-Mukden.

24/ From the Inada paper.

The Tokyo-Dairen line was completed in 1919 and contains six automatic repeaters, situated at Osaka, Shimonoseki, Fuzan, Keijo, Antung-Ken and Mukden.

From Nagasaki -- at the extreme western end of Japan, on the island of Kyushu, -- there are several submarine telegraph cables. Examples are the three to Shanghai and two to Vladivostock, four of which are owned and were -- perhaps still are -- operated by the Great Northern Telegraph Company of Norway. One Shanghai line is owned by the Japanese Government. In addition, there are cables from Ruikiu to Naha-Yap, Keujo to Vladivostock, Sasebo (Kyushu) to Tsingtau (China), Taihoku (Formosa) to Sharp-Peak, Toyohara (Karafuto) to Alexandrowski.

IV. WIRELESS COMMUNICATION 25/

A. Survey

The Japanese Government owns its own radio stations. In addition, licenses are granted to private stations for mobile service, but no such licenses are granted for fixed stations except where no telephone or telegraph is available. An exception is the Japanese Broadcasting Corporation (Nihon Hoso Kyokai). It enjoys a monopoly granted by the Government for radio telephone broadcasting. Another exception is Nihon Musen Denshin K.K. or Japan Wireless Telegraph Co., Ltd., which is owned in part by the Government and in part by the public. This company is permitted to erect and maintain transmitting and receiving stations for foreign communications, except radio telegraphs, which are handled by the Government itself.

Since 1926, a ship of 2,000 gross tons or more or carrying fifty or more persons is compelled by law to install a radio telegraph on board. In March, 1929, 1,071 vessels had radio sets, of which 191 had tube transmitters and the remainder used the "quenched spark system". In addition, six passenger boats had radio telephones. This number has, of course, increased very much since 1929.

In 1929, in the Kobe and Moji -- northern tip of Kyushu and opposite Shimonoseki -- telephone exchange offices, there were radio telephone transmitters of 200 watts and selective receivers. Communications could be had with ships within a radius of only from sixty to seventy-five miles at that time.

B. Coast Stations for Marine Service

The table below shows the Coast Stations open for service in 1929.

25/ This entire section is simply a revision and condensation from the Inada paper.

Table 7. LIST OF COAST STATIONS

Name of Station	Call Sign	Antenna Power (Watt.)	Frequency (Kc/s) A1		A2		Opened
Horomushire	JHJ	1000	119	143	450	500	9.1920
Otchishi	JOC	3000	143	147	438	500	12.1908
		1000					
Hakodate	JHK	1000	140	143	433	500	4.1929
		500					
Wakanei	JGB	250			460	500	4.1925
Niigata	JGE	100			391	500	9.1925
Choshi	JCS	3000	132	143	418	500	5.1908
		500					
Yokohama	JGC	250			454	500	7.1924
Wakasa	JWA	1000	138	143	403	500	4.1929
		1000					
Shiomisaki	JSM	1000	143	149	397	500	7.1908
Shimotsui	JSX	1000	109	143	433	500	4.1915
Tsunoshima	JTS	1000	134	143	415	500	7.1908
Osezaki	JOS	1000	141	143	400	500	7.1908
Kagoshima	JKB	1000	133	143	435	500	4.1925
Naha	JCX	1000	143	148	450	500	11.1923
Keijo	JBB	2500	143	145	394	500	6.1923
Moppo	JBH	300	117	143	391	500	5.1925
Saishu	JBI	200			435	500	5.1927
Chinnampo	JBL	500			435	500	2.1928
Fuzan	JBT	500			435	500	5.1927
Dairen	JDA	3000	123	143	421	500	6.1922
Kelung	JFK	750	127	143	405	500	10.1910
Garampi	JFG	750	105	143	460	500	12.1925
Taito	JFE	200			435	500	1.1915
Karenko	JFF	200			391	500	4.1914
Otomari	JTW	3000	128	143	430	500	8.1921
Palao	JRW		117	143	445	500	4.1922
Truk	JRT	2000	123	143	438	500	4.1922
Yap	JRZ	500	107	143	394	500	4.1922
Saipan	JRV	2000	105	143	405	500	4.1922
Angaur	JRY				391	500	4.1922
Ponape	JRU	500	109	143	421	500	4.1922
Jaluit	JRX	1000	119	143	433	500	4.1922

Appendix KKK shows the geographical distribution of these stations.

Otchishi, Choshi and Osezaki were the most important stations on Honshu Island in 1929. In the colonies, at that time, Otomari, Keijo, Dairen, and Kelung were the most important. The Dairen receiving antenna is situated from ten to twelve miles southwest of Dairen, near a small village named Hoshigura (Star Beach).

In addition to these, in 1929 there were fourteen private small stations, designed for the use of sixty-three fishing boats equipped with telephone and telegraph sets.

C. Aviation Stations

These are located in the principal air fields or along aviation routes. They furnish special meteorological information for aviation. A list of those existing in 1929 follows.

Table 8. LIST OF AVIATION STATIONS

Name of Station	Call Sign	Antenna Power (kW)		Frequency (kc/s)		Opened
Tokyo	JYX	3 & 1	200	205	333	4.1929
Hakone	JXH	0.5	200	225	333	5.1929
Kameyama	JXH	0.5	200	215	333	
Osaka	JEA	1.0	200	240	333	4.1929
Fukuoda	JXF	2.0	200	220	333	7.1929
Tsushima		0.5	200	225	333	
Tomie		0.5	200	325	333	
Keijo			200	210	333	
Dairen			200	230	333	

D. Colonial and Inland Stations

There are certain additional, colonial and inland fixed stations listed below.

Table 9. LIST OF FIXED STATIONS

Name of Station	Call Sign	Antenna Power (kW)	Frequency (kc/s)	Opened
	JYR	15	36.5	
	JYS	5	54.5	
Tokyo	JYT	3	77.0	7.1926
	JYZ	3	S	
	JYX	1	92.0	
	JYB	1	S	
	JYP	1	S	
	JEA	1	97.0	4.1923
Osaka	JES	1	S	
	JEW	1	S	
	JBK	1	S	
Sapporo	JPS	1	S	4.1927

(over)

Table 9.
(cont'd.)

LIST OF FIXED STATIONS

Name of Station	Call Sign	Antenna Power (kW)	Frequency (kc/s)		Opened
Kanazawa	JKV	0.5	97.0		4.1927
Hiroshima	JHL	0.5	S		4.1927
Otomari	JTW	3	72.0		8.1922
Keijo	JBA	5	47.5	65	6.1923
	JBC	0.5	S		
Dairen	JDP	17.5	43	91.5	6.1922
Taihoku	JFN	20	45.5		10.1928
	JFA	5	S		
	JFB	3	S		

Tokyo and Osaka are the principal stations of this network. They communicate with Keijo, Dairen, Taihoku, and Otomari and Palao in the South Sea Islands. They are both long and short-wave.

E. Stations for Transoceanic Service

In 1925, transpacific service was centralized in Nihon Musen Denshin K.K. It took over Haranomachi transmitting station and Tomioka receiving station. The former is notable because of its reinforced concrete tower 656 feet in height.

A new station was erected at Fukuoka near Tokyo and transpacific service was centralized in Tokyo radio. At Tomuioka, a ten kilowatt short-wave transmitter was installed.

Osaka and Nagoya radio have also been used for European transmitting and receiving.

Nihon Musen Denshin K.K. has a transmitting station at Yosami near Kariya, and a receiving station at Kaizo near Yokkaichi (opposite Nagoya on the west side of Atsuta Bay). In 1929, the transmittal station had a maximum antenna power of 700 kilowatts.

The following table gives the technical information concerning these high power stations of Nihon Musen Denshin K.K., as of 1929.

Table 10. LIST OF TRANSOCEANIC STATIONS

1. Tokyo Radio
   a. Tokyo Radio Central. (centralized 8.8.1927)
      2-control lines. 4-tone channels
      2-telephone lines

Table 10.
(cont'd.)

LIST OF TRANSOCEANIC STATIONS

b. Haranomachi Transmitting Station (opened 26.3.1921)
Call sign JAA
Transmitter 400 kW H.F. Alternator (19, 8 kc)
Towers 1-concrete tower (200 m)
5-steel towers (200 m)
Antenna effect 63000 meteramperes

c. Tomioka Transmitting Station (transformed 8.8.1927)
Call sign JAN
Transmitter 10 kW short wave valve transmitter
(9600 12300 18600 kc.)
Antenna 1-saw teeth 2-horizontal

d. Fukuoka Receiving Station (opened 8.8.1927)
(i) Long wave receivers 2 sets
Long wave antenna 1-wave antenna
4-loop antenna
2-coil antenna
(ii) Short wave receivers 1-diversity combined receiver
4-auxiliaries
1-directive antenna
Short wave antenna 2-horizontal doublets

2. Nagoya Radio

a. Nagoya Radio Central (opened 24.9.1928)
2-control lines 3-tone channels
2-telephone lines

b. Yosami Transmitting Station (opened 15.4.1929)
(i) Call sign JND
Transmitter 550 kW H.F. Alternator (17.44 kc)
Towers 8-steel towers (250 m)
Antenna effect 15000 meteramperes
(ii) Call sign JNI
Transmitter 10 kW short wave valve transmitter
(7820 12200 19000 kc)
Antenna 2-horizontal doublets with reflectors

c. Kaizo Receiving Station (opened 24.9.1928)
(i) Long wave receivers 4 sets
Long wave antenna 1-double cross antenna
2-loop antenna
(ii) Short wave receivers 4-diversity combined receivers
Short wave antenna 2-horizontal doublets

F. Broadcasting for the Public

These are operated by Japan Broadcasting Corporation (Nihon Hoso Kyokai).

A picture of the well-known J-O-A-K Station in Tokyo (Appendix HHH) is attached, and the Station is located on Appendix B.

(over)

V. JAPAN'S FACILITIES FOR PRODUCTION OF TELEPHONE AND TELEGRAPH EQUIPMENT

A. Introduction

Prior to 1930, all automatic telephone equipment in use in Japan was manufactured by Automatic Electric Company in Chicago, or by its related company, Automatic Telephone Mfg. Co., Ltd., in Liverpool, by Siemens Bros. & Co., Ltd. in London or by Siemens & Halske A.G. in Berlin. About 1931, the Japanese Government commenced a concerted effort to have manufactured in Japan all automatic equipment to be used in Japan. Although the great bulk of existing equipment was made outside of Japan, today Japanese factories are undoubtedly able to manufacture most or all essential automatic equipment, if raw materials are available.

There are three principal producers of telephone equipment as well as six or eight additional very small companies.

B. Nippon Denki K.K.

This company is now controlled by Sumitomo Cable Company, which is part of the vast Sumitomo family's holdings. Prior to about 1936, the controlling stock interest was held by International Telegraph and Telephone Company which had acquired it from Western Electric in 1926. International Telegraph and Telephone Company still has a minority stock interest.

The company has two principal factories -- both in Tokyo. The older one known as Mita plant was constructed on the grounds of the original building after the eqrthquake partially destroyed it. The present structure is concrete with a steel frame. It is located on Appendix B. A sketch of the plant is attached (Appendix III).

The second plant was erected sometime between 1935 and 1940, and is situated in the southwest suburbs of Tokyo. It is believed that no American has ever been inside the plant.

Today, it is believed that the Mita plant is producing the usual line of telephone equipment plus some war items, while the new plant is undoubtedly engaged in items used in warfare, such as gun-control equipment, airplane radios, walkie-talkie sets, etc.

In normal times, the Mita plant produced central office equipment including manual and dial switching apparatus and switching cable; station equipment (i.e. telephone sets); private branch exchanges; line equipment, except wire, but including loading coils and repeater stations; volt, ampere and ohm meters; test sets and radios. This plant also made telegraph equipment as well as many of its own tools.

A few blocks east of the Mita plant is the company's warehouse, situated in the Shiba-ura area. This building is approximately 80 x 150 feet, and is of reinforced concrete construction.

The present value of the company's annual output is estimated at 45 million dollars. Number of employees is estimated at between 6,000 and 6,500. These figures, however, are no more than intelligent guesses. One expert estimates employment may be as high as 8500 - 9000, although this seems too high. It is known that in 1927 the number of employees was 1,500.

It is believed almost certain that by 1941 there were on hand large stocks of raw materials and certain spare parts which the Japanese found it somewhat difficult to manufacture.

C. Oki Denki Kaisha

This company has always been owned by Japanese. Its plant is located on Appendix B. Number of employees is estimated at from 4000 - 5500.

D. Fujukura Denki Kaisha

This company is controlled by Japanese, but it is thought that the Germans have a substantial stock interest. At any rate, it has worked under a patent license arrangement with Siemens & Halske, which furnished Fujukura with some technical personnel. The number of employees is estimated at from 4000 - 5500.

VI. JAPANESE ELECTRICAL RESEARCH

Japanese research in electricity and electrical communications is said to consist largely of a study of what has been done abroad. 26/

The Electrotechnical Laboratory is situated somewhere in the Gotanda area in Tokyo, as indicated on Appendix B. A picture of the exterior of the Laboratory is attached (Appendix JJJ). The building should not be difficult to locate because of its three steel towers.

VII. SOURCES

A. Oral

1. Messrs. Harry Janes, A. O. Perry, and Dooley, all of Automatic Electric Company, 1033 W. Van Buren Street, Chicago.

Mr. Janes was in charge of the company's affairs in the Far East for about twenty-five years. Mr. Perry installed equipment in Tokyo, Shanghai, and Nanking. Mr. Dooley sold equipment in Harbin, and in Japan.

26/ According to Confidential Report by Robert Wohlforth, Economic Warfare Section, New York, on the Japanese radio industry, dated March 4, 1942.

2. Mr. R. R. McFarland. He is an engineer with Western Electric Company, Hawthorne Works, Cicero Avenue, Chicago. In 1927, he was technical advisor and engineer in the Mita plant of Nippon Denki K.K.

B. Written

1. Automatic Telephone. This by-monthly magazine is published by the Automatic Electric, Inc., in Chicago. Vol. 12, pp. 1924-25 (March-April, 1928) contains valuable pictures, which are reproduced here, as do several other issues

2. The Files of Automatic Electric disclosed several photographs and blue prints, which are reproduced here.

3. A paper written in English in 1930 by Dr. Inada (see footnote p. 3 supra).

4. Pamphlet by Dr. Inada: "A Brief Description of the Damages done by the Earthquake to the Wired and Wireless Telegraph and Telephone Installation of Japan" (December, 1925). This is Selected Paper No. 9 from The Journal of the Institute of Electrical Engineers of Japan (see footnote p. 2 supra).

5. Pamphlet printed in Japanese. From this pamphlet the pictures of Marunouchi, the pictures of the repeater stations in Ashigara and Ejiri, and all the pictures of long distance telephone lines were taken.

6. Far Eastern Review, October 1929 (pp. 468-9) for the article on Canton' telephone system.

7. Far Eastern Review, October 1930 (pp. 546-8, 566-7) for the tables of telephone exchanges in Japan, supra, pp. 5, 6 and 7

8. Telephony, Vol. 100, No. 6 (1930) for the article on the Hongkong telephone system.

9. Confidential Report by Robert Wohlforth, Economic Warfare Section, New York, on Japanese radio industry, dated March 4, 1942.

VIII. LEADS

A complete search should be made of the files and personnel of International Telephone and Telegraph Company for information on Chinese telephone systems, and on the Nippon Denki plant.

Similar action should be undertaken with respect to the eastern offices of Western Electric Company.

2371-A

Economic Warfare Section
War Division
Department of Justice
Washington, D. C.

Confidential Report
January 1, 1943
Re: First Addendum to Report on Telephonic and other Communications in Japan and Occupied China
Submitted by: Victor H. Kramer
Economic Warfare Section
Department of Justice
Chicago, Illinois

I. INTRODUCTION

On December 17, 1942, we forwarded a Report on Telephonic and Other Communications in Japan and Occupied China. Since that time, we have located several excellent photographs which we shall endeavor to integrate by reference into the original report. Additional details on the Mita plant of Nippon Electric Company have also been found.

II. TELEPHONE EXCHANGE IN MUKDEN

A view of the Central Telephone Exchange in Mukden is attached as Appendix LLL (see Page 8 of original report).

III. TELEPHONE EXCHANGES IN SHANGHAI INTERNATIONAL SETTLEMENT

A rather good aerial view of the Central Office in the International Settlement has been obtained and is attached as Appendix MMM. Similarly, a photograph of the new West Exchange is attached as Appendix NNN (See Pages 9 and 10 of the original report.)

IV. NIPPON ELECTRIC COMPANY

From Pages 22 to 23 in the original report we described as fully as the information that was at hand permitted, the Mita plant of Nippon Electric Co. Since that writing, several views of the exterior of the plant and a rather poor set of floor plans were obtained. They are attached hereto as Appendices OOO, PPP, QQQ and RRR.

The principal factor of interest about the construction of the Mita plant is the extreme care that was taken to guard against earthquake and fire damage which more or less ruined the original plant of the company.

The new buildings are of steel-frame construction with reinforced concrete walls, floors and roof slabs. The buildings are set back from the property lines on the sides and back of the compound, thus greatly reducing the fire hazard, and permitting all building entrances, except the main entrance, to open within the company's property instead of to the public streets. The structures are built to the property line on the front street, which is sufficiently wide to permit of this without undue hazard.

The three connecting buildings at the front of the compound are sixty feet wide and four stories high. Buildings in the parallel wings which join the front buildings are partly four and partly three stories high, being eighty feet wide on the first floors and sixty feet wide on the floors above, thus providing light courts for the illumination of the second, third and fourth floors. Skylights in the roofs over the first floors at the bottom of the light courts provide additional illumination for the first floors. This plan gives a large proportion of first floor area which is of great importance in a country regularly visited by earthquakes, because it permits keeping all heavy loads on the second floor.

The total gross floor area in the main buildings is 441,940 square feet, while that in the two-story warehouse, a few blocks east of the plant and used for the storage of highly inflammable materials, automobile garage, etc., is 5,876 square feet.

The foundations consist of individual footings under interior columns and continuous footings under outside and special columns. All foundations are of reinforced concrete and are connected by structural steel tie-beams encased in concrete.

Steel window sash glazed with one quarter inch wire glass is used throughout the plant, while doors are of steel, and are fitted with closing devices which operate automatically in case of fire.

There is an artesian well and extra large storage reservoir, together with an auxiliary oil engine for operating the pumps when the regular power supply is cut off.

V. SOURCES

Pictures of the Mukden Exchange are taken from the magazine article published in Vol. 27 Far Eastern Review, p. 46 (1931).

The pictures of the Shanghai Exchanges are taken from Volume 11 of Electrical Communication, p. 43 (1932) and from Volume 13 Electrical Communication, p. 102 (1934). This magazine is the house organ of International Standard Electric Corporation, an affiliate of International Telephone Compahy.

Pictures and the description of the plant of Nippon Electric are taken from an article by Mr. A. G. Jillard, then Far Eastern Director and Manufacturer of International Standard Electric and resident at the Nippon Electric plant. The article appears in Volume 8 Electrical Communication, pages 28-33 (1929).

DEPARTMENT OF JUSTICE

CONFIDENTIAL REPORT

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ECONOMIC WARFARE SECTION
WAR DIVISION

1944