

Twenty Years of Telephony in Spain

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FOLLOWING careful study of the possibilities of installing a modern telephone system throughout Spain, the International Telephone and Telegraph Corporation started negotiations in April of 1924 for an exclusive contract of concession to be granted the *Compañía Telefónica Nacional de España*, a Spanish company organized and controlled by the I. T. & T. These negotiations resulted in the signing of a contract on August 29, 1924, between the Spanish Government and the CTNE for furnishing a homogeneous and comprehensive telephone system throughout Spain, excepting local service in the province of Guipuzcoa.

The concession provided that the Spanish Government would have the right, after the expiration of twenty years, to purchase the telephone properties under a predetermined formula for ascertaining the purchase price, and since the Spanish Government has now completed negotiations with I. T. & T. to purchase its stock interest in CTNE, in lieu of the purchase under the contract, it is timely to review the construction and development of this telephone system for the last twenty years under the aegis of I. T. & T.

The then-existing system was composed of various plants owned by the State, municipalities, and numerous private companies, large and small. The main toll lines connected only the large cities with a network which was both deficient and inadequate. It was not possible to talk from one boundary of the country to a point on the opposite boundary. No repeaters were used and such long-distance service as was rendered was of very poor quality and was limited mostly to calls to and from Madrid.

Local telephone service, even in the large cities such as Madrid, was unsatisfactory. While certain areas had common-battery service, the majority were still on a magneto basis, and all of the switchboards were of antiquated types and of inadequate capacity. Fig. 1 contrasts the typical urban switchboards of this era with the modern units which replaced them. Local dis-

tribution consisted of overhead cables covered with a fabric in place of lead, feeding large towers and roof-top fixtures from which open wire lines were strung to the subscriber's premises. Illustrations of these structures are shown in Figs. 2 and 3 and of a typical new cable entrance in Fig. 4.

The existing system was so deficient that available data on traffic and commercial possibilities could not be used for calculating future growth. However, it was considered that the financial returns would justify the investment required to build a modern telephone system to provide an adequate service which would be of great benefit to the country.

1. Reconstruction and Expansion Program

While negotiations for the concession were in progress, plans were formulated for the reconstruction of the telephone system. As soon as the contract was signed, a group of engineers and technicians were sent to Spain to initiate these plans, supervise their execution, and train the necessary large staff of Spanish personnel.

As a first step in providing for adequate local service, suitable building sites for central offices were purchased in Madrid, Barcelona, and other large cities and towns. Construction of buildings was begun as soon as final plans could be prepared and contracts let. About this time, the I. T. & T. purchased the International Western Electric factories in the foreign field and changed the name of the company to International Standard Electric Corporation. It was decided to standardize on the well-known Rotary Automatic System, which had been developed by the International Standard Electric engineers, for all the principal local service areas. Initial orders for 7-A-1 Rotary equipment were placed with the Bell Telephone Manufacturing Company, Antwerp, an International Standard Electric associated company, for the central-office exchanges in Madrid, Barcelona, Valencia, Sevilla, Bilbao, Santander, and other important cities.

Such was the speed with which this program was prosecuted that automatic service was inaugurated in Santander in the summer of 1926 and in Madrid in December of the same year. Conversion of the service in other cities followed in rapid succession.

Concurrently with the reconstruction of the local plants, a vast program of toll-line construction and rehabilitation was undertaken. This work advanced so rapidly that at the inauguration of automatic service in Madrid in December, 1926, it was possible to stage a toll demonstration in which stations in principal cities throughout the country were interconnected with each other and with Madrid over a built-up circuit having a cumulative length of 3,800 kilometers.

In the layout of a toll network, Madrid is not only the capital but is almost the exact geographical center of the country, making an ideal point from which to distribute toll traffic. The toll operating room in Madrid is shown in Fig. 5.

The coal mining industry lies to the northwest, centering around the city of Leon; heavy industries, such as steel mills, are located at Bilbao, some 250 kilometers east of Leon. The textile industries are located in and around Barcelona. Copper mines are in the southwest near the city of Huelva. Plains to the north of Madrid are devoted almost exclusively to the raising of wheat. The south central area is the great olive-producing section of the country; dates and hemp are raised around Murcia in the southeast with the coastal region around Valencia devoted to

rice and oranges. As Spain is almost surrounded by water, there are many excellent ports and the fishing industry is active at every part of the seacoast.

A map of Spain, Fig. 6, shows the network of main toll lines and indicates those sections in which cable has been installed. Carrier systems are used extensively to provide the longer circuits, with 24 three-channel carrier terminals in Madrid. The map also shows the cities having automatic local service. To indicate the extent of the network, the distance from Madrid to Zaragoza can be taken as being approximately 300 kilometers.

The cable network was originally designed to extend from Madrid to Zaragoza and from there to Barcelona and to Bilbao and France. The sections represented in the map cover about 440 kilometers of buried toll cable. This cable is made up of 16-gauge quads for 2-wire circuits and 19-gauge quads for 4-wire operation. The Barcelona-Valls section is a full-size cable with 58 quads of 16-gauge and 40 quads of 19-gauge conductors. The section between Zaragoza and the French border is a $\frac{2}{3}$ -full-size cable and is spliced to the French cable extending direct to Paris.

It would appear logical that the cable network should have started at Madrid, but when the cable program was initiated the section between Zaragoza and Tolosa consisted of a 6-arm toll lead while the Zaragoza-Madrid section utilized only 3 crossarms. The reason for

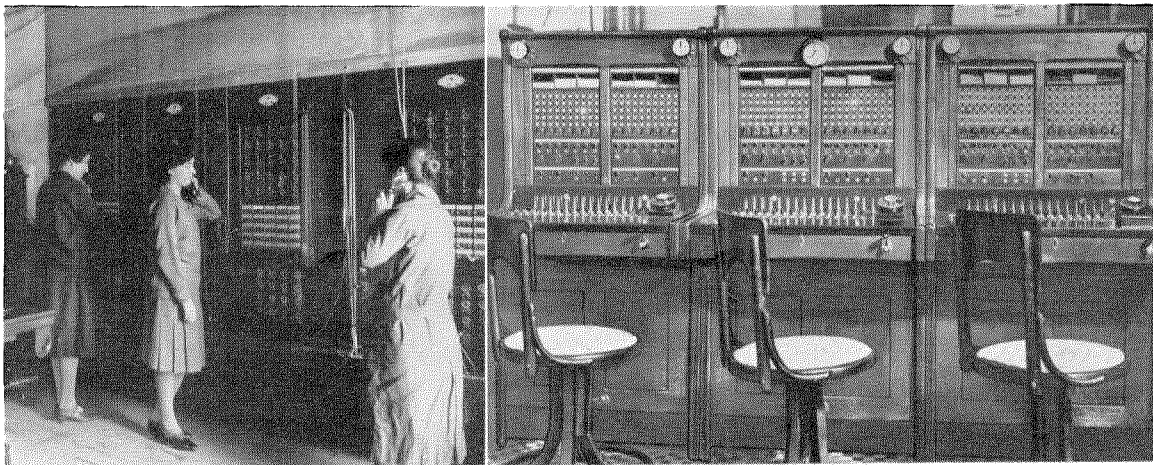


Fig. 1—In 1924, the urban switchboards at the left required 3 operators for each 100 subscribers. One of the modern boards at the right, under the control of a single operator, serves that number of subscribers.

this is the close community of interest in the Bilbao-Zaragoza area which requires a large number of circuits for intercity service. Also a large number of circuits were operated between Bilbao and Barcelona, the two principal industrial cities and the largest ports.

Barcelona is connected with Palma, Majorca Island, by ultra-short-wave radio designed for 9 channels, ultimately, and with 2 channels equipped initially. Palma in turn is connected to Ibiza and Minorca by ultra-short-wave radio.

Algeciras is connected with Ceuta on the African continent by submarine cable and by ultra-short-wave radio with land lines to Tetuan and other Moroccan points except Melilla, which is in direct communication with Malaga by an ultra-short-wave radio link.

Not shown on the map are the Canary Islands which are connected direct to Madrid by short-wave radio. The two largest islands of the group, Tenerife and Gran Canaria, are interconnected by submarine cable equipped for carrier operation ultimately. The smaller islands have recently been interconnected by radio.

The growth in total length of toll circuits, and the proportion of physical, phantom, carrier, cable, and radio are shown in Fig. 7. The chart

covers only the period to 1936 when the Spanish Civil War started. Very little change has occurred since then because of unsettled conditions.

2. Growth of Service

Within five years after the signing of the contract, automatic equipment had been installed in 27 offices giving automatic service to 18 cities. In 1943 there were 57 automatic offices in 47 cities.

Only 738 cities and towns had toll service in 1924. There are now 3,605 Spanish cities and towns with toll service not only to each other but to the telephone network of the world.

In 1924 there were about 80,000 telephones in the territory now served by the CTNE. At the end of 1944 there were 406,513 telephones, 72 percent of which were automatic.

Long-distance toll calls, in the first year of operation under the CTNE, totalled 3,169,883. In 1944, 41,623,586 calls were handled within Spain in addition to 212,755 calls to foreign countries although the traffic was naturally curtailed because of war restrictions.

At the time the contract was made, there were 40,145 kilometers of toll circuits in service, while in 1944 there were 137,976 kilometers of

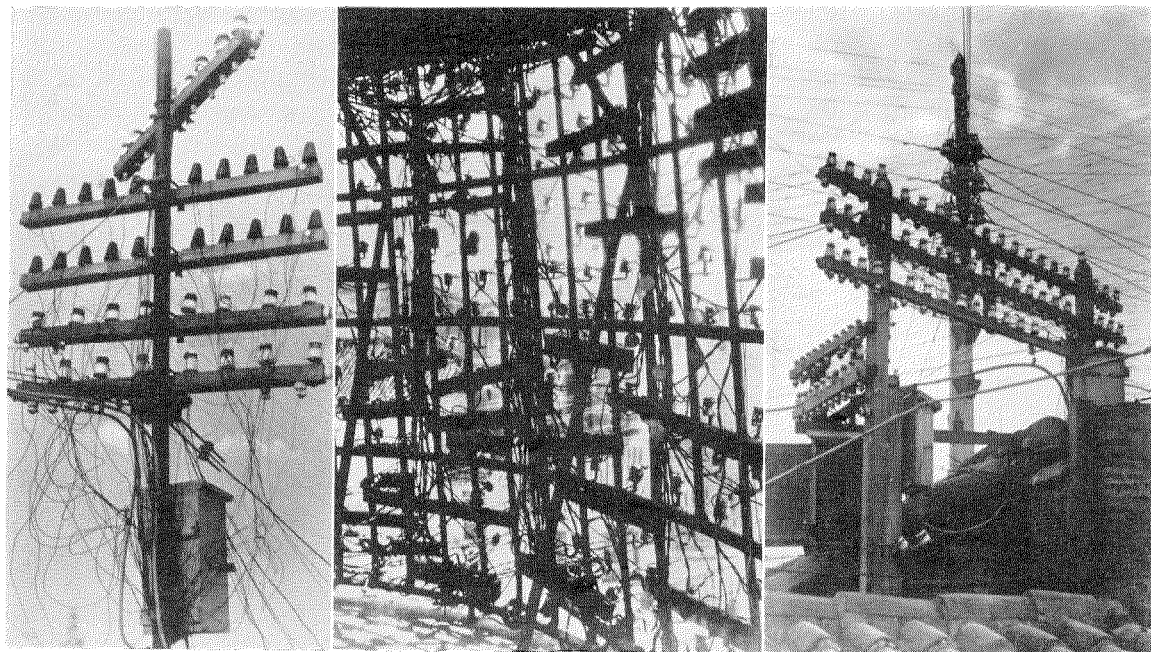


Fig. 2—Outside plant of the type utilized in 1924.

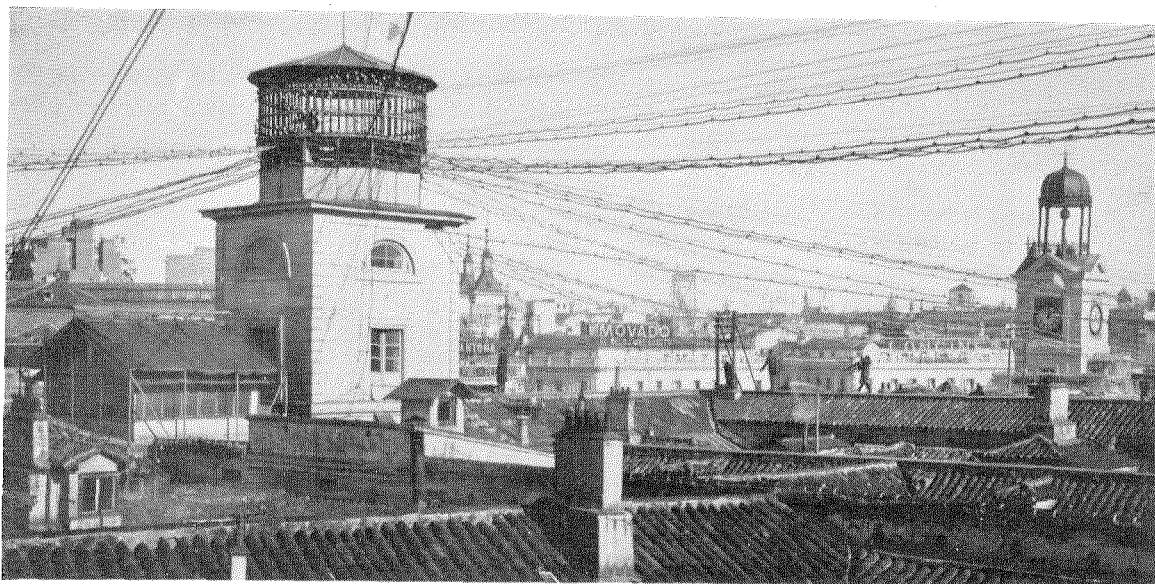


Fig. 3—Cable tower in the Puerta del Sol, Madrid, 1924.

open wire circuits. Through the use of toll cables, phantom circuits, carrier, and radio, a total of 387,699 kilometers of talking channel was available in 1944.

The growth of stations and long-distance traffic is shown in Fig. 8. The years 1936 to 1939, inclusive, are omitted as accurate data are not available for this period.

In 1924, international telephone service was available only to France and Switzerland through a Madrid-Paris circuit. In 1928, service was opened with the United States, Canada, and Cuba, via direct circuits from Madrid to London and thence to the U. S. A. by radio. In 1929, the Pozuelo del Rey radio transmitting station was opened with direct service to Argentina and by subfluvial cable to Uruguay. By 1936, service had been established to 78 foreign countries.

Development of the Spanish telephone system was interrupted in 1936 by the outbreak of the Civil War. The telephone company had hardly recovered from the effects of that conflict when World War II started. The consequent restrictions on materials have not permitted as extensive development during the war period as is considered desirable to meet the continuously growing demand for telephone service, both long distance and local. To meet this need, plans have been formulated for furnishing equipment and outside plant for 136,500 new subscribers and

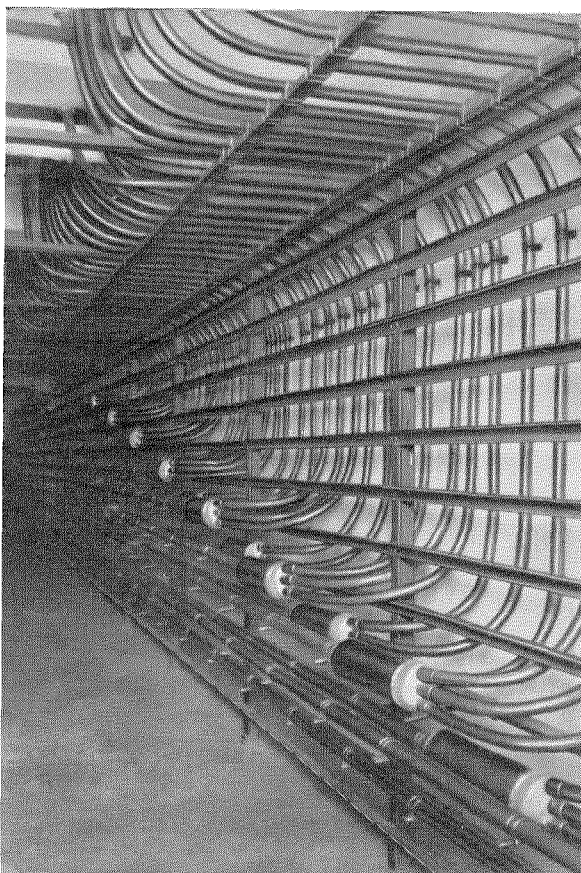


Fig. 4—Modern installation of underground entrance cables of the Jordan central office, Madrid.

for providing 224,000 kilometers of toll circuit, the latter to consist of cable and the maximum use of multichannel carrier telephone systems.

3. Personnel Training

One of the first steps taken by the company after obtaining the concession was the establishment of schools for training local personnel in the various phases of telephone work, a program which has been continued and amplified with highly gratifying results. Initially, these were purely practical schools teaching workmen how to do specific kinds of work. They were gradually developed over the years to include theoretical training in subjects such as geometry, trigonometry, physics, electricity, automatic telephony, plant-construction methods, and bookkeeping. The schools were designed to accommodate 200 students at a time. Terms lasted from two to six months depending on the subjects being taught. Students were selected by competitive examinations which in certain cases were open also to nonemployees. Salaries were paid to the students while learning and, in the case of those from out of town, certain living expenses were defrayed. Up to 1944, about 5,000 students had passed through the various courses at the school; the majority of them are today employed in some department of the CTNE.

As a result of this policy, the company is now staffed almost exclusively by Spanish nationals, who have been prepared in these schools for positions requiring the highest degree of specialized knowledge and training.

4. Spanish Factories

Although the initial demands compelled immediate importation of telephone equipment, two factories were planned, one for telephone apparatus and one for cable, to be operated by a newly organized company of the I. T. & T. system, Standard Electrica, S. A. For engineering personnel, promising students were selected from the famous universities in Madrid, Barcelona, and other cities of Spain. Many were sent abroad to study in the London, Paris, and Antwerp laboratories and factories of the I. T. & T. System.

Santander was chosen as the site for a cable plant. Aided by the manufacturing departments of associate companies in London, Paris, and Antwerp, this factory, soon after its inauguration in August, 1927, produced its first lead-covered cable, a 1212-pair paper-insulated subscribers' cable. In 1930 and 1931, the extensive toll cable between Zaragoza and San Sebastian was manufactured completely at Santander.

It was decided in 1925 to build the telephone factory in Madrid, where the engineering and technical services were located. While this factory was being constructed, a small staff, some machines, and two buildings in Madrid were obtained from a manufacturer of household electrical appliances, and production was started on simple telephone parts. Here were assembled and tested the first telephone repeaters to be installed in Spain to complete the initial long-distance circuit from Madrid to Ceuta on the north coast of Africa.



Fig. 5—Madrid toll operating room.

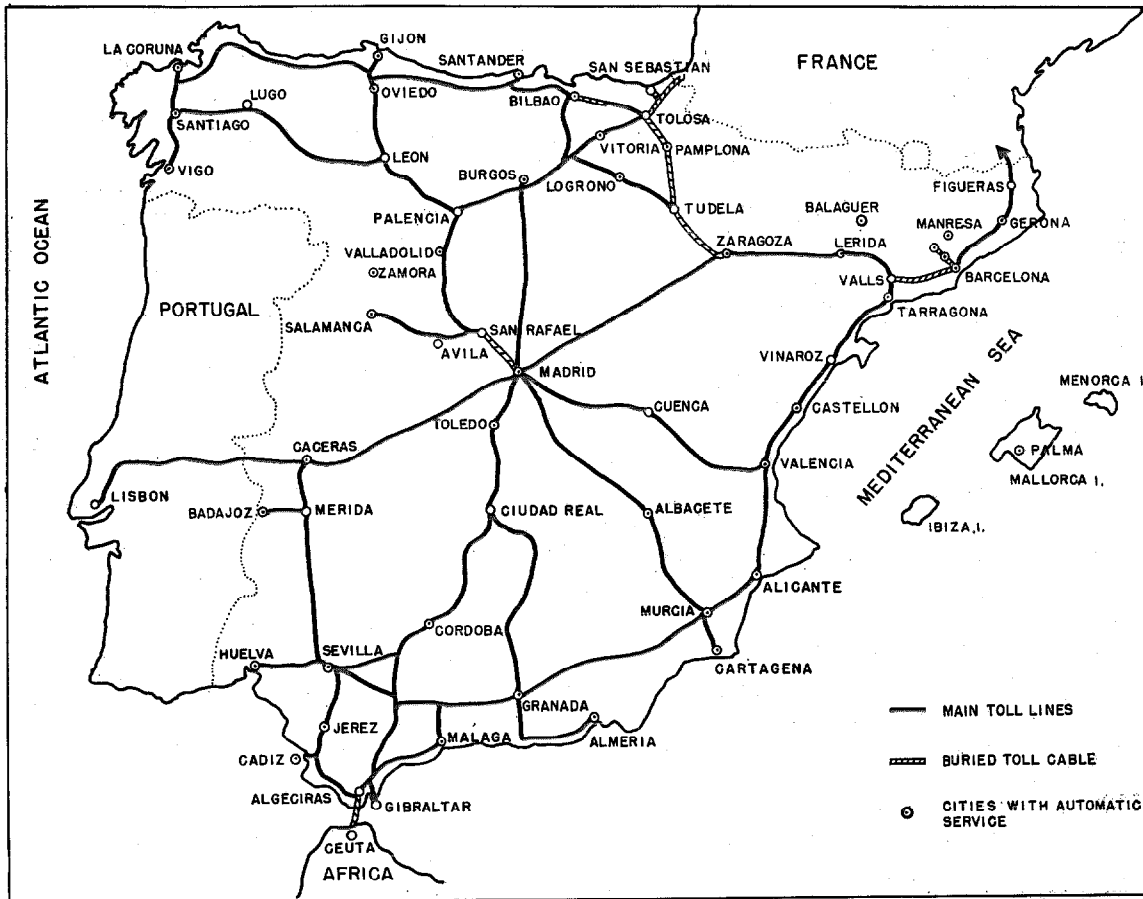


Fig. 6—Main toll network of Spain. Cities having fully automatic local service are indicated.

By February, 1928, when the factory shown in Fig. 9 was inaugurated, complete subscribers' sets were being manufactured in temporary quarters and the assembly of many items of equipment was well under way. Soon thereafter, a full-fledged engineering department was engaged in designing toll and central-office equipment. Even before the factory could produce all of the apparatus for those complex systems, parts were ordered from other I. T. & T. plants and the engineering and manufacturing was controlled from Madrid. Special radio apparatus for the Spanish army and navy was also being developed. A sales and engineering office was handling industrial and special communication installations.

After 1929, with these two factories, Standard Electrica, S. A., became the principal manufacturer for Compañia Telefónica Nacional de España. During the years 1934-35, Standard

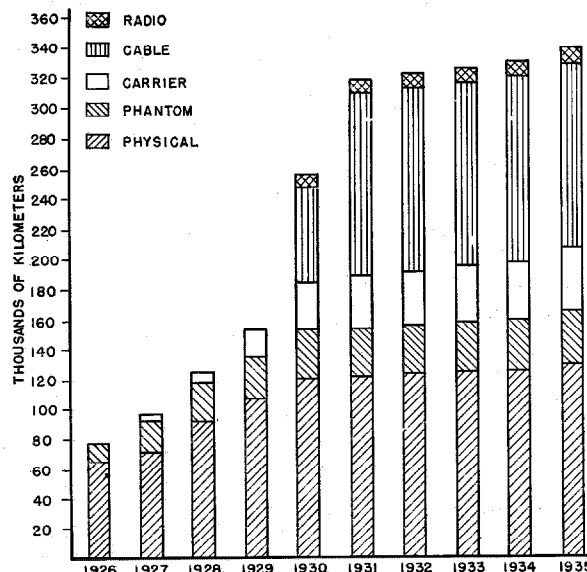


Fig. 7—Total length of toll circuits from 1926 through 1935, when the Civil War started. Unsettled conditions have prevented substantial expansion since then.

produced an average of approximately 10,000 lines each of 7-A and 7-B Rotary equipment. The program at that time contemplated the conversion of approximately 8 to 10 provincial capitals per year for which the complete automatic and toll equipment was engineered and manufactured locally.

At the present time, the Madrid factory, which continues under the control of the International Standard Electric Corporation, a subsidiary of I. T. & T., has built or has under construction approximately 400,000 square feet of manufacturing floor space and has a staff of about 2,200 trained employees. It has become a well-established national industry which, in addition to producing communications equipment for the telephone company and many branches of the Spanish Government, is Spain's principal producer of precision apparatus of all types.

5. *Résumé*

In 1924, the Compañía Telefónica Nacional de España was formed by I. T. & T. to receive from the Spanish Government an exclusive con-

tract to provide telephone service in Spain. Through the installation of automatic Rotary equipment for local and toll switching services, a reliable, rapid, and efficient system has been provided.

Careful planning and design; the installation of adequate equipment, properly maintained; and the effective handling of engineering, traffic, and commercial problems have in the twenty years of this system, resulted in a telephone service to the public second to no other and established a most successful company from all viewpoints.

This modern telephone system is now in the control of the Spanish Government. It should perhaps be added that the Spanish Government has indicated its intentions of maintaining the CTNE as a private enterprise by distribution of the shares acquired from I. T. & T. to the Spanish public, in which case, the Government has also indicated its desire that I. T. & T. reacquire a small block of shares and enter into a technical and advisory contract to assist the CTNE in its further development and operation.

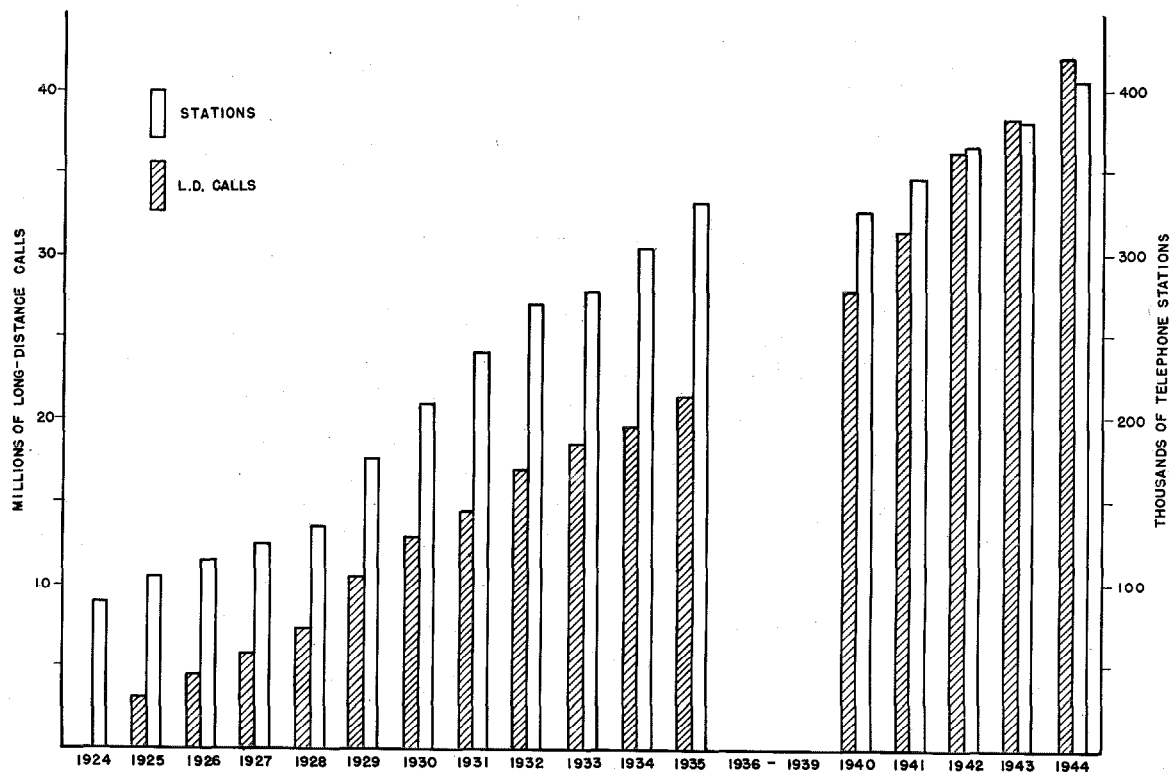


Fig. 8—Growth of subscribers' stations and long-distance calls. Data for the period of the Civil War are not available.



Fig. 9—The Madrid factory of Standard Electrica, S. A., one of the two I.T.&T. plants in Spain.

The use of associate-company laboratories and factories in training engineering personnel, the availability of their experienced staffs in getting Spanish factories in operation, together with the establishment of a trade-type school in Madrid, reduced greatly the time that would ordinarily have been required in building and manning this organization with Spanish nationals.

Since the modernization program was initiated, the number of subscribers has increased over five times. Moreover, the length of toll talking channels has been extended more than ninefold, and the volume of long-distance traffic has multiplied about thirteen times.

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