The Volta Centenary Exhibition at Como

MAY TO OCTOBER, 1927

THE object of this exhibition cannot be better stated than in the words of the invitation of the Executive Official Committee:

> Alessandro Volta, by his marvelous invention of the voltaic cell rendered possible telephony and telegraphy. These are foremost amongst the applications of electricity to the practical problems of civilisation. To recall his achievements, it was thought appropriate to regard telegraphy and telephony as a symbol, and to promote at Como an International Exhibition and an International Technical and Scientific Congress relating to them and to radio. We therefore invite all public and private telephone administrations, all manufacturers of apparatus and telegraph and telephone material, and all persons interested in the problems of telegraphy, telephony, and radio to participate in the Exhibition and at the Congresses.

The historic Villa del'Olmo (Figure 1), that recently became the property of the Como Council, was utilised for the Exhibition. It is situated about a mile from Como, at the edge of the lake. With its large park and spacious pavilions it admirably served its purpose.

The Exhibition was formally opened on May 28, 1927, by H. M. the King of Italy. The operating administrations or companies, giving telegraph and telephone service in different countries, exhibited representative items in the Villa del'Olmo itself. Manufacturers' exhibits were located in the new pavilions on the left of the Villa. Professor di Pirro, Director General of the Istituto Sperimentale of the Italian Post, Telegraphs and Telephones, was responsible for the organisation of the first group. Mr. Comboni, Secretary of the Italian Electrotechnical Association, organised the second group. There was also an exhibit to convey an idea of the development of hydro-electricity in Italy and another of silk material and silk-weaving machinery.

The exhibits (Figure 2) of the International Standard Electric Corporation and the Standard Elettrica Italiana, its Italian Associated Company, located in the largest pavilion, were intended to show the various aspects of electrical communication. The outside plant exhibit included underground and open-wire lines installed in the park. The underground exhibit demonstrated the method of laying a cable into a trench from a cable reel trailer, and the arrangements for jointing, pressure testing, mechanical protection and bonding.

A loading coil manhole, of countersunk type, had a base of concrete, supporting two concrete cylinders containing the bodies of the loading pots. The sides and ends were of concrete and the top was made of removable slabs of reinforced concrete, so that the cable joint was easily accessible. One of the loading pots was jointed to the main cable. The second pot was in position, ready to be jointed.

Another method of protecting the joints, especially for non-armoured cables laid in ducts, was illustrated, in which two cable joints were protected by means of a collapsible concrete box. The base and the ends of the box were in one piece. The sides and the lid could be removed to give enough space when working on the joint.

Toll and exchange cables, including an armoured cable and a leading-in cable from an aerial route, entered a manhole from different sides and through a glazed earthenware duct, thus indicating the manner in which it could be led into the basement of an exchange.

The aerial exhibit showed how a underground cable may be extended from a terminal pole of an aerial route. An insulating joint separated the underground and aerial sheaths to prevent stray currents from passing to or from the underground system. The steel strand was of suitable strength for the suspension of the heaviest type of telephone cable manufactured. The loading of an aerial cable was illustrated by an H-pole structure, carrying two loading pots supported by brackets and girders. Provision was made also for the two additional pots to be placed subsequently. On the next pole, the toll cable was terminated through fuses and lightning

arresters contained in a No. 18 type cable terminal, and from this point the toll circuits were continued by ten pairs of open-wire toll-lines, suitably transposed. In the same span, a subscriber's aerial cable was erected. Half of this was terminated on the next pole through carbon arresters and a "B" type cable terminal. Some of the remaining circuits were taken underground; the others were carried over the last span in a small aerial cable and ended in a C-type terminal.

Figure 1—The Villa del'Olmo.

The repeater exhibit, Figure 3, displayed specimens of the various types of bays placed in one row. From left to right they were: the No. 5 Toll Testboard, the repeating coils and networks, the 20-cycle ringers, the voice frequency ringers, the 4-wire terminating sets, the 2-wire and 4-wire repeaters, and the testing and supply apparatus.

The No. 5 Toll Testboard employs the ordinary iron racks used for repeater mounting, in place of the switchboard type used heretofore. This testboard is used in repeater and terminal stations for making maintenance measurements on the lines and apparatus, and for making temporary connections between the lines and apparatus to meet emergencies. A voltmeter position and a Wheatstone Bridge position were exhibited and part of the jack field was wired to the apparatus on the other racks. The next three bays contained the repeating coils used to obtain the proper impedance ratio between the line circuits and the repeater or office equipment, also the balancing networks for 2-wire repeaters and the low frequency correctors for 4-wire repeaters. The first bay on the left was for the 2-wire circuits, while the two bays on the right were for the 4-wire circuits.

The repeater rack itself consisted of five bays. The first from the left included the 20 to 20 ~ through ringer panels, the second the voice-frequency ringer panels, and their test panel,

while at the bottom were the terminating sets for the 4-wire circuits. The third and fourth bay included respectively the 2-wire and 4-wire repeaters, the latter being used for long circuits. The last bay on the right carried echo suppressors and their test panel. The echo suppressor is designed to eliminate the echo currents coming back on a long 4-wire circuit.

The exhibit of automatic switching machines consisted of various types of automatic private branch exchanges. The telephone service in the whole exhibition was given by a No. 7000 P.B.X., with its associated attendant's board to establish and record the toll calls.

The second part of the automatic exhibit was a demonstration of the Rotary System for large

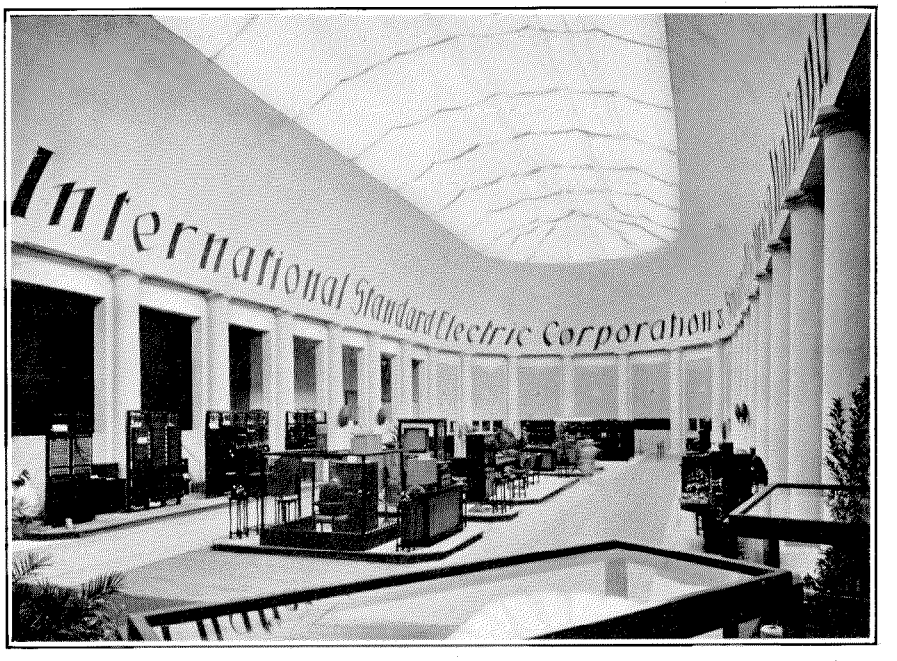

Figure 2—Exhibit of the International Standard Electric Corporation and Its Associated Company, Standard Elettrica Italiana.

The last rack consisted of four bays of testing and control apparatus. On the left was a transmission measuring set, capable of measuring transmission line levels and losses, repeater gains or apparatus losses. The second bay included a variable frequency oscillator, having a range of 35 to 50,000 cycles per second and its special amplifier, for the supply of amplified testing frequencies.

The third bay carried the meter panels for measuring currents in the filament and plate circuits, a filament control panel for making valve rejection tests, and a key panel. The last bay on the right contained the fuse panels and the plate (circuit and 20 ~ ringing supply) protection lamps. A small rack, erected behind the main exhibit held a generator giving the voice frequency ringing current, at 500 cycles magnetically interrupted at 20 cycles.

city areas, showing the way in which a call is established through the interconnected offices. Though there were only five lines completely equipped, every particular case, such as "busy line" and "non-completed call," could be shown and demonstrated.

The third part consisted of a certain number of small automatic P.B.X's of the step-by-step type. On each side of the No. 7000 automatic switchboard was a No. 7001 P.B.X., the capacity of which was 35 lines.

In order that the visitors might get an idea of the different kinds of manual switchboards used in urban and toll telephony, some typical specimens were exhibited. The first on the right consisted of two positions of a No. 1 Toll Board, and an associated cord circuit repeater. Every line which can be used with this repeater has a balancing network and the operator has a de-

vice to put them in circuit and to control the gain.

One of the principal exhibits was the broadcasting station, complete with its studio, control, and machine rooms. The radio transmitter was

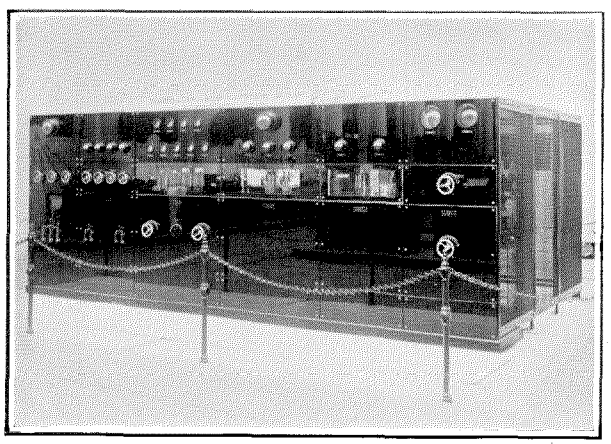

Figure 3—Repeater Exhibit of the International Standard Electric Corporation.

capable of delivering 5 KW. to the antenna system, and it operated on a wave-length of 500 metres. It is similar to that of Prague, except that the speech input equipment and oscillator modulator unit have been modified.[1]

Two forms of microphone were used; i.e., the condenser type and the double-button carbon instrument. Adjacent to the studio was the control room, which contained the speech input equipment and a power switchboard at the back.

The radio transmitter itself (Figure 4) was of recent type, in which the carrier current is generated at very low power level. Modulation also is performed at low level, subsequent multi-stage high frequency amplification giving the power required for feeding the antenna. This arrangement results in high quality modulation and it has other important advantages.

A No. 1 Public Address System was used for distributing speeches and music. The connections were such that, if desired, the System could be operated from the microphone and the speech input equipment used in broadcasting.

The loud speakers were arranged in four groups, giving different kinds of service. Some of the projectors were set in a direction to send speech and music over the lake and to the other bank, east of Como. The broadcasting station and Public Address System were used regularly and they relayed daily the orchestra of the Villa d'Este; another orchestra also played nearly every day in the studio.

The Public Address System was used during the Italian and International Regattas, on the Lake of Como. A small radio transmitter was installed in a motor-boat, while the receiving set in the studio transmitted directly the results, through the Public Address System, to the thousands of people crowded over the Exhibition ground.

In September, when numerous congresses were held in Como, the broadcasting station and the Public Address System were used to relay the principal speeches delivered in the Villa del'Olmo, the Social Theatre or the Carducci Institute of Como.

Apart from the testing apparatus shown in the repeater exhibit, specimens of portable sets were exhibited; i.e., a transmission measuring set, a crosstalk measuring set, a capacity unbalance set and several artificial lines. The oscillators used to provide the testing current for these sets included small vibrators as well as vacuum tube oscillators of large frequency range. There was also a test set, giving the complex wave used for crosstalk measurements. These oscillators were located near a cathode ray

Figure 4—5 KW. Radio Transmitter—Front View.

oscillograph on which their wave-forms could be examined by the visitors. A microphone was used also to show the wave forms of the vowels of speech. In all these tests the time

[1] "The Prague Radio Broadcasting Station," E. M. Deloraine, ELECTRICAL COMMUNICATION, Vol. 5, No. 3, January 1927.

base was obtained with low frequency oscillating current controlled by a neon lamp.

There could be seen also different types of subscribers' sets, either for local battery or for central battery plants, and for automatic lines. Among them were different models of the French Administration 1924 type, manufactured by Le Matériel Téléphonique, and chosen by the Administration as the standard set.

Next were a few examples of radio apparatus, including a two-tube receiving set, made in Antwerp, an amplifier and the associated Kone Loudspeaker. The exhibit included also a field strength measuring set, developed in London, used for the determination of antenna efficiency. The field to be measured could be adjusted to a value as low as one microvolt/metre. At the back of the broadcasting station, was a 50 watt point-to-point transmitter, of the type used in whalers.[1]

A collection of vacuum tubes showed the types employed in repeater equipment and those for radio telephony. Among them was the 10 KW. water-cooled tube with pyrex glass envelope used for large broadcasting stations, such as the Rugby station on the transatlantic radio-telephone circuit.[2]

The chief items of importance among the telegraph exhibits were two No. 14 Morkrum Teletype Printers,[3] operating upon an artificial line, and a Keyboard Perforator[4] and a Tape Transmitter for the Baudot Multiplex System.

The train or tram dispatching installation consisted of a dispatcher station and three way-stations.

Exhibits of the Telephone and Telegraph Administrations

Instructive features were to be observed in the Exhibition of the Telephone and Telegraph Administrations, located in the Villa del'Olmo itself.

The Austrian Administration exhibited among other items the Hauck type battery made in 1866 at Vienna, a diagram of the first duplex telegraph experiments carried out at the Vienna Imperial Academy of Science in 1853, a complete collection of parts of telephone and telegraph installations, and a map of the Austrian cables.

The French Exhibit comprised some historical apparatus, including Bourseul's receiver and Branly's coherer. There were also parts of a small broadcasting station and of a short wave station and a model of the buildings and antenna of the Bordeaux-Lafayette wireless station. It was completed by some examples of aerial lines, switchboards and subscribers' sets, among which the type 1924 handset made by Le Matériel Téléphonique, and chosen by the Administration as a standard set, could be seen.

The German Administration had gathered a number of early models of telegraph sets, among which those of Steinheil, Gauss and Werner were especially to be noticed. It also had a collection illustrating the history of the electric cell, from a Volta's "pila" to the modern telephone cells.

The General Post Office of Great Britain showed a model of one of the Rugby masts for the transatlantic radio-telephone station and for their long-wave radio-telegraph stations. In front of the mast were a number of early models of vacuum tubes. The historical part contained a d'Arsonval microphone and receivers of the Bell and Reiss type. The modern apparatus included some measuring sets, particularly for checking microphone efficiency.

The Dutch exhibit included photographs, drawings, and parts of equipment, illustrating the short-wave links between Holland and Java.

The Hungarian Administration exhibited two models of the wireless station at Csepel and Szekesfehervar and a great deal of apparatus manufactured by leading Hungarian firms.

The exhibition of the Italian State was very important, as a great number of government departments had taken part in its preparation. A special commission had been appointed by the King of Italy for the publication of a national edition of Volta's works; the volumes ready at the time of the Exhibition were exhibited as well as photographs of Volta's most interesting manuscripts and apparatus (Figure 5).

[1] "Radio Telephony Applied to Antarctic Whale Hunting," E. A. Rattue, ELECTRICAL COMMUNICATION, Vol. 5, No. 4, April 1927.

[2] "Transatlantic Radio Telephony—Radio Station of the British Post Office at Rugby," E. M. Deloraine, ELECTRICAL COMMUNICATION, Vol. V, No. 1, July 1926.

[3] "Morkrum—Kleinschmidt Printing Telegraph Systems," H. P. Clausen, ELECTRICAL COMMUNICATION, Vol. 5, No. 3, January 1927.

[4] "A New Keyboard Perforator for the Baudot Printing Telegraph System," A. E. Thompson, ELECTRICAL COMMUNICATION, Vol. 3, No. 4, April 1925.

A collection of Marconi's first radio telegraph transmitters and receivers and early radio-telephone transmitters was shown; and among other historical apparatus, the Istituto Superiore Postale Telegrafico Italiano sent the transmitter used in the radio-telephony experiments[1] between Rome and Tripoli in 1908.

showing the rapid development of the telephone plant, particularly in the northern part of that country.

The Swiss Administration exhibited some of their earliest switchboards. A map illustrated the efforts made to provide adequate national and international service.

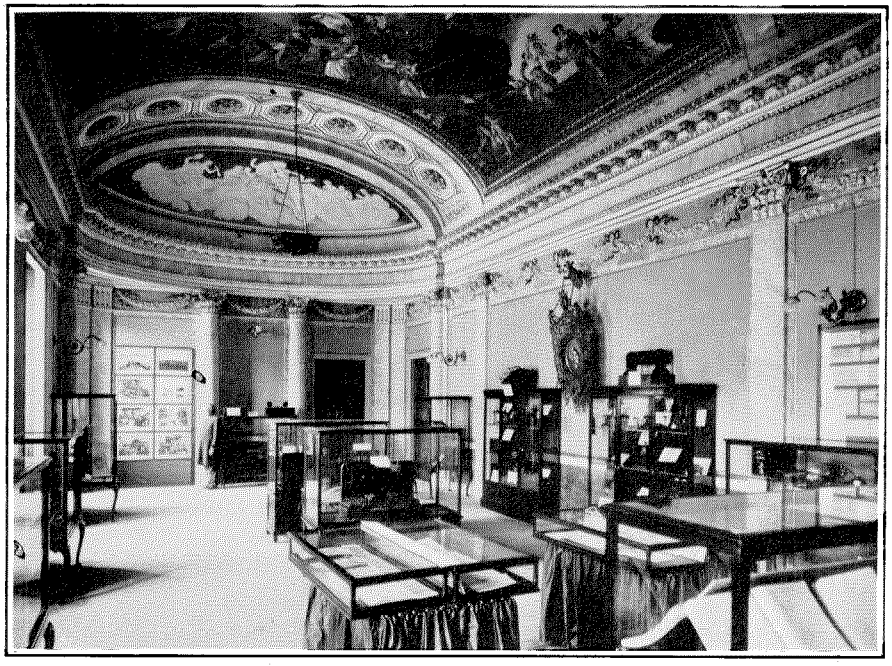

Figure 5—Italian State Exhibit, Including Volta Relics.

The Italian Services exhibited telephone and radio-telephone sets specially made for specific purposes. The Italian Navy had erected, near the side of the lake, a short-wave wireless telegraph station, using a simple self-oscillating water-cooled tube of the 10-KW. type.

The Japanese Administration sent photographs showing automatic exchanges in course of installation in Tokio and the development of radio, in which the International Standard Electric Corporation and its Associated Company, the Nippon Electric Company, Ltd., are playing a very large part.

A representative collection of apparatus used in Sweden was completed by a luminous map

[1] See Jour. Inst. E. E., Vol. 64, November 1926, page 1113.

A few models of telephone poles and a number of photographs illustrated the work of the Czecho-Slovakian Administration and particularly the beginning of their cable network.

In addition, the American Telephone and Telegraph Company's exhibit presented a general survey of the activities of the Bell System, together with the important steps in the history of telephony in the United States. A replica of Dr. Bell's Exhibit at the Centennial Exposition at Philadelphia in 1876 could be seen. There were three models of the first commercial telephones employed in the United States, and also a working model of the first commercial switchboard. It had eight lines and was installed in 1878 to connect fifty subscribers at New Haven, Connecticut.