

Uddrag af

# **Electrical Communication**

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## Recent Achievements

**Soviet Minister Sergueitchuk Visits Standard Elektrik Lorenz**—A delegation of experts led by K. Sergueitchuk, First Vice-Minister of the Soviet Post, Telegraph, and Telephone Administration, visited Standard Elektrik Lorenz during its stay in the Federal Republic of Germany from 24 August to 8 September 1966. Some members of the delegation are shown in Figure 1.

Primarily interested in post office automation, they inspected installations in Cologne, Hamburg, and Wiesbaden, as well as the postal check handling system in Nuremberg. At Stutt-

gart, they visited the cable plant and the quasi-electronic telephone switching center in Stuttgart-Blumenstrasse.

*Standard Elektrik Lorenz  
Germany*

**Satellite Earth Terminal in Grand Canary Island**—Telephone tests have been made from the newest satellite earth terminal on Grand Canary Island via the newest commercial communication satellite, Intelsat 2, to the earth station of the Communications Satellite Corporation at Andover, Maine, and to Ascension



Figure 1—Soviet delegation visits Standard Elektrik Lorenz. From left to right are: Messrs Zabotin, Head of the Engineering and Designing Department of the Soviet Telecommunications Administration; Gille, Director of Standard Elektrik Lorenz; Abtmeyer, General Manager at Standard Elektrik Lorenz; Lamm, chief engineer in the Soviet Telecommunications Administration; Ponomarjew (interpreter); and Minister Sergueitchuk.

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Island also. These are, respectively, 3500 and 3000 miles (5600 and 4800 kilometers) away over the surface of the earth.

Built for *Compañía Telefónica Nacional de España*, the new earth station is near an existing spacecraft tracking station of the United States National Aeronautics and Space Administration to which it will be available for use in the Apollo man-on-the-moon program. The station uses two automatic-tracking antennas that are 42 feet (12.8 meters) in diameter, ultra-low-noise receivers, and high-power transmitters.

*ITT Federal Laboratories  
United States of America*

**Nationwide Dialing Nearly Complete for Vienna**  
—In October 1966 a new crossbar telephone

exchange in Vienna-Treustrasse was cut over. (See Figure 2.) Among other services, the new crossbar switching equipment provides direct distance dialing to Austria, Germany, Switzerland, and Liechtenstein by the 9100 connected subscribers.

This is the seventh new crossbar exchange in Austria, which for the past ten years has been modernizing its telephone system with crossbar switching equipment.

*Standard Telephon und Telegraphen  
Austria*

**European Mediterranean Tropo Network**—The United States Air Force has accepted the last five sites that complete the European Mediterranean Tropo (EMT) section of the Mediterranean Communications Network (Medcom).

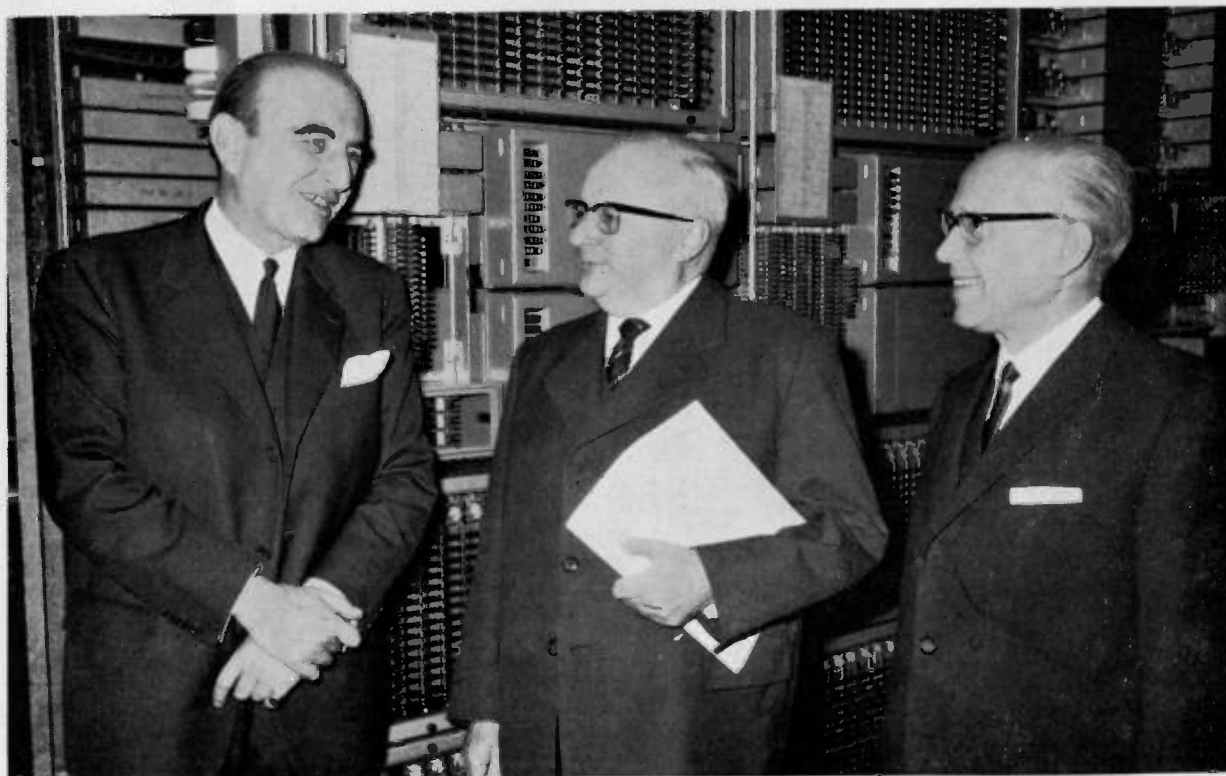


Figure 2—Dr. Machold, President of Austrian Telecommunications Administration—Lower Austria; F. W. Mayer, Managing Director of Standard Telephon und Telegraphen; and E. Klose at the inauguration of the new crossbar telephone central office in Vienna-Treustrasse.

The newly completed European Mediterranean Tropo system comprises 23 sites in Spain, Italy, Greece, and Turkey. Voice, teleprinter, facsimile, and digital data are handled over 2.7-gigahertz tropospheric-scatter and 8-gigahertz line-of-sight transmission links. It is designed to be 99.9 percent reliable despite equipment breakdown, radio disturbances, and human errors.

The Mediterranean Communications Network uses 99 sites to cover a route of 2700 miles (4300 kilometers) and has a potential of about 300 000 circuit miles (480 000 circuit kilometers). It links the Spain-United Kingdom Tropo System running from England to Morocco with the German-United States Armed Services Network (USAFE) at Livorno, Italy, and with the United States Air Force-Turkey Tropo System.

The following services were provided for the European Mediterranean Tropo system: program management; engineering; preparation of equipment specifications; procurement and installation of equipment including operational and depot spare parts; installation, checkout, and alignment of all electronic equipment; documentation of all operations; and final testing for acceptance by the Air Force.

*Federal Electric Corporation  
United States of America*

**Tellurium Deposition for Recording**—The high-speed teleprinter system *Lo 2000* uses a printing principle in which a paper surface in contact with a tellurium plate is inked by tellurium electrolytically transported at points where an electric current flows through the wetted paper. Inexpensive normal teleprinter paper may be used and the instantaneous printing does not need processing or stabilization.

This technique offers the possibility of recording a large amount of binary information at one time by replacing the printing heads of the printer by a stationary comb of many printing needles lightly pressed against the paper.

One such application is in the testing of thick metal plates by ultrasonics. The plates move continuously through the test equipment in which one or more lines of ultrasonic heads are mounted. The tellurium printer uses a set of printing needles arranged in the same pattern as the ultrasonic heads. The electrical signals generated by the ultrasonic heads indicate laminations and cavities; they are fed to the printing needles after having passed through an electrical threshold network. The result is a scaled-down diagram of the tested plate with all defects localized. Special print needles at both edges of the paper produce scales to facilitate the plotting of the recording.

This kind of equipment has been approved by rolling mills. Many other applications include the recording of data relating to traffic and seismic research.

*Standard Elektrik Lorenz  
Germany*

**Automatic Manufacture of Wire Springs for Relays**—A new multipurpose machine has been designed, developed, and put into operation for all of the mechanical operations involved in the manufacture of the wire springs for twin relays that are to be carried out after the "moulding-in" and before the "contact-welding" operations.

The spring nests pass through the machine on a guide-block for the following operations: wire-ends are "contact-shaped," terminals are cut to length, terminals are twisted in 1st step at 6 positions and in 2nd step at 4 positions, twisted terminals are flattened, and the appropriate shape is given to the terminals after which they are cut to the required length.

Operations are performed by hydro-pneumatic presses having capacities of 2.4, 9.6, and 22.5 tons. The production speed is 14 units/minute.

The machine is protected against any deterioration due to badly shaped pieces by both electrical and pneumatic devices.

*Bell Telephone Manufacturing Company  
Belgium*

## Recent Achievements

**Standard Telecommunication Laboratories Increases Plant**—During 1964, when an article describing Standard Telecommunication Laboratories\* was written, a third laboratory wing had been added to the original two, and now a fourth wing has been completed, which is to be seen in Figure 3. In this aerial view, the four laboratory wings stretch towards the left from the office block and restaurant; at the right top corner is the garage, a 2-megavolt Van de Graaff electron accelerator, and the physico-chemical laboratory.

*Standard Telecommunication Laboratories  
United Kingdom*

\*J. K. Webb, "Standard Telecommunication Laboratories," *Electrical Communication*, volume 40, number 1, pages 109-123; 1965.

**New Factories in Belgium**—During October 1966 three new plants were the object of official ceremonies attended by important personalities, among whom were Willy de Clercq, Vice Prime Minister of Belgium; Henri Maise, Minister and Secretary of State of the Belgian telecommunications administration; and Ridgway B. Knight, United States Ambassador to Belgium.

The new 20 000-square-meter (215 000-square-foot) Frigibell refrigerator factory in Geel houses 350 employees and has a production capacity of 50 000 deep-freeze chests per year. This plant shown in Figure 4 will soon be extended by some 3500 square meters (38 000 square feet) to house the activities of the radio and television department.

Construction was started on a second plant in Geel that will cover 50 000 square meters

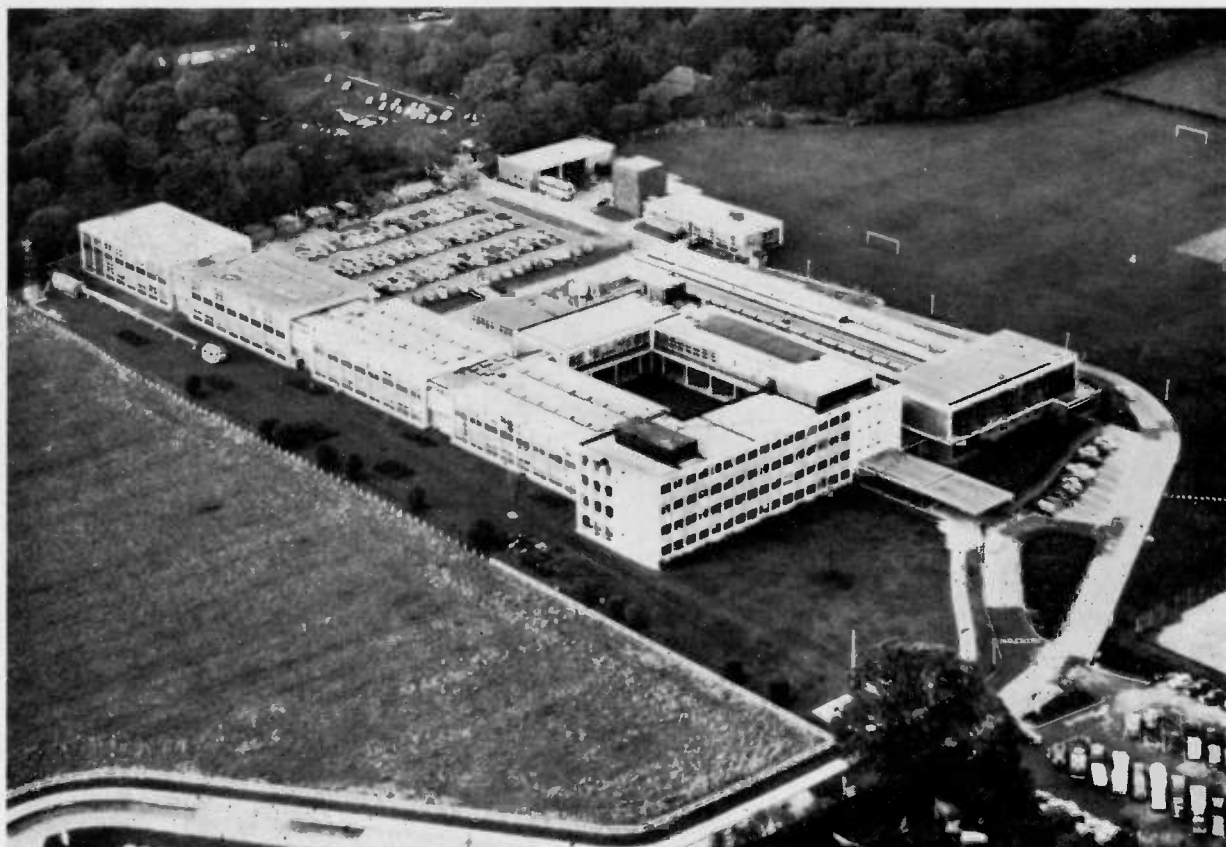


Figure 3—Aerial view of Standard Telecommunication Laboratories in Harlow, Essex, England.

(540 000 square feet) and employ 3000 workers by the end of 1969. Rotary and Pentaconta switching equipment manufacturing operations will be linked with those of the main factory, established in Antwerp in 1882.

In Wasmes, construction was commenced on an industrial products plant that will produce telephone sets and signaling equipment.

*Bell Telephone Manufacturing Company  
Belgium*

**Components for Hobbyists**—A new division, Electroniques, has been formed to supply components and equipment through the United Kingdom retail trade to radio and electronics enthusiasts. The range of equipment includes test sets, modules, tools, and components—11 000 items in all—produced by over 80 British and overseas manufacturers. A 608-page reference book called “Hobbies Manual of Suppliers and Ideas” is on general sale to assist the hobbyist. It includes details of components and circuits and shows how to obtain the best performance.

*Standard Telephones and Cables  
United Kingdom*

**Grosscitomat Crossbar Exchanges to Finland and Mexico**—Kansallis Osaki Pankki, the largest Finnish banking institute, in Helsinki, has placed an order for a Grosscitomat crossbar telephone exchange to replace an existing installation. The new switching equipment has a capacity of 150 exchange lines and 1200 extensions.

A hotel version of the Grosscitomat private automatic branch exchange for 60 trunk lines and 450 extensions will be installed in one of the modern hotels now being built in Mexico City to accommodate visitors to the 1968 Olympic Games.

*Standard Elektrik Lorenz  
Germany*

**Pentaconta Crossbar Equipment for Zambia**—An order has been received for Pentaconta crossbar equipment to be installed at four main trunk switching centers in Lusaka, Kitwe, Livingstone, and Ndola with interfacing equipment at ten other exchanges in various parts of Zambia. The equipment will provide Zambia with a modern subscriber trunk dialing system.

*Standard Telephones and Cables  
United Kingdom*



Figure 4—New Frigibell refrigerator factory at Geel in Belgium.

## Recent Achievements

**Artemis Electronic Exchange Completed**—The Artemis exchange, shown in Figure 5, utilizes reed-contact switches and a stored-program centralized control. It has a capacity of 2000 lines and is now equipped for 800 subscribers.

It will be used as a private automatic exchange at the main factory of Le Matériel Téléphonique near Paris but, to study its interconnection with rotary and Pentaconta exchanges, it has been integrated into the Paris public network in the sense that it will operate as a normal public exchange for a certain number of lines. The corresponding telephone sets will arbitrarily be equipped with dial or push-button signalling.

This Artemis exchange is the result of close cooperation with the CNET (Centre National

d'Études des Télécommunications) and SO-COTEL (Société Mixte pour le Développement de la Technique de la Commutation dans le Domaine des Télécommunications). The former developed the computer with centralized control unit, called a multiregister, which was constructed by the latter. Le Matériel Téléphonique designed and built the speech network and the junctors for connection with the various rotary and Pentaconta public exchanges (urban, suburban, and toll exchanges) and provided the programming.

Artemis was operative, carrying a progressively increasing load, for several months before its official inauguration in June 1967. It is the first automatic exchange using reed contacts and

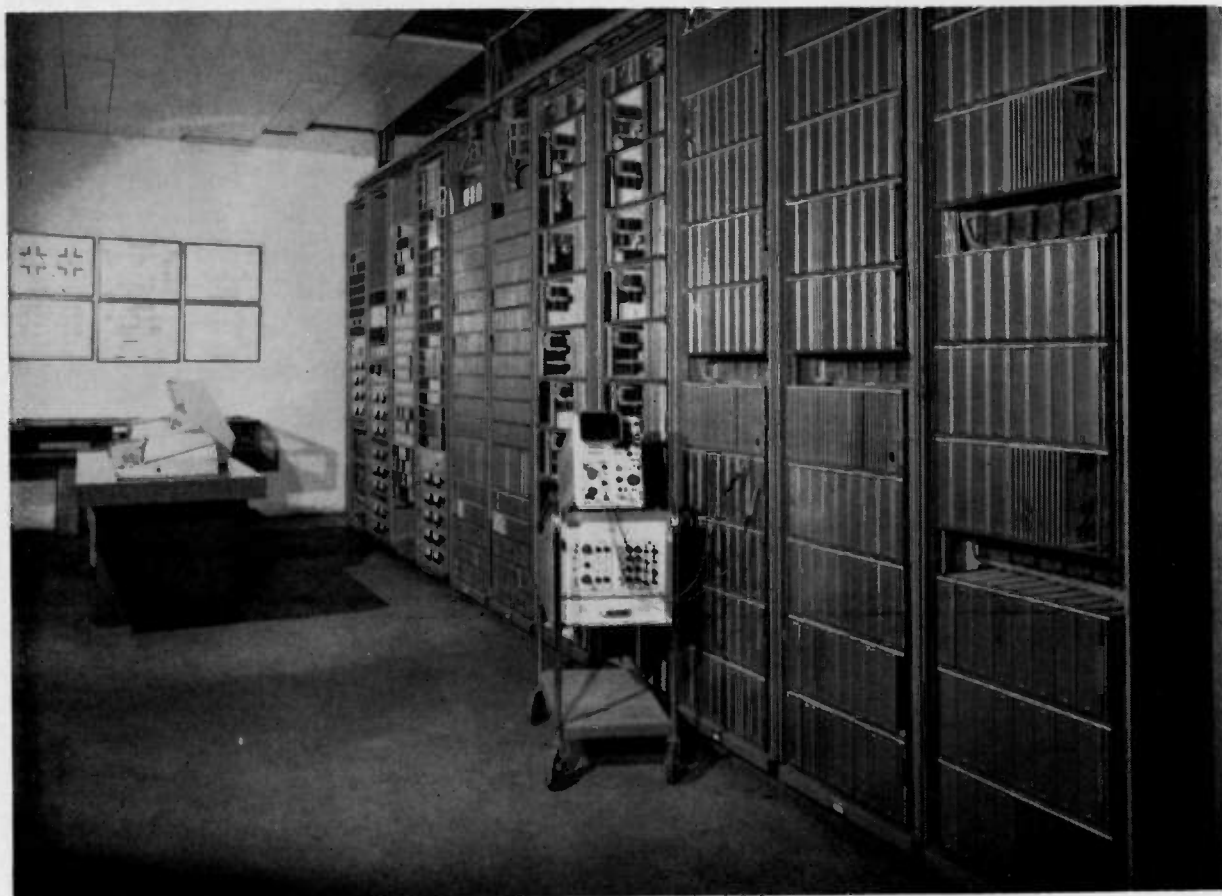


Figure 5 —The Artemis exchange in Paris uses reed contacts and stored-program centralized control.

stored program that has been cut over in Europe. Its integration into a large public network required solving many difficult inter-connection problems.

*Le Matériel Téléphonique  
France*

**Programed Instruction**—An 8th-grade class of students taught by programed instruction acquired the same knowledge of algebra in a half year as a 9th-grade class learned in a year with conventional teaching. In another case 400 employees were selected to learn a new data collecting system. A control group of 40 taught by conventional means reached a 2-percent error level in 7 weeks while the larger group under programed instruction achieved a 1-percent error level after only 1 week.

Based on behavioral psychology, programed instruction takes the form of a book, a text, or a manual that presents small units of information one at a time in the most-informative and easy-to-remember order and regularly challenges the student to prove that he has learned what he read. Each student works at his own pace, the fast learner accelerates his pace to avoid boredom, while the slow learner goes at a reduced pace to avoid anxiety over possible failure.

The cycle of learning involves presentation of a small unit of information followed by a question, these two providing a stimulus. If the response to the stimulus is wrong, the subsequent material will show him how to derive the correct answer. This is called feedback. If the answer is correct, he is so informed. This is a psychological reward or, as the psychologists say, his knowledge is reinforced.

In experiments by the United States Army, trainees taking programed instruction progressed twice as fast as those using conventional lecture-textbook methods and retained the information longer.

Over the past few years, dozens of programed instruction texts and training courses have been developed for industry and government and have shown their effectiveness in many subjects and with a wide range of students.

*Federal Electric Corporation  
United States of America*

**Isolator Filters Use Active Signal Regeneration**—The series 4200 isolator filters use active solid-state design to control the loss in the pass band. A typical unit has zero attenuation in the pass band from direct current to 8 kilohertz and at least 100 decibels attenuation from 14 kilohertz to 1 gigahertz in the input-to-output direction. In the reverse direction the attenuation is not less than 100 decibels from direct current to 1 gigahertz.

The input and output are powered from separate direct-current sources, which may be obtained from the associated equipment or from special power supplies. This provides direct-current isolation between the interfacing equipments of greater than 50 megohms.

Input and output signals may be polarized pulses, sine waves, or the equivalent of electronic switch contacts. The latter permit locally generated output signals of any variety.

This ferrous-shielded device has input and output connectors at opposite ends; a flange near the middle provides for bulkhead mounting.

The capability of regenerating signals with voltage level and/or polarity conversion is particularly suited to teleprinter systems. Input and output modules may be separated by up to 50 feet (15 meters) and coupled with a low-level interface.

*ITT Federal Laboratories  
United States of America*

**Submarine Cable between Portugal and Britain Uses Transistors**—A 1000-mile (1850-kilometer) undersea telephone cable between Lisbon,



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Portugal, and Cornwall, England, will use 5-megahertz repeaters at intervals of 7.5 nautical miles (14 kilometers) to provide both-way amplification for 480 circuits with 4-kilohertz spacing or 640 with 3-kilohertz spacing. Each repeater is fully transistorized and has a gain at top frequency of 43 decibels. Supervisory techniques employing pulses allow all repeaters to be similar. Gas-discharge and zener diodes are incorporated for surge protection. The repeater housing is suitable down to 3400 fathoms (6200 meters).

The laying of the cable will be simplified by a new technique for testing equalizers. The equalizers will be permanently jointed into the

cable and as each one appears during the laying operation it will be opened and a shipboard test lead attached. Adjustments can then be made, the test lead detached, and the equalizer resealed and paid out with the cable. This technique removes the need for the time-consuming task of jointing equalizers into the cable aboard ship during the laying operation.

About 700 miles (1300 kilometers) of cable will be British Post Office Mark-II lightweight cable shown in Figure 6 and 300 miles (550 kilometers) at shore ends will be heavily armored cable.

*Standard Telephones and Cables  
United Kingdom*

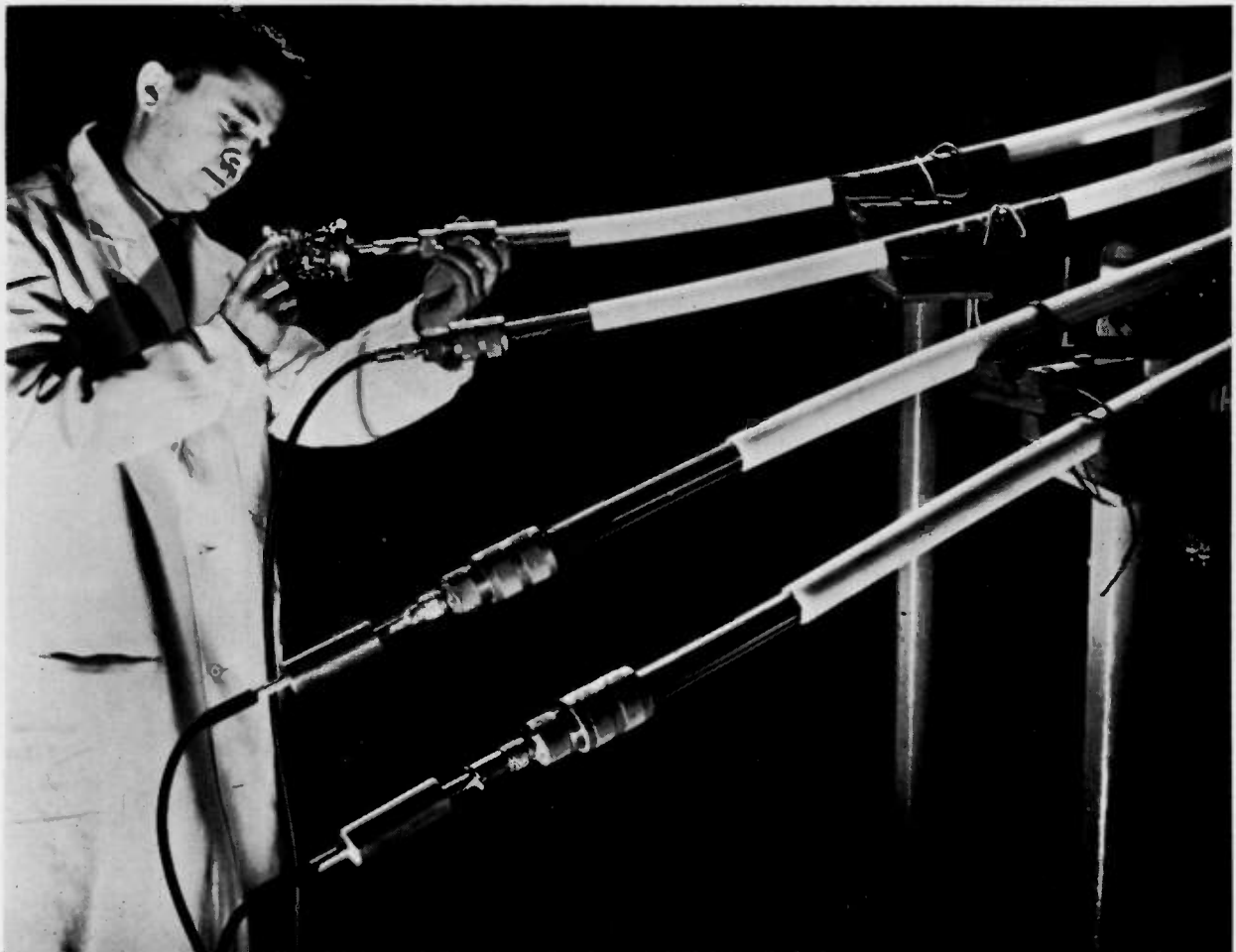


Figure 6—Transmission tests being carried out on completed lengths of deep-water submarine cable.

**Automatic Toll Network for Spain**—Pentaconta telephone switching exchanges are being installed to permit the Spanish Telephone Company to provide fully automatic toll operation on a national basis.

During 1966, nine new toll exchanges were cut over in Valencia, Seville, Gerona, Málaga, Bilbao, Las Palmas de Gran Canaria, Santa Cruz de Tenerife, Barcelona, and Madrid. The last two are complementary exchanges of existing toll offices although installed in separate buildings. Part of the Madrid-Almagro exchange is shown in Figure 7. Among other exchanges required to complete the national network will be two exchanges having a total of 17 000 incoming and outgoing junctions for Madrid and Barcelona.

The present signaling method uses a single-voice-frequency ahythmic code; subsequent ex-

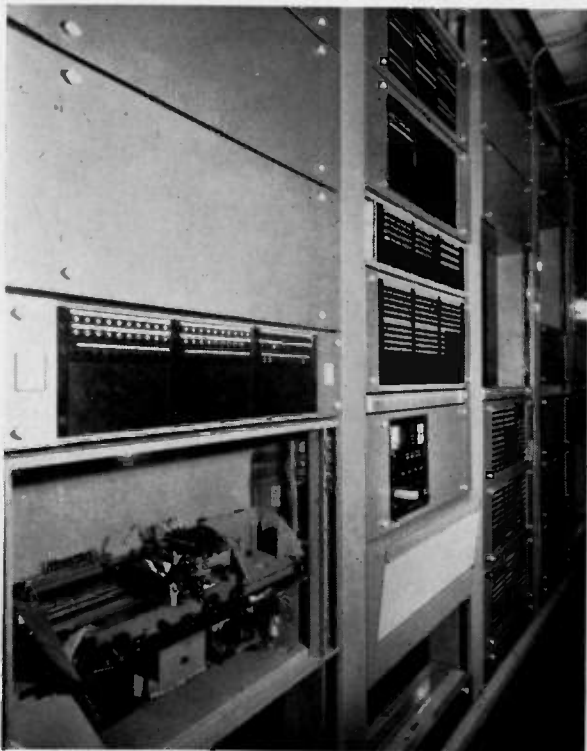


Figure 7—Madrid-Almagro toll exchange test and traffic control bays. A punched-card machine is shown at the lower left.

tensions of the network will use a multifrequency compelled code.

*Standard Eléctrica  
Spain*

**Transponder NR-A1-2A**—The *NR-A1-2A* transponder is an airborne part of the Identification-Friend-or-Foe system. It receives coded pulses transmitted by ground radar equipment, decodes these pulses, then transmits a coded response signal, which provides the ground controller with data such as aircraft identification, altitude, et cetera. The transmissions from the aircraft are much stronger than the echoes that would be produced by normal radar reflections, and this greatly aids the ground radar in locating the aircraft.

The transponder uses transistors except for a single lighthouse triode in a self-oscillating circuit in the transmitter. The transmitted peak power is 500 watts at 1090 megahertz. The receiver, tuned to 1030 megahertz, has a sensitivity of  $-74$  decibels referred to 1 milliwatt. The video circuits, which make use of plug-in printed cards, provide for decoding 5 distinct modes and for encoding 4096 response signals.

The height is less than that of the previous model; the dimensions are 325 by 268 by 182 millimeters (12.8 by 10.6 by 7.2 inches). The total weight is 8.5 kilograms (18.7 pounds).

This new radio navigation apparatus is being manufactured for the French Air Force.

*Le Matériel Téléphonique  
France*

**TransITT 12 Very-High-Frequency Main Station**—TransITT 12 is a very-high-frequency frequency-modulation 50-watt radiotelephone set for operation on 8 channels as a base station for mobile and portable systems. It meets international specifications.

This simplex base station may be extended to duplex service by adding a hybrid or by using two antennas. It can be operated directly

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through the control unit in the cabinet or through a subcontrol unit connected over a multicore cable of up to 100 meters (325 feet) in length.

Operation over public telephone lines is made possible by adding units that fit in the cabinet, continuing the use of the controls for normal functions. Remote control can be achieved over a 600-ohm balanced line with a maximum loop resistance of 2000 ohms.

This set is built in Ministac design. It is shown in Figure 8.

*Standard Electric  
Denmark*

**TransITT Very-High-Frequency Marine Radiotelephone STR 60**—Fulfilling the international regulations of the Hague, this extremely small marine radiotelephone set is provided with a 20-watt transmitter and will operate on 37 very-high-frequency channels. Transistors are used throughout.

It provides for continuous supervision on a calling and emergency channel (normally chan-



Figure 8—The TransITT 12 base station for very-high-frequency mobile frequency-modulation systems.

nel 16) even when listening to signals on another channel. Up to four remote control positions are available with provision for 2- or 4-wire telephone operation and with connectors for handsets on the wings of the bridge of the ship. The built-in test instrument also indicates radio-frequency output.

The set is made in two versions. The one shown in Figure 9 is a 19-inch (480-millimeter) rack unit measuring 135 by 320 millimeters (5.3 by 12.6 inches); the other is mounted in a modern style wall cabinet measuring 440 by 520 by 140 millimeters (17.3 by 20.5 by 5.5 inches). It is in the Ministac line of equipment, characterized by a miniaturization technique based on compact assembly of components.

*Standard Electric  
Denmark*

**Measurement Instruments Introduced**—A new range of measurement equipment has recently been introduced.

(A) **Multimeter MX 101 A.** This meter allows measurements of direct and alternating voltages up to 500 volts with a sensitivity of 2000 and 666 ohms per volt, respectively, of direct and alternating currents up to 30 amperes, of resistance in two ranges from 0.1 to 500 ohms and from 0.01 to 50 megohms, and of temperature with a thermal probe from  $-20$  to  $+150$  degrees Celsius.

(B) **Multimeter MX 202 A.** Shown in Figure 10, this instrument is designed for simplicity in use, having a single large scale for voltage and current measurements and a single control for selecting ranges and functions. The internal resistance for direct voltage measurements is 40 000 ohms per volt.

It permits high-precision measurements of direct and alternating currents and voltages and of resistance. Additional accessories extend the direct-current ranges to 500 amperes and 30 kilovolts and the alternating-current ranges to 1000 amperes and 3000 volts. Simultaneous voltage and current measurements may be made

on machines operated from the power mains. Lighting intensity may also be measured.

(C) Multimeter *MX 205A*. This instrument is for research and laboratory work. Its taut-band-suspension meter allows the sensitivity to reach 100 000 ohms per volt for direct voltages. It is very well protected against overloads, external magnetic fields, and mechanical shocks. Full-scale measurement ranges for direct current are 100 millivolts to 1500 volts and 10 microamperes to 5 amperes. For alternating current the full-scale ranges are 1.6 to 1500 volts and 1.6 milliamperes to 5 amperes. Signal levels may be measured from  $-6$  to  $+56$  decibels. Resistance values between 1 ohm and 20 megohms are measured, and capacitance scales of 1000 picofarads and 10 microfarads are provided.

Accessories increase the direct-current ranges to 33 kilovolts and 160 amperes and the alter-

nating-current ranges to 16 kilovolts and 1000 amperes.

(D) Electronic Millivoltmeter *VX 203 A*. Shown in Figure 11, this universal test instrument may be used as a normal multimeter

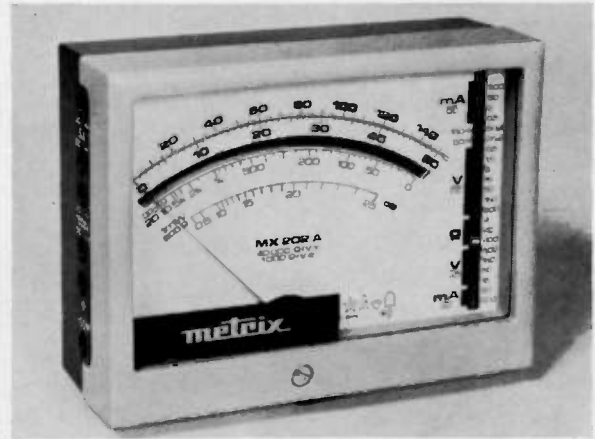


Figure 10—Multimeter *MX 205A* with connector side visible.

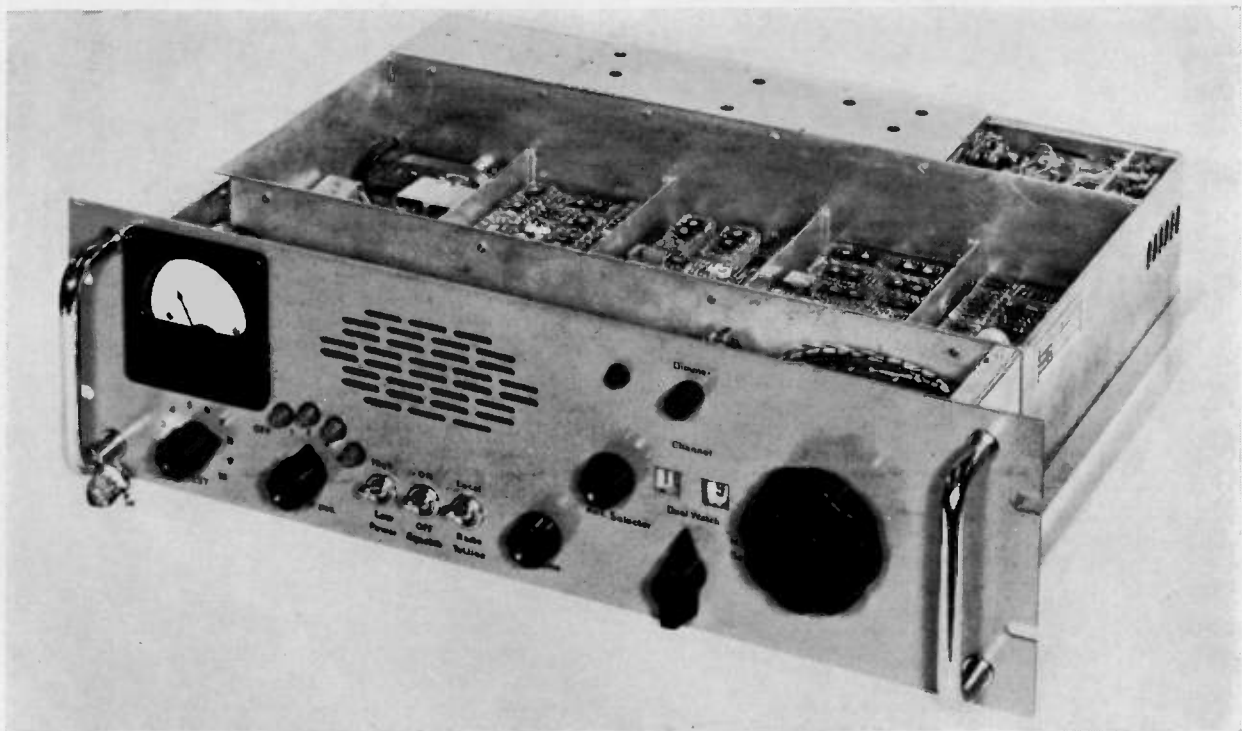


Figure 9—Rack version of TransITT very-high-frequency marine radiotelephone set showing Ministac construction.

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as well. It comprises a differential transistor amplifier with battery power supply. It permits measurements of direct voltages from 10 millivolts to 1000 volts, positive or negative, with a sensitivity of 1 megohm per volt. Direct currents are measured from 1 microampere to 10 amperes. Resistances are measured from 3 ohms to 30 megohms. Additional accessories extend these ranges to 30 kilovolts and 300 amperes, direct current, and permit the measurement of alternating voltages and direct voltages on radio-frequency circuits.

(E) Television Signal Strength Meter *VX 403A*. This equipment has been especially designed for optimizing adjustments on television antenna installations. It covers four megahertz frequency ranges: 41.25, 48–110, 160–230, and 470–850. The voltage range is from 10 microvolts to 30 millivolts in six subranges.

(F) Amplitude- and Frequency-Modulation Generator *GX 303 A*. This generator shown in Figure 12 is intended for testing and maintenance of domestic radio sets. It consists of two parts. The first part is an amplitude-modulation generator (*G1 303 A*) covering the range from 100 kilohertz to 30 megahertz, with an expanded range between 420 and 500 kilohertz. The signal may be modulated at 1000 hertz and the expanded band wobbled at 50 hertz.

The second part is a frequency-modulation generator (*G2 303 A*) covering the range from 88 to 108 megahertz and the intermediate-frequency range from 9 to 12 megahertz. The first one may be modulated internally at 1000 hertz or externally at frequencies between 0 and 100 kilohertz. The second one may be wobbled at 50 hertz. There is also a crystal-controlled marker giving reference frequencies of  $10.7 \pm 0.1$  megahertz.

(G) Telephone Multimeter *1034 B*. This instrument is approved by the French telecommunications administration and permits measurements of direct and alternating voltages from 3 to 500 volts and currents from 0.003 to 6 amperes. Resistances from 0 to 20 kilohms and from 0 to 2 megohms may be measured.

(H) Luxmeter *MX 602A*. This very compact instrument has been designed to be used by lighting technicians and conforms to the latest French standards. It has two ranges, 0–50 and 0–200 foot-candles, as well as other features such as correction of errors due to the angle of incidence of light and spectrum correcting filter.

*Compagnie Générale de Métrologie  
France*

**Leaffield Radio Station Officially Opened**—The radio station in Leaffield, Oxfordshire, was opened by the Assistant Postmaster General of



Figure 11—Millivoltmeter *VX 203 A* with selector control visible.



Figure 12—Generator *GX 303 A*.

the British Post Office in October 1966. The equipment consists of 12 transmitters, type *QT4*, of 30-kilowatt rating for radiotelegraph services to Aden, Athens, Beirut, Bombay, Dar-es-Salaam, Nairobi, Pretoria, and for combined telephone and telegraph services to Nicosia and Tehran; and 6 transmitters, type *QT5*, of 75-kilowatt rating for press services to East and West Africa, the Middle East, India, and Southeast Asia. A view of the transmitter room is shown in Figure 13.

Transmitters are tuned automatically. To maintain traffic under varying conditions, the transmitters automatically change frequency; a motorized switching system chooses the appropriate aerial.

Only one man is needed to control the entire station from a central console. A single switch controls all the functions necessary to set up a radio circuit. From the console the operator can start up and shut down a service, initiate frequency changes, arrange for simultaneous operation of two transmitters (dualling), and monitor performance. Automatic switchover from a faulty transmitter is provided.

For reliability, solid-state circuits have been used wherever possible and all components are conservatively rated. The system is designed so that control might later be exercised from the radio traffic terminal in London.

*Standard Telephones and Cables  
United Kingdom*

**Microwave Link for Electricity Authority**—The North-Eastern Electricity Board have ordered a microwave link for light traffic between Newcastle and York in England. It will initially provide 12 circuits for telemetry, telegraphy, data transmission, and speech.

The *RM15A* equipment has been designed to meet the British Post Office specification *W6503* for 1500-megahertz private user service. It provides in a single 6-foot (1.8-meter) rack a duplicated radio terminal together with up to 24 channels of Mark-6 multiplex. It is all solid state. An engineering order wire and alarm facilities are provided.

*Standard Telephones and Cables  
United Kingdom*



Figure 13—The interior of the new overseas radio station at Leafield.

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**Transmission Test Set UN2**—Transmission test set UN2 permits program-controlled automatic testing of active or passive 4-terminal networks within the range of 30 to 30 000 hertz. It is shown in Figure 14.

Control is by a 5-track perforated tape, which can be punched by a standard teleprinter. For series tests, the tape can be made endless by joining the ends together.

The following characteristics can be checked: effective attenuation, input return loss, output return loss, input longitudinal to transverse attenuation (symmetry), and output longitudinal to transverse attenuation (symmetry).

Each of these characteristics can be tested at various levels and frequencies. The automatic test set compares the sample with the limits of the test program.

The measurement consists in principle of comparing a reference quantity with an unknown quantity. The reference path supplies a constant-level signal to the input of a differential amplifier. In the measuring path, the sample is in series with the attenuation compensation device and the latter is controlled in such a manner that, with the mean value of the sample,

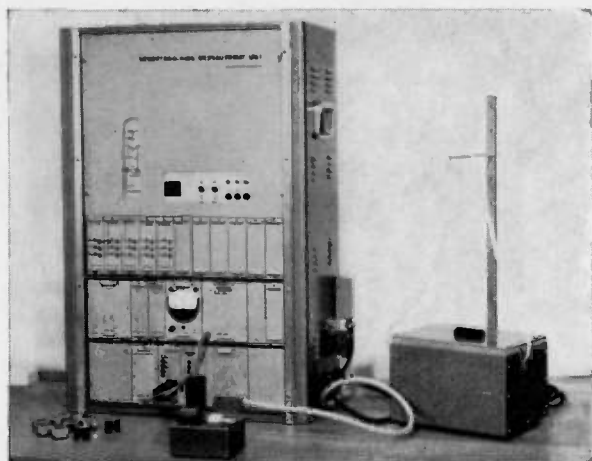


Figure 14—Automatic transmission test set UN2. To the right is the perforated tape reader; in front, the adapter with plug-in socket for the samples; and to the left are some samples.

the same level is obtained at the other input of the differential amplifier. An evaluation unit decides between "good" or "reject."

If a fault occurs, the program operation is interrupted and the fault is signaled. After its registration, the operation continues when the start button is pressed. The serial number of the measurement can be printed out when a printer is used.

Any 20 frequencies may be selected for broadband reception. Measurement of attenuation is within  $\pm 0.01$  neper between 300 and 20 000 hertz and with  $\pm 0.02$  neper for the full range from 30 to 30 000 hertz. Send level is adjustable in 1-neper steps from 0 to  $-7$  nepers referred to 1 milliwatt, the receive level in steps of 0.01 neper between  $+1.99$  and  $-6.99$  nepers referred to 1 milliwatt. The input and output impedances are 600 ohms, symmetrical. The test time per measurement is approximately 3 seconds between 30 and 300 hertz and 0.6 second between 300 and 30 000 hertz.

*Standard Téléphone et Radio  
Switzerland*

**Frequency-Modulation Discriminator Using Thin Films**—The responses shown in Figure 15 can be obtained from a frequency-modulation discriminator that uses distributed resistance-capacitance null networks instead of inductance-capacitance circuits. This makes it suitable for production as a thin-film circuit.

Two resistance-capacitance null networks with different null frequencies situated on either side of the carrier frequency determine the frequency range in which a signal can be demodulated. The frequency scale of the graph is normalized, unity corresponding to the mean value of the two null frequencies. The steepness of the response depends on the distribution of resistive and capacitive components of the networks. Those shown are responses for uniform distribution ( $D = 1$ ) and exponentially tapered distribution ( $D = 10$ ). The output signals of the networks are separately amplified and rectified and are then subtracted. The resulting

output signal can be either balanced or unbalanced.

Discriminators studied so far are suitable for the demodulation of frequency-modulated signals with frequency deviations of up to  $\pm 20$  percent. Harmonic distortion of the demodulated signal resulting from nonlinearity of the response is approximately 0.35 percent for each 1 percent of frequency deviation. This value remains constant if the carrier frequency is not situated at the zero-axis crossing frequency, but anywhere on the response. Adjustment is consequently not critical.

Experimental thin-film discriminators for carrier frequencies of 10 megahertz have been produced on a single substrate of 25 by 12.5 millimeters (1 by 0.5 inch) that includes all passive circuit components, with transistors and diodes attached.

Standard Telecommunication Laboratories  
United Kingdom

**Relay for Printed Circuits**—A miniature relay type *A2600* has been produced for the 2.5- or 2.54-millimeter reference grid. Its dimensions are 15 by 24 by 29 millimeters (0.59 by 0.95 by 1.14 inches).

The maximum switched voltage is 60 volts and the current is 200 milliamperes. It has 4 change-over contacts. The contact springs carry twin precious-metal contacts.

It is available for operation at 6, 12, 24, 36, and 48 volts. The operate time is 5 to 10 milliseconds at nominal voltage, the release time 2 to 5 milliseconds. The number of operations during the assessed lifetime is  $2 \times 10^8$ . The relay is protected against the environment by a plastic casing from which the connecting wires protrude.

Standard Elektrik Lorenz  
Germany

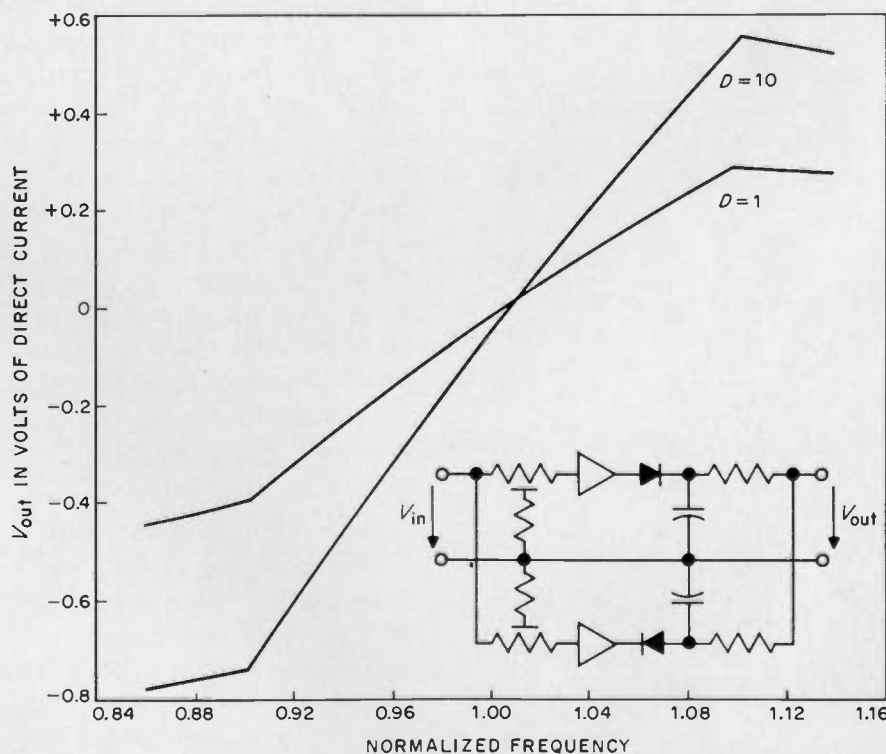


Figure 15—Frequency-modulation discriminator for wideband demodulation using two thin-film distributed resistance-capacitance null networks.  $D$  is the ratio of the width of the resistive film at the input and output of the network. The amplifiers have gains of 20 decibels and the input signal is 1 volt, root mean square.



## Recent Achievements

**Alarm Receiver E 47**—The signaling and alarm receiver type E 47 in Figure 16 is designed for operation in the very-high-frequency radiotelephone bands. In case of an alarm, the associated fixed stations radiate coded call signals for alerting the alarm receivers individually or in groups. A call is indicated by sound from the built-in loudspeaker, a visual indicator, and optionally an external buzzer or bell. Following the alarm signal, a message can be transmitted.

The receiver is intended for portable, mobile, and stationary use. A plug-in rod antenna is available but any other 60-ohm antenna suitable for the receiving frequency can be connected via a coaxial cable. The transistor circuits are arranged in functional groups mounted on easily replaced printed-wiring boards.

The receiver is delivered tuned to the receiving frequency stated in the order. The loudspeaker

and the visual indicator are automatically actuated on arrival of a call and the latter is reset by momentarily depressing a clearing push button. The sound volume of the loudspeaker can be reduced by use of a locking push button.

Operation is from the alternating-current mains, a built-in rechargeable nickel-cadmium battery, or a 12-volt external battery. In case of mains failure, automatic changeover to battery operation takes place. The battery can be recharged from the mains by pressing the charging push button.

*Standard Elektrik Lorenz  
Germany*

**Piezoelectric Materials**—There is a need for new piezoelectric materials capable of being used in crystal filters operating between 0.1 and 30 megahertz and in electromechanical filters operating in the intermediate-frequency band. Quartz is used extensively in many of these applications, but it has the disadvantages of a low electromechanical coupling constant and it can only be grown extremely slowly by the hydrothermal process. Apart from the requirement of superior piezoelectric properties, any new material should also be capable of being grown in single-crystal form, both rapidly and of good quality. Growth from the melt offers obvious advantages in this respect, but not many piezoelectric materials are known which can be grown in this way. However, an unusual material reported to be piezoelectric is calcium pyroniobate.  $\text{Ca}_2\text{Nb}_2\text{O}_7$ , and single crystals have been melt grown by the Czochralski pulling method.

Calcium pyroniobate reputedly belongs to the monoclinic crystal system, and growth in any crystallographic direction in the (100) plane has been found to be easy, at rates greater than 1 centimeter per hour. With careful control of the growing process, thin ribbon crystals typically 10 centimeters long by 1 centimeter wide by 0.1 centimeter thick have been obtained with large-area mirror facets parallel to the (100) plane. On these facets, occasional growth steps

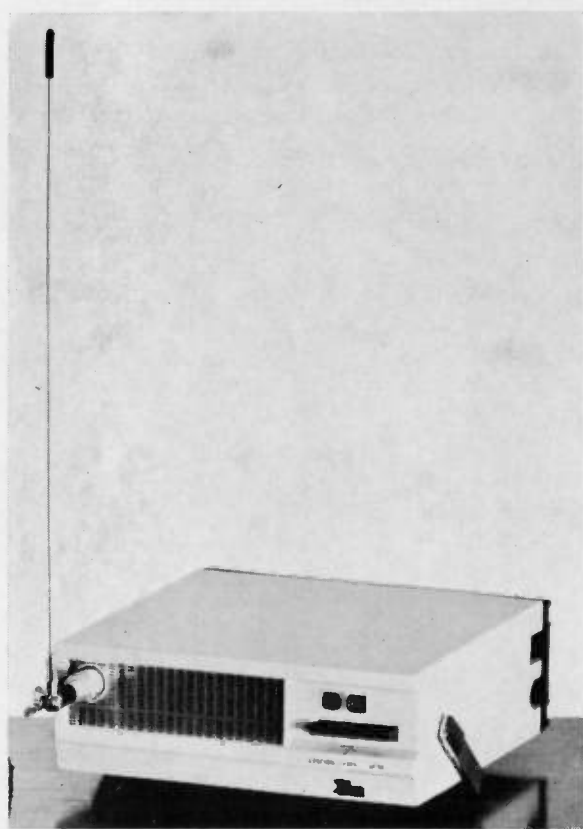


Figure 16—Signaling and alarm receiver E 47. A suitable rod antenna is mounted at the left.

occur with a height between 0.5 and 1 micrometer but between the steps the surface appears to be atomically flat, as shown by multiple beam interferometric techniques. A photograph of a ribbon crystal is shown in Figure 17, and a double reflection of the caption in the (100) mirror facets on opposite sides of the crystal is evident in the original photograph. The stability of such large facets indicates that there is a very great difference between the surface free energy of a (100) plane and other principal planes in the lattice. This makes growth in the [100] direction difficult, and slow growth rates of about 0.3 centimeter per hour have had to be used to obtain small crystals, typically 1 centimeter in diameter by 3 centimeters long, of this orientation.

Piezoelectric measurements have been made at the Quartz Crystal Division of Standard Telephones and Cables. For X-cut crystals the electromechanical coupling constant  $k$  is approximately 14 percent (the value for X-cut quartz is 9.8 percent),  $Q$  lies in the range 1800–3600, and the temperature coefficient is about 220 parts per million per degree Celsius, while for Y-cut crystals  $k$  falls to approximately 6 percent and the temperature coefficient to about 100 parts per million per degree Celsius. While these figures are not encouraging for piezoelectric applications as filters, the high temperature coefficient might be of interest for temperature sensing applications. Crystals of

other materials, for example lithium metatantalate  $\text{LiTaO}_3$  and lithium metagallate  $\text{LiGaO}_2$ , are now being grown; their piezoelectric properties are more promising.

*Standard Telecommunication Laboratories  
United Kingdom*

**Toll Originating Exchange for Paris Area**—A new originating toll exchange for the Paris area was cut into service in March 1966. It is called CESAR for *C*Entre *S*ortant *A*utomatique *R*égional.

This exchange handles part of the Paris area toll traffic toward what is called the Paris Regional Area 2, extending for 70 kilometers (44 miles) beyond the Paris suburbs.

Since 1951, such traffic was handled by *2FR*, a special outgoing exchange using rotary apparatus located in the same building with the new exchange.

Using the Pentaconta switching system, CESAR is connected to the Paris network either by rotary code adaptors or by multifrequency code when other Pentaconta exchanges are involved. The originating toll junctors are usable with decimal toll code or with multifrequency code depending on the connected terminating point.

At present 600 circuits are in operation. By next year 1000 originating circuits will be

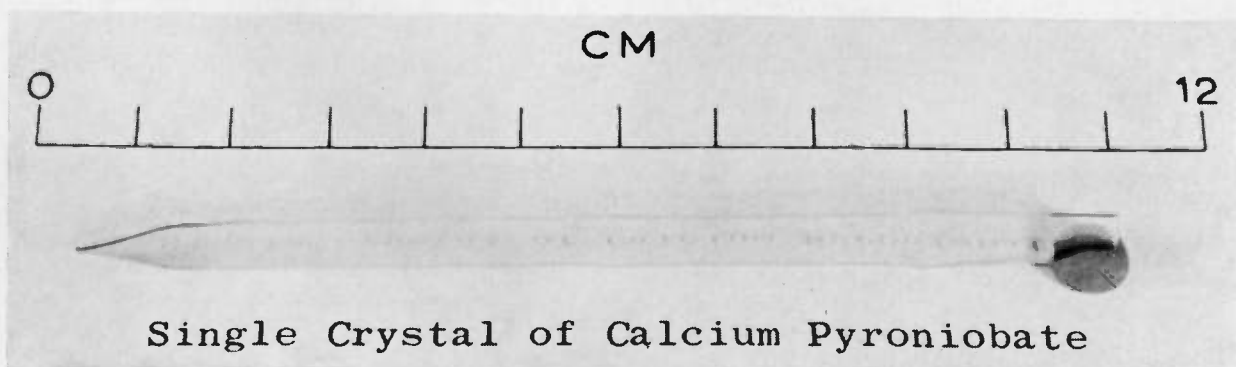


Fig. 17—A ribbon crystal of calcium pyroniobate. The reflections of the caption seen in the (100) mirror facets are precisely doubled owing to extreme parallelism of opposite sides of the ribbon.

## Recent Achievements

connected. A second originating toll exchange is planned for 1969.

*Le Matériel Téléphonique  
France*

**Computer Type 822 P**—Testing has been completed on the prototype of the 822 P computer intended to be a centralized computer for installation in aircraft. Shown in Figure 18, it is composed of 1400 direct-coupled transistor logic integrated circuits in TO5 packages and a ferrite microcore memory having a capacity of 4096 words of 25 bits each. Programed with a set of 40 instructions, it is able to perform 100 000 additions per second or 15 000 multiplications, divisions, or square roots per second. Its volume is 10 liters (610 cubic inches), its weight 12 kilograms (27 pounds), its power consumption 70 watts, and the mean time between failures is 400 hours.

*Laboratoire Central de Télécommunications  
France*

**Computer Type 825 P**—The 825 P laboratory model computer is now completed and fully tested. It is a general-purpose microminiature digital computer for real-time applications, particularly for aircraft. It is a single-address computer with indexing and interrupt features and is composed of 500 diode-transistor micrologic flat-pack integrated circuits and of a ferrite

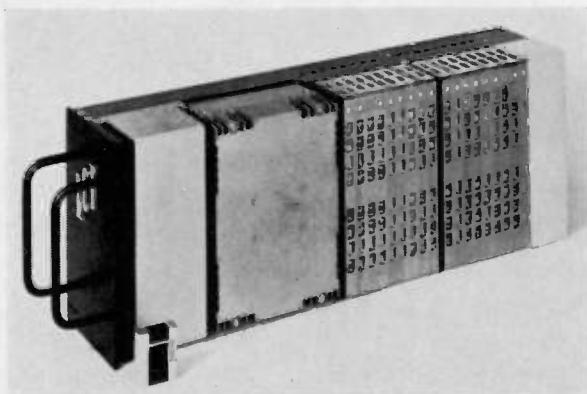


Figure 18—Side view of the 822P computer. Lettered circuit cards are at right; the memory case and power supply, both provided with cooling fins, are at the left.

microcore memory having a capacity of 4096 words of 25 bits each. It can be programed with a set of 30 instructions and is able to perform 160 000 additions or a tenth as many multiplications or divisions per second. A symbolic language has been defined and both assembling and simulating programs are available. The computer model is now in operation on various experimental programs.

*Laboratoire Central de Télécommunications  
France*

**Computer Center Expands Capabilities**—Our data processing centers at Paramus, New Jersey, and El Segundo, California, have been expanded with the installation of the new System/360, Model 50, computers. These large-scale multipurpose computers by International Business Machines have 65 000-word core memories, disk packs, and magnetic tapes for processing and storing data. For use by outside clients, satellite data processing and data transmission facilities in the greater New York area are connected to the Paramus center over high-speed data transmission lines.

A computer program called *Staff* provides an economical way to convert existing programs written in Fortran 4, the most commonly used scientific computer language in the United States, to Fortran H required by the System/360 series of computers. *Staff* analyzes programs presently used for scientific computers, detects those instructions or statements that are incompatible or incomprehensible to System/360, and converts them to a form acceptable to the new computers.

*ITT Data Services  
United States of America*

**Solenoids for Linear Action**—A new series of solenoids operating either push or pull plungers are more powerful and economical than conventional units. The smaller unit in Figure 19 weighs 1.5 ounces (43 grams), occupies 0.5 cubic inch (8 cubic centimeters), and will pro-

vide 11 ounces-force (300 grams-force) over a stroke of 2.17 inches (5.5 centimeters) for an input power of 30 watts for the direct-current version. The larger size has a volume of 0.8 cubic inch (13 cubic centimeters) and weighs 2.25 ounces (64 grams). Under the same operating conditions, it produces 25 ounces-force (700 grams-force) for a 35-watt input.

Both units are available for either alternating or direct current with coils rated from 6 to 48 volts and from a 5-percent to a continuous working cycle.

*Standard Telephones and Cables  
United Kingdom*

**Motor Protector**—The small solid-state plug-in module in Ministac construction shown in Figure 20 has been developed to protect the windings of electric motors from overheating by controlling the alternating-current power supply to the motor. A positive-temperature-coefficient thermistor is embedded in the motor windings to control the switching action.

*Standard Telephones and Cables  
United Kingdom*

**Finland and Chile Radio Relay Systems**—A radio relay system will be installed in the lake district of Finland between Iyvaskylä and Kuopio to expand the telephone network. The

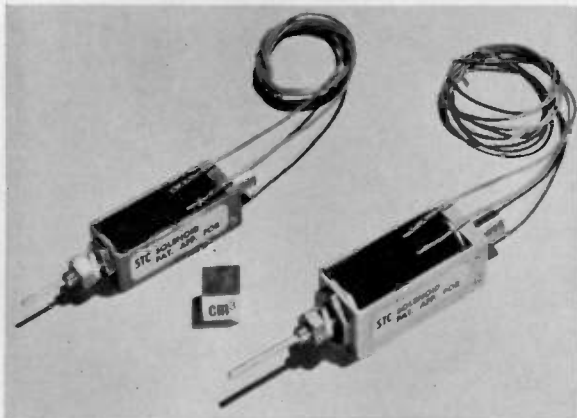


Figure 19—Small and large solenoid linear actuators fitted with push plungers. Corresponding pull-plunger units are also available.

6-gigahertz equipment will provide up to 1800 telephone circuits.

In Chile, a radio relay route from Santiago to Concepción is about to be installed and a further order has been placed by the Chilean telephone company to equip the route from Chillán to Temuco with 4-gigahertz equipment.

*Standard Elektrik Lorenz  
Germany*

**Toll Terminating Exchange "Pastourelle"**—In May 1966 a Paris terminating toll exchange located in the Pastourelle exchange building was cut into service. A view of the test positions is shown in Figure 21.



Figure 20—Motor protection device type 001C.

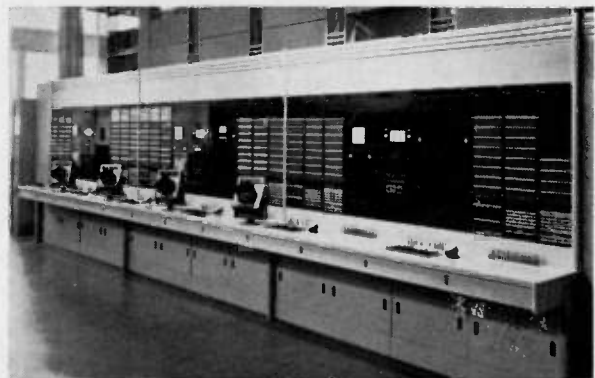


Figure 21—Test positions of the Pastourelle toll exchange.

## Recent Achievements

Using the Pentaconta switching system, this exchange has a final capacity of 5500 terminating toll circuits and 7000 originating junctions toward the Paris network exchange. At present, 1500 toll circuits are equipped with 2700 being planned for early connection.

The three selection stages needed for such an important exchange are made up of a single guide switching stage operating with two normal switching stages.

Signals for long-distance and large-capacity toll connections are transmitted in SOCOTEL multifrequency code. This is also used at the originating exchange and enables transit connections toward local Pentaconta exchanges to be made; thus the exchange control equipment may be released rapidly.

*Le Matériel Téléphonique  
France*

**Interorgtechnika Exhibition in Moscow**—At the Interorgtechnika in Moscow in September 1966, Standard Elektrik Lorenz participated in a special display on "The Modern Office" provided by the German Federal Republic. Part of the display is visible in Figure 22.

Among its contributions were a push-button

system for interconnection between various desks in a large office, a lightweight pneumatic tube system for conveying letters and documents among three stations, an optical document sorter type ODS 2, an Lo 133 teleprinter with Cyrillic characters, a model of an automatic letter sorter, and a station for a pneumatic tube system using a tube of 125-millimeter (5-inch) diameter.

*Standard Elektrik Lorenz  
Germany*

**Exploding Bridgewire Electronics Units**—A follow-on contract has been received from The Martin Company for electronic modules and cables for the exploding bridgewire system used in the United States Army Pershing missile program.

Exploding bridgewire is a type of fine wire exploded by a high-voltage pulse to activate a thrust device, which may separate parts of a rocket, start an engine, extend a radio antenna, or perform a variety of such tasks. An important feature is that relatively insensitive thrust charges can be used to avoid accidental explosion from stray radio fields or other stimuli.

*ITT Industrial Products  
United States of America*



Figure 22—Part of "The Modern Office" display at the Interorgtechnika in Moscow.