Automatic message accounting

C. F. SEIBEL
Switching Systems Development

Within the past few years, the Automatic Message Accounting (AMA) system has been placed in commercial service by the Bell System in a number of metropolitan areas. These systems record in the central offices all the data required to charge for subscriber-dialed telephone messages, both local and toll, and process this record in accounting centers through computing, sorting, summarizing, and printing machinery. Both the recording and processing arrangements employ many novel circuit and apparatus components. The use of the system will permit wide expansion of direct subscriber dialing to nearby and more remote points, with resultant increased speed, and convenience to telephone customers. Although AMA is the first system to carry out automatically both recording and accounting for toll calls, it is not the first step in this direction but is rather the culmination of a long line of developments.

During the early years of the telephone, subscribers were charged exclusively on a flat monthly or yearly basis but since the end of the last century, message rate service has been available in most of the larger cities. Initially the record of such calls was in the form of tickets prepared by operators. This method was later supplemented by the use of a small electromagnetic counter, called a message register, associated with each message rate line and operated once for each call made. As the metropolitan areas grew larger and subscribers began to call regularly beyond their local areas, zone registration was adopted. It provides circuits that, on each call beyond the local area, operate the message register the proper number of times to represent the cost of the call. Thus

The photograph at the top of the page shows part of the Automatic Message Accounting center at Philadelphia.

if the charge on a call was 20 cents and each message register operation represented a charge of five cents, the register would be operated four times for this particular call.

Although zone registration is an economical method of charging for short toll calls, it does not, of course, leave any record of the details of the various calls. For calls requiring more than five or six message register operations, it has generally been felt preferable to have a record not only of the point to which the call was placed but of the day and time it was made. To secure such a record, and at the same time to obtain the economies and increased speed possible from automatic operation, an automatic ticketing arrangement* was developed some years ago for step-by-step areas. With this system a toll ticket is automatically printed for each toll call, and thus all essential information pertaining to the call is permanently available.

*Record, *July*, 1944, *page* 445.

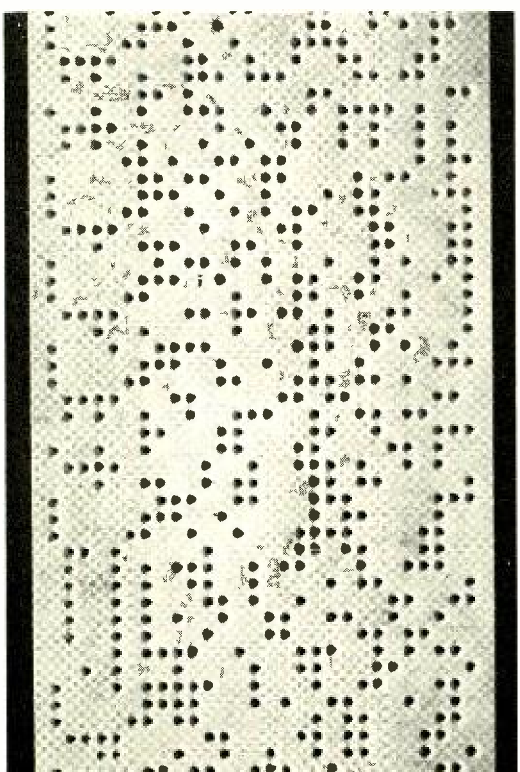


Fig. 1—A section of AMA tape after it has been perforated.

The alternative to all such methods, of course, is to bring in an operator for each such call and to have her make out a ticket. This is a less economical method of handling the call in many areas, however, and may delay its completion. It has of necessity always been used for calls beyond the range of the available automatic charging methods. The writing of a toll ticket, moreover, is only part of the work of charging for calls. Before subscribers can be billed for their respective calls, the thousands of tickets from hundreds of operators must be brought together, sorted out according to subscriber, computed, and totaled, and then the bill must be prepared. This work is extremely laborious and represents an appreciable item of expense.

It was recognized for some time that the entire process of recording calls and preparing the customer's bills could be done mechanically. One of the early suggestions was to provide an automatic accounting system that would supplement the automatic ticketing system, using the automatically prepared tickets as the basic information. Problems encountered, however, indicated that it would be desirable to record the information pertaining to the calls in a different manner. As a result, a completely new system from recording to billing was projected.

As now developed and being put into use, the automatic message accounting system, besides providing automatic accounting of messages, records the information pertaining to calls in an entirely different form from any used before. The potential usefulness of the system, moreover, has greatly increased with the prospect of nationwide subscriber dialing, since to take full advantage of nationwide subscriber dialing, an automatic method of recording billable information on calls dialed must be available.

In this new automatic message accounting system, the information pertaining to all calls requiring a charge is perforated in code on an oil impregnated paper tape three inches wide. A specimen of the section of the tape after perforation is shown in Figure 1. There is space for twenty-eight holes across the tape, which is used for recording six digits, each representing a single item of information. Adjacent rows are about one-tenth inch apart, and either four or six rows of information are required per call. The items of perforated information are automatically read and interpreted at the accounting center at a rate of over 80 digits per second.

The recording machines are installed in cabinets like those shown in Figure 2. They are associated with the outgoing trunks in the No. 5 crossbar system and with the district junctors in the No. 1 crossbar system. One recorder serves 100 trunks or district junctors. Together with their associated equipment, they are installed in the individual telephone central offices. Each day at about 3:00 a.m. the tapes in all the recorders are automatically prepared for cutting by perforating a readily recognized pattern to indicate the section where the tape is to be manually cut. After cutting they are transported to the accounting center for processing. This accounting center may handle the tapes from many central offices and may be remote from any of them.

Since each tape from a recorder includes the information for all calls handled by a group of 100 trunks or district junctors, calls from a particular subscriber may be distributed over a number of tapes, and the information for any one particular call, although on a single tape, will not usually be on adjacent lines of the tape. Certain of the information is recorded as the call is dialed or shortly thereafter, but the time the called subscriber answers, which is the beginning of the charge period, is somewhat later, and in the meantime information relating to other calls may have been recorded on the same tape. The time the conversation is completed will in general be considerably later, and thus there will be information pertaining to many calls between the recording of the beginning and the ending of any particular call. Each tape, moreover, will include information on calls that are charged for in entirely different ways. For calls that are billed in bulk, it is not necessary to record the office and number of the called subscriber, since the duration of the call and other billing information provided in the call record is sufficient to determine the charge. This is the type of call that requires only four lines on the tape, while six lines are required when information pertaining to the called subscriber must be recorded.

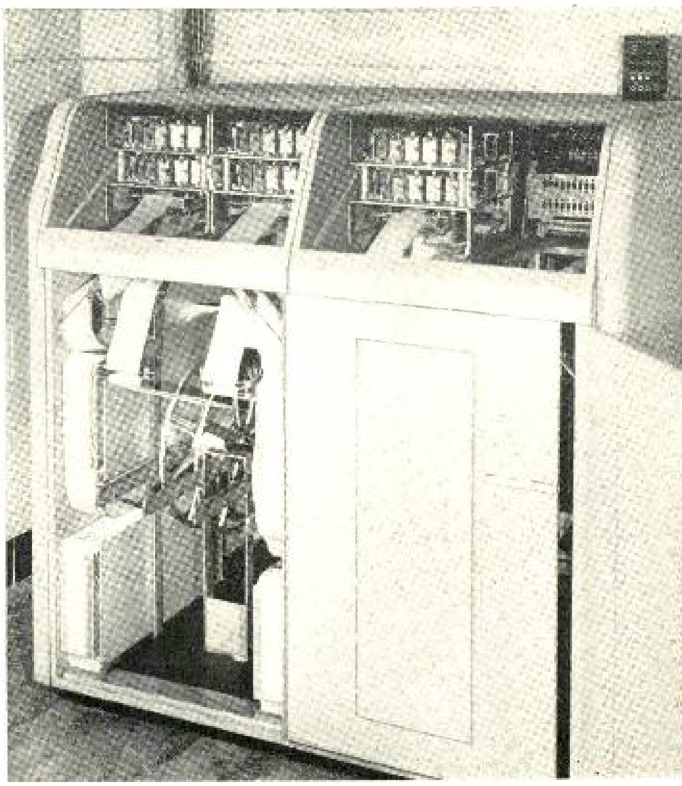


Fig. 2—Two tape perforators with their supplies of used and unused tape are mounted in a single cabinet.

In the accounting centers, the work in general consists in automatically assembling the information pertaining to each call, computing the conversation time for each call, sorting as to type of call—that is, toll calls, those that are bulk billed, and miscellaneous types—and then grouping the calls according to the subscriber. A list of toll calls, and a summary of bulk-billed calls, made by each subscriber during the billing period is then automatically printed. The total bill, including local, toll, other services and credits, is at present produced manually at the accounting center.

Because of the entirely new character of the AMA system, and the need for great accuracy in recording the calls dialed by the subscribers and in processing this information at the accounting center, it was concluded that a fairly large amount of this equipment should be observed in actual operation prior to placing it in regular service.

That part of the system which is located in the telephone central offices was installed in a 5,000-line No. 1 crossbar office at Washington, D. C., which had not yet been placed in service. Many hundreds of carefully controlled test calls were put through this equipment, and the recorded output of the AMA equipment checked against the known input of test calls. The result was extremely gratifying.

About this time the No. 5 crossbar system and the AMA accounting center developments were nearing completion. The No. 5 system was designed with provision for AMA, and AMA equipment was included in the first No. 5 installation at Media, Pa. The associated AMA accounting center was installed at Philadelphia. Before the Media office was cut into service an extended test run was made similar to that at Washington. The Media tape recordings were processed at the Philadelphia accounting center. The performance of both the central office and accounting center AMA equipment was very satisfactory.

A number of other AMA equipped offices and their associated accounting centers have since been installed around the country. AMA is particularly attractive in areas where a large number of short haul toll calls is originated, and where it is economical to permit the subscribers to dial such calls directly. The use of the system will further increase as steps are taken toward nationwide subscriber dialing. Subsequent articles that will be published in the Record will describe the features of this system in some detail.

THE AUTHOR: C. F. Seibel joined the Engineering Department of the Western Electric Company in 1911 and since then has been continually concerned in the field of switching development. During the first few years he was assigned the testing of manual telephone switchboards, central office power plants, telephone and telegraph line materials and the writing of specifications for line materials. He was then engaged as a test engineer on the initial installations of panel type semi-mechanical switching systems at Newark. He then planned the construction of a machine switching laboratory at West Street and supervised a group taking part in the development of the panel system. As a field engineer he participated in the initial installation of the panel type tandem switching system at New York and the panel type dial system at Omaha, Neb. Following this he supervised groups responsible for the development of systems for interconnection of dial and manual central offices, the engineering of relays for telephone systems, and the writing of central office installation performance and maintenance requirements. Since 1934 Mr. Seibel has been directing groups developing No. 1 crossbar, crossbar tandem, No. 4 crossbar toll, automatic ticketing for step-by-step areas systems, and the AMA accounting system, which includes a provision for nationwide subscriber dialing.

Induction heater control system

R. W. KETCHLEDGE
Transmission Development

One of the many problems frequently encountered in the building of communication equipment is that of silver soldering or brazing in close proximity to rubber or plastic insulation. It is essential that the operation be performed rapidly so as to prevent excessive heating of the insulation, and at the same time avoid overheating of the parts being brazed or soldered. Under such requirements, use of a relatively high power induction heater is necessary, but equipped with a control system to reduce the power when the desired temperature is reached and to disconnect it when the braze is completed.

Induction heaters using high-frequency power are readily available, but recently the need for very closely controlled brazes made essential the development of a control system of extreme sensitivity and one that would not disturb the work either thermally or mechanically. The system developed controls a power source of as much as 40 kw at 10,000 cycles per second. When the power is first applied to the work, full power is made available, but upon reaching the operating temperature the control system reduces the power to that required to hold the temperature constant. A detector circuit turns off the power when the braze or soldering operation is completed.

This control system compares the radiation from the work to that of a standard lamp to control the power fed to the work by the induction heater. The method has a number of advantages: (a) the spectral character of the radiation from the work and the response characteristic of the photocell are closely alike, resulting in high sensitivity; (b) operating the standard lamp at the same color as the work makes the system independent of color sensitivity variations in the photocell; (c) variation of the radiation with the fourth power of the temperature is an aid to temperature accuracy; and (d) illumination of approximately the same portion of the photocell cathode by both sources makes the temperature control largely independent of the photocell.

A spinning slotted disc is used as an optical commutator to switch the photocell view back and forth between the work and the lamp. This disc is provided with 20 slots each ¼ inch wide, ½ inch long, and ¼ inch between adjacent edges; they are cut along radii and are therefore not quite rectangular. The disc is located between the photocell and a stationary plate, the latter having two ⅛ inch wide slots spaced ⅛ inch between adjacent edges.

The relationship of these parts is shown in Figure 1. The slots in the stationary plate are aligned with those of the disc; behind one stationary slot is the standard lamp,

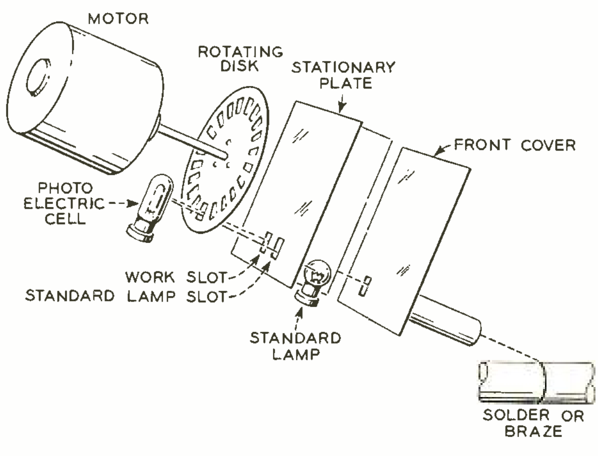


Fig. 1—Optical commutator for temperature control.

and the work is behind the other. As a disc slot scans across the two stationary slots, the successive positions of the disc slot, as indicated in Figure 2, produce a wave shape of the incident light on the photocell. It will be noted that this commutation method causes no switching transients, and when the work and lamp radiations are in balance, only a constant illumination falls on the photocell. With no transients to overload the following amplifiers, when the optical system indicates balance, the amplifiers may be operated at high gain and thus provide precise control.

As the photocell "looks" through the stationary slot and the spinning disc, the same portion of the photocell cathode "sees" alternately, radiation of the standard lamp and of the work. This is done by mounting the standard lamp slightly to the side behind the stationary plate and providing a tube to bring the light from the work to its proper stationary disc slot. The tube extends to within about 1 inch of the work and is terminated in a horizontal slit that defines the portion of the work surface "seen" by the photocell.

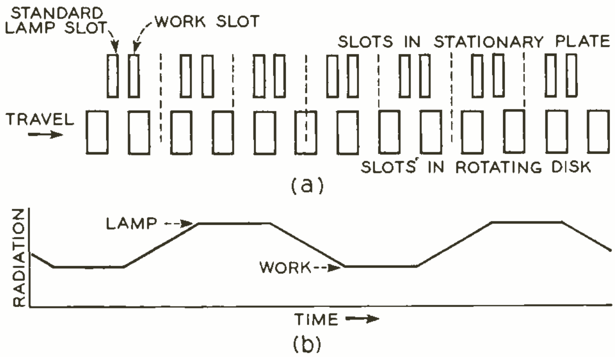


Fig. 2—Optical commutation cycle.

To prevent extraneous light or reflections from causing errors in the control equipment, the entire optical system is enclosed in a light-tight case and the compartment containing the standard lamp is blackened. The viewing tube also is blackened. No difficulty from ambient room light has been experienced, presumably because of the light shield precautions and also because of the use of a red sensitive photocell. The optical paths are entirely in air, except for the glass envelopes of the photocell and standard lamp. If a dirt film should form on the photocell, this would not disturb the calibration, because the light from both sources would pass through the same film. The standard lamp, which is an ordinary automobile headlight, is in a closed compartment having only a small slot through which dirt can enter.

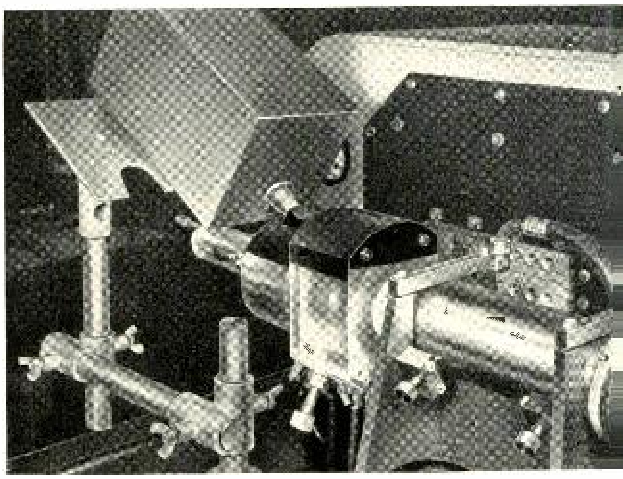


Fig. 3—Viewing unit in place for controlling a braze on a copper tube.

In addition to the standard lamp, a separate lamp in another compartment radiates through another portion of the rotating disc into a second photocell. This produces a "reference" wave to perform switching func-

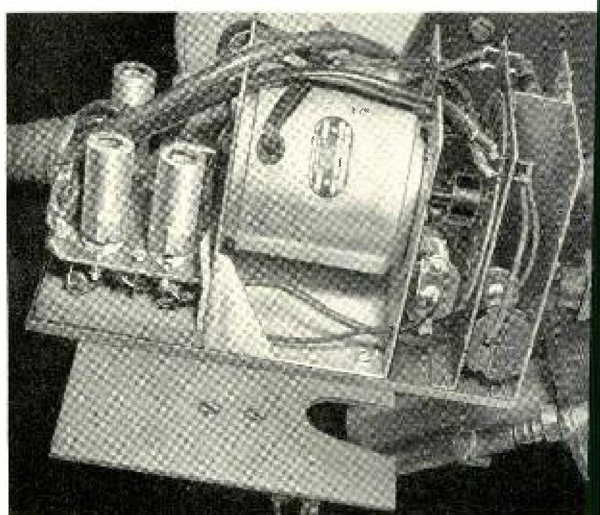


Fig. 4—Viewing unit with cover removed.

tions in the electrical circuit. With the disc rotating at 1800 rpm, the reference wave has a frequency of 600 cycles per second.

The viewing unit is shown in Figure 3. The case is 10 inches long, 5 inches high, and 5 inches wide, and is supported by an adjustable framework as shown. An interior view of the unit is shown in Figure 4 in which the various compartments may be seen. The motor is in the center, photocells, spinning disc, and standard lamp to the right, and pre-amplifiers at the left end of the unit.

A block diagram of the electrical portion of the system is shown in Figure 5. These circuits consist of the pre-amplifiers located in the viewing unit and a bench mounted control and amplifier unit that also contains the circuits for the delay feature, i.e., to disconnect the power when the braze is completed. A field supply unit for the generator used to supply the 10,000-cycle heating power, is mounted underneath the bench. Figure 6 is an over-all view of the equipment.

An important part of this system is the phase sensitive rectifier. This unit receives the "temperature comparison" signal and the "phase reference" signal from their respective pre-amplifiers and rectifies them so as to develop a d-c voltage output proportional to the magnitude and phase sense of the temperature comparison signal. If the braze requires more power, the output voltage will have one polarity; conversely, to reduce the heating power, the polarity will be reversed. The magnitude of the voltage will be proportional to the temperature unbalance between the work and the standard lamp.

This signal is then passed through an amplifier whose gain compensates for the effect of the inductance of the 40-kw generator field. Because of this inductance, the power delivered to the braze tends to lag the application of voltage to the generator field. Provision of this compensating gain characteristic makes the thermal time constant of the work the controlling parameter in this servo system.

There are other reasons too, for making the work time constant control the servo loop. First, the rapidity of cooling (time constant) of a narrow hot band is much faster than the cooling rate when a large amount of the work has been heated. Second, the loop is not a linear system. The power delivered to the work by the generator varies approximately with the square of the applied field voltage, but while the temperature of the work tends to be approximately proportional to the applied power, the radiation varies as the fourth power of the temperature. Thus the servo loop must be stable over a wide range of effective work time constants and loop gains which, in turn, requires compensation for the generator "lag."

As an example of the stability of the circuits, a copper tube having a 0.032 inch thick wall will melt in a few seconds with the continued application of 40 kw to the induction coil. With the control circuits operating, it is possible to apply this power and to hold the tubing at a desired temperature, despite the low thermal capacity and

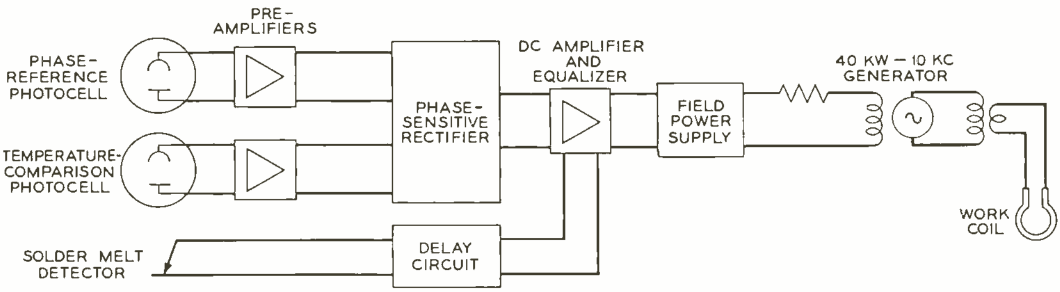


Fig. 5—Block diagram of temperature control system.

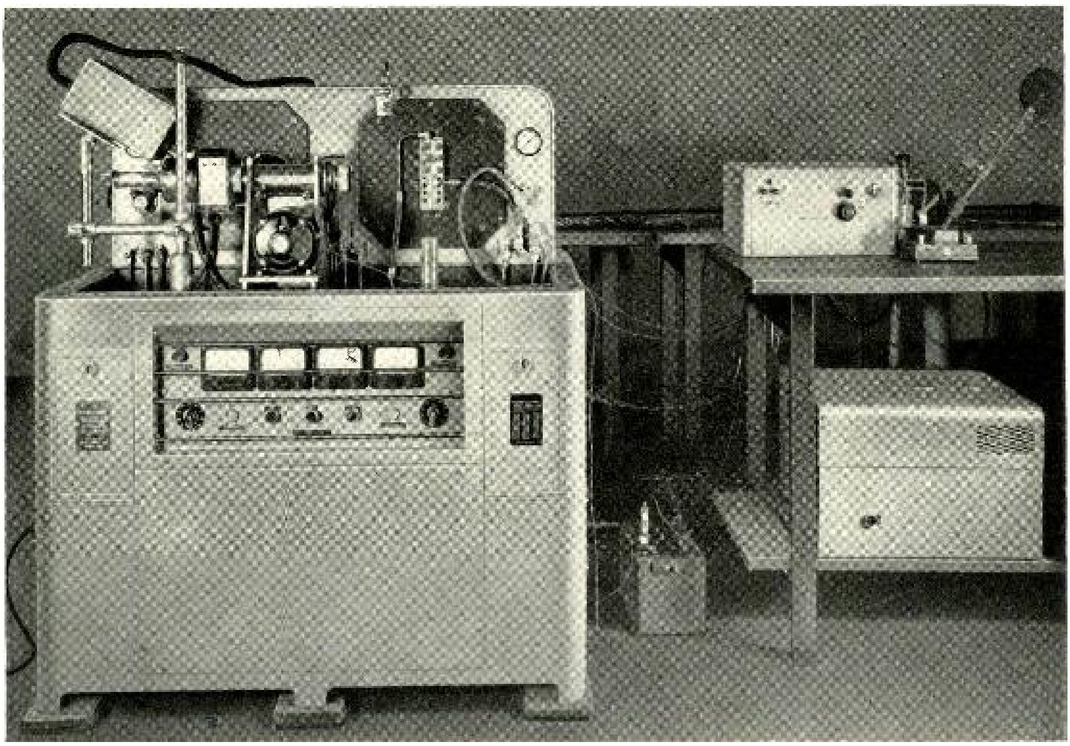


Fig. 6—Over-all view of complete control equipment.

short effective thermal time constant of the tubing alone. It is interesting to note that the control of the 40-kw generator is obtained by means of a few microwatts of light.

Field power for the generator is supplied from thyratrons that are controlled by using a saturable reactor. The current through the reactor is, of course, derived from the output of the control unit; thus the field supply acts simply as a d-c amplifier. Figure 7 shows a schematic of the circuit of the field supply.

Turning off the power at the completion of the soldering or brazing operation is done by a solder-melt detector circuit. This consists of one or more solder wires held by spring pressure against the work in such

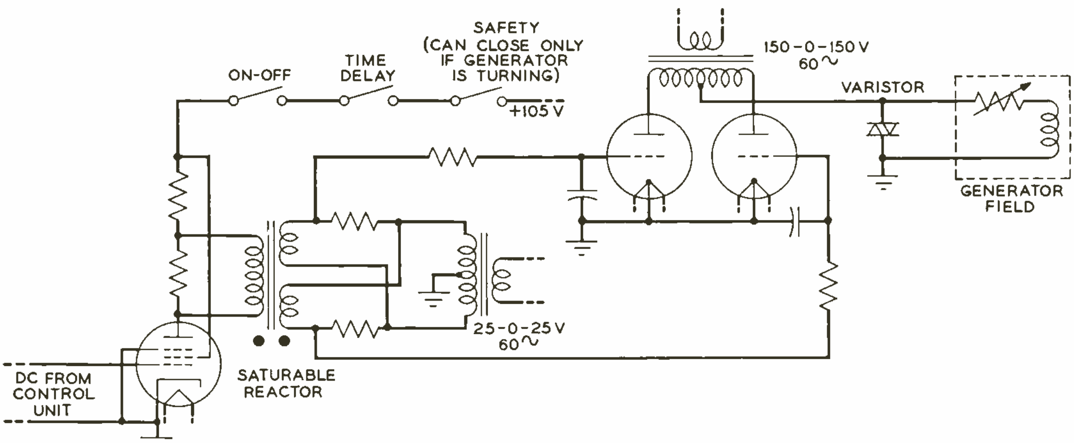


Fig. 7—Schematic circuit of field current supply.

a way that when the parts being fastened become hot enough, the wire or wires melt and allow the spring to swing them clear of the work and open the electrical circuit at that point. Opening this circuit initiates a time delay cycle whose completion cuts off the generator field power.

Two methods have been used to study the temperature control performance of the system. One method has been to paint suitable work pieces with a plastic material having the property of melting at a predetermined temperature, and to observe the melting pattern in relation to standard lamp current. This method is useful in determining transient effects and nonuniformity of heating. The other method has been to use a thermocouple mounted in a suitable work piece to measure the temperature of the piece at various lamp currents. The latter method is highly accurate, but is slow relative to the former because it requires long heating periods for the thermocouple to stabilize. Thermocouple measurements cannot be made in quick succession.

It is somewhat difficult to state an exact relationship between lamp current and temperature because of the thermal gradients present and their variation with time. Assuming the temperature of a part of the surface of the work to be held constant by the control system there will still be a temperature difference to the inner surface or between different points on the surface. The deviation of one thermocouple reading from another, however, has generally been less than 10 degrees at 1400 degrees F and with careful adjustment of lamp current, the readings usually check within 2 or 3 degrees.

THE AUTHOR: R. W. Ketchledge attended the Massachusetts Institute of Technology where he received the degrees of B.S. and M.S. in E.E. in 1942. Upon graduation he joined the Systems Development Department of the Laboratories. During the war he worked on various projects including new sonar techniques, and other special underwater sound devices, an aircraft position indicator, and infrared detection devices. In 1946 he was assigned to repeatered submarine cable work, and was concerned with a variety of special testing and development projects. Since 1949 Mr. Ketchledge has been in charge of a group developing regulators for the L3 coaxial system. Recently he has also assumed responsibility for L3 system design and trial.

Leaf spring vibration machine

F. W. STUBNER
Electronic Apparatus Development

In the early days of radio broadcast reception, music or speech was frequently overshadowed by a loud noise caused by what is called a "microphonic" electron tube. A microphonic tube is one in which one or more elements have been excited either by mechanical or acoustic shock, so as to chatter or vibrate at their natural frequency, causing variations in the plate current, which in turn results in the annoying sound in the loudspeaker.

Although electron tubes are still subject to this condition, we are very seldom troubled by microphonics, because in the newer tubes the internal elements are generally smaller and more rugged, so that their natural frequency of vibration is relatively high and therefore not excited so readily.

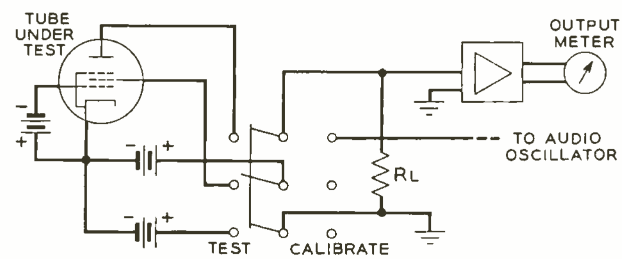


Fig. 1—Schematic circuit used for vibration tests.

In some tube applications, however, the high-frequency vibrations cannot be tolerated for other reasons. While not necessarily falling within the normal audio range, changes in plate current as a result of vibration of tube elements may cause serious distortion of the desired signals. This is especially true in the construction of electron tubes destined for mobile equipment, and specifications for that use include requirements for vibration tests. These requirements specify that the tube shall be rigidly mounted on a platform and vibrated with simple harmonic motion, for given periods of time, frequencies, and length of excursion, depending upon the type of tube being tested. Measurements of the voltage produced across a resistor in the plate circuit, with specified voltages on the elements, give the acceptable or non-acceptable characteristics. Figure 1 shows the circuit used for these measurements.

Selection of the type of vibration machine to be used is left to the manufacturer. It has been found, however, that a lack of agreement exists in the results obtained with different types of test apparatus; although the machines may vibrate nominally at a fixed amplitude and at the specified frequency, they produce varying amounts of high frequency vibrations—called "hash" —composed of discrete frequencies superimposed on the fundamental vibration frequency. Since these frequencies may fall in the range of the natural frequencies of tube structure, vibrations of the elements may be excited. It is therefore unavoidable that major differences in tube response may occur almost at random, depending upon chance coincidences, in the frequency spectra of the testing table and the tube structure.

One way of avoiding the difficulty with "hash" is, of course, to prevent it from reaching the tube. This involves locating the sources of the unwanted vibrations and then adopting a design in which the sources do not appear at all or the noise products are filtered out before reaching the tube.

Two types of vibration machines commonly used for microphonic tests are illustrated schematically in Figures 2 and 3. Both include some type of connecting rod device to drive a table back and forth at constant amplitude. Unavoidable play in

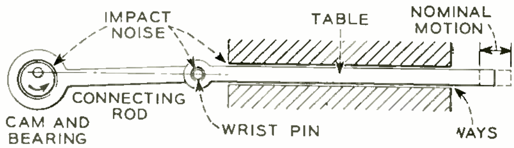


Fig. 2—Reciprocating vibration testing machine with table supported by guides or ways.

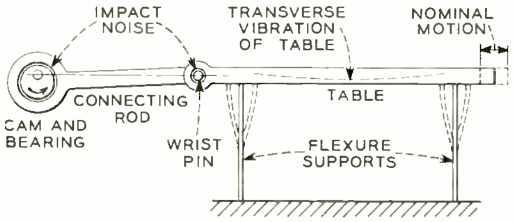


Fig. 3—Reciprocating vibration testing machine with table supported by flexure plates.

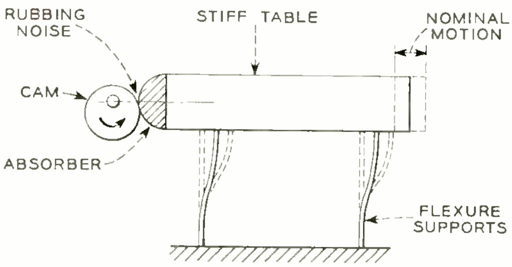


Fig. 4—Schematic arrangement of new leaf spring machine.

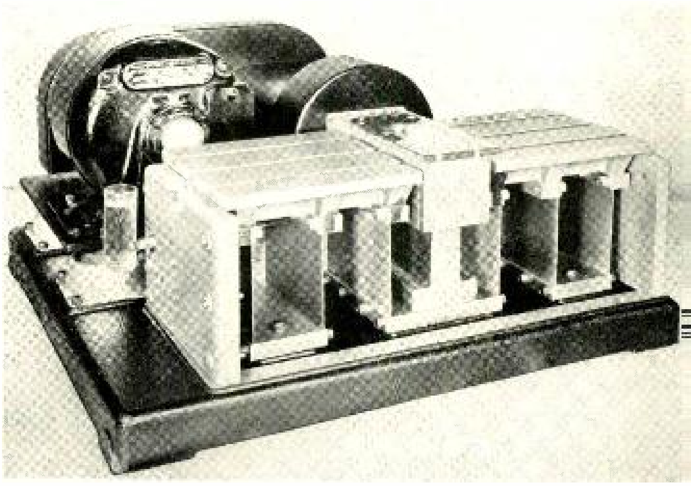
the junction between the connecting rod and the cam, and between the connecting rod and the table, produce metal-to-metal impacts in each half cycle. Vibrations resulting from these impacts are transmitted directly through the table to the tube. Additional disturbances are produced in the type of machine represented in Figure 2, by rubbing noise and play in the guides or ways, in which the table slides back and forth. In the machine shown in Figure 3, this type of noise is eliminated by the use of flexure plates or rods to support the table, but connecting rod bearing knocks may still be produced.

A new type of machine in which the objectionable features of the older machines are excluded has been developed by the Laboratories. Figure 4 shows the schematic arrangement. Flexure plates are used as both table supports and pressure springs, while the table itself acts as the cam follower. Impact noise from bearings is thus eliminated, and, although rubbing noise is generated between the cam and follower, this is attenuated in a plastic absorber before entering the table proper. Rubbing noise is kept to a minimum by designing the flexure springs so that the pressure between cam and table is small at rated speed. This is achieved by making the resonant frequency of the table on these springs almost equal to, but somewhat higher than, the rated frequency of the machine, so that the table does not leave the cam up to that frequency.

The motor, not shown in Figure 4, is supported on rubber mountings and its shaft is rubber coupled to the cam shaft ahead of the flywheel to prevent motor noise from entering the table. An oil pump raises oil to a reservoir above the main drive shaft and the oil feeds by gravity to the main bearings and the cam shaft. The oil pump is of the "slinger" type—using no gears or connecting rods—to provide noiseless operation. Actually, a pair of opposing tables is used to make the machine self balancing. Figure 5 shows the complete machine.

Comparisons between the new machine and those of earlier types show a marked improvement in the table acceleration output of this machine. These comparisons were made by using a quartz crystal accel-

Fig. 5—The new leaf spring vibration machine.



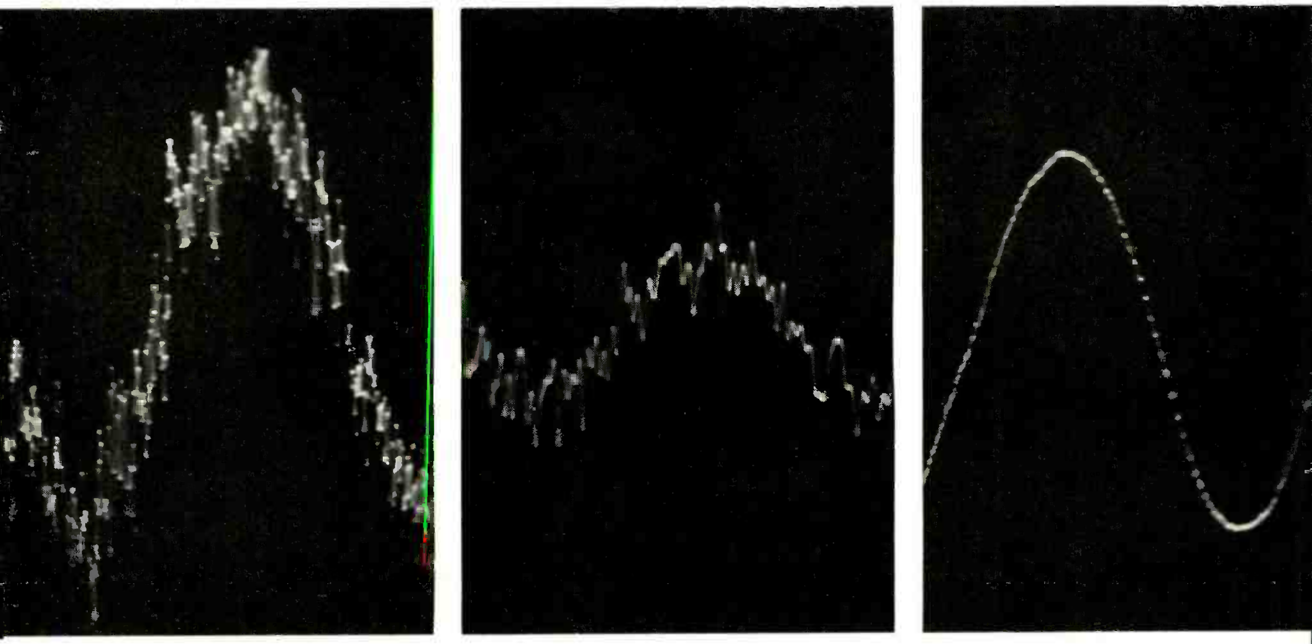


Fig. 6A—Oscillographic record of vibration testing machine of Figure 2; Fig. 6B—Record of machine of Figure 3; and Fig. 6C—Record of machine of Figure 4.

erometer attached to the tables, having its output fed to a cathode ray tube. Records for the three machines are shown in Figure 6. Figure 6A is the type of wave obtained from a connecting rod type, Figure 2. Figure 6B is the record of a machine represented by Figure 3, in which some improvement resulted in replacing the table guides by flexible supports. Figure 6C, for the new machine, shows that the "hash" has been almost entirely eliminated from the table. A mathematical analysis of the principal design features of the machine has been made by R. D. Mindlin.

What this reduction in "hash" means in vibration studies on electron tubes can be illustrated by comparative noise measurements on various tube types. Tests on a number of tubes, such as oxide coated filament pentodes, thoriated filament pentodes and tetrodes, and indirectly heated cathode types, gave noise output voltages from 1.3

THE AUTHOR: When F. W. Stubner came to the Laboratories in 1929 as a draftsman, he had almost completed his course for a B.S. degree at Cooper Union, graduating the following year. Shortly afterward he became a Member of the Technical Staff, and in 1931 was made a design engineer in charge of a drafting group concerned with the design and building of telephone apparatus and test equipment. In 1940, he was transferred to the Electronic Apparatus Development Department where his work included the design of vacuum tubes, magnetic switches, and the glass work and pumping on the carbon deposited resistor. He is presently in charge of the applied mechanics laboratory at Allentown, where his activities include mechanical tests on electron tubes, shock and vibration studies, and the development of equipment for making these tests.

to more than three times as large for the connecting rod machines as for the new leaf spring design. On testing the same tubes a number of times, the noise readings were always lower, more uniform, and reached a steady value with a lower swing of the output meter needle when the tubes were vibrated on the leaf spring machine. When especially high noise measurements are obtained for given tubes when tested on the new machine, mechanical defects, such as loose filament springs, have been found when the tubes were analyzed.

Because of the superiority of the leaf spring machine over the earlier designs, the Joint Electron Tube Engineering Council has recommended this device as suitable for performing the Joint Army-Navy Specification vibration test F-6b(1). This test specifies that certain tubes shall be checked for microphonic characteristics when vibrated at 25 cycles per second and at an excursion of 0.080 inch.

A number of machines have been built by a machine tool company, using working drawings furnished by the Laboratories. The Laboratories agreed to inspect the first six of these machines before their delivery to government agencies and to several electron tube manufacturers who are members of the Joint Electron Tube Engineering Council.

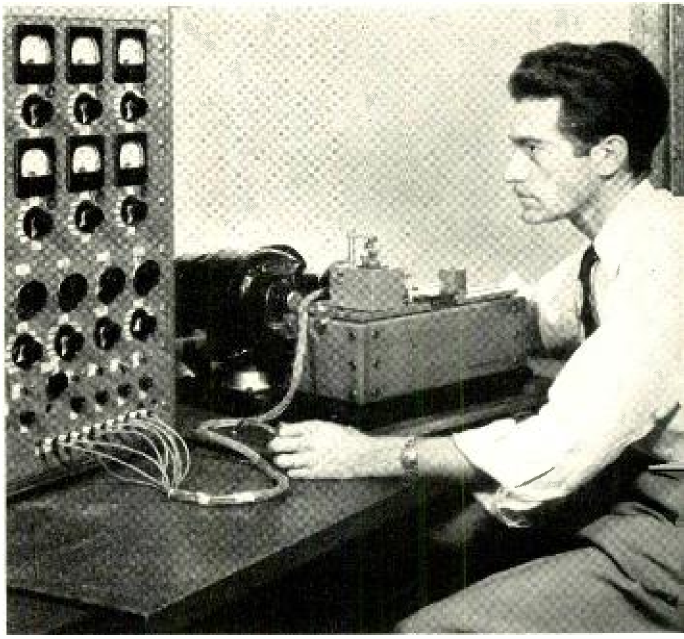


Fig. 7—G. I. Dixon operating the leaf spring vibration machine

Army Commends Laboratories-Western Electric Team

Major-General C. L. Ford, Chief of Ordnance, has written to the Western Electric Company, prime contractor for the new Fire Control System,* as follows:

"I am very gratified to hear of your continued success in producing the Fire Control System and especially of the fact that such units are being produced ahead of the schedule which we require.

"I appreciate the conditions involved in the manufacture of this complex electronic equipment and the efforts of your organization in solving the problems encountered reflect great credit upon the Western Electric Company."

Transmitting a copy of the letter to the Laboratories, Vice-President Lack said, "It continues to be a nicely co-ordinated project between our two organizations and we appreciate being associated with you in this successful project."

*Record, *April*, 1951, *page* 174.

500 type telephone set

W. L. TUFFNELL
Station Apparatus Development

In comparison with earlier telephone sets, whose components were designed at different times, the new 500 type telephone set has the distinction of being the first complete station set to be designed as an integrated unit. With all its components designed to work with each other and embodying the latest technology, the new set is superior to its predecessors.

For many years, the standard telephone set (Figure 1) was of the desk stand type with the transmitter in a fixed position on a stand and the receiver suspended on a side switchhook, while the ringer, induction coil and condensers were separately housed in a bell box on a nearby wall. Later the transmitter was detached from the stand and combined with the receiver to form a handset which was more convenient to use and also provided better transmission. During the thirties, improvements in apparatus design made it feasible to take the further step of combining all of the elements in a single package of agreeable size which resulted in the familiar combined telephone set as illustrated by the 302 type (see Figure 1) which came out in 1937.

The combined set was an immediate success. Some indication of its merits may be had from the realization that there are now some 25,000,000 of this type of set in the telephone plant. It became apparent at the close of the war that if a completely new set could be developed as an integrated unit, taking full advantage of improvements in structures, materials and design techniques, as related to service requirements, it would be possible to provide a new telephone set that would be still better than the 302. The development was started; the new set was ready for its first field trials by 1948, was placed in limited production in 1949, and production has been steadily increasing since then.

A primary objective of the new set was to raise the level of transmission over long loops. Such an improvement in transmission would make it possible to take further advantage of smaller gauge cables and also to extend the loop range. It was recognized, however, that an increase in level of transmission on short loop connections would be undesirable since the level for the existing 302 type set on short loops was already as high as could be used. The objective, therefore, was to secure transmission levels on the short loops no greater than with the existing 302 type set but to improve transmission on limiting loops by approximately 10 db, equally divided between transmitting and receiving. Other objectives were: a smaller handset of lighter weight; a dial with better pulse regulation and easier to see and operate; a ringer with higher acoustic output, more pleasing sound, and facilities for subscriber control of its loudness.

In order to achieve the objective of increased transmission levels on the long loops without a similar increase on short loops, two important changes in the circuit of the new set were required. First, it was necessary to provide some means for limiting the volume level on short loops. Also, in order to avoid zoning on the basis of loop length it was desirable that level-limiting be accomplished automatically. Second, improved sidetone balance was necessary to offset the increased volume levels of the new transmitter and receiver.

The schematic circuit of the new telephone set and the manner in which these changes in the station circuit were carried out are shown in Figure 2. Control of level with change in loop length is obtained by the use of an element entirely new in station circuits —the 311A equalizer. The loss characteristic of the equalizer is controlled by the magnitude of the dc line current through the set. Essentially, the equalizer consists of a tungsten filament connected in series with the station transmitter and a thermistor located nearby in the same glass envelope and electrically bridged across the receiver. The resistance of the thermistor is controlled by heat from the nearby filament. On short loops where the dc line current through the set is high, the tungsten filament introduces a combined battery supply and ac circuit loss of about 5 db. On long loops where the line current through the set is low, the effect of

Fig. 1—Left to right, the deskstand of 1919, *the handset of* 1927, *the combined set of* 1937, *and the* 500-*type set of* 1950.

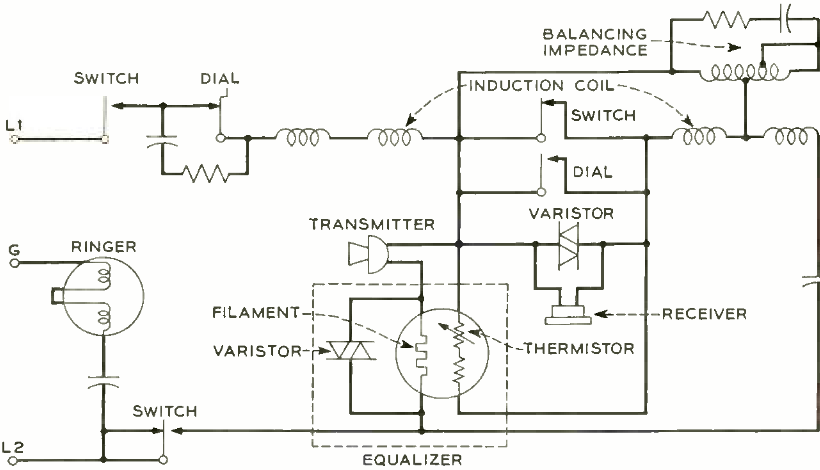


Fig. 2—Schematic of 500 *type telephone set.*

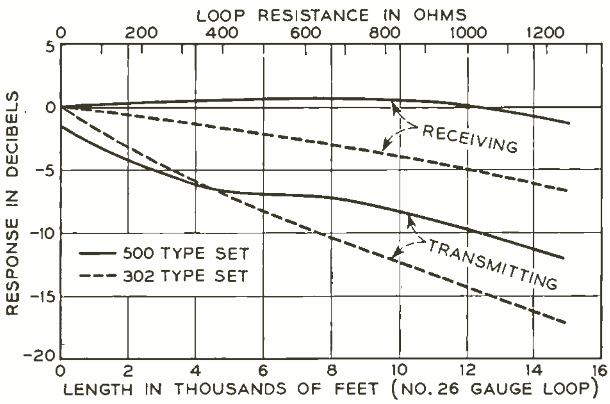


Fig. 3—Relative volume levels.

the filament resistance is negligible. Because of the negative coefficient of resistance of the thermistor a corresponding graduated receiving loss with change in loop is obtained. Thus, the higher gains of the new transmitter and receiver are permitted to work to full advantage on long loops but are reduced on short loops to keep the over-all level approximately equal to that of the 302 set.

The improved sidetone balance necessary with the higher efficiency instruments was secured with a new three-element balancing impedance. Radio interference in dialing is suppressed by a .1 mf condenser associated with a resistive element and the induction coil line winding.

As may be seen from the headpiece, the design of the 500 set is characterized by a low silhouette with the dial face set at a lower angle than formerly. The numbers and letters are arranged outside the dial fingerwheel, thus permitting a greater angle of vision for dialing than in the previous design where the characters could be seen only by looking through the holes of the fingerwheel. Also, with the characters outside the fingerwheel, there is less tendency to scratch or mar them when dialing.

The handset is shorter and weighs only 12 ounces—4.5 ounces less than the previous design. Because of its size and shape, the new handset provides a better average fit for the distribution of head sizes. This results in a higher acoustic input to the transmitter which, in turn, steps up the modulation of the carbon and so increases the transmitter output. Additional increase in transmission is obtained by an inherently more efficient transmitter. The life of the neoprene jacketed handset cord is much increased by reinforcing it with a grommet where it enters the handle. The grommet also provides an acoustic seal for the cavity leading through the

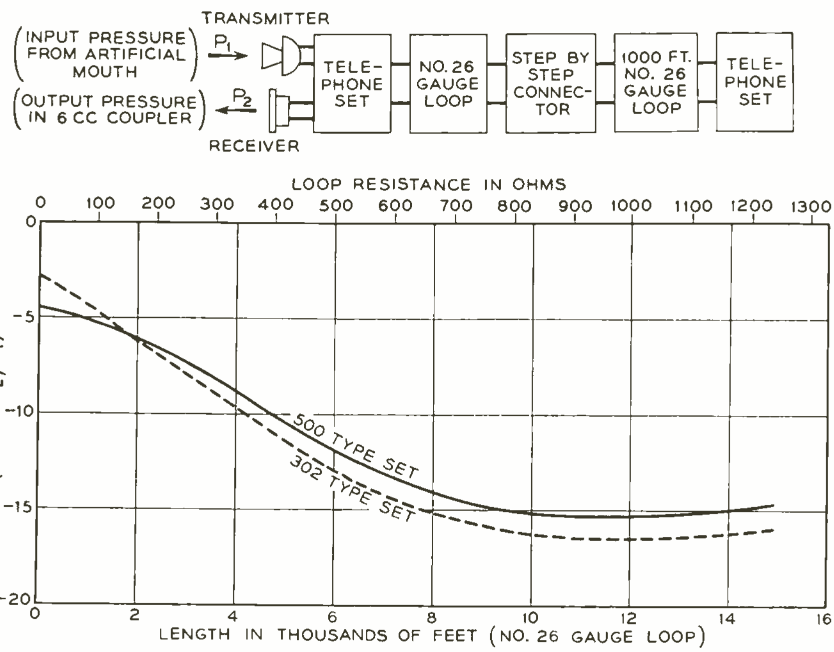


Fig. 4—Comparative sidetone levels. Sidetone level is a function of the instrument efficiencies and of the balance between a balancing impedance in the set and the line impedance which in turn varies with circuit length. Superior balance of the 500 set counteracts effect of higher instrument efficiencies on sidetone.

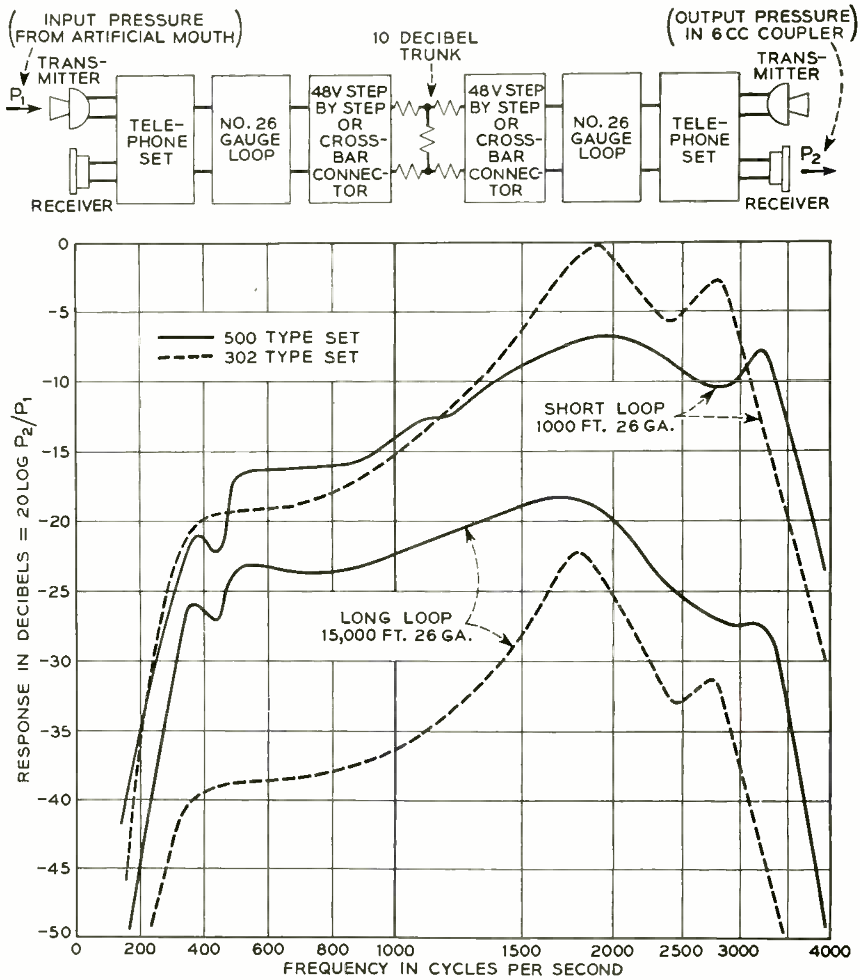


Fig. 5—The over-all frequency response characteristics of the new and old sets on short and long loop circuits.

handset handle to the back of the receiver. The grommet is notched to fit a projection in the handle so that the cord is anchored in a simple and positive manner.

The comparative transmission characteristics as a function of loop length of the new and old sets are shown in Figure 3. There is approximately 5 db gain in both transmitting and receiving under long loop conditions while on zero loop the levels for transmitting and receiving are essentially the same as for the 302 set as indicated above. The curves shown in Figure 3 represent loudness comparisons only and do not include the additional transmission improvement achieved through broader frequency range in the receiver and more nearly orthotelephonic quality in transmitting. The curves for sidetone, Figure 4, indicate how effectively the new circuit achieves the objective of keeping the sidetone level on short loops at or below the level of the 302 set. The over-all frequency response characteristics of the new and old sets on short and long loop circuits are shown in Figure 5.

The fundamental ringer tones have been made considerably stronger by mounting formed aluminum resonators under the gongs. In previous ringers, resonators have been added in the field only when required. Figure 6 shows the sound output spectrum of the new ringer as compared to that of its predecessor. It should be noted that the fundamental frequencies of the two gongs of the new ringer are lower, which results in a more pleasing and effective tone. To produce a harmonious sound, the two gongs were made to differ in their fundamental fre-

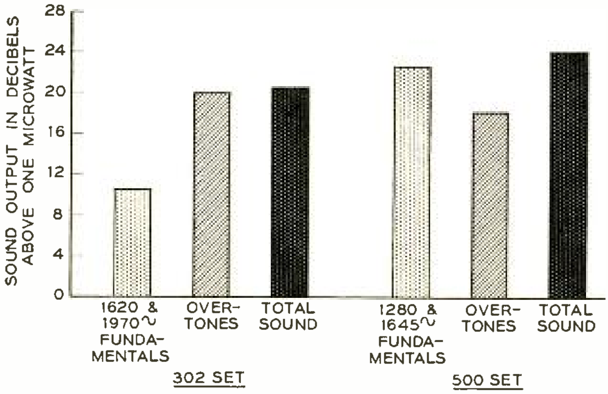


Fig. 6—Ringer sound output spectrum.

quencies by a major third. An outstanding feature of the new set is the provision for ringer sound level control by the subscriber. A notched wheel that projects through the base of the set can be shifted to four different positions for four levels of ringer output.

In the design of the new telephone set, full advantage was taken of the fact that all the components were being developed simultaneously. Thus, for example, the ringer and network have been designed to nest together to save space. The switch bracket has been designed to accommodate a flexible support for mounting one end of the ringer. The switch has been laid out to require as little space as possible at the base where space is at a premium and spreads out at the top where more space is available. All the components of the set are directly mounted on a metal base (Fig. 7) with the plastic housing serving only as a cover. This facilitates assembly, wiring and testing of the set in production and greatly facilitates maintenance in the field.

Early preproduction models of the 500 set and later several thousand sets of the first run of production were installed for comprehensive service trials in various areas selected on a basis of range of service and climatic conditions and have since been carefully observed for performance in relation to that of an equal number of 302 sets installed in comparable locations in the same areas. Trials to date have fully confirmed expecta-

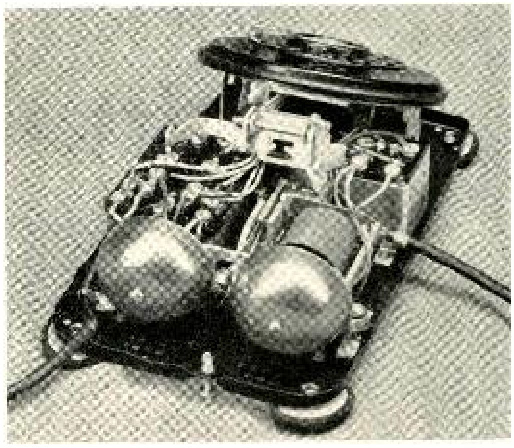


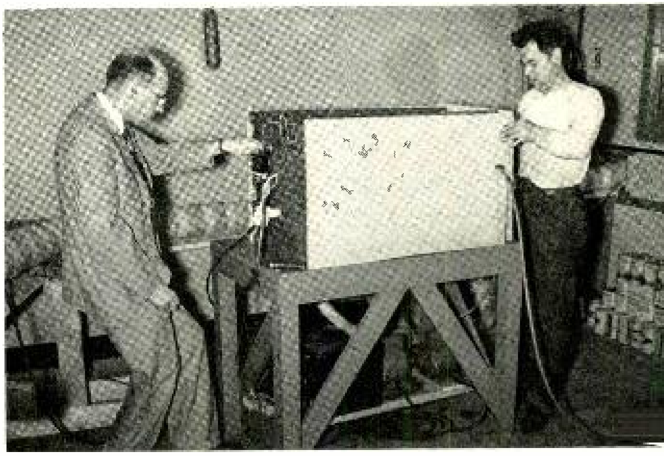
Fig. 7—Internal view of 500 set.

tions as to improved performance in transmission, dialing and ringing, and public reaction has been universally favorable.

THE AUTHOR: W. L. Tuffnell joined the Engineering Department of the Western Electric Company in 1922 and took the three-year student assistant course. For two years of this period he took part in the design of transmitters and receivers with the Research Department. After the Laboratories were organized in 1925, he worked on the development of carbon transmitters and electromagnetic recorders. In 1927 he left to study at the University of Wisconsin, where he received the B.S. degree in 1930. He then returned to the Laboratories, where for many years he was concerned with the development of transmitters for handsets and deskstands, and with the development and commercialization of the transmitter and amplifier of the orthotechnic audiphone. Since 1949 he has assisted in the development of station apparatus such as telephone sets, dials, ringers, coin collectors, cords, and telephone booths.

Laboratories' People Away from Home

Point Breeze

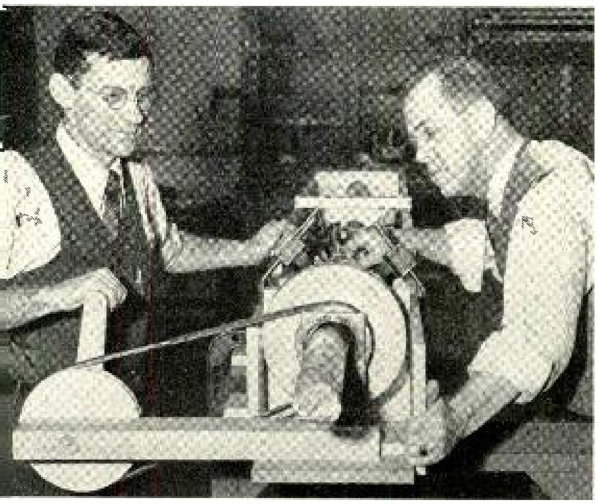


Above, R. B. Ramsey (left) adjusts the thermostatic switch in the test set-up for making measurements on a section of K cable under controlled temperature conditions. R. A. Ragan, Western Electric craftsman, is placing a cover on the refrigerant container.

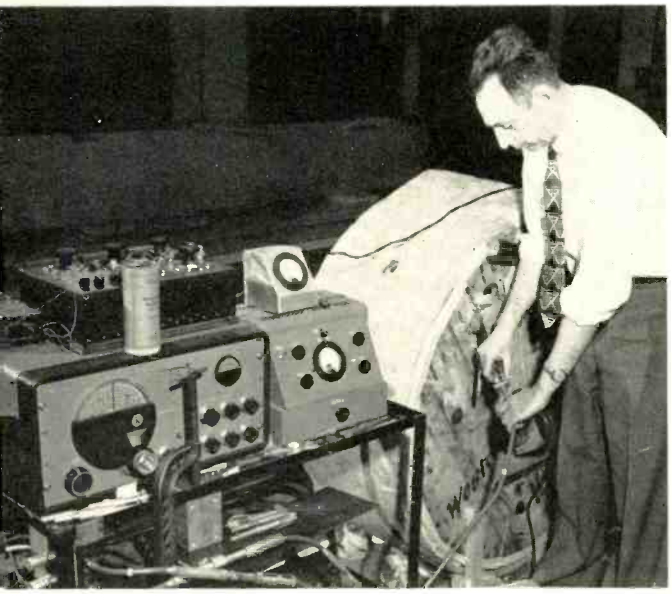
M. C. Biskeborn (right) discusses with J. T. Maupin the data obtained with the echo measuring set, on an experimental coaxial cable.

Those of us who work each day at West Street, Whippany, or Murray Hill may not know, or may seldom recall, that a number of Laboratories' people are normally working at other locations than the usual Laboratories' areas.

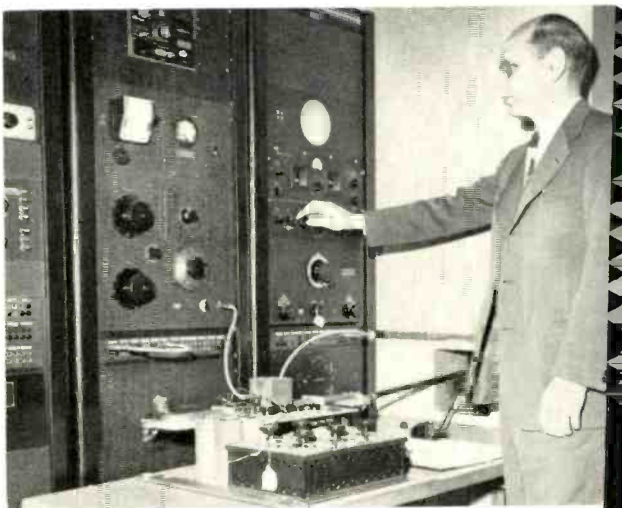
Cable manufacture, for example, is one of those processes that require very close cooperation between the development group and the manufacturing engineers. Such close relations are therefore obtained by placing members of the technical staff right in the Western Electric plants, where laboratory and office space is provided by Western, and where they can work directly with their Western Electric associates. This cooperation makes it possible to construct development samples of new cable with the machines that will eventually build the cable. It also facilitates the testing of cables in which design changes or differences in manufacturing procedures have been incorporated.



W. C. Royal (left) and A. L. Loucks, Western Electric, prepare an experimental model of a machine for applying aluminum tape longitudinally to composite sheath cable.



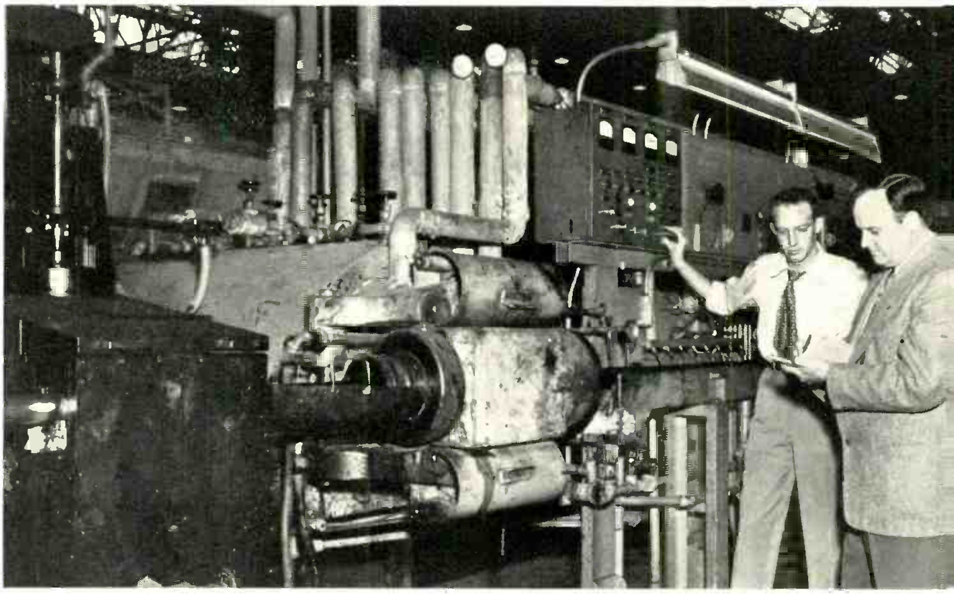
R. A. Kempf is preparing a test arrangement to make measurements on a reel of coaxial cable under varying temperature conditions.



Above right, G. I. Schaible is making connections to a cable under test preparatory to measuring the primary constants, i.e., inductance, resistance, capacitance, and conductance. These measurements will be made over a wide temperature range and at a frequency between 1 kc and 350 kc.

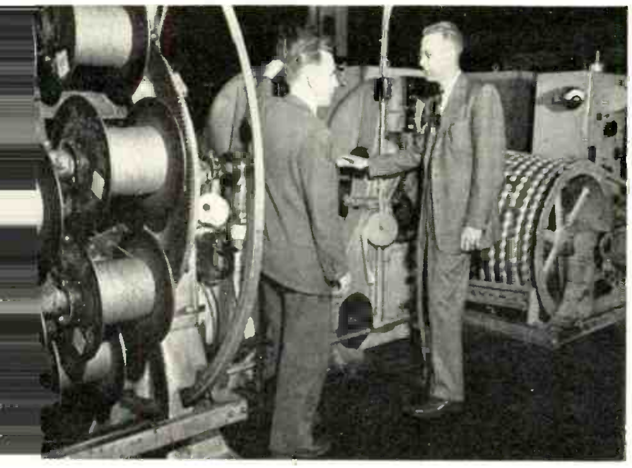
Right, center, A. S. Windeler is making 140 kc frequency measurements of inductance and capacitance on an experimental shielded quad.

Right, Ruth Ammons (left) and Audrey Beatty receive instructions in connection with the editing of cable orders from their supervisor, R. E. Alberts.

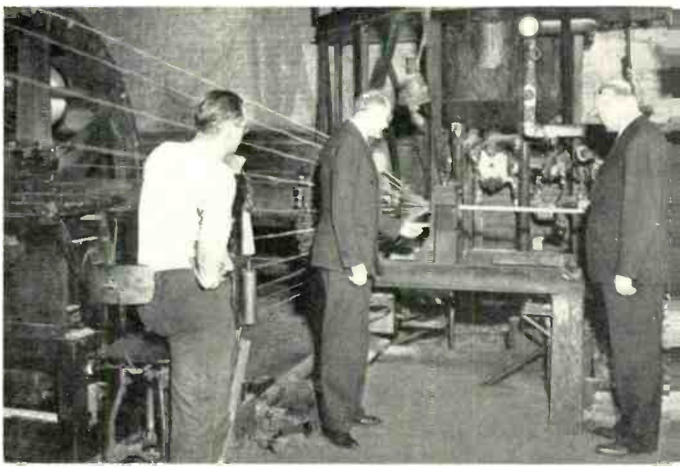


C. R. Noble (right) with E. D. Long (Western Electric) review the operation of the plastics extrusion machine for applying the polyethylene jacket to a Lepeth sheathed cable core. The cable core enters the extrusion die at the left, and the covered core emerges from the die to enter the water trough just below Mr. Long's right arm.

C. E. Howard (right) discusses the stranding of coaxial cable with W. J. Franz (Western Electric) at one of the stranding machines. The paper tape covered cable, ready for drying and sheathing, may be seen at the extreme right.

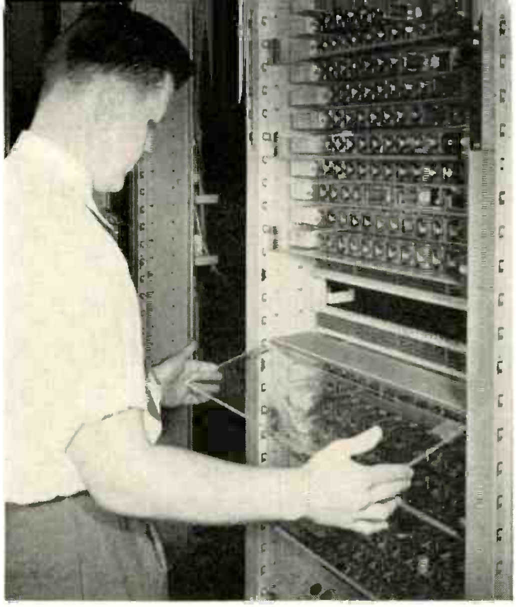


N. V. Firth (center) and E. V. Rice (Western Electric) (right) are checking the wire armoring of lead covered cable as it passes through the armoring machine. Operator of the machine is J. M. Seglinski, Western Electric.



No. 5 crossbar frames

E. T. BALL
Switching Systems Development



Front view of translator and route relay frame showing method of removing front covers.

One of the many novel features of the No. 5 crossbar system is the design of the switch frame. Heretofore, switch frames for central offices have been designed primarily as supporting structures. The protecting covers and shields required for much of the apparatus have formed part of the equipment units mounted on the frame rather than of the frame itself. In general, these have taken the form of individual or strip type can covers or of cabinet type casings enclosing a group of apparatus. These types of covers impose restrictions in the arrangement of apparatus, particularly when functional

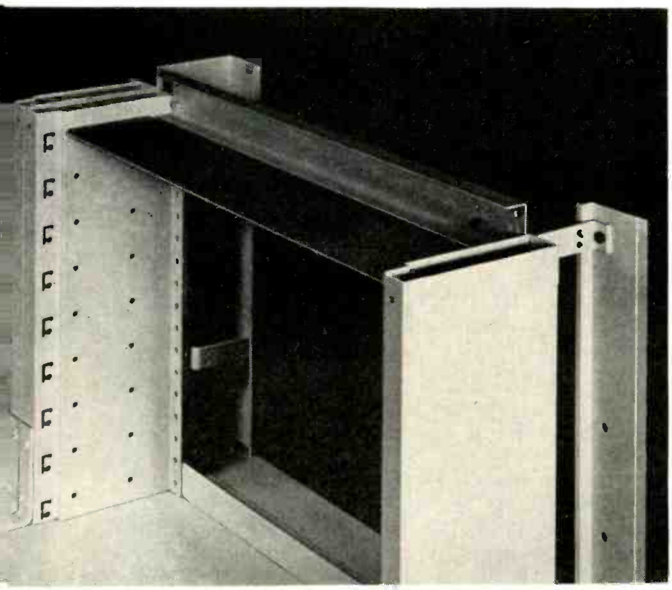


Fig. 1 (above)—Model showing some of the structural features of the No. 5 crossbar frame.

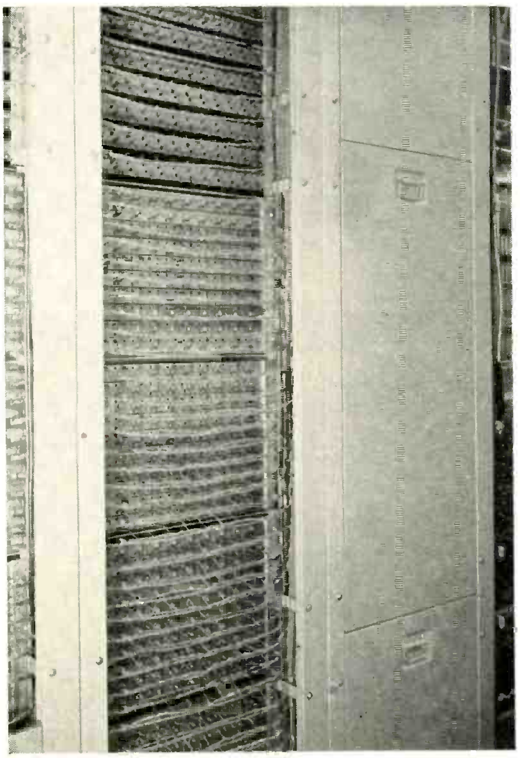


Fig. 2 (at right)—Rear of message register frame at Towson, Md., showing stile strip and covers.

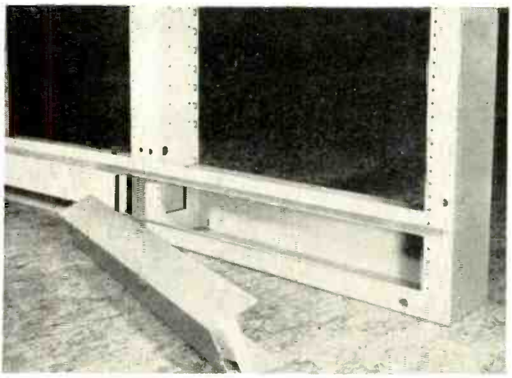
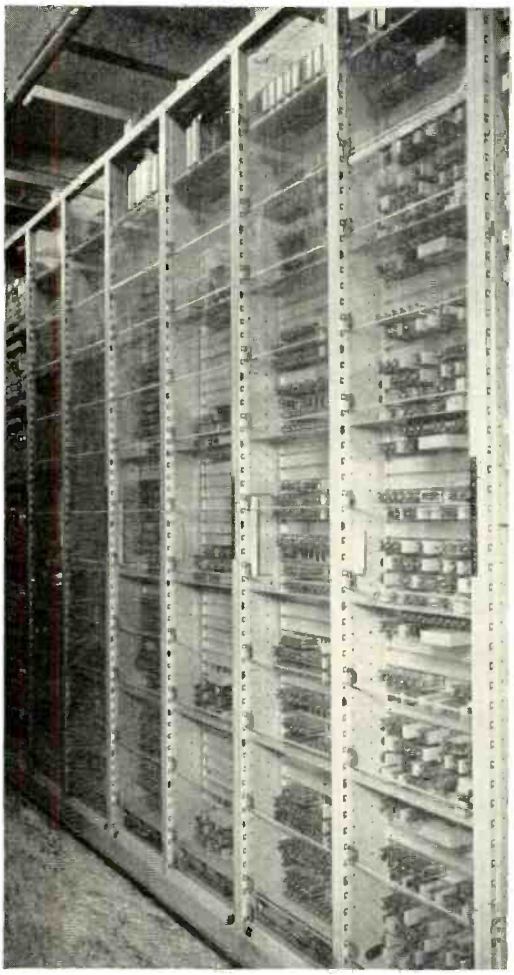


Fig. 3—Rear view of base of frame before equipment has been mounted.

TABLE I—WEIGHTS AND MOMENTS OF INERTIA OF VARIOUS TYPES OF FRAME STRUCTURES USED IN CENTRAL OFFICES

	Weight Per Ft.	Section Area	Moment of Inertia Major Axis	Moment of Inertia Minor Axis
I-Beam . . .	5.4	1.60	2.300	0.400
Channel . . .	4.1	1.19	1.600	0.200
Bulb	4.54	1.31	2.140	0.177
Cable Duct . .	3.53	1.01	1.070	0.181
Box Shape — No. 5 X-Bar	2.80	0.875	3.500	0.300

units are employed. To secure greater freedom in the use of functional units in the No. 5 crossbar system, covering and shielding provisions were made part of the basic frame itself. This permits a frame to be covered to the extent desired, and the covering may be readily modified at any time to accommodate changes in the arrangement of apparatus or in the amount of covering desired.



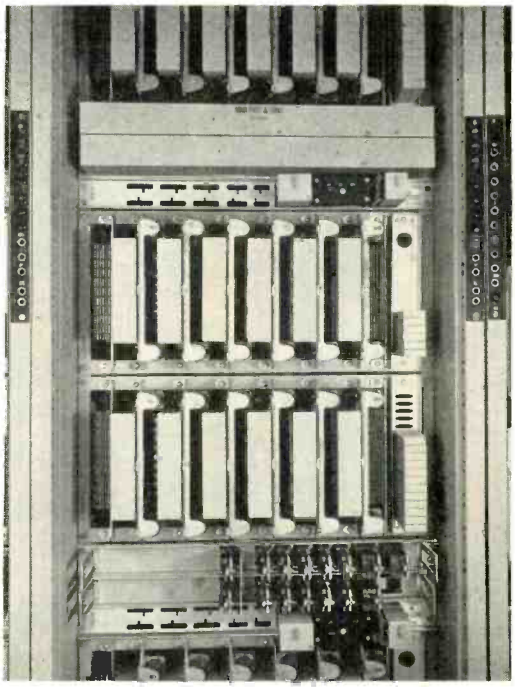


Fig. 4 (above)—On this line link connector frame, the jack strips in the face of the frame uprights are plainly evident.

Fig. 5 (at left)—A line-up of incoming register frames at the No. 5 crossbar office in Towson, Md. The transparent plastic covers may be seen in place on all frames.

Another radical difference in the new frames is that the supporting uprights, instead of being solid steel sections, as were those for earlier types of local central-office frames, are hollow rectangular sections of sheet steel. They are deep enough to extend beyond the switches or other apparatus mounted on them, and thus permit the front covers to be simple panels hinged near the front edges of the uprights. Although the box type uprights of the new frames are only a little over half as heavy as the bulb type frame used in No. 1 crossbar, they are more than 60 per cent stiffer along both major and minor axes. In fact is not required even for the heaviest equipment. This freedom from cross bracing, together with the fact that there are no cabinets to divide up the mounting space, results in a frame that imposes no restrictions on the equipment arrangements, and has made extensive unitization practical.

The shape of the box section of the new frames, and the methods of attaching the mounting plates to the uprights are shown in Figure 1. The front of the uprights are perforated and formed to support and seat the front covers. These are of transparent plastic, and are hung from the "F" slots as evident in the photograph at the head of

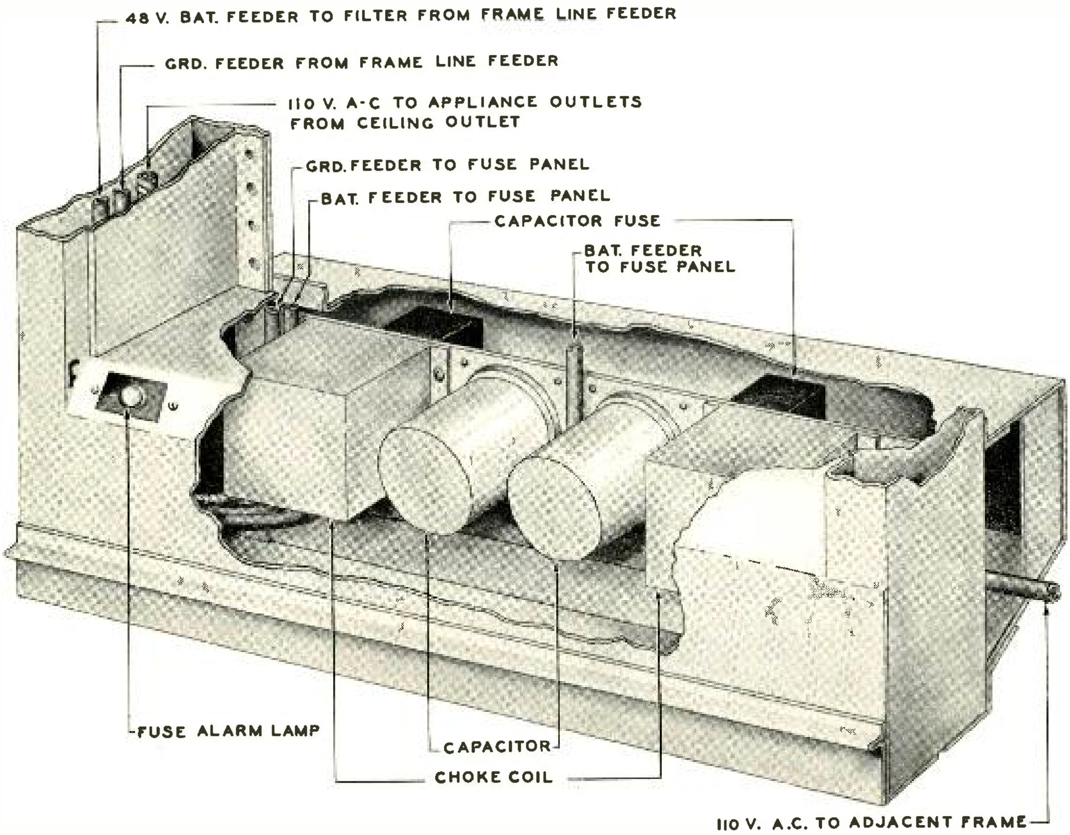


Fig. 6—Perspective drawing showing arrangement of base of the No. 5 crossbar frame.

they are lighter and stiffer than any of the other previously used types of frames, as shown in Table I. Because of this increased stiffness of the new frames, cross bracing this article. A series of round holes, also evident in the illustrations, is perforated in the inner face of each upright to accommodate slides into which may be inserted horizontal baffles or separators. These are on two-inch vertical centers so that a frame

Functional units are described on page 245 of the June 1950 Record.

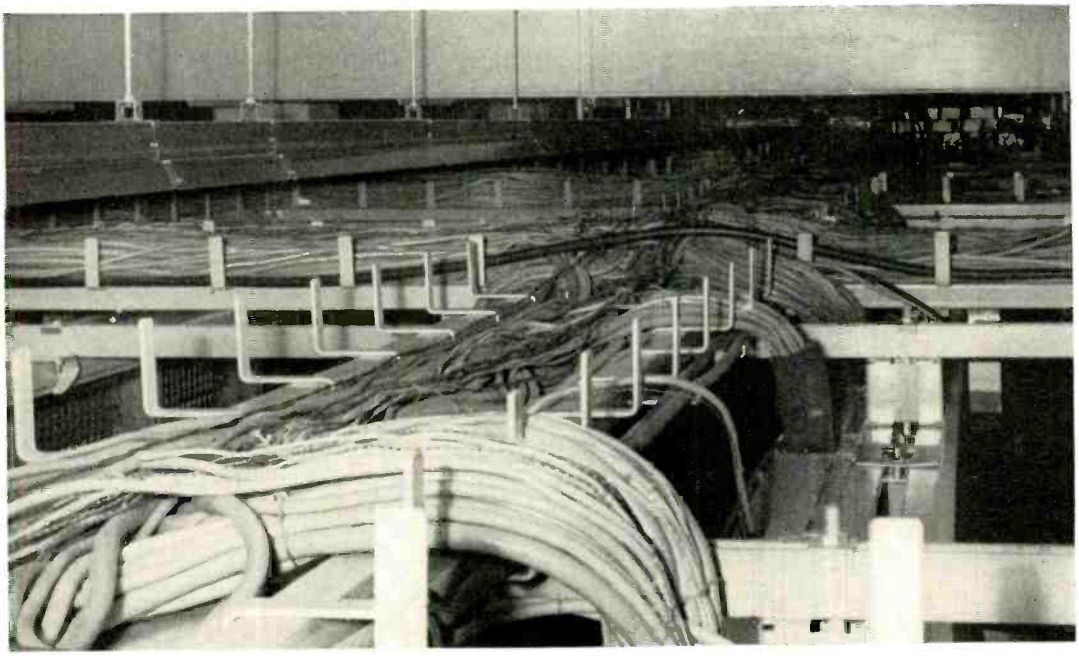


Fig. 7—View of cable racks over wiring aisle in a No. 5 crossbar office as seen from above.

may be divided up in any manner desired, each compartment accommodating a given number of two-inch mounting plates or their equivalent. In line with the front baffles but at the rear of the frame are corresponding baffles mounted by similar slides fastened to the cable brackets. Rear covers of the lift type, three per bay, are arranged to mount on fixed stiles that cover the cable ducts, as evident in Figure 2.

The frame provides for 62 two-inch mounting plates or the equivalent of other apparatus, with the bottom mounting plate 12 inches from the floor. In addition, battery filters and similar equipment requiring little maintenance may be mounted inside the base of the frame, where four additional inches of vertical mounting space is available. This arrangement is evident in Figure 6. Access to this equipment is obtained by removing the rear cover of the base, which forms the rear guard rail, as shown in Figure 3. In the front cover of the base, which is welded to the upright, are the fuse alarm

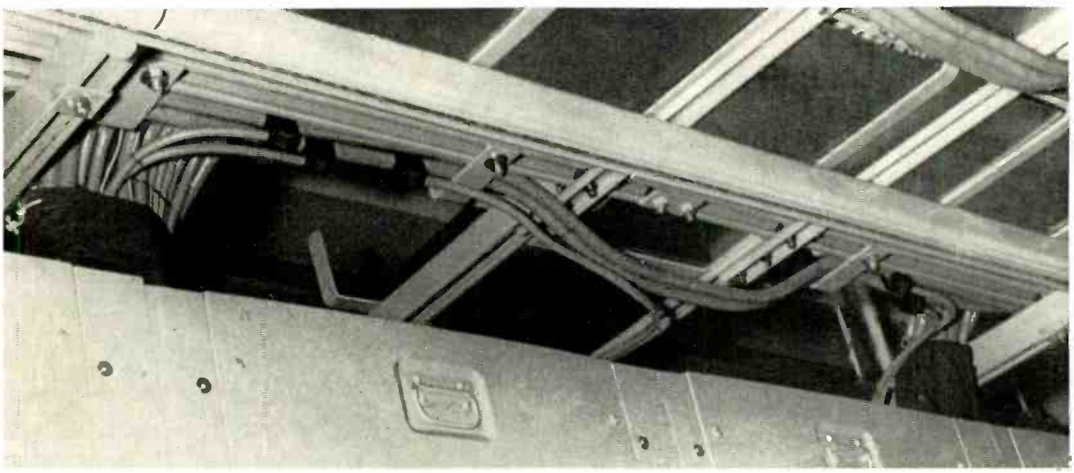


Fig. 8—View of the cabling as seen from the floor.

lamps and an appliance outlet. Both front and rear appliance outlets are connected with a common harness that is installed in the shop. It is provided with connecting leads to permit the installer to connect it quickly to the supply and to the outlet circuits of adjacent frames. The fuse panel alarm lamps are mounted in the bevel at the front of the base, where they are easily visible along the aisle. The fuse panel itself is mounted immediately above the base closely adjacent to both the alarm lamp and the filter, as may be seen in Figure 5. Advantage is taken of the hollow upright to build in accommodations for miscellaneous jacks and keys, as is evident in Figure 4. Battery and commercial power feeders are also run in the uprights.

The associated overhead cable racks are so designed that sewing and clipping of cables and much of the planning is avoided. The rack is placed over the rear or wiring aisle, and feeds two adjacent rows of frames. The rack structure consists of a pair of stringers, shown in Figure 7, to which are welded cable straps formed to provide cable space both between and above the stringers. The ends of the straps point upward to form a series of horns around which cables are broken out of the run. The cables are thrown loosely into the rack with a minimum of dressing. To conceal this and to prevent dust from slipping through the cable pileup, thin sheets of aluminum are laid in the bottom of the rack prior to cabling. In spite of this lack of dressing, the cabling presents a good appearance from the floor as evident in Figure 8.

THE AUTHOR: As Equipment Practices Engineer, E. T. Ball spent some fifteen years with the Western Electric Company, and then in 1939 transferred to the Laboratories. Here, with the general standards group, he worked chiefly on studies of framework designs. After Pearl Harbor he transferred to Whippany in charge of a drafting group. Since the war he has been engaged in the design of framework components for the No. 5 crossbar system except for a year spent on the development of toll switching equipment.

Coast-To-Coast Radio Relay System Opens

Spanning the American continent by radio relay is the crowning achievement of a long pursuit of electronic telephony that followed de Forest's grid-controlled tube as perfected by Arnold's high vacuum in the Laboratories in 1913. First flowering in this pursuit was the attainment of transcontinental telephone service in time for the San Francisco Exposition of 1915. That same year saw the famous long distance radio experiments whereby the continent, and also the oceans, were first bridged experimentally by radiotelephony. Subsequent extensive development of multiplex carrier, radio in its many forms, wideband coaxial cables, and wider band wave guides leading to microwaves, yields today this great new kind of "line" across the continent—one which combines projected and guided wave techniques to convey sight, as well as sound! **L. ESPENSCHIED**

In the relatively brief period of four years, microwave relay has grown from the initial New York-Boston system to the continent-spanning "line" opened on August 17, 1951.

Ceremonies marking the opening of the new system were held at noon on August 17, in which Wayne Coy, Chairman of the FCC, Cleo F. Craig, president of A T & T, and H. T. Killingsworth, Long Line vice-president, participated at the New York end. At San Francisco, Mark R. Sullivan, president of Pacific Telephone and Telegraph and Harold P. Huls, member and former president of the California Public Utilities Commission, took part. A roll call of Bell Company presidents in terminal cities along the microwave route brought in Keith S. McHugh, *New York*, Randolph Eide, *Ohio*, W. V. Kahler, *Illinois*, E. J. McNeely, *Northwestern*, and F. P. Ogden, *Mountain States*.

In effect, the initial New York - Boston installation was essentially a full-scale field trial that made possible a valuation of the economic and technical aspects of microwave relaying, paving the way for the nationwide system.

Installation of the coast-to-coast system was accomplished in steps between cities. The New York - Chicago link was put in service on September 1, 1950. The Chicago - Omaha section, which has been in operation as part of the television network since September 1950, has now been equipped to carry telephone service. Building west from Omaha and east from San Francisco, reminiscent of the first transcontinental railroad, construction crews met at Crow Creek Hill, Wyoming, between Cheyenne and Laramie, where the "Golden Spike" tower was built.

More than 100 through telephone circuits between Chicago and San Francisco are provided by the new system. It is also equipped to handle several hundred shorter haul telephone circuits connecting cities along the route and tying in with other circuits running north and south from the cross-country system. The facilities initially provided, however, represent only a small portion of the potential capacity.

Along the 3000-mile route are 107 towers spotted every thirty miles or so. Mounted on top of each tower are four 10-foot square,

Mr. Killingsworth, Mr. Coy and Mr. Craig inspect a radio relay exhibit set up in the Long Lines headquarters building where the first call originated.

Completion of the radio relay route recalled memories of another "golden spike" celebration, which took place at Wendover, Utah, in 1914, when the final pole in the first transcontinental telephone line was placed.

The "golden spike" station of the Bell System's transcontinental radio relay route at Crow Creek, Wyoming.

horned-shaped antennas—a transmitting and a receiving antenna facing in each direction. High gain amplifiers boost the voice signals by a million-fold before they are sent out to the next relay station. Commercial electric power operates the equipment at the relay stations, but gasoline or diesel generator units are automatically cut into service in case of power failure. Alarm circuits carry trouble warnings to Long Lines control centers.

Locating the relay stations to maintain clear line-of-sight paths between transmitting and receiving antennas involved problems other than simply selecting the highest spot in the locality. The perfect spot might be far too difficult to reach, both for building and maintenance purposes. Roads might have to be built to the site, and power and telephone lines brought in.

One unforeseen problem in Colorado arose when a site owner warned Long Lines people that, although he was willing to grant right-of-way, he thought his "ferocious" bull grazing on the site wouldn't like the idea. Perhaps a fence should be erected around the site, he said. It was.

And in Utah another owner was willing to grant right-of-way, but under one condition: No work could be done between May 15 and June 15, the lambing season. It seems that ewes frighten easily, and the clatter of construction work might reduce the wool and meat crop. This request was also granted, and the ewes had their little lambs as usual without interruption.

For a number of years before World War II, Bell Laboratories had carried on a program of research and development to find out how radio relaying might supplement wire and cable facilities in the telephone system. Although interrupted by the war, this program was resumed in 1945 by the radio research group under H. T. Friis, making use of some of the developments in microwave electronics that had progressed rapidly under the impetus of war-time needs. Developments in radio relay equipment and the application of the system to commercial use were brought to fruition by the organizations reporting to H. A. Affel, G. N. Thayer, G. W. Gilman and H. H. Lowry. Electronic Apparatus under J. R. Wilson developed a dozen new tubes for the system.

Long before the New York - Boston system was completed in 1947, a committee consisting of M. L. Almquist, chairman, G. N. Thayer, J. F. Wentz, and T. J. Grieser, was already engaged in formulating the over-all technical objectives for a system capable of meeting transcontinental transmission requirements. Early in 1947 this committee, with the co-operation of all major departments of the Laboratories, had completed a rather firm proposal, and development of the system, now known as the TD-2 radio relay system, began. A T & T and Long Lines began planning a New York - Chicago system and its extension to the west coast.

Almost every major department of the Laboratories was involved in the TD-2 development by early 1948. While the Transmission Engineering Department under G. W. Gilman was primarily responsible for establishing the over-all system transmission requirements, and Transmission Systems under H. A. Affel and G. N. Thayer for the over-all coordination of development and design, large and important contributions were made by Research, Electronic Apparatus Development, Transmission Apparatus Development, Systems Engineering, and Switching Development Departments. Contributions of individuals, too numerous to mention, all went into the project to make it another example of traditional Bell System cooperation.

Telephone People Battle the Greatest Flood in the Nation's History

Once again, Bell System teamwork has been called into play--this time as a result of the greatest flood in the Nation's history. When Kansas and Missouri were struck by the billion-dollar flood that occurred in July, damage to telephone plant was estimated at about $3,500,000, with 37,000 telephones and 400 toll circuits knocked out of service. But the real story behind the disaster concerns the telephone men and women who toiled night and day to keep vital communication lines operating.

In terms of telephones out of service, Manhattan, Kansas, was hardest hit, with all of its 7500 telephones silenced by the flood. But it was not isolated for long. The day after the operators had been evacuated from the second floor of the telephone building (the switchboard was under water downstairs), plant men managed to connect four magneto phones to the toll line from Salina, Kansas. Water was still eight feet deep in the main street. Operating from a card table set up in a filling station driveway, Southwestern Bell commercial service representatives took orders for toll calls, handling over 400 the first day their "drive-in or row-in" headquarters was in operation. As the flood crest passed, other emergency centers were set up and even portable microwave units were brought in to take over in case the transcontinental toll line should fail.

Kansas City, Kansas, lost 8000 telephones, including an unknown number in some 3500 homes that were completely swept away by the flood. Kansas City, Missouri, situated on a bluff across the river, got off lightly, losing only 4100 telephones, most of them in the riverfront area. St. Louis also escaped serious damage because of its location on high ground.

As in all telephone emergencies, telephone people from all departments, and even those off duty and on vacation flocked back to help in the huge job of maintaining and restoring

Tons of mud and debris left by the flood still cover this Kansas City street as telephone men put emergency lines in service.

communications. At Salina, Kansas, a single radio appeal for former operators brought twice as many as were needed within thirty minutes. One girl heard about the flood while on vacation in California and cut short her holiday to get back to her telephone job.

Mobility of trained telephone people again proved to be a vital factor in combating an emergency. More than 600 telephone plant men from all parts of the Southwestern area and from Iowa and Nebraska in Northwestern Bell territory drove into the flood area to lend a hand. In Kansas City, where a flood of toll calls followed the flood of muddy water, Long Lines operators were cheered by the arrival by plane of 100 additional girls from long distance offices at New York, Chicago and Louisville.

Then, too, Western Electric, with the know-how born of long acquaintance with hurry-up orders, soon had necessary supplies flowing toward Kansas from distributing houses throughout the country, and from Western Electric plants and outside suppliers. Over 161,000,000 conductor feet of exchange cable and 5,000,000 feet of drop wire were channeled into the flood area by Western.

One of the most dramatic supply operations involved a portable generator needed to keep a repeater station on a transcontinental line in operation. Flown from a Western Electric supply house to Topeka, the generator was then trucked most of the way to the repeater station after a fairly dry route had been charted by a Western technician in an Air Force C-47. The final leg of the journey was made in a power boat.

So, once again Bell System teamwork and preparation has paid off. The girls in the water-logged Manhattan office, the service representatives in the filling station "business office," the plant men fighting to keep equipment going and the men behind the scenes in Western Electric distributing houses—all helped write another chapter in the finest traditions of telephone service.

J. T. Quisenberry Appointed General Attorney of A T & T

John T. Quisenberry has been appointed General Attorney of the American Telephone and Telegraph Company. He succeeds T. Brooke Price, who on July 1 became Vice President and General Counsel of A T & T. Mr. Quisenberry is a native Kentuckian and a graduate of Kentucky Wesleyan College and Harvard Law School. He joined the Bell System in 1937 as an attorney in the Legal Department of A T & T after a number of years in private law practice and with the Law Department of the Illinois Central Railroad. He comes to his new post from Washington where he has been General Counsel for the Chesapeake and Potomac Telephone Companies since 1949.

Former BTL Messenger Named C. & P. General Counsel

A one-time summer messenger at the Laboratories has just been named successor to J. T. Quisenberry as General Counsel of the Chesapeake & Potomac Telephone Companies. He is Stephen H. Fletcher, who began his telephone career during the summer of 1928, just after graduating from high school, as a messenger at West Street. He went on to get his A.B. degree from Columbia in 1932 and his law degree, also from Columbia, in 1935. He is the son of Dr. Harvey Fletcher, who was Director of Physical Research when he retired in 1949.

F. G. Foster Honored

F. G. Foster has been made a Fellow of the Royal Photographic Society of Great Britain. Fellowship in this Society is granted "in recognition of outstanding ability (with special regard for originality) in one or more branches of photography"—in Gordon Foster's case, this was for photography applied to scientific purposes. The letters F.R.P.S. thus denote one who stands in the front rank of the photographers of the world.

Mr. Foster came to the Laboratories as a draftsman in 1929, but subsequently became interested in microscopy. While engaged in drafting, and later in the microscopical laboratory, he continued his studies at Newark College of Engineering, receiving his B.S. in M.E. degree. He also took graduate courses in electron microscopy at Stevens Institute and taught optical microscopy at Newark College of Engineering.

Florence M. Gorman New Chief Operator

Florence M. Gorman has been appointed Chief Operator at the West Street Exchange succeeding Anna Menig who is now on a disability leave of absence. Miss Gorman's career in the Bell System has been a varied one. Beginning as an operator in Brooklyn with the New York Telephone Company, she has been an instructor in the PBX School at 140 West Street, and has instructed in various PBX areas in the city. She has also participated in the voice training program of the New York Company. Miss Gorman's recent assignment has been as evening Chief Operator at 195 Broadway. She has been a group leader in the "Design for Living" out-of-hour courses sponsored by A T & T and given by the operating companies.

A resident of Jackson Heights, Long Island, Miss Gorman makes her home with her mother.

Laboratories Members Run Rapids of Colorado River

Two groups from West Street joined river parties during July to run the rapids of the Colorado River. The Mexican Hat expedition of eight passengers and four guides included three Laboratories engineers, P. L. Wright, who with his wife ran 87 miles of rapids from Lee's Ferry to Phantom Ranch on the floor of the Grand Canyon, and Esther Rentrop and Eugenia Wyckoff who ran 278 miles of rapids from Lee's Ferry to Pierce's Ferry on Lake Mead in oar-propelled specially constructed cataract boats. For their feat Miss Rentrop and Miss Wyckoff were initiated into the *River Rats* becoming the 59th and 60th persons, respectively, of the Mexican Hat expedition and the 159th and 160th persons known to have run the big river in its entire history.

The second expedition, under the direction of Russell Anspach of Long Lines who became a *River Rat* last year, included Georgine Fredericks and E. S. Savage. They were members of a party of eight who rode 162 miles of rapids through beautiful Glen Canyon in rubber boats powered by outboard motors.

Miss Rentrop, Miss Wyckoff and Mr. Wright each took a turn in piloting their boats through one treacherous rapid where, in some instances, the waves ran twenty-five to thirty-five feet high and the current thirty miles an hour. Miss Rentrop rode through Badger Rapid, Miss Wyckoff through Soap Creek Rapid.

On the second day out, Miss Wyckoff was on deck when the boat hit fast water. She was thrown into the turbulent, silty Colorado and, because of the strength and cross-currents of the eddies, she could not tell whether she was on the surface or bed of the river. As she came up a second time she touched the bottom of her boat. The third time, she was twenty feet from her boat but in calmer water was able to reach it.

During the trip there were days when they were as much as six air miles removed from their nearest contact, the Desert View Tower on the rim of the canyon. Their communication with the outside world was by reflectors by day, signal fires and flashlight Morse code by night. As they sped through the roaring rapids they brushed against the oldest granite in the world. By night they slept on sandbars or on the rocky ledges of the Grand Canyon. Among the rapids they conquered were the "ripsnorting" Sockdolagers and the Grapevine.

The Mexican Hat Expedition with Laboratories engineers Esther Rentrop and Eugenia Wyckoff discussing a portion of the Colorado River trip with J. Frank Wright, their boatman and the leader of the Expedition.

Rate Cases and YOU

BY K. P. WOOD, *Assistant Vice President*

American Telephone and Telegraph Company

We're all busy people.

We work at many different jobs—all aimed at the same result, which is to give good telephone service.

And some of us may sometimes be tempted to say to ourselves, "Telephone rates? They aren't *my* job. Joe Smith does that. I've got my own work to look after."

But when you stop and think, that doesn't really make sense, does it?

For telephone rates are the money the Bell System takes in to pay *all* the costs of giving service.

We need them to pay our wages. And telephone taxes. And the cost of the materials we use in our jobs. And to pay investors for the use of their money, which they let the telephone companies have to build telephone lines and switchboards and buildings.

So, rates are *everybody's* business.

The Bell System Companies have been asking for increases in telephone rates in the last five years for a very obvious reason.

It's because the cost of giving service has gone up, up and still further up.

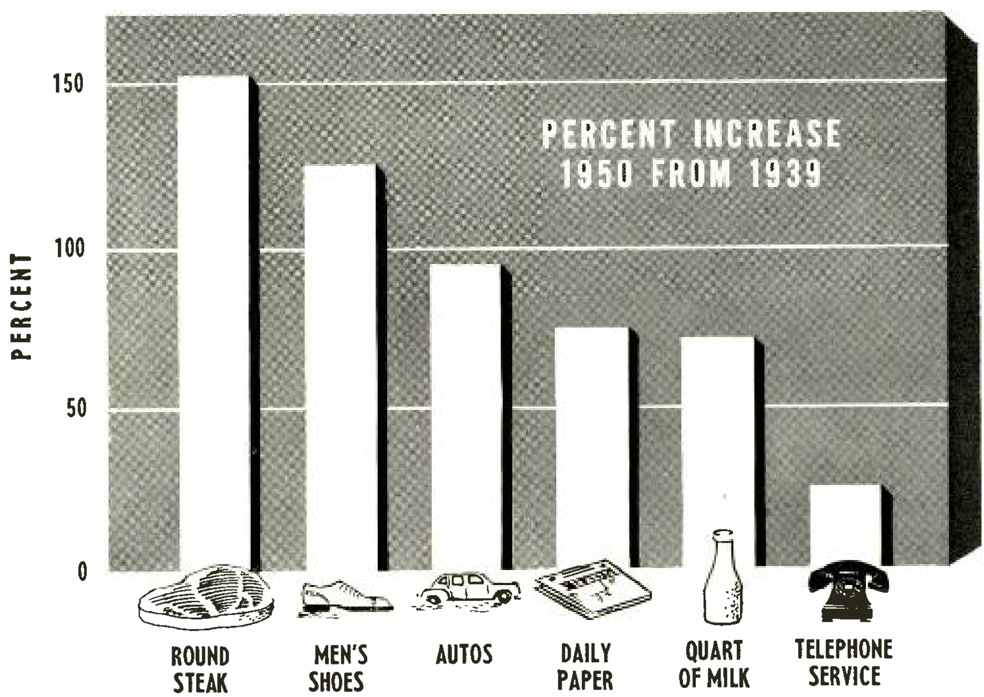
Now let's take stock of the big main facts as they are today. Every telephone man and woman ought to know them.

1. Wage Increases Are Nearly Double Rate Increases

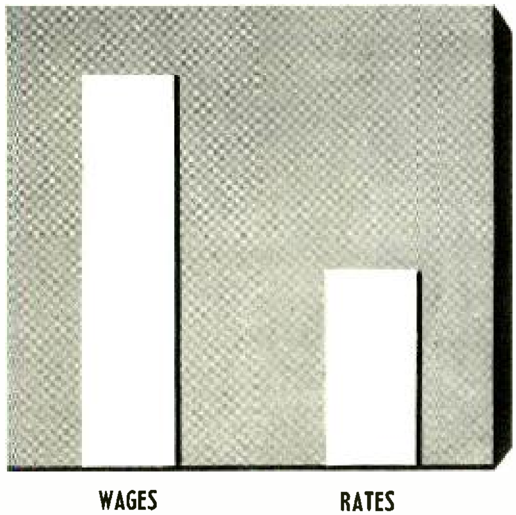
Numerous rate increases have been granted. But all of them so far add up to only a little more than *half* the current annual cost of the telephone *wage* increases made effective in the war and postwar periods.

Out of every dollar the Bell System spends for expenses other than taxes, 63 cents go for

OTHER PRICES HAVE GONE UP MUCH MORE THAN TELEPHONE RATES



HOW WAGE INCREASES AND RATE INCREASES DURING THE WAR AND POSTWAR YEARS STACK UP



wages. Here is the biggest single item in the cost of doing business. With us, wages represent a much bigger part of the expense dollar than in most other concerns. And rate increases—let's fix the fact in mind—have only a little more than half caught up with *wage* increases alone.

2. Our Other Costs Have Soared, Too

Taxes have gone way, way up also since before the war. That is the System's second biggest item of expense today—$500 million last year, and more to come!

And the cost of materials?

Lead is up 228 per cent, copper 112 per cent, automobiles 93 per cent, building materials 133 per cent, pine telephone poles 100 per cent. Those are examples.

Each telephone added since the war has cost, on the average, $340 when you include all the wires and switchboards and buildings and other equipment needed to serve it.

This average cost in 1945 was $254.

Quite a difference.

3. Telephone Rates Up Much Less Than Other Prices

So far, how much have telephone rates gone up?

On the average, the increases granted, plus those asked for but not yet authorized, total less than 25 per cent of Bell System revenues.

The general cost of living has gone up 78 per cent since 1939.

Telephone rate increases, granted and pending, average less than *one-third* the rise in the cost of living.

Most other things people buy have gone up many times.

Adequate Earnings Depend On Adequate Rates

Costs keep going up. It will cost more to run the Bell System in 1951 than it did in 1950.

Yet we haven't yet caught up with *past* increases in costs.

Sufficient earnings are a "must." The Bell System must earn well to serve the nation well. And in these critical times the country is counting on us for a top-notch job.

That is the reason why additional increases in rates are being asked for.

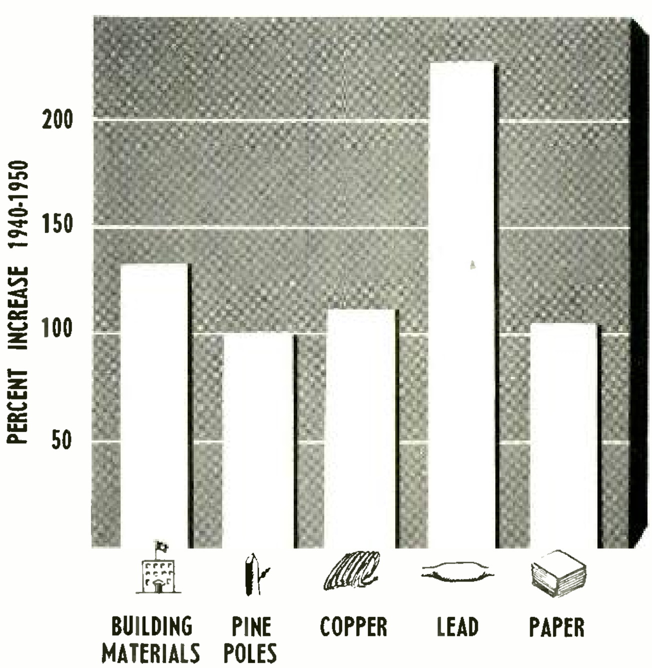
Some may think, "Oh, the Bell System will always be around, adequate rates or not. It'll get along somehow."

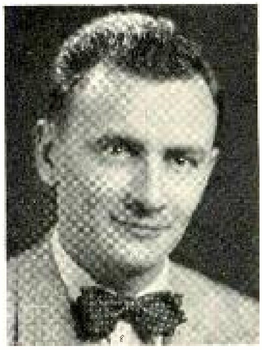
That is poor thinking. There is no bulging purse tucked away in the dresser drawer.

If rates do not provide for essential earnings —if we don't keep up with increased costs of doing business—we won't be the kind of outfit we ought to be. It will become difficult to attract investors' savings. There won't be as good jobs for all of us. We won't be as good a company for the public.

That *can* happen here. But it must not. And it will not, when rates are *everybody's* business.

OUR MATERIAL COSTS HAVE SOARED

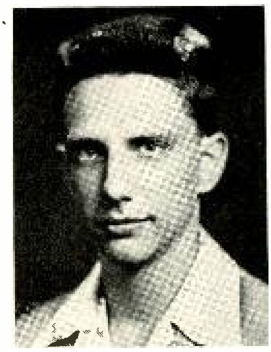




W. H. Burgess

E. J. Zillian

F. T. Muhlenbeck



Rudolph Tonn

Called to Active Duty

Forty-eight members of the Laboratories have been granted military leaves of absence since June 1950. The following men have recently left for service:

KURT W. BAUEREISS, a reservist in the Navy, has been recalled to active duty at the Brooklyn Navy Yard. He was a technical assistant in the Military Equipment Development Department at Whippany.

WILLIAM H. BURGESS, a technical assistant in Switching System Development, has been recalled to active duty in the Air Force. A veteran of two and a half years of service in the 15th Air Force as a P38 Lightning Fighter Pilot, his fighting missions in World War II were over the Ploesti oil fields in Roumania.

FRED T. MUHLENBECK has enlisted in the Navy. He had been a clerk in the General Service Department of New York Area Management and is stationed at Bainbridge, Md.

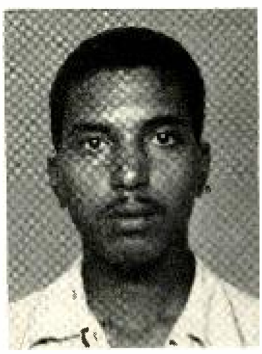
VICTOR J. PIANESE has been inducted into the Marine Corps and is now training at Parris Island. He had been a member of the Central Files.

LEAVY RAY has enlisted in the Navy. Since joining the Murray Hill Laboratories in 1950 he had been in the building service department on the night shift.

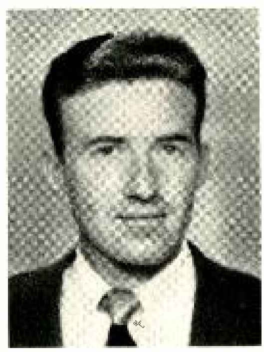
RUDOLPH TONN, a member of the Quality Assurance Department, was engaged in clerical work before he entered the Army on July 18.

EDWARD J. ZILLIAN enlisted in the Air Force in 1943 and became a navigator. When the war ended he was assigned to fly B29's at Elliott Field, Texas. Following his return to West Street, he became a technical assistant in the Quality Assurance Department. He has been called up from the reserves to serve in the Air Force.

V. J. Pianese



Leavy Ray



K. W. Bauereiss

Bell of Pennsylvania Supervisors Visit Murray Hill

One hundred and twenty-seven supervisors of the Bell Telephone Company of Pennsylvania visited Murray Hill in two sections of approximately equal numbers in early July. This series of visits from associated Companies is in the interest of fuller understanding of the research and development work done for the Bell System by the Laboratories.

Each group was conducted from Newark to the Arnold Auditorium where a series of talks on the Laboratories and the work of various special departments were given by R. K. Honaman, P. G. Edwards, A. G. Ganz, D. A. McLean and Nelson Botsford.

Following luncheon in the Murry Hill restaurant, the tour of the various laboratories for sub-divided groups included talks on *Electron Tube Research* by P. J. Rice; *The TD2 Microwave System* by T. J. Grieser and J. B. Maggio; *The Transistor* by J. N. Shive and R. J. Kircher; *Outside Plant Development* by J. W. Kennard and T. A. Durkin; *The Instrumentation Laboratories* by K. H. Storks; and *The Metallurgical Laboratory* by K. M. Olsen. They also saw the free space room in the Acoustics Building and various areas such as the Concourse Exhibits of the microwave radio relay system and of crystals.

Guides for the tour groups included A. J. Akehurst, A. R. Brooks, H. B. Ely, J. T. Lowe, J. W. Pollio, T. N. Pope and I. W. Whiteside. The groups returned to Philadelphia in late afternoon from Newark.

T. M. Day talking to part of his staff before opening the Whippany restaurant for a day's business. Left to right, with him are Ruth Quick, cook, Loretta Pogorzelski, counter girl, Eunice Kellogg, salad girl, and Hannah Fegan, the cashier.

Changes in Organization

Recent changes in organization include the transfer of H. J. Wallis, Murray Hill General Service Manager, to the Sandia Corporation as Superintendent, Development Staff Services. R. H. Kendall has been appointed General Service Manager at Murray Hill in Mr. Wallis' stead. W. C. Somers of New York has become Plant Operation Manager at Whippany, replacing Mr. Kendall. The Plant Engineering functions for which Mr. Kendall was responsible will for the present be under direct supervision of S. H. Willard. M. M. McKee, formerly General Occupancy Engineer in Plant Engineering, has been appointed Superintendent, Building Operation and Maintenance, in New York replacing Mr. Somers.

In the Systems Engineering Department, H. W. Collier has been appointed Executive Assistant to G. W. Gilman, who is Director of Systems Engineering.

T. M. Day Joins Whippany Restaurant

T. M. Day has been appointed manager of the Whippany restaurant succeeding Miss Charlotte B. Honeycutt who recently resigned. Thomas Day brings to Whippany a number of years training and experience in the restaurant and catering fields. His family is well known in the Morristown area and his brother Wilbur F. Day, Jr., is a member of the Murray Hill Laboratories. Mr. Day has recently moved from Cambridge, Massachusetts, and is planning to establish his home in Parsippany.

Two days a week the noontime project of the West Street Model Railroad Club is this TT-gauge layout called "The New York and Union Railroad." They meet in Section 140 on Tuesdays and Fridays and are looking forward to seeing regular members and newcomers visit their layout and lend a hand in building it. Shown manipulating a new switching section are left to right, J. C. Berka, R .W. Wickham, C. W. Haas, J. N. Walter, L. F. Kniffen and H. J. Braun.

Civil Defense Aided by Radio Amateurs

Not to be outdone by its neighbors in Essex and Morris Counties* the Tri-County Amateur Radio Association has set up a network in Middlesex, Union and Somerset Counties. Together with other units of the American Radio Relay League they form a part of the overall communication network that will be used for maintaining communications in an emergency. Several of its members work at Murray Hill; one of them, C. E. Scheideler, designed a portable radio telephone transmitter which could be powered either from an automobile battery or from a central station system. Parts were bought in quantity and about twenty sets were built by members of the Association, including R. A. Jensen, W. F. Wolfertz, J. L. Wenger, H. O. Emmons, G. W. Schober and Mr. Scheideler. The Association meets every week for practice and late in June joined in the annual field day of the American Radio Relay League. For 24 hours they conducted tests with amateurs all over the country from a site atop the Watchung Mountain. An engine-generator set owned by the Association furnished power to a number of 30-watt transmitters. The group finished fifth in a nation-wide contest for the largest number of stations contacted by radio telephone or telegraph.

* "Laboratories Radio Amateurs Aid Civil Defense Effort," RECORD, *March*, 1951, *page* 132.

Trying out J. L. Wenger's 144 mc set at Murray Hill at noontime are R. A. Jensen, W. F. Wolfertz, C. E. Scheideler, and Mr. Wenger.

Japanese Peace Treaty Conference to be Televised

Coast-to-coast television will be introduced on September 4, when the Japanese Peace Treaty Conference in San Francisco will be televised over the new transcontinental microwave radio relay system opened for telephone transmission August 17. (See page 427.) President Truman will speak at ceremonies opening the Conference at 10:30 p.m. E.D.T. Other sessions of the Conference, which will run from September 4 to September 9, will also be telecast.

Originally planned for a TV opening on September 30, the new microwave system, at the request of the State Department, is being temporarily arranged to meet the earlier date. Designed to carry television as well as telephone messages, the system is already transmitting network TV shows as far west as Omaha, midway point on the 3000-mile New York-San Francisco route. Work on installation and testing of the additional equipment needed to adapt radio-relay facilities to carry television is progressing rapidly. After the Treaty Conference is over, the temporary west-east San Francisco-Omaha channel will be out of service and work will be continued on the permanent arrangement.

June Graduates

The following members of the Laboratories received their degrees during the month of June: George Abrams, Master of Arts from Columbia; R. B. Ardis, E. R. Casey and J. W. Falk, Bachelor of Law from New York University; M. W. Bowker, D. R. Frantz, J. McLay, Jr. and R. C Townley, Master of Science from Stevens Institute; G Hecht, Electrical Engineering from Cooper Union; Josephine Meglino, Master of Arts from Hunter College; Melvin Posin, Master of Electrical Engineering from Brooklyn Polytechnic Institute; and W. M. Sharpless, Bachelor of Electrical Engineering, University of Minnesota.

J. L. Allison
35 Years

A. B. Clark
40 Years

H. B. Gilmore
35 Years

E. Vroom
40 Years

E. G. Fracker
35 Years

September Service Anniversaries of Members of the Laboratories

40 Years
A. B. Clark
Edward Vroom

35 Years
J. L. Allison
E. G. Fracker
H. B. Gilmore

30 Years
L. H. Allen
W. L. Clarke
R. I. Crisfield
E. L. Erwin
V. J. Mayer
Oscar Myers
A. B. Reynolds
G. Riggs
D. Ritchie
W. W. Seibert
W. M. Stover
A. L. Whitman

25 Years
C. Anderson
V. H. Baillard
J. T. Dixon
J. L. Doncourt
H. G. Fisher
C. E. Germanton
R. W. Gutshall
C. W. Halligan
C. L. Johnson
W. C. Kirkman
W. E. Kirkpatrick
R. C. Koernig
A. H. Kuhlman
L. R. Lowry
E. C. McDermott
D. McNamara
R. G. Orton
R. E. Polk
H. J. Talty
H. N. Wagar
H. G. Wehe
Augusta Weingart
F. H. Willis
W. H. Wise

20 Years
J. Barr
G. Simco

15 Years
W. R. Davis
R. S. Duncan
W. W. Grote
F. M. Hodge
M. P. Hughes
G. F. G. Kastner
A. W. Koenig
G. T. Loman
Beulah Marion
J. H. Miller
J. R. Pierce
R. W. Schulte
W. Shockley
F. M. Thayer
P. H. Thayer

10 Years
F. J. Arvay
G. Baraff
W. F. Bodtmann
H. H. Buck
J. B. Dalbora
J. J. Doody
C. P. Frazee
F. G. Galter
L. J. Kammerer
J. T. McCormick
A. J. Osinski
B. Polishook
L. G. Rainhart
R. J. Renahan
Gertrude Rooney
A. O. Schmitz
Loretta Simpson
G. J. Stiles
L. C. Tillotson
G. B. Troussoff
W. D. Varian

Grace Cooney, left, supervisor of the 5B Files discussing assignments with Mary Misan, seated, and Evelyn Wojciechowski.

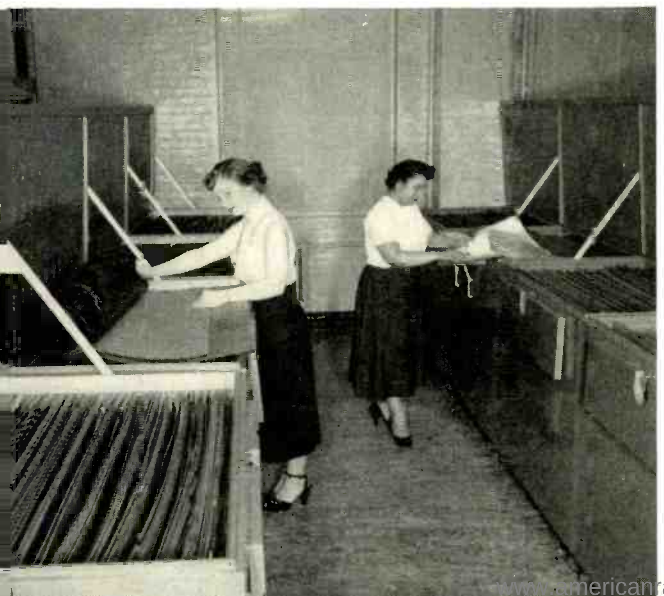
Inga Gaviglia demonstrates the microfilm projector available for the use of engineers at West Street.

SYSTEMS TRACING FILES

The staff of the systems tracing files is enjoying its recently remodeled quarters and its new filing and microfilm equipment. For the twenty girls and their supervisor, Grace Cooney, there has been a transition from filing in horizontal "lie flats" to vertical filing in new *Planfiles*. This improved method has simplified their work by enabling them to file in one dust-free folder several sizes of engineering tracings which formerly were filed in as many as five different places. In addition it has resulted in a saving of floor space.

New facilities have been made available for reading and projecting microfilm. The storage facilities house microfilm of 300,000 pages of Systems Specification material, a quarter of a million systems inactive tracings and 162,000 pages of "D" specifications for "manufacture-discontinued" apparatus. A current project will add another quarter of a million microfilms of inactive apparatus tracings. All of the viewing equipment and microfilm now occupy less than 1/20 of the area formerly occupied by the originals.

Edea Canina and Rosita Garcia are shown returning tracings to their proper places in a close-up of the new Planfiles.



Marion Canavan is responsible for Apparatus, Systems and Specifications Files in the New York Laboratories.

Therese Bentele at the service counter presents a tracing for F. J. Canavan. From 350 to 500 tracings are charged out daily from this area.

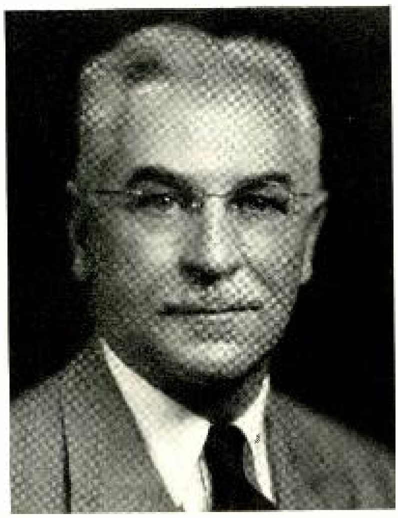
Helen Reece's work includes the filing of negative Van Dykes from which blue line prints are made by the Photocopy Department.

Overall view of the files showing the Planfiles, with Mary Misan and Dorothy Kramer, foreground; Helen Reece, center; and Edea Canina and Rosita Garcia rear.

Helen Fitzgerald handles calls concerning the status of engineering tracings. She is also responsible for the work of several clerks.

Josephine Monte is preparing a requisition for these engineers who are ordering rush prints from their tracings.

Eugenia Wyckoff,
Second Vice-President



A. R. Brooks,
President

W. J. Carroll,
First Vice-President

OFFICERS OF BELL LABORATORIES CLUB

A. R. Brooks of Murray Hill is president of Bell Laboratories Club for the coming year, W. J. Carroll of Murray Hill, first vice-president, and Eugenia Wyckoff of West Street, second vice-president. The following Club Representatives are now serving: *New York,* M. J. Doody and G. A. Pullis; *Murray Hill, Deal and Holmdel,* R. N. Larson, H. Peters; and *Whippany,* A. B. Watrous.

Mr. Brooks was originally hired in 1916 by Western Electric to report in June 1917, on his graduation as an electrochemical engineer from M.I.T.. Following graduation, Mr. Brooks went into the Army, became an ace flier and commanded world famous pursuit units in World War I. When he finally reported to West Street it was to establish and supervise the air group which helped to incorporate telephony into the air age. After this group was disbanded, Mr. Brooks engaged in engineering for an interval before joining the Publication Department. At present he is associated with the Publication Manager at Murray Hill. He is the Murray Hill Record representative and a member of the editorial staff of the Record. Mr. Brooks has served as president of the M.I.T. Club of Northern New Jersey and is a scholarship committeeman and an M.I.T. Hononary Secretary for Short Hills. He has recently become chairman of the New Jersey Council of the Frank B. Jewett Chapter of the Telephone Pioneers of America.

Mr. Carroll has had an active part in Club activities for many years. For the past two years he has been Club elector. He has played in and managed the basketball team, played baseball with West Street, is now chairman of the Murray Hill softball league, and has held offices on several occasions in the Bowling League. Mr. Carroll is a member of the crystal group at Murray Hill where he is engaged in the design and development of crystal units for network application. He also is responsible for liaison work between Western Electric and the Laboratories groups on the manufacture of crystal units for telephone application.

Miss Wyckoff is an M.T.S. in Switching Engineering where she is engaged in traffic and probability studies in connection with the development and engineering of dial systems. It would be difficult to find a person more diversified than Miss Wyckoff. She has developed a remarkable skill in hobbies which range from photography, jewelry making, knitting, and painting to singing soprano in the Gena Branscombe Chorus. If you were to visit her apartment on Bank Street in the Village, you would find in neat rows the many jars of preserves she puts up during the canning season. Miss Wyckoff's run of the rapids of the Colorado River is described on page 431.

Dr. Elizabeth Wood Visits Europe

Elizabeth Wood of the Physics of Solids group visited Europe during the summer, primarily to attend the meetings of the International Congress of Crystallography in Stockholm. Traveling by air to Oslo via the Azores, French Morocco and London, she crossed Norway and Sweden by train to Stockholm.

Before the Congress opened she visited Mr. Sven Nordström of the Royal Board of Swedish Telegraphs and Telephones at his summer home, and Mr. Ragnar Stålemark of the L. M. Ericsson Telephone Company, who showed her work on crystals and related subjects at their plant on the outskirts of Stockholm.

From June 27 to July 5, Dr. Wood participated in meetings of the Congress which were attended by 350 representatives of twenty-five countries. The King of Sweden attended the opening meeting. After the Congress closed she crossed Sweden to Gothenberg via the Göta canal.

Proceeding to England she was met by a friend who drove her across northern England. They walked along the top of Hadrian's Wall, climbed among the Roman ruins, drove on the steep rough roads of the lake districts and around Mt. Snowdon in Wales to Stoke Poges near London. The trip circling England took only two days.

During the following week Dr. Wood visited the Imperial Chemical Industries Laboratories at Welwyn Garden City; General Electric Company Laboratories at Wembley; the Cavendish Laboratory at Cambridge University; the Crystal Group at Oxford University; and the University College of London. During her stay in England she was in close touch with the U. S. Office of Naval Research and attended a staff meeting in London.

Highlights of Dr. Wood's trip abroad included the raft *Kon-Tiki* which she saw in Oslo and the Fourth of July celebration, complete with fireworks for 200 Americans, which she attended at the American Embassy at Stockholm.

5755/420A Electron Tube

Due to a typographical error, the grid current for this tube, given on page 370 of the August Record, is shown as 10.9 ampere. This should be 10^{-9} ampere.

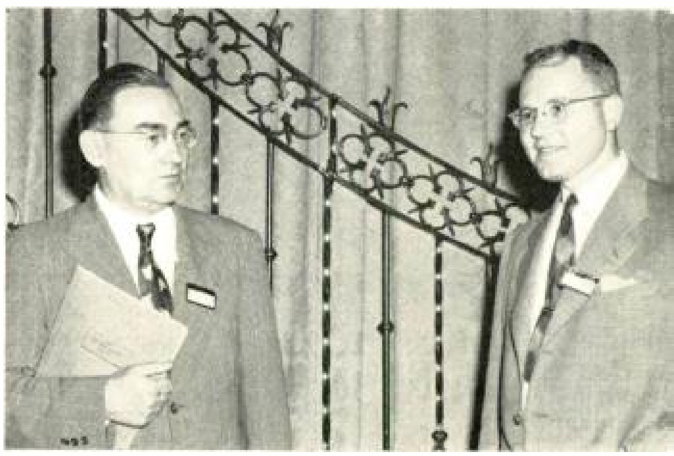
The control grid bias resistor is connected to a point approximately 45 volts positive with respect to the negative of the plate-supply voltage.

H. D. Bender Dies

1894-1951

For most of his thirty-one years in the Bell System, Hugh Bender, who died on July 16, had been concerned with the development and standardization of the hand tools and associated equipment used by the outside plant construction and maintenance forces of the System.

Mr. Bender received his B.E.E. degree from Ohio State University in 1917 and upon completion of the A. T. & T. student course undertook the preparation of Bell System Practices in the Engineering Department of that company. In World War I, he was commissioned a lieutenant and served as an instructor in the Field Artillery Reserve Corps. Returning to 195 Broadway, he joined the group handling the standardization of outside plant materials. That group carried over to the D. & R. at its formation in 1919. Late in 1920 Mr. Bender transferred to the group which handled outside plant tool development and standardization and with it transferred to the Laboratories in 1934. During his career he participated in American Standards Association activities, being Chairman of Sectional Committee A-14 on ladders at the time of his death. He is survived by his wife, Elsa Silsbe Bender, a daughter and two grandchildren.



T. Slonczewski (left) and D. E. Trucksess both presented papers at the A.I.E.E. Summer General meeting in Toronto

P. T. Higgins

A. A. Catlin

H. C. Pauly

Charles Seacord

RETIREMENTS

Recent retirements from the Laboratories include P. T. Higgins with 45 years of service; H. C. Pauly, 42 years; A. A. Catlin, 39 years; Vincent Montagna, 30 years; and Charles Seacord and Dominick Volpecello, 7 years.

Paul T. Higgins

At the end of World War I the Laboratories were completing the development of the panel dial system, and they called upon some of the operating companies for men with plant experience and technical training. P. T. Higgins was one of those who came to us from the New England company; he had graduated from the electrical course at Lowell Institute and had had experience as a P.B.X. installer and inspector and as a central office maintenance and test man.

Mr. Higgins' first job at the Laboratories was preparing circuit descriptions; later he also prepared and checked Bell System Practices for panel and step-by-step apparatus. When during 1926 the Laboratories was preparing the specifications for the production by Western of step-by-step apparatus, Mr. Higgins was transferred to the Apparatus Development Department to assist in this work. Except for a period during World War II when he was associated with devices for mines and rocket control, Mr. Higgins' activity continued on step-by-step development. During these many years Mr. Higgins also had many opportunities to become familiar with standard and special switching apparatus, an attribute that resulted in his more recent assignment, namely, the review of thousands of special apparatus items for the purpose of evaluating their future need.

Former residents of Maplewood, Mr. and Mrs. Higgins have bought a home in Bedminster, N. J. There is a large garden and a stable where Mr. Higgins will keep his riding horse. One married daughter lives in Denver, the other one, Ruth, is a member of the Laboratories and was married on August 4.

Howard C. Pauly

Before he graduated from the University of Kansas (B.S. 1914) Howard Pauly had had five years' telephone experience in and near Kansas City, Missouri. After a few months at Hawthorne in 1914, he came to New York and became a transmission engineer. During World War I he worked on a submarine detection system to protect the entrance to Chesapeake Bay. Subsequently he did development engineering on transmitters for many special purposes, as well as conducting articulation tests on station telephone sets and transmitters. These tests included—during the recent war—the throat microphone and the tank microphone. Since the war he has been doing development engineering on station telephone sets.

One of the Pauly boys is a plant physician, the other conducts a big "hobby shop" in Los Angeles with instruction in various crafts.

Dominick Volpecello

Vincent Montagna

Mr. Pauly thinks he will not join any of his son's classes; he has recently bought a house that needs a great deal to be done to it, and when that job is done he may even go to work again. At any rate, as long as their third boy is in high school, the Paulys will remain in Upper Montclair.

Arthur A. Catlin

Joining Western Electric at Hawthorne in 1912 with a B.S. in E.E. from Colorado State College, Arthur A. Catlin soon went into cord and switchboard cable development. Transferring to New York in 1917, he continued this work, and for a time added repeating coils, retardation coils and transformers. Going over to equipment development, he worked on dial systems and on the first transatlantic radio control board. From 1928 to 1936 Mr. Catlin was an engineer with E.R.P.I. where he specialized on newsreel equipment and later on studio recording equipment. Returning to the Laboratories, he joined one of the circuit analyzation groups. In 1941, he became an Apparatus Specification writer, specializing on cords and switchboard cable.

While Mr. Catlin expects to continue doing engineering work following his retirement from the Laboratories, his first concern on retirement will be his grandson and his garden—two pleasures which, quite naturally, Mrs. Catlin shares.

Vincent Montagna

After Vincent Montagna retires, he expects to keep busy at something because, he says, a busy man is a happy man. Born in Sicily, Vincent was a farmer there until he was 31, when he came to America. After several jobs elsewhere, he joined us in 1921 as a night cleaner. In a couple of years he was shifted to the day gang.

A single man and a Manhattanite, Mr. Montagna would like to join a monastery in one of the missionary orders overseas.

Charles Seacord

If you've had a desk done over, the chance is good that Charlie Seacord did it, for he is one of the expert wood finishers at West Street, where all that sort of work is done. During World War I Charlie was a policeman in New Rochelle and, having been practically brought up on painting, he got permission to open an automobile paint shop on the side.

In 1943 Mr. Seacord became a spray finisher at West Street and some four years ago he went over to wood finishing. After retirement he will continue in that kind of work.

Dominick Volpecello

For seven years Dominick Volpecello has been a handyman around the buildings at Whippany. Along with his job of tidying up the working quarters, he has exchanged "good nights" with many of the staff who leave soon after he arrives.

Dominick came over from Italy—Salerno to be exact—some 42 years ago and settled in Morristown. Along with his various other jobs he has cared for a small greenhouse adjoining his home, and in retirement he will try to raise flowers for market. One daughter is a nurse in Morristown; another is with the Ciba States Export Corporation; and his son is stationed at Fort Dix.

Laboratories Chemists Participate in World Chemical Conclave

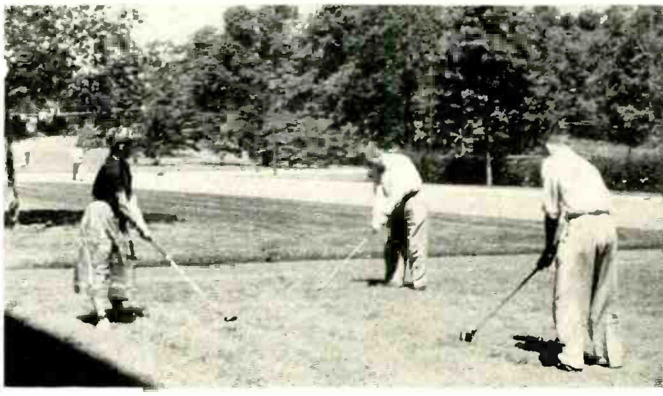
The largest scientific gathering of all times is expected when the World Chemical Conclave, including the American Chemical Society, the International Congress of Pure and Applied Chemistry and the International Union of Chemistry, assembles in New York City September 3-14, 1951. More than one thousand distinguished delegates from overseas, including most famous European chemists, will join the 66,000 members of the American Chemical Society in presenting and celebrating the position of chemistry in the mind and matter of mankind.

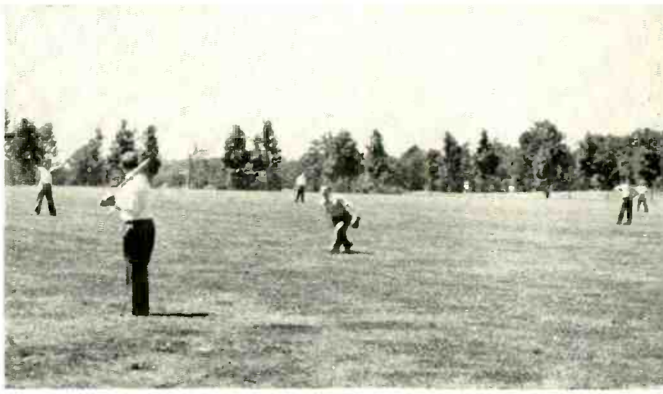
Initiating this commemoration of the 75th anniversary of the American Chemical Society, New Jersey's Governor Alfred E. Driscoll will present the keynote address. The North Jersey section of the American Chemical Society, with B. S. Biggs as chairman, is cooperating in an official capacity. J. H. Heiss is in charge of local information; J. F. Ambrose, a member of the Publicity Committee.

Bell Laboratories will play host to 125 visitors from the Congress on Wednesday, September 12. The Laboratories will also be represented at the scientific sessions where their contributions to the new discoveries will be announced. W. O. Baker will preside as vice-chairman of a session of the Section on Macromolecules, the chairmen of sessions being guests from abroad. Among the papers to be presented are, *Mechanical Properties of Discrete Polymer Molecules*, by W. O. Baker, W. P. Mason and J. H. Heiss and *Polymer Carbon and Its Derivatives*, by F. H. Winslow and W. O. Baker. C. D. Thurmond is co-author of *Studies of Branching in Polymer Molecules.*

NOONTIME ACTIVITIES AT WHIPPANY

NOONTIME ACTIVITIES AT MURRAY HILL





"The Telephone Hour"

NBC, Monday Nights, 9:00 p.m.

September 3	Lily Pons, *coloratura-soprano*
September 10	Jussi Bjorling, *tenor*
September 17	Bidu Sayao, *soprano*
September 24	Jascha Heifetz, *violinist*
October 1	Jose Iturbi, *pianist*
October 8	Ferruccio Tagliavini, *tenor*
October 15	Lucile Cummings, *contralto*
October 22	Michael Rabin, *violinist*
October 29	Ezio Pinza, *basso*

News Notes

The Record welcomes *Doings of Life Members,* a news sheet for Pioneer life members, the first issue of which was published July 17. Its editor is Heber E. Marting of 137 Woodland Avenue, Rutherford, New Jersey, who retired on August 1. *Doings* is his idea and came into being as a result of his having been appointed by the Pioneers to contact retired members of the Laboratories. A single sheet of news items, it is written informally and in this issue tells about such people as H. H. Lowry and Charles White, Kentuckians, A. H. Heitsmith and Stanley Watkins in England, as well as a number of other engineers who work in retirement.

S. P. Shackleton has been elected Chairman of the New York Engineers' Committee on Student Guidance. The committee operates under the auspices of the Engineers' Council for Professional Development and is composed of 100 representatives of the New York Sections of the major engineering societies. It has functioned for fifteen years, counseling and guiding high school students and faculties on engineering education and on opportunities in the engineering field. Its services have been offered to all high schools and preparatory schools in New York City and suburbs. Mr. Shackleton has been Chairman of the A.I.E.E. sub-committee and treasurer and liaison secretary of the larger group. As Chairman of the New York Committee he will serve on the national guidance committee of Engineers' Council for Professional Development.

"I guess I'd better hang up now, Helen, someone just threw a threatening note in here!"

At the American Physical Society meeting in Vancouver, W. H. Brattain presented a paper on *Problems in the Understanding of the Semi-conducting Properties of Germanium* and G. L. Pearson one on *The Properties of p-n Junctions in Germanium.* At the Society's Schenectady meeting J. A. Becker presented a paper *The Adsorption of N_2 as a Function of Pressure, Temperature and Time* which C. D. Hartman co-authored. The *Effect of Ordering on the Magnetic Anisotropy of Iron-Nickel Alloys* was the subject of a paper by R. M. Bozorth which he had prepared with J. G. Walker. J. B. Johnson and K. K. Darrow were also present at the meeting.

R. A. Sykes visited the Northern Electric Company in Montreal, Canada, to confer on crystal unit manufacturing problems. The need of the Armed Services for precise frequency control in communication equipment has placed severe requirements on quartz crystal units, and recent expansion in the defense activities calls for manufacture of these in large quantities. Mr. Sykes also attended a conference at Carlisle, Pa., in connection with the manufacture of crystal units.

The promotion of Paul Mallery to Captain U. S. Army Reserve, was announced recently. Captain Mallery has been assigned to the Public Communication Section of the 302nd Military Government Group.

As previously announced in the Record, the Laboratories are developing a new field telephone set for the Army to replace the set that has been used for many years. A. C. Ekvall and R. J. Morris visited the Western Electric Shadeland Plant at Indianapolis to discuss the network for use in this set.

Recent items of interest from Winston-Salem and Burlington Laboratories' members include the election of HARRY A. DOLL as first vice-president of the Wenoca Club for 1951-52. The Club is a Western Electric sponsored organization which provides recreation, noontime entertainment and study courses for members of the Bell System at those locations. Also mentioned in news releases was the election of K. O. THORP as 1951-52 Chairman of the Radio Shops Council of the Telephone Pioneers of America.

AS CHAIRMAN of the Research and Development Board Subpanel on Dielectrics, G. T. KOHMAN attended a meeting of the Component Panel held in San Francisco. In addition to the normal business of the Panel, visits were arranged to several West Coast manufacturers of electric components and to the California and Stanford University Radiation Laboratories. A symposium on dielectrics and other component problems attended by representatives of West Coast industry was also held in Los Angeles.

H. W. HERMANCE visited Chicago to study problems concerned with extension of treatment of panel banks with contact protectant to several offices of the Illinois Bell Company.

MEMBERS OF THE LABORATORIES who attended AAAS sponsored meetings recently include W. O. BAKER who spoke on *Mechanical Properties of Dilute Solutions of Macromolecules* at the Conference on Polymers in New London, New Hampshire; C. J. CALBICK, who presented an invited paper on *The Exploration of the Structure of Surfaces and Interfaces with the Aid of the Electron Microscope* at the Gordon Research Conference on Chemistry and Physics of Metals at the New Hampton School, New Hampton, New Hampshire; and D. B. HERRMANN, who attended the Gordon Research Conference on Microbiological Deterioration also at New Hampton, New Hampshire. Mr. Herrmann served as commentator on papers on the deterioration of electrical insulating materials by microorganisms. J. CRABTREE also attended the same Conference and presented a paper on *Rubber and the Ozone Effect.* Conyers Herring gave an invited paper before the Chemistry and Physics section of the Conference entitled *The Atomistic Theory of Metallic Surfaces.*

G. N. THAYER attended the Annual General Engineering Conference of the Ohio Bell Telephone Company at Catawba Island, Ohio, on June 20 and 21, where he spoke on *The Laboratories Approach to Carrier and Other Developments.* During the following week, R. J. NOSSAMAN participated in the annual Plant Operation Conference of the Northeastern Area of the Ohio Company also held at Catawba Island. Mr. Nossaman talked on the subject *Things to Come in Outside Plant,* with emphasis on the new mechanical splice closures now under development and probable effects, on outside plant, of new materials of design and shortages of traditional materials in the days ahead.

A NEW STUDY of dust conditions in accounting centers of the AMA system is being undertaken, and M. M. ATALLA, A. A. BURGESS, and G. E. LINEHAN recently went to Philadelphia to get the study started. For some days previously, J. B. WORTH, who was engineering the study, had been in Philadelphia making the necessary preparations. N. V. MANSUETTO of the Trial Installation group also took part in the preparatory work.

J. E. WAGNER of the Patent Department at Murray Hill has been awarded first prize in the 1951 Burkan Memorial Competition at the University of Iowa College of Law. The announcement was made by Otto A. Harbach, president of the American Society of Composers, Authors and Publishers, who has advised that the winning eassy will be considered with other prize winning essays submitted at leading law schools throughout the nation for a national award. Presentation of the first prize was made by Dean Mason Ladd of the University of Iowa College of Law. Mr. Wagner holds a B.S. in engineering from Iowa State College and a J.D. from the law

"Don't ask so many questions, just try to locate Hopalong Cassidy."

school. He served with the Navy during the war and was commissioned an ensign.

AN IMPROVED METHOD of fastening the lids of the printers and readers of the AMA system recently called A. A. BURGESS and F. H. MARTIN to New Britain, Connecticut, for discussion with the Stanley Works Company.

W. KEISTER has just completed a recruiting trip through the south that included Emory University in Atlanta, Alabama Polytechnic Institute at Auburn, and the University of Georgia at Athens.

RALPH WALKER, eleven-year-old son of J. G. WALKER of Murray Hill, has been credited with rescuing a woman, Mrs. Albert Liming, who was trapped when her boat caught in the rocks in the Delaware River rapids at Callicoon, New York. The boy, a Tenderfoot in Boy Scout Troop 63, New Providence, rowed his boat as close to hers as the rocks permitted, then entirely clothed and holding on to his own boat, waded to where he could shove her boat from the rocks and pull it out of the swift current. Five days later the woman's husband, Albert Liming, suffered an attack and toppled from his boat. He was rescued by the J. G. Walkers who brought him ashore.

H. C. Essig shows W. E. Grutzner the trophy that he and Mrs. Essig won for high score in the mixed pair event of the 18th Annual Finger Lakes Bridge Tournament held at Ithaca. While visiting their daughter just prior to her graduation from Cornell, the Essigs happened to be in the Hotel Ithaca when the tournament was going on and decided to take part in the competition.

A. J. BUSCH, F. A. KORN, J. MESZAR, C. G. MILLER, and C. F. SEIBEL visited Hawthorne early in May for one of their periodical conferences with Western Electric engineers. At these meetings the more important new projects are discussed, and difficulties that have been encountered are cleared up.

Engagements

Katherine Buchanan*—James Quinn
Elsie Coronges*—John Arcos
Eileen Doyle*—Victor A. Firtion
Lucy Francabandera*—E. Roberti
Marianna Mueller*—Robert P. Berger
Gertrude Scocca*—Frank L. Petrozzo, Jr.
Beverly Walsh—Garry DeBoer, Jr.*
Marilyn Winters*—Charles V. Cangro, Jr.
Jean Young*—Philip J. Spinella, U. S. Army

Weddings

Clotilde Abascal*—Salvatore V. Licata
Mary Bianco*—George J. Graff
Marie Bontempo*—James E. Thomson
Jean Chambers*—James R. Truscott, Jr.
Anne Dowling*—Robert Finnesey
Ruth Higgins*—George J. Wilson
Gwendolyn Hopwood*—Herbert J. Basewit
Catherine Klotz—Edwin A. Irland*
Eileen Lally—Philip P. Daniele*
Laurina O'Brien*—Lt. Francis C. Bergin, U. S. Army
Judith Ruddell—David Jarett, Jr.*
Marie Sabatini*—Theodore H. Cortright
Mary Storey—D. H. Jackson*
Carla Unger—Roger I. Wilkinson*
Marie Wagner*—Philip Rieth
Sonja Young*—Edward Gutowsky
Alberta Shoemaker*—Robert Tomb*

Births

Karen Frances on June 27 to Mr. and Mrs. Eugene A. Baker. Mr. Baker is a member of the Microwave Radio Department.

Christine Ann on June 20 to Mr. and Mrs. John Scharf. Mr. Scharf is in the Project Service group.

*Members of the Laboratories. Notices of engagements, weddings and births should be given to Mrs. Helen McLoughlin, Room 1321, Ext. 296.